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**RESULTS OF THE SEPTEMBER 21 - 23, 1993
AIR EMISSION COMPLIANCE TESTS
AT THE LOUISIANA PACIFIC WAFERBOARD
PLANT IN DAWSON CREEK, BRITISH COLUMBIA**

Submitted to:

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ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	diameter
FP	finished product for plant
FT/SEC	feet per second
g	gram
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
MW	megawatt
m ³ /MIN	cubic meter/minute
mg/m ³	milligrams per cubic meter
ug/Nm ³	micrograms per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
ohm-cm	ohm-centimeter
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight
<	≤ (when following a number)

Standard conditions are defined as 293.15°K (20°C), 101.325 KPa pressure and zero water vapor.

1 INTRODUCTION

During the Period September 21 - 23, 1993 Interpoll Laboratories personnel conducted air emission compliance tests on the Dryers, Press Vent and Thermal Oil Heater at the Louisiana Pacific Corporation (LP) Waferboard Plant located in Dawson Creek, British Columbia. On-site testing was performed by M. Kaehler and J. Bergstrom. Coordination between testing activities and plant operation was provided by Sue Somers of LP.

The Dryer tested is a 13' x 60' dryer manufactured by Heil Company. Particulate emissions from the wafer dryer are controlled by primary cyclones followed by twin secondary cyclones. Cleaned flue gas is emitted to the atmosphere by a 100-foot high radial steel stack which has a diameter of 48 inches.

The press vents tested are the exhaust from general ventilators positioned over the board press and unloader. Axial fans in the duct above the roof provide the air movement.

20 each
The Thermal Oil Heater tested is manufactured by Konus. It is equipped with a ram-type stoker and is fired with a mixture of wet bark and wood. The unit has a design heat input capacity of ~~20~~⁴⁰ 10⁶ BTU/HR. Particulate emissions from the Konus are controlled by a large diameter cyclone in series with a fabric filter dust collector manufactured by C.E. Preheater. The baghouse has a pulsed air cleaning system. Cleaned flue gas is emitted to the atmosphere by a 100-foot high radial steel stack which has a diameter of 67.5 inches.

Particulate evaluations were performed in accordance with EPA Methods 2-5, CFR Title 40, Part 60, Appendix A (revised July 1, 1992). A preliminary determination of the gas linear velocity profile was made at each test location 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. Condensible particulate material was collected in the back half of the Method 5 sampling train and analyzed in accordance with EPA Method 202.

Formaldehyde samples were collected using EPA 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.

Phenol concentrations were determined using a Method 5 sampling train with neutral buffered absorbing reagent followed by extraction with methylene chloride and direct analysis by GC/MS with no concentration (EPA Method 8270). The first impinger was spiked with 5.33 mg of phenol-d6 prior to the start of each run as a check on over all sampling efficiency and recovery. An aliquot was taken and analyzed for hydrogen cyanide in accordance with EPA Method SW-846, 9010.

MDI concentrations in the exhaust from the Press and Unloader Vent Stacks were determined in accordance with Interpoll Laboratories Method II-8791 (Version 1.2) based on NIOSH Method P&CAM 347 (N-p-nitrobenzyl-N-propylamine impregnated filters with analysis of the urea reaction product after solvent switch by reverse phase HPLC/UV. An Interpoll Labs sampling train was used to extract the MDI samples by means of a non-heated stainless steel probe and an out-stack filter assembly.

Integrated flue gas samples were extracted from the Dryer and Thermal Oil Heater exhaust gas streams using a specially designed gas sampling system. Integrated flue gas samples were collected in 44-liter Tedlar bags housed in a protective aluminum container. After sampling was complete, the bags were sealed and analyzed on site or returned to the laboratory for Orsat analysis. Prior to sampling, the Tedlar bags are leak checked at 15 IN.HG. vacuum with an in-line rotameter. Bags with any detectable inleakage are discarded.

Testing at the Dryer Stack was also conducted from two test ports oriented at 90 degrees on the stack. These test ports are located 12.0 stack diameters downstream of the

nearest flow disturbance and 7.9 stack diameters upstream of the stack exit. A 12-point traverse was used to collect the particulate and formaldehyde samples. Each traverse point was sampled 5 minutes for the particulate and formaldehyde testing to give a total sampling time of sixty minutes per run. A 3-point traverse was used for the phenol and THC sampling. Each traverse point was sampled for 20 minutes for a total sampling time of 60 minutes.

Testing on the Press and Unloader Vents was conducted as one source by performing one half of the test run in one vent and one half the test run in the second vent. Sampling was performed from using a horizontal row of eight test ports (four on each stack) on the vertical ducts. A 32-point traverse was used to collect the formaldehyde and MDI samples. Each traverse point was sampled 2.5 minutes for a total sampling time of 80 minutes per run. Phenol sampling was conducted from two test ports (one from each duct). A four-point traverse was used to collect the phenol samples. Each traverse point was sampled 15 minutes for a total sampling time of 60 minutes per run.

Testing on the Thermal Oil Heater exhaust was also conducted from two test ports oriented at 90 degrees on the Stack. These test ports are located 11.7 stack diameters from the nearest flow disturbance and 3.0 diameters from the stack exit. A 12-point traverse was used to collect representative samples. Each traverse point was sampled for 5 minutes for the particulate testing to give a total sampling time of 60 minutes per run.

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

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance tests are summarized in Tables 1 and 2. The particulate emission concentration averaged 398 mg/m³ for the Dryer and 1176 mg/m³ for the Konus.

The results of the formaldehyde tests are presented in Table 3. The formaldehyde concentration averaged 6.2 mg/Nm³ for the Surface Dryer and 2.5 mg/Nm³ for the Press Vent.

The total hydrocarbon results are summarized in Table 4. The THC concentration averaged 135, 13.0 and 32.8 mg/Nm³ for the Surface Dryer, Press Vent and Thermal Oil Heater, respectively.

A summary of the phenol results is presented in Table 5. The phenol concentration averaged <0.67 mg/Nm³ for the Surface Dryer and 1.18 mg/Nm³ for the Press Vent.

The hydrogen cyanide and MDI results are summarized in Tables 6 and 7, respectively. The hydrogen cyanide concentration averaged 0.31 mg/Nm³ for the Surface Dryer and the MDI concentration averaged 0.11 mg/Nm³ for the Press Vent.

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 1. Summary of the Results of the September 21, 1993 Particulate Emission Test on the Surface Dryer Stack at the Louisiana Pacific - Dawson Creek Located in Dawson Creek, British Columbia.

ITEM	Run 1	Run 2	Run 3
Date of test	09-21-93	09-21-93	09-21-93
Time runs were done (HRS)	1420/1525	1622/1723	1804/1905
Process rate (TFP/HR)	29.1	29.1	29.1
Volumetric flow actual (ACFM)	56980	55845	56248
standard (DSCFM)	32189	32225	32501
(CM/MIN)	912	913	920
Gas temperature (DEG-F)	238	237	219
Moisture content (%V/V)	19.33	17.81	19.83
Gas composition (%V/V, dry)			
carbon dioxide	2.90	2.90	3.00
oxygen	17.80	17.90	17.80
nitrogen	79.30	79.20	79.20
Isokinetic variation (%)	101.1	98.3	100.5
Particulate concentration			
actual (GR/ACF)	.0859	0.103	0.110
standard (GR/DSCF)	0.152	0.179	0.190
(MG/CM)	348	410	435
Part. emission rate (LB/HR)	41.95	49.36	52.93

Note: Dry Catch + Condensible Particulate Material

Table 2. Summary of the Results of the September 23, 1993 Particulate Emission Test on the No. 1 Konus Stack at the Louisiana Pacific - Dawson Creek Located in Dawson Creek, British Columbia.

ITEM	Run 1	Run 2	Run 3
Date of test	09-23-93	09-23-93	09-23-93
Time runs were done (HRS)	910/1012	1047/1149	1207/1310
Process rate (TFP/HR)	29.1	29.1	29.1
Volumetric flow actual (ACFM)	19671	17901	18498
standard (DSCFM)	9018	7893	8316
(CM/MIN)	255	224	236
Gas temperature (DEG-F)	484	481	482
Moisture content (%V/V)	11.05	14.75	12.86
Gas composition (%V/V, dry)			
carbon dioxide	8.50	9.10	8.60
oxygen	11.60	11.00	11.50
nitrogen	79.90	79.90	79.90
Isokinetic variation (%)	106.5	101.5	97.7
Particulate concentration actual (GR/ACF)	0.149	0.207	0.150
standard (GR/DSCF)	0.324	0.470	0.333
(MG/CM)	741	1075	762
Part. emission rate (LB/HR)	25.07	31.77	23.74
Particulate concentration (MG/CM @12%CO2)	1046	1418	1063

Note: Dry Catch + Condensable Particulate Matter

Table 3. Summary of the Formaldehyde Emission Determinations at the Louisiana Pacific Waferboard Plant in Dawson Creek, British Columbia.

<u>Time</u>	<u>Concentration</u> (mg/Nm ³)	<u>Emission Rate</u> (LB/HR)
(Surface Dryer 9/21/93)		
0824-0938	5.6	0.68
1025-1129	5.9	0.72
1215-1318	7.5	0.91
Avg.	6.2	0.77
(Press Vent 9/22/93)		
1014-1152	3.0	0.99
1217-1348	2.7	0.91
1410-1539	1.7	0.59
Avg.	2.5	0.83

Table 4. Summary of the Total Hydrocarbon Emission Determinations at the Louisiana Pacific Waferboard Plant in Dawson Creek, British Columbia.

Time	Concentration (mg/Nm ³)	Emission Rate (LB/HR)
(Surface Dryer 9/21/93)		
1420-1525	167	20.1
1622-1743	109	13.1
1804-1925	129	15.7
Avg.	135	16.3
(Press Vent 9/22/93)		
1414-1531	14.5	5.32
1608-1717	11.4	4.17
1736-1845	13.1	4.64
Avg.	13.0	4.71
(Thermal Oil Heater 9/23/93)		
0910-1012	23.0	0.85
1046-1150	30.6	0.90
1205-1310	44.8	1.39
Avg.	32.8	1.05

Table 5. Summary of the Phenol Emission Determinations at the Louisiana Pacific Waferboard Plant in Dawson Creek, British Columbia.

<u>Time</u>	<u>Concentration</u> (mg/Nm ³)	<u>Emission Rate</u> (LB/HR)
(Surface Dryer 9/21/93)		
0835-0939	<0.68	<0.083
1025-1129	<0.67	<0.082
1215-1319	<0.67	<0.081
Avg.	<0.67	<0.082
(Press Vent 9/22/93)		
1014-1130	1.34	0.44
1142-1245	1.27	0.43
1255-1356	0.93	0.32
Avg.	1.18	0.40

Note: Recovery of Phenol-d6 spikes averaged 53%.

Table 6. Summary of the Hydrogen Cyanide Emission Determinations at the Louisiana Pacific Waferboard Plant in Dawson Creek, British Columbia.

<u>Time</u>	<u>Concentration</u> (mg/Nm ³)	<u>Emission Rate</u> (LB/HR)
(Surface Dryer 9/21/93)		
0835-0939	0.32	0.039
1025-1129	0.31	0.038
1215-1319	0.31	0.037
Avg.	0.31	0.038

Table 7. Summary of the MDI Emission Determinations at the Louisiana Pacific Waferboard Plant in Dawson Creek, British Columbia.

<u>Time</u>	<u>Concentration</u> (mg/Nm ³)	<u>Emission Rate</u> (LB/HR)
(Press Vent 9/22/93)		
1608-1718	0.11	0.039
1736-1845	0.11	0.039
1856-2004	0.11	0.039
Avg.	0.11	0.039

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, formaldehyde, phenol, hydrogen cyanide and MDI results. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on a personal computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs.

The emission rates have been calculated using the product of the concentration times flow method.

3.1 Results of Orsat and Moisture Determinations

Test No. 1
Surface Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	09-21-93	09-21-93	09-21-93

Dry basis (orsat)

carbon dioxide.....	3.20	3.00	3.00
oxygen.....	17.60	17.60	17.70
nitrogen.....	79.20	79.40	79.30

Wet basis (orsat)

carbon dioxide.....	2.60	2.42	2.42
oxygen.....	14.28	14.17	14.29
nitrogen.....	64.25	63.94	64.00
water vapor.....	18.88	19.47	19.29
Dry molecular weight.....	29.22	29.18	29.19
Wet molecular weight.....	27.10	27.01	27.03
Specific gravity.....	0.936	0.933	0.934

FO	1.031	1.100	1.067
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Test No. 2
Surface Dryer Stack

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

Date of run	Run 1 09-21-93	Run 2 09-21-93	Run 3 09-21-93
Dry basis (orsat)			
carbon dioxide.....	3.20	3.00	3.00
oxygen.....	17.60	17.80	17.70
nitrogen.....	79.20	79.20	79.30
Wet basis (orsat)			
carbon dioxide.....	2.57	2.40	2.41
oxygen.....	14.16	14.24	14.24
nitrogen.....	63.72	63.38	63.80
water vapor.....	19.55	19.98	19.55
Dry molecular weight.....	29.22	29.19	29.19
Wet molecular weight.....	27.02	26.96	27.00
Specific gravity.....	0.933	0.931	0.933
FO	1.031	1.033	1.067

Test No. 3
Surface Dryer Stack

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

Date of run	Run 1 09-21-93	Run 2 09-21-93	Run 3 09-21-93
Dry basis (orsat)			
carbon dioxide.....	2.90	2.90	3.00
oxygen.....	17.80	17.90	17.80
nitrogen.....	79.30	79.20	79.20
Wet basis (orsat)			
carbon dioxide.....	2.34	2.38	2.41
oxygen.....	14.36	14.71	14.27
nitrogen.....	63.97	65.10	63.50
water vapor.....	19.33	17.81	19.83
Dry molecular weight.....	29.18	29.18	29.19
Wet molecular weight.....	27.02	27.19	26.97
Specific gravity.....	0.933	0.939	0.932
Water mass flow.....(LB/HR)	21629	19585	22545
FO	1.069	1.034	1.033

Test No. 5
Press Vent Stack

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

Date of run	Run 1 09-22-93	Run 2 09-22-93	Run 3 09-22-93
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.63	20.63	20.70
nitrogen.....	78.06	78.03	78.33
water vapor.....	1.28	1.31	0.94
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.70	28.70	28.74
Specific gravity.....	0.991	0.991	0.993

Test No. 6
Press Vent Stack

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

Date of run	Run 1 09-22-93	Run 2 09-22-93	Run 3 09-22-93
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.63	20.70	20.65
nitrogen.....	78.04	78.30	78.12
water vapor.....	1.30	0.98	1.20
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.70	28.73	28.71
Specific gravity.....	0.991	0.993	0.992

Test No. 7
Press Vent Stack

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

	Run 1	Run 2	Run 3
Date of run	09-22-93	09-22-93	09-22-93

Dry basis (orsat)

carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
nitrogen.....	79.07	79.07	79.07

Wet basis (orsat)

carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.56	20.55	20.52
nitrogen.....	77.78	77.76	77.63
water vapor.....	1.64	1.65	1.82
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.66	28.66	28.64
Specific gravity.....	0.990	0.990	0.989

Test No. 9
No. 1 Konus Stack

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

Date of run	Run 1 09-23-93	Run 2 09-23-93	Run 3 09-23-93
Dry basis (orsat)			
carbon dioxide.....	8.50	9.10	8.60
oxygen.....	11.60	11.00	11.50
nitrogen.....	79.90	79.90	79.90
Wet basis (orsat)			
carbon dioxide.....	7.56	7.76	7.49
oxygen.....	10.32	9.38	10.02
nitrogen.....	71.07	68.11	69.62
water vapor.....	11.05	14.75	12.86
Dry molecular weight.....	29.82	29.90	29.84
Wet molecular weight.....	28.52	28.14	28.31
Specific gravity.....	0.985	0.972	0.978
Water mass flow.....(LB/HR)	3144	3831	3443
FO	1.094	1.088	1.093

3.2 Results of Particulate Determinations

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Test No. 3
Surface Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	09-21-93	09-21-93	09-21-93
Time run start/end.....(HRS)	1420/1525	1622/1723	1804/1905
Static pressure.....(IN.WC)	-0.68	-0.68	-0.68
Cross sectional area (SQ.FT)	12.31	12.31	12.31
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	226.0	211.0	238.0
desiccant.....(GRAMS)	25.0	10.0	22.0
total.....(GRAMS)	251.0	221.0	260.0
Total particulate material..			
.....collected(grams)	0.4868	0.5570	0.6104
Gas meter coefficient.....	0.9980	0.9980	0.9980
Barometric pressure..(IN.HG)	27.76	27.76	27.76
Avg. orif.pres.drop..(IN.WC)	2.24	2.18	2.31
Avg. gas meter temp..(DEF-F)	65.5	68.4	67.2
Volume through gas meter....			
at meter conditions...(CF)	52.81	51.70	53.15
standard conditions.(DSCF)	49.40	48.09	49.57
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.239	.239	.239
Avg.stack gas temp ..(DEG-F)	238	237	219
Volumetric flow rate.....			
actual.....(ACFM)	56980	55845	56248
dry standard.....(DSCFM)	32189	32225	32501
Isokinetic variation.....(%)	101.1	98.3	100.5
Particulate concentration...			
actual.....(GR/ACF)	0.08585	0.10308	0.10974
dry standard.....(GR/DSCF)	0.15204	0.17871	0.19000
Particle mass rate...(LB/HR)	41.948	49.362	52.929

Test No. 9
No. 1 Konus Stack

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

	Run 1	Run 2	Run 3
Date of run	09-23-93	09-23-93	09-23-93
Time run start/end.....(HRS)	910/1012	1047/1149	1207/1310
Static pressure.....(IN.WC)	-0.12	-0.12	-0.12
Cross sectional area (SQ.FT)	24.85	24.85	24.85
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	73.0	142.0	131.0
desiccant.....(GRAMS)	7.0	21.0	10.0
total.....(GRAMS)	80.0	163.0	141.0
Total particulate material..			
.....collected(grams)	0.6381	1.3516	0.9724
Gas meter coefficient.....	0.9967	0.9967	0.9967
Barometric pressure..(IN.HG)	27.58	27.58	27.56
Avg. orif.pres.drop..(IN.WC)	0.90	2.11	2.12
Avg. gas meter temp..(DEF-F)	68.8	76.0	77.4
Volume through gas meter....			
at meter conditions...(CF)	33.02	48.82	49.68
standard conditions.(DSCF)	30.35	44.41	45.05
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.490	.649	.649
Avg.stack gas temp ..(DEG-F)	484	481	482
Volumetric flow rate.....			
actual.....(ACFM)	19671	17901	18498
dry standard.....(DSCFM)	9018	7893	8316
Isokinetic variation.....(%)	106.5	101.5	97.7
Particulate concentration...			
actual.....(GR/ACF)	0.14865	0.20694	0.14969
dry standard.....(GR/DSCF)	0.32439	0.46956	0.33307
Particle mass rate...(LB/HR)	25.074	31.766	23.742

3.3 Results of Formaldehyde Determinations

Test No. 1
Surface Dryer Stack

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

	Run 1 09-21-93	Run 2 09-21-93	Run 3 09-21-93
Date of run			
Time run start/end.....(HRS)	835/ 938	1025/1129	1215/1318
Static pressure.....(IN.WC)	-0.68	-0.68	-0.68
Cross sectional area (SQ.FT)	12.31	12.31	12.31
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	226.0	237.0	218.0
desiccant.....(GRAMS)	14.0	18.0	32.0
total.....(GRAMS)	240.0	255.0	250.0
Formaldehyde in sample..(uG)	7600	8230	10400
Gas meter coefficient.....	0.9967	0.9967	0.9967
Barometric pressure..(IN.HG)	27.76	27.76	27.76
Avg. orif.pres.drop..(IN.WC)	2.17	2.31	2.30
Avg. gas meter temp..(DEF-F)	53.2	63.7	70.0
Volume through gas meter....			
at meter conditions...(CF)	50.84	53.05	53.23
standard conditions.(DSCF)	48.63	49.74	49.32
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.239	.239	.239
Avg.stack gas temp ..(DEG-F)	238	237	238
Volumetric flow rate.....			
actual.....(ACFM)	57254	57797	57584
dry standard.....(DSCFM)	32535	32636	32567
(CM/MIN)	921	924	922
Isokinetic variation.....(%)	98.5	100.4	99.8
CH2O concentration.....			
(GR/DSCF).....	0.0024	0.0026	0.0033
(MG/DSCM).....	5.55	5.88	7.49
(PPM-DRY).....	4.45	4.71	6.00
(PPM-WET).....	3.61	3.79	4.85
CH2O emission rate...(LB/HR)	0.67610	0.71822	0.91347

CH2O = Formaldehyde

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

Test No. 5
Press Vent Stack

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

	Run 1 09-22-93	Run 2 09-22-93	Run 3 09-22-93
Date of run			
Time run start/end.....(HRS)	1014/1152	1217/1348	1410/1539
Static pressure.....(IN.WC)	-0.63	-0.63	-0.63
Cross sectional area (SQ.FT)	46.32	46.32	46.32
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	1.0	0.0	-1.0
desiccant.....(GRAMS)	12.0	14.0	11.0
total.....(GRAMS)	13.0	14.0	10.0
Formaldehyde in sample..(uG)	3960	3710	2370
Gas meter coefficient.....	0.9967	0.9967	0.9967
Barometric pressure..(IN.HG)	27.61	27.61	27.61
Avg. orif.pres.drop..(IN.WC)	1.27	1.41	1.43
Avg. gas meter temp..(DEF-F)	64.1	68.5	74.4
Volume through gas meter....			
at meter conditions...(CF)	50.90	53.75	54.64
standard conditions.(DSCF)	47.30	49.56	49.82
Total sampling time....(MIN)	80.00	80.00	80.00
Nozzle diameter.....(IN)	.239	.239	.239
Avg.stack gas temp ..(DEG-F)	103	99	100
Volumetric flow rate.....			
actual.....(ACFM)	104019	106696	107948
dry standard.....(DSCFM)	88725	91596	92890
(CM/MIN)	2513	2594	2631
Isokinetic variation.....(%)	99.1	100.6	99.7
CH2O concentration.....			
(GR/DSCF).....	0.0013	0.0012	0.0007
(MG/DSCM).....	2.97	2.65	1.69
(PPM-DRY).....	2.38	2.13	1.35
(PPM-WET).....	2.35	2.10	1.34
CH2O emission rate...(LB/HR)	0.98527	0.90999	0.58640
CH2O = Formaldehyde			

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

3.4 Results of Phenol Determinations

Interpoll Report No. 3-1060
Louisiana Pacific Corporation
Dawson Creek, British Columbia

Test No. 2
Surface Dryer Stack

Results of Phenol Determinations

	Run 1	Run 2	Run 3
Date of Run	09-21-93	09-21-93	09-21-93
Time run start/end (HRS)	0835-0939	1025-1129	1215-1319
Barometric pressure (IN.HG)	27.76	27.76	27.76
Meter temperature (DEG-F)	50.46	45.80	45.75
Meter correction coefficient	0.9980	0.9980	0.9980
Volume through gas meter at meter conditions (CF)	45.400	45.800	45.750
standard conditions (DSCF)	43.686	44.477	44.433
Total sampling time (MIN)	60	60	60
Moisture content (%V/V)	19.55	19.98	19.55
Volumetric flow rate (DSCFM)	32535	32636	32567
. (M ³ MIN)	921	924	922
Phenol in sample (MG)	<0.84	<0.84	<0.84
Phenol concentration (GR/DSCF)	<297	<291	<292
(MG/Nm ³)	<0.68	<0.67	<0.67
(PPM-DRY)	<0.17	<0.17	<0.17
(PPM-WET)	<0.14	<0.14	<0.14
Phenol emission rate (LB/HR)	<0.083	<0.082	<0.081

Analysis performed according to EPA Method 8270

Interpoll Report No. 3-1060
Louisiana Pacific Corporation
Dawson Creek, British Columbia

Test No. 6
Press Vent Stack

Results of Phenol Determinations

	Run 1	Run 2	Run 3
Date of Run	09-22-93	09-22-93	09-22-93
Time run start/end (HRS)	1014-1130	1142-1245	1255-1356
Barometric pressure (IN.HG)	27.61	27.61	27.61
Meter temperature (DEG-F)	64.17	68.08	69.88
Meter correction coefficient	0.9980	0.9980	0.9980
Volume through gas meter			
at meter conditions (CF)	46.240	46.450	46.350
standard conditions (DSCF)	43.098	42.958	42.735
Total sampling time (MIN)	60	60	60
Moisture content (%V/V)	1.30	0.98	1.20
Volumetric flow rate (DSCFM)	88725	91596	92890
. (M ³ MIN)	2513	2594	2631
Phenol in sample (MG)	1.6	1.5	1.1
Phenol concentration			
(GR/DSCF)	584	553	404
(MG/Nm ³)	1.34	1.27	0.93
(PPM-DRY)	0.34	0.32	0.24
(PPM-WET)	0.34	0.32	0.23
Phenol emission rate (LB/HR)	0.44	0.43	0.32

Analysis performed according to EPA Method 8270

3.5 Results of Hydrogen Cyanide Determinations

Interpoll Report No. 3-1060
Louisiana Pacific Corporation
Dawson Creek, British Columbia

Test No. 2
Surface Dryer Stack

Results of Hydrogen Cyanide Determinations

	Run 1	Run 2	Run 3
Date of Run	09-21-93	09-21-93	09-21-93
Time run start/end (HRS)	0835-0939	1025-1129	1215-1319
Barometric pressure (IN.HG)	27.76	27.76	27.76
Meter temperature (DEG-F)	50.46	45.80	45.75
Meter correction coefficient	0.9980	0.9980	0.9980
Volume through gas meter			
at meter conditions (CF)	45.400	45.800	45.750
standard conditions (DSCF)	43.686	44.477	44.433
Total sampling time (MIN)	60	60	60
Moisture content (%V/V)	19.55	19.98	19.55
Volumetric flow rate (DSCFM)	32535	32636	32567
. (M ³ MIN)	921	924	922
Cyanide in sample (uG)	400	390	385
Hydrogen cyanide concentration			
(MG/Nm ³)	0.32	0.31	0.31
(PPM-DRY)	0.29	0.28	0.28
Hydrogen cyanide emission rate . (LB/HR)	0.039	0.038	0.037

Analysis performed according to EPA Method SW-846, 9010

3.6 Results of MDI Determinations

Interpoll Report No. 3-1060
Louisiana Pacific Corporation
Dawson Creek, British Columbia

Test No. 7
Press Vent Stack

Results of MDI Determinations

	Run 1 09-22-93	Run 2 09-22-93	Run 3 09-22-93
Date of Run			
Time run start/end (HRS)	1608-1718	1736-1845	1856-2004
Static pressure (IN.WC)	-0.93	-0.93	-0.93
Cross sectional area (SQ.FT)	46.32	46.32	46.32
Pitot tube coefficient	0.840	0.840	0.840
Water in sample gas			
condenser (ML)	3.0	3.0	3.0
impingers (GRAMS)	0	0	0
desiccant (GRAMS)	12.0	12.0	13.0
total (GRAMS)	15.0	15.0	16.0
Barometric pressure (IN.HG)	27.61	27.61	27.61
Meter temperature (DEG-F)	75.3	75.6	74.9
Meter correction coefficient	0.9967	0.9967	0.9967
Avg. orif. pres. drop (IN.WC)	1.60	1.55	1.61
Volume through gas meter			
at meter conditions (CF)	46.69	46.27	44.65
standard conditions (DSCF)	42.52	42.11	40.69
Total sampling time (MIN)	60	60	60
Nozzle diameter (IN)	0.239	0.239	0.239
Avg. stack gas temp (DEG-F)	99	100	100
Volumetric flow rate			
actual (ACFM)	114818	114359	110883
dry standard (DSCFM)	98269	97565	94495
. (M ³ /MIN)	2783	2763	2676
Isokinetic variation (%)	100.6	100.3	100.1
MDI in sample (uG)	129	128	128
MDI concentration			
(MG/Nm ³)	0.11	0.11	0.11
(PPM-DRY)	0.010	0.010	0.011
MDI emission rate (LB/HR)	0.039	0.039	0.039

4 RESULTS OF FUEL ANALYSIS

INTERPOLL LABORATORIES, INC.

Fuel Laboratory

(612) 786-6020

10/19/93

Client : LOUISIANA PACIFIC/DAWSON CREEK

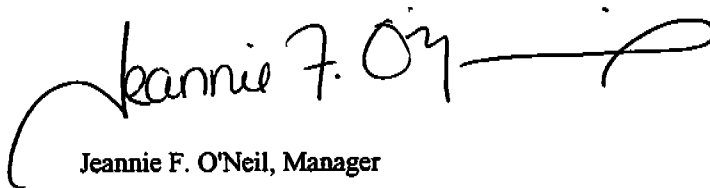
Laboratory Log Number : 1060-39-5473

Sample Identification : DRYER FUEL DRY WOOD, 9/23/93

Short Proximate Analysis WT %

Parameter	Moisture & Ash Free	Moisture Free	As Received
Moisture, Total			2.54
Ash		0.97	0.94
Sulfur	0.08	0.08	0.08
Heating Value, BTU/LB.	8489	8407	8193

Respectfully submitted,



Jeannie F. O'Neil, Manager
Inorganic Chemistry Group

INTERPOLL LABORATORIES, INC.

Fuel Laboratory

(612) 786-6020

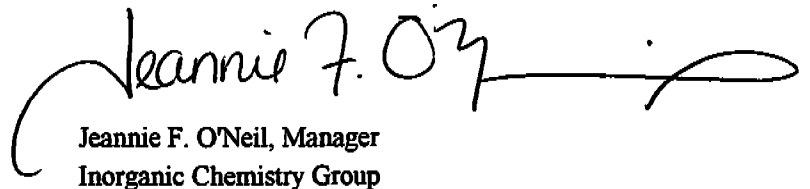
10/19/93

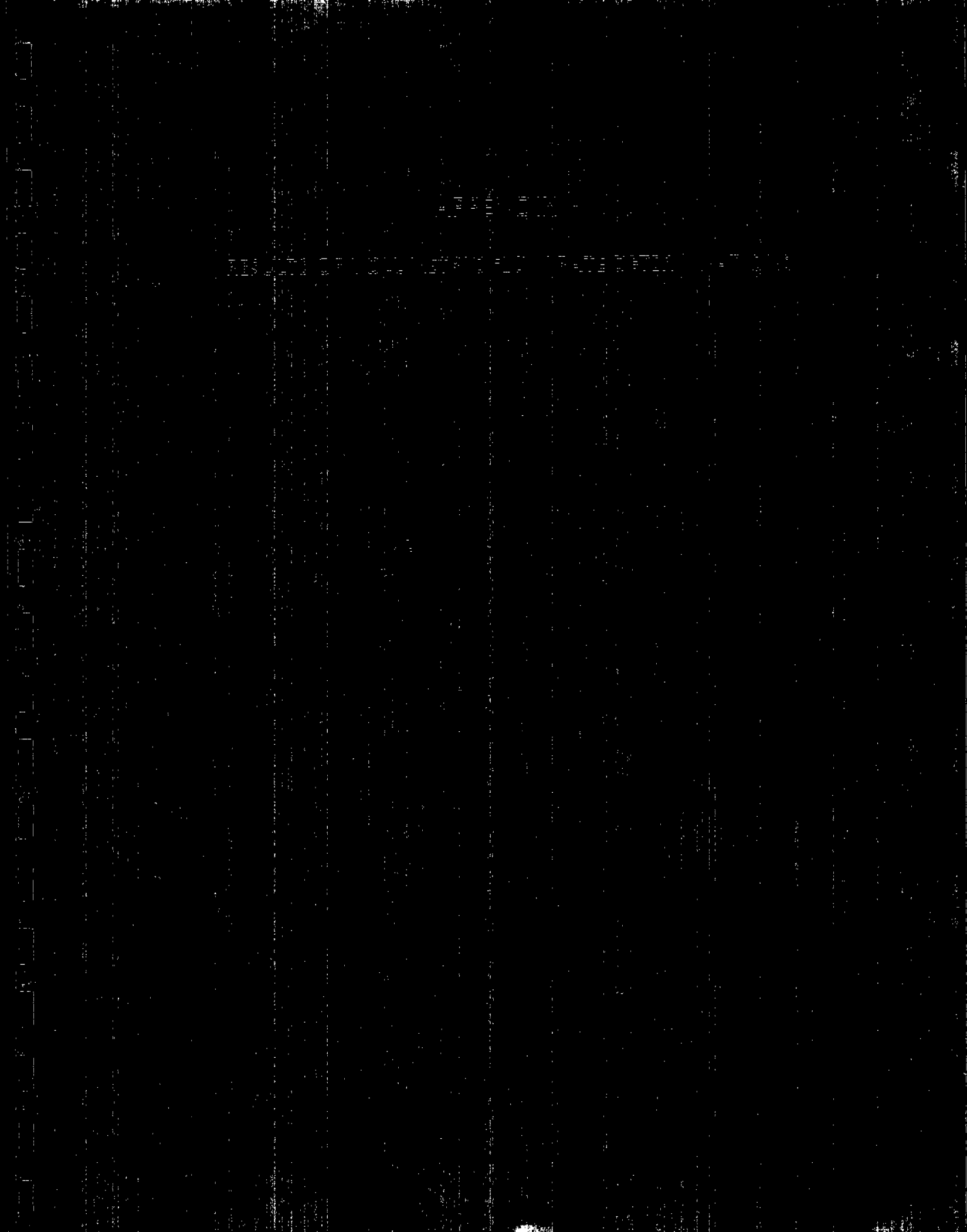
Client : LOUISIANA PACIFIC/DAWSON CREEK
Laboratory Log Number : 1060-40-5474
Sample Identification : KONUS FUEL WET BARK, 9/23/93

Short Proximate Analysis WT %

Parameter	Moisture & Ash Free	Moisture Free	As Received
Moisture, Total			41.75
Ash		2.63	1.53
Sulfur	0.12	0.12	0.07
Heating Value, BTU/LB.	9490	9241	5382

Respectfully submitted,


Jeannie F. O'Neil, Manager
Inorganic Chemistry Group



Test No. 1
Surface Dryer Stack

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

Date of Determination.....	09-21-93
Time of Determination.....(HRS)	813
Barometric pressure.....(IN.HG)	27.76
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	47.5
Duct area.....(SQ.FT)	12.31
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.68
Avg. gas temp.....(DEG-F)	236
Moisture content.....(% V/V)	18.88
Avg. linear velocity.....(FT/SEC)	77.1
Gas density.....(LB/ACF)	.04944
Molecular weight.....(LB/LBMOLE)	29.22
Mass flow of gas.....(LB/HR)	168833
Volumetric flow rate.....	
actual.....(ACFM)	56912
dry standard.....(DSCFM)	32438

Test No. 5
Press Vent Stack

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

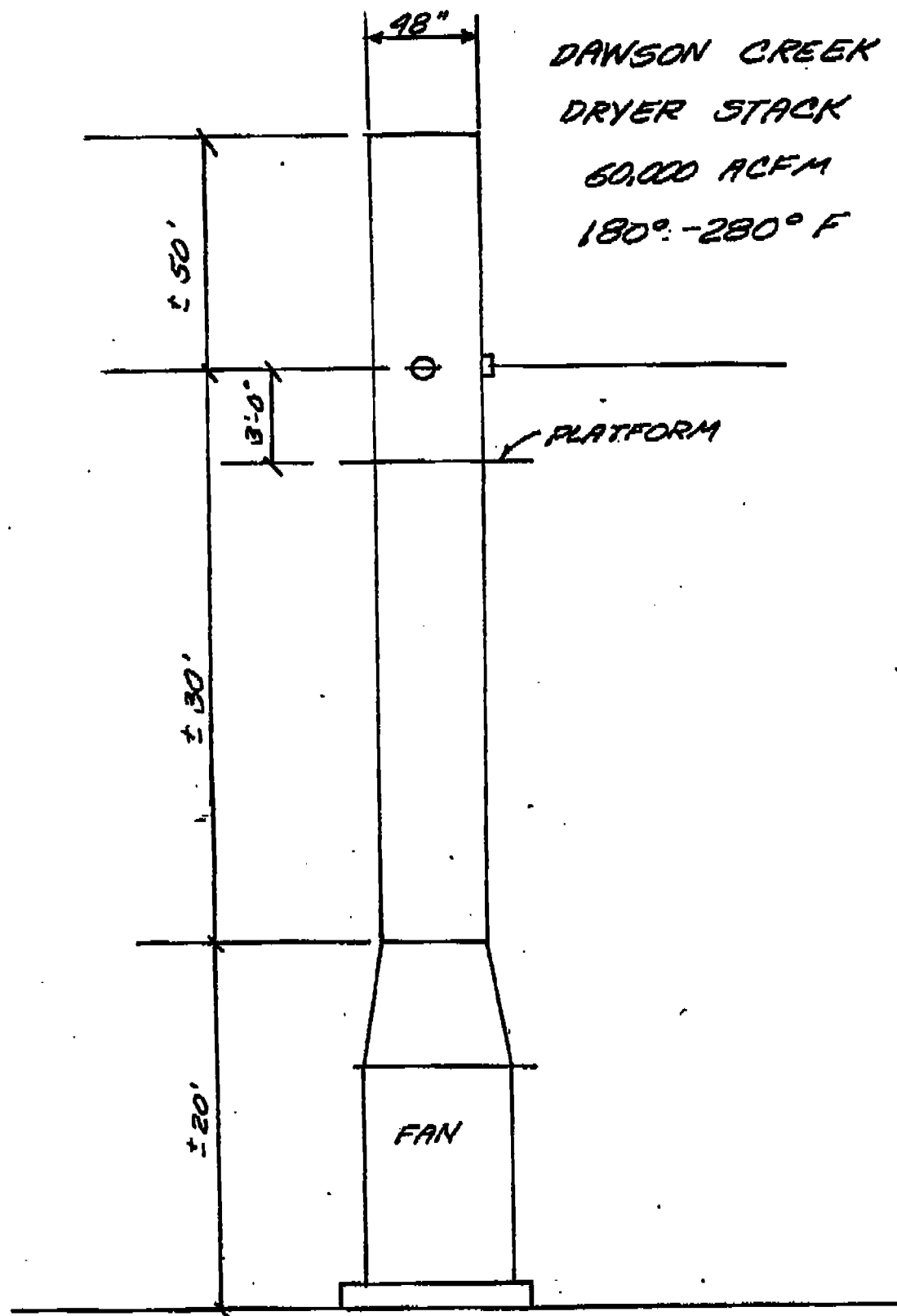
Date of Determination.....	09-22-93
Time of Determination.....(HRS)	928
Barometric pressure.....(IN.HG)	27.61
Pitot tube coefficient.....	.84
Number of sampling ports.....	8
Total number of points.....	32
Shape of duct.....	Rectangular
Duct width.....(IN)	116
Duct length.....(IN)	57.5
Duct area.....(SQ.FT)	46.32
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.63
Avg. gas temp.....(DEG-F)	105
Moisture content.....(% V/V)	1.28
Avg. linear velocity.....(FT/SEC)	37.9
Gas density.....(LB/ACF)	.06417
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	405438
Volumetric flow rate.....	
actual.....(ACFM)	105304
dry standard.....(DSCFM)	89498

Test No. 9
No. 1 Korus Stack

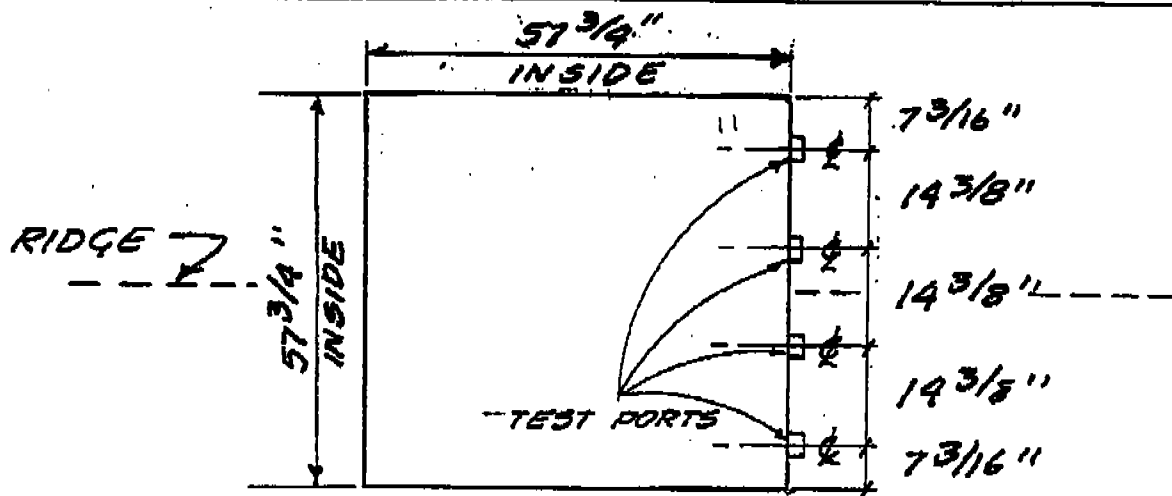
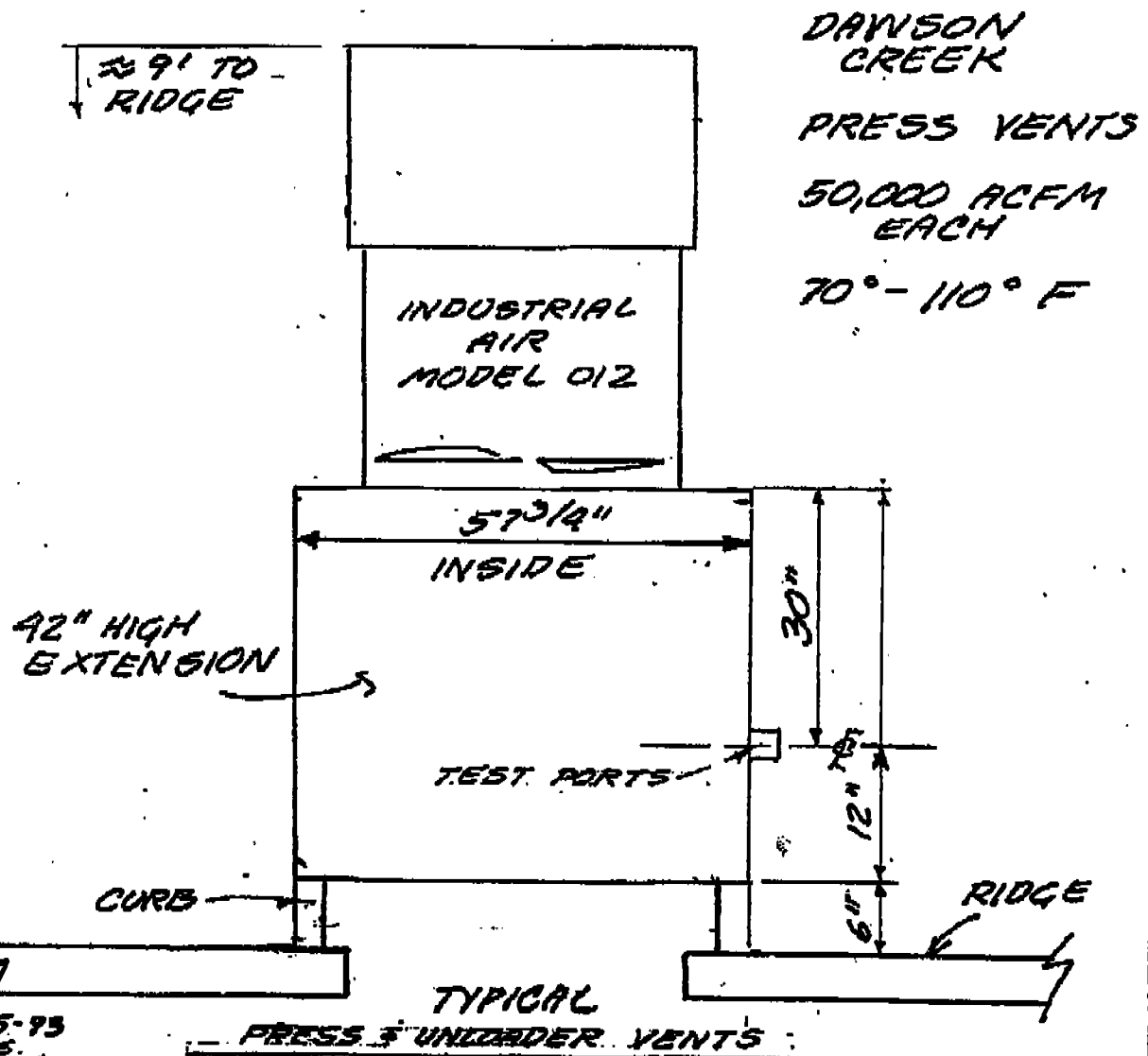
Results of Volumetric Flow Rate Determination-----Method 2

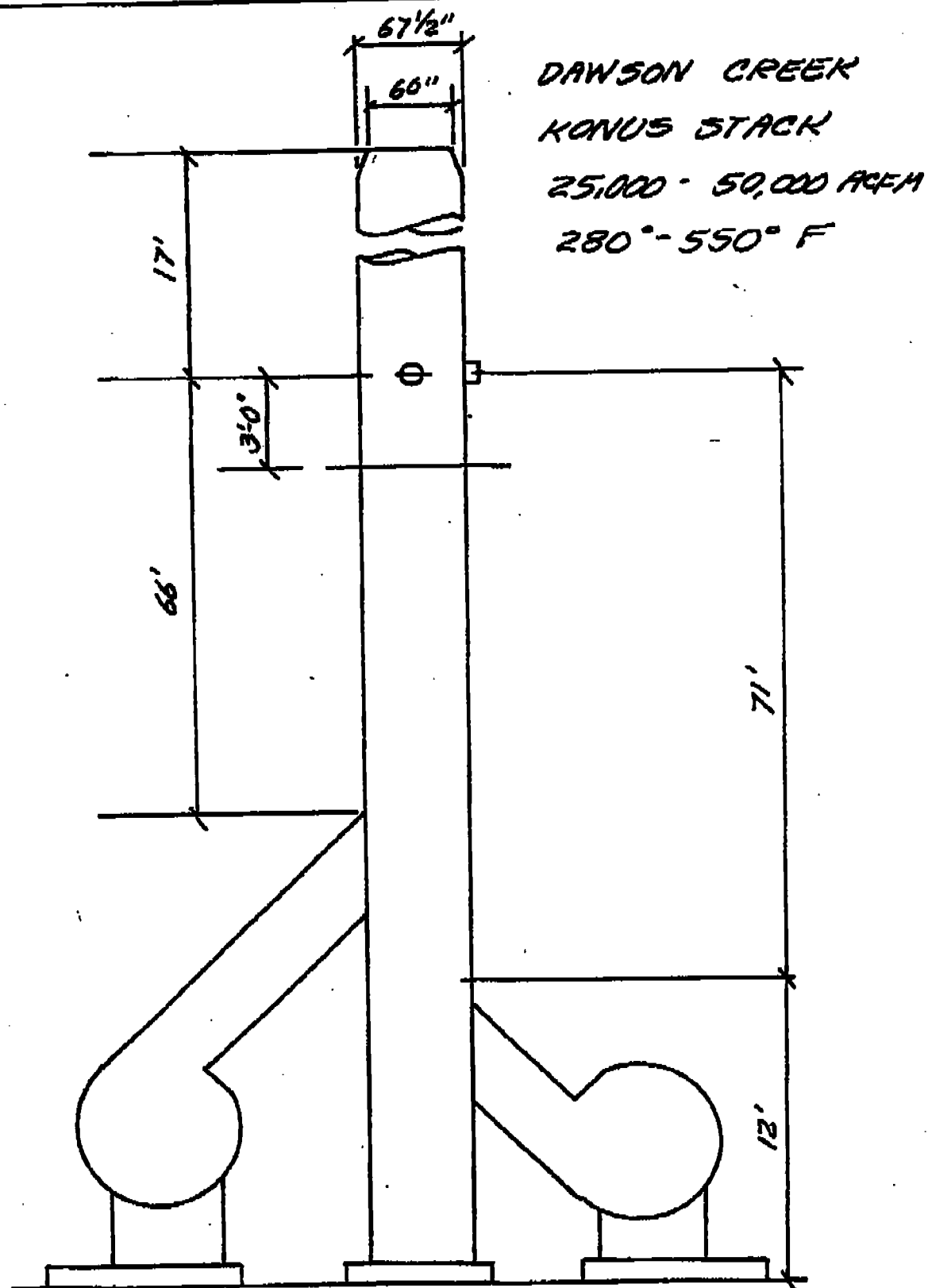
Date of Determination.....	09-23-93
Time of Determination.....(HRS)	827
Barometric pressure.....(IN.HG)	27.58
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	67.5
Duct area.....(SQ.FT)	24.85
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.123
Avg. gas temp.....(DEG-F)	465
Moisture content.....(% V/V)	11.05
Avg. linear velocity.....(FT/SEC)	12.6
Gas density.....(LB/ACF)	.03895
Molecular weight.....(LB/LBMOLE)	29.82
Mass flow of gas.....(LB/HR)	43743
Volumetric flow rate.....	
actual.....(ACFM)	18717
dry standard.....(DSCFM)	8757





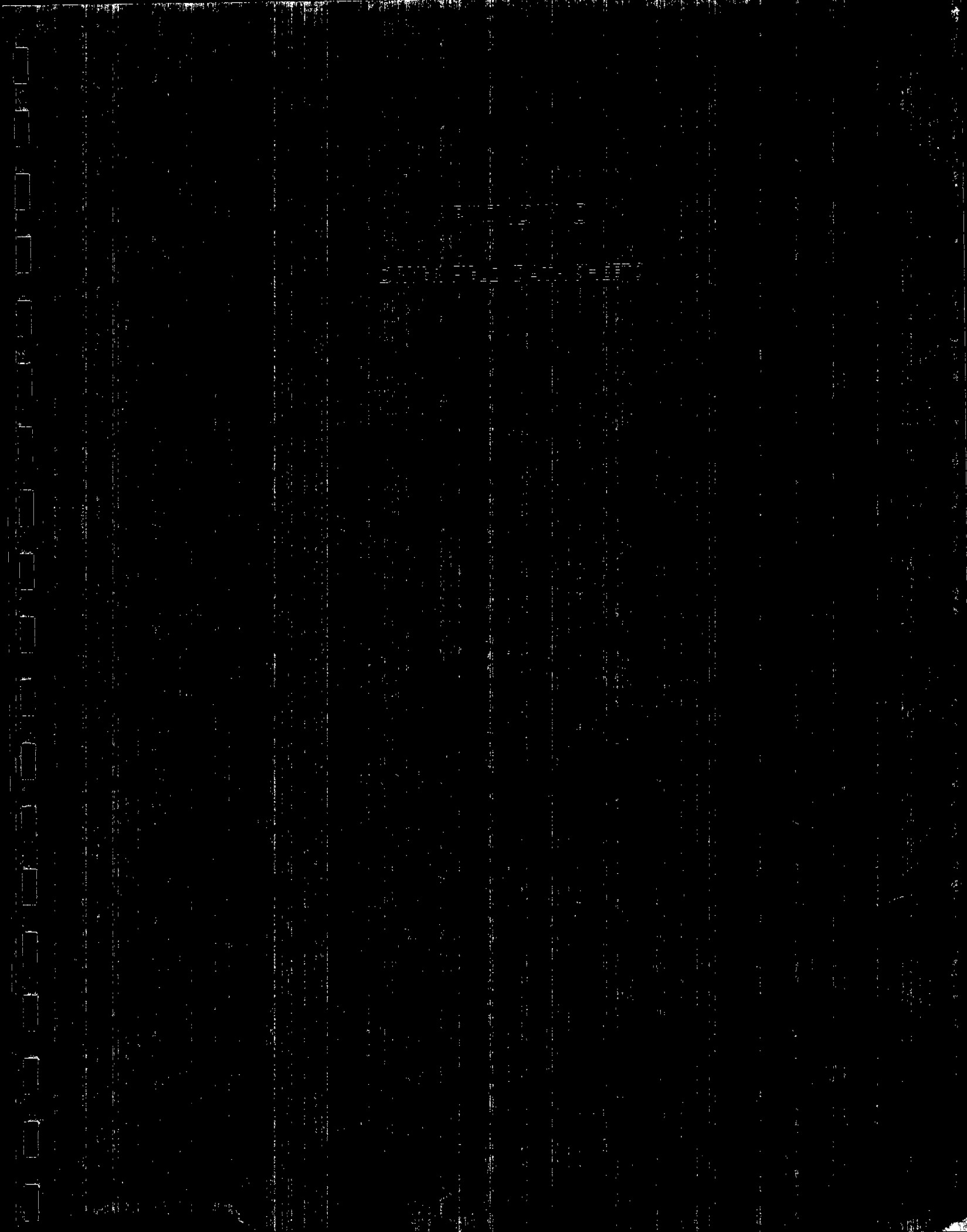
9-15-93
N.T.S.

PLAN VIEW9-15-93
N.T.S.



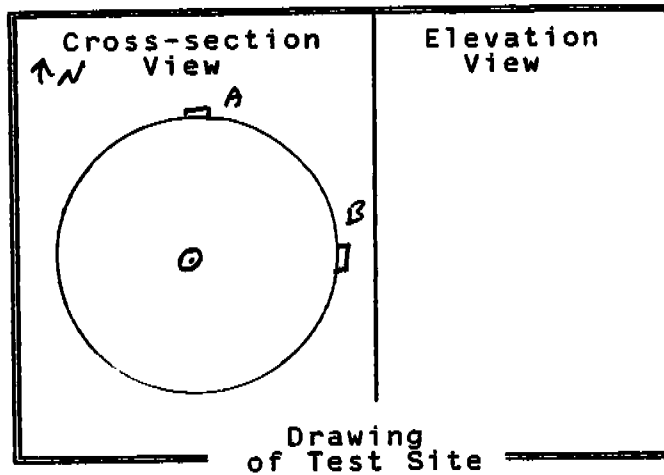
9-15-93
N.T.S.





INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
Source Surface Dryer / stack
Test 1 Run 0 Date 9-21-93
Stack dimen. 47.5 IN.
Dry bulb 236 °F Wet bulb 150 °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.76 in Hg
Static pressure -7.68 in WC
Operators M. Kaehler & S. Bergstrom
Pitot No. 29V-4 Cp .94



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 3 in.	Time start: 0813 hrs		
A-1	.044	2.09	5.09	.62	
2	.146	6.94	9.94	.99	
3	.296	14.06	17.06	1.19	
4	.704	33.44	36.44	1.30	1
5	.854	40.57	43.57	1.45	
6	.956	45.41	48.41	1.55	238
B-1				1.08	↓
2				1.44	
3				1.38	
4				1.29	
5				1.40	
6				1.40	
		76.87 ft/sec			
		56764 ACFM			
		31905 DSCFM			
Temp. meas. device & S/N: PDT-1/TC				Time end: 0818 hrs	

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 9-21-93 Test 1 Run 1
 Source Surface Dryer / Stack No. of traverse points 12
 Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 2 0.02 cfm at 12 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ 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	700	474	226
Impinger No. 2			
Impinger No. 3			
Condenser <u>Mech. Rinse</u>	666	264	
Desiccant	1390	1376	14
Total			240

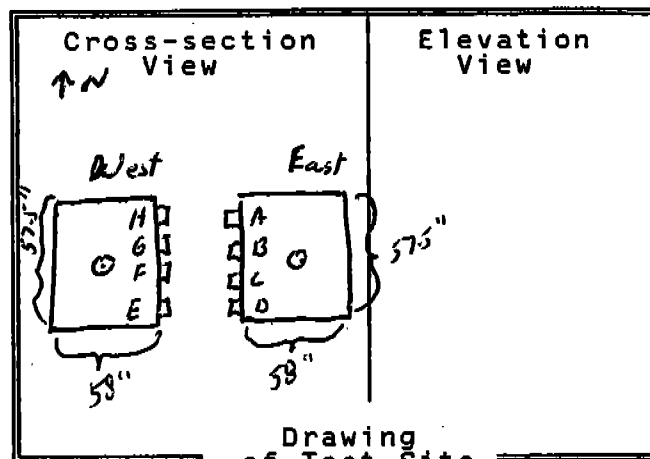
Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 23 Bag No. 1
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 0935 (HRS) Time end: 0938 (HRS)
 Sampling rate: 400 cc/min Operator: McKachlar
 S/N of O₂ Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

Job L.P. / Dawson Creek, B.C.
Source Press Vent / Stack
Test 5 Run 0 Date 9-22-95
Stack dimen. 58 x 57.5 IN.
Dry bulb 105 °F Wet bulb _____ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.61 in Hg
Static pressure -63 in WC
Operators M. Kachlen & S. Bergstrom
Pitot No. 2905 Cp .84



FAST

[illegible]

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.

Source Press Vent / Stack

Test 5 Run 0 Date 9-22-93

Stack dimen. 50 X 57.5 IN.

Dry bulb 103 °F Wet bulb °F

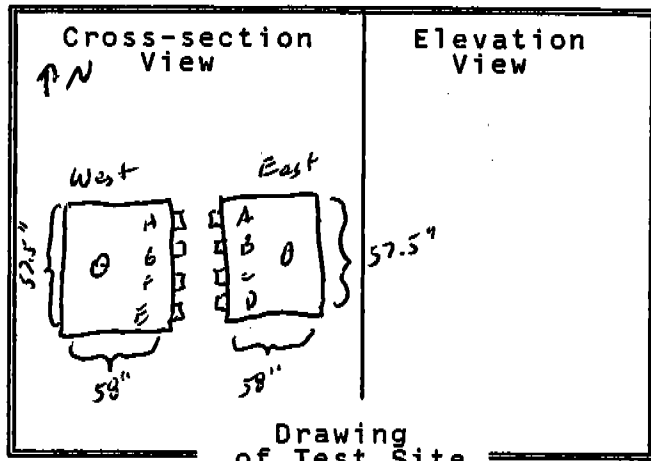
Manometer: ☒ Reg. ☒ Exp. ☐ Elec.

Barometric pressure 27.61 in Hg

Static pressure 7.93 in WC

Operators M. Kähler & J. Bergstrom

Pitot No. 2AV-5 Cp .84



Drawing
of Test Site

WEST

Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas ($^{\circ}$ F)
		Port length:	2 in.	Time start:	hrs
E - 1		9.25	9.25	.05	
2		21.75	23.75	.46	
3		36.25	38.25	.47	
4		50.75	52.75	.51	
F - 1				.42	
2				.50	
3				.69	
4				.47	
G - 1				.55	
2				.43	
3				.52	
4				.47	
H - 1				.05	
2				.69	
3				.48	
4				.25	
Temp. meas. device & S/N: PDT-1/TC				Time end: 0940 hrs	

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 9-22-93 Test 5 Run 1
 Source Press Ventral Stacks No. of traverse points 32
 Method DC11 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: { 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 0.02 cfm at 10 in. Hg. (vac) ☒

Particulate Catch Data: NA

No. of filters used: _____ 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	47.3	472	1
Impinger No. 2			
Impinger No. 3			
Condenser <u>He C12</u>	735	473	
Desiccant	1459	1447	12
Total			13

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

CF-023

S-0046RR

INTERPOL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C. Operator McKuchley, J.S. Berwick Pitot No. 246-5 CP EV
 Source Press Vent / Streets Meter Box No. 4 Bar. Press. 27.61 inHg 2 X
 Date 5-22-93 Computer Code 9967 Nozzle No. 5-4 Nozzle Dia. 2.53 in.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inHg)	Drifts Meter (inHg)	Des. Vol. (cf)	VAC. inHg	Temperature (°F)					Oxygen (xv/v)	
							Stack	Probe	Duct	Ingr.	Gas In		Gas Out
E-4	42.5	990.80	.55	1.71	0.82	5	105	258	260	42	69	63	20.9
3	45	992.37	.37	1.16	2.40	3.5	98				70	63	
2	47.5	994.25	.52	1.64	4.28	5	95	255	258	43	71	63	
1	50	994.83	.05	.15	4.87	2	104				68	63	
F-4	52.5	996.80	.54	1.68	6.76	5	104	253	261	43	70	64	
3	55	999.10	.85	2.64	9.14	8.5	105				65	63	
2	57.5	1001.32	.72	2.26	1.34	8	95	256	258	44	66	63	
1	60	1003.10	.43	1.33	3.04	8	103				67	63	
G-4	62.5	1004.98	.53	1.65	4.92	5	100	259	260	44	68	63	
3	65	1006.57	.37	1.15	6.50	3	102				70	64	
2	67.5	1008.35	.47	1.46	8.27	4	105	260	263	44	70	64	
1	70	1009.72	.32	1.00	9.74	3	103				71	64	
H-4	72.5	1010.73	.13	.41	0.68	2	100	257	265	43	69	64	
3	75	1011.99	.23	.73	1.94	2	94				69	65	
2	77.5	1013.63	.38	1.20	3.55	2.5	94	258	262	43	70	65	
1	80	1014.30	.10	.31	4.38	2	102				70	65	↓
(1152)													
Avg. = 64.7													
V _s = 50.90													
θ = 80													

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 8-22-93 Test 5 Run 2
 Source Press Vent / Stacks No. of traverse points 32
 Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: { 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 0.02 cfm at 10 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ 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	469	469	-
Impinger No. 2			
Impinger No. 3			
Condenser <u>Me Cl₂</u>	697	469	
Desiccant	1480	1466	14
Total			14

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

CF-023

S-0046RR

Job L.P. Dawson Grech
 Supt's Dress Vent / Stacks
 Date 9-12-93 Run 2
 5

Degruturs M. Saeple & J. Bergstrom
 Water Box No. 9 172 IN WC
 Cominator Coalt. 9967
 Pitut No. 2405 LP
 Sur. Press. 1766 IN HG
 Nozle No. 8-4 Nozle Dia 235 IN.

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[illegible]

Job	L.P. / Dawson Creek, B.C.
Source	Press Vent / Stacks
Date	9-22-93
	1991
	Run
	2

[illegible]

Pilot No. 240-5 Cp 04
Bar. Press. 27.61 in Hg H2O 1.2 x
Nozzle No. 8-2 Nozzle Dia. 1.25 in.

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[illegible]

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 9-22-93 Test 5 Run 3
 Source Press Vent / Stacks No. of traverse points 32
 Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 12 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: 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	469	470	(1)
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1470	1459	11
Total			10

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

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INTERPOL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
 Survey Grass Vent / Stacks
 Date 9-22-93 1961 5 Run 3
 Operator McKeeley & J. Bessstrom
 Water Box No. 4 HN 1.22 IN HC
 Compressor Cyl. 9967
 Pitot No. 29V-5 Cp 0.1
 Bar. Press. 27.61 IN Hg H2O 7.3
 Nozzle No. 0-4 Nozzle Dia. 239 IN.

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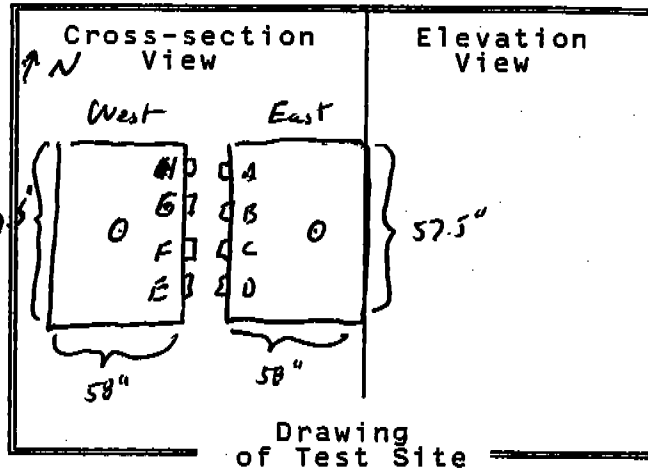
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S-0037R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
Source Press Vent / Stack
Test 6 Run 0 Date 9-22-93
Stack dimen. 58 x 57.5 IN.
Dry bulb 105 °F Wet bulb °F
Manometer: ☐ Reg. ☐ Exp. ☐ Elec.
Barometric pressure in Hg
Static pressure in WC
Operators M. Kecklen & J. Benson
Pitot No. 29V-6 C_p .04

[illegible]

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P./Dawson Creek, BC
 Source Press Vent / Stack
 Method Phenol Filter holder: 4" Glass

Date 9-26-93 Test 6 Run 1
 No. of traverse points 4
 Filter type: 4" GT.

Sample Train Leak Checks:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 13 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ Recovery solvent(s) _____

☐ acetone _____
☐ other(s) _____

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

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. <u>A</u>	<u>262</u>	<u>266</u>	<u>(4)</u>
Impinger No. <u>B</u>	<u>268</u>	<u>265</u>	<u>3</u>
Impinger No. 3			
Condenser			
Desiccant	<u>1350</u>	<u>1337</u>	<u>13</u>
Total			<u>12</u>

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

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INTERPOL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job 2.P. / Dawson Creek, B.C.
Source Press Vent / Stueh
Date 9-22-92 Test 6 Run 1

Operator(s) M. Kuehler + J. Bergstrom
Meter Box No. 5 Gasmeter coef. 1.9980
 ΔH 1.77 in.WC Bar. press 27.61 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg.
Posttest: 0.02 cfm at 13 in. Hg.

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Drift. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)
					Probe	Oven	Impg.	Gas/In	Gas/Out	
	(1014)	10.60								
F-2	5	14.45	1.77	8	253	246	39	60	59	20.9
2	10	18.25	1.77	8	256	252	39	62	59	
2	15	22.13	1.77	8	255	257	39	65	59	
1	20	25.98	1.77	8	259	256	40	67	59	
1	25	29.83	1.77	8	263	254	40	69	60	
1	30	33.67	1.77	8	260	258	40	70	60	
B-2	35	37.52	1.77	8	262	255	40	70	60	
2	40	41.30	1.77	8	259	259	40	71	61	
2	45	45.25	1.77	8	255	262	41	72	61	
1	50	49.13	1.77	8	257	262	41	72	62	
1	55	53.01	1.77	8	256	264	41	72	62	
1	60	56.84	1.77	8	253	266	42	66	62	✓
	(1130)									
	$\theta = 60$	$V_m = 46.24$	$(\Delta H)_{avg} = 1.77$					$(t_m)_{avg} = 64.17$		

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers A	262	266	(4)
Condenser B	268	265	3
Desiccant	1350	1337	13
	Total		12

Preliminary results of SO ₂ concentration determination		
V _{std}	=	DSCF
Moisture	=	1.30 %v/v
SO ₂ , dry	=	ppm
SO ₂ , wet	=	ppm
LB/MMBtu	=	

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek BC
 Source Press Vent / Stack
 Method Phenol Filter holder: 4" Glass

Date 9-22-93 Test 6 Run 2
 No. of traverse points 4
 Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☐
 Posttest: 20.02 cfm at 13 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ Recovery solvent(s) _____

_____ ☐ acetone _____
 _____ ☐ other(s) _____

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

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. <u>A</u>	<u>260</u>	<u>266</u>	<u>(6)</u>
Impinger No. <u>B</u>	<u>266</u>	<u>264</u>	<u>2</u>
Impinger No. 3			
Condenser			
Desiccant	<u>1301</u>	<u>1368</u>	<u>13</u>
	<u>1</u>		
Total			<u>9</u>

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

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INTERPOLL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job L.P. / Dawson Creek, BC
Source Press Vent / Stack
Date 9-22-93 Test B Run 2

Operator(s) McKachler & J. Benstrom
Meter Box No. 5 Gas meter coef. 9900
 ΔH 1.77 in.WC Bar. press 22.01 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg.

Posttest: 0.02 cfm at 12 in. Hg.

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)
					Probe	Oven	Impg.	Gas/In	Gas/Out	
	(1142)	57.20								
B-2	5	61.08	1.77	8	247	260	43	64	62	10.9
2	10	64.95	1.77	8	244	262	43	68	62	1
2	15	68.93	1.77	8	248	257	44	70	62	
1	20	72.70	1.77	8	253	261	44	72	63	
1	25	76.58	1.77	8	255	259	44	73	63	
1	30	80.43	1.77	8	256	260	43	74	64	
F-2	35	84.28	1.77	8	259	262	43	74	64	-
2	40	88.14	1.77	8	257	262	43	75	64	
2	45	92.00	1.77	8	255	261	43	75	65	
1	50	95.90	1.77	8	257	263	43	75	65	
1	55	99.78	1.77	8	252	260	43	75	66	
1	60	103.65	1.77	8	255	257	43	73	66	✓
	(1245)									
	$\theta = 60$	$V_m = 46.45$	$(\Delta H)_{ave} = 1.77$					$(t_m)_{ave} = 69.08$		

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers <u>A</u>	<u>260</u>	<u>266</u>	<u>(6)</u>
Condenser <u>B</u>	<u>266</u>	<u>264</u>	<u>2</u>
Desiccant	<u>1381</u>	<u>1368</u>	<u>13</u>
	Total		<u>9</u>

Preliminary results of SO ₂ concentration determination		
V_{std}	=	DSCF
Moisture	=	.98 %v/v
SO ₂ , dry	=	ppm
SO ₂ , wet	=	ppm
LB/MMBtu	=	

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, BC
 Source Process Vent / Stack
 Method Thermal Filter holder: 4"6/6cs

Date 9-26-93 Test 6 Run 3
 No. of traverse points 4
 Filter type: 4"6.1F

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 10.02 cfm at 13 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ Recovery solvent(s) _____

_____ ☐ acetone _____
 _____ ☐ other(s) _____

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

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. <u>1</u>	<u>260</u>	<u>266</u>	<u>(6)</u>
Impinger No. <u>2</u>	<u>268</u>	<u>264</u>	<u>4</u>
Impinger No. 3			
Condenser			
Desiccant	<u>1363</u>	<u>1350</u>	<u>13</u>
Total			<u>11</u>

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

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INTERPOLL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job L.P. / Dawson Creek, BC
Source Press Vent / Stack
Date 9-26-93 Test #6 Run 3

Operator(s) Mr. Koehler & J. Bergstrom
Meter Box No. 5 Gasmeter coef. .9980
 ΔH 1.77 in.WC Bar. press 22.61 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. 8
Posttest: 0.02 cfm at 13 in. Hg. 8

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Drift. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen
					Probe	Oven	Impg.	Gas/In	Gas/Out	(%v/v)
	(1255)	104.20								
F-2	5	108.08	1.77	8	247	258	43	67	65	20.9
2	10	111.93	1.77	8	245	259	43	71	65	
2	15	115.77	1.77	8	249	262	43	73	65	
1	20	119.63	1.77	8	253	262	43	74	65	
1	25	123.49	1.77	8	255	260	44	74	65	
1	30	127.35	1.77	8	255	257	44	75	66	
B-2	35	131.22	1.77	8	258	256	44	75	66	
2	40	135.09	1.77	8	256	259	43	75	66	
2	45	138.96	1.77	8	254	262	42	76	66	
1	50	142.83	1.77	8	255	258	42	76	66	
1	55	146.72	1.77	8	253	261	42	76	67	
1	60	150.55	1.77	8	250	255	42	76	67	
	(1356)									
	$\theta = 60$	$V_m = 46.35$	$(\Delta H)_{avg} = 1.77$					$(t_m)_{avg} = 69.88$		

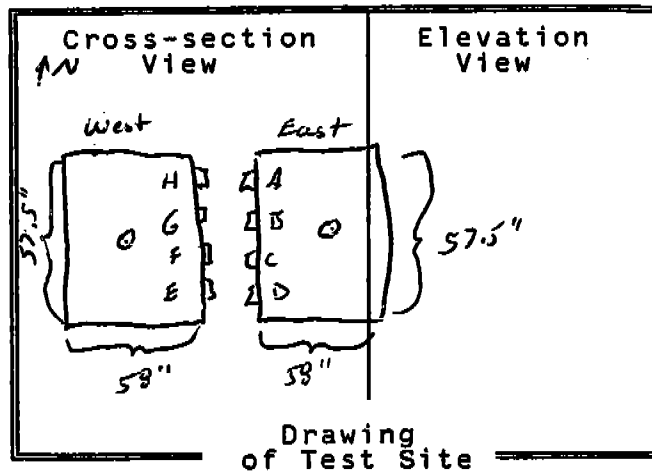
Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers	260	266	(6)
Condenser	268	264	4
Desiccant	1363	1350	13
		Total	11

Preliminary results of SO ₂ concentration determination	
V _{std}	= DSCF
Moisture	= 1.20 %v/v
SO ₂ , dry	= ppm
SO ₂ , wet	= ppm
LB/MMBtu	=

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
Source Press Vent / Stacks
Test #7 Run 0 Date 9-22-93
Stack dimen. 50 X 57.5 IN.
Dry bulb 105 °F Wet bulb °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.61 in Hg
Static pressure -.93 / -.63 in WC
Operators A. Gachler & J. Bergstrom
Pitot No. 29V-5 C_p .84

[illegible]

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek B.C. Date 9-22-93 Test 2 Run 1
 Source Press Vent / Stacks No. of traverse points 32
 Method MDI Filter holder: ERC Filter type: 2.5" G.F.

Sample Train Leak Checks:

Pretest: { 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 7 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

Treated MDI ☐ acetone
☒ other(s) Me. Cl₂

No. of probe wash bottles: 1
 Sample recovered by: M. Kachler & J. Bergstrom

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser	<u>3</u>	<u>0</u>	<u>3</u>
Desiccant	<u>1492</u>	<u>1480</u>	<u>12</u>
Total			<u>15</u>

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

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INTERPOL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job h.p. / Dawson Creek B.C. Operator Mr. Kuehler + J. Renshaw Pitot No. MDI-5 Cp 0.0
Source Press Vent / Stacks Meter Box No. 9 Bar. Press. 27.67 inHg H₂O 1 x
Date 9-22-93 Computer Config. 9967 Nozzle No. 27-1 Nozzle Dia 1.38 in.

Page 2 of 2

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Des. Vol. (cf)	VAC. inHg	Temperature (°F)						Oxygen (xv/v)
							Stack	Probe	Duct	Ingr.	Gas/In	Gas/Out	
D-4	34	150.46	.38	1.21	0.52	2	109	Ambient	43	78	71	20.9	
3	36	151.30	.13	.41	1.28	2	107			78	72		
2	38	152.65	.45	1.43	2.70	2	111		44	79	72		
1	40	154.16	.50	1.62	4.10	2.5	100		44	80	72		
C-4	42	155.77	.53	1.72	5.76	2.5	99			80	72		
3	44	157.20	.44	1.40	7.16	2	111			80	72		
2	46	158.74	.51	1.65	8.68	2	102		45	81	72		
1	48	160.13	.43	1.39	9.08	2	102			81	73		
B-4	50	161.52	.42	1.35	1.46	2	107		45	81	72		
3	52	162.91	.51	1.63	2.97	2	109			81	73		
2	54	164.52	.55	1.77	4.55	2.5	105		45	81	73		
1	56	166.17	.59	1.97	6.17	2.5	113			82	73		
A-4	58	167.05	.16	.51	7.02	2	107		45	80	72		
3	60	168.51	.53	1.68	8.56	2	111			83	74		
2	62	170.80	.47	1.52	9.03	2	103		45	82	73		
1	64	171.29	.35	1.12	1.29	2	108	↓		82	76	↓	
(1718)													

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C.
 Source Press Vent / Stacks
 Method MDI Filter holder: ERC

Date 9-22-93 Test 7 Run 2
 No. of traverse points 32
 Filter type: 2.5" 6.F.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 0.02 cfm at 7 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

Treated MDI ☐ acetone
☒ other(s) MeCl₂

No. of probe wash bottles: 1
 Sample recovered by: M. Kaehler & J. Bergstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser	<u>3</u>	<u>0</u>	<u>3</u>
Desiccant	<u>1375</u>	<u>1363</u>	<u>12</u>
Total			<u>15</u>

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

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INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
 Employer Press Plant / Stash
 Date 9-22-93 Run 2

D **M** **C** **E** **N** **T**

Mr. J. Bernstein
HQ 6-22-67

Pitot No. 2911-5 Cp 102
 Bar. Press. 27.61 in Hg H2L
 Nozzle No. 0-4 Nozzle Dia. 2.2

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[illegible]

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job A.P. / Dawson Creek, B.C. Date 9-22-93 Test 7 Run 3
 Source Press Vent / Stacks No. of traverse points 32
 Method MDI Filter holder: ERC Filter type: 2.5" G.F.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 0.02 cfm at 7 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

Treated MDI

☐ acetone
☒ other(s) MeCl₂

No. of probe wash bottles: 1
 Sample recovered by: M. Kuehler + J. Bergstrom

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser	<u>3</u>	<u>0</u>	<u>3</u>
Desiccant	<u>1483</u>	<u>1470</u>	<u>13</u>
Total			<u>16</u>

Integrated Gas Sampling Data: NA / Ambient

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

S/N of O₂ Analyzer used to monitor train outlet: _____

CF-023

Job L.P./ Dawson Creek, B.C.
 SOUTHERN Poss Vent / Stacks
 DATE 9-27-93 RUN 3

Operator M. Kuchler + J. Bergstrom
 Pitot No. 29V-5 CP '84
 Water Box No. 9 IN HC in HQ
 Hose No. 622 Bar. Press. 27.61 H₂O 16"
 Compressor Count. 9962 Nozzle No. 8-7 NOZZLE DIA. .239 IN

[illegible]

Job L.P. / Dawson Creek B.C.
 Source Press Vent / Stacks
 Date 9-22-97 161 5 RU

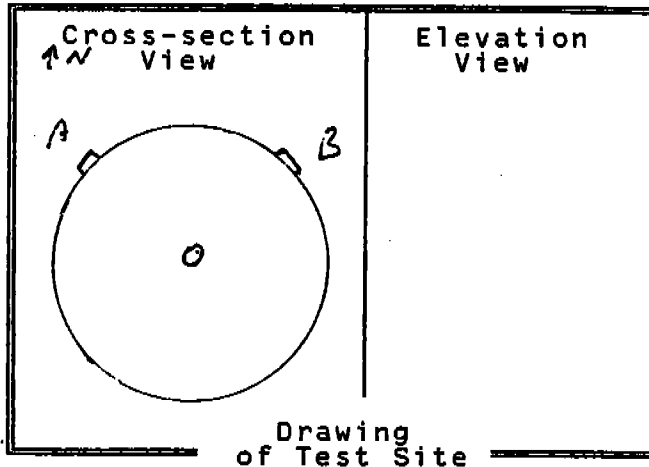
Operators Mr. Kaehle & J. Bongstrom
 Water Box No. 9 2nd 1st 1st 1st
 Condenser Code: 9967 1st 1st 1st 1st
 Pitot No. 2905 Cp .89
 Bar. Press. 27.61 inHg 20 1.6 2
 Nozzle No. 8-4 Nozzle Dia. .139 in.

Job L.P. / Dawson Creek B.C.
 Source Press Vent / Stacks
 Date 9-22-97 161 5 RU

[illegible]

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job R.P. Dawson Creek, 13L
Source No. 1 Kanus / Stack
Test 9 Run 0 Date 9-23-93
Stack dimen. 67.5 IN.
Dry bulb 46.5 °F Wet bulb 103 °F
Manometer: ☐ Reg. ☒ Exp. ☐ Elec.
Barometric pressure 27.50 in Hg
Static pressure -1.123 in WC
Operators M. Kachler + J. Benetrom
Pitot No. 79U-6 Cp 84

[illegible]

INTERPOL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, BC Date 9-23-93 Test 9 Run 1
 Source No. 1 Road / Stack No. of traverse points 12
 Method 5 Filter holder: 4" G.I. Filter type: 4" G.I.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 7 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

5700 ☒ acetone
☐ other(s)

No. of probe wash bottles: 1
 Sample recovered by: M. Kaehler & J. Bergstrom

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	<u>574</u>	<u>501</u>	<u>73</u>
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	<u>1490</u>	<u>1483</u>	<u>7</u>
Total			<u>80</u>

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 26 Bag No. 1
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 0910 (HRS) Time end: 1012 (HRS)
 Sampling rate: 400 cc/min Operator: M. Kaehler
 S/N of O₂ Analyzer used to monitor train outlet: 3

CF-023

Job L.P. / Dawson Creek, BC
 Source Abel / Homes / Strach
 Date 9-23-93 1991 9 Run 1
 Operators McKeeley, J. Benson
 Water Box No. 2 HW 1.72 NWC
 Computer Code 9902
 Pilot No. 290-6 Cp 84
 Bar. Press. 22.78 inHg H2O 3 x
 Nozzle No. 8-88 Nozzle Dia 450 in.

[illegible]

INTERPOL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek BC Date 9-23-93 Test 9 Run 2
 Source No. 1 Road / Stack No. of traverse points 12
 Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 19 in. Hg. (vac) ☒

Particulate Catch Data:

No. of filters used: _____ Recovery solvent(s) _____

5784 ☒ acetone _____
☐ other(s) _____

No. of probe wash bottles: 1
 Sample recovered by: Michael T. Bertram

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	<u>638</u>	<u>496</u>	<u>142</u>
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	<u>1402</u>	<u>1381</u>	<u>21</u>
Total			<u>163</u>

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 26 Bag No. 2
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1047 (HRS) Time end: 1149 (HRS)
 Sampling rate: 400 cc/min Operator: Michael
 S/N of O₂ Analyzer used to monitor train outlet: 9

CF-023

Job L.P. / Dawson Creek, B.C.
Source du / Kanus / Stash
Date 9-23-93 1951 9 Run 2

Operators McKaeblent J. Bergstrom
Water Box No. 9 111 1.72 IN NO
Compressor code. 29967

Pitot No. 29V-6 CP 184
Bar. Press. 27.58 IN Hg H2O 12.5 X
Nozzle No. 8-10 Nozzle ID 649 IN.

[illegible]

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek B.C. Date 9-23-93 Test 9 Run 3
 Source W. I. Korus / Stuck No. of traverse points 12
 Method 5 Filter holder: 4"6/acc Filter type: 4"6.F.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) 6
 Posttest: 20.02 cfm at 17 in. Hg. (vac) 8

Particulate Catch Data:

No. of filters used: _____ Recovery solvent(s) _____

_____ ☒ acetone _____
 _____ ☐ other(s) _____

No. of probe wash bottles: 1
 Sample recovered by: Michael & T. Beaton

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	<u>627</u>	<u>496</u>	<u>131</u>
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	<u>1500</u>	<u>1490</u>	<u>10</u>
Total			<u>141</u>

Integrated Gas Sampling Data:

Bag Pump No. 244 Box No. 26 Bag No. 3
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1207 (HRS) Time end: 1310 (HRS)
 Sampling rate: 400 cc/min Operator: Michael
 S/N of O₂ Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

Job L.P. / Dawson Creek, B.C.
 Source
 Date 1961 9 HUN 3
 Operators Mikuehler & J. Berzovsky
 Meter Box No. 9 HUN 672 IN NG
 Gasometer conf. 9967
 Pitot No. 24V-6 Cp 84
 Bar. Press. 27.56 in Hg H2O 24.7 x
 Nozzle No. 9-10 Nozzle Dia .640 IN.

[illegible]

Sub L.P. / Dawson Creek, B.C.
 SURF Surface Drayer / Stack
 Date 9-21-93 1 HUN 1

Operators M. Kuehler + J. Bergstrom
 Water Box No. 9 SH 1.77 N NE
 Computer cost. 9962

Pilot No. 290-4 CP 84
 Bar. Press. 27.26 IN Hg 120
 Nozzle No. 8-4 Nozzle Dia. .332 IN.

[illegible]

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 9-21-93 Test 1 Run 2
 Source Surface Dryer / Stack No. of traverse points 12
 Method 0011 Filter holder: 4-glass NA Filter type: NA

Sample Train Leak Check:

Pretest: { 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 2 0.02 cfm at 11 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ 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	712	475	237
Impinger No. 2			
Impinger No. 3			
Condenser <u>Mech. Rinse</u>	676	264	
Desiccant	1480	1462	18
Total			255

Integrated Gas Sampling Data:

Bag Pump No. 294 Box No. 23 Bag No. 2
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1025 (HRS) Time end: 1129 (HRS)
 Sampling rate: 400 cc/min Operator: M. Kachler
 S/N of O₂ Analyzer used to monitor train outlet: 9

CF-023

0000 L.P. / Dawson Creek B.C.
0500100 Surface Dryer / 5 Stack Run 2
0010 9-21-93 1

Operator _____
Meter Box No. 9
Compressor Code: 9967

Pilot No. 290-4 CP 10Y
 Bar. Press. 27.26 IN Hg H2O 10.31
 Nozzle No. 0-4 Nozzle Dia. 2.32 IN.

[illegible]

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 9-21-93 Test 1 Run 3
 Source Surface Dryer / Stack No. of traverse points 12
 Method 0011 Filter holder: NA Filter type: NA

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 12 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ 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	690	472	218
Impinger No. 2			
Impinger No. 3			
Condenser Net Cl. Rinse	738 670	263	
Desiccant	1422	1390	32
Total			250

Integrated Gas Sampling Data:

Bag Pump No. 294 Box No. 23 Bag No. 3
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1215 (HRS) Time end: 1318 (HRS)
 Sampling rate: 400 cc/min Operator: M. Kachler
 S/N of O₂ Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

Job L.P. / Dawson Creek, B.C.
 Surface Surface Drier / 5' x 1'
 Date 9-21-93 1061 1

X **A** **T** **E** **R**

NO. 1003
MAY 1964

Kachler + J
9-111-9967

1.77 2N 1N 2N
Bensford

Pitt
Bur.
Noriz

$$\begin{array}{r} 290 \\ 27.7 \\ \hline 262.3 \end{array}$$

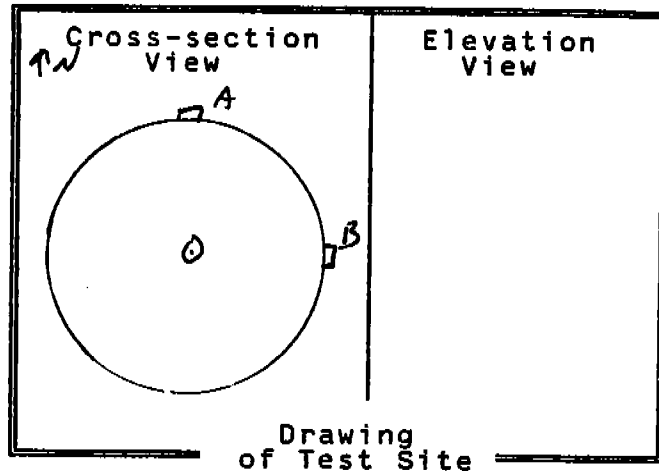
2 in H₂ H₂O
Nozzle Dia. 1.5

$$\begin{array}{r} 19.4 \times \\ \underline{239} 111. \end{array}$$

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (in H ₂ O)	Drifted Meter (in H ₂ O)	Dis. Vol. (cf)	VAC. in Hg	Temperature (°F)				Gas/Dist	Dwyer (xv/v)
							Stack	Probe	Dye	Imp.		
13-6	5	899.70	1.39	2.48	4.28	8	238	263	265	40	64	17.6
5	10	904.25	1.41	2.52	8.91	9	238	259	265	40	64	17.5
4	15	908.91	1.26	2.26	3.30	8.5	238	260	261	40	65	17.5
3	20	917.93	1.38	2.48	2.91	9	238	263	257	41	66	17.7
2	25	922.58	1.43	2.58	2.61	9	238	261	257	41	68	17.4
1	30	926.20	1.05	1.90	6.66	7	236	262	255	40	67	17.3
A-6	35	931.63	1.53	2.77	15.4	10	236	262	253	41	67	17.3
5	40	936.42	1.52	2.73	6.38	10	240	261	250	41	68	17.4
4	45	940.99	1.34	2.42	0.95	9	240	260	247	42	68	17.4
3	50	945.23	1.14	2.06	5.17	7	239	257	253	42	69	17.5
2	55	949.15	.99	1.79	9.11	6	239	259	256	43	70	17.6
1	60	952.93	.86	1.57	2.80		236	256	258	43	70	17.3
(1318)												
Avg. = 70.0												

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
Source Surface Dryer / Stack
Test 2 Run 0 Date 9-21-93
Stack dimen. 47.5 IN.
Dry bulb 236 °F Wet bulb 150 °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.76 in Hg
Static pressure - .69 in WC
Operators M. Kachler + J. Bergstrom
Pitot No. 29V-4 C_p .84

[illegible]

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek B.C. Date 9-21-93 Test 2 Run 1
 Source Surface Driller / Stach No. of traverse points 3
 Method Panel Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 13 in. Hg. (vac) ☒

Particulate Catch Data: NA

No. of filters used: _____ 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	405	266	139
Impinger No. 2	332	264	68
Impinger No. 3	270	268	2
Condenser			
Desiccant	1354	1338	16
Total			225

Integrated Gas Sampling Data:

Bag Pump No. 29B Box No. 5 Bag No. 1
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 0835 (HRS) Time end: 0939 (HRS)
 Sampling rate: 400 cc/min Operator: M. Kaphler
 S/N of O₂ Analyzer used to monitor train outlet: 3

CF-023

INTER-CELL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job L.P. / Dawson Creek, B.C.
Source Surface Drier / Stack
Date 9-21-95 Test 2 Run 1

Operator(s) M. Kaehler & J. Bergstrom
Meter Box No. 5 Gas meter coef. 9980
 ΔH_0 1.77 in.WC Bar. press 27.76 in.Hg

Sample Train Leak Checks:

Pretest: < 0.02 cfm at 15 in. Hg. 8
Posttest: 0.02 cfm at 13 in. Hg. 8

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Drift Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)
					Probe	Oven	Impg.	Gas/In	Gas/Out	
	0935	705.30								
A-3	5	709.08	1.77	8.5	270	261	37	44	41	17.5
3	10	712.84	1.77	8.5	263	260	37	48	41	17.1
3	15	716.59	1.77	9	258	263	37	52	42	17.5
3	20	720.36	1.77	9.5	258	260	37	55	42	17.4
2	25	724.17	1.77	10	255	264	39	57	43	17.5
2	30	727.97	1.77	10	257	261	38	59	44	17.5
B-2	35	731.81	1.77	10	259	256	38	57	45	17.4
2	40	735.50	1.77	10	263	258	38	59	46	17.5
1	45	739.20	1.77	11	260	262	39	60	46	17.2
1	50	743.10	1.77	12	258	263	39	62	48	17.3
1	55	746.88	1.77	12	255	265	39	62	48	17.3
1	60	750.70	1.77	12	255	262	40	62	48	17.4
	(0939)									
	$\theta = 60$	$V_m = 45.40$	$(\Delta H)_{avg} = 1.77$					$(t_m)_{avg} = 50.46$		

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers 1	405	266	139
Condenser 2	332	264	68
3	270	268	2
Desiccant	1354	1338	16
		Total	225

Preliminary results of SO ₂ concentration determination	
V _{total}	= DSCF
Moisture	= 19.55 %v/v
SO ₂ , dry	= ppm
SO ₂ , wet	= ppm
LB/MMBtu	=

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C.
 Source Surface Dryer / Stack
 Method Phenol Filter holder: 4" Glass

Date 9-21-93 Test 2 Run 2
 No. of traverse points 3
 Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: { 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 17 in. Hg. (vac) ☒

Particulate Catch Data: NA

No.s of filters used: _____ 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	426	267	159
Impinger No. 2	310	263	47
Impinger No. 3	269	264	5
Condenser			
Desiccant	1374	1355	19
Total			230

Integrated Gas Sampling Data:

Bag Pump No. 29B Box No. 5 Bag No. 2
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1025 (HRS) Time end: 1129 (HRS)
 Sampling rate: 400 cc/min Operator: W. Kaeller
 S/N of O₂ Analyzer used to monitor train outlet: 3

CF-023

INTERIM ALL LABORATORIES
EPA Method 4 and 6 Field Data Sheet

Job L.P. / Dawson Creek, B.C.
Source Surface Dryer / Stack
Date 9-21-93 Test 2 Run 2

Operator(s) M. Kasper + J. Bergstrom
Meter Box No. 5 Gasmeter coef. 1.180
 ΔH 1.77 in.WC Bar. press 22.76 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. 8
Posttest: < 0.02 cfm at 17 in. Hg. 8

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Drift Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)
					Probe	Oven	Impg.	Gas/In	Gas/Out	
	1025	751.10								
B-3	5	754.99	1.77	11.5	259	260	40	53	52	17.5
3	10	758.85	1.77	12	262	257	40	56	52	17.1
3	15	762.60	1.77	12	263	259	39	59	52	16.9
3	20	766.40	1.77	12.5	258	261	38	60	53	17.0
2	25	770.20	1.77	13	257	262	38	62	54	17.1
2	30	774.02	1.77	13.5	257	260	39	63	54	16.9
A-2	35	777.81	1.77	14	250	262	39	60	55	17.0
2	40	781.73	1.77	14	255	261	39	63	55	17.0
1	45	785.51	1.77	14.5	257	264	39	64	56	17.0
1	50	789.30	1.77	15	258	263	39	64	56	17.0
1	55	793.10	1.77	15.5	255	260	40	64	57	16.9
1	60	796.90	1.77	15.5	257	260	40	64	57	17.0
	(1129)									
	$\theta = 60$	$V_{m} = 75.80$	$(\Delta H)_{avg} = 1.77$					$(t_m)_{avg} = 57.71$		

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers 1	426	267	159
Condenser 2	310	263	47
3	269	264	5
Desiccant	1374	1355	19
		Total	230

Preliminary results of SO ₂ concentration determination	
V _{std}	= DSCF
Moisture	= 19.98 %v/v
SO ₂ , dry	= ppm
SO ₂ , wet	= ppm
LB/MMBtu	=

INTERPOL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C.
 Source Surface Dryer / Stack
 Method Phenol Filter holder: 4 1/8 inch

Date 9-21-93 Test 2 Run 3
 No. of traverse points 3
 Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: 0.02 cfm at 15 in. Hg. (vac) 8
 Posttest: < 0.02 cfm at 13 in. Hg. (vac) 8

Particulate Catch Data: NA

No.s of filters used: _____ 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	<u>417</u>	<u>266</u>	<u>151</u>
Impinger No. 2	<u>311</u>	<u>263</u>	<u>48</u>
Impinger No. 3	<u>269</u>	<u>264</u>	<u>5</u>
Condenser			
Desiccant	<u>1370</u>	<u>1354</u>	<u>16</u>
Total			<u>220</u>

Integrated Gas Sampling Data:

Bag Pump No. 29B Box No. 5 Bag No. 3
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1215 (HRS) Time end: 1319 (HRS)
 Sampling rate: 400 cc/min Operator: M. Kaehler
 S/N of O₂ Analyzer used to monitor train outlet: 3

CF-023

EPA Method 4 and 6 Field Data Sheet

Job L.P. / Dawson Creek, B.C.
 Source Surface Dryer / Stack
 Date 9-21-93 Test 2 Run 3

Operator(s) Michael & J. Berstrom
 Meter Box No. 5 Gasmeter coef. 9980
 ΔH 1.77 in.WC Bar. press 27.76 in.Hg

Sample Train Leak Checks:

Pretest: < 0.02 cfm at 15 in. Hg.

Posttest: 60.02 cfm at 13 in. Hg.

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Drift Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)
					Probe	Oven	Impg.	Gas/In	Gas/Out	
	(1215)	797.50								
A-3	5	801.38	1.77	8	260	255	41	59	59	17.1
3	10	805.26	1.77	8.5	257	259	41	65	60	17.1
3	15	809.07	1.77	8.5	258	260	40	69	60	17.2
3	20	812.85	1.77	9	256	262	40	71	60	17.3
2	25	816.65	1.77	9	259	263	40	72	61	16.9
2	30	820.49	1.77	9	262	260	39	73	62	16.9
B-2	35	824.76	1.77	9	257	262	39	69	62	16.8
2	40	828.18	1.77	9.5	260	259	40	73	63	16.8
1	45	831.98	1.77	10	256	263	40	74	63	16.9
1	50	835.73	1.77	10	254	265	41	74	63	17.0
1	55	839.52	1.77	10	257	261	41	74	64	17.0
1	60	843.25	1.77	11	255	260	41	73	64	16.8
	(1319)									
	$\theta = 60$	$V_{\text{std}} = 75.75$	$(\Delta H)_{\text{avg}} = 1.77$					$(t_m)_{\text{avg}} = 66.13$		

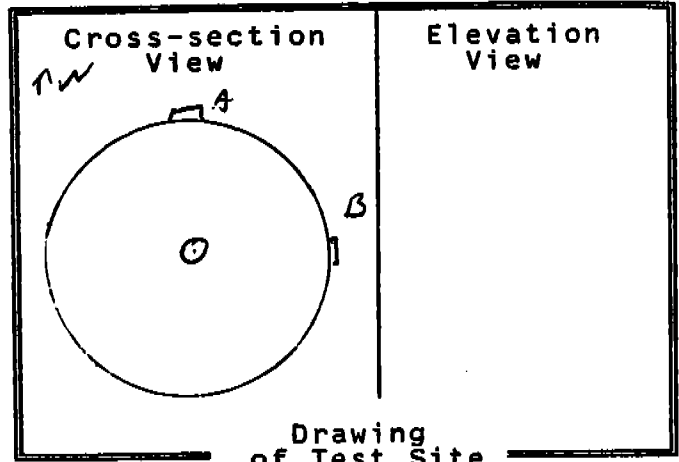
Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers 1	417	266	151
Condenser 2	311	263	48
3	269	264	5
Desiccant	1370	1354	16
	Total		220

Preliminary results of SO ₂ concentration determination	
V _{std}	= DSCF
Moisture	= 19.55 %v/v
SO ₂ , dry	= ppm
SO ₂ , wet	= ppm
LB/MMBtu	=

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L. P. / Dawson Creek, B.C.
Source Surface Dryer / Stack
Test 3 Run 0 Date 9-21-93
Stack dimen. 47.5 IN.
Dry bulb 236 °F Wet bulb 140 °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.76 in Hg
Static pressure -.68 in WC
Operators M. Kaehler + S. Bergstrom
Pitot No. 29V-4 Cp 184



Drawing of Test Site

[illegible]

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 9-21-93 Test 3 Run 1
 Source Surface Drager / Stack No. of traverse points 12
 Method 5 Filter holder: 4" G/ass Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 17 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5694 + 5695 Recovery solvent(s) ☒ acetone ☒ other(s) MeCl₂
 No. of probe wash bottles: 1
 Sample recovered by: M. Kaehler + J. Bergstrom

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	<u>723</u>	<u>497</u>	<u>226</u>
Impinger No. 2			
Impinger No. 3			
Condenser pH			
Desiccant	<u>1505</u>	<u>1480</u>	<u>25</u>
Total			<u>251</u>

Integrated Gas Sampling Data:

Bag Pump No. 29B Box No. 1 Bag No. 1
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1420 (HRS) Time end: 1525 (HRS)
 Sampling rate: 400 cc/min Operator: M. Kaehler
 S/N of O₂ Analyzer used to monitor train outlet: 3

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C.
 Source Surface Dryer / Stack
 Method 5 Filter holder: 4" Glass

Date 9-21-93 Test 3 Run 2
 No. of traverse points 12
 Filter type: 1" G.F.

Sample Train Leak Check:

Pretest: { 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 14 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

5697 ☒ acetone
☒ other(s) Me Cl₂

No. of probe wash bottles: 1
 Sample recovered by: M. Kaehler + J. Bergstrom

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	704	493	211
Impinger No. 2			
Impinger No. 3			
Condenser <u>1</u>	1432	1390 1422	10
Desiccant		773	
Total			221

Integrated Gas Sampling Data:

Bag Pump No. 29 B Box No. 1 Bag No. 2

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

Pretest leak check: 0 cc/min at 20 in. Hg.

Time start: 1622 (HRS) Time end: 1723 (HRS)

Sampling rate: 400 cc/min Operator: M. Kaehler

S/N of O₂ Analyzer used to monitor train outlet: 83

CF-023

JOB L.P. / Dawson Creek, B.C.
SURFERS Surface Dryer / Stand HUN 2
UNITS 8-21-53 3

C-19

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job L.P. / Dawson Creek, B.C. Date 9-21-93 Test 3 Run 3
 Source Surface Diver / Stack No. of traverse points 12
 Method 5 Filter holder: 4" Glas. Filter type: 4" G.F.

Sample Train Leak Checks:

Pretest: { 0.02 cfm at 15 in. Hg. (vac) ☒
 Posttest: 20.02 cfm at 17 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: Recovery solvent(s)

5698 ☒ acetone
☒ other(s) MeCl₂

No. of probe wash bottles: 1
 Sample recovered by: M. Koshler + J. Benstrom

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	<u>736</u>	<u>498</u>	<u>238</u>
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	<u>1527</u>	<u>1505</u>	<u>22</u>
Total			<u>260</u>

Integrated Gas Sampling Data:

Bag Pump No. 29B Box No. 1 Bag No. 3
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L
 Pretest leak check: 0 cc/min at 20 in. Hg.
 Time start: 1804 (HRS) Time end: 1905 (HRS)
 Sampling rate: 400 cc/min Operator: M. Koshler
 S/N of O₂ Analyzer used to monitor train outlet: 3

CF-023

Pittot No. 290-4 C4, 84
 800. Press. 27-76 10H9 H20 18 X
 NOZIL NO. 8-4 NOZIL DIB 235 IN.

S-0037R



1000

1000

1000

1000

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L.P. Dawson Creek B.C. Source Surface Dryer
 Team Leader MK Test Site Stack
 Date Submitted 10-1-93 Date of Test 9-21-93
 Test No. 1 No. of Runs Completed 3
 Date of Analysis 10-1-93 Technician C. Helgeson

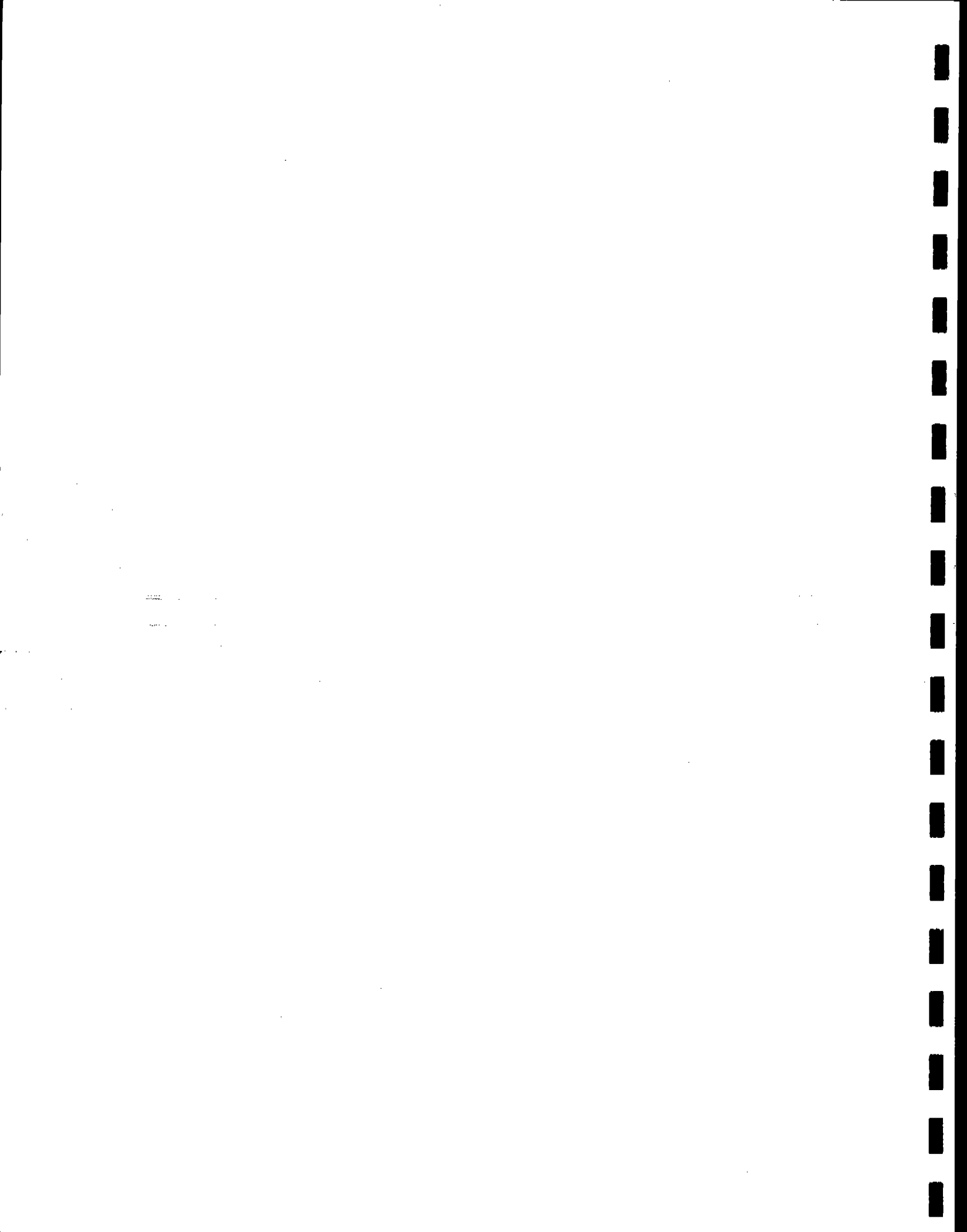
Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO ₂ %v/v Dry	Conc. O ₂ %v/v Dry	F _o
			Zero Pt.	After CO ₂	After O ₂			
1/1	1060-26 ☒ B ☐ F	1	0.00	3.20	20.80	3.20	17.60	1.03
		2	0.00	3.20	20.80	3.20	17.60	1.03
		Avg				3.20	17.60	
1/2	-07 ☒ B ☐ F	1	0.00	3.00	20.80	3.00	17.80	1.03
		2	0.00	3.00	20.80	3.00	17.80	1.03
		Avg				3.00	17.80	
1/3	-08 ☒ B ☐ F	1	0.00	3.00	20.70	3.00	17.70	1.07
		2	0.00	3.00	20.70	3.00	17.70	1.07
		Avg				3.00	17.70	
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						

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

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

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

EPA Method 3 Guidelines	
Fuel Type	F _o Range
Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
Wood/Wood Bark	1.000-1.130



EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L. P. Dawson Creek B.C. Source Surface Dryer
Team Leader MK Test Site Stack
Date Submitted 10-1-93 Date of Test 9-21-93
Test No. 2 No. of Runs Completed 3
Date of Analysis 10-1-93 Technician C. Helgeson

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO ₂ %v/v Dry	Conc. O ₂ %v/v Dry	F _o
			Zero Pt.	After CO ₂	After O ₂			
2/1	1060-36 ☒ B ☐ F	1	0.00	3.20	20.80	3.20	17.60	1.03
		2	0.00	3.20	20.80	3.20	17.60	1.03
		Avg				3.20	17.60	
2/2	-37 ☒ B ☐ F	1	0.00	3.00	20.80	3.00	17.80	1.03
		2	0.00	3.00	20.80	3.00	17.80	1.03
		Avg				3.00	17.80	
2/3	-38 ☒ B ☐ F	1	0.00	3.00	20.70	3.00	17.70	1.07
		2	0.00	3.00	20.70	3.00	17.70	1.07
		Avg				3.00	17.70	
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						
	☐ B ☐ F	1						
		2						
		Avg						

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

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

EPA Method 3 Guidelines
Fuel Type F_o Range

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

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



EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L.P. Dawson Creek B.C. Source Surface Dryer
 Team Leader MK Test Site Stack
 Date Submitted 10-1-93 Date of Test 9-21-93
 Test No. 3 No. of Runs Completed 3
 Date of Analysis 10-1-93 Technician _____

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO ₂ %v/v Dry	Conc. O ₂ %v/v Dry	F _o
			Zero Pt.	After CO ₂	After O ₂			
3/1	1060-15 □ B □ F	1	0.00	2.90	20.70	2.90	17.80	1.07
		2	0.00	2.90	20.70	2.90	17.80	1.07
		Avg				2.90	17.80	
3/2	-17 □ B □ F	1	0.00	2.90	20.80	2.90	17.90	1.03
		2	0.00	2.90	20.80	2.90	17.90	1.03
		Avg				2.90	17.90	
3/3	-19 □ B □ F	1	0.00	3.00	20.80	3.00	17.80	1.03
		2	0.00	3.00	20.80	3.00	17.80	1.03
		Avg				3.00	17.80	
	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
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	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						

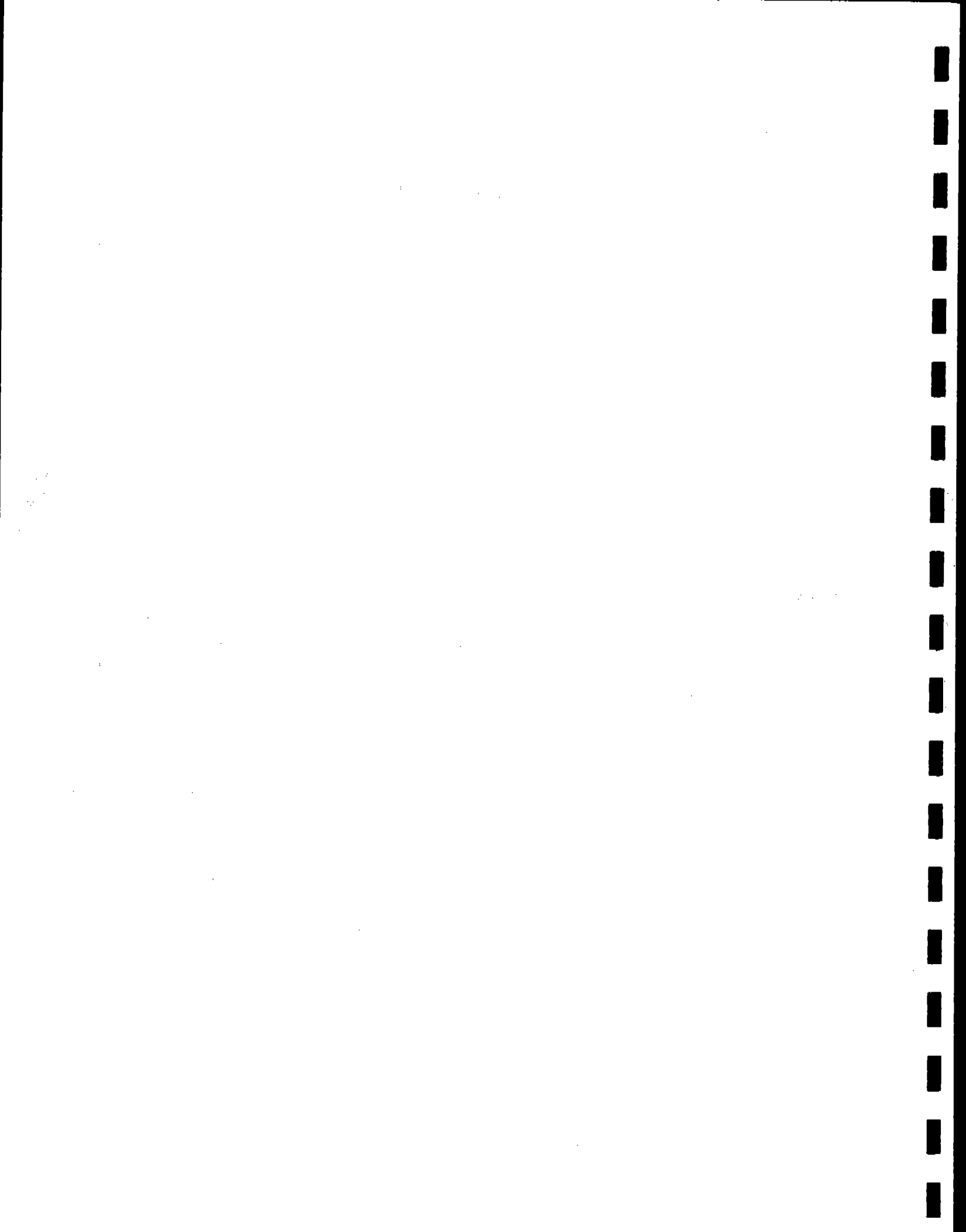
- ☒ Ambient Air QA Check
☒ Orsat Analyzer System Leak Check
☐ F_o Within EPA M-3 Guidelines
 for fuel type.

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

EPA Method 3 Guidelines
Fuel Type F_o Range

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

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



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EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job L.P. Dawson Creek B.C. Source #1 Konus
Team Leader MA Test Site Stack
Date Submitted 10-1-93 Date of Test 9-23-93
Test No. 9 No. of Runs Completed 3
Date of Analysis 10-1-93 Technician C. Helgeson

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO ₂	Conc. O ₂	F ₀
			Zero Pt.	After CO ₂	After O ₂	%v/v Dry	%v/v Dry	
9/1	1060-31 □ B □ F	1	0.00	8.50	20.01	8.50	11.60	1.09
		2	0.00	8.50	20.01	8.50	11.60	1.09
		Avg				8.50	11.60	
9/2	-33 □ B □ F	1	0.00	9.10	20.10	9.10	11.00	1.09
		2	0.00	9.10	20.10	9.10	11.00	1.09
		Avg				9.10	11.00	
9/3	-35 □ B □ F	1	0.00	9.10	20.10	8.60	11.50	1.09
		2	0.00	9.10	20.10	8.66	11.50	1.09
		Avg				8.60	11.50	
	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						
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		2						
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		2						
		Avg						
	□ B □ F	1						
		2						
		Avg						

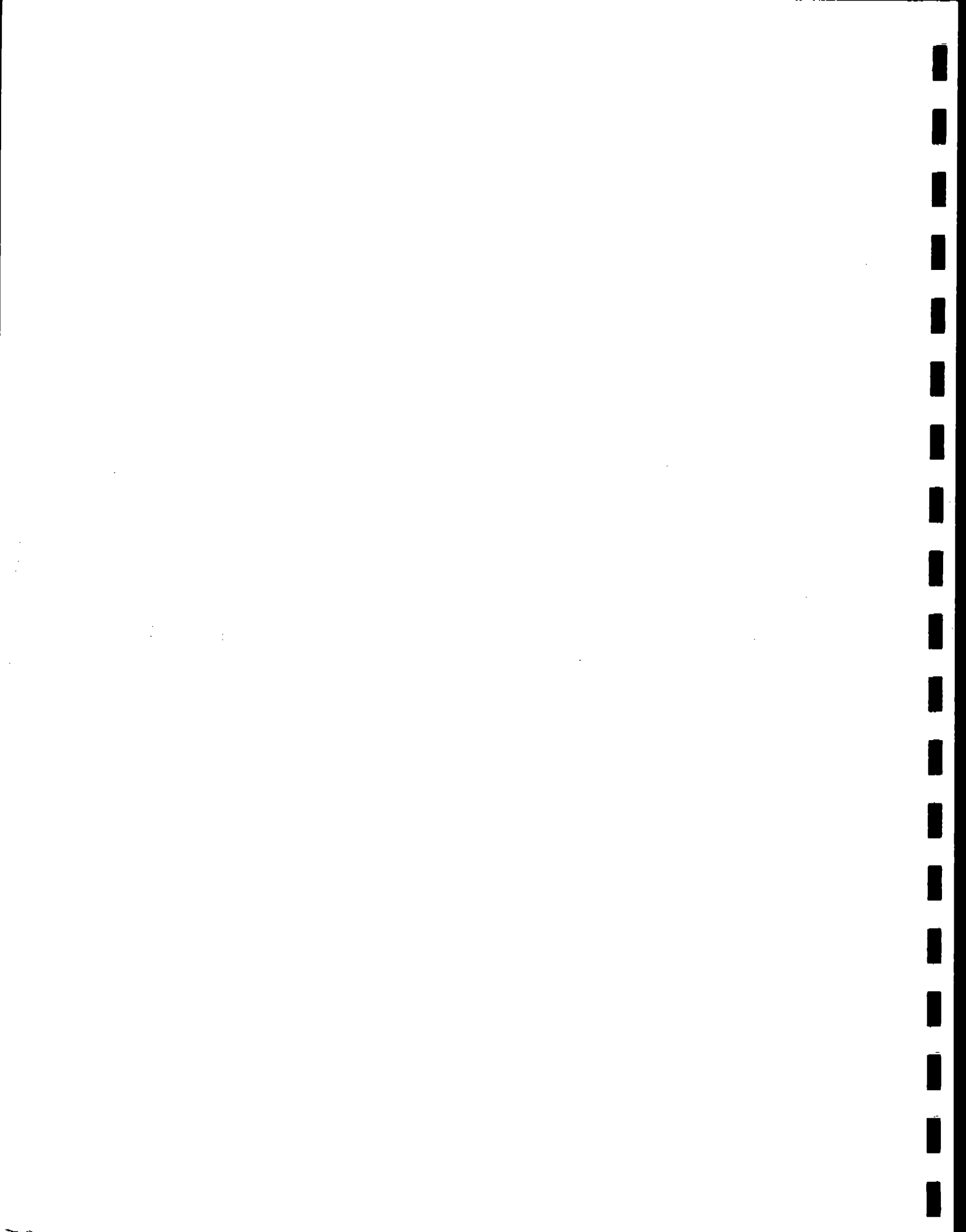
- ☒ Ambient Air QA Check
☒ Orsat Analyzer System Leak Check
☐ F₀ Within EPA M-3 Guidelines
for fuel type.

Where $F_0 = \frac{20.9 - O_2}{CO_2}$

EPA Method 3 Guidelines

Fuel Type	F ₀ Range
Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
Wood/Wood Bark	1.000-1.130

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



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EPA Method 5 Data Reporting Sheet
Impinger Catch/Wisconsin Protocol

Job L.P. Dawson Creek Source Surface Dryer
Team Leader MK Test Site Stack
Date Submitted 10-8-93 Date of Test 9-21-93
Test No. 3 No. of Runs Completed 3
Date of Analysis 10-13-93 Technician C. Helgeson

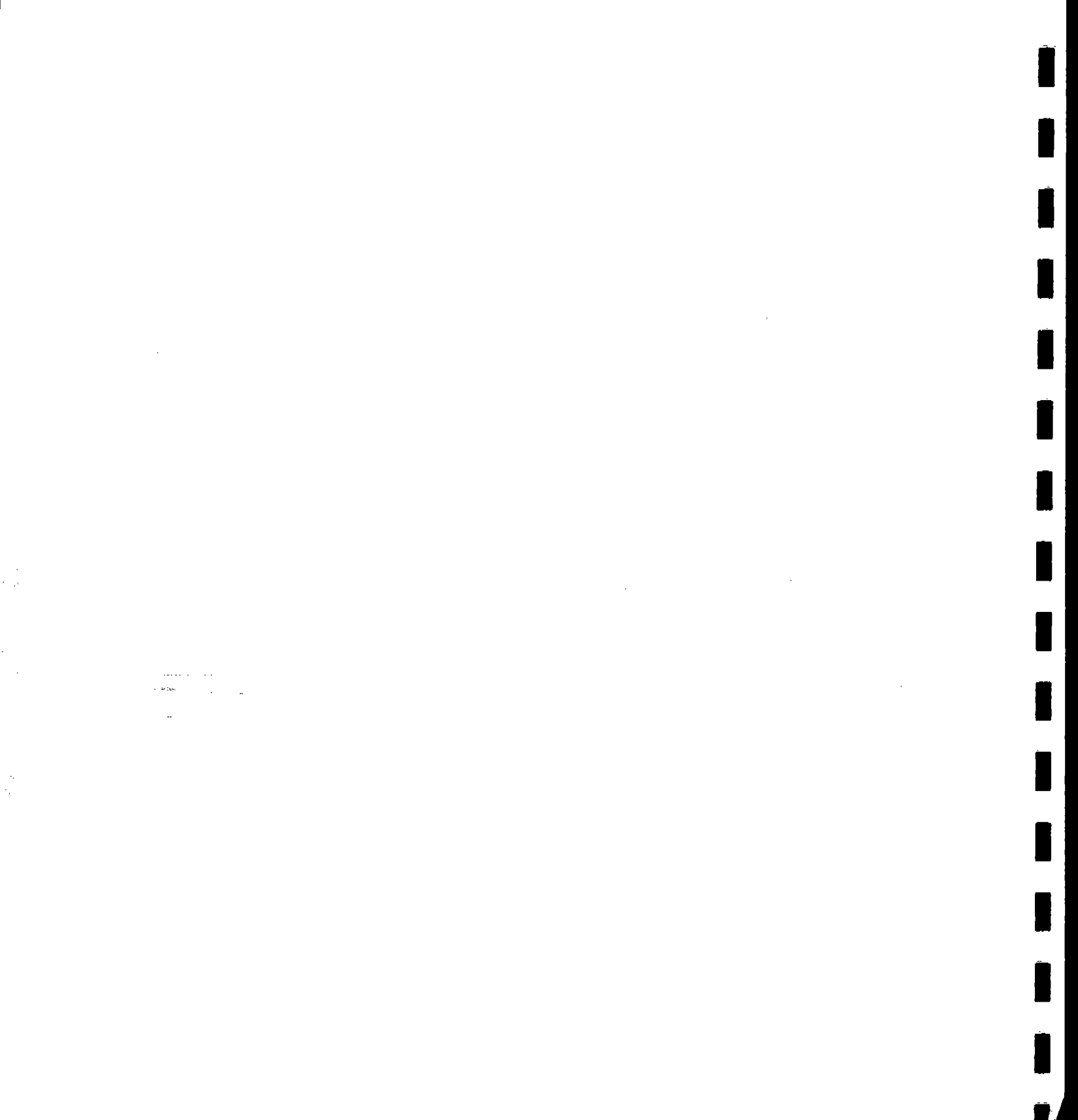
	Solvent Phase	Aqueous Phase
0	Test <u>3</u> Run <u>0</u> Field Blank Log Number <u>1060-13I</u> Comments _____	Dish No. <u>5</u> Dish Tare Wt. <u>50.6821</u> g Dish+Sample Wt. <u>50.6824</u> g Sample Wt. <u>0.0003</u> g
		Dish No. <u>19</u> Dish Tare Wt. <u>48.9572</u> g Dish+Sample Wt. <u>48.9581</u> g Sample Wt. <u>0.0009</u> g
1	Test <u>3</u> Run <u>1</u> Log Number <u>-14I</u> Comments _____	Dish No. <u>6</u> Dish Tare Wt. <u>48.2713</u> g Dish+Sample Wt. <u>48.3194</u> g Sample Wt. <u>0.0481</u> g
		Dish No. <u>22</u> Dish Tare Wt. <u>51.3603</u> g Dish+Sample Wt. <u>51.4972</u> g Sample Wt. <u>0.1369</u> g
2	Test <u>3</u> Run <u>2</u> Log Number <u>-16I</u> Comments _____	Dish No. <u>7</u> Dish Tare Wt. <u>50.0161</u> g Dish+Sample Wt. <u>50.0478</u> g Sample Wt. <u>0.0317</u> g
		Dish No. <u>23</u> Dish Tare Wt. <u>46.0844</u> g Dish+Sample Wt. <u>46.1961</u> g Sample Wt. <u>0.1117</u> g
3	Test <u>3</u> Run <u>3</u> Log Number <u>-18I</u> Comments _____	Dish No. <u>12</u> Dish Tare Wt. <u>48.1481</u> g Dish+Sample Wt. <u>48.1867</u> g Sample Wt. <u>0.0386</u> g
		Dish No. <u>38</u> Dish Tare Wt. <u>48.6497</u> g Dish+Sample Wt. <u>48.7809</u> g Sample Wt. <u>0.1312</u> g
4	Test _____ Run _____ Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
		Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
		Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

Results Solvent Phases:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0003	0.0478	0.0314	0.0383		

Results Aqueous Phases:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0009	0.1360	0.1108	0.1303	F=5	



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EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job L.P. / Dawson Creek Source Surface Dryer
Team Leader MK Test Site Stack
Date Submitted 10-8-93 Date of Test 9-21-93
Test No. 3 No. of Runs Completed 3
Date of Analysis 10-11-93 Technician B. Duke
Transport Leakage ☒ None ☐ _____ ml Solvent Acetone

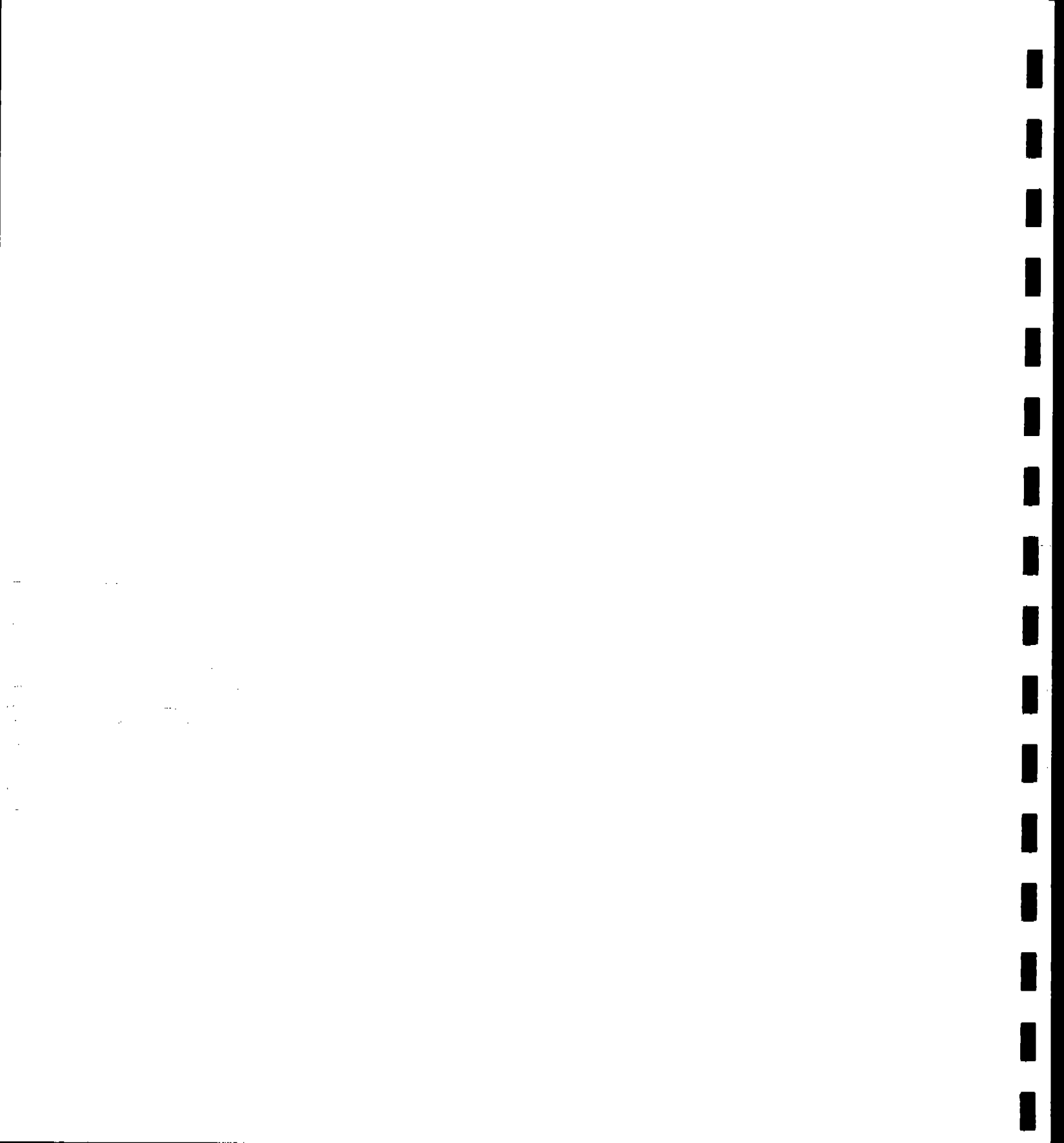
0	Test <u>3</u> Run <u>0</u> Field Blank Log Number <u>1060-13P</u> Vol. of Solvent <u>100</u> ml *Solvent Residue <u>2.0</u> ug/ml	Dish No. <u>40</u> Dish Tare Wt. <u>47.6425</u> g Dish+Sample Wt. <u>47.6427</u> g Sample Wt. <u>0.0002</u> g
1	Test <u>3</u> Run <u>1</u> Vol. of Solvent <u>140</u> ml Log Number <u>-14P</u> Comments _____	Dish No. <u>41</u> Dish Tare Wt. <u>45.3214</u> g Dish+Sample Wt. <u>45.4382</u> g Sample Wt. <u>0.1168</u> g
2	Test <u>3</u> Run <u>2</u> Vol. of Solvent <u>140</u> ml Log Number <u>-16P</u> Comments _____	Dish No. <u>46</u> Dish Tare Wt. <u>42.4262</u> g Dish+Sample Wt. <u>42.5531</u> g Sample Wt. <u>0.1269</u> g
3	Test <u>3</u> Run <u>3</u> Vol. of Solvent <u>140</u> ml Log Number <u>-18P</u> Comments _____	Dish No. <u>49</u> Dish Tare Wt. <u>46.8795</u> g Dish+Sample Wt. <u>46.9854</u> g Sample Wt. <u>0.1059</u> 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 2.0 ug/ml = [(Sample Wt. 0.0002 g) (100)] / Vol. of Sol. 100 ml
EPA-M5 Acetone Residue Blank Spec. {7.8 ug/ml

Results:

Field Blk. Run 1 Run 2 Run 3 Run 4 Run 5

0.0002	0.11656	0.12687	0.10567	#-6	
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EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

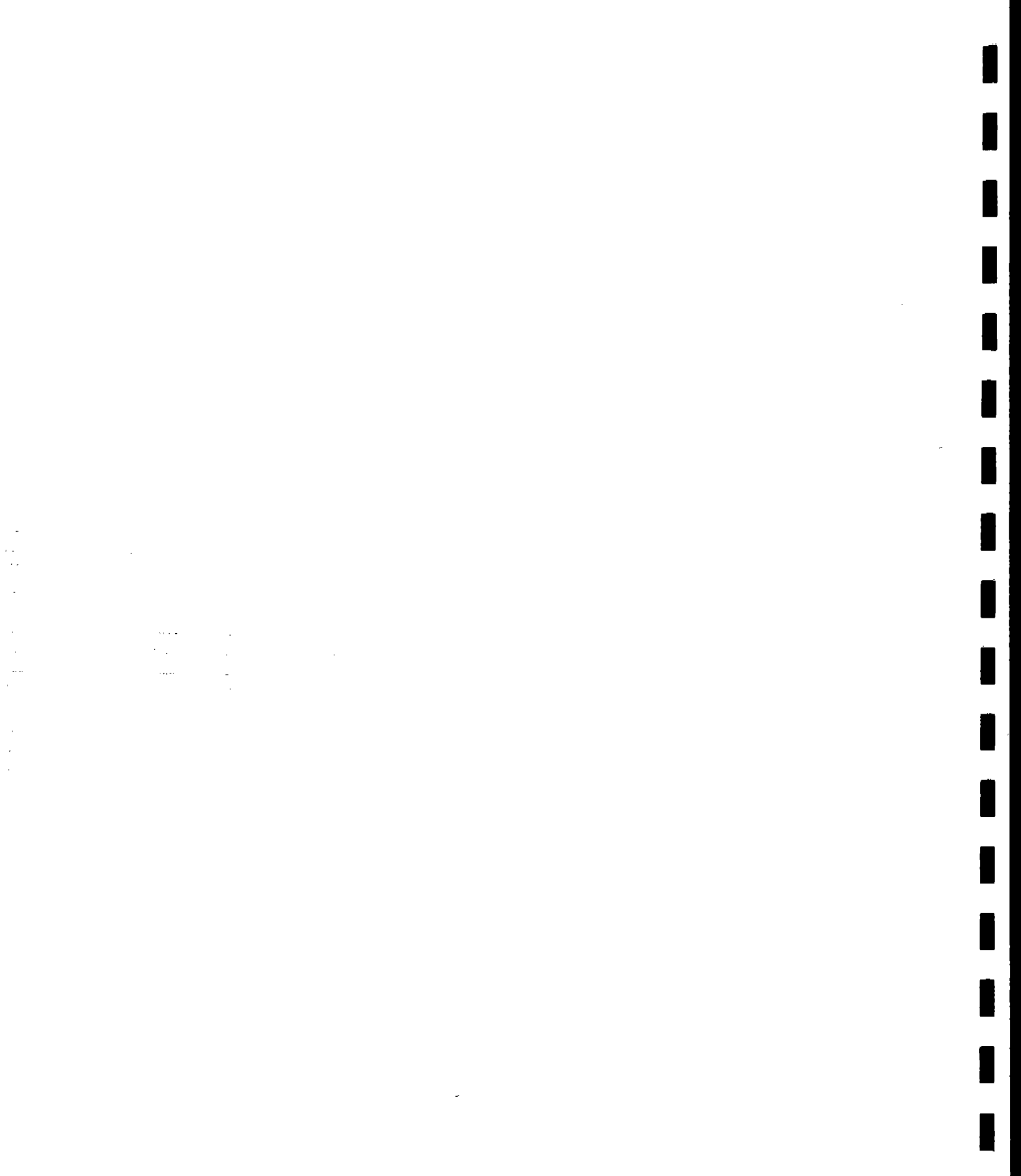
Job LP. / Dawson Creek, B.C. Source Surface Dryer
Team Leader MK Test Site Stack
Date Submitted 10-8-93 Date of Test 9-21-93
Test No. 3 No. of Runs Completed 3
Date of Analysis 10-11-93 Technician A. Dube

0	Test <u>3</u> Run <u>0</u> Field Blank Log Number <u>1060-13F</u> Comments _____	Filter No. <u>5699</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>.9177</u> g Filter+Sample Wt. <u>.9179</u> g Sample Wt. <u>.0002</u> g
1	Test <u>3</u> Run <u>1</u> Log Number <u>-14F</u> Comments <u>10F2</u>	Filter No. <u>5694</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>.9184</u> g Filter+Sample Wt. <u>1.1062</u> g Sample Wt. <u>0.1878</u> g
2	Test <u>3</u> Run <u>2</u> Log Number <u>-16F</u> Comments _____	Filter No. <u>5697</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>.9235</u> g Filter+Sample Wt. <u>1.2129</u> g Sample Wt. <u>0.2894</u> g
3	Test <u>3</u> Run <u>3</u> Log Number <u>-18F</u> Comments _____	Filter No. <u>5698</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>.9247</u> g Filter+Sample Wt. <u>1.2621</u> g Sample Wt. <u>0.3374</u> 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

	0.1878	0.2894	0.3374	F-7		
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EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job LP. / Dawson Creek, B.C. Source Surface Dryer
Team Leader mk Test Site Stack
Date Submitted 10- Date of Test 5-21-93
Test No. 3 No. of Runs Completed 3
Date of Analysis 10-11-93 Technician B. Dubé

0	Test <u>Run 0</u> Field Blank Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____g Filter+Sample Wt. _____g Sample Wt. _____g
1	Test <u>3</u> Run <u>1</u> Log Number <u>-14F</u> Comments <u>20F2</u>	Filter No. <u>5645</u> Filter Type <u>4" G-F</u> Filter Tare Wt. <u>.9167</u> g Filter+Sample Wt. <u>1.0831</u> g Sample Wt. <u>0.1664</u> g
2	Test _____ Run _____ Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____g Filter+Sample Wt. _____g Sample Wt. _____g
3	Test _____ Run _____ Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____g Filter+Sample Wt. _____g Sample Wt. _____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

	0.1664				
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Field Blk. Run 1 Run 2 Run 3 Run 4 Run 5

	0.6545	0.5582	0.6116		
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EPA Method ~~5~~ Data Reporting SheetImpinger Catch/~~Wisconsin~~ Protocol

Job L.P Dawson Creek Source #1 Kouns
 Team Leader MK Test Site Stack
 Date Submitted 10-8-93 Date of Test 9-23-93
 Test No. 9 No. of Runs Completed 3
 Date of Analysis 10-13-93 Technician C. Helgeson

		Solvent Phase	Aqueous Phase
0	Test <u>Run 0</u> Field Blank Log Number Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test <u>9</u> Run <u>1</u> Log Number <u>1060-301</u> Comments	Dish No. <u>14</u> Dish Tare Wt. <u>47.6591</u> g Dish+Sample Wt. <u>47.6633</u> g Sample Wt. <u>0.0042</u> g	Dish No. <u>43</u> Dish Tare Wt. <u>47.3881</u> g Dish+Sample Wt. <u>47.3951</u> g Sample Wt. <u>0.0070</u> g
2	Test <u>9</u> Run <u>2</u> Log Number <u>-321</u> Comments	Dish No. <u>16</u> Dish Tare Wt. <u>49.1347</u> g Dish+Sample Wt. <u>49.1382</u> g Sample Wt. <u>0.0035</u> g	Dish No. <u>44</u> Dish Tare Wt. <u>47.6188</u> g Dish+Sample Wt. <u>47.6267</u> g Sample Wt. <u>0.0079</u> g
3	Test <u>9</u> Run <u>3</u> Log Number <u>-341</u> Comments	Dish No. <u>17</u> Dish Tare Wt. <u>48.3901</u> g Dish+Sample Wt. <u>48.3928</u> g Sample Wt. <u>0.0027</u> g	Dish No. <u>45</u> Dish Tare Wt. <u>48.1512</u> g Dish+Sample Wt. <u>48.1555</u> g Sample Wt. <u>0.0043</u> g
4	Test <u>Run</u> Log Number Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test <u>Run</u> Log Number Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

Results Solvent Phase:

Field Blk. Run 1 Run 2 Run 3 Run 4 Run 5

	0.0039	0.0032	0.0024		
--	--------	--------	--------	--	--

Results Aqueous Phase:

Field Blk. Run 1 Run 2 Run 3 Run 4 Run 5

	0.0069	0.0070	0.0034	F-9	
--	--------	--------	--------	-----	--

LSC-03WYP

100

100

100

100

100

100

100

100

100

100

100

100

100

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job L.P. / Dawson Creek, B.C. Source No. 1 Korus
Team Leader MLK Test Site Stack
Date Submitted 10-8-93 Date of Test 9-23-93
Test No. 9 No. of Runs Completed 3
Date of Analysis 10-11-93 Technician B. Dush
Transport Leakage ☒ None ☐ _____ ml Solvent Acetone

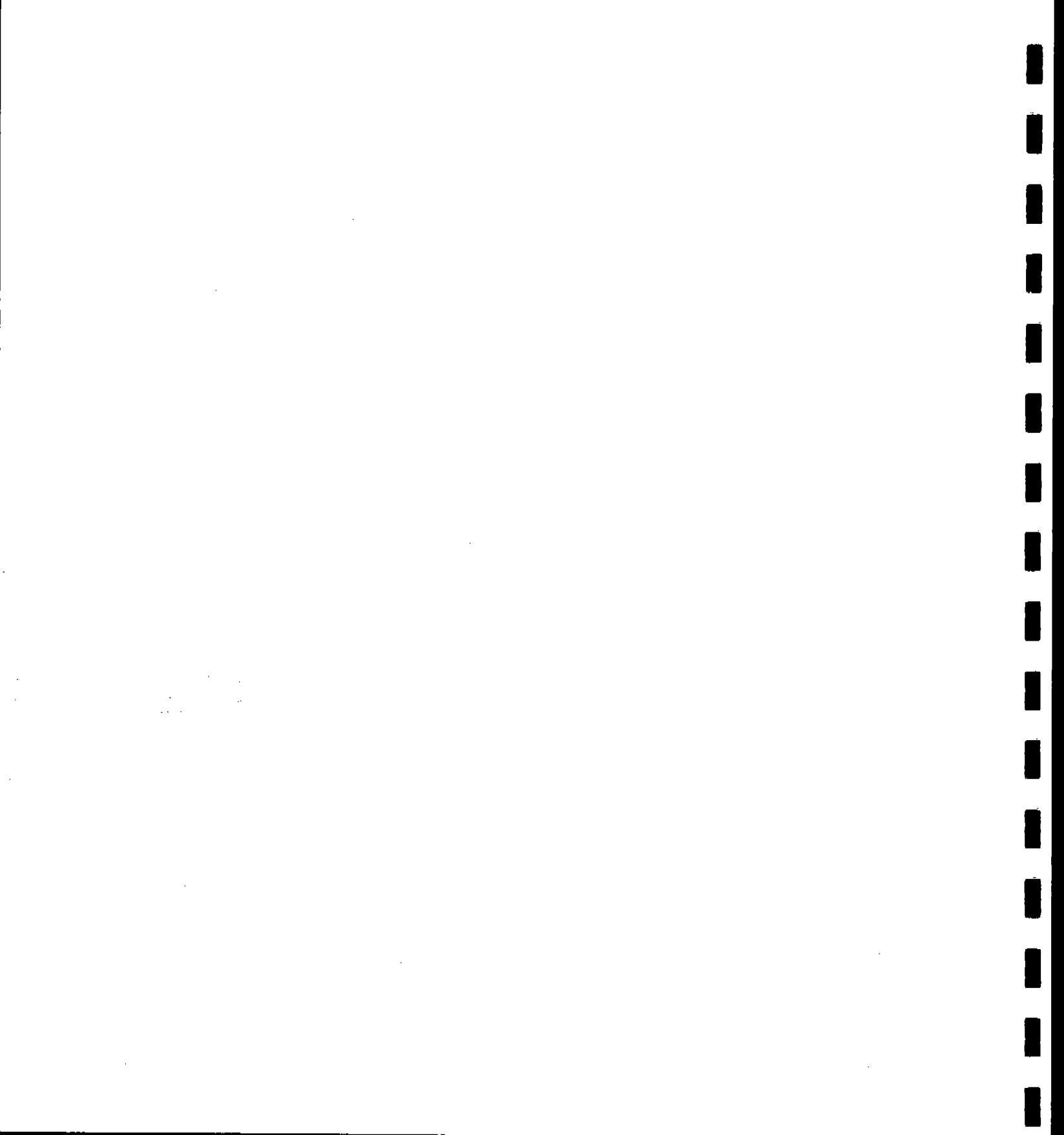
0	Test <u>Run 0</u> Field Blank Log Number _____ Vol. of Solvent _____ ml *Solvent Residue <u>2.0</u> ug/ml	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test <u>9</u> Run <u>1</u> Vol. of Solvent <u>140</u> ml Log Number <u>1060-30P</u> Comments _____	Dish No. <u>609</u> Dish Tare Wt. <u>45.5605</u> g Dish+Sample Wt. <u>45.8208</u> g Sample Wt. <u>0.2603</u> g
2	Test <u>9</u> Run <u>2</u> Vol. of Solvent <u>170</u> ml Log Number <u>-32P</u> Comments _____	Dish No. <u>619</u> Dish Tare Wt. <u>47.5522</u> g Dish+Sample Wt. <u>48.3071</u> g Sample Wt. <u>0.7549</u> g
3	Test <u>9</u> Run <u>3</u> Vol. of Solvent <u>140</u> ml Log Number <u>-34P</u> Comments _____	Dish No. <u>621</u> Dish Tare Wt. <u>49.9374</u> g Dish+Sample Wt. <u>50.3517</u> g Sample Wt. <u>0.4143</u> g
4	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

*Solvent Residue ug/ml = [(Sample Wt. _____ g) (10⁶)] / Vol. of Sol. _____ ml
EPA-M5 Acetone Residue Blank Spec. { 7.8 ug/ml

Results:

Field Blk. Run 1 Run 2 Run 3 Run 4 Run 5

	0.2600	0.7546	0.4140	FF10	
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Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job L.P. / Dawson Creek, B.C. Source No. 1 Korus
Team Leader MK Test Site Stack
Date Submitted 10-8-93 Date of Test 9-23-93
Test No. 9 No. of Runs Completed 3
Date of Analysis 10-11-93 Technician B. Decker

0	Test <u>Run 0</u> Field Blank Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____ g Filter+Sample Wt. _____ g Sample Wt. _____ g
1	Test <u>9</u> Run <u>1</u> Log Number <u>1060-30F</u> Comments _____	Filter No. <u>5700</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>.9083</u> g Filter+Sample Wt. <u>1.2768</u> g Sample Wt. <u>0.3685</u> g
2	Test <u>9</u> Run <u>2</u> Log Number <u>-32F</u> Comments _____	Filter No. <u>5784</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>.9207</u> g Filter+Sample Wt. <u>1.5087</u> g Sample Wt. <u>0.5880</u> g
3	Test <u>9</u> Run <u>3</u> Log Number <u>-34F</u> Comments _____	Filter No. <u>5785</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>.9248</u> g Filter+Sample Wt. <u>1.4786</u> g Sample Wt. <u>0.5538</u> g
4	Test <u>Run</u> Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____ g Filter+Sample Wt. _____ g Sample Wt. _____ g
5	Test <u>Run</u> 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

	0.3685	0.5880	0.5538		
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Field Blk. Run 1 Run 2 Run 3 Run 4 Run 5

	0.6393	1.3528	0.9736		
--	--------	--------	--------	--	--

LSC-02PR

Interpoll Laboratories, Inc.
(612) 786-6020

Ion Chromatography Laboratory

DIONEX MODEL 40001 WITH ANION MICRO MEMBRANE SUPPRESSION

Analyst: AMS

Date of Analysis: 10-19-93

Job: LP/Dawson Creek, B.C. Source: Surface Dryer Site: Stack

Chromatography Conditions

Column	Flow Rate	Eluent	Flow Rate	Suppressor Acid
AS3	ml/min	2.4 mM Na ₂ CO ₃ & 3.0 mM NaHCO ₃	10 ml/min	12.5 mM Sulfuric Acid
X AS4A	2 ml/min	1.8 mM Na ₂ CO ₃ & 1.7 mM NaHCO ₃	ml/min	
AS5	ml/min	100 mM NaOH	X	Isocratic
	ml/min			Gradient (List program below)

Gradient Program	Time (Min.)									
Eluent	0.0									
† A										
† B										

Impinger Catch
EPA M-202

804

Results of Sulfate Determination

Sample Name	Interpoll Log Number	Tot. Sample Volume (ml)	Dilution	Solution Conc. (ug/ml)	Total ug Sulfate	meq of Sulfate
T ₃ R ₀	1060-13E	200	1	0.082	16.4	
T ₃ R ₁	-14E	440	1	0.909	399.96	
T ₃ R ₂	-16E	415	1	0.376	156.04	
T ₃ R ₃	-18E	435	1	0.427	185.75	

Total ug = (Sample Vol.) x (Dilution) x (Solution Conc.)
meq = Total ug / 48000

25 ml from each sample taken,
sent to I.C. Lab

F-12

Samples
14E 16E 18E LSC-08RR
had methylene chloride
in sample when vol was
measured. less than 25ml

Field
Blank

Interpoll Laboratories, Inc.
(612) 786-6020

Ion Chromatography Laboratory

DIONEX MODEL 40001 WITH ANION MICRO MEMBRANE SUPPRESSION

Analyst: BMS

Date of Analysis: 10-19-93

Job: LP/Dawson Creek, B.C. Source: Surface Dryer Site: Stack

Chromatography Conditions

Column	Flow Rate	Eluent	Flow Rate	Suppressor Acid
AS3	ml/min	2.4 mM Na ₂ CO ₃ & 3.0 mM NaHCO ₃	10 ml/min	12.5 mM Sulfuric Acid
X AS4A	2 ml/min	1.8 mM Na ₂ CO ₃ & 1.7 mM NaHCO ₃	ml/min	
AS5	ml/min	100 mM NaOH	X	Isocratic
	ml/min			Gradient (List program below)

Gradient Program	Time (Min.)									
Eluent	0.0									
* A										
* B										

Impinger Catch
EPA M-202

SO₄ and SO₃ as SO₄

Results of Sulfate Determination

Sample Name	Interpoll Log Number	Tot. Sample Volume (ml)	Dilution	Solution Conc. (ug/ml)	Total ug Sulfate	meq of Sulfate
T ₃ R ₀	1060-13I	200	1	0.142		
T ₃ R ₁	-14I	440	1	1.39		
T ₃ R ₂	-16I	415	1	0.840		
T ₃ R ₃	-18I	435	1	0.896		

Field
Blank

Total ug = (Sample Vol.) x (Dilution) x (Solution Conc.)
meq = Total ug / 48000

25 ml from each sample taken.
Sent to I.C. Lab

Samples
14I 16I 18I LSC-08RR
had methylene chloride
in sample when vol was
measured. less than 25 ml

Interpoll Laboratories, Inc.
(612)786-6020

Ion Chromatography Laboratory

DIONEX MODEL 40001 WITH ANION MICRO MEMBRANE SUPPRESSION

Analyst: BMS

Date of Analysis: 10-19-93

Job: LPI Dawson Creek, B.C. Source: No. 1 Korus Site: Stack

Chromatography Conditions

Column	Flow Rate	Eluent	Flow Rate	Suppressor Acid
AS3	ml/min	2.4 mM Na ₂ CO ₃ & 3.0 mM NaHCO ₃	10 ml/min	12.5 mM Sulfuric Acid
X AS4A	2 ml/min	1.8 mM Na ₂ CO ₃ & 1.7 mM NaHCO ₃	ml/min	
AS5	ml/min	100 mM NaOH	X	Isocratic
	ml/min			Gradient (List program below)

Gradient Program	Time (Min.)									
Eluent	0.0									
% A										
% B										

Impinger Catch
EPA M-202

Results of Sulfate Determination

Sample Name	Interpoll Log Number	Tot. Sample Volume (ml)	Dilution	Solution Conc. (ug/ml)	Total ug Sulfate	meq of Sulfate
TaR ₁	1060-30I	290	1	0.118		
TaR ₂	-32I	350	1	<0.025		
TaR ₃	-34I	340	1	<0.025		

Total ug = (Sample Vol.) x (Dilution) x (Solution Conc.)
meq = Total ug / 48000

LSC-08RR

25 ml taken from each sample
Sent to I.C. Lab

INTERPOLL LABORATORIES, INC.
(612)786-6020

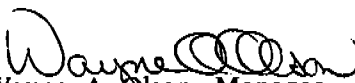
Louisiana Pacific/Dawson Creek, B.C.
Laboratory Log No. 1060

Results of Formaldehyde Analysis¹

Test: 1
Source: Surface Dryer Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde
		Total ug
1060-01	Run 0, Field Blank	5.68
1060-02	Spike	60.6
1060-03	Run 1	7600
1060-04	Run 2	8230
1060-05	Run 3	10400

Respectfully submitted,


Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

¹Analysis performed by EPA Method 0011.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana Pacific/Dawson Creek, B.C.
Laboratory Log No. 1060

Results of Formaldehyde Analysis¹

Test: 5
Source: Press Vent Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Formaldehyde
		Total ug
1060-20	Run 1	3960
1060-21	Run 2	3710
1060-22	Run 3	2370

Respectfully submitted,


Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

¹Analysis performed by EPA Method 0011.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana Pacific/Dawson Creek, B.C.
Laboratory Log No. 1060

Results of Phenol Analysis¹

Test: 2
Source: Surface Dryer Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Phenol
		Total mg
1060-09 (AB)	Run 0 Field Blank	< 0.84
1060-10 (AB)	Run 1	< 0.84
1060-11 (AB)	Run 2	< 0.84
1060-12 (AB)	Run 3	< 0.84

Respectfully submitted,


Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

¹Analysis performed by EPA Method SW-846, 8270.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana Pacific/Dawson Creek, B.C.
Laboratory Log No. 1060

Results of Phenol Analysis¹

Test: 6
Source: Press Vent Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Phenol
		Total mg
1060-23 (AB)	Run 1	1.63
1060-24 (AB)	Run 2	1.54
1060-25 (AB)	Run 3	1.12

Respectfully submitted,


Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

¹Analysis performed by EPA Method SW-846, 8270.

INTERPOLL LABORATORIES, INC.
(612)786-6020

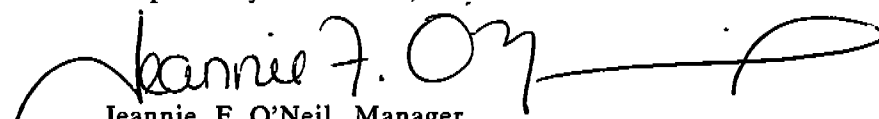
Louisiana Pacific/Dawson Creek, B.C.
Laboratory Log No. 1060

Results of Cyanide Analysis¹

Test: 2
Source: Surface Dryer Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	Cyanide
		Total ug
1060-09 (ABC)	Run 0 Field Blank	< 4.0
1060-10 (ABC)	Run 1	400
1060-11 (ABC)	Run 2	390
1060-12 (ABC)	Run 3	385

Respectfully submitted,


Jeannie F. O'Neil, Manager
Inorganic Chemistry Group

JFO/cg

¹Analysis performed by EPA Method SW-846, 9010.

INTERPOLL LABORATORIES, INC.
(612)786-6020

Louisiana Pacific/Dawson Creek, B.C.
Laboratory Log No. 1060

Results of Methylenebis (Phenyl Isocyanate) - MDI Analysis¹

Test: 7
Source: Press Vent Stack
Sample Type: Impinger Catch

Sample Log No.	Sample Description	MDI
		Total ug
1060-26	Run 0 Field Blank	< 2.6
1060-27	Run 1	129
1060-28	Run 2	128
1060-29	Run 3	128

Respectfully submitted,


Wayne A. Olson, Manager
Organic Chemistry Group

WAO/cg

¹Analysis performed by Reverse Phase HPLC.

Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C.Source Surface DryerField Engineer M. KachlerTest Site Stack

Date Submitted _____

Date of Test 9-21-93Test No. 1No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
3 + 1 + 1	Probe Wash: ☐ Acetone ☒ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☒ Other <u>0011</u>	<u>Added to</u> <u>Imp. Catch</u>
—	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
3 + 1 + 1	Impingers: ☐ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☒ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other <u>0011</u>	
3	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	
—	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
1	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
1	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Wood Dryer

Fuel Type:

Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

Wood: ☒ Wood Waste
☐ Dust
☐ Bark

Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other _____

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GASTACKIWPFORMS-278.LAS

Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C.Source Surface DryerField Engineer M. RaehlerTest Site Stack

Date Submitted _____

Date of Test 9-21-93Test No. 2No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
—	Probe Wash: ☐ Acetone ☐ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	
—	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
3 + 1	Impingers: ☐ DI Water ☐ 3% H ₂ O ₂ ☒ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other <u>Phenol + HCN</u>	<u>The Third Imp.</u> <u>Bottle Should Be</u> <u>Analyzed For</u> <u>HCN Only</u>
3	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	
—	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
—	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Wood Dryer

Fuel Type:

Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

Wood: ☒ Wood Waste
☐ Dust
☐ Bark

Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other _____

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Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C.Source Surface DryerField Engineer M. KachlerTest Site Stuck

Date Submitted _____

Date of Test 8-21-93Test No. 3No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
3+1	Probe Wash: ☒ Acetone ☐ MeCl ₂ ☐ DI Water ☐ _____	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	_____
3+1	Filter: ☒ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	_____
3+1	Impingers: ☒ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other <u>B.C.</u>	_____
3	Integrated Gas Sample ☒ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	_____
-	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	_____
-	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	_____
-	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	_____
-	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	_____

Type of Source: Wood Dryer

Fuel Type:

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

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Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C. Source Surface Dryer
 Field Engineer M. Kachler Test Site Stack
 Date Submitted _____ Date of Test 9-21-93
 Test No. 4 No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
—	Probe Wash: ☐ Acetone ☐ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	_____
—	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	_____
—	Impingers: ☐ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	_____
—	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	_____
—	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	_____
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	_____
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	_____
3	Misc Samples ☒ <u>THC</u> ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☒ Other <u>254</u>	<u>Strip Chart</u>

Type of Source: Wood Dryer

Fuel Type:

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

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GASTACKWPIFORMS-278.LAS

Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C.Source Press VentField Engineer M. KachlerTest Site Stacks

Date Submitted _____

Date of Test 9-22-93Test No. 5No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
3	Probe Wash: ☐ Acetone ☒ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☒ Other <u>0011</u>	<u>Added to Imp. Catch</u>
—	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
3	Impingers: ☐ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☒ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other <u>0011</u>	
—	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	<u>Ambient Air</u>
—	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
—	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Wood PressFuel Type: NA

Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

Wood: ☐ Wood Waste
☐ Dust
☐ Bark

Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other _____

S-278

GASTACKWPF09MS-278.LAS

Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek B.C.Source Ab-1 House Press VentField Engineer M. KaehlerTest Site StairDate Submitted 10-1-93Date of Test 9-23-93Test No. 6No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
-	Probe Wash: ☐ Acetone ☐ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	
-	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	
3	Impingers: ☐ DI Water ☐ 3% H ₂ O ₂ ☒ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other <u>Phenols</u>	
-	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	<u>Ambient Air</u>
-	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	
-	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
-	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
-	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Wood PressFuel Type: NA
 Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

 Wood: ☐ Wood Waste
☐ Dust
☐ Bark

 Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other _____

S-278

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

Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C.Source Press VentField Engineer MikehlerTest Site Stacks

Date Submitted _____

Date of Test 9-22-93Test No. 2No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
3+	Probe Wash: ☐ Acetone ☒ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☒ Other <u>MDI</u>	<u>Added to</u> <u>Imp. Solution</u>
3+	Filter: ☐ 4" Glass ☐ SS Thimble ☒ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☒ Other <u>MDI</u>	<u>Added to</u> <u>Imp. Solution</u>
3	Impingers: ☒ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other <u>MDI</u>	
—	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	<u>Ambient Air</u>
—	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
—	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Wood PressFuel Type: NA
 Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

 Wood: ☐ Wood Waste
☐ Dust
☐ Bark

 Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other _____

S-278

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

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C.

Source Press Vent

Field Engineer M. Kaehler

Test Site Stacks

Date Submitted _____

Date of Test 9-22-93

Test No. 8

No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
-	Probe Wash: ☐ Acetone ☐ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	_____
-	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	_____
-	Impingers: ☐ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	_____
-	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	<u>Ambient Air</u>
-	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	_____
-	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	_____
-	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	_____
3	Misc Samples ☐ _____ ☒ <u>THC</u>	☐ As per EPA M-6 ☐ As per EPA M-7A ☒ Other <u>254</u>	<u>Strip Charle</u>

Type of Source: Wood Press

Fuel Type: NA

Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

Wood: ☐ Wood Waste
☐ Dust
☐ Bark

Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other _____

S-278

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

Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, B.C.Source No. 1 Kony.Field Engineer M. KaehlerTest Site StackDate Submitted 10-1-93Date of Test 9-23-93Test No. 9No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
3	Probe Wash: ☒ Acetone ☐ MeCl ₂ ☐ DI Water ☐	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other	
3	Filter: ☒ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☒ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other	
3	Impingers: ☒ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☒ Other <u>B.C. Protocol</u>	
3	Integrated Gas Sample ☒ Tedlar Bag ☐	☒ As per EPA M-3 ☐ As per EPA M-10 ☐ Other	
-	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other	
-	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
-	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other	
-	Misc Samples ☐ ☐	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other	

Type of Source: Kony

Fuel Type:

Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

Wood: ☒ Wood Waste
☐ Dust
☐ Bark

Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other

S-278

GASTACKWP\FORMS\S-278.LAS

Interpoll Laboratories

(612) 786-6020

Sample Deposition

Job L.P. / Dawson Creek, BCSource Area 1 KonusField Engineer M. KaeplerTest Site StartDate Submitted 10-1-93Date of Test 9-23-93Test No. 10No. of Runs Completed 3

No.	Sample Type	Analysis	Comments
—	Probe Wash: ☐ Acetone ☐ MeCl ₂ ☐ DI Water ☐ _____	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ Other _____	_____
—	Filter: ☐ 4" Glass ☐ SS Thimble ☐ 2.5" Glass ☐ Pallflex	☐ As per EPA M-5 ☐ As per EPA M-29 ☐ As per EPA M-201A ☐ As per EPA M-17 ☐ Other _____	_____
—	Impingers: ☐ DI Water ☐ 3% H ₂ O ₂ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H ₂ SO ₄ (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	_____
—	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	_____
—	Oxides of Nitrogen (NO _x)	☐ As per EPA M-7A ☐ Other _____	_____
—	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	_____
—	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	_____
3	Misc Samples ☒ <u>TTC</u> ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☒ Other <u>25A</u>	<u>Strip Chart</u>

Type of Source: Konus

Fuel Type:

Coal: ☐ Bituminous
☐ Anthracite
☐ Lignite

Wood: ☒ Wood Waste
☐ Dust
☐ Bark

Oil: ☐ Waste Oil
☐ No. 2
☐ No. 6

☐ Natural Gas
☐ RDF
☐ Other _____

S-278

GASTACKWPF0RMSIS-278.1AS

0 20 40 60 80 100

Start Run 1
1420 HRS
0-1000 ppm w
as propane

0-1000 scale 1420 Hrs

Ambient thru Propane 0-100 scale 1455 Hrs

0 20 40 60 80 100
30 ppm 0-100 scale System Bias 1455 Hrs

calibration
DATA

110 ppm 0-100 scale System Bias 1455 Hrs

3034 ppm 0-1000 scale Linearity Check 1455 Hrs

3011.8 ppm 0-1000 scale Linearity Check

0 20 40 60 80 100
30 ppm 0-100 scale Linearity Check 1457 Hrs

Linearity Check 0-100 scale 1458 Hrs

R.P. / Dawson Creek, BC

Surface Dryer / Stack

Method 25A / DMC

Test No. 4 / Run 1, 2, 3

9-21-93

Analyzer No. 3

Sample Rate 2 ps.

Chart Speed 300 mm/hr

THC
DRYER
STACK

9-21-93

0 20 40 60 80 100

2 post change

1 m40cm

0 20 40 60 80 100

CHART NO. B9565AW/NN

0 20 40 60 80 100

0-2000 scale 1120 hrs

Ambient thru probe 0-100 scale 1125 hrs

Start Run 2

1622 HRS

4M 12.2 0-100 Scale 1622 HRS

0 Base Run 2

System
bias
check

0 20 1150 ppm 0-100 Scale System Bias 1535 HRS 100

0 ppm 0-100 Scale System Bias 1530 HRS

END TAIL R 0-100 Scale 1525 HRS

End Run 1

1525 HRS

CHART NO. B9565AW/NN

0 20 40 60 80 100

changed
scale

0-100 ppm

0-100 scale

0 20 40 60 80 100

2 point change

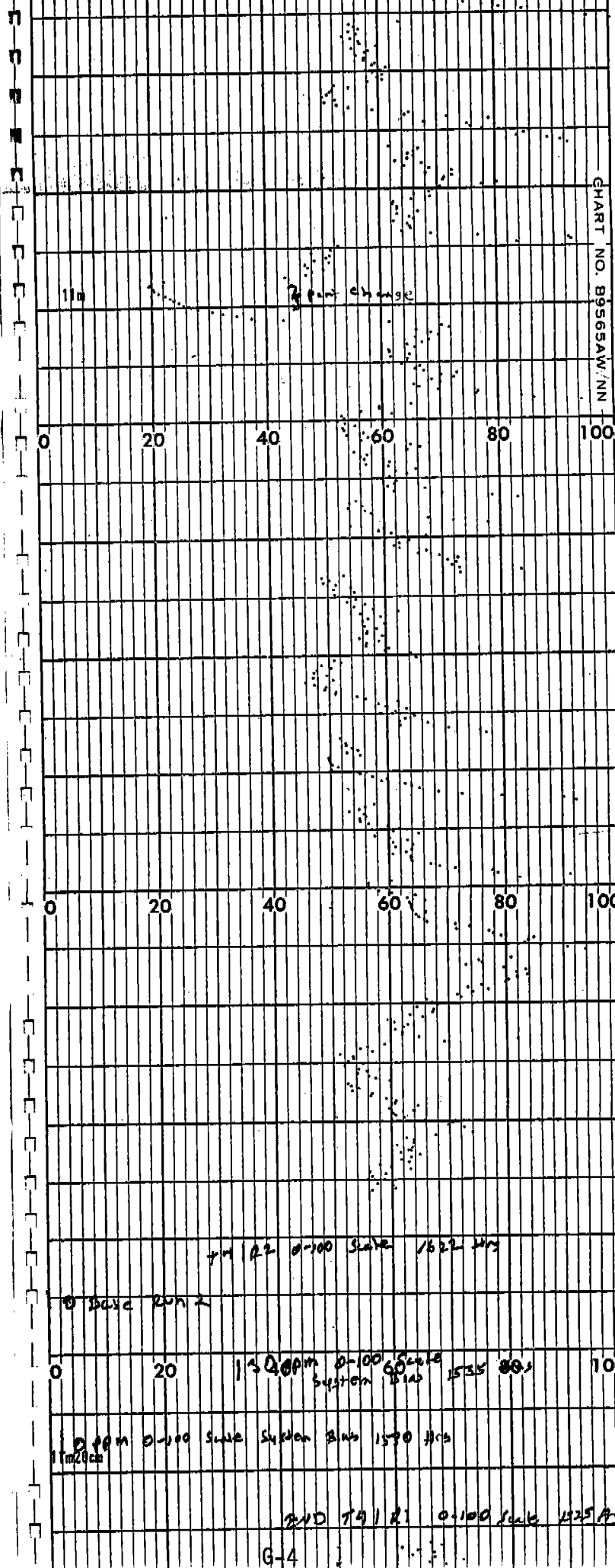


CHART NO. B9565AW/NN

(6648)

11a

Point change

0 20 40 60 80 100

0 20 40 60 80 100

TH R2 0-100 Scale 1622 Hrs

0 Base Run 2

0 20 1300pm 0-100 Scale System Bias 1535 Hrs 100

0-100 Scale System Bias 1530 Hrs

END T4 R1 0-100 Scale 1525 Hrs

ART. NO. B9565AW/NN

0 20 40 60 80 100

Start Run 3
1804 HRS

THURS 0700 Scale 1804 HRS

10m80cm

0 Scale Run 3

1300pm 0-100 Scale System Bias 1745 HRS

(Scale)
system
bias
check

0 ppm 0-100 Scale System Bias 1745 HRS

END TU 122 0700 Scale

end Run 2
1743 HRS

0 20 40 60 80 100

0 20 40 60 80 100

CHART NO. B9565AW/NN

11m Beam change

10m50cm

0 20 40 60 80 100

Part Change

0 20 40 60 80 100

CHART NO. B9565AW/NN

0 20 40 60 80 100

10m80cm

THIRZ 0700 Scale 1804 H15

0 20 40 60 80 100

G-6 0700 Scale 1804 H15

0 ppm 0-100 scale System Bias (1400 Hrs)

Press Vent / Stack

10, 4, 10, 5 (Rms 1, 2, 3)

7-22-93

50 ppm 0-100 scale System Bias 1934 Hrs

0 ppm 0-100 scale System Bias 1931 Hrs

END 7/23/93 0-100 scale

1925 Hrs

System
bias check

End Run 3
1925 HRS

0 20 40 60 80 100

10m40cm

0 20 40 60 80 100

0 20 40 60 80 100

CHART NO. B9565AW/NN

0 20 40 60 80 100

0 20 40 60 80 100

Start Run 1

1414 HRS

0-100 ppmw
scale

TG/PA 0-100 scale 1414 Hrs

CHART NO. B9565AW/NN

30 ppm 0-100 scale System Bias
1402 Hrs

0 20 40 60 80 100
0 ppm 0-100 scale System Bias 1400 Hrs

Press Vent / Stack

Test No 0 / Run 1, 2, 3

9-22-93

PRESS
VENT

9-22-93

30 ppm 0-100 scale System Bias 1430 Hrs

0 ppm 0-100 scale System Bias 1431 Hrs

G-8

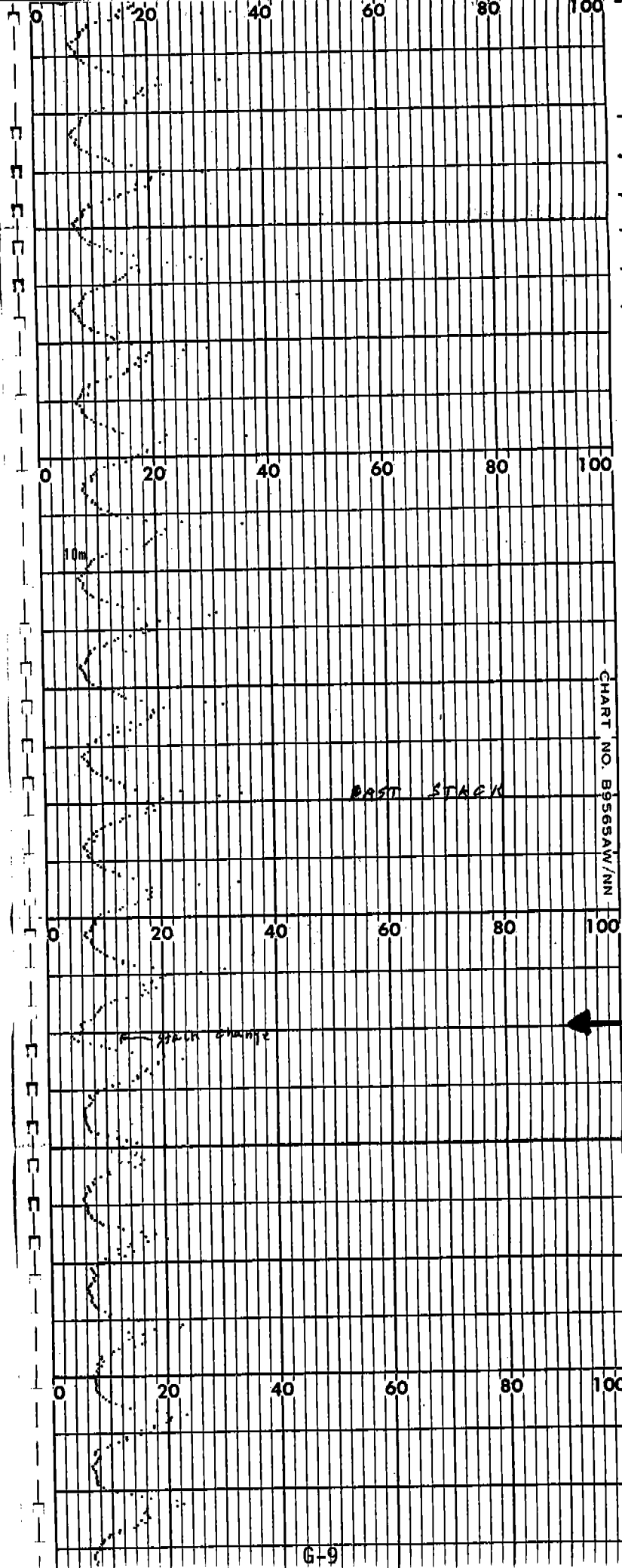


CHART NO. B9565AW/NN

stack change
(6548)

ART NO. B9565AW/NN

0m 0.0m

T812 0-100 Scale 1608 Hrs East Stack

0.0 Bias 28m 2 20100 Scale 60 80 100

20 0.0m 0-100 Scale System Bias 154 Hrs

1.0 0.0m 0-100 Scale System Bias 1538 Hrs

END T811 0-100 Scale 1531 Hrs

system
bias
check

End Run 1
1531 HRS

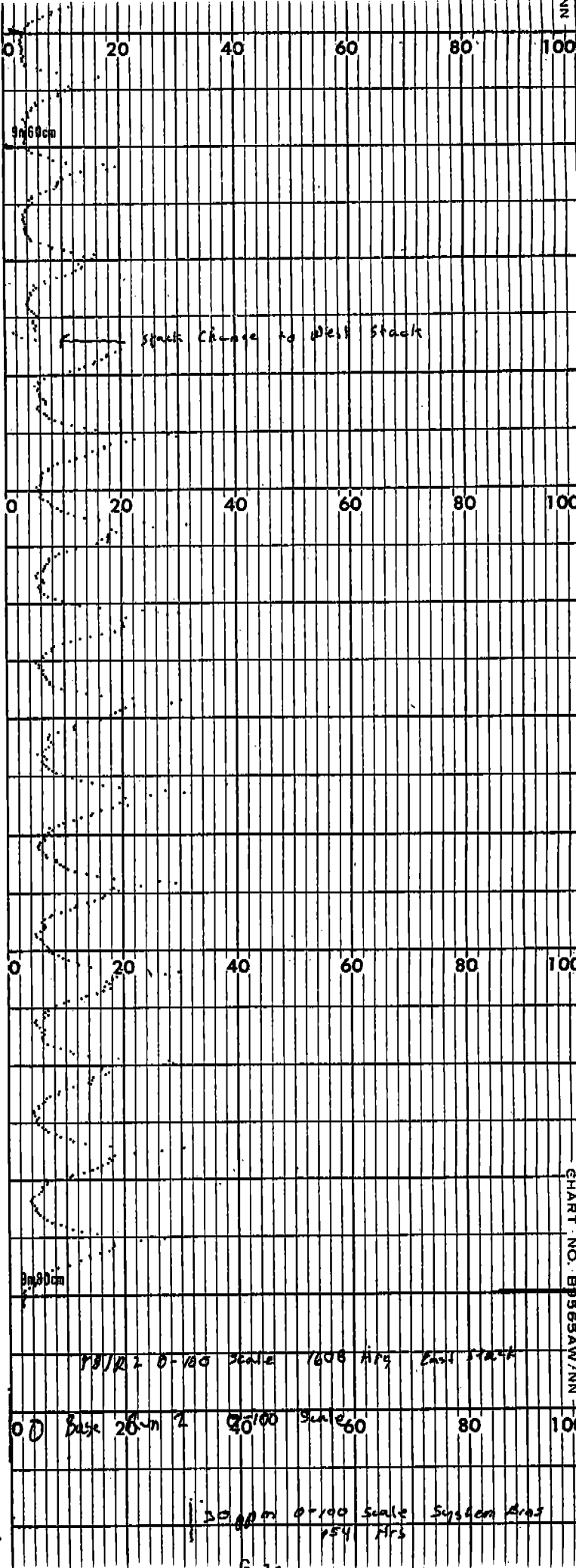
0 20 40 60 80 100

0 20 40 60 80 100

10m

EAST STACK

CHART NO. B9565AW



5m 40cm

West stack

0 18123 0-100 Scale 17360 Hrs 80 100

30 ppm 0-100 Scale System Bias

0 ppm 0-100 Scale System Bias 1729 Hrs

END 1812 0-100 Scale 1717 Hrs

system
bias
check

End Run 2
1717 HRS

0 20 40 60 80 100

0 20 40 60 80 100

5m 40cm

Stack Change to West Stack

stack
change

CHART NO. B9565AW/NN

(6046)

9m20cm

0 20 40 60 80 100

0 20 40 60 80 100

Stack
change

CHART NO. B9565AW/NN

(6648)

9m18cm

0 10 20 0-100 Scale 17360 Hrs 80 100

10 ppm 0-100 Scale System Error

0 ppm 0-100 Scale System Error 1736 Hrs

END 10 10 0-100 Scale 1737 Hrs

Start Run 3

1736 HRS

0-100 ppm w
scale

200m 0-100 Scale System Bias 0843 hrs

9-23-93 No. 1 Kohig

0 20 40 60 80 100

300m 0-100 Scale System Bias 1901 hrs

0 100 0-100 Scale System Bias 1859 hrs

END 18/103 0-100 Scale 1845 hrs

system
bias
check

end Run 3
1845 HRS

CHART NO. B9565AW/NN

0 20 40 60 80 100

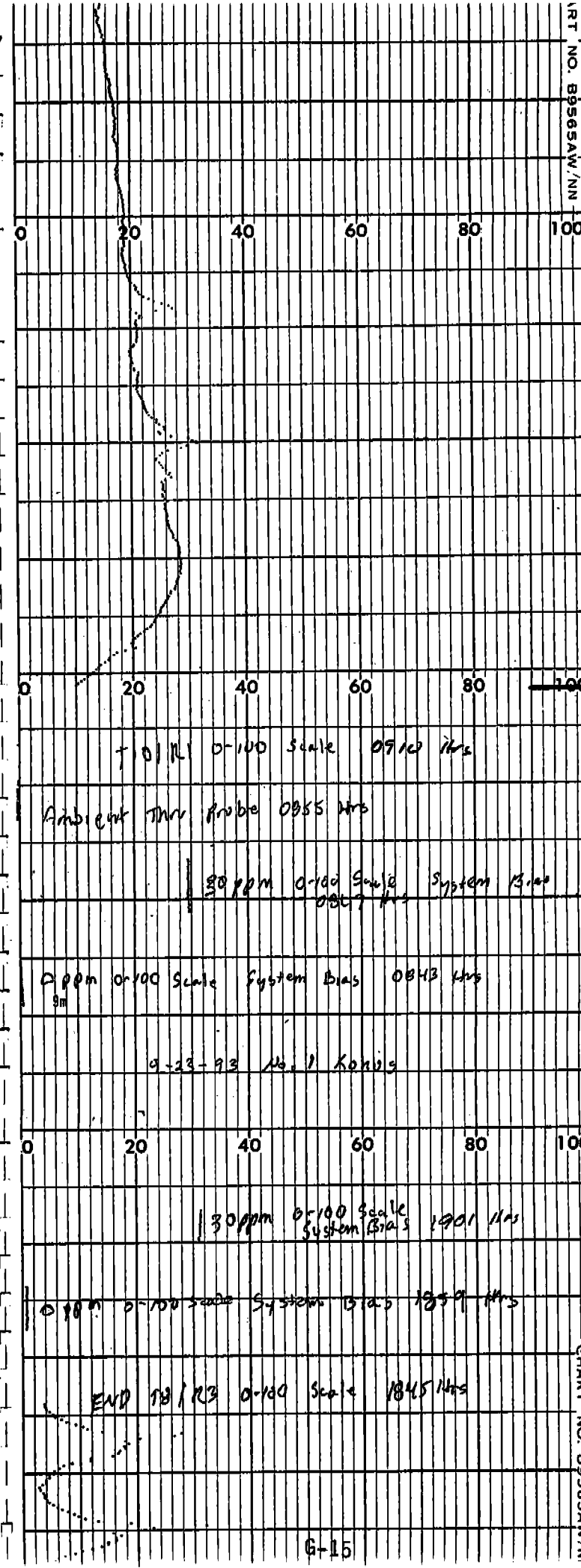
(6648)

0 20 40 60 80 100

3m20cm

stretch changed to FAST

ART NO. B9565AW/NN



Start Run 1
0910 HRS
0-100 ppmw
Scale

10/1/11 0-100 Scale 0910 Hrs

Ambient THW Probe 0855 Hrs

30 ppm 0-100 Scale System Bias 0847 Hrs

2 ppm 0-100 Scale System Bias 0843 Hrs

9-23-93 No. 1 Kohlig

Thermal
Oil Heater
9-23-93

30 ppm 0-100 Scale System Bias 1801 Hrs

10 ppm 0-100 Scale System Bias 1839 Hrs

END 10/1/11 0-100 Scale 1845 Hrs

CHART NO. B9565AW/NN

END TID/R1 0700 SALT 1012 HRS

End Run 1
1012 HRS

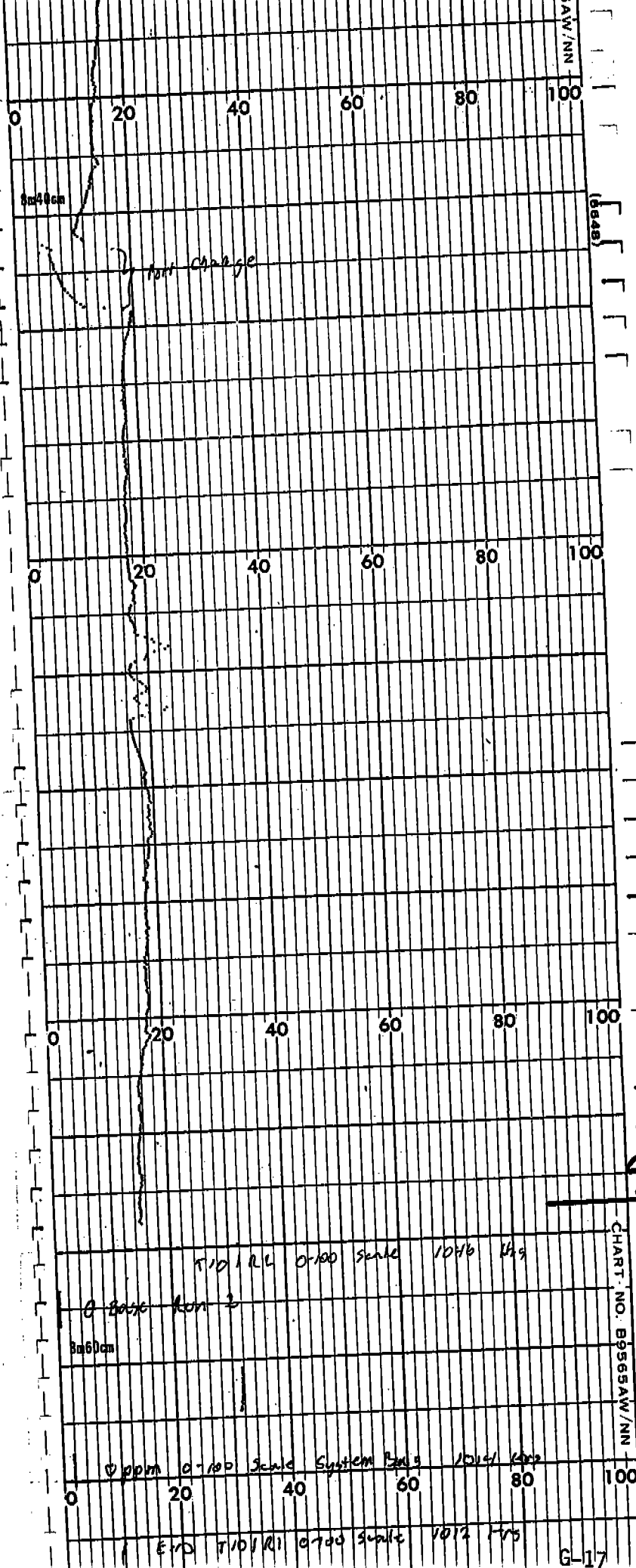
0 20 40 60 80 100

0 20 40 60 80 100

8m80cm

CHART NO. B9565AW/NN

0 20 40 60 80 100



Start Run 2
1046 HRS

System
bias check

6m20cm

T10/123 0-100 scale 120 HRS

0 Base

Run 3

0 20 40 60 80 100

System
bias
check

0 ppm 0-100 scale System Bias 1155 HRS

END T10/123 0-100 scale 1150 HRS

end Run 2

1150 HRS

0 20 40 60 80 100

CHART NO. B9565AW/NN

0 20 40 60 80 100

6m40cm

port change

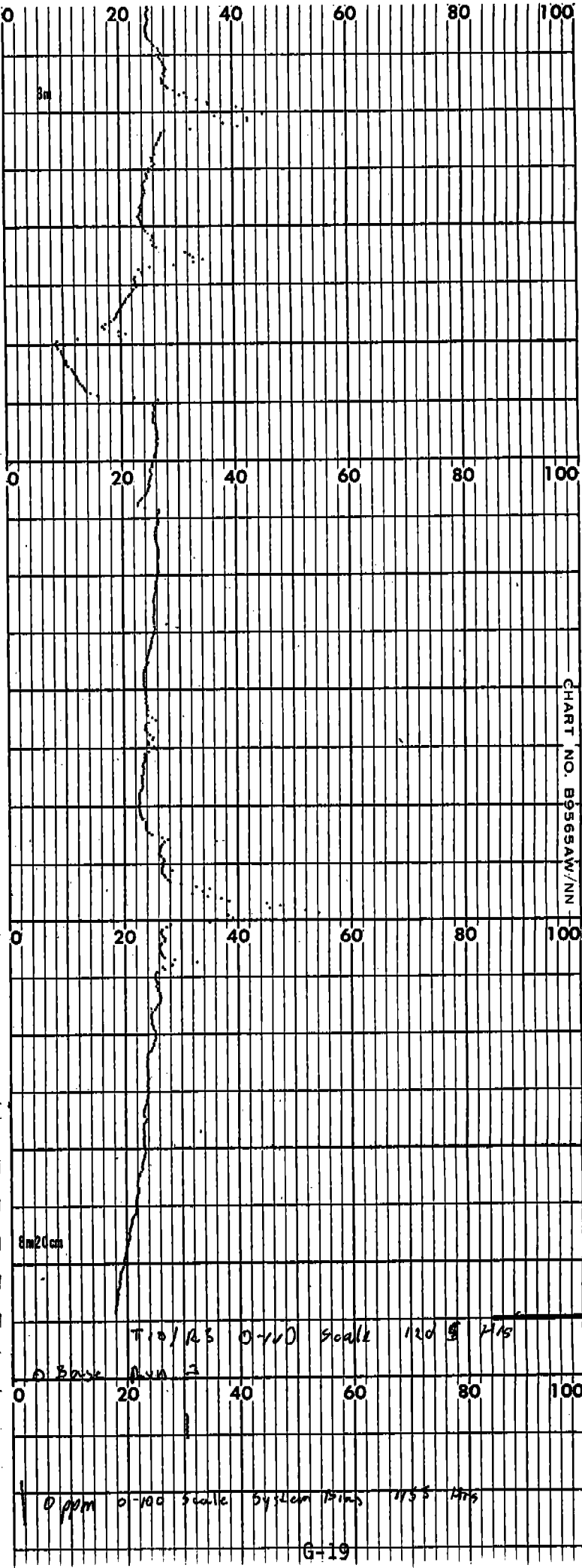
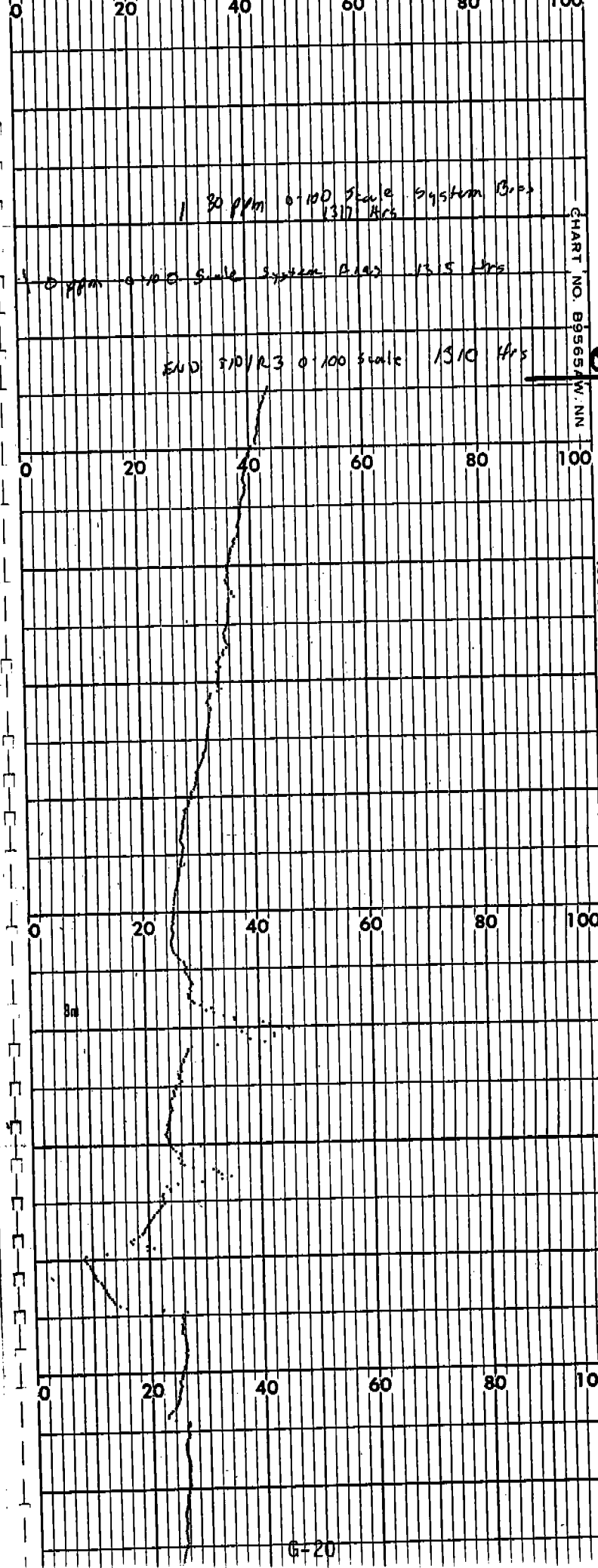


CHART NO. B9565AW/NN

(0848)

Start Run 3
1205 HRS



System
bias
check

End Run 3
1310 HRS

CHART NO. B95654 W.N.N



TOTAL HYDROCARBON ANALYZER (FLAME IONIZATION)
Model RS 55

TECHNICAL DATA

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

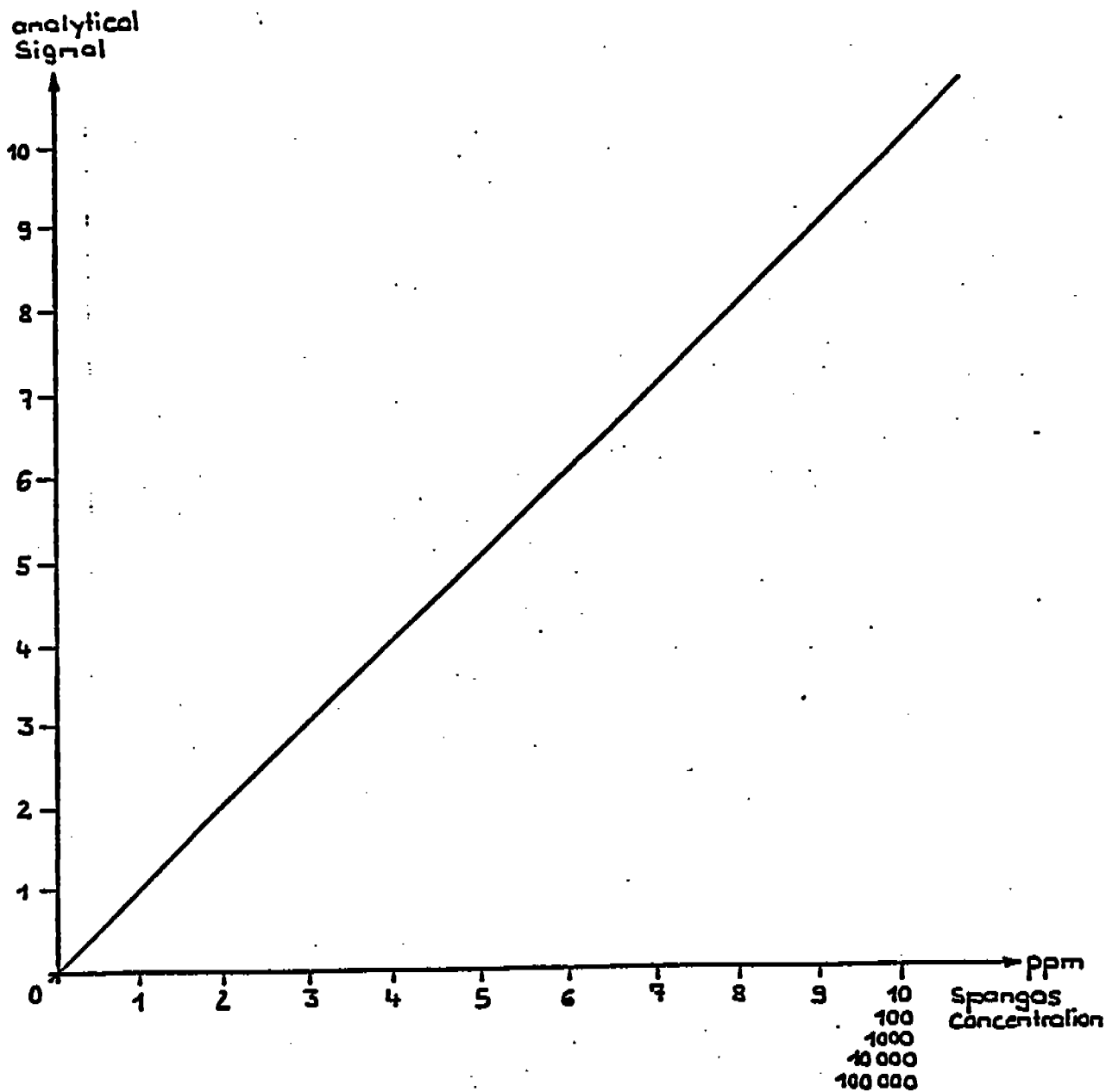
Fuel: Hydrogen : 0,35 bar

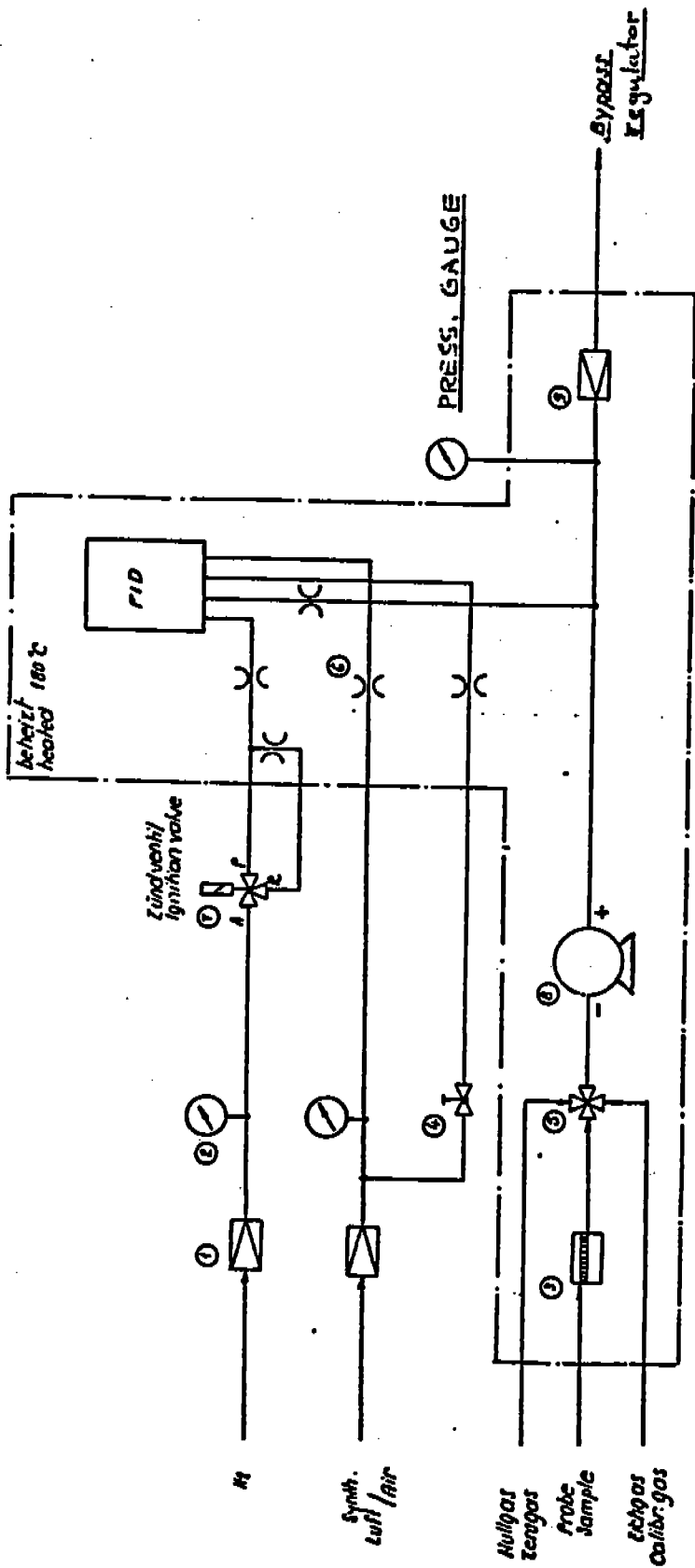
Combustion Air : 0,80 bar

Span Gases : 300 ppm C₁

24.000 ppm C₁

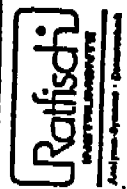
CALIBRATION DIAGRAMM





- 1 Druckregler
pressure regulator
- 2 Manometer
gauge
- 3 Filter
filter
- 4 Zündventil/
needle valve
- 5 3 Wege Ventil/
3 way valve
- 6 Kapillare
capillary
- 7 Magnetventil/
solenoid valve
- 8 Pumpe
pump
- 9 Rückdruckregler
back pressure regulator

Zündventil/
ignition valve
P-A angeschlossen
energized
E-A Stromlos
at rest



FLAMMEN IONISATIONS DETEKTOR
Flame Ionization Detector

Handumschaltung
manual switching

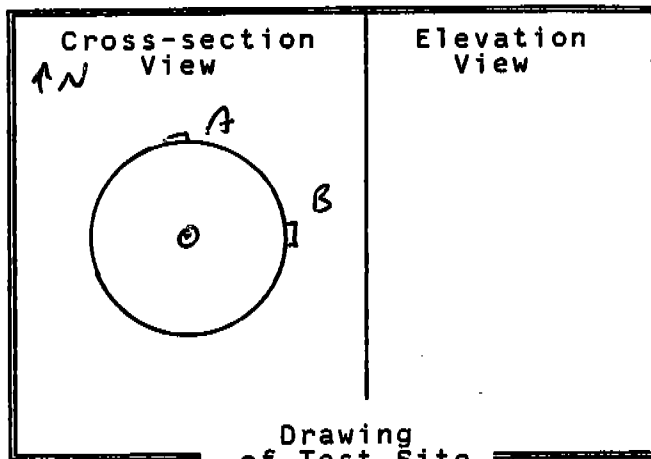
Fließplan
Flow diagram

RS 35

13.04.88

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
Source Surface Dry / Stack
Test 4 Run 0 Date 9-21-93
Stack dimen. 47.5 IN.
Dry bulb 236 °F Wet bulb 150 °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.76 in Hg
Static pressure -.68 in WC
Operators M. Kachler + J. Bergstrom
Pitot No. Inst C_p NA

[illegible]

INTERPOLL LABORATORIES
EPA Method 25A
Calibration Error Check & Drift Determination

Job L.P. / Dawson Creek, B.C.

Test 4 Run 0 Date 9-21-93

Operator M. Kachler

THC Calibration (Low Range):

Time (HRS) 1253

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	100	0
Low level	30.10	30	.1	100	.1
Mid level	301.6	305	3.4	1,000	.34
High level	3038	2997	41	10,000	.41

THC Calibration (High Range):

Time (HRS) _____

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

O₂ Calibration:

Time (HRS) _____

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

CO₂ 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

INTERPOL LABORATORIES
(612) 786-6020

System Bias Check

Job L.P. / Dawson Creek, B.C. Source Surface Dryer
Test 4 Run 1,2,3 Date 9-21-93 Site Stack
Operator M. Kachler

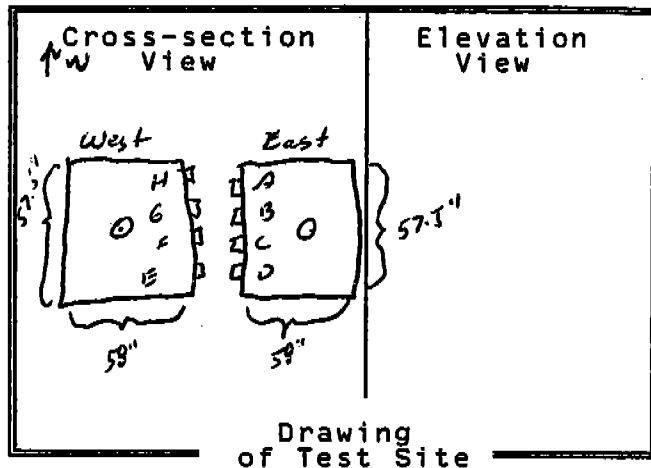
Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1300	Zero gas	0	0	0	0	100	0
		Upscale	30.10	30	30	0	100	0
2	1530	Zero gas	0	0	2	2	100	2
		Upscale	30.10	30	33	3	100	3
3	1743	Zero gas	0	0	2	2	100	2
		Upscale	30.10	30	32	2	100	2
4	1930	Zero gas	0	0	#	#	100	1
		Upscale	30.10	30	30	0	100	0
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

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, B.C.
Source Dress Vent / Stack
Test 6 Run 0 Date 9-22-93
Stack dimen. 58 X 57.5 IN.
Dry bulb 105 °F Wet bulb °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.61 in Hg
Static pressure -.93 / -.63 in WC
Operators M. Kachler + J. Bergstrom
Pitot No. Just - 4 Cp NA

[illegible]

INTERPOL LABORATORIES
EPA Method 25A
Calibration Error Check & Drift Determination

Job L.P. / Dawson Creek, B.C.

Test 6 Run 0 Date 9-22-93

Operator M. Kaehler

THC Calibration (Low Range):

Time (HRS) 1053

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	100	0
Low level	30.10	30	.1	100	.1
Mid level	301.6	305	3.4	1,000	.34
High level	3038	2997	41	10,000	.41

THC Calibration (High Range):

Time (HRS) _____

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

O₂ Calibration:

Time (HRS) _____

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

CO₂ 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

INTERPOLL LABORATORIES
(612) 796-6020

System Bias Check

Job L.P. / Dawson Creek, B.C.
Test 6 Run 1,2,3 Date 9-22-93
Operator M. Kaehler

Source Press Vent
Site Stacks

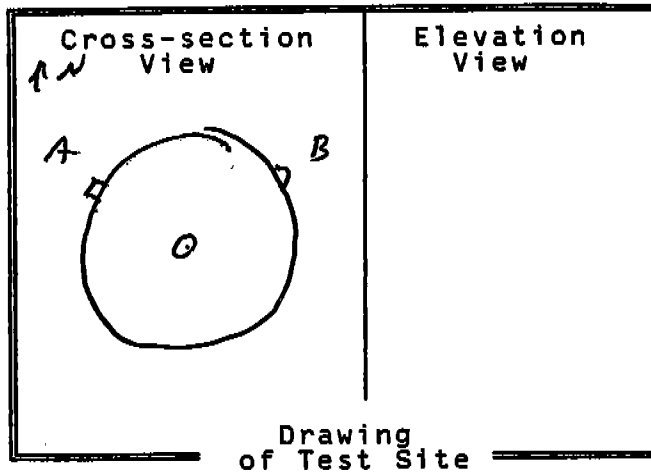
Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1400	Zero gas	0	0	0	0	100	0
		Upscale	30	30	30	0	100	0
2	1538	Zero gas	0	0	1	1	100	1
		Upscale	30	30	31	1	100	1
3	1723	Zero gas	0	0	0	0	100	0
		Upscale	30	30	30	0	100	0
4	1959	Zero gas	0	0	1	1	100	1
		Upscale	30	30	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

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job L.P. / Dawson Creek, BC
Source No. 1 Road / Street
Test 10 Run 0 Date 9-23-92
Stack dimen. 67.5 IN.
Dry bulb 46.5 °F Wet bulb 10.3 °F
Manometer: ☐ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 27.50 in Hg
Static pressure -1.23 in WC
Operators M. Kachler & J. Bengtson
Pitot No. INST C_p 1.64

[illegible]

INTERPOLL LABORATORIES
(612) 786-6020

System Bias Check

Job A.P. 1 Dawson Creek, BC
Test 10 Run 123 Date 9-23-93
Operator M. Kachler

Source A.P. 1 Kowai
Site Stretch

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	0843	Zero gas	0	0	0	0	100	0
		Upscale	30	30	30	0	100	0
2	1014	Zero gas	0	0	2	2	100	2
		Upscale	30	30	32	2	100	2
3	1153	Zero gas	0	0	2	2	100	2
		Upscale	30	30	32	2	100	2
4	1315	Zero gas	0	0	2	2	100	2
		Upscale	30	30	29	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



Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48064 (313) 589-2950

Customer :

GENEX

2455 CLEVELAND AVENUE N.
ROBEVILLE, MN. 55113

1111 CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Procedure # 81

Protocol # 1

File # PD-2189

Certified Accuracy 1 % NBS Traceable

ANALYZED CYLINDER

REFERENCE STD

INSTRUMENTATION

COMPONENT
PROpane

SRM #
CRM #

CYLINDER
NUMBER

INSTR./MODEL/SERIAL #

LAST CALIBRA-
TION DATE

ANALYTICAL PRINCIPLE

30.10 PPM

16688 CLN-000694 95.30 PPM

BECKMAN 2-A-92

FLAME IONIZATION DETECTOR

8H191

ALN-008846 31.20 PPM

400

1002059

BALANCE GAS : AIR

ANALYSIS

DATE : 2-6-92

ZERO	TEST	REFERENCE	RESULTS	CONC.	(mV)	PPM
GAS	GAS	GAS	PPM	PPM		
0.00	30.40	95.30 PPM	30.10	95.30	95.30	95.30
0.00	30.40	95.30	30.10	95.30	95.30	95.30
0.00	30.40	95.30	30.10	95.30	95.30	95.30

CALCULATED
RESULTS
30.10
30.10
30.10

AVERAGE : 30.10 PPM

CALIBRATION CURVE				2 nd DEGREE	
SRM #	CONC.	SPLIT	DVM	FITTED PERCENT	
(CRM #)	PPM	PT (%)	(mV)	VALUE	ERROR
16688	95.30	100	95.30	95.30	-0.00
	31.20	33	31.40	31.30	0.32
	22.61	24	22.70	22.43	-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
8H191	8.171	LOW	8.30	8.171	0.00
16688	95.30	HIGH	95.30	95.30	-0.00

GENEX - GAS MANUFACTURER'S INTERNAL STANDARD of this Company shall be replaced with this analysis shall be replaced thereon by the company without notice.

Shapiro

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

Shipped from: Scott MacKenzie

Our Project #: 333559

1290 COMBERMERE STREET, TROY, MICHIGAN 48064 (313) 589-2950

Customer:

GENEX
2455 CLEVELAND AVENUE N.
ROBEVILLE, MN. 55113

*** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ***

PERFORMED ACCORDING TO SECTION 2.0.7.

Certified Per Traceability Procedure # 62

Protocol # 2

File # PQ-2184

Certified Accuracy 2% ANALYTICAL UNCERTAINTY

1 OF 1 COMPONENTS

ANALYZED CYLINDER

REFERENCE STD

INSTRUMENTATION

COMPONENT
PROPANE

CERTIFIED CONC. 3038 PPM
SRM # CYLINDER NUMBER
(CRM #) CLM-000702
CLM-000694

INSTR/MODEL/SERIAL #
BECKMAN 400 1002059

ANALYTICAL PRINCIPLE

FLAME IONIZATION DETECTOR

BALANCE GAS: AIR

ANALYSIS

DATE: 2-6-92

ZERO	TEST	REFERENCE	RESULTS
GAS	GAS	GAS	PPH
(mV)	(mV)	CONC.	PPH
0.00	65.60	466.0 PPM	100.00
0.00	65.60	100.00	100.00
0.00	65.60	100.00	100.00

CALCULATED RESULTS
303.8
303.8
303.8
AVERAGE: 303.8 PPM

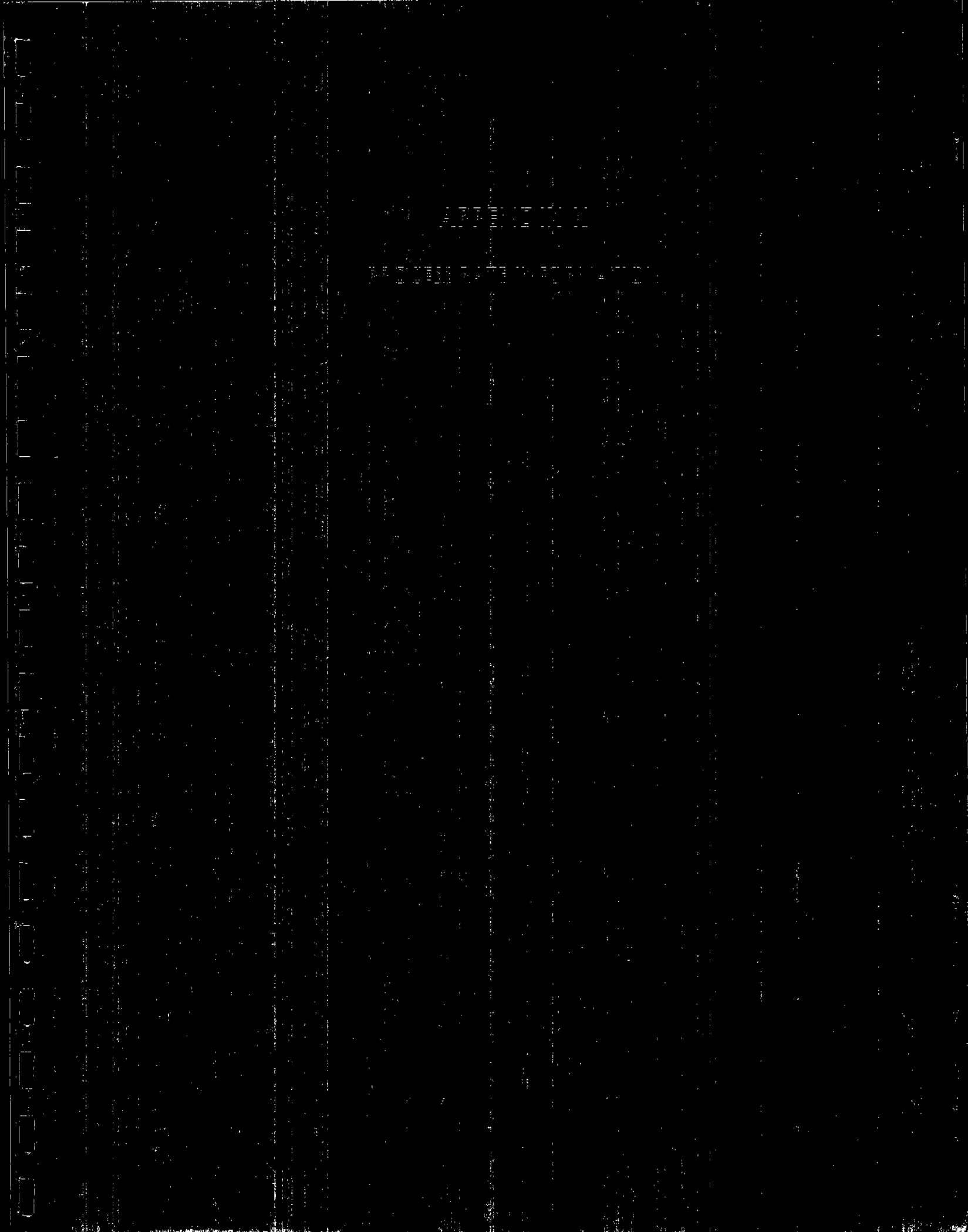
SAMPLE GAS SPLIT # 10%
OF FULL CONC.
303.8 PPM DIVIDED BY
10% = 3038 PPM.

CALIBRATION CURVE				2 ND DEGREE	
SRM #	CONC.	SPLIT	DMV	FITTED PERCENT	
(CRM #)	PPH	PT (%)	(mV)	VALUE	ERROR
16699	466.0	100	100.00	466.0	0.00
	315.8	68	68.10	315.6	-0.08
	199.9	43	43.30	199.7	-0.10
16688	95.00	20	20.80	95.45	0.47
	0.0000	0	0.00	0.0000	0.00
		0		0.0000	0.00
		0		0.00	0.00
16688	95.00	LOW	20.80	95.45	0.47
16698	466.0	HIGH	100.00	466.0	0.00

Approved By:

Shapiro

8819 - GAS MANUFACTURER'S INTERPRETATION OF THIS COMPANY'S ANALYSIS SHALL BE THE RESPONSIBILITY OF THE COMPANY WITHOUT EXTRA COST.



DAWSON CREEK TESTING 9-21 THROUGH 9-23 1993
PROCESS DATA

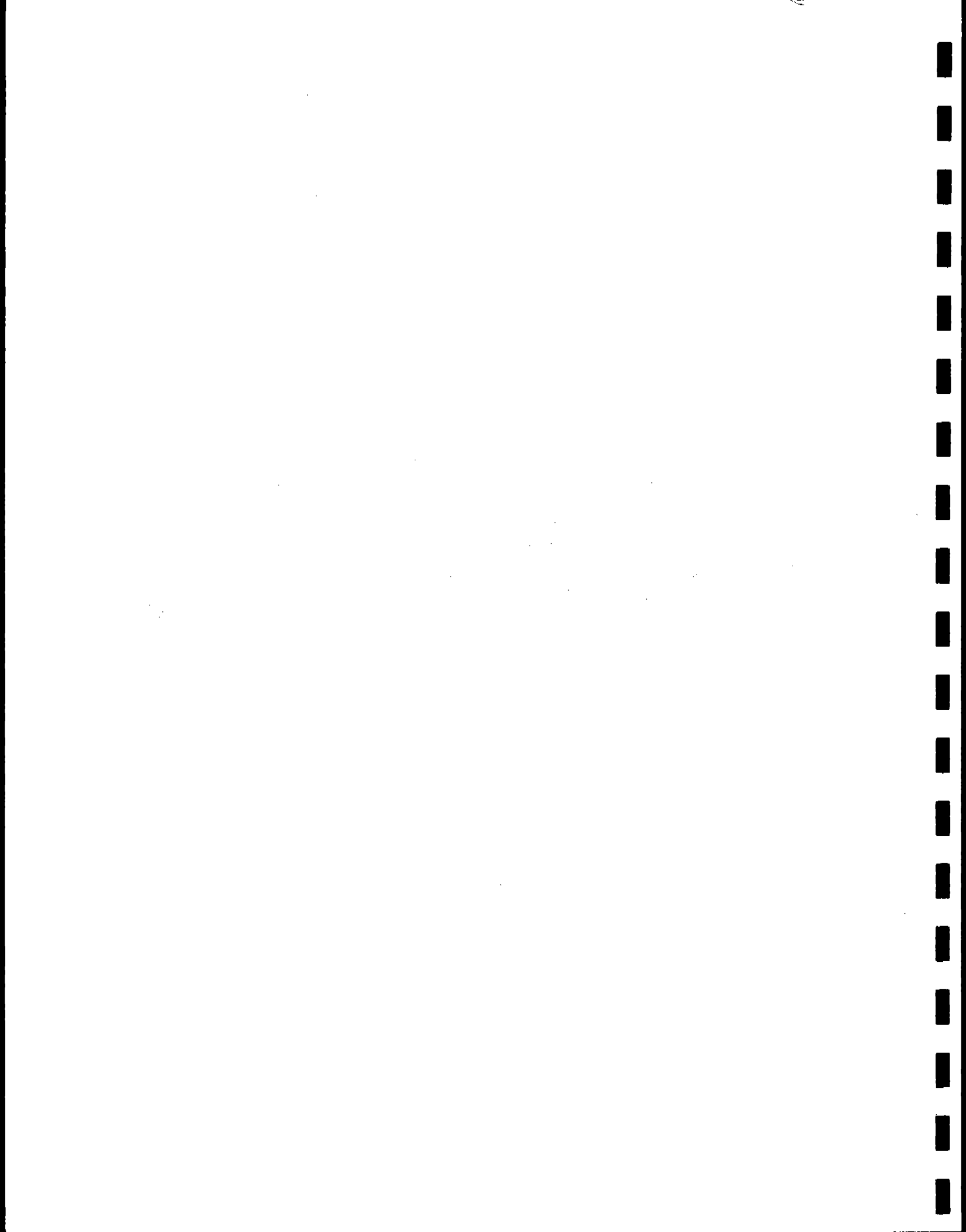
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2	TEST SCHEDULE
3	PROCESS DATA SUMMARY
	DRYER TESTING 9-21-93
4-7	BOARD WEIGHTS / PRODUCTION / FUEL BURNING RA
8-10	SURFACE DRYER DATA SHEETS
11-16	DRYER REPORTS
17-18	DRYER CHARTS
19-20	PRESS REPORTS
21-22	PRESS CHARTS
	PRESS VENT TESTING 9-22-93
23-24	BOARD WEIGHTS / PLANT PRODUCTION
25-26	PRESS CHARTS
27-28	PRESS REPORTS
29	RESIN USAGE LOG
30	DAILY INVENTORY REPORT
	THERMAL OIL HEATER TESTING 9-23-93
31	BOARD WEIGHTS / PRODUCTION
32	PRESS CHARTS
33	PRESS REPORTS
34	BTU INPUT
35-36	THERMAL OIL HEATER LOG

TEST SCHEDULE

<u>DATE</u>	<u>POLLUTANT</u>	<u>RUN #1</u>	<u>RUN #2</u>	<u>RUN #3</u>		
<u>SURFACE DRYER OUTLET TESTING</u>						
9-21	HCHO	0835-0939	1025-1129	1215-1319	08:30	13:30
9-21	PHENOL & HCN	0835-0939	1025-1129	1215-1319	08:30	13:30
9-21	TSP	1420-1425	1622-1723	1804-1905	14:20	19:20
9-21	VOC	1420-1425	1622-1723	1804-1905	14:20	19:20
<u>PRESS</u>						
9-22	HCHO	1014-1152	1217-1238, 1240-1348	1410-1539	10:00	20:30
9-22	PHENOL	1014-1107 1120-1152	1142-1238 1240-1245	1255-1356	10:00	20:30
9-22	VOC	1414-1531	1608-1717	1731-1845	10:00	20:30
9-22	MDI	1609-1718	1736-1845	1856-2004	10:00	20:30
<u>TO HEATER</u>						
9-23	TSP	0910-1012	1047-1150	1207-1310	09:00	13:20
9-23	VOC	0910-1012	1047-1150	1207-1310	09:00	13:20

TEST SCHEDULE

<u>DATE</u>	<u>POLLUTANT</u>	<u>RUN #1</u>	<u>RUN #2</u>	<u>RUN #3</u>		
<u>SURFACE DRYER OUTLET TESTING</u>						
9-21	HCHO	0835-0939	1025-1129	1215-1319	08:30	13:30
9-21	PHENOL & HCN	0835-0939	1025-1129	1215-1319	08:30	13:30
9-21	TSP	1420-1425	1622-1723	1804-1905	14:20	19:20
9-21	VOC	1420-1425	1622-1723	1804-1905	14:20	19:20
<u>PRESS</u>						
9-22	HCHO	1014-1152	1217-1238, 1240-1348	1410-1539	10:00	20:30
9-22	PHENOL	1014-1107 1120-1152	1142-1238 1240-1245	1255-1356	10:00	20:30
9-22	VOC	1414-1531	1608-1717	1731-1845	10:00	20:30
9-22	MDI	1609-1718	1736-1845	1856-2004	10:00	20:30
<u>TO HEATER</u>						
9-23	TSP	0910-1012	1047-1150	1207-1310	09:00	13:20
9-23	VOC	0910-1012	1047-1150	1207-1310	09:00	13:20



DAWSON CREEK TESTING 9-21 THROUGH 9-23 1993

PROCESS DATA SUMMARY

SURFACE DRYER TESTING FOR FORMALDEHYDE, PHENOL AND HCN

29.58 = PLANT PRODUCTION RATE IN TONS PER HOUR
1.80 = DRY FUEL INPUT IN TONS PER HOUR
23089 = LB PER HOUR OF FURNISH PRODUCED BY DRYER
900.00 = AVERAGE DRYER INLET TEMPERATURE IN DEGREES F
43.9% = MOISTURE CONTENT OF INCOMING WOOD
4.6% = MOISTURE CONTENT OF WOOD AFTER DRYING

SURFACE DRYER TESTING FOR PARTICULATE AND VOC

29.13 = PLANT PRODUCTION RATE IN TONS PER HOUR
1.77 = DRY FUEL INPUT IN TONS PER HOUR
22742 = LB PER HOUR OF FURNISH PRODUCED BY DRYER
864.00 = AVERAGE DRYER INLET TEMPERATURE IN DEGREES F
44.6% = MOISTURE CONTENT OF INCOMING WOOD
4.6% = MOISTURE CONTENT OF WOOD AFTER DRYING

PRESS

27.90 = PLANT PRODUCTION RATE IN TONS PER HOUR
5288 = MDI RESIN USAGE IN LBS PER HOUR
0.95% = MDI RESIN USAGE IN % OF FINISHED PRODUCT
837.7 = LIQUID PHENOLIC RESIN USAGE IN LBS PER HOUR (100% SOLIDS)
1.50% = LIQUID PHENOLIC RESIN USAGE IN % OF FINISHED PRODUCT (100%)
373 = WAX USAGE IN LBS PER HOUR
0.67% = WAX USAGE IN % OF FINISHED PRODUCT

THERMAL OIL HEATER TESTING

28.12 = PLANT PRODUCTION RATE IN TONS PER HOUR
1.29 = ESTIMATED TONS OF DRY FUEL INPUT BASED FUEL MEASUREMENT
23.18 = ESTIMATED MMBTU OF HEAT INPUT BASED FUEL MEASUREMENT

DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993

DRYER TESTING 9-21-93

FORMALDEHYDE, PHENOL AND HCN

DATA START TIME= 08:30 END TIME= 13:30 DATA TIME (HOURS)= 5.00

TOTAL DATA TIME 5.00

BOARD WEIGHTS - LBS

WEIGHTS OF ONE MAT APPROXIMATELY EVERY 10 MINUTES DURING TESTING
CORRECTED FOR SCALE ADJUSTMENT

276	265	270
268	267	270
271	271	261
276	269	265
274	275	
274	269	
271	271	
268	267	
267	272	
270	275	
267	265	
271	268	
260	265	

269.27 LB = AVERAGE
UNTRIMMED
MAT WEIGHT

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

6.6% = TRIM

PLANT PRODUCTION RATE

35.93 , (lb per cubic foot)

7/16 = THICKNESS PRODUCED

5.00 = HOURS DURING TESTING

98 = PRESSLOADS

1176.00 = NO. OF (8' X 24') BOARDS PRODUCED (PRESSLOADS x 12 BOARDS/LOAD)

295764 = LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)

59153 = LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED
PROD./TESTING HOURS)

29.58 = TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD
PROD/HR / 2000 LB)

52384 = SQUARE FEET OF BOARD PRODUCED (3/8" BASIS) PER HOUR

1257210 = PROJECTED DAILY FOOTAGE

DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993
 DRYER TESTING 9-21-93 FORMALDEHYDE, PHENOL AND HCN
 DATA START TIME= 08:30 END TIME= 13:30 DATA TIME (HOURS)= 5.00
 TOTAL DATA TIME 5.00

DRYER PRODUCTION RATE:

23089 =LB OF DRYER PRODUCTION / HR (LB OF FINISHED PROD./
 3 DRYERS/ (1-(% TRIM + % FINES)

8.0% =%FINES

6.6% =%TRIM

43.9% = MOISTURE CONTENT OF INCOMING WOOD

4.6% = MOISTURE CONTENT OF WOOD AFTER DRYING

SURFACE DRYER FUEL BURNING RATE

7.77 =FUEL CALIBRATION IN LB/COUNT

2317 = TOTAL COUNTS DURING TESTING HOURS

5.00 =HOURS DURING TESTING

18003 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CAL.)

3601 =LB. OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED /
 TESTING HOURS

1.80 =TONS OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED PER
 HOUR / 2000 LB)

8600 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)

30.97 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

900 = AVERAGE INLET TEMPERATURE

212 = AVERAGE OUTLET TEMPERATURE

DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993

DRYER TESTING 9-21-93

PARTICULATE AND VOC

DATA START TIME=

14:20 END TIME=

19:20 DATA TIME (HOURS)=

5.00

TOTAL DATA TIME

5.00

BOARD WEIGHTS - LBS

WEIGHTS OF ONE MAT APPROXIMATELY EVERY 10 MINUTES DURING TESTING
CORRECTED FOR SCALE ADJUSTMENT

269	266	273
267	268	266
266	270	261
262	271	263
259	275	263
261	275	
267	274	
265	274	
267	269	
264	277	
263	277	
261	271	
274	269	

267.97 LB = AVERAGE
UNTRIMMED
MAT WEIGHT

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

6.6% = TRIM

PLANT PRODUCTION RATE

35.75 , (lb per cubic foot)

7/16 = THICKNESS PRODUCED

5.00 = HOURS DURING TESTING

97 = PRESSLOADS

1164.00 = NO. OF (8' X 24') BOARDS PRODUCED (PRESSLOADS x 12 BOARDS/LOAD)

291326 = LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)

58265 = LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED
PROD./TESTING HOURS)

29.13 = TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD
PROD/HR / 2000 LB)

51849 = SQUARE FEET OF BOARD PRODUCED (3/8" BASIS) PER HOUR

1244381 = PROJECTED DAILY FOOTAGE

DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993

DRYER TESTING 9-21-93

PARTICULATE AND VOC

DATA START TIME=

14:20 END TIME=

19:20 DATA TIME (HOURS)=

5.00

TOTAL DATA TIME

5.00

DRYER PRODUCTION RATE:

22742 =LB OF DRYER PRODUCTION / HR (LB OF FINISHED PROD./
3DRYERS/ (1-(% TRIM + % FINES)

8.0% =%FINES

6.6% =%TRIM

44.6% = MOISTURE CONTENT OF INCOMING WOOD

4.6% = MOISTURE CONTENT OF WOOD AFTER DRYING

SURFACE DRYER FUEL BURNING RATE

7.77 =FUEL CALIBRATION IN LB/COUNT

2272 = TOTAL COUNTS DURING TESTING HOURS

5.00 =HOURS DURING TESTING

17653 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CAL.)

3531 =LB. OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED /
TESTING HOURS

1.77 =TONS OF FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED PER
HOUR / 2000 LB)

8600 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)

30.37 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

864 = AVERAGE INLET TEMPERATURE

212 = AVERAGE OUTLET TEMPERATURE

SURFACE DRYER DATA

DATE 9-21-93

10 MIN.

60 MIN.

TIME	OUTLET SET	FEED RATE	INLET TEMP	OUTLET TEMP	FURN. TEMP	FUEL COUNT	60 MIN.			
							DRY BIN %	WET BIN %	MOISTURE % IN	MOISTURE % OUT
0740	213.4	75	783	214.1	1496				45.6	3.7
0750	213.4	75	887	214.0	1582	420				
0800	213.4	75	855	213.5	1593	506	74/79	41	44	5.0
0810	213.4	75	894	214.3	1601	592				
0820	213.4	75	866	212.9	1602	661				
0830	213.4	75	872	212.9	1598	745				
0840	213.4	75	932	214.1	1601	817				
0850	213.4	75	949	212.9	1610	897				
0900	213.4	75	882	213.6	1596	979	76/64	76	44	4.2
0910	213.4	75	891	213.6	1598	1045				
0920	212.4	75	926	211.9	1611	1125				
0930	212.4	75	898	211.0	1607	1210				
0940	212.4	75	949	213.3	1595	1287				
0950	212.4	75	872	214.0	1595	1364				
1000	212.4	75	843	212.1	1596	1432	69/66	79	42.8	5.0
1010	212.4	75	854	210.9	1602	1517				
1020	212.4	75	882	212.0	1597	1589				
1030	212.4	75	959	212.7	1592	1677				
1040	212.4	75	979	212.2	1608	1753				
1050	212.4	75	928	211.6	1607	1835				
1100	212.4	75	925	212.7	1606	1915	71/64	91	44.4	4.2
1110	212.4	75	936	213.8	1594	1995				
1120	212.4	75	851	212.7	1598	2085				
1130	212.4	75	852	211.0	1595	2144				
1140	212.4	75	899	211.8	1588	2213				
1150	212.4	75	887	212.6	1599	2301				
1200	212.4	75	860	212.1	1605	2375	65/72	87	44.8	5.0
1210	212.4	75	892	212.5	1609	2450				
1220	211.4	75	844	211.5	1602	2536				
1230	211.4	75	834	211.1	1610	2600				

SURFACE DRYER DATA

DATE 9-21-93

TIME	OUTLET SET	FEED RATE	INLET TEMP	OUTLET TEMP	FURN. TEMP	FUEL COUNT	DRY BIN %	WET BIN %	MOISTURE % IN	MOISTURE % OUT
12:40	211.4	75	879	211.3	1604	2679				
12:50	212.4	75	948	212.7	1592	2751				
1300	212.4	75	897	212.8	1597	2830	71/70	85	43.6	4.6
1310	212.4	75	849	212.1	1605	2899				
1320	212.4	75	969	212.1	1596	2990				
1330	213.4	75	956	213.6	1584	3062				
1340	213.4	75	889	213.4	1600	3143				
1350	213.4	75	857	213.0	1609	3218				
1400	213.4	75	836	213.9	1614	3297	69/79	90	44	4.6
1410	213.4	75	841	213.1	1602	3367				
1420	213.4	75	950	214.0	1609	3430				
1433	213.4	75	950	212.2	1610	3546				
1441	213.4	75	962	213.6	1591	3621				
1450	213.4	75	942	213.5	1600	3678				
1500	213.4	75	861	213.2	1597	3754	75/74	81	44.4	4.6
1510	212.4	75	808	211.4	1591	3824				
1520	211.4	75	850	211.4	1591	3899				
1530	210.4	75	806	210.0	1591	3969				
1540	210.4	75	855	210.0	1614	4049				
1550	211.4	75	888	210.3	1603	4127				
1600	212.4	75	939	212.5	1590	4193	75/70	78	45.2	5.0
1610	212.4	75	873	211.0	1621	4275				
1620	212.4	75	855	213.0	1598	4350				
1630	212.4	75	853	210.5	1615	4424				
1640	211.4	75	815	212.5	1599	4493				
1650	214.4	75	830	211.3	1607	4573				
1700	211.4	75	856	211.8	1582	4652	77/70	87	43.2	4.2
1710	211.4	75	857	212.9	1605	4725				
1720	211.4	75	846	212.7	1591	4793				
1730	211.4	75	850	210.0	1597	4866				

SURFACE DRYER DATA

DATE 9-21-93

TIME	OUTLET FEED		INLET TEMP	OUTLET TEMP	TURN TEMP	FUEL PLANT	DRY BIN		WET BIN		MOISTURE	
	SET	RATE					%	%	%	%	IN	OUT
1740	211.4	75	841	211.5	1597	4950						
1750	211.4	75	859	211.1	1599	5020						
1800	211.4	75	826	212.5	1602	5084	80/71	91	43.6	4.6		
1812	211.4	75	852	211.5	1599	5783						
1820	211.4	75	853	212.3	1597	5230						
1832	211.4	75	875	210.5	1601	5322						
1840	211.4	75	897	211.0	1606	5377						
1851	211.4	75	876	211.2	1599	5012 (5513=0)						
1900	211.4	75	872	211.4	1608	5078	79/75	86	46.4	4.6		
1910	211.4	75	860	212.0	1587	0147						
1921	211.4	75	896	212.5	1585	0222						
1931	211.4	75	881	210.6	1616	0305						

LOUISIANA-PACIFIC CANADA LTD.
DRYER REPORT

DRYER: Amf

OPERATOR: Boel.F

SHIFT: BH4 Day

DATE: Sept 21st/87

	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00
WET BIN LEVEL	57	41	76	79	91	87	85	90	81	78	82	91
FEED RATE	75	75	75	75	75	75	75	75	75	75	75	75
DRYER INLET TEMP	828	857	887	852	909	905	904	814	839	878	877	830
DRYER OUTLET TEMP	216	212	213	212	212	211	212	213	213	213	211	212
MOISTURE	3.7	5.0	4.2	5.0	4.2	5.0	4.6	4.6	4.6	5.0	4.0	4.6
L.D. AMPS	251	248	246	250	244	240	244	247	244	241	245	243
L.D. DAMPER SETTING	100	100	100	100	100	120	100	150	100	100	100	100
BURNER ON WOOD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BURNER ON SUSTAINING GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
BURNER ON GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
WOOD VALVE SET POINT	38	44	43	42	42	43	41	38	40	40	40	38
BURNER TEMP	1474	1606	1605	1596	1605	1609	1602	1571	1598	1597	1605	158
REFRACTORY TEMP	1050	1150	1150	1200	1200	1250	1240	1250	1250	1280	1250	125
BURNER GRECON	0	0	0	0	0	0	0	0	0	0	0	0
DILUENT AIR SET POINT	1500	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
BURNER OUTLET TEMP	50	5.5	5.3	5.6	5.6	5.4	5.7	5.3	5.5	5.5	5.3	5.3

TOTAL METERING SCREW REVOLUTIONS: _____

TOTAL WEIGHT OF FLY ASH: _____

IF DRYER WAS SHUT DOWN, PLEASE INDICATE WHY AND FOR HOW LONG: _____

MAINTENANCE AND PRODUCTION ITEMS DONE TO DRYER SYSTEM: _____

LOUISIANA-PACIFIC CANADA LTD.
DRYER REPORT

DRYER: Core
SHIFT B#4 Day

OPERATOR: Roel F
DATE: Sept 21st / 93

	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00
WET BIN LEVEL	57	32	63	40	93	84	92	80	66	73	91	87
FEED RATE	72	65	65	75	75	75	75	75	75	75	75	75
DRYER INLET TEMP	1119	1123	1089	1182	1201	1135	1217	967	1007	978	1114	1112
DRYER OUTLET TEMP	222	234	238	228	225	223	232	231	234	233	235	235
MOISTURE	46	59	46	46	46	55	46	42	59	46	50	50
LD. AMPS	262	272	262	264	266	265	268	267	267	269	269	265
LD. DAMPER SETTING	100	100	100	100	100	100	100	100	100	100	100	100
BURNER ON WOOD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BURNER ON SUSTAINING GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
BURNER ON GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
WOOD VALVE SET POINT	41	23	38	47	45	46	43	42	44	45	47	47
BURNER TEMP	1415	1374	1376	1402	1402	1375	1408	1408	1373	1405	1402	1401
REFRACTORY TEMP	1250	1200	1200	1200	1200	1200	1200	1250	1200	1250	1200	1200
BURNER GRECON	0	0	0	0	0	0	0	0	0	0	0	0
DILUENT AIR SET POINT	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
BURNER OUTLET TEMP	3.7	4.8	4.7	3.9	5.0	4.9	4.9	5.0	5.3	4.5	4.4	4.5

TOTAL METERING SCREW REVOLUTIONS: _____

TOTAL WEIGHT OF FLY ASH: _____

IF DRYER WAS SHUT DOWN, PLEASE INDICATE WHY AND FOR HOW LONG: _____

MAINTENANCE AND PRODUCTION ITEMS DONE TO DRYER SYSTEM: _____

LOUISIANA-PACIFIC CANADA LTD.

DRYER REPORT

DRYER: SLOPERATOR: Roel FSHIFT: B Day #4DATE: Sept 21st/92

	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00
WET BIN LEVEL	56	26	78	74	41	41	43	34	32	77	88	94
FEED RATE	72	65	65	75	75	75	75	75	75	75	75	75
DRYER INLET TEMP	380	759	858	951	1004	933	923	877	779	986	986	986
DRYER OUTLET TEMP	230	238	246	232	233	232	230	231	230	235	234	232
MOISTURE	5.9	6.4	4.6	4.2	4.2	4.6	4.6	4.6	4.2	5.0	5.0	4.2
I.D. AMPS	271	263	267	263	263	271	267	271	269	264	266	26
I.D. DAMPER SETTING	100	100	100	100	100	100	100	100	100	100	100	100
BURNER ON WOOD	/	/	/	✓	/	✓	/	/	/	✓	✓	✓
BURNER ON SUSTAINING GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
BURNER ON GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
WOOD VALVE SET POINT	43	39	59	45	47	45	47	46	43	42	45	48
BURNER TEMP	1416	1427	1380	1431	1429	1396	1412	1401	1426	1420	1427	1431
REFRACTORY TEMP	1200	1250	1200	1200	1250	1250	1200	1250	1250	1250	1250	1250
BURNER GRECON	0	0	0	0	0	0	0	0	0	0	0	0
DILUENT AIR SET POINT	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421
BURNER OUTLET TEMP	57	3.3	2.7	5.5	5.3	5.4	5.2	5.8	4.7	5.2	5.5	5.7

TOTAL METERING SCREW REVOLUTIONS: _____

TOTAL WEIGHT OF FLY ASH: _____

IF DRYER WAS SHUT DOWN, PLEASE INDICATE WHY AND FOR HOW LONG: _____

MAINTENANCE AND PRODUCTION ITEMS DONE TO DRYER SYSTEM: _____

LOUISIANA-PACIFIC CANADA LTD.
DRYER REPORT

DRYER: Surf
SHIFT: Even N#4

OPERATOR: K. S. H.
DATE: Sept 21/83

	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00
WET BIN LEVEL	57	79	88	67	89	85	89	83	91	86	82	80
FEED RATE	73	68	65	69	72	72	72	72	62	62	62	60
DRYER INLET TEMP	904	789	724	752	870	884	939	966	774	713	755	741
DRYER OUTLET TEMP	2118	2117	2022	2100	2127	2119	2145	2114	2118	2006	2000	1769
MOISTURE	460	460	420	420	550	3130	4160	550	550	480	375	0
I.D. AMPS	240	246	240	240	247	244	240	246	240	248	250	250
I.D. DAMPER SETTING	100	100	100	100	100	100	100	100	100	100	100	100
BURNER ON WOOD	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
BURNER ON SUSTAINING GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
BURNER ON GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
WOOD VALVE SET POINT	34.3	37.2	36.4	37.4	40.9	38.1	37.0	41.5	36.3	32.3	38.5	153
BURNER TEMP	1590	1611	1611	1607	1449	1444	1445	1451	1445	1465	1470	1420
REFRACTORY TEMP	1125	1300	1325	1300	1050	1050	1050	1000	1000	1100	1050	650
BURNER GRECON	0	0	0	0	0	0	0	0	0	0	0	0
DILUENT AIR SET POINT	1600	1400	1400	1400	1400	1400	1445	1445	1445	1445	1445	1445
BURNER OUTLET TEMP	59	43	51	55	60	54	58	58	52	58	57	0

TOTAL METERING SCREW REVOLUTIONS: _____

TOTAL WEIGHT OF FLY ASH: _____

IF DRYER WAS SHUT DOWN, PLEASE INDICATE WHY AND FOR HOW LONG: 540-618
m/w tightened I.D.

MAINTENANCE AND PRODUCTION ITEMS DONE TO DRYER SYSTEM: _____

LOUISIANA-PACIFIC CANADA LTD.
DRYER REPORT

DRYER: Core OPERATOR: Kris H.
SHIFT: Even N#4 DATE: 2007 2/1/03

	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00
WET BIN LEVEL	17	59	69	82	92	86	86	91	87	89	87	90
FEED RATE	737	68	65	68	71	71	71	71	63	63	63	48
DRYER INLET TEMP	1060	768	835	882	958	1011	1060	1037	953	825	887	991
DRYER OUTLET TEMP	2354	2361	2316	2303	2301	2318	2318	2317	2322	2289	2315	2316
MOISTURE	420	420	460	590	460	460	3,30	550	590	550	500	370
I.D. AMPS	260	269	259	264	268	266	265	266	267	270	267	262
I.D. DAMPER SETTING	100	100%	100	100	100%	100%	100	100	100	100%	100%	100%
BURNER ON WOOD	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
BURNER ON SUSTAINING GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
BURNER ON GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
WOOD VALVE SET POINT	428	406	362	420	450	454	430	461	411	454	423	510
BURNER TEMP	1405	1402	1428	1398	1393	1383	1408	1403	1394	1369	1297	1420
REFRACTORY TEMP	1440	1428	1300	1375	1350	1350	1250	1250	1225	1250	1275	1250
BURNER GRECON	0	0	0	0	0	0	0	0	0	0	0	0
DILUENT AIR SET POINT	1140	1140	1140	1400	1400	1400	1400	1400	1400	1400	1400	1400
BURNER OUTLET TEMP	42	59	48	47	56	47	48	51	51	54	49	50

TOTAL METERING SCREW REVOLUTIONS: _____

TOTAL WEIGHT OF FLY ASH: _____

IF DRYER WAS SHUT DOWN, PLEASE INDICATE WHY AND FOR HOW LONG: _____

MAINTENANCE AND PRODUCTION ITEMS DONE TO DRYER SYSTEM: _____

LOUISIANA-PACIFIC CANADA LTD. DRYER REPORT

DRYER: S/L

OPERATOR: K.A.S.

SHIFT Crew N#4

DATE: Sept 2, 1972

	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00
WET BIN LEVEL	80	82	83	77	82	90	91	94	94	92	92	85
FEED RATE	73	68	65	68	71	71	71	71	63	63	63	78
DRYER INLET TEMP	819	744	679	788	806	892	847	819	767	728	742	821
DRYER OUTLET TEMP	231.9	234.8	231.2	234.4	232.7	231.0	232.5	233.6	231.0	233.7	235.7	233
MOISTURE	40.0	46.0	50.0	55.0	42.0	4.60	4.60	5.50	5.00	55.0	50.0	40.0
L.D. AMPS	266	269	267	264	270	267	265	269	267	266	265	26
L.D. DAMPER SETTING	100%	100%	100	100%	100%	100	100	100	100	100%	100%	100%
BURNER ON WOOD	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
BURNER ON SUSTAINING GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
BURNER ON GAS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
WOOD VALVE SET POINT	45	44.0	42.6	45.9	45.4	44.2	45.7	46.2	46.0	44.1	42.9	49.
BURNER TEMP	1114	1125	1104	1117	1135	1131	1145	1131	1159	1122	1128	1148
REFRACTORY TEMP	1254	1250	1275	1275	1300	1250	1300	1300	1250	1300	1275	1300
BURNER GRECON	0	0	0	0	0	0	0	0	0	0	0	0
DILUENT AIR SET POINT	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421	1421
BURNER OUTLET TEMP	5.4	5.1	4.7	5.5	5.5	5.7	5.1	5.8	5.9	6.2	5.7	4.9

TOTAL METERING SCREW REVOLUTIONS: _____

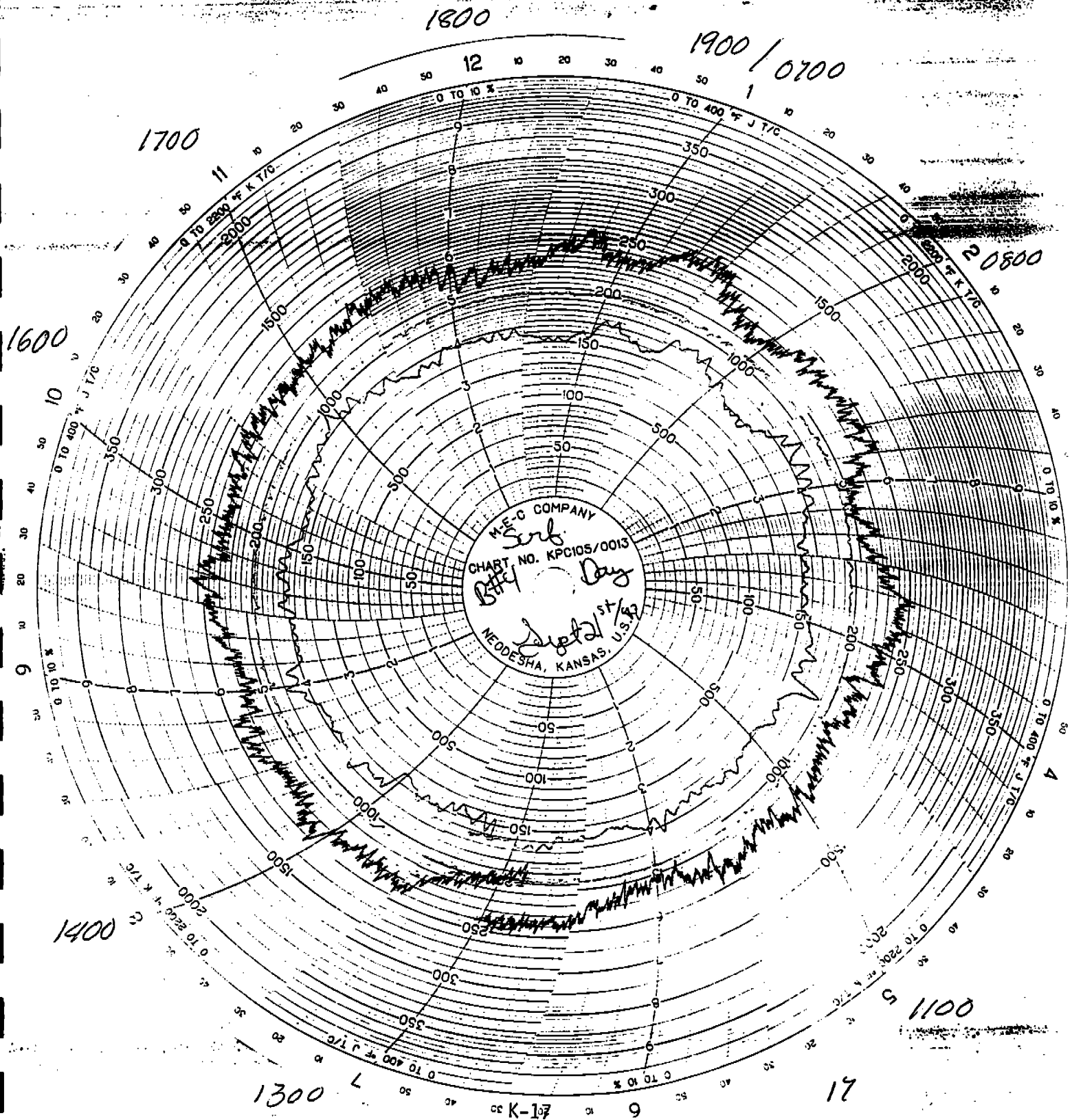
TOTAL WEIGHT OF FLY ASH: _____

IF DRYER WAS SHUT DOWN, PLEASE INDICATE WHY AND FOR HOW LONG: SHUT

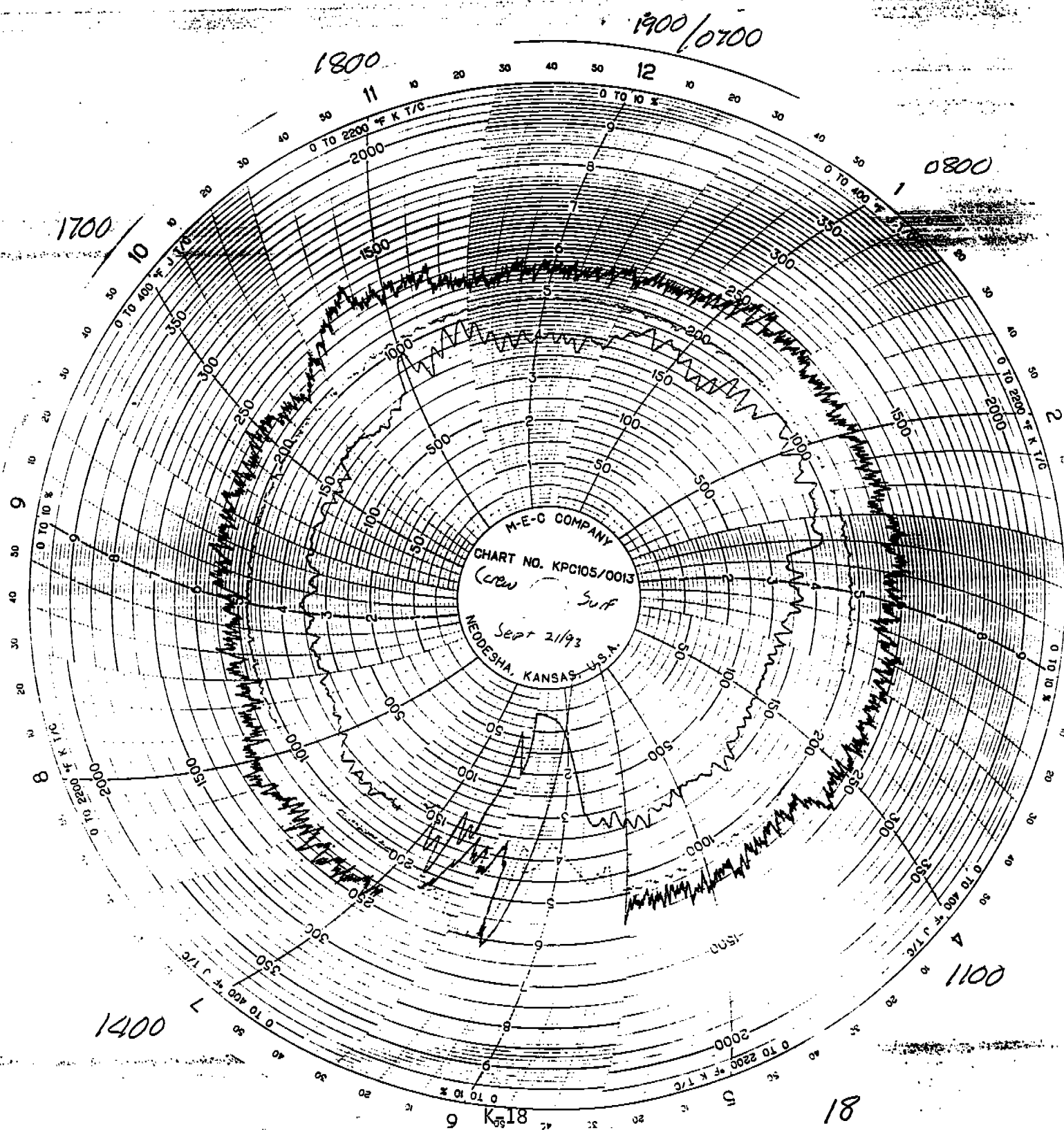
MAINTENANCE AND PRODUCTION ITEMS DONE TO DRYER SYSTEM: _____

SURFACE DRYER

9-21-93 - DAYS



9-21-83 - NIGHTS



OPERATOR

SHIFT

CREW

Sept. 21/23

LINE		
77.5	7:00	7:50
77-58	7:50	8:05
58.5	8:05	7:00

BOARD SIZE	PRESS LOADS	FOOTAGE FEET
7/16	2.1	56,450
23/32H	125	552,010
SHIFT TOTAL	146	608,460

PRESS TEMP. (*F) 405-412 TP

TOTAL DOWNTIME (min)

CONVERSION FACTORS:

$1/4 = 0.66667$	$19/32 = 1.58333$
$3/16 = 0.8333$	$5/8 = 1.66667$
$3/8 = 1.0000$	$23/32 = 1.9167$
$7/16 = 1.1667$	$3/4 = 2.0000$
$15/32 = 1.25$	$1 = 2.66667$
$1/2 = 1.3333$	$1 1/8 = 3.0000$

DOWN TIME		D.T. (min)	
FROM	TO	M	SEC

REASONS FOR DOWNTIME

4:12	7:13	1'		
------	------	----	--	--

line backed up at 97.5%

10:03	10:04	1		
-------	-------	---	--	--

miss clamp flight 4 HB24
1 sp back

2:40	72:4	1		
------	------	---	--	--

miss, clamp flight 2
4324 to par. back

2:49	12:50				
------	-------	--	--	--	--

change screen; 24 off
816 on

25	26	27	28	29	30	31
----	----	----	----	----	----	----

MISSED CLAMP FLIGHT #4
H.A. #1

4:5	4:5			
-----	-----	--	--	--

missed clamp of flight 4
HB 316

7:34	5:37	5		5
------	------	--------------	--	---

Saw one down 8x24
stopped in rip. DEC 16
to record 2nd. 11/16

slowing down? Savoyne drive 11/3/11

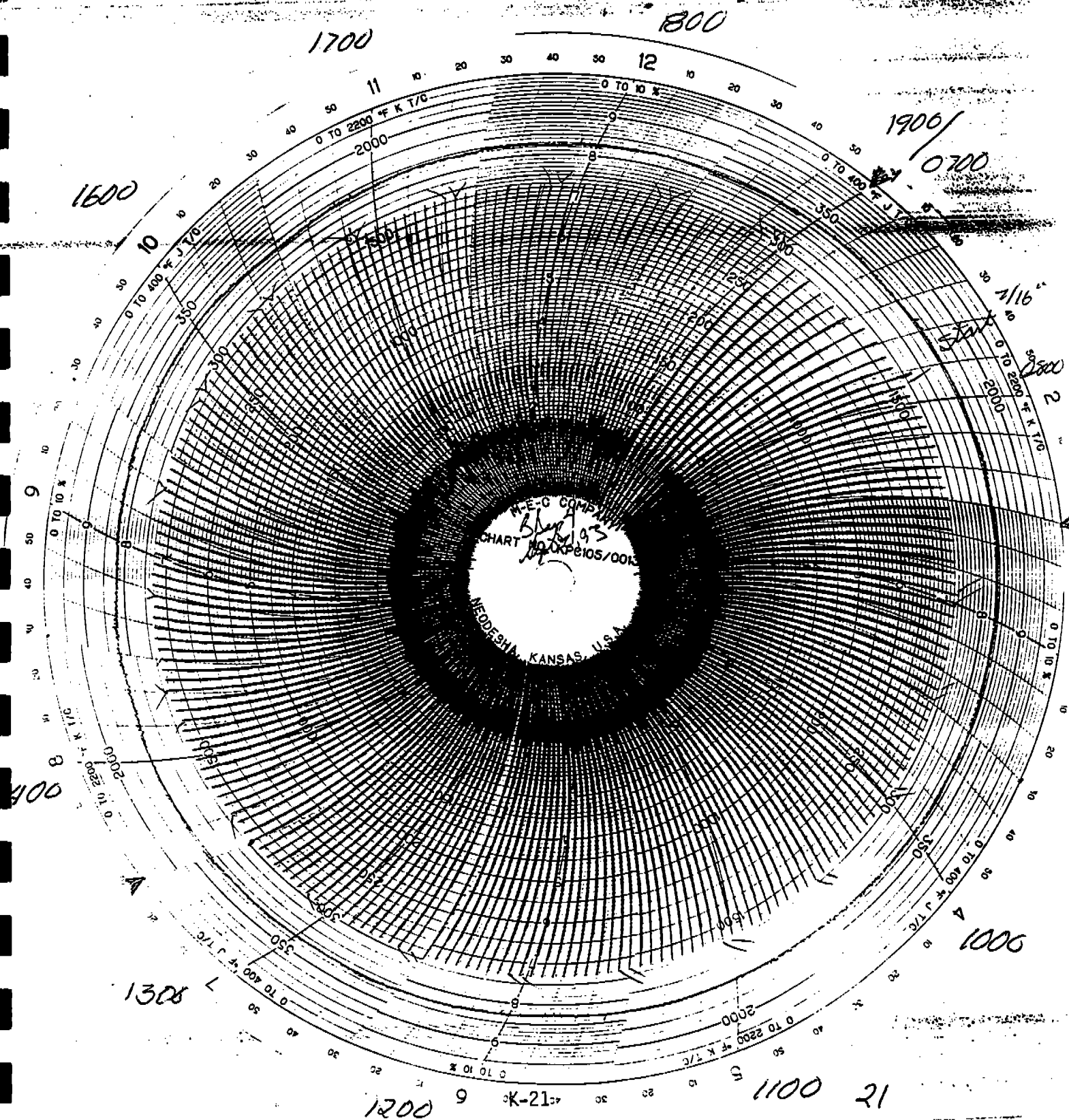
54	55	1		
----	----	---	--	--

west side of mat hung up
mat at 1/2 p.m. saw hood.

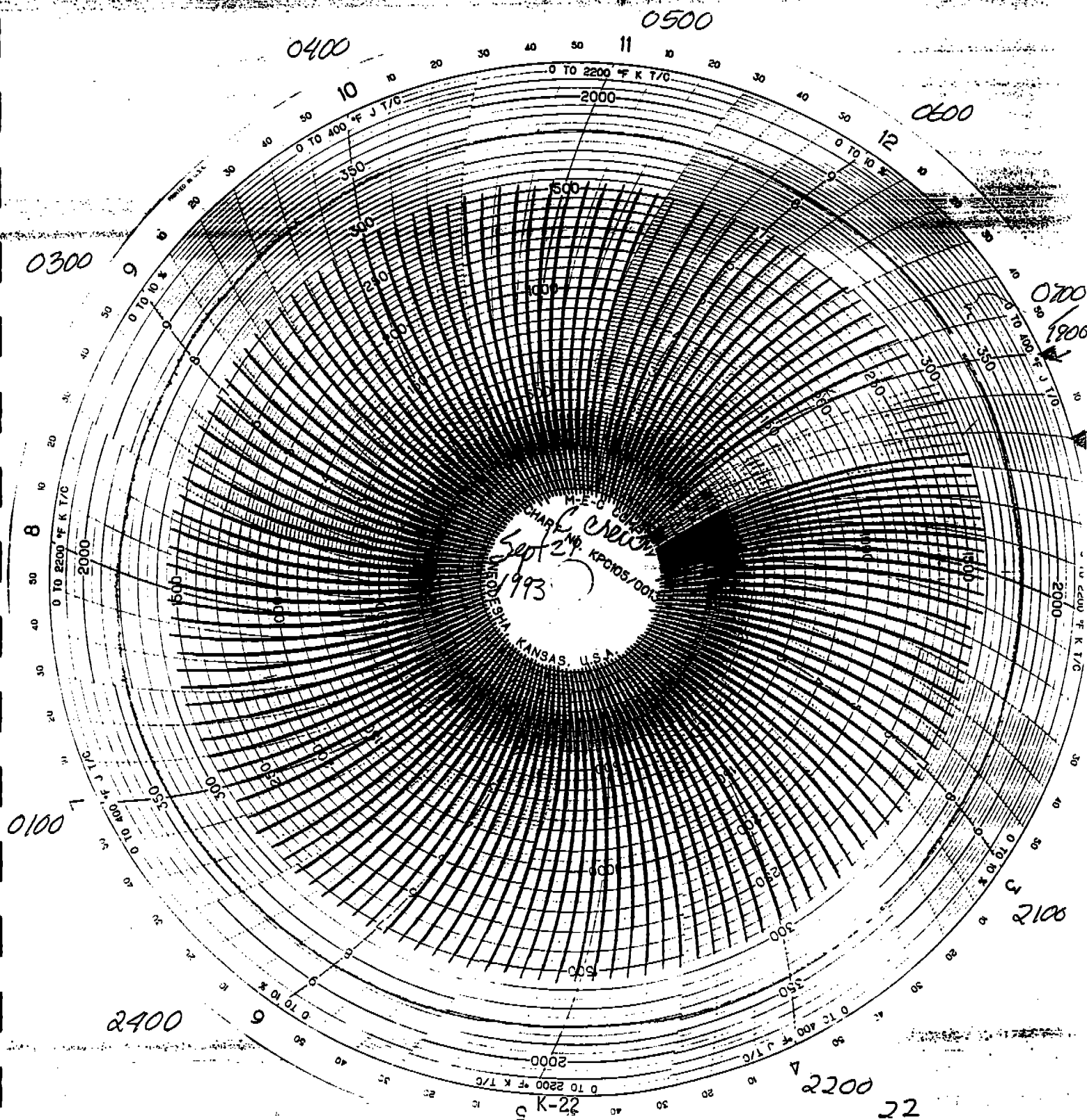
1 44	61 68	121 53	181
2 44	62 68	122 53	182
3 46	63 69	123 60	183
4 45	64 66	124 60	184
5 47	65 64	125 55	185
6 48	66 61	126 54	186
7 48	67 60	127 51	187
8 46	68 58	128 53	188
9 46	69 64	129 55	189
10 44	70 62	130 55	190
11 44	71 61	131 55	191
12 45	72 65	132 55	192
13 45	73 61	133 55	193
14 46	74 61	134 51	194
15 47	75 62	135 49	195
16 46	76 61	136 49	196
17 46	77 60	137 46	197
18 51	78 70	138 48	198
19 55	79 70	139 49	199
20 57	80 73	140 52	200
21 56	81 75	141 50	201
22 59	82 71	142 54	202
23 53	83 73	143 53	203
24 55	84 71	144 57	204
25 54	85 70	145 56	205
26 53	86 66	146 52	206
27 55	87 68	147 55	207
28 58	88 69	148 55	208
29 54	89 70	149 55	209
30 52	90 66	150 50	210
31 53	91 62	151 50	211
32 53	92 59	152 50	212
33 53	93 56	153 50	213
34 54	94 60	154 50	214
35 52	95 56	155 50	215
36 53	96 53	156 50	216
37 55	97 52	157 50	217
38 53	98 57	158 50	218
39 55	99 61	159 50	219
40 55	100 60	160 50	220
41 58	101 60	161 50	221
42 66	102 58	162 50	222
43 77	103 58	163 50	223

9-21-93 DAYS

PRESSLOADS 0830-1330 = 98
PRESSLOADS 0420-1900 = 91



PRESS CHART
9-21-93 NIGHTS
PRESSLOADS 1900-1920 = 6



DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993

PRESS VENT TESTING 9-22-93 PARTICULATE AND VOC

DATA START TIME= 10:03 END TIME= 20:30 DATA TIME (HOURS)= 10.45

TOTAL DATA TIME 10.45

BOARD WEIGHTS - LBS

WEIGHTS OF ONE MAT APPROXIMATELY EVERY 10 MINUTES DURING TESTING
CORRECTED FOR SCALE ADJUSTMENT

264	266	260	258	262
272	262	259	253	266
269	264	259	261	263
273	266	264	262	263
269	266	263	257	255
262	263	259	268	259
269	260	265	259	258
266	262	258	257	259
265	261	257	252	259
263	253	258	251	254
263	254	255	261	260
268	258	254	259	
269	261	257	262	
268	260	262	269	

261.39 LB = AVERAGE
UNTRIMMED
MAT WEIGHT

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

6.6% = TRIM

PLANT PRODUCTION RATE

34.88 , (lb per cubic foot)

7/16 = THICKNESS PRODUCED

10.45 = HOURS DURING TESTING

199 = PRESSLOADS (171+28)

2388.00 = NO. OF (8' X 24') BOARDS PRODUCED (PRESSLOADS x 12 BOARDS/LOAD)

583006 = LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)

55790 = LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED
PROD./TESTING HOURS)

27.90 = TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD
PROD/HR / 2000 LB)

50895 = SQUARE FEET OF BOARD PRODUCED (3/8" BASIS) PER HOUR

1221486 = PROJECTED DAILY FOOTAGE

DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993
PRESS VENT TESTING 9-22-93 PARTICULATE AND VOC

RESIN USAGE FROM 10:00 TO 20:00

TOTAL DATA TIME

10.00

RESIN AND WAX USAGE

5288 = LBS OF MDI RESIN USED DURING TESTING

528.80 = LBS OF MDI RESIN USED PER HOUR

8377 = LBS OF LIQUID PHENOLIC RESIN USED DURING TESTING (100% SOLIDS)

837.71 = LBS OF LIQUID PHENOLIC RESIN USED PER HOUR (100% SOLIDS)

3731 = LBS OF WAX USED DURING TESTING

373.10 = LBS OF WAX USED PER HOUR DURING TESTING

RESIN AND WAX USAGE AS PERCENTAGE OF FINISHED PRODUCT

0.95% = % OF MDI RESIN USED DURING TESTING

1.50% = % OF LIQUID PHENOLIC RESIN USED DURING TESTING (100% SOLIDS)

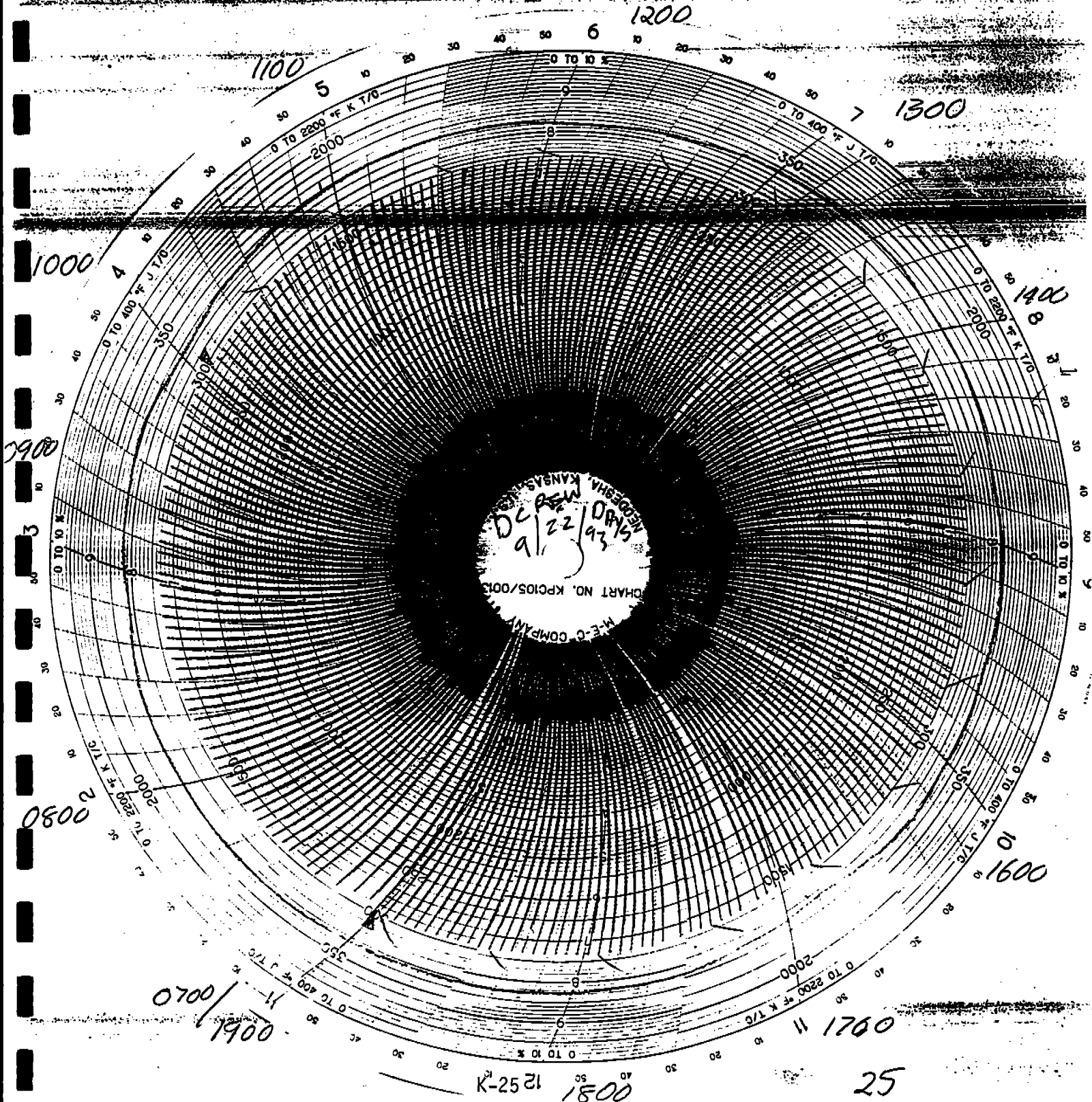
0.67% = % OF WAX USED DURING TESTING

PRESS CHART

9-22-93

DAYS

PRESS LOADS 1003 - 1900 = 171



PRESS CHART

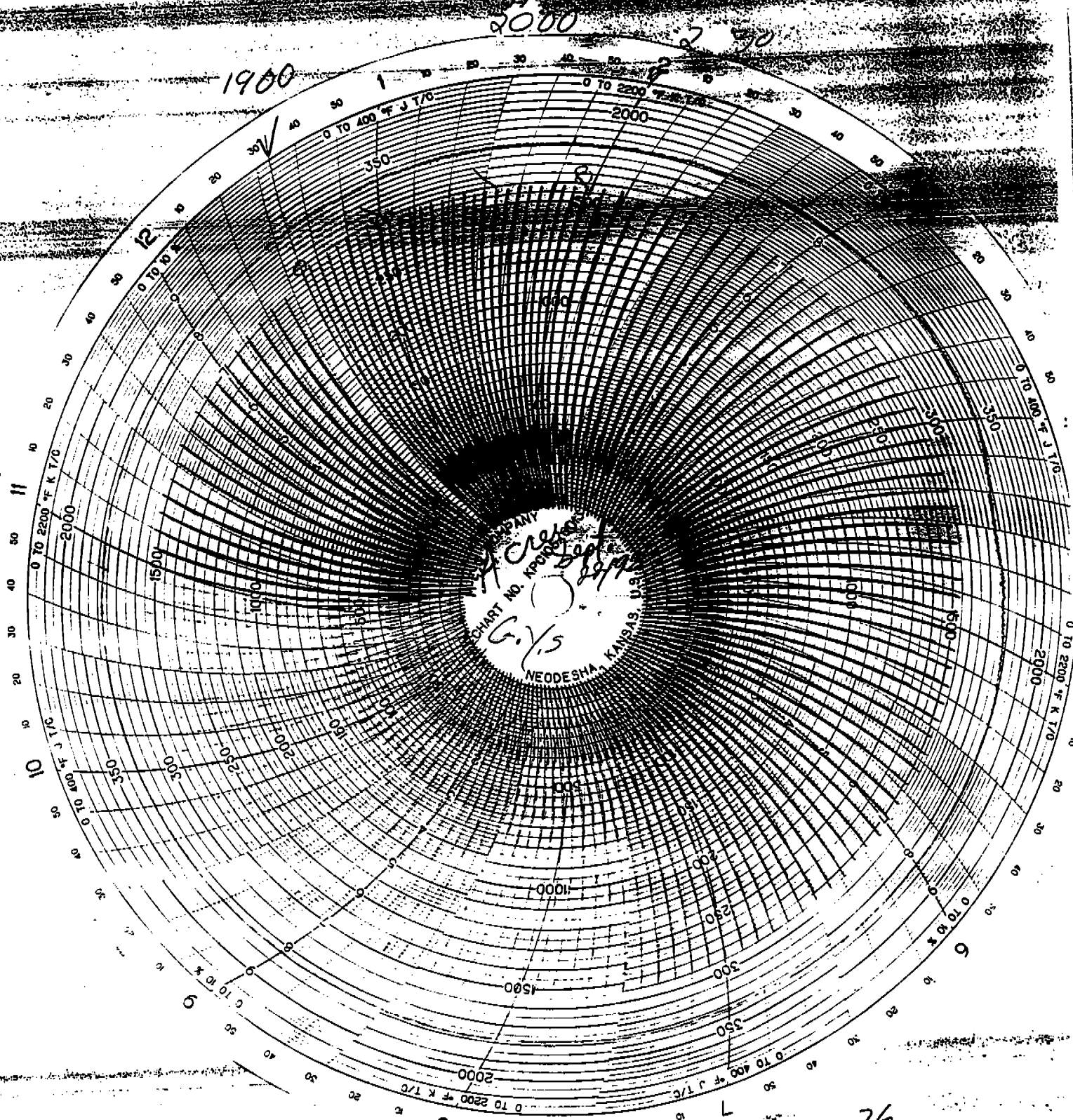
9-22-93

NIGHTS

PRESS LOADS 1900-2030 = 28

2000

1900



DAWSON-CREEK, BC

OPERATOR: LEE

SHIFT: DAYS 9/22/93 CREW: D-CREW

LINE	FROM	TO
58.7	7:00	7:20
96.5	7:20	7:30
97.5	7:30	11:00
97	11:00	5:10
96.8	5:10	

BOARD SIZE	PRESS LOADS	FOOTAGE 3/8'S
3/32 H	2	8,932
7/16	224	602,129
SHIFT TOTAL	1.26	610,961

PRESS TEMP. (*F) 108°

TOTAL DOWNTIME (min) 13

CONVERSION FACTORS:

1/4 = 0.66667	19/32 = 1.58333
3/16 = 0.8333	5/8 = 1.66667
3/8 = 1.0000	23/32 = 1.9167
7/16 = 1.1667	3/4 = 2.0000
15/32 = 1.25	1 = 2.66667
1/2 = 1.3333	1 1/8 = 3.0000

DOWN TIME D.T. (min)

REASONS FOR DOWNTIME

FROM TO M E O

7:15 7:16 1 DROPPED HIB# NO NUMBER
AT NO #6 WBU

1001 1003 2 CANT STAY
TRIANGLE TRIPPED

12:38 12:40 2
1:33 1:35 2
OP ON A N-1 IN LOADER
FLEW HIT #4

4:06 4:07 1 DROPPED HIB AT BOTTOM
OF NO #6

5:07 5:10 3 TOOK OFF # NBZ PLAT ON # B-17
SAWLINE DOWN DCH
BELT FLAKE INTO PROX

1 56	61 52	121 48	181 46
2 59	62 52	122 50	182 45
3 59	63 57	123 50	183 48
4 59	64 59	124 49	184 46
5 51	65 59	125 51	185 46
6 42	66 51	126 42	186 46
7 44	67 50	127 42	187 47
8 46	68 50	128 41	188 47
9 46	69 51	129 42	189 49
10 48	70 51	130 40	190 42
11 49	71 52	131 40	191 48
12 46	72 51	132 42	192 46
13 48	73 53	133 45	193 46
14 48	74 53	134 45	194 48
15 49	75 52	135 44	195 47
16 50	76 53	136 44	196 47
17 50	77 54	137 44	197 46
18 52	78 52	138 45	198 47
19 48	79 52	139 44	199 46
20 48	80 52	140 44	200 46
21 49	81 54	141 44	201 48
22 49	82 55	142 45	202 44
23 50	83 54	143 46	203 44
24 51	84 52	144 48	204 42
25 48	85 54	145 46	205 42
26 46	86 55	146 46	206 42
27 46	87 54	147 46	207 43
28 44	88 57	148 46	208 43
29 46	89 56	149 44	209 44
30 46	90 60	150 44	210 44
31 48	91 58	151 48	211 46
32 48	92 58	152 48	212 46
33 50	93 60	153 49	213 48
34 51	94 60	154 48	214 46
35 52	95 58	155 48	215 46
36 51	96 58	156 49	216 48
37 46	97 58	157 50	217 48
38 48	98 56	158 51	218 46
39 48	99 52	159 50	219 46
40 46	100 50	160 50	220 46
41 47	101 51	161 48	221 44
42 47	102 54	162 49	222 45
43 50	103 55	163 49	223 45
44 50	104 54	164 50	224 45
45 48	105 55	165 52	225 45

LOUISIANA-PACIFIC CANADA LTD.
JAWSON CREEK, BC

PRESS REPORT
OPERATOR: *Don Hornsby*

SHIFT: *G.Y.S*

CREW: *A crew - Sgt.*

LINE	FROM	TO
7:5	7:0	4:0
59.5	3:30	

BOARD SIZE	PRESS LOADS	FOOTAGE 3/8'S
7/16	30	80,642
23/24	120	329929
SHIFT TOTAL		610571

PRESS TEMP. (*F) *408*

TOTAL DOWNTIME (min) *7 min*

CONVERSION FACTORS:

1/4 = 0.66667 19/32 = 1.58333
3/16 = 0.83333 5/8 = 1.66667
3/8 = 1.0000 23/32 = 1.9167
7/16 = 1.1667 3/4 = 2.0000
15/32 = 1.25 1 = 2.66667
1/2 = 1.3333 1 1/8 = 3.0000

DOWN TIME D.T. (min)					REASONS FOR DOWNTIME		1	61	121	181
FROM	TO	M	E	O			45	54	51	181
7:34	9:00				2. Bottoms Core through Molten Fault		45	62	53	182
8:08	10:10				2. Lower Decking Sawling down. Boards not going through the B&B saws.		45	63	53	183
4:11	3:42				1. Missed clamp #4 for loader. H.B. Pushed Back.		46	64	54	184
4:33	4:31				1. Missed clamp #9 under loader. H.B. #9 - New screen.		46	65	50	185
5:23	6:24				1. Backup line		46	66	51	186
							46	67	53	187
							46	68	53	188
							45	69	54	189
							43	70	51	190
							44	71	52	191
							44	72	57	192
							43	73	49	193
							44	74	50	194
							44	75	49	195
							45	76	49	196
							45	77	49	197
							45	78	52	198
							46	79	53	199
							46	80	53	200
							46	81	53	201
							45	82	53	202
							45	83	57	203
							47	84	54	204
							48	85	52	205
							48	86	54	206
							49	87	54	207
							47	88	52	208
							57	89	53	209
							70	90	55	210
							53	91	55	211
							58	92	54	212
							64	93	54	213
							68	94	54	214
							70	95	51	215
							70	96	56	216
							70	97	54	217
							74	98	51	218
							74	99	54	219
							70	100	44	220
							56	101	49	221
							71	102	49	222
							71	103	47	223
							71	104	45	224
							70	105	45	225

LOUISIANA-PACIFIC CANADA, LTD.
DAVISON CRUISE, INC.

MICRO MOTIN LOG

NAME: _____

DATE: 9/22/93

SHIFT: 1D-CREW DAY

TIME	PRESS LOAD	BOARD SIZE	SURFACE SP/HD LBS/MIN	TOTAL	RPM	CORE SP/HD LBS/MIN	TOTAL	RPM
7:00					1 2 3 4 5			1 2 3 4 5
8:00 8:10	20	7/16	27.21	2720	1 2 3 4 5	9.60	979	1 2 3 4 5
9:00		7/16	26.20 27.18	2133	1 2 3 4 5	9.02 9.58	1480	1 2 3 4 5
10:00	55	7/16	26.20	5580	1 2 3 4 5	9.02	1985	1 2 3 4 5
11:00 11:30	84	7/16	26.07	7784	1 2 3 4 5	9.00	2764	1 2 3 4 5
12:00	94	7/16	26.07	8668	1 2 3 4 5	9.60	3073	1 2 3 4 5
1:00	112	7/16	26.07	10096	1 2 3 4 5	9.10	3566	1 2 3 4 5
2:00	131	7/16	26.07	11578	1 2 3 4 5	9.10	4678	1 2 3 4 5
3:00	150	7/16	26.07	13131	1 2 3 4 5	9.00	1613	1 2 3 4 5
4:00	170	7/16	26.07	14724	1 2 3 4 5	8.98	5173	1 2 3 4 5
5:00	188	7/16	26.07	16174	1 2 3 4 5	9.00	5676	1 2 3 4 5
6:00	206	7/16	26.07	17615	1 2 3 4 5	9.00	6173	1 2 3 4 5
6:30	216	7/16	26.07	18413		9.00	6446	-C
7:00				893			311	
8:00				2380			527	

RECORD
READINGS
EVERY
HOUR.

ZERO OUT
AT SHIFT
END.

IF YOU ARE
RUNNING
LOWER OR
HIGHER
LINE
SPEEDS
THAN
WHAT IS
IN MICRO
MOTION
BOOK, USE
CRITICAL
RATIO TO
ADJUST.

Sub
1000 - 2000

18413

5580

12851

+2380

15231

CORL

6446

-1985

4461

+827

5288

DAILY INVENTORY SHEET

Louisiana-Pacific Canada Ltd
Dawson Creek, B.C.

DATE: 09-22-93

1221.533 Total MSF for Day

610.961 MSF 1st Shift

610.572 MSF 2nd Shift

4732.137 MSF WTD

27939.214 MSF MTD

99.46 % A Grade Average

99.59 % 1st Shift

99.33 % 2nd Shift

Thickness	3/8	7/16	15/32	1/2	19/32 SL	19/32 II	23/32 SF	23/32 II	7/8 H	1/4
Conversion	1.0000	1.1667	1.2500	1.3333	1.5833	1.5833	1.9167	1.9167	2.3333	0.6667
Proseloads	0	254	0	0	0	0	0	122	0	0
MSF/Thick.	0.000	682.772	0.000	0.000	0.000	0.000	0.000	538.761	0.000	0.000
Wt.Conv.	248	270	299	312	375	388	439	452	534	172
Total Wt/Th.	0	822960	0	0	0	0	0	561728	0	0

60/40 Surf. Brd. Wt.	0
60/40 Core Brd. Wt.	0
55/45 Surf. Brd. Wt.	411480
55/45 Core Brd. Wt.	411480
Total Brd. Wt.	1484688
Surface Brd. Wt.	742344
Core Brd. Wt.	742344

INVENTORY	LPH	MDI	WAX	
			N.T.	S.T.
Today's Height	216.50	275.00	12.67	12.67
X Factor	884.33	876.14	5667	5667
= Total Lbs	191462	240939	71801	71801

	LPH	MDI	WAX	
Total Amount From Day Before-	144149	68996	152556	LPH
Add Incoming-	83444	186399	0	
Total Amount Today	191462	240939	143602	MDI
Total Usage	36131	14457	8954	
LBS/MSF	29.58	11.83	7.33	WAX

Percent Used-	2.68 %	1.95 %	0.60 %
---------------	--------	--------	--------

Total Cost (\$/MSF)	\$/MSF	\$/MSF	\$/MSF
---------------------	--------	--------	--------

TOTAL RESIN COST FOR DAY 16.58 \$/MSF

Average MTD Grade %

Avg MTD Wax Cost/MSF 1.52 \$/MSF
Avg MTD LPH Cost/MSF 6.48 \$/MSF
Avg MTD MDI Cost/MSF 9.42 \$/MSF
Total Resin Cost/MSF 15.89 \$/MSF

MTD

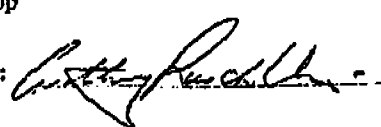
A-Grade 99.50 %
U-Grade 0.13 %
II-Grade 0.37 %

U.S. COST	STD
4.61 LPH	5.25
7.95 MDI	8.30
12.56 Total	13.55

Cause of Downgrade:

Dayshift -
Nightshift -

40 U-Grade - tails/loader cage
64 U-Grade - tails/sawline backstop

Signature: 

WAX $\frac{8954 \text{ lbs}}{24 \text{ hrs}} = 373.1 \text{ lbs/hr}$

DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993

THERMAL OIL HEATER TESTING 9-23-93, PARICULATE AND VOC

DATA START TIME= 09:10 END TIME= 13:21 DATA TIME (HOURS)= 4.18

TOTAL DATA TIME 4.18

BOARD WEIGHTS - LBS

WEIGHTS OF ONE MAT APPROXIMATELY EVERY 10 MINUTES DURING TESTING
CORRECTED FOR SCALE ADJUSTMENT

265	269
267	264
268	264
265	267
273	267
272	271
267	276
270	277
270	276
267	273
269	271
270	269
257	272

269.08 LB = AVERAGE
UNTRIMMED
MAT WEIGHT

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

6.6% = TRIM

PLANT PRODUCTION RATE

35.90 , (lb per cubic foot)

7/16 = THICKNESS PRODUCED

4.18 = HOURS DURING TESTING

78 = PRESSLOADS

936.00 = NO. OF (8' X 24') BOARDS PRODUCED (PRESSLOADS x 12 BOARDS/LOAD)

235236 = LBS FINISHED PRODUCT (BOARDS x WEIGHT OF FINISHED BOARD)

56232 = LBS FINISHED PRODUCT PRODUCED PER HOUR (LBS FINISHED
PROD./TESTING HOURS)

28.12 = TONS FINISHED PRODUCT PRODUCED PER HOUR (LB FINISHED PROD
PROD/HR / 2000 LB)

49832 = SQUARE FEET OF BOARD PRODUCED (3/8" BASIS) PER HOUR

1195980 = PROJECTED DAILY FOOTAGE

PRESS CHART

9-23-93

DAYS

0700

0800

0900

1000

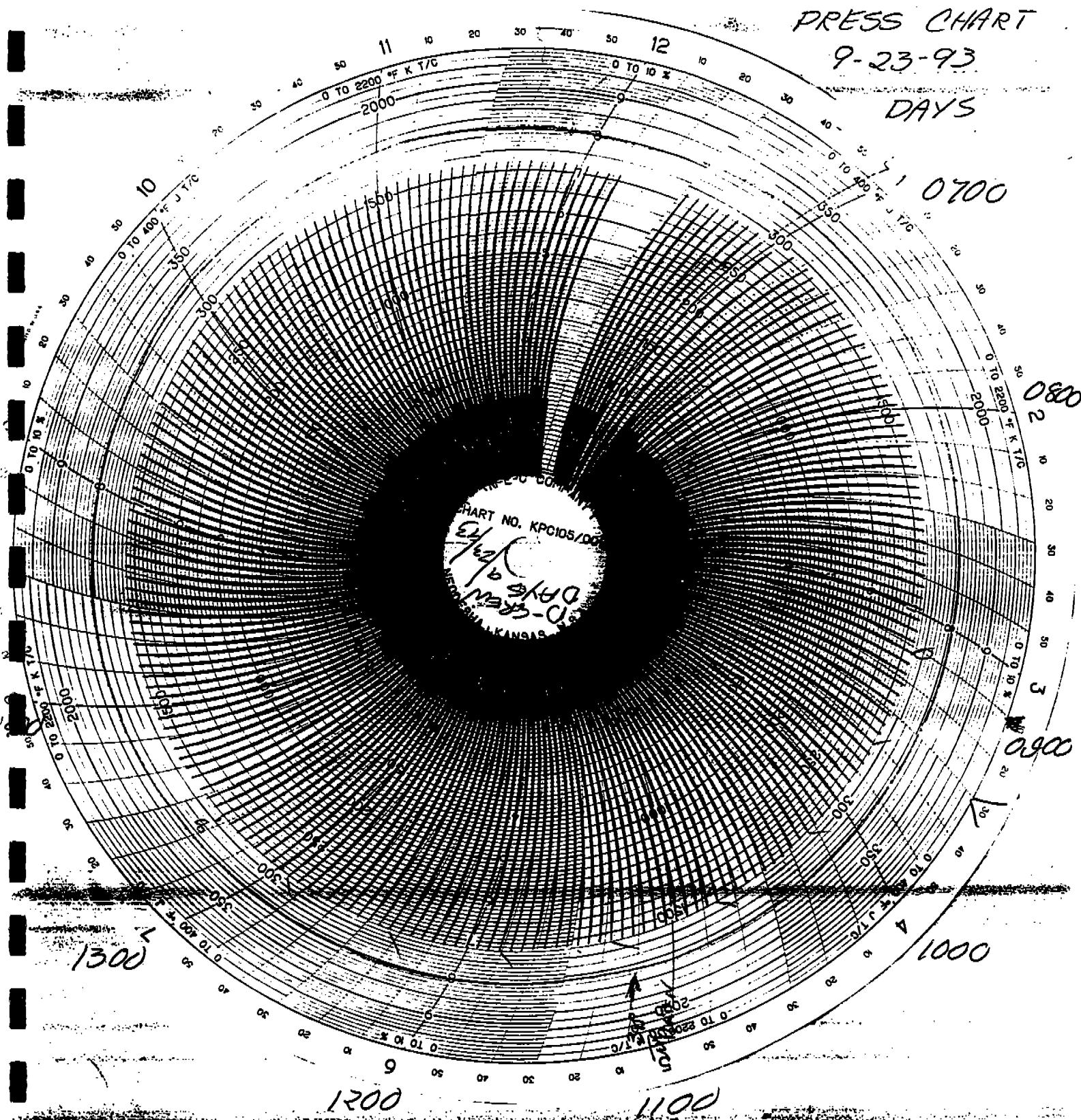
1100

1200

1300

PRESS LOADS

$$0910 - 1321 = 78$$



DAWSON CREEK, BC

OPERATOR: Russ Lees

PRESS REPORT 9-23

SHIFT: DAYS 9/23/93 CREW: D-CREW

LINE	FROM	TO
58.5	7:00	7:20
77	7:20	8:35
94	8:35	10:20
92	10:20	

BOARD SIZE	PRESS LOADS	FOOTA(2 3/8'S
23/32H	2	8,832
7/16	216	569,872
SHIFT TOTAL	214	578,704

PRESS TEMP. (*F) 405°

TOTAL DOWNTIME (min) 21

CONVERSION FACTORS:

1/4 = 0.66667 19/32 = 1.58333
 3/16 = 0.83333 5/8 = 1.66667
 3/8 = 1.0000 23/32 = 1.9167
 7/16 = 1.1667 3/4 = 2.0000
 15/32 = 1.25 1 = 2.66667
 1/2 = 1.3333 1 1/8 = 3.0000

DOWN TIME	D.T. (min)
FROM TO M E O	

7:32	7:33	1		
------	------	---	--	--

7:35	7:36	1		
------	------	---	--	--

7:46	7:48	2		
------	------	---	--	--

7:39	1:40	1		
------	------	---	--	--

6:20	6:36	16		
------	------	----	--	--

REASONS FOR DOWNTIME

SAWLINE DOWN R.C.
 CHECKING BANANA CUT

" " " "

TOOK OFF # NO # PUT ON # NB-2
 SCREEN TORE

A CYCLE FAULT

POWER OUTAGE, CHANGE
 FUSES IN DRIVE R.P. FEEDER

1	54	61	54	121	55	181	46
2	54	62	54	122	54	182	45
3	55	63	54	123	54	183	47
4	52	64	51	124	53	184	47
5	42	65	56	125	51	185	47
6	40	66	56	126	51	186	48
7	40	67	54	127	52	187	46
8	48	68	54	128	53	188	47
9	51	69	53	129	52	189	49
10	48	70	53	130	52	190	48
11	49	71	51	131	51	191	50
12	43	72	51	132	54	192	50
13	46	73	51	133	51	193	51
14	47	74	51	134	52	194	52
15	47	75	50	135	52	195	52
16	45	76	50	136	54	196	54
17	46	77	52	137	56	197	56
18	48	78	51	138	56	198	56
19	46	79	51	139	57	199	57
20	48	80	50	140	57	200	56
21	48	81	48	141	52	201	54
22	49	82	49	142	54	202	53
23	49	83	52	143	60	203	54
24	47	84	51	144	58	204	54
25	49	85	51	145	56	205	53
26	45	86	51	146	58	206	53
27	52	87	44	147	57	207	51
28	56	88	50	148	55	208	44
29	54	89	50	149	56	209	48
30	52	90	53	150	54	210	48
31	51	91	53	151	56	211	49
32	50	92	51	152	56	212	45
33	52	93	53	153	55	213	43
34	52	94	53	154	55	214	42
35	52	95	53	155	54	215	
36	51	96	53	156	52	216	
37	51	97	58	157	52	217	
38	53	98	59	158	54	218	
39	53	99	57	159	48	219	
40	51	100	57	160	52	220	
41	51	101	60	161	48	221	
42	51	102	55	162	48	222	
43	55	103	57	163	47	223	
44	52	104	58	164	48	224	
45	51	105	58	165	50	225	

DAWSON CREEK TESTING 9-21 THROUGH 9-23, 1993

THERMAL OIL HEATER TESTING 9-23-93, PARICULATE AND VOC

DATA START TIME= 09:10 END TIME= 13:21 DATA TIME (HOURS)= 4.18

TOTAL DATA TIME 4.18

THERMAL OIL HEATER FUEL BURNING RATE

18.44 =FUEL CALIBRATION IN LB/COUNT

1018 = TOTAL COUNTS DURING TESTING HOURS

4.18 =HOURS DURING TESTING

18772 =TOTAL LB. OF FUEL BURNED DURING TESTING (TOTAL COUNTS x CAL.)

4487 =LB. OF WET FUEL BURNED PER HOUR (TOTAL LB OF FUEL BURNED /
TESTING HOURS

42.60% =AVERAGE MOISTURE CONTENT DURING TESTING

2576 =LBS OF DRY FUEL BURNED PER HOUR (LBS OF WET FUEL BURNED PER
HOUR * (1-MOISTURE CONTENT))

9000 = ESTIMATED BTU CONTENT OF DRY FUEL (BTU / LB)

23.18 = ESTIMATED MMBTU INPUT PER HOUR (LB OF FUEL/HR x BTU CONTENT)

1.29 =TONS OF DRY FUEL BURNED PER HOUR (LBS / 2000)

DAWSON CREEK 9-23-93 KONUS READINGS - #1

TIME	OIL SET	OIL OUT	OIL IN	RK	CFM COMB.	FUEL COUNT	FUEL %	FLUE TEMP	MC
0730	496	497	449	-5	5000	28	57	661	
740	496	508	450	-8	5000	42	55	682	
0750	496	483	446	-5	5000	74	55	637	
0800	496	508	448	-8	5000	104	54	682	
0810	496	491	442	-6	5000	153	54	664	
0820	496	496	449	-5	5000	172	54	677	
0830	496	488	440	-5	5400	218	54	670	
0840	496	488	447	-5	5700	242	53	664	
0850	496	499	444	-5	5800	291	53	700	
0900	496	483	442	-5	5000	317	53	655	
0911	496	492	447	-6	4950	357	53	675	
0920	496	503	444	-6	4900	384	51	704	
0930	496	482	439	-5	4850	419	50	661	
0940	496	490	444	-6	5000	461	49	677	
0951	496	488	439	-5	5000	508	49	678	
1000	496	491	439	-6	5000	549	49	692	
1010	496	495	441	-5	5100	592	49	701	
1020	496	502	444	-5	5600	634	49	720	
1032	496	482	438	-6	6000	673	49	674	
1040	496	501	442	-6	6100	703	49	716	
1050	496	482	437	-6	6000	744 664	49	670	
1100	496	498	441	-5	6000	786	49	718	
1112	496	470	434	-5	6000	833	52	643	42.6%

K-36

Particulate Loadings and Emission Rates

The particulate emission rates were determined per EPA Methods 1-5, CFR title 40, Part 60, Appendix A (revised July 1, 1987). In this procedure, a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

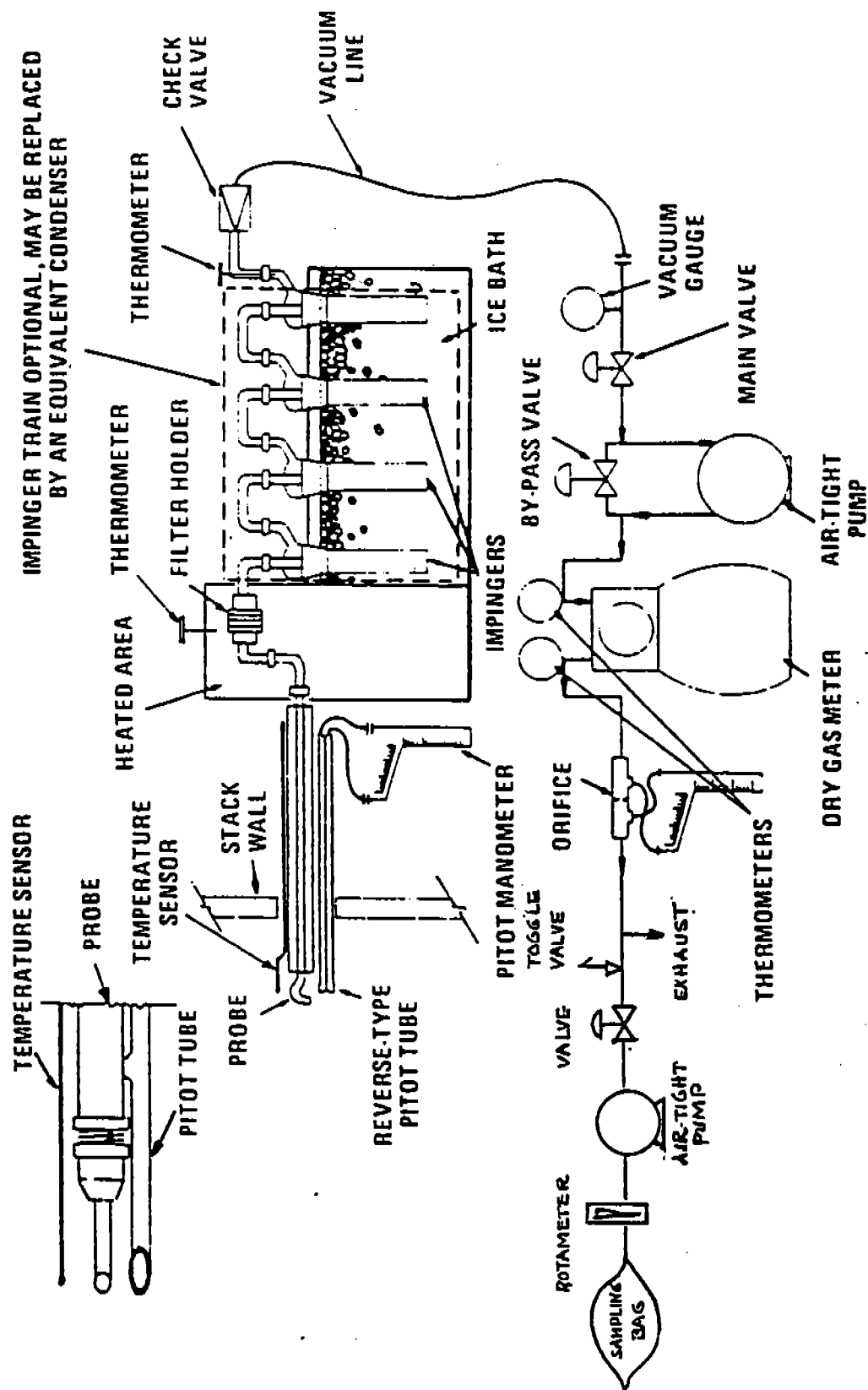
The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the impinger case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

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

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

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

Integrated flue gas samples for Orsat analysis were collected simultaneously from the stack and from the breeching at the inlet to the wet scrubber. The samples were collected in 15-liter gas sampling bags at a constant flow rate throughout each particulate run. The bags were then returned to the laboratory and analyzed by Orsat analysis. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen).



Particulate sampling train.

**ENVIRONMENTAL PROTECTION
AGENCY**

40 CFR Part 51

[AD-FRL-3977-4]

**Preparation, Adoption, and Submittal
of State Implementation Plans, Method
for Measurement of Condensible
Particulate Emissions From Stationary
Sources**

AGENCY: Environmental Protection
Agency (EPA).

ACTION: Final rule.

SUMMARY: Method 202 for the measurement of condensible particulate matter (CPM) was proposed in the Federal Register on October 12, 1990, at (55 FR 41546). This action promulgates this method. On April 17, 1990 at (55 FR 14246) EPA promulgated two methods for measuring particulate matter (PM) with an aerodynamic diameter of $10\text{ }\mu\text{m}$ or less (PM_{10}). Since CPM emissions form very fine particles in the PM_{10} size range and are considered PM_{10} emissions, the Agency is adding a method for measuring CPM emissions from stationary sources to appendix M in 40 CFR part 51. The purpose of this

rule is to provide the States with a method for measuring CPM.

EFFECTIVE DATE: December 17, 1991.

ADDRESSES: Background Information Document. The Background Information Document for the promulgated test methods may be obtained from Candace Sorrell or Peter Westlin, MD-19, U.S. EPA, Research Triangle Park, North Carolina 27711, telephone number (919) 541-1064. Please refer to "Summary of Comments and Responses for Method 202."

Docket. Docket No. A-90-03, containing materials relevant to this rulemaking, is available for public inspection and copying between 8:30 a.m. to 12 Noon and 1:30 to 3:30 p.m., Monday through Friday, at EPA's Air Docket Section, Waterside Mall, room M1500, 1st Floor, Gallery 1, 401 M Street SW., Washington, DC 20460. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Candace Sorrell or Peter Westlin, Emission Measurement Branch (MD-19), Technical Support Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-1064.

SUPPLEMENTARY INFORMATION:

I. The Rulemaking

The EPA is proposing to add a method for measuring CPM emissions to appendix M in 40 CFR part 51 to provide a method that States can use in their State implementation plans.

II. Public Participation

The opportunity to hold a public hearing on November 2, 1990 at 10 a.m. was presented in the proposal notice, but no one desired to make an oral presentation. The public comment period was from October 12, 1990 to December 17, 1990.

III. Significant Comments and Changes to the Proposed Rulemaking

Six comment letters were received from the proposal rulemaking. A detailed discussion of these comments is contained in the background document entitled "Summary of Comments and Responses for Method 202" which is referred to in the ADDRESSES section of this preamble. The major comments raised in these letters and the Agency's responses follow.

One commenter suggests that EPA determine the chemical composition of the material collected in the sampling train to verify that it will form ambient condensibles.

The EPA believes that material will collect in the impingers only by

condensation or dissolution. Dissolved gases will evaporate during analysis and will not be measured unless the gases react to form a solid or liquid while they are in solution. The EPA has designed Method 202 to prevent the formation of reaction materials from dissolved gases. The EPA believes that any remaining material collected and measured by Method 202 represents the material that would condense in the ambient air. Additional analysis of chemical composition is not necessary.

Another comment raises the concern that the method may collect some portion of the sulfur dioxide (SO_2) as condensible.

The dissolution of SO_2 in water does not lead immediately to the formation of sulfuric acid (H_2SO_4), but tends to lower the solution pH, which further inhibits sulfate or H_2SO_4 formation. The method includes a purging procedure which effectively removes SO_2 before significant oxidation occurs. No additional revisions are necessary.

The commenter feels that if EPA is allowing Method 202 to be used in conjunction with Method 201 or 201A or another dry catch procedure to determine the total PM_{10} measurement, the combined methods should be tested for precision.

The imprecision associated with combining Method 202 with Method 201 or 201A or any other dry catch procedure is not additive because each train provides a separate measurement. Since the total precision associated with the combined methods cannot be larger than the least precise sampling method, a precision evaluation of a combined sampling system is unnecessary.

A commenter suggests that EPA add specific language to the applicability section of the method stating that Method 202 cannot be used on wet sources. He notes that Method 17 is excluded from use on wet sources, and Methods 201 and 201A are not recommended for wet sources.

The EPA agrees that Method 202 with an in-stack filter is not recommended for wet sources, and such a statement has been added to the applicability. However, a heated Method 5 filter could be used in Method 202 instead of the in-stack filter which would allow application to wet sources.

One commenter requests that EPA clearly state that Method 202 should not be used for assessing compliance with emission limits set on the basis of data derived from a different measurement approach.

The EPA agrees that a violation must be shown, in the first instance, by means of measurements made with the

applicable test method. Once such a showing is made, however, section 113(e) of the Clean Air Act allows the Agency to rely on any credible evidence, including evidence other than the applicable test method, to establish the duration of the period of noncompliance for the purposes of assessing a penalty.

A commenter believes that the sample collection efficiency and method precision may be affected by the sampling conditions such as impinger temperature and sampling flow rate and the method should address this possibility.

The EPA agrees that the nature of the material in the sample gas may affect collection efficiency. For example, a field demonstration of Method 202 at an oil-fired boiler resulted in about 75 percent impinger collection efficiency. This collection efficiency can be improved with the addition of a second filter plate between the second and third impinger. This option has been included in the method with a discussion of applicability.

The commenter feels the 1-hour nitrogen (N_2) purge is too long. He believes the majority of the SO_2 is removed in the first few minutes. He suggests the method be revised to reduce the purge time in conjunction with maintaining the sample under cold conditions and analyzing it within 48 hours.

The EPA does not agree with reducing the purge time. Laboratory tests have shown that a 1-hour purge time is necessary to ensure the adequate removal of SO_2 from the impinger solution.

Another commenter suggests that the method should be revised to give credit for ammonium sulfate ($(\text{NH}_4)_2\text{SO}_4$) dihydrate and other condensible particulate matter formed in the gas stream due to ammonia (NH_3) injection used to enhance the efficiency of a control device.

The EPA does not agree. The condensible particulate matter formed in the gas stream due to NH_3 injection is emitted to the atmosphere. The EPA believes that condensible particulate matter emitted from the source should be counted as such even if it is a product of a pollution-control technique.

The commenter suggests that EPA consider an alternative to MeCl_2 consistent with the Montreal Protocol.

The EPA investigated the effectiveness of a chloroform-ether extraction during the method development phase. The chloroform-ether was not as effective as the MeCl_2 in removing organic materials; however, the chloroform-ether procedure was

found to be acceptable for organic extraction. The method has been revised to allow a chloroform-ether extraction.

The commenter supports the exclusion of ammonium chloride as a condensible; however, he expresses concern about $(\text{NH}_4)_2\text{SO}_4$ forming in the impingers.

The N_2 purge removes SO_2 before significant oxidation occurs. If NH_3 is present in the flue gas, the $(\text{NH}_4)_2\text{SO}_4$ formed in the impingers would not be counted as a condensible, although the H_2SO_4 , which reacted with NH_3 , would be counted as a condensible. Method 202 corrects for the NH_3 by measuring the sulfate using an IC analysis and subtracting out the ammonium ion (NH_4^+) mass.

The commenter agrees that the NH_3 added during the titration should be subtracted from the final weight. However, he does not agree with adding back in the water removed by the acid-base reaction.

Because H_2SO_4 is hygroscopic, the H_2SO_4 mass found in the atmosphere would have the water attached to it. The method has been revised to allow the source to correct for only the NH_4^+ or for both NH_4^+ and water as an option depending on the basis for the regulation.

A. Docket

The docket is an organized and complete file of all the information submitted to or otherwise considered by EPA in the development of this proposed rulemaking. The principle purposes of the docket are to: (1) Allow interested parties to identify and locate documents so that they can effectively participate in the rulemaking process, and (2) serve as the record in case of judicial review except for interagency review materials (Section 307(d)(7)(A)).

B. Office of Management and Budget Review

Under Executive Order 12291, EPA must judge whether a regulation is "major" and, therefore, subject to the requirement of a regulatory impact analysis. This rulemaking would not result in any of the adverse economic effects set forth in Section 1 of the Order as grounds for finding a "major rule." It will neither have an annual effect on the economy of \$100 million or more, nor will it result in a major increase in costs or prices. There will be no significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of U.S.-based enterprises to compete with foreign-based enterprises in domestic or export markets. This rulemaking was submitted to the Office of Management

and Budget (OMB) for review as required by Executive Order 12291.

C. Regulatory Flexibility Act Compliance

Pursuant to the provisions of 5 U.S.C. 605(b), I hereby certify that this attached rule, if promulgated, will not have any economic impact on small entities because no additional costs will be incurred.

This rule does not contain any information collection requirements subject to OMB review under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.*

Dated: December 6, 1991.

F. Henry Habicht II,
Acting Administrator.

List of Subjects in 40 CFR Part 51

Administrative practice and procedure.
Air pollution control.
Carbon Monoxide.
Inter-governmental relations.
Lead.
Nitrogen dioxide.
Ozone.
Particulate matter.
Reporting and recordkeeping requirements.
Sulfur Oxides.
Volatile Organic Compounds.

The EPA amends title 40, chapter I, part 51 of the Code of Federal Regulations as follows:

PART 51—[AMENDED]

1. The authority citation for part 51 continues to read as follows:

Authority: Section 110 of the Clean Air Act as amended (42 U.S.C. 7410).

2. Appendix M, to part 51 Table of Contents is amended by adding an entry to read as follows:

Method 202—Determination of Condensible Particulate Emissions From Stationary Sources

3. By adding Method 202 to Appendix M to part 51 to read as follows:

Method 202—Determination of Condensible Particulate Emissions From Stationary Sources

1. Applicability and Principle

1.1 Applicability. 1.1.1 This method applies to the determination of condensible particulate matter (CPM) emissions from stationary sources. It is intended to represent condensible matter as material that condenses after passing through a filter and as measured by this method (Note: The filter catch can be analyzed according to the appropriate method).

1.1.2 This method may be used in conjunction with Method 201 or 201A if the

probes are glass-lined. Using Method 202 in conjunction with Method 201 or 201A, only the impinger train configuration and analysis is addressed by this method. The sample train operation and front end recovery and analysis shall be conducted according to Method 201 or 201A.

1.1.3 This method may also be modified to measure material that condenses at other temperatures by specifying the filter and probe temperature. A heated Method 5 out-of-stack filter may be used instead of the in-stack filter to determine condensible emissions at wet sources.

1.2 Principle. 1.2.1 The CPM is collected in the impinger portion of a Method 17 (appendix A, 40 CFR part 60) type sampling train. The impinger contents are immediately purged after the run with nitrogen (N_2) to remove dissolved sulfur dioxide (SO_2) gases from the impinger contents. The impinger solution is then extracted with methylene chloride (MeCl_2). The organic and aqueous fractions are then taken to dryness and the residues weighed. The total of both fractions represents the CPM.

1.2.2 The potential for low collection efficiency exist at oil-fired boilers. To improve the collection efficiency at these type of sources, an additional filter placed between the second and third impinger is recommended.

2. Precision and Interference

2.1 Precision. The precision based on method development tests at an oil-fired boiler and a catalytic cracker were 11.7 and 4.8 percent, respectively.

2.2 Interference. Ammonia. In sources that use ammonia injection as a control technique for hydrogen chloride (HCl), the ammonia interferes by reacting with HCl in the gas stream to form ammonium chloride (NH_4Cl) which would be measured as CPM. The sample may be analyzed for chloride and the equivalent amount of NH_4Cl can be subtracted from the CPM weight. However, if NH_4Cl is to be counted as CPM, the inorganic fraction should be taken to near dryness (less than 1 ml liquid) in the oven and then allowed to air dry at ambient temperature to prevent any NH_4Cl from vaporizing.

3. Apparatus

3.1 Sampling Train. Same as in Method 17, section 2.1, with the following exceptions noted below (see Figure 202-1). *Note:* Mention of trade names or specific products does not constitute endorsement by EPA.

3.1.1 The probe extension shall be glass-lined or Teflon.

3.1.2 Both the first and second impingers shall be of the Greenburg-Smith design with the standard tip.

3.1.3 All sampling train glassware shall be cleaned prior to the test with soap and tap water, water, and rinsed using tap water, water, acetone, and finally, MeCl_2 . It is important to completely remove all silicone grease from areas that will be exposed to the MeCl_2 during sample recovery.

3.2 Sample Recovery. Same as in Method 17, section 2.2, with the following additions:

3.2.1 N_2 Purge Line. Inert tubing and fittings capable of delivering 0 to 28 liters/min of N_2 gas to the impinger train from a

standard gas cylinder (see Figure 202-2). Standard 0.95 cm (3/8-inch) plastic tubing and compression fittings in conjunction with an adjustable pressure regulator and needle valve may be used.

3.2.2 Rotameter. Capable of measuring gas flow at 20 liters/min.

3.3 Analysis. The following equipment is necessary in addition to that listed in Method 17, section 2.3:

3.3.1 Separatory Funnel. Glass, 1-liter.

3.3.2 Weighing Tins. 350-ml.

3.3.3 Dry Equipment. Hot plate and oven with temperature control.

3.3.4 Pipets. 5-ml.

3.3.5 Ion Chromatograph. Same as in Method 5F, Section 2.1.6.

4. Reagents

Unless otherwise indicated, all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

4.1 Sampling. Same as in Method 17, section 3.1, with the addition of deionized distilled water to conform to the American Society for Testing and Materials Specification D 1193-74, Type II and the omission of section 3.1.4.

4.2 Sample Recovery. Same as in Method 17, section 3.2, with the following additions:

4.2.1 N_2 Gas. Zero N_2 gas at delivery pressures high enough to provide a flow of 20 liters/min for 1 hour through the sampling train.

4.2.2 Methylene Chloride, ACS grade. Blanks shall be run prior to use and only methylene chloride with low blank values (0.001 percent) shall be used.

4.2.3 Water. Same as in section 4.1.

4.3 Analysis. Same as in Method 17, section 3.3, with the following additions:

4.3.1 Methylene Chloride. Same as section 4.2.2.

4.3.2 Ammonium Hydroxide. Concentrated (14.8 M) NH_4OH .

4.3.3 Water. Same as in section 4.1.

4.3.4 Phenolphthalein. The pH indicator solution, 0.05 percent in 50 percent alcohol.

5. Procedure

5.1 Sampling. Same as in Method 17, section 4.1, with the following exceptions:

5.1.1 Place 100 ml of water in the first three impingers.

5.1.2 The use of silicone grease in train assembly is not recommended because it is very soluble in $MeCl_2$, which may result in sample contamination. Teflon tape or similar means may be used to provide leak-free connections between glassware.

5.2 Sample Recovery. Same as in Method 17, section 4.2 with the addition of a post-test N_2 purge and specific changes in handling of individual samples as described below.

5.2.1 Post-test N_2 Purge for Sources Emitting SO_2 . (Note: This step is recommended, but is optional. With little or no SO_2 is present in the gas stream, i.e., the pH of the impinger solution is greater than 4.5, purging has been found to be unnecessary.) As soon as possible after the post-test leak check, detach the probe and filter from the impinger train. Leave the ice in

the impinger box to prevent removal of moisture during the purge. If necessary, add more ice during the purge to maintain the gas temperature below 20 °C. With no flow of gas through the clean purge line and fittings, attach it to the input of the impinger train (see Figure 202-2). To avoid over- or under-pressurizing the impinger array, slowly commence the N_2 gas flow through the line while simultaneously opening the meter box pump valve(s). When using the gas cylinder pressure to push the purge gas through the sample train, adjust the flow rate to 20 liters/min through the rotameter. When pulling the purge gas through the sample train using the meter box vacuum pump, set the orifice pressure differential to ΔH_2 and maintain an overflow rate through the rotameter of less than 2 liters/min. This will guarantee that the N_2 delivery system is operating at greater than ambient pressure and prevents the possibility of passing ambient air (rather than N_2) through the impingers. Continue the purge under these conditions for 1 hour, checking the rotameter and ΔH value(s) periodically. After 1 hour, simultaneously turn off the delivery and pumping systems.

5.2.2 Sample Handling.

5.2.2.1 Container Nos. 1, 2, and 3. If filter catch is to be determined, as detailed in Method 17, section 4.2.

5.2.2.2 Container No. 4 (Impinger Contents). Measure the liquid in the first three impingers to within 1 ml using a clean graduated cylinder or by weighing it to within 0.5 g using a balance. Record the volume or weight of liquid present to be used to calculate the moisture content of the effluent gas. Quantitatively transfer this liquid into a clean sample bottle (glass or plastic); rinse each impinger and the connecting glassware, including probe extension, twice with water, recover the rinse water, and add it to the same sample bottle. Mark the liquid level on the bottle.

5.2.2.3 Container No. 5 ($MeCl_2$ Rinse). Follow the water rinses of each impinger and the connecting glassware, including the probe extension with two rinses of $MeCl_2$; save the rinse products in a clean, glass sample jar. Mark the liquid level on the jar.

5.2.2.4 Container No. 6 (Water Blank). Once during each field test, place 500 ml of water in a separate sample container.

5.2.2.5 Container No. 7 ($MeCl_2$ Blank). Once during each field test, place in a separate glass sample jar a volume of $MeCl_2$, approximately equivalent to the volume used to conduct the $MeCl_2$ rinse of the impingers.

5.3 Analysis. Record the data required on a sheet such as the one shown in Figure 202-3. Handle each sample container as follows:

5.3.1 Container Nos. 1, 2, and 3. If filter catch is analyzed, as detailed in Method 17, section 4.3.

5.3.2 Container Nos. 4 and 5. Note the level of liquid in the containers and confirm on the analytical data sheet whether leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in Container No. 4 either volumetrically to ± 1 ml or gravimetrically to ± 0.5 g. Remove a 5-ml aliquot and set aside for later ion

chromatographic (IC) analysis of sulfates. (Note: Do not use this aliquot to determine chlorides since the HCl will be evaporated during the first drying step; Section 8.2 details a procedure for this analysis.)

5.3.2.1 Extraction. Separate the organic fraction of the sample by adding the contents of Container No. 4 ($MeCl_2$) to the contents of Container No. 4 in a 1000-ml separatory funnel. After mixing, allow the aqueous and organic phases to fully separate, and drain off most of the organic/ $MeCl_2$ phase. Then add 75 ml of $MeCl_2$ to the funnel, mix well, and drain off the lower organic phase. Repeat with another 75 ml of $MeCl_2$. This extraction should yield about 250 ml of organic extract. Each time, leave a small amount of the organic/ $MeCl_2$ phase in the separatory funnel ensuring that no water is collected in the organic phase. Place the organic extract in a tared 350-ml weighing tin.

5.3.2.2 Organic Fraction Weight Determination (Organic Phase from Container Nos. 4 and 5). Evaporate the organic extract at room temperature and pressure in a laboratory hood. Following evaporation, desiccate the organic fraction for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg.

5.3.2.3 Inorganic Fraction Weight Determination. (Note: If NH_4Cl is to be counted as CPM, the inorganic fraction should be taken to near dryness (less than 1 ml liquid) in the oven and then allow to air dry at ambient temperature. If multiple acid emissions are suspected, the ammonia titration procedure in section 8.1 may be preferred.) Using a hot plate, or equivalent, evaporate the aqueous phase to approximately 50 ml; then, evaporate to dryness in a 105 °C oven. Redissolve the residue in 100 ml of water. Add five drops of phenolphthalein to this solution; then, add concentrated (14.8 M) NH_4OH until the sample turns pink. Any excess NH_4OH will be evaporated during the drying step. Evaporate the sample to dryness in a 105 °C oven, desiccate the sample for 24 hours, weigh to a constant weight, and record the results to the nearest 0.1 mg. (Note: The addition of NH_4OH is recommended, but is optional when little or no SO_2 is present in the gas stream, i.e., when the pH of the impinger solution is greater than 4.5, the addition of NH_4OH is not necessary.)

5.3.2.4 Analysis of Sulfate by IC to Determine Ammonium Ion (NH_4^+) Retained in the Sample. (Note: If NH_4OH is not added, omit this step.) Determine the amount of sulfate in the aliquot taken from Container No. 4 earlier as described in Method 5F (appendix A, 40 CFR part 60). Based on the IC SO_4^{2-} analysis of the aliquot, calculate the correction factor to subtract the NH_4^+ retained in the sample and to add the combined water removed by the acid-base reaction (see section 7.2).

5.3.3 Analysis of Water and $MeCl_2$ Blanks (Container Nos. 6 and 7). Analyze these sample blanks as described above in sections 5.3.2.3 and 5.3.2.2, respectively.

5.3.4 Analysis of Acetone Blank (Container No. 8). Same as in Method 17, section 4.3.

6. Calibration

Same as in Method 17, section 5, except for the following:

6.1 IC Calibration. Same as Method 5F, section 5.

6.2 Audit Procedure. Concurrently, analyze the audit sample and a set of compliance samples in the same manner to evaluate the technique of the analyst and the standards preparation. The same analyst, analytical reagents, and analytical system shall be used both for compliance samples and the EPA audit sample. If this condition is met, auditing of subsequent compliance analyses for the same enforcement agency within 30 days is not required. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies, unless prior arrangements are made with both enforcement agencies.

6.3 Audit Samples. Audit Sample Availability. Audit samples will be supplied only to enforcement agencies for compliance tests. The availability of audit samples may be obtained by writing:

Source Test Audit: Coordinator (MD-77B), Quality Assurance Division, Atmospheric Research and Exposure Assessment Laboratory, U.S. Environmental Protection Agency, Research Triangle, Park, NC 27711

or by calling the Source Test Audit Coordinator (STAC) at (919) 541-7834. The request for the audit sample must be made at least 30 days prior to the scheduled compliance sample analysis.

6.4 Audit Results. Calculate the audit sample concentration according to the calculation procedure described in the audit instructions included with the audit sample. Fill in the audit sample concentration and the analyst's name on the audit response form included with the audit instructions. Send one copy to the EPA Regional Office or the appropriate enforcement agency and a second copy to the STAC. The EPA Regional Office or the appropriate enforcement agency will report the results of the audit to the laboratory being audited. Include this response with the results of the compliance samples in relevant reports to the EPA Regional Office or the appropriate enforcement agency.

7. Calculations

Same as in Method 17, section 6, with the following additions:

7.1 Nomenclature. Same as in Method 17, section 6.1 with the following additions.

C_{gas} = Concentration of the CPM in the stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

C_{SO_4} = Concentration of SO_4^{2-} in the sample, mg/ml.

m_b = Sum of the mass of the water and MeCl_2 blanks, mg.

m_c = Mass of the NH_4^+ added to sample to form ammonium sulfate, mg.

m_i = Mass of inorganic CPM matter, mg.

m_o = Mass of organic CPM, mg.

m_s = Mass of dried sample from inorganic fraction, mg.

V_a = Volume of aliquot taken for IC analysis, ml.

V_w = Volume of impinger contents sample, ml.

7.2 Correction for NH_4^+ and H_2O .

Calculate the correction factor to subtract the NH_4^+ retained in the sample based on the IC SO_4^{2-} and if desired, add the combined water removed by the acid-base reaction.

$$m_c = K C_{\text{SO}_4} V_w \quad \text{Eq. 202-1}$$

where:

$K = 0.0205$, when correcting for NH_4^+ and H_2O .

$= 0.1840$, when only correcting for NH_4^+ .

7.3 Mass of Inorganic CPM.

$$m_i = m_s \frac{V_w}{V_w - V_a} - m_c \quad \text{Eq. 202-2}$$

7.4

Concentration of CPM.

$$C_{\text{CPM}} = \frac{m_o + m_i - m_b}{V_{\text{mtd}}} \quad \text{Eq. 202-3}$$

8. Alternative Procedures

8.1 Determination of NH_4^+ Retained in Sample by Titration.

8.1.1 An alternative procedure to determine the amount of NH_4^+ added to the inorganic fraction by titration may be used. After dissolving the inorganic residue in 100 ml of water, titrate the solution with 0.1 N NH_4OH to a pH of 7.0, as indicated by a pH meter. The 0.1 N NH_4OH is made as follows: Add 7 ml of concentrated (14.8 M) NH_4OH to 1 liter of water. Standardize against standardized 0.1 N H_2SO_4 and calculate the exact normality using a procedure parallel to that described in section 5.5 of Method 6 (appendix A, 40 CFR part 60). Alternatively, purchase 0.1 N NH_4OH that has been standardized against a National Institute of Standards and Technology reference material.

8.1.2 Calculate the concentration of SO_4^{2-} in the sample using the following equation.

$$C_{\text{SO}_4} = \frac{48.03 V_t N}{100} \quad \text{Eq. 202-4}$$

where

N = Normality of the NH_4OH , mg/ml.

V_t = Volume of NH_4OH titrant, ml.

48.03 = mg/meq.

100 = Volume of solution, ml.

8.3.1 Calculate the CPM as described in section 7.

8.2 Analysis of Chlorides by IC. At the conclusion of the final weighing as described in section 5.3.2.3, redissolve the inorganic fraction in 100 ml of water. Analyze an aliquot of the redissolved sample for chlorides by IC using techniques similar to those described in Method 5F for sulfates. Previous drying of the sample should have

removed all HCl. Therefore, the remaining chlorides measured by IC can be assumed to be NH_4Cl , and this weight can be subtracted from the weight determined for CPM.

8.3 Air Purge to Remove SO_2 from Impinger Contents. As an alternative to the post-test N_2 purge described in section 5.2.1, the tester may opt to conduct the post-test purge with air at 20 liter/min. Note: The use of an air purge is not as effective as a N_2 purge.

8.4 Chloroform-ether Extraction. As an alternative to the methylene chloride extraction described in section 5.3.2.1, the tester may opt to conduct a chloroform-ether extraction. Note: The Chloroform-ether was not as effective as the MeCl_2 in removing the organics, but it was found to be an acceptable organic extractant. Chloroform and diethylether of ACS grade, with low blank values (0.001 percent), shall be used. Analysis of the chloroform and diethylether blanks shall be conducted according to Section 5.3.3 for MeCl_2 .

8.4.1 Add the contents of Container No. 4 to a 1000-ml separatory funnel. Then add 75 ml of chloroform to the funnel, mix well, and drain off the lower organic phase. Repeat two more times with 75 ml of chloroform. Then perform three extractions with 75 ml of diethylether. This extraction should yield approximately 450 ml of organic extraction. Each time, leave a small amount of the organic/ MeCl_2 phase in the separatory funnel ensuring that no water is collected in the organic phase.

8.4.2 Add the contents of Container No. 5 to the organic extraction. Place approximately 300 ml of the organic extract in a tared 350-ml weighing tin while storing the remaining organic extract in a sample container. As the organic extract evaporates, add the remaining extract to the weighing tin.

8.4.3 Determine the weight of the organic phase as described in Section 5.3.2.2.

8.5 Improving Collection Efficiency. If low impinger collection efficiency is suspected, the following procedure may be used.

8.5.1 Place an out-of-stock filter as described in Method 8 between the second and third impingers.

8.5.2 Recover and analyze the filter according to Method 17, Section 4.2. Include the filter holder as part of the connecting glassware and handle as described in sections 5.2.2.2 and 5.2.2.3.

8.5.3 Calculate the Concentration of CPM as follows:

$$C_{\text{CPM}} = \frac{m_o + m_i + m_f - m_b}{V_{\text{mtd}}} \quad \text{Eq. 202-5}$$

where:

m_f = amount of CPM collected on out-of-stock filter, mg.

8.6 Wet Source Testing. When testing at a wet source, use a heated out-of-stock filter as described in Method 5.

9. Bibliography

1. DeWees, W.D., S.C. Steinsberger, G.M. Plummer, L.T. Lay, C.D. McAlister, and R.T.

Shigenara. "Laboratory and Field Evaluation of the EPA Method 5 Impinger Catch for Measuring Condensible Matter from Stationary Sources." Paper presented at the 1989 EPA/AWMA International Symposium on Measurement of Toxic and Related Air Pollutants. Raleigh, North Carolina. May 1-5, 1989.

2. DeWees, W.D. and K.C. Steinsberger. "Method Development and Evaluation of Draft Protocol for Measurement of Condensible Particulate Emissions." Draft Report. November 17, 1989.

3. Texas Air Control Board, Laboratory Division. "Determination of Particulate in Stack Gases Containing Sulfuric Acid and/or Sulfur Dioxide." *Laboratory Methods for Determination of Air Pollutants*. Modified December 3, 1978.

4. Nothstein, Greg. Masters Thesis. University of Washington. Department of Environmental Health. Seattle, Washington.

5. "Particulate Source Test Procedures Adopted by Puget Sound Air Pollution Control Agency Board of Directors." Puget Sound Air Pollution Control Agency.

Engineering Division. Seattle, Washington. August 11, 1983.

6. Commonwealth of Pennsylvania. Department of Environmental Resources. Chapter 139, Sampling and Testing (Title 25, Rules and Regulations, Part I, Department of Environmental Resources, Subpart C, Protection of Natural Resources, Article III, Air Resources). January 8, 1980.

7. Wisconsin Department of Natural Resources. *Air Management Operations Handbook, Revision 3*. January 11, 1988.

BILLING CODE 6560-50-M

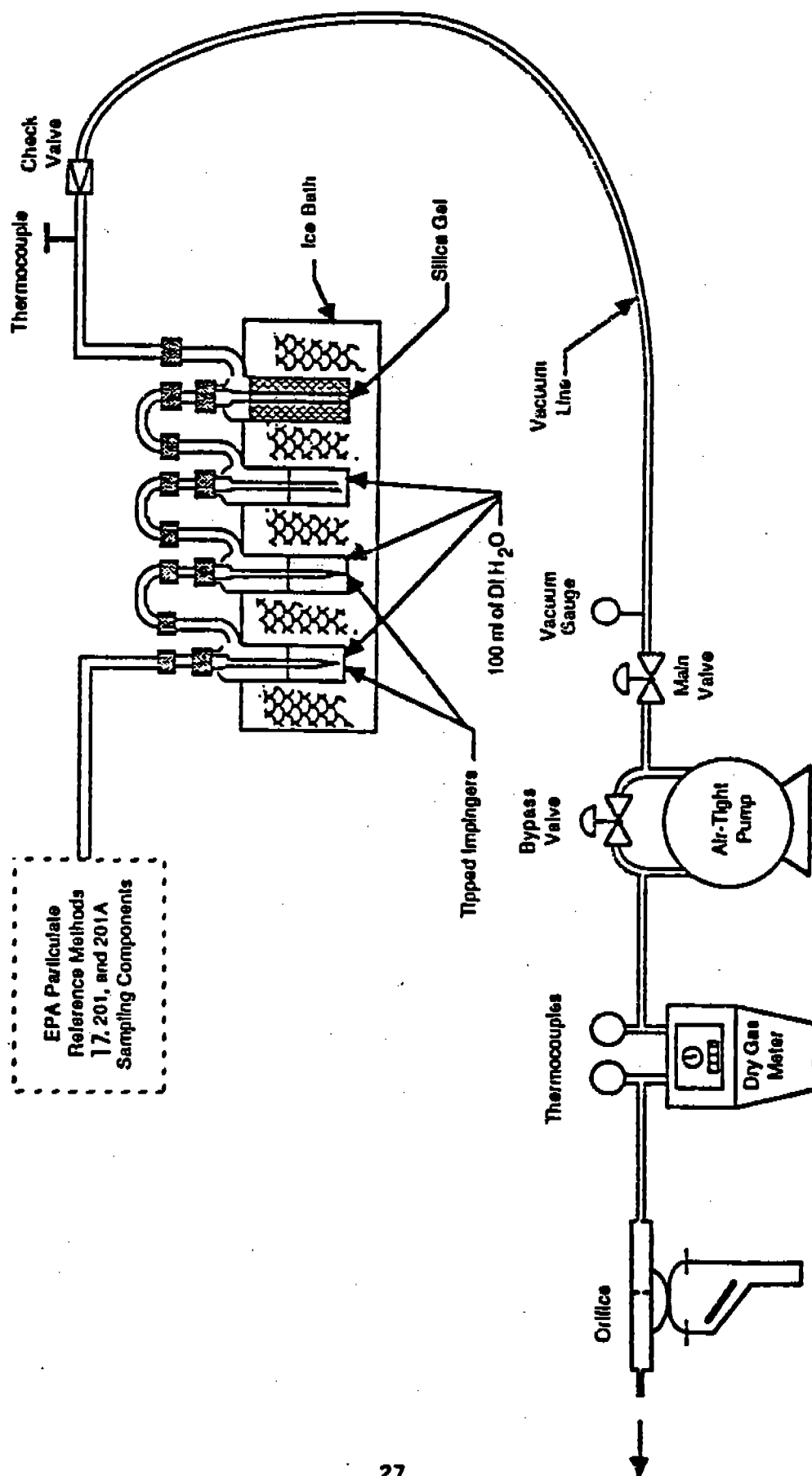


Figure 202-1. . Schematic of condensible particulate sampling train.

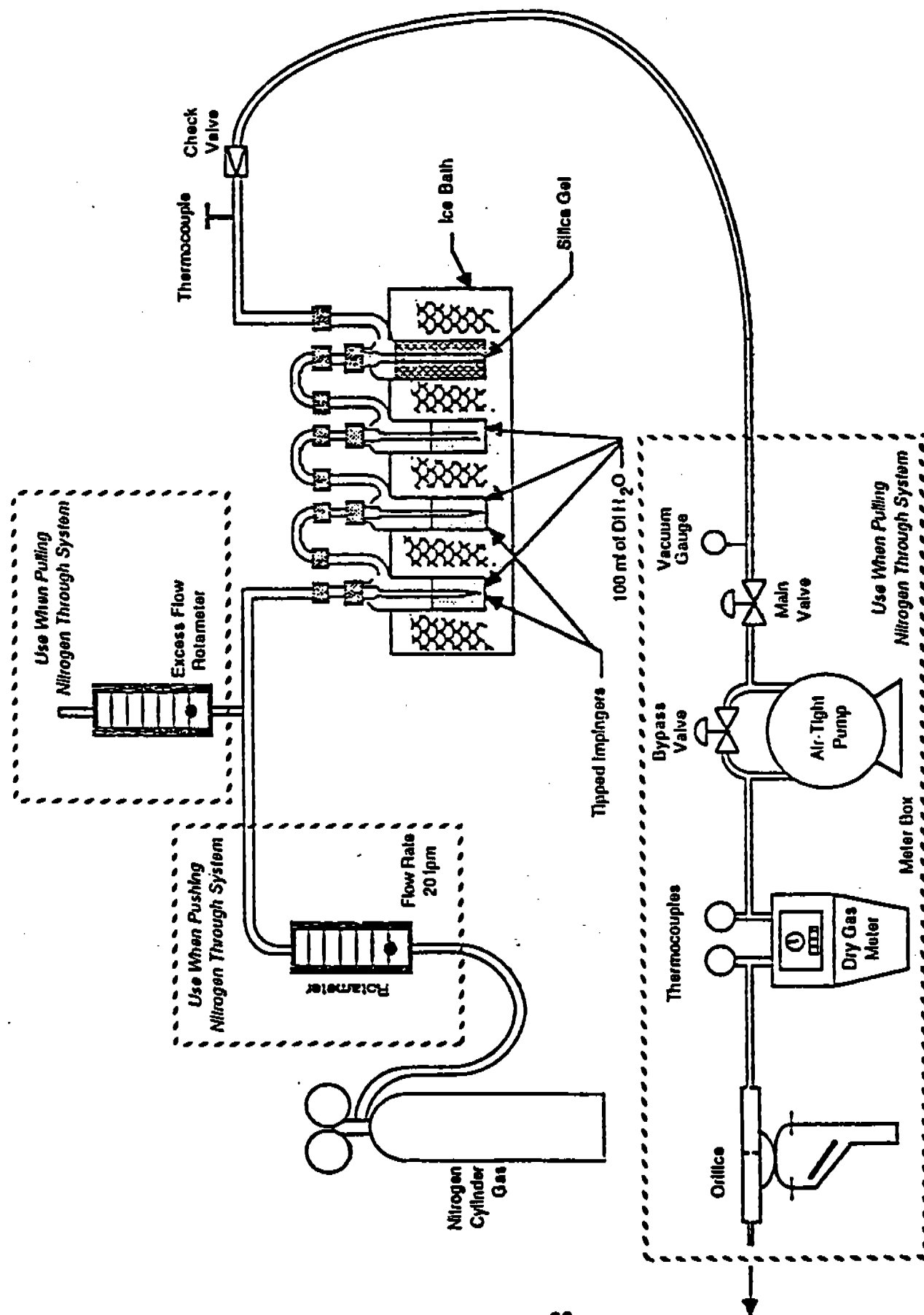


Figure 202-2. Schematic of post-test nitrogen purge system.

Moisture Determination

Volume or weight of liquid in impingers: _____ ml or g

Weight of moisture in silica gel: _____ g

Sample Preparation (Container No. 4)

Amount of liquid lost during transport: _____ ml

Final volume: _____ ml

pH of sample prior to analysis: _____

Addition of NH_4OH required: _____

Sample extracted 2X with 75 ml MeCl_2 : _____

For Titration of Sulfate

Normality of NH_4OH : _____ N

Volume of sample titrated: _____ ml

Volume of titrant: _____ ml

Sample Analysis

Container number	Weight of condensible particulate, mg		
	Final weight	Tare weight	Weight gain
4 (Inorganic) _____			
4 & 5 (Organic) _____			

Total: _____

Less Blank: _____

Weight of Condensable Particulate: _____

Figure 302-3. Analytical data sheet.

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BILLING CODE 6540-60-M

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:

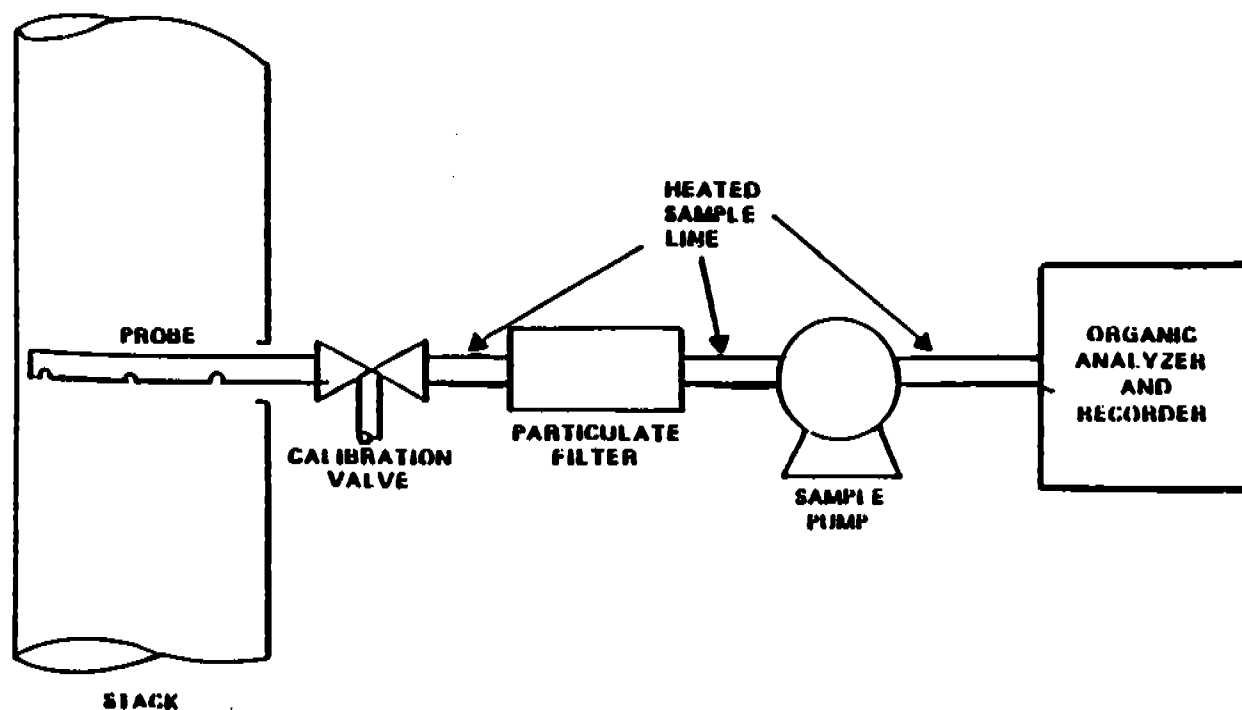


Figure 25A-1. Organic Concentration Measurement System.

PH 55, App A, Mem. 25A

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.

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

4.1 Fuel. A 40 percent H₂/60 percent He or 40 percent H₂/60 percent N₂ 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

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.

$$C_c = K C_{meas}$$

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.

EPA
METHOD 0011

RECEIVED

SAMPLING FOR FORMALDEHYDE EMISSIONS FROM STATIONARY SOURCES JUL 16 1990

1.0 SCOPE AND APPLICATION

INTERPOLL LABORATORIES

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

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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 $120 \pm 14^{\circ}\text{C}$ ($248 \pm 25^{\circ}\text{F}$).

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 containers. 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 ft³ of sample volume is required for the determination of the Destruction and Removal Efficiency (DRE) of formaldehyde from incineration systems (45ft³ is equivalent to one hour of sampling at 0.75 dscf). Additional sample volume shall be collected as necessitated 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 $>0.00057 \text{ m}^3/\text{min}$ (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 m³/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 m³/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 $<20^{\circ}\text{C}$ (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 m³/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 m³/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 $\pm 2^{\circ}\text{C}$ (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 $\pm 0.5\%$ 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:

$$\text{Total mg formaldehyde} = C_d \times V \times DF \times \\ \left(\frac{[\text{g/mole aldehyde}]}{[\text{g/mole DNPH derivative}]} \right) \times \\ 10^{-3} \text{ mg/}\mu\text{g}$$

where:

C_d - measured concentration of DNPH-formaldehyde derivative, $\mu\text{g/mL}$.

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:

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

where:

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

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

$V_{m(\text{std})}$ - 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 $V_{m(\text{std})}$ 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 FORM₁ Mass -

$$[(WF) (FORM_1 \text{ conc}) (100 - \%DRE)] / 100$$

where:

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

FORM₁ - 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:

$$\text{Max FORM}_1 \text{ conc} = [\text{Max FORM}_1 \text{ Mass}] / DV_{\text{eff(Std)}}$$

where:

DV_{eff(Std)} - volumetric flow rate of exhaust gas, dscm (dscf)

FORM₁ 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.

$$[LDL_{\text{FORM}} \times 10] / [FORM_1 \text{ conc}] = V_{\text{std}}$$

where:

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

V_{std} - 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 Analysis¹

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 passed 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 μ L 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.

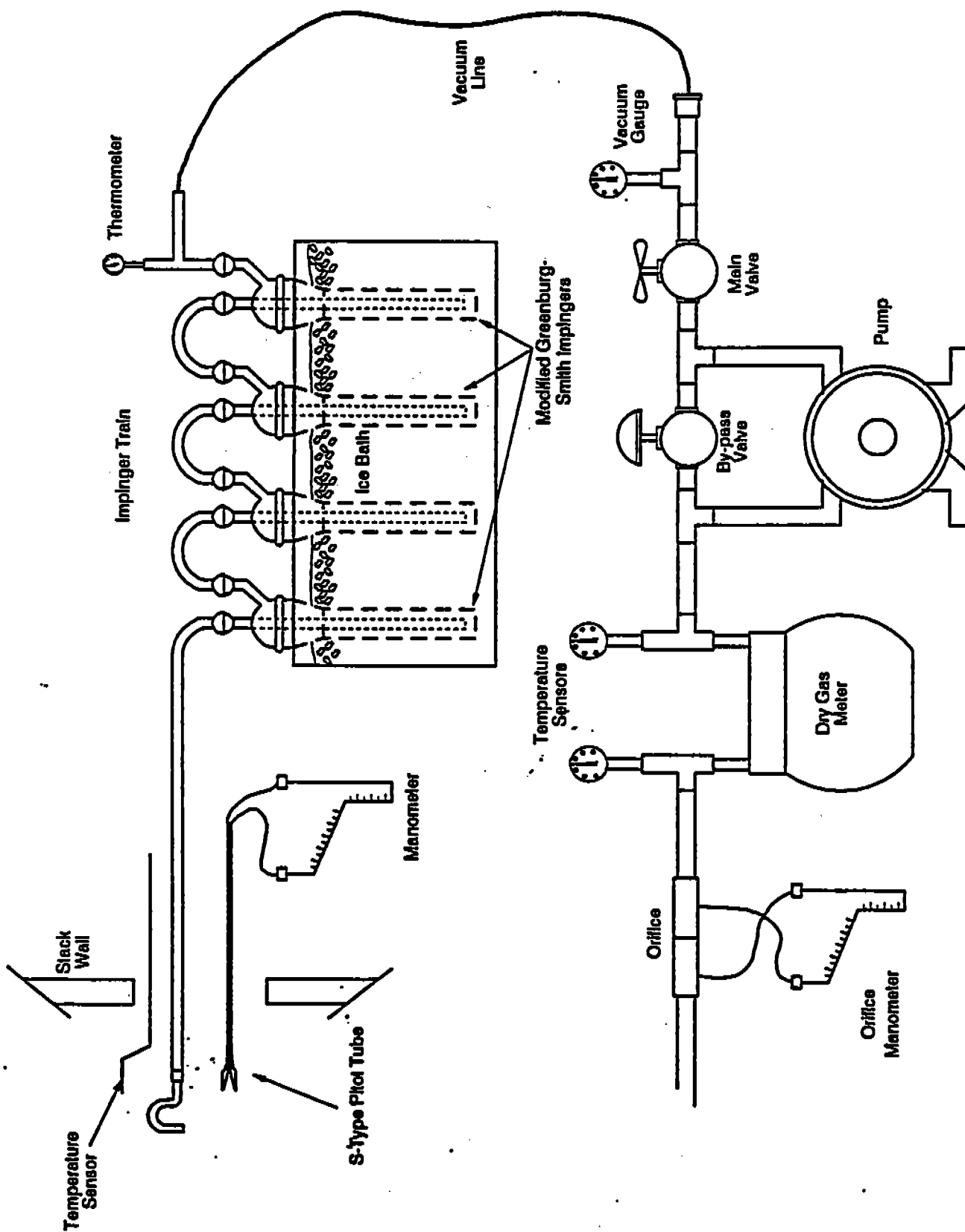
Table 3. Expected Method Performance for Formaldehyde

Parameter	Precision	¹ Accuracy ²	Detection Limit ³
Matrix: Dual trains	$\pm 15\%$ RPD	$\pm 20\%$	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

[illegible]

Schematics of Stack Cross Section

Pilot Tube Coefficient C_p

34043467

Figure 2. Field Data Sheet

MDI

MDI concentration and emission rate (three (3) one-hour determinations) - Interpoll Labs Method II-8791 (Ver 1.2) based on NIOSH Method P&CAM 347 (N-p-nitrobenzyl-N-propylamine impregnated filters with analysis of the reaction product after solvent switch by reverse phase HPLC/UV).

7/90

C O N F I D E N T I A L

Version 1.1

Interpoll Laboratories

Method II-8791

Determination of 4,4'-Methylenebis
(phenyl isocyanate)(MDI) in
Wood Board Press Vent Exhausts

This method is a modification of NIOSH Method 347 in which a known volume of stack gas is drawn out of the stack through a glass-fiber filter impregnated with N-p-nitrobenzyl-N-propylamine to collect MDI. MDI reacts with this reagent to form a stable urea. The urea derivative is analyzed by HPLC. The modifications and the rationale therefor are enumerated below. The modifications used in this work were chosen expressly to accomodate the conditions normally encountered in board press exhaust gas stacks and may not be appropriate for other sources.

The method was modified by Interpoll Laboratories to 1) protect the urea derivative from exposure to high temperature; 2) to provide for isokinetic collection of samples, since some MDI will be associated with particles larger than 3 microns in diameter; 3) to make possible field recovery of samples, since stack testing requires repetitive determinations with large sophisticated sampling trains; 4) to increase the sensitivity of the determination; 5) and to more rigorously protect the collected samples since stack sampling normally requires transport of the samples by truck for extended periods of time.

The NIOSH was modified to meet the requirement of isokinetic collection by using a larger filter so that the same or a lower face velocity than that specified in the NIOSH Method is maintained, since the

superficial face velocity is the controlling parameter in analyte breakthrough.

A non-heated probe liner and out-stack filter holder assembly will be used to sample the vents since the gas is essentially ambient air (100-110 °F) with very low moisture content. The filter holder will be of the "out-stack" type to minimize the effect of increased temperature on breakthrough. Sampling will be isokinetic to ensure representative collection of particles which may have MDI adsorbed on their surfaces.

Sample recovery will be quantitative using methylene chloride as the recovery solvent. Samples will be recovered into amber jars with Teflon lids and stored on ice or in a refrigerator until analysis. The filter and probe rinse will be recovered into the same container to initiate extraction immediately upon recovery in the field.

Criteria used in developing stack procedure:

1. The method as conceived for OSHA work uses a filter with an effective filtering area diameter of 1 cm. A flow rate of 1 LPM is recommended. At this superficial velocity, the collection efficiency for MDI was found to be >99.3%.

If $t_{amb} \leq 18^{\circ}\text{C}$ then $\phi \leq 10$ HRS

$18 \leq t_{amb} \leq 29^{\circ}\text{C}$ then $\phi \leq 5.5$ HRS

$29 \leq t_{amb} \leq 40^{\circ}\text{C}$ then $\phi \leq 3$ HRS

where ϕ = total sampling time

2. Since some of the MDI or other diisocyanates (DIs) could and will be associated with particulate material, samples will be collected isokinetically.
3. Since breakthrough is temperature dependent, it is necessary to use an out-stack filter holder. The probe and filter holder should not be heated.
4. Since interferences form on long standing especially in the presence of light, samples are to be recovered into amber bottles and stored at 4 °C.
5. Methylene chloride should be used as the recovery solvent. The filter and the probe wash should be placed in the same container. The filter must be preweighed as well as the sample container. After the sample is recovered, the container is weighed again. The total volume of methylene chloride may then be calculated from the above weights and the density of methylene chloride.

Note: This method of recovery initiates extraction of the urea derivative immediately and probably increases the stability of the samples.

The total volume of CH_2Cl_2 should be about 35-50 ml. The aliquot for HPLC analysis may then be drawn directly from the sample container (after sonication).

Alternatively, the entire mixture may be filtered through a methylene chloride rinsed glass fiber filter, the filter

rinsed and combined with the filtrate and brought to a known volume. This method, however, results in some dilution and also increases the possibility of contamination.

6. A 2.5 inch glass fiber filter with an effective filtration diameter of 5.69 cm will allow sampling at a flow rate 32.4 times greater than the NIOSH procedure and still maintain the same superficial velocity. Thus a flow rate of up to 1.14 CFM can be used and still give a collection efficiency of $\geq 99.3\%$.
7. For an M5 sampling train, this means that an orifice pressure drop as high as 4.3 IN.WC. can be used without concern about reduction in the collection efficiency of MDI. At a temperature up to 104 °F (40 °C), sampling can be performed for a period up to three hours without concern of breakthrough.
8. Based on the above consideration, a normal MDI sampling will consist of three one-hour samplings at a flow rate not to exceed 1.14 CFM.

Note: $(\text{ppb v/v}) = 0.0978 \times (\text{ug/Nm}^3)$

4,4'-METHYLENEBIS(PHENYL ISOCYANATE) (MDI)

Methods Research Branch

Analytical Method
II-8791

Analyte:	A urea derivative of MDI	Method No:	P&CAM 347 <i>0.43 to 78 ppb</i>
Matrix:	Air	Range:	4.4 to 800 $\mu\text{g}/\text{m}^3$
Procedure:	Collection and derivatization on impregnated filter, HPLC	Precision:	0.078 <i>PPB = 0.0978 ($\mu\text{g}/\text{m}^3$)</i>
Date Issued:	8/31/81		
Date Revised:		Classification:	E (Proposed)

1. Synopsis

- 1.1 A known volume of air is drawn through a glass-fiber filter impregnated with a reagent, N-p-nitrobenzyl-N-propylamine, to collect MDI. MDI reacts with the reagent to form N,N'-(methylenedi-4,1-phenylene)bis[N'-[(4-nitrophenyl)methyl]-N'-propylurea] (MDIU) as a derivative. (Reference 11.1)
- 1.2 The impregnated filter is treated with dichloromethane to recover the urea derivative.
- 1.3 The dichloromethane solution is analyzed by high pressure liquid chromatography (HPLC) with an ultraviolet detector set at 254 nm to determine the concentration of MDIU.
- 1.4 The concentration of MDI in air is calculated from the quantity of MDIU on the filter and the volume of air sampled.

2. Working Range, Sensitivity and Detection Limit

- 2.1 MDI in air can be quantified at concentrations ranging from 4.4 to 800 $\mu\text{g}/\text{m}^3$ for 180-L air samples and at ceiling concentrations ranging from 80 to 1000 $\mu\text{g}/\text{m}^3$ for 10-L air samples. The range useful for quantitation of the urea derivative (MDIU) in solution is equivalent to 0.8 to more than 150 μg MDI per mL of solution when 50- μL aliquots are injected into the HPLC.

- 2.2 The impregnated filter can collect more than 298 μg of MDI (greater than 99.3% of the MDI) at a concentration of 500 $\mu\text{g}/\text{m}^3$ during a 10-hour sampling period at 1 L/min when the air temperature is 18 °C.
- 2.3 It has been estimated that MDI at a concentration of 0.6 $\mu\text{g}/\text{m}^3$ could be detected in a 180-L air sample. The detection limit of MDIU in solution is equivalent to approximately 0.1 μg of MDI per mL if a 50- μL aliquot is injected into the HPLC.

3. Interferences

- 3.1 When other compounds are known or suspected to be present in the air, such information, including their suspected identities, should be transmitted with the sample.
- 3.2 N-p-Nitrobenzyl-N-propylamine on glass fiber filters is unstable in the presence of light and is unstable to a smaller degree during storage in the dark at room temperature. Interference during HPLC analysis may result if impregnated filters in filter holders are exposed to light for an excessive period or are stored in the dark at room temperature for an excessive period. Exposure of two impregnated filters inside filter holders to fluorescent lighting for 25 hours gave rise to interferences during HPLC analysis which corresponded to roughly 2 μg of MDI per filter. Storage of three impregnated filters for 41 days in the dark (33 days at room temperature and 8 days at -21 °C) gave rise to interferences which corresponded to an average of roughly 0.4 μg MDI per filter. Storage of six impregnated filters for 42 days in the dark at -21 °C gave rise to no interferences during HPLC analysis.
- 3.3 The following compounds would not interfere with the analysis of MDI in this method: toluene-2,4-diisocyanate (2,4-TDI), toluene-2,6-diisocyanate (2,6-TDI), and hexamethylene diisocyanate (HDI).
- 3.4 Any compound which has the same retention time as that of MDIU and is detected under the HPLC conditions indicated in this method is an interference.

4. Precision and Accuracy

- 4.1 The pooled relative standard deviation for the sampling and analytical method in the approximate range from 170 to 800 $\mu\text{g}/\text{m}^3$ was 0.060 when critical orifices were used to maintain sampling rates near 1 L/min. The relative standard deviation for the sampling and analytical method in the same approximate range of concentrations would be 0.078 if a pump error of 0.05 is assumed for personal-sampling pumps.

4.2 Average recoveries of MDIU from impregnated filters ranged from 0.96 to 0.99 over the range 0.8 to 67 μ g of MDI per filter. The pooled relative standard deviation for the average recoveries was 0.030.

4.3 MDIU on impregnated filters is stable during storage at room temperature in the dark for at least 15 days.

5. Advantages and Disadvantages

5.1 Advantages of the method are: (a) the sampler is small, portable and convenient for personal sampling; (b) the sampler can collect MDI in both vapor and aerosol forms; and (c) the analytical method is specific for MDI.

5.2 Disadvantages of the method are: (a) a time limitation of approximately 21 days for storage of impregnated filters at room temperature in the dark because of the instability of the reagent, N-p-nitrobenzyl-N-propylamine; (b) a need to protect impregnated filters from light; and (c) a need to wash the HPLC column when N-p-nitrobenzyl-N-propylamine causes a large detector response (see Sections 3.2 and 8.3.6).

6. Apparatus

6.1 Sampling Equipment

6.1.1 Samplers. Each sampler contains a glass-fiber filter, 13 mm in diameter, which has been impregnated with N-p-nitrobenzyl-N-propylamine. The impregnated filter is housed in a 13-mm filter holder (Catalogue No. SX00 013 00, Millipore Corporation, Bedford, MA, or equivalent). The internal diameter of the inlet of the filter holder is 4 mm. The filter holders may be wrapped with black tape in order to help protect the impregnated filters from light. Seal the inlets and outlets of the filter holders with plastic tape for storage. The samplers may be stored at -21 °C in the dark for at least 6 weeks. Limit the storage time of the samplers at room temperature in the dark to approximately 21 days (see Section 3.2).

6.1.2 Impregnated Filters. Place 300 mg (0.0013 mole) of N-p-nitrobenzyl-N-propylamine hydrochloride into a 125-mL separatory funnel. Add 25 mL of deionized water and shake the mixture until all of the hydrochloride has dissolved. Cause free amine to separate from the solution by adding 15 mL of 1 N NaOH solution and shaking the mixture. Extract the N-p-nitrobenzyl-N-propylamine with 50 mL of hexane.

Place six glass-fiber filters which are free of binders and 6 mL of the hexane solution into a 50-mL beaker. In dim light, allow hexane to evaporate from the beaker with the aid of a stream of nitrogen. Occasionally swirl the mixture. The filters are sufficiently dry when they no longer cling to the beaker. It has been estimated that there is 4.5 mg of N-p-nitrobenzyl-N-propylamine on each impregnated filter.

- 6.1.3 Calibrated Personal-Sampling Pump. The personal sampling pump should be calibrated for the recommended flow rate of 1 L/min with a representative sampler in line.
- 6.1.4 Stopwatch.
- 6.1.5 Thermometer.
- 6.2 High pressure liquid chromatograph with an ultraviolet detector set at 254 nm.
- 6.3 HPLC column, 25-cm x 4.6-mm internal diameter, packed with Partisil 10 (a porous silica packing; diameter, 10 μ m; surface area, 400 m²/g; Whatman, Inc., Clifton, NJ).
- 6.4 Frits, 0.5-micrometer pore diameter, for use in front of the packing in the HPLC column.
- 6.5 Partisil 10 or other silica packing for use in replacing packing which may be lost from the HPLC column (see Section 8.3.7).
- 6.6 Spectrophotometer set at 555 nm.
- 6.7 Quartz cells for spectrophotometer, 5-cm path length.
- 6.8 Glass vials, 1-mL, with caps lined with polytetrafluoroethylene.
- 6.9 Volumetric flasks, 5-mL and other convenient sizes.
- 6.10 Graduated cylinders, 10-, 25-, 100-, and 1000-mL.
- 6.11 Tweezers.

7. Reagents

Except where otherwise indicated, each reagent should be of ACS reagent grade or better.

- 7.1 4,4'-Methylenebis(phenyl isocyanate) (MDI), practical grade or better.

- 7.2 N-p-Nitrobenzyl-N-propylamine hydrochloride.
- 7.3 Dichloromethane, distilled in glass.
- 7.4 Solution of MDI in dichloromethane. Mix 2.0 g of MDI with 200 mL of dichloromethane. Filter the solution with a glass frit of fine porosity. Determine the concentration of MDI according to Section 9.1.
- 7.5 Water, deionized.
- 7.6 MDIU. Mix 1.500 g (0.00650 mole) of N-p-nitrobenzyl-N-propylamine hydrochloride with 25 mL of deionized water in a 125-mL separatory funnel. Cause free amine to separate from the solution by adding 15 mL of 1 N NaOH and shaking the mixture. Extract the N-p-nitrobenzyl-N-propylamine with 50 mL of hexane. Determine the volume of the solution prepared according to Section 7.4 which would contain 577 mg (0.00231 mole) of MDI, and add 577 mg of MDI in solution to 40 mL of the hexane solution. Reduce the volume of the mixture to approximately 25 mL with a rotary evaporator. Collect the solid by filtration. Wash the solid with several portions of hexane. Recrystallize the product from benzene by dissolving the product in hot benzene, filtering the solution quickly, and allowing the filtrate to cool. Collect the crystals in a Buchner funnel, and dry the product in vacuo at 80 °C. Melting point = 161-162 °C. (Reference 11.2)
- NOTE: Benzene is a carcinogen and should be handled with care in a ventilated fume hood.
- 7.7 4,4'-Methylenedianiline, high purity.
- 7.8 Acetic acid, glacial.
- 7.9 Standard solution of 4,4'-methylenedianiline. Dissolve 238 mg of 4,4'-methylenedianiline in 700 mL of glacial acetic acid. Dilute the solution to 1 liter with deionized water.
- 7.10 Hydrochloric acid, 12 M.
- 7.11 Hydrochloric acid-acetic acid solution. Add 35 mL of 12 M hydrochloric acid and 22 mL of glacial acetic acid to 600 mL of deionized water. Dilute the solution to 1 liter with deionized water.
- 7.12 Sodium nitrite-sodium bromide solution. Dissolve 3.0 g of sodium nitrite and 5.0 g of sodium bromide in deionized water and dilute the solution to 100 mL. Discard the solution after 1 week.

- 7.13 Sulfamic acid solution. Dissolve 10.0 g of sulfamic acid in 100 mL of deionized water.
- 7.14 Sodium carbonate solution. Dissolve 16.0 g of anhydrous sodium carbonate in deionized water and dilute the solution to 100 mL. Discard the solution after 1 week.
- 7.15 N-(1-Naphthyl)ethylenediamine dihydrochloride solution. Dissolve 1.0 g of N-(1-naphthyl)ethylenediamine dihydrochloride in 50 mL of deionized water, add 2 mL of 12 M hydrochloric acid, and dilute the solution to 100 mL. Discard the solution after 1 week.
- 7.16 N,N-Dimethylformamide-hydrochloric acid solution. Mix 90 mL of N,N-dimethylformamide with 10 mL of 6 M hydrochloric acid. Discard the solution after 1 week.
- 7.17 2-Propanol, distilled in glass.
8. Procedure
- 8.1 Cleaning of Equipment. All glassware to be used for laboratory analysis should be washed with detergent and rinsed thoroughly with tap water and deionized water.
- 8.2 Collection and Shipping of Samples
- 8.2.1 In each set of samplers consisting of six or fewer samplers, label two samplers as "blank" samplers. The "blank" samplers and the corresponding samplers used in actual air sampling should contain impregnated filters from the same batch (Section 6.1.2).
- 8.2.2 Handle the "blank" samplers and other samplers under the same conditions of temperature, light exposure and storage time. Do not unseal and do not draw air through the "blank" samplers.
- 8.2.3 Immediately before sampling, unseal the inlet and outlet of the sampler.
- 8.2.4 Connect the sampler to a calibrated personal-sampling pump with flexible tubing.
- 8.2.5 Sample at a flow rate of 1 L/min for 10 hours or less if the maximum air temperature will be 18 °C or less. (Experiments were performed at air temperatures near 18 °C, and 12 hours of sampling was borderline for breakthrough to occur. Breakthrough volumes would be expected to decrease with increases in concentration)

of MDI vapor, and the maximum vapor concentration of MDI would increase with temperature. Maximum sampling periods should be decreased with increases in air temperature.) Sample at 1 L/min for 5.5 hours or less if the maximum air temperature will be between 18 °C and 29 °C. Sample at 1 L/min for 3 hours or less if the maximum air temperature will be between 29 °C and 40 °C.

8.2.6 Record pertinent data in regard to sampling including sampling time, air temperatures, and atmospheric pressures. If pressure data are not available, record the elevation.

8.2.7 After sampling, seal the inlets and outlets of the samplers with plastic tape. Store these samplers and the "blank" samplers in the dark and, if practical, at -21 °C until analyses are performed. If the samplers are stored at room temperature, limit the total storage time at room temperature to approximately 21 days. Consider storage time before sampling as part of the total storage time. The samplers may be stored in the dark at -21 °C for at least 6 weeks.

8.2.8 If a bulk sample of material suspected to contain MDI is to be submitted to the laboratory, place the bulk sample into a glass container, and seal it with a cap lined with polytetrafluoroethylene. Secure the cap in place with tape.

8.2.9 Do not transport the bulk sample and the air samples in the same container.

8.3 Analysis of Samples

8.3.1 Preparation of Samples. Remove the impregnated filter from the filter holder with tweezers, and place the filter into a 1-mL glass vial. Place 1 mL of dichloromethane into the vial. Seal the vial with a cap lined with polytetrafluoroethylene. Shake the vial vigorously for approximately 1 minute.

8.3.2 HPLC Conditions. Operating conditions for high pressure liquid chromatography are:

Column temperature:	Room temperature
Mobile phase:	1.4:98.6 2-Propanol-dichloromethane (v/v)
Flow rate:	2.0 mL/min
Detector:	UV (254 nm)

Injection volume: 50 μ L
 Column efficiency: Approximately 300
 theoretical plates
 for MDIU

Compound*	Adjusted Retention Volume (V_R')	Capacity Factor (k')
MDIU	4.1 mL	1.9
2,4-TDIU	11.1 mL	5.0
2,6-TDIU	>18.4 mL	>8.3
HDIU	>30 mL	>13.6

*2,4-TDIU, 2,6-TDIU, and HDIU are the corresponding urea derivatives of toluene-2,4-diisocyanate (2,4-TDI), toluene-2,6-diisocyanate (2,6-TDI), and hexamethylene diisocyanate (HDI), respectively.

NOTE: If HPLC conditions are employed which are different from those mentioned for this method, "blank" impregnated filters should be analyzed after storage of such filters and after exposure of such filters to light in order to help determine possibilities of interference.

- 8.3.3 Inject a 50- μ L aliquot of sample solution into the high pressure liquid chromatograph, and determine the size of the peak corresponding to MDIU.
- 8.3.4 If the quantity of MDIU is above the lower quantitation limit, analyze another aliquot of the sample solution with two standards at concentrations above and below that of the MDIU in the sample solution. Precede and follow an injection of sample solution with an injection of standard solution.
- 8.3.5 Analyze the "blank" samples with the field samples.
- 8.3.6 After an aliquot of sample solution has been injected into the liquid chromatograph, N-p-nitrobenzyl-N-propylamine will emerge eventually from the HPLC column and cause a large response in the detector. Wash the column periodically to remove excess N-p-nitrobenzyl-N-propylamine by pumping 50:50 2-propanol-dichloromethane (v/v) at 2 mL/min through the column for at least 1 minute. Then pump 1.4:98.6

2-propanol-dichloromethane (v/v) at 2 mL/min through the column for 15 minutes before the next injection.

- 8.3.7 Replace the frit in front of the column packing when pressure becomes excessive (see Section 6.4). If a small quantity of packing is lost, replace the lost packing with fresh Partisil 10 or other silica packing.
- 8.3.8 Measure either peak heights or peak areas.
- 8.3.9 Construct a calibration curve for each sample based on the two adjacent standards (see Section 8.3.4).

8.4 Determination of Analytical-Method Recovery

- 8.4.1 Significance of Determination. The determination of analytical-method recovery may provide information which would aid in correcting for bias, if any, in the analytical method. Analytical-method recoveries should be determined at three levels of MDI which span the range of interest.

- 8.4.2 Procedure. Prepare three solutions of MDI in dichloromethane at concentrations appropriate for the application of approximately 10- μ L aliquots to filters (a solution at a concentration of 0.08 μ g/ μ L would be appropriate for the application of 0.8 μ g of MDI per filter). Determine the concentrations of MDI according to Section 9.2. Place 18 impregnated filters (six filters for each level of MDI) into separate 1-mL glass vials, and add a known quantity of MDI in approximately 10 μ L of dichloromethane solution to each filter. Seal each vial with a cap lined with polytetrafluoroethylene, and store each vial at room temperature in the dark for several hours. Analyze the samples and nine "blanks" (three "blanks" for each level) according to Section 8.3.

The analytical-method recovery for a level of MDI equals the average quantity of MDIU found in the samples corrected for the average blank and divided by the quantity of MDIU corresponding to the quantity of MDI applied.

Construct a curve of recovery versus average quantity of MDIU found.

9. Calibration and Standardization

9.1 Determination of Concentration of MDI in Dichloromethane Solution by a Colorimetric Method. (Reference 11.3)

- 9.1.1 Mix 10 mL of the standard solution of 4,4'-methylenedianiline (Section 7.9) with 35 mL of 12 M hydrochloric acid and 15 mL of glacial acetic acid, and dilute the solution to 1 liter with deionized water.
- 9.1.2 Prepare a series of standards in the range from 1.2 to 12 μ g 4,4'-methylenedianiline per 15 mL of solution by diluting aliquots of the diluted standard solution (Section 9.1.1) with hydrochloric acid-acetic acid solution (Section 7.11).
- 9.1.3 Take 15 mL of hydrochloric acid-acetic acid solution (Section 7.11) as a blank.
- 9.1.4 Mix 0.5 mL of sodium nitrite-sodium bromide solution with 15 mL of each standard solution prepared according to Section 9.1.2 and with the blank (Section 9.1.3).
- 9.1.5 Add 1 mL of sulfamic acid solution to each mixture, stir each mixture for 0.5 minute, and allow each mixture to stand for 2 minutes.
- 9.1.6 Add 1.5 mL of sodium carbonate solution to each mixture, and stir each mixture.
- 9.1.7 Add 1 mL of N-(1-naphthyl)ethylenediamine dihydrochloride solution to each mixture, and stir each mixture.
- 9.1.8 Transfer a portion of each solution to a 5-cm cell 15 minutes after the addition of N-(1-naphthyl)ethylene-diamine dihydrochloride solution, and measure the absorbance of each solution within 15 minutes after transfer. Water may be placed into the reference cell.
- 9.1.9 Construct a calibration curve of absorbance versus quantity of 4,4'-methylenedianiline in μ g per 15 mL of solution.
- 9.1.10 Mix four 0.5-mL samples of the solution of MDI in dichloromethane with quantities of N,N-dimethylformamide-hydrochloric acid solution

(Section 7.16) in 10-mL graduated cylinders sufficient to make 9.5 mL of solution for each sample.

- 9.1.11 Add 10 μ L of each solution prepared according to Section 9.1.10 to a separate 14-mL quantity of hydrochloric acid-acetic acid solution (Section 7.11), and dilute each solution to 15 mL with hydrochloric acid-acetic acid solution.
- 9.1.12 Analyze each sample solution according to Sections 9.1.3 through 9.1.8.
- 9.1.13 Determine the quantity of 4,4'-methylenedianiline in each 15-mL quantity of the sample solution (Section 9.1.11) from the calibration curve.
- 9.1.14 Calculate the concentration, D, of MDI in each sample of dichloromethane solution in mg/mL according to the following equation:

$$D = 2.39 \times B$$

where: 2.39 = a value based on three volumes (9.5 mL, 10 μ L and 0.5 mL) specified in Sections 9.1.10 and 9.1.11 and the molecular weights of MDI and 4,4'-methylenedianiline (250.26 and 198.27, respectively)
B = quantity of 4,4'-methylenedianiline in μ g in 15 mL of solution according to the calibration curve (see Section 9.1.13).

- 9.1.15 Calculate the average concentration of MDI.

9.2 Determination of Concentration of MDI in Dichloromethane Solution by an HPLC Method.

- 9.2.1 Mix four 10- μ L aliquots of the solution of MDI in dichloromethane with separate volumes of a solution of N-p-nitrobenzyl-N-propylamine in hexane sufficient to make 1-mL quantities of solution (see Section 6.1.2 for preparation of a solution of N-p-nitrobenzyl-N-propylamine in hexane).
- 9.2.2 Analyze each solution according to Section 8.3.
- 9.2.3 Determine each concentration of MDIU from a calibration curve (see Section 8.3.9).

- 9.2.4 Calculate the concentration of MDI in each sample of dichloromethane solution, D' , in $\mu\text{g}/\mu\text{L}$ according to the following equation:

$$D' = 0.0392 \times J$$

where: 0.0392 = a value based on the 10- μL aliquot of solution of MDI and the molecular weights of MDI and MDIU (250.26 and 638.73, respectively)

J = the concentration of MDIU in $\mu\text{g}/\text{mL}$.

- 9.2.5 Calculate the average concentration of MDI.

- 9.3 Construction of Calibration Curve. A calibration curve will be an aid in selecting standards to be analyzed with samples. Prepare 5 mL of a dichloromethane solution containing 50 mg of MDIU. Prepare a series of standard solutions at concentrations ranging from 0.3 to 380 μg MDIU per mL of solution. Analyze 50- μL aliquots of the standards according to the HPLC conditions indicated in Section 8.3. Construct a calibration curve of either peak height or peak area versus concentration of MDIU.

10. Calculations

- 10.1 Determine the quantity of MDIU in μg found on the impregnated filter from the appropriate calibration curve (see Section 8.3.9).
- 10.2 Correct the quantity of MDIU for the corresponding "blank" value.
- 10.3 Determine the value of the recovery, R , from the recovery curve (see Section 8.4.2).
- 10.4 Correct the quantity of MDIU for recovery by dividing the quantity by R .
- 10.5 Calculate the concentration of MDI, C , in $\mu\text{g}/\text{m}^3$ in the air sample according to the following equation:

$$C = \frac{392 \times Q}{V}$$

where: 392 = a value based on 1000 liters/ m^3 and the molecular weights of MDI and MDIU (250.26 and 638.73, respectively)

Q = the corrected quantity of MDIU in μg

V = the volume of air sampled in liters.

11. References

- 11.1 Tucker, S. P., and J. E. Arnold, "Sampling and Analytical Methods for Toluene-2,4-diisocyanate and 4,4'-Methylenebis(phenyl isocyanate) in Air" (report in preparation).
- 11.2 Hastings Vogt, C. R., C. Y. Ko and T. R. Ryan, "Simple Ureas Derived from Diisocyanates and Their Liquid Chromatography on a 5-cm Column," J. Chromatogr., 134, 451-458 (1977).
- 11.3 Method No. P&CAM 142, "p,p- Diphenylmethane Diisocyanate (MDI) in Air," in NIOSH Manual of Analytical Methods, Vol. 1, Second Ed., D. G. Taylor, Ed., National Institute for Occupational Safety and Health, Cincinnati, Ohio, 1977. DHEW (NIOSH) Publication No. 77-157-A.

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HYDROGEN CYANIDE

LOUISIANA PACIFIC CORPORATION DAWSON CREEK

SURFACE DRYER STACK 9-21-93

TEST 2

RUN	Vstd (DSCF)	MASS (ug)	CONC (ug/Nm3)	CONC (ppmv)	FLOW (DSCFM)	MASS RATE (LB/HR)
1	43.69	280	226.3200	0.2016	32535	0.027583
2	44.48	270	214.3611	0.1909	32636	0.026207
3	44.43	310	246.3952	0.2195	32567	0.030059

HYDROGEN CYANIDE

LOUISIANA PACIFIC CORPORATION DAWSON CREEK

SURFACE DRYER STACK 9-21-93

TEST 2

RUN	Vstd (DSCF)	MASS (ug)	CONC (ug/Nm3)	CONC (ppmv)	FLOW (DSCFM)	MASS RATE (LB/HR)
1	43.69	400	323.3143	0.2880	32535	0.039404
2	44.48	390	309.6326	0.2758	32636	0.037854
3	44.43	385	306.0070	0.2726	32567	0.037332

Particulate Loadings and Emission Rates

The particulate emission rates were determined per EPA Methods 1-5, CFR title 40, Part 60, Appendix A (revised July 1, 1987). In this procedure, a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

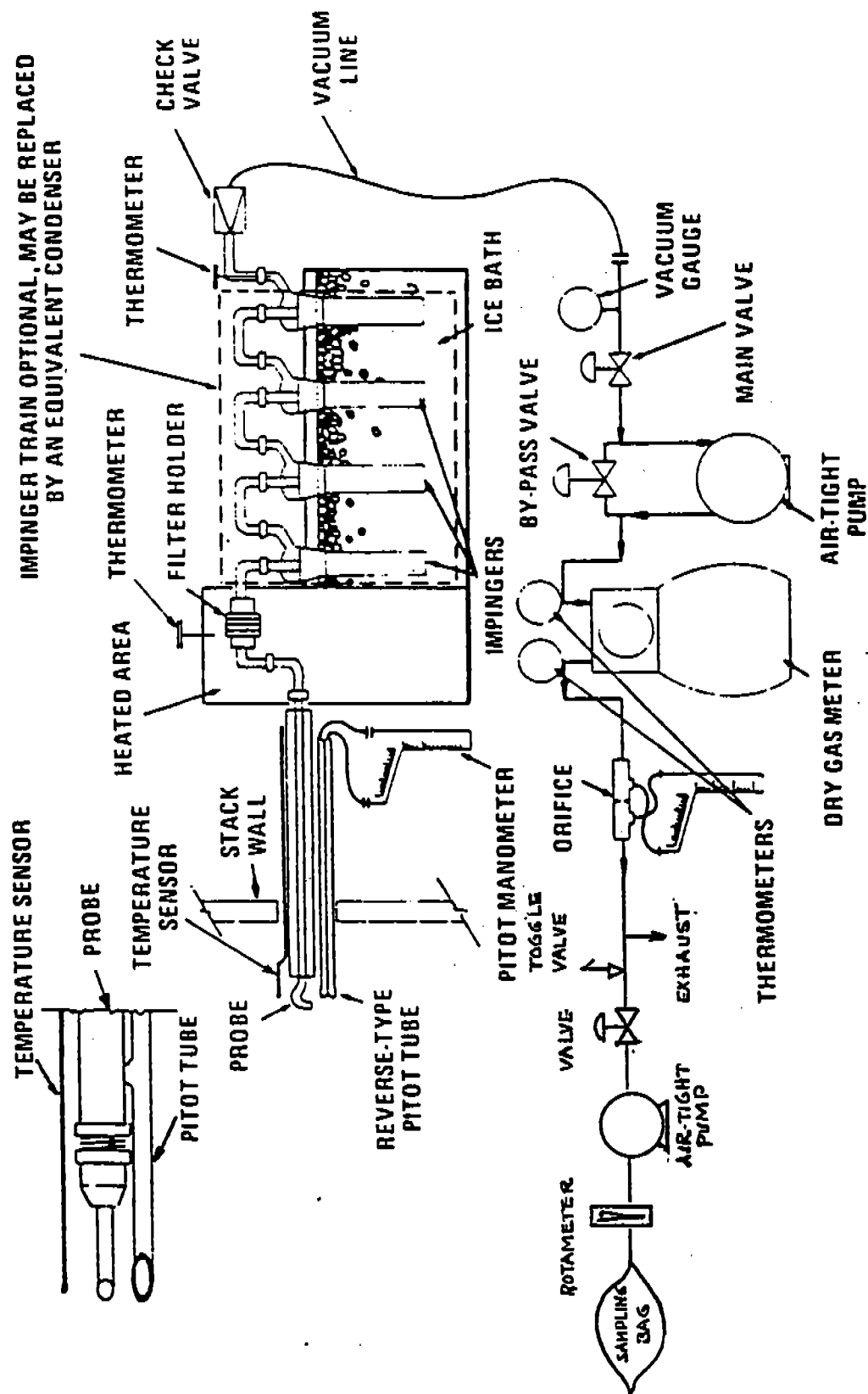
The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the impinger case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

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

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

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

Integrated flue gas samples for Orsat analysis were collected simultaneously from the stack and from the breeching at the inlet to the wet scrubber. The samples were collected in 15-liter gas sampling bags at a constant flow rate throughout each particulate run. The bags were then returned to the laboratory and analyzed by Orsat analysis. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen).



Particulate-sampling train.

**ENVIRONMENTAL PROTECTION
AGENCY**

40 CFR Part 51

[AD-FRL-3977-4]

**Preparation, Adoption, and Submittal
of State Implementation Plans, Method
for Measurement of Condensible
Particulate Emissions From Stationary
Sources**

AGENCY: Environmental Protection
Agency (EPA).

ACTION: Final rule.

SUMMARY: Method 202 for the measurement of condensible particulate matter (CPM) was proposed in the Federal Register on October 12, 1990, at (55 FR 41546). This action promulgates this method. On April 17, 1990 at (55 FR 14246) EPA promulgated two methods for measuring particulate matter (PM) with an aerodynamic diameter of 10 μ m or less (PM₁₀). Since CPM emissions form very fine particles in the PM₁₀ size range and are considered PM₁₀ emissions, the Agency is adding a method for measuring CPM emissions from stationary sources to appendix M in 40 CFR part 51. The purpose of this

rule is to provide the States with a method for measuring CPM.

EFFECTIVE DATE: December 17, 1991.

ADDRESSES: Background Information Document. The Background Information Document for the promulgated test methods may be obtained from Candace Sorrell or Peter Westlin, MD-19, U.S. EPA, Research Triangle Park, North Carolina 27711, telephone number (919) 541-1064. Please refer to "Summary of Comments and Responses for Method 202."

Docket. Docket No. A-90-03, containing materials relevant to this rulemaking, is available for public inspection and copying between 8:30 a.m. to 12 Noon and 1:30 to 3:30 p.m., Monday through Friday, at EPA's Air Docket Section, Waterside Mall, room M1500, 1st Floor, Gallery 1, 401 M Street SW., Washington, DC 20460. A reasonable fee may be charged for copying.

FOR FURTHER INFORMATION CONTACT: Candace Sorrell or Peter Westlin, Emission Measurement Branch (MD-19), Technical Support Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-1064.

SUPPLEMENTARY INFORMATION:

I. The Rulemaking

The EPA is proposing to add a method for measuring CPM emissions to appendix M in 40 CFR part 51 to provide a method that States can use in their State implementation plans.

II. Public Participation

The opportunity to hold a public hearing on November 2, 1990 at 10 a.m. was presented in the proposal notice, but no one desired to make an oral presentation. The public comment period was from October 12, 1990 to December 17, 1990.

III. Significant Comments and Changes to the Proposed Rulemaking

Six comment letters were received from the proposal rulemaking. A detailed discussion of these comments is contained in the background document entitled "Summary of Comments and Responses for Method 202" which is referred to in the ADDRESSES section of this preamble. The major comments raised in these letters and the Agency's responses follow.

One commenter suggests that EPA determine the chemical composition of the material collected in the sampling train to verify that it will form ambient condensibles.

The EPA believes that material will collect in the impingers only by

condensation or dissolution. Dissolved gases will evaporate during analysis and will not be measured unless the gases react to form a solid or liquid while they are in solution. The EPA has designed Method 202 to prevent the formation of reaction materials from dissolved gases. The EPA believes that any remaining material collected and measured by Method 202 represents the material that would condense in the ambient air. Additional analysis of chemical composition is not necessary.

Another comment raises the concern that the method may collect some portion of the sulfur dioxide (SO_2) as condensible.

The dissolution of SO_2 in water does not lead immediately to the formation of sulfuric acid (H_2SO_4), but tends to lower the solution pH, which further inhibits sulfate or H_2SO_4 formation. The method includes a purging procedure which effectively removes SO_2 before significant oxidation occurs. No additional revisions are necessary.

The commenter feels that if EPA is allowing Method 202 to be used in conjunction with Method 201 or 201A or another dry catch procedure to determine the total PM_{10} measurement, the combined methods should be tested for precision.

The imprecision associated with combining Method 202 with Method 201 or 201A or any other dry catch procedure is not additive because each train provides a separate measurement. Since the total precision associated with the combined methods cannot be larger than the least precise sampling method, a precision evaluation of a combined sampling system is unnecessary.

A commenter suggests that EPA add specific language to the applicability section of the method stating that Method 202 cannot be used on wet sources. He notes that Method 17 is excluded from use on wet sources, and Methods 201 and 201A are not recommended for wet sources.

The EPA agrees that Method 202 with an in-stack filter is not recommended for wet sources, and such a statement has been added to the applicability. However, a heated Method 5 filter could be used in Method 202 instead of the in-stack filter which would allow application to wet sources.

One commenter requests that EPA clearly state that Method 202 should not be used for assessing compliance with emission limits set on the basis of data derived from a different measurement approach.

The EPA agrees that a violation must be shown, in the first instance, by means of measurements made with the

applicable test method. Once such a showing is made, however, section 113(e) of the Clean Air Act allows the Agency to rely on any credible evidence, including evidence other than the applicable test method, to establish the duration of the period of noncompliance for the purposes of assessing a penalty.

A commenter believes that the sample collection efficiency and method precision may be affected by the sampling conditions such as impinger temperature and sampling flow rate and the method should address this possibility.

The EPA agrees that the nature of the material in the sample gas may affect collection efficiency. For example, a field demonstration of Method 202 at an oil-fired boiler resulted in about 75 percent impinger collection efficiency. This collection efficiency can be improved with the addition of a second filter place between the second and third impinger. This option has been included in the method with a discussion of applicability.

The commenter feels the 1-hour nitrogen (N_2) purge is too long. He believes the majority of the SO_2 is removed in the first few minutes. He suggests the method be revised to reduce the purge time in conjunction with maintaining the sample under cold conditions and analyzing it within 48 hours.

The EPA does not agree with reducing the purge time. Laboratory tests have shown that a 1-hour purge time is necessary to ensure the adequate removal of SO_2 from the impinger solution.

Another commenter suggests that the method should be revised to give credit for ammonium sulfate ($(\text{NH}_4)_2\text{SO}_4$) dihydrate and other condensible particulate matter formed in the gas stream due to ammonia (NH_3) injection used to enhance the efficiency of a control device.

The EPA does not agree. The condensible particulate matter formed in the gas stream due to NH_3 injection is emitted to the atmosphere. The EPA believes that condensible particulate matter emitted from the source should be counted as such even if it is a product of a pollution-control technique.

The commenter suggests that EPA consider an alternative to MeCl_2 consistent with the Montreal Protocol.

The EPA investigated the effectiveness of a chloroform-ether extraction during the method development phase. The chloroform-ether was not as effective as the MeC in removing organic materials; however the chloroform-ether procedure was

found to be acceptable for organic extraction. The method has been revised to allow a chloroform-ether extraction.

The commenter supports the exclusion of ammonium chloride as a condensible; however, he expresses concern about $(\text{NH}_4)_2\text{SO}_4$ forming in the impingers.

The N_2 purge removes SO_2 before significant oxidation occurs. If NH_3 is present in the flue gas, the $(\text{NH}_4)_2\text{SO}_4$ formed in the impingers would not be counted as a condensible, although the H_2SO_4 , which reacted with NH_3 , would be counted as a condensible. Method 202 corrects for the NH_3 by measuring the sulfate using an IC analysis and subtracting out the ammonium ion (NH_4^+) mass.

The commenter agrees that the NH_3 added during the titration should be subtracted from the final weight. However, he does not agree with adding back in the water removed by the acid-base reaction.

Because H_2SO_4 is hygroscopic, the H_2SO_4 mass found in the atmosphere would have the water attached to it. The method has been revised to allow the source to correct for only the NH_4^+ or for both NH_4^+ and water as an option depending on the basis for the regulation.

A. Docket

The docket is an organized and complete file of all the information submitted to or otherwise considered by EPA in the development of this proposed rulemaking. The principle purposes of the docket are to: (1) Allow interested parties to identify and locate documents so that they can effectively participate in the rulemaking process, and (2) serve as the record in case of judicial review except for interagency review materials (Section 307(d)(7)(A)).

B. Office of Management and Budget Review

Under Executive Order 12291, EPA must judge whether a regulation is "major" and, therefore, subject to the requirement of a regulatory impact analysis. This rulemaking would not result in any of the adverse economic effects set forth in Section 1 of the Order as grounds for finding a "major rule." It will neither have an annual effect on the economy of \$100 million or more, nor will it result in a major increase in costs or prices. There will be no significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of U.S.-based enterprises to compete with foreign-based enterprises in domestic or export markets. This rulemaking was submitted to the Office of Management

and Budget (OMB) for review as required by Executive Order 12291.

C. Regulatory Flexibility Act Compliance

Pursuant to the provisions of 5 U.S.C. 605(b), I hereby certify that this attached rule, if promulgated, will not have any economic impact on small entities because no additional costs will be incurred.

This rule does not contain any information collection requirements subject to OMB review under the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.*

Dated: December 6, 1991.

F. Henry Habicht II,
Acting Administrator.

List of Subjects in 40 CFR Part 51

Administrative practice and procedure.
Air pollution control.
Carbon Monoxide.
Inter-governmental relations.
Lead.
Nitrogen dioxide.
Ozone.
Particulate matter.
Reporting and recordkeeping requirements.
Sulfur Oxides.
Volatile Organic Compounds.

The EPA amends title 40, chapter I, part 51 of the Code of Federal Regulations as follows:

PART 51—[AMENDED]

1. The authority citation for part 51 continues to read as follows:

Authority: Section 110 of the Clean Air Act as amended (42 U.S.C. 7410).

2. Appendix M, to part 51 Table of Contents is amended by adding an entry to read as follows:

Method 202—Determination of Condensible Particulate Emissions From Stationary Sources

3. By adding Method 202 to Appendix M to part 51 to read as follows:

Method 202—Determination of Condensible Particulate Emissions From Stationary Sources

1. Applicability and Principle

1.1 Applicability. 1.1.1 This method applies to the determination of condensible particulate matter (CPM) emissions from stationary sources. It is intended to represent condensible matter as material that condenses after passing through a filter and as measured by this method (Note: The filter catch can be analyzed according to the appropriate method).

1.1.2 This method may be used in conjunction with Method 201 or 201A if the

probes are glass-lined. Using Method 202 in conjunction with Method 201 or 201A, only the impinger train configuration and analysis is addressed by this method. The sample train operation and front end recovery and analysis shall be conducted according to Method 201 or 201A.

1.1.3 This method may also be modified to measure material that condenses at other temperatures by specifying the filter and probe temperature. A heated Method 5 out-of-stack filter may be used instead of the in-stack filter to determine condensible emissions at wet sources.

1.2 Principle. 1.2.1 The CPM is collected in the impinger portion of a Method 17 (appendix A, 40 CFR part 60) type sampling train. The impinger contents are immediately purged after the run with nitrogen (N_2) to remove dissolved sulfur dioxide (SO_2) gases from the impinger contents. The impinger solution is then extracted with methylene chloride (MeCl_2). The organic and aqueous fractions are then taken to dryness and the residues weighed. The total of both fractions represents the CPM.

1.2.2 The potential for low collection efficiency exist at oil-fired boilers. To improve the collection efficiency at these type of sources, an additional filter placed between the second and third impinger is recommended.

2. Precision and Interference

2.1 Precision. The precision based on method development tests at an oil-fired boiler and a catalytic cracker were 11.7 and 4.8 percent, respectively.

2.2 Interference. Ammonia. In sources that use ammonia injection as a control technique for hydrogen chloride (HCl), the ammonia interferes by reacting with HCl in the gas stream to form ammonium chloride (NH_4Cl) which would be measured as CPM. The sample may be analyzed for chloride and the equivalent amount of NH_4Cl can be subtracted from the CPM weight. However, if NH_4Cl is to be counted as CPM, the inorganic fraction should be taken to near dryness (less than 1 ml liquid) in the oven and then allowed to air dry at ambient temperature to prevent any NH_4Cl from vaporizing.

3. Apparatus

3.1 Sampling Train. Same as in Method 17, section 2.1, with the following exceptions noted below (see Figure 202-1). *Note:* Mention of trade names or specific products does not constitute endorsement by EPA.

3.1.1 The probe extension shall be glass-lined or Teflon.

3.1.2 Both the first and second impingers shall be of the Greenburg-Smith design with the standard tip.

3.1.3 All sampling train glassware shall be cleaned prior to the test with soap and tap water, water, and rinsed using tap water, water, acetone, and finally, MeCl_2 . It is important to completely remove all silicone grease from areas that will be exposed to the MeCl_2 during sample recovery.

3.2 Sample Recovery. Same as in Method 17, section 2.2, with the following additions:

3.2.1 N_2 Purge Line. Inert tubing and fittings capable of delivering 0 to 28 liters/min of N_2 gas to the impinger train from a

standard gas cylinder (see Figure 202-2). Standard 0.95 cm (3/8-inch) plastic tubing and compression fittings in conjunction with an adjustable pressure regulator and needle valve may be used.

3.2.2 Rotameter. Capable of measuring gas flow at 20 liters/min.

3.3 Analysis. The following equipment is necessary in addition to that listed in Method 17, section 2.3:

3.3.1 Separatory Funnel. Glass, 1-liter.

3.3.2 Weighing Tins. 350-ml.

3.3.3 Dry Equipment. Hot plate and oven with temperature control.

3.3.4 Pipets. 5-ml.

3.3.5 Ion Chromatograph. Same as in Method 5F, Section 2.1.6.

4. Reagents

Unless otherwise indicated, all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

4.1 Sampling. Same as in Method 17, section 3.1, with the addition of deionized distilled water to conform to the American Society for Testing and Materials Specification D 1193-74, Type II and the omission of section 3.1.4.

4.2 Sample Recovery. Same as in Method 17, section 3.2, with the following additions:

4.2.1 N_2 Gas. Zero N_2 gas at delivery pressures high enough to provide a flow of 20 liters/min for 1 hour through the sampling train.

4.2.2 Methylene Chloride. ACS grade. Blanks shall be run prior to use and only methylene chloride with low blank values (0.001 percent) shall be used.

4.2.3 Water. Same as in section 4.1.

4.3 Analysis. Same as in Method 17, section 3.3, with the following additions:

4.3.1 Methylene Chloride. Same as section 4.2.2.

4.3.2 Ammonium Hydroxide. Concentrated (14.8 M) NH_4OH .

4.3.3 Water. Same as in section 4.1.

4.3.4 Phenolphthalein. The pH indicator solution, 0.05 percent in 50 percent alcohol.

5. Procedure

5.1 Sampling. Same as in Method 17, section 4.1, with the following exceptions:

5.1.1 Place 100 ml of water in the first three impingers.

5.1.2 The use of silicone grease in train assembly is not recommended because it is very soluble in $MeCl_2$, which may result in sample contamination. Teflon tape or similar means may be used to provide leak-free connections between glassware.

5.2 Sample Recovery. Same as in Method 17, section 4.2 with the addition of a post-test N_2 purge and specific changes in handling of individual samples as described below.

5.2.1 Post-test N_2 Purge for Sources Emitting SO_2 . (Note: This step is recommended, but is optional. With little or no SO_2 is present in the gas stream, i.e., the pH of the impinger solution is greater than 4.5, purging has been found to be unnecessary.) As soon as possible after the post-test leak check, detach the probe and filter from the impinger train. Leave the ice in

the impinger box to prevent removal of moisture during the purge. If necessary, add more ice during the purge to maintain the gas temperature below 20 °C. With no flow of gas through the clean purge line and fittings, attach it to the input of the impinger train (see Figure 202-2). To avoid over- or under-pressurizing the impinger array, slowly commence the N_2 gas flow through the line while simultaneously opening the meter box pump valve(s). When using the gas cylinder pressure to push the purge gas through the sample train, adjust the flow rate to 20 liters/min through the rotameter. When pulling the purge gas through the sample train using the meter box vacuum pump, set the orifice pressure differential to ΔH_2 and maintain an overflow rate through the rotameter of less than 2 liters/min. This will guarantee that the N_2 delivery system is operating at greater than ambient pressure and prevents the possibility of passing ambient air (rather than N_2) through the impingers. Continue the purge under these conditions for 1 hour, checking the rotameter and ΔH value(s) periodically. After 1 hour, simultaneously turn off the delivery and pumping systems.

5.2.2 Sample Handling.

5.2.2.1 Container Nos. 1, 2, and 3. If filter catch is to be determined, as detailed in Method 17, section 4.2.

5.2.2.2 Container No. 4 (Impinger Contents). Measure the liquid in the first three impingers to within 1 ml using a clean graduated cylinder or by weighing it to within 0.5 g using a balance. Record the volume or weight of liquid present to be used to calculate the moisture content of the effluent gas. Quantitatively transfer this liquid into a clean sample bottle (glass or plastic); rinse each impinger and the connecting glassware, including probe extension, twice with water, recover the rinse water, and add it to the same sample bottle. Mark the liquid level on the bottle.

5.2.2.3 Container No. 5 ($MeCl_2$ Rinse). Follow the water rinses of each impinger and the connecting glassware, including the probe extension with two rinses of $MeCl_2$; save the rinse products in a clean, glass sample jar. Mark the liquid level on the jar.

5.2.2.4 Container No. 6 (Water Blank). Once during each field test, place 500 ml of water in a separate sample container.

5.2.2.5 Container No. 7 ($MeCl_2$ Blank). Once during each field test, place in a separate glass sample jar a volume of $MeCl_2$ approximately equivalent to the volume used to conduct the $MeCl_2$ rinse of the impingers.

5.3 Analysis. Record the data required on a sheet such as the one shown in Figure 202-3. Handle each sample container as follows:

5.3.1 Container Nos. 1, 2, and 3. If filter catch is analyzed, as detailed in Method 17, section 4.3.

5.3.2 Container Nos. 4 and 5. Note the level of liquid in the containers and confirm on the analytical data sheet whether leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in Container No. 4 either volumetrically to ± 1 ml or gravimetrically to ± 0.5 g. Remove a 5-ml aliquot and set aside for later ion

chromatographic (IC) analysis of sulfates. (Note: Do not use this aliquot to determine chlorides since the HCl will be evaporated during the first drying step. Section 8.2 details a procedure for this analysis.)

5.3.2.1 Extraction. Separate the organic fraction of the sample by adding the contents of Container No. 4 ($MeCl_2$) to the contents of Container No. 4 in a 1000-ml separatory funnel. After mixing, allow the aqueous and organic phases to fully separate, and drain off most of the organic/ $MeCl_2$ phase. Then add 75 ml of $MeCl_2$ to the funnel, mix well, and drain off the lower organic phase. Repeat with another 75 ml of $MeCl_2$. This extraction should yield about 250 ml of organic extract. Each time, leave a small amount of the organic/ $MeCl_2$ phase in the separatory funnel ensuring that no water is collected in the organic phase. Place the organic extract in a tared 350-ml weighing tin.

5.3.2.2 Organic Fraction Weight Determination (Organic Phase from Container Nos. 4 and 5). Evaporate the organic extract at room temperature and pressure in a laboratory hood. Following evaporation, desiccate the organic fraction for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg.

5.3.2.3 Inorganic Fraction Weight Determination. (Note: If NH_4Cl is to be counted as CPM, the inorganic fraction should be taken to near dryness (less than 1 ml liquid) in the oven and then allow to air dry at ambient temperature. If multiple acid emissions are suspected, the ammonia titration procedure in section 8.1 may be preferred.) Using a hot plate, or equivalent, evaporate the aqueous phase to approximately 50 ml; then, evaporate to dryness in a 105 °C oven. Redissolve the residue in 100 ml of water. Add five drops of phenolphthalein to this solution; then, add concentrated (14.8 M) NH_4OH until the sample turns pink. Any excess NH_4OH will be evaporated during the drying step. Evaporate the sample to dryness in a 105 °C oven, desiccate the sample for 24 hours, weigh to a constant weight, and record the results to the nearest 0.1 mg. (Note: The addition of NH_4OH is recommended, but is optional when little or no SO_2 is present in the gas stream, i.e., when the pH of the impinger solution is greater than 4.5, the addition of NH_4OH is not necessary.)

5.3.2.4 Analysis of Sulfate by IC to Determine Ammonium Ion (NH_4^+) Retained in the Sample. (Note: If NH_4OH is not added, omit this step.) Determine the amount of sulfate in the aliquot taken from Container No. 4 earlier as described in Method 5F (appendix A, 40 CFR part 60). Based on the IC SO_4^{2-} analysis of the aliquot, calculate the correction factor to subtract the NH_4^+ retained in the sample and to add the combined water removed by the acid-base reaction (see section 7.2).

5.3.3 Analysis of Water and $MeCl_2$ Blank: (Container Nos. 6 and 7). Analyze these sample blanks as described above in sections 5.3.2.3 and 5.3.2.2, respectively.

5.3.4 Analysis of Acetone Blank (Container No. 8). Same as in Method 17, section 4.3.

6. Calibration

Same as in Method 17, section 5, except for the following:

6.1 IC Calibration. Same as Method 5F, section 5.

6.2 Audit Procedure. Concurrently, analyze the audit sample and a set of compliance samples in the same manner to evaluate the technique of the analyst and the standards preparation. The same analyst, analytical reagents, and analytical system shall be used both for compliance samples and the EPA audit sample. If this condition is met, auditing of subsequent compliance analyses for the same enforcement agency within 30 days is not required. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies, unless prior arrangements are made with both enforcement agencies.

6.3 Audit Samples. Audit Sample Availability. Audit samples will be supplied only to enforcement agencies for compliance tests. The availability of audit samples may be obtained by writing:

Source Test Audit Coordinator (MD-77B), Quality Assurance Division, Atmospheric Research and Exposure Assessment Laboratory, U.S. Environmental Protection Agency, Research Triangle, Park, NC 27711

or by calling the Source Test Audit Coordinator (STAC) at (919) 541-7834. The request for the audit sample must be made at least 30 days prior to the scheduled compliance sample analysis.

6.4 Audit Results. Calculate the audit sample concentration according to the calculation procedure described in the audit instructions included with the audit sample. Fill in the audit sample concentration and the analyst's name on the audit response form included with the audit instructions. Send one copy to the EPA Regional Office or the appropriate enforcement agency and a second copy to the STAC. The EPA Regional Office or the appropriate enforcement agency will report the results of the audit to the laboratory being audited. Include this response with the results of the compliance samples in relevant reports to the EPA Regional Office or the appropriate enforcement agency.

7. Calculations

Same as in Method 17, section 6, with the following additions:

7.1 Nomenclature. Same as in Method 17, section 6.1 with the following additions.

C_{org} = Concentration of the CPM in the stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

C_{SO_4} = Concentration of SO_4^{2-} in the sample, mg/ml.

m_b = Sum of the mass of the water and MeCl_2 blanks, mg.

m_c = Mass of the NH_4^+ added to sample to form ammonium sulfate, mg.

m_i = Mass of inorganic CPM matter, mg.

m_o = Mass of organic CPM, mg.

m_s = Mass of dried sample from inorganic fraction, mg.

V_a = Volume of aliquot taken for IC analysis, ml.

V_w = Volume of impinger contents sample, ml.

7.2 Correction for NH_4^+ and H_2O .

Calculate the correction factor to subtract the NH_4^+ retained in the sample based on the IC SO_4^{2-} and if desired, add the combined water removed by the acid-base reaction.

$$m_c = K C_{\text{SO}_4} V_w \quad \text{Eq. 202-1}$$

where:

$K = 0.0205$, when correcting for NH_4^+ and H_2O .

$= 0.1840$, when only correcting for NH_4^+ .

7.3 Mass of Inorganic CPM.

$$m_i = m_s \frac{V_w}{V_w - V_a} - m_c \quad \text{Eq. 202-2}$$

7.4

Concentration of CPM.

$$C_{\text{CPM}} = \frac{m_o + m_i - m_b}{V_{\text{mold}}} \quad \text{Eq. 202-3}$$

8. Alternative Procedures

8.1 Determination of NH_4^+ Retained in Sample by Titration.

8.1.1 An alternative procedure to determine the amount of NH_4^+ added to the inorganic fraction by titration may be used. After dissolving the inorganic residue in 100 ml of water, titrate the solution with 0.1 N NH_4OH to a pH of 7.0, as indicated by a pH meter. The 0.1 N NH_4OH is made as follows: Add 7 ml of concentrated (14.8 M) NH_4OH to 1 liter of water. Standardize against standardized 0.1 N H_2SO_4 and calculate the exact normality using a procedure parallel to that described in section 5.5 of Method 6 (appendix A, 40 CFR part 60). Alternatively, purchase 0.1 N NH_4OH that has been standardized against a National Institute of Standards and Technology reference material.

8.1.2 Calculate the concentration of SO_4^{2-} in the sample using the following equation.

$$C_{\text{SO}_4} = \frac{48.03 V_t N}{100} \quad \text{Eq. 202-4}$$

where

N = Normality of the NH_4OH , mg/ml.

V_t = Volume of NH_4OH titrant, ml.

48.03 = mg/meq.

100 = Volume of solution, ml.

8.3.1 Calculate the CPM as described in section 7.

8.2 Analysis of Chlorides by IC. At the conclusion of the final weighing as described in section 5.3.2.3, redissolve the inorganic fraction in 100 ml of water. Analyze an aliquot of the redissolved sample for chlorides by IC using techniques similar to those described in Method 5F for sulfates. Previous drying of the sample should have

removed all HCl. Therefore, the remaining chlorides measured by IC can be assumed to be NH_4Cl , and this weight can be subtracted from the weight determined for CPM.

8.3 Air Purge to Remove SO_2 from Impinger Contents. As an alternative to the post-test N_2 purge described in section 5.2.1, the tester may opt to conduct the post-test purge with air at 20 liter/min. Note: The use of an air purge is not as effective as a N_2 purge.

8.4 Chloroform-ether Extraction. As an alternative to the methylene chloride extraction described in section 5.3.2.1, the tester may opt to conduct a chloroform-ether extraction. Note: The Chloroform-ether was not as effective as the MeCl_2 in removing the organics, but it was found to be an acceptable organic extractant. Chloroform and diethylether of ACS grade, with low blank values (0.001 percent), shall be used. Analysis of the chloroform and diethylether blanks shall be conducted according to Section 5.3.3 for MeCl_2 .

8.4.1 Add the contents of Container No. 4 to a 1000-ml separatory funnel. Then add 75 ml of chloroform to the funnel, mix well, and drain off the lower organic phase. Repeat two more times with 75 ml of chloroform. Then perform three extractions with 75 ml of diethylether. This extraction should yield approximately 450 ml of organic extraction. Each time, leave a small amount of the organic/ MeCl_2 phase in the separatory funnel ensuring that no water is collected in the organic phase.

8.4.2 Add the contents of Container No. 5 to the organic extraction. Place approximately 300 ml of the organic extract in a tared 350-ml weighing tin while storing the remaining organic extract in a sample container. As the organic extract evaporates, add the remaining extract to the weighing tin.

8.4.3 Determine the weight of the organic phase as described in Section 5.3.2.2.

8.5 Improving Collection Efficiency. If low impinger collection efficiency is suspected, the following procedure may be used.

8.5.1 Place an out-of-stock filter as described in Method 6 between the second and third impingers.

8.5.2 Recover and analyze the filter according to Method 17, Section 4.2. Include the filter holder as part of the connecting glassware and handle as described in sections 5.2.2.2 and 5.2.2.3.

8.5.3 Calculate the Concentration of CPM as follows:

$$C_{\text{CPM}} = \frac{m_o + m_i + m_f - m_b}{V_{\text{mold}}} \quad \text{Eq. 202-5}$$

where:

m_f = amount of CPM collected on out-of-stock filter, mg.

8.6 Wet Source Testing. When testing at a wet source, use a heated out-of-stock filter as described in Method 5.

9. Bibliography

1. DeWees, W.D., S.C. Steinsberger, G.M. Plummer, L.T. Lay, C.D. McAlister, and R.T.

Shigenara. "Laboratory and Field Evaluation of the EPA Method 5 Impinger Catch for Measuring Condensible Matter from Stationary Sources." Paper presented at the 1989 EPA/AWMA International Symposium on Measurement of Toxic and Related Air Pollutants. Raleigh, North Carolina. May 1-5, 1989.

2. DeWees, W.D. and K.C. Steinberger. "Method Development and Evaluation of Draft Protocol for Measurement of Condensible Particulate Emissions." Draft Report. November 17, 1989.

3. Texas Air Control Board, Laboratory Division. "Determination of Particulate in Stack Gases Containing Sulfuric Acid and/or Sulfur Dioxide." *Laboratory Methods for Determination of Air Pollutants*. Modified December 3, 1978.

4. Nothstein, Greg. Masters Thesis. University of Washington. Department of Environmental Health. Seattle, Washington.

5. "Particulate Source Test Procedures Adopted by Puget Sound Air Pollution Control Agency Board of Directors." Puget Sound Air Pollution Control Agency.

Engineering Division. Seattle, Washington. August 11, 1983.

6. Commonwealth of Pennsylvania. Department of Environmental Resources. Chapter 139, Sampling and Testing (Title 25, Rules and Regulations, Part I, Department of Environmental Resources, Subpart C, Protection of Natural Resources, Article III, Air Resources). January 8, 1980.

7. Wisconsin Department of Natural Resources. *Air Management Operations Handbook, Revision 3*. January 11, 1988.

SELLING CODE 6540-59-M

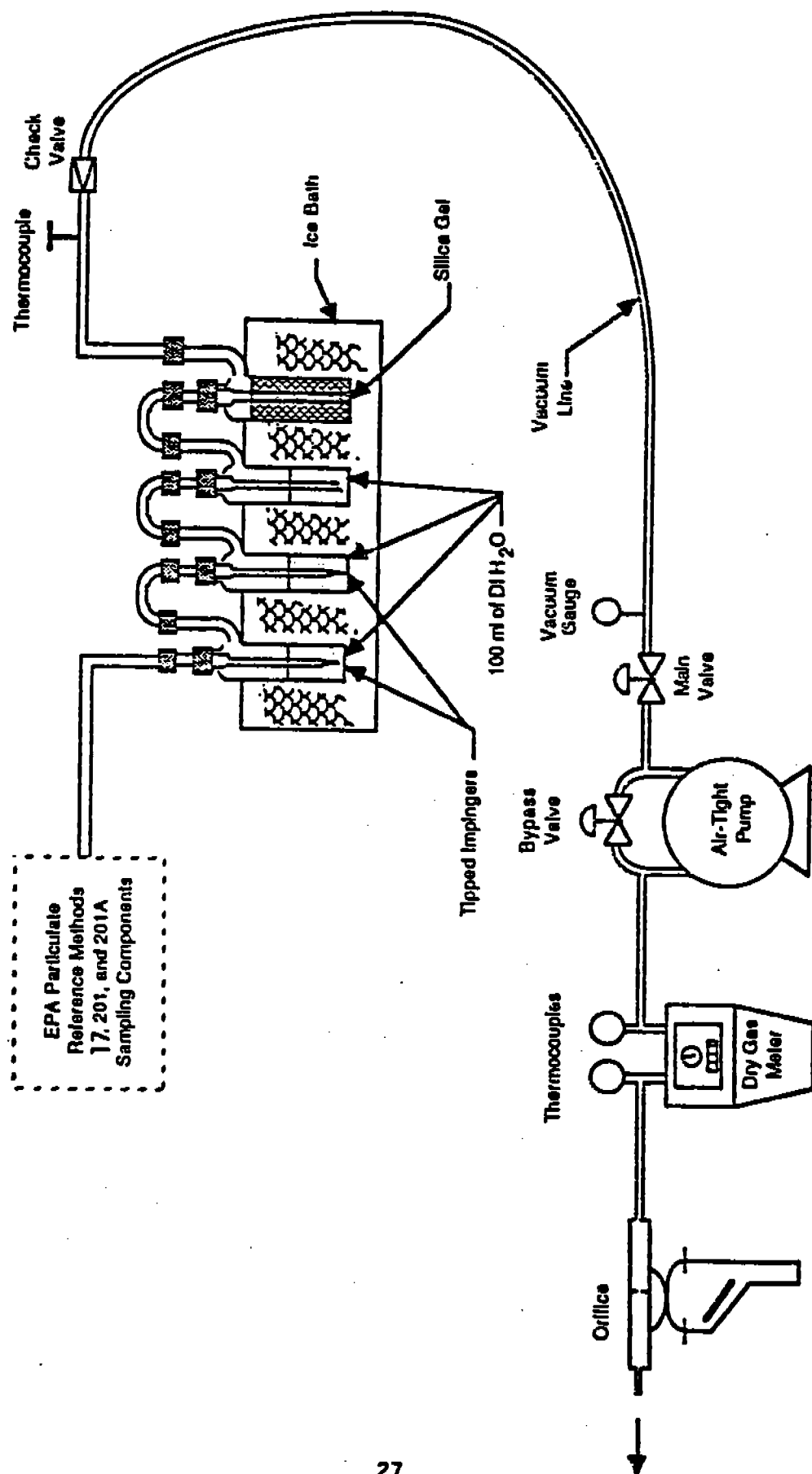


Figure 202-1. . Schematic of condensable particulate sampling train.

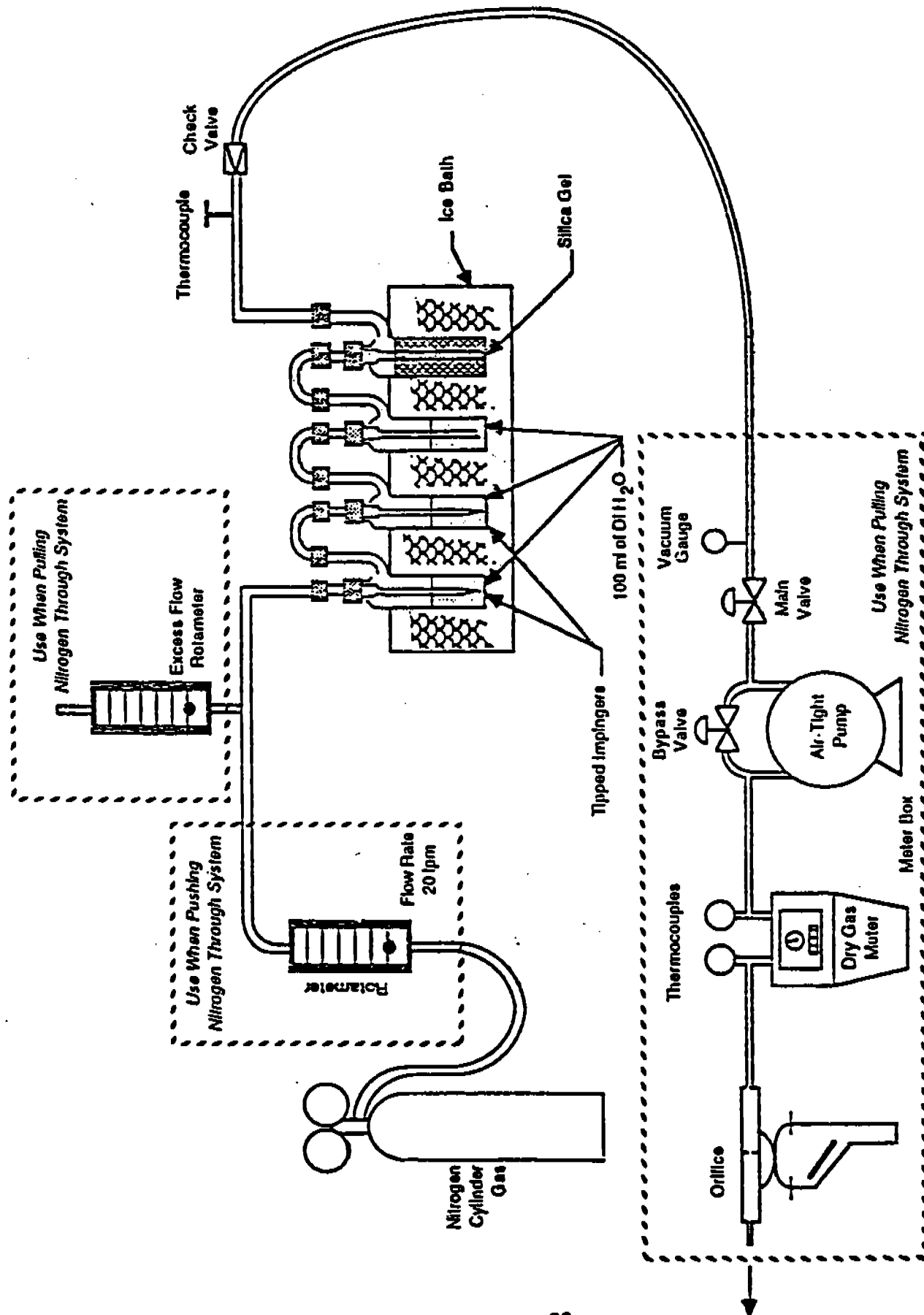


Figure 202-2. Schematic of post-test nitrogen purge system.

Moisture Determination

Volume or weight of liquid in impingers: _____ ml or g

Weight of moisture in silica gel: _____ g

Sample Preparation (Container No. 4)

Amount of liquid lost during transport: _____ ml

Final volume: _____ ml

pH of sample prior to analysis: _____

Addition of NH_4OH required: _____

Sample extracted 2X with 75 ml MeCl_2 : _____

For Titration of Sulfate

Normality of NH_4OH : _____ N

Volume of sample titrated: _____ ml

Volume of titrant: _____ ml

Sample Analysis

Container number	Weight of condensible particulate, mg		
	Final weight	Tare weight	Weight gain
4 (Inorganic) _____			
4 & 5 (Organic) _____			

Total: _____

Less Blank: _____

Weight of Condensible Particulate: _____

Figure 202-3. Analytical data sheet.

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BILLING CODE 6540-50-M

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:

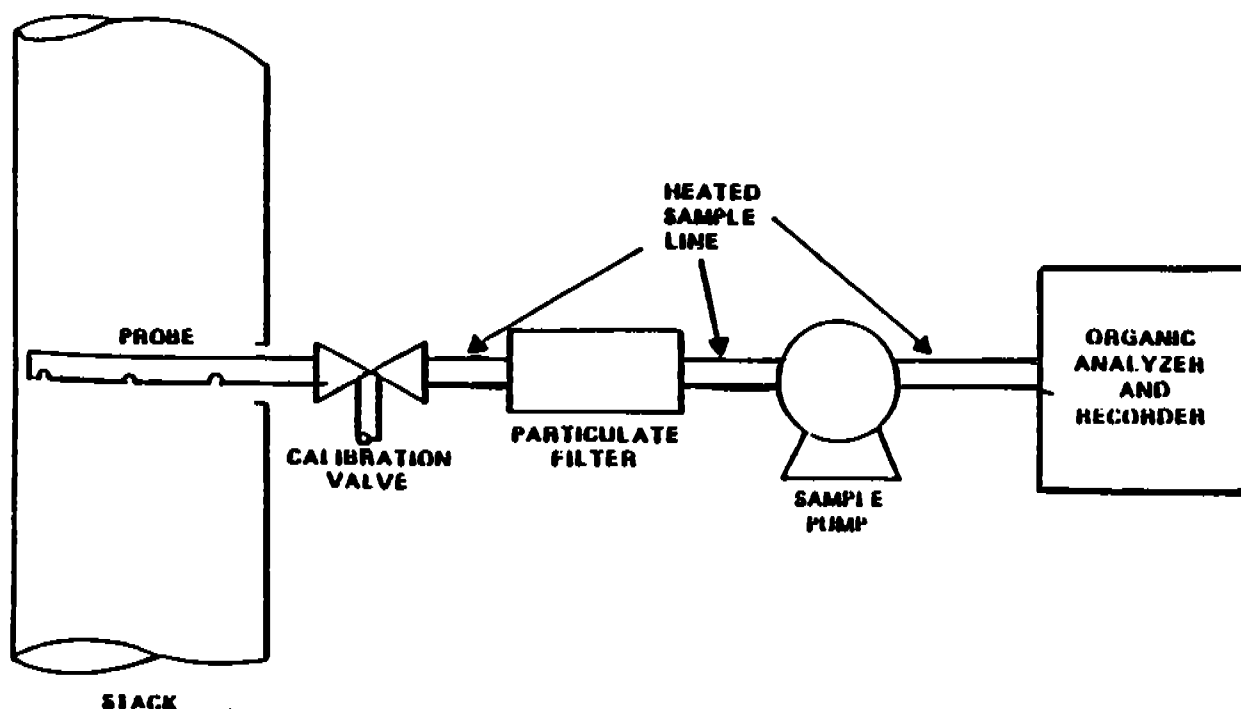


Figure 25A 1. Organic Concentration Measurement System.

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.

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

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

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.

$$C_c = K C_{\text{meas}}$$

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.

EPA
METHOD 0011

RECEIVED

SAMPLING FOR FORMALDEHYDE EMISSIONS FROM STATIONARY SOURCES JUL 16 1990

1.0 SCOPE AND APPLICATION

INTERPOLL LABORATORIES

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

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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 $120 \pm 14^{\circ}\text{C}$ ($248 \pm 25^{\circ}\text{F}$).

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, $\mu\text{g/mL}$) 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):

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

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 500 μL 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 containers. 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 ft³ of sample volume is required for the determination of the Destruction and Removal Efficiency (DRE) of formaldehyde from incineration systems (45ft³ is equivalent to one hour of sampling at 0.75 dscf). Additional sample volume shall be collected as necessitated 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 $>0.00057 \text{ m}^3/\text{min}$ (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 m³/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 m³/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 $<20^{\circ}\text{C}$ (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 m³/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 m³/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 $\pm 2^{\circ}\text{C}$ (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 $\pm 0.5\%$ 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:

$$\text{Total mg formaldehyde} = C_d \times V \times DF \times \\ \left(\frac{[\text{g/mole aldehyde}]}{[\text{g/mole DNPH derivative}]} \right) \times \\ 10^{-3} \text{ mg/}\mu\text{g}$$

where:

C_d = measured concentration of DNPH-formaldehyde derivative, $\mu\text{g/mL}$.

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:

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

where:

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

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

$V_{m(\text{std})}$ = 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 $V_{m(\text{std})}$ 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 FORM₁ Mass -

$$[(WF) (FORM_1 \text{ conc}) (100 - ZDRE)] / 100$$

where:

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

FORM₁ - 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:

$$\text{Max FORM}_1 \text{ conc} = [\text{Max FORM}_1 \text{ Mass}] / DV_{\text{eff(Std)}}$$

where:

DV_{eff(Std)} - volumetric flow rate of exhaust gas, dscm (dscf)

FORM₁ 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.

$$[LDL_{\text{FORM}} \times 10] / [FORM_1 \text{ conc}] = V_{\text{tbc}}$$

where:

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

V_{tbc} - 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 Analysis¹

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 passed 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 μ L 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.

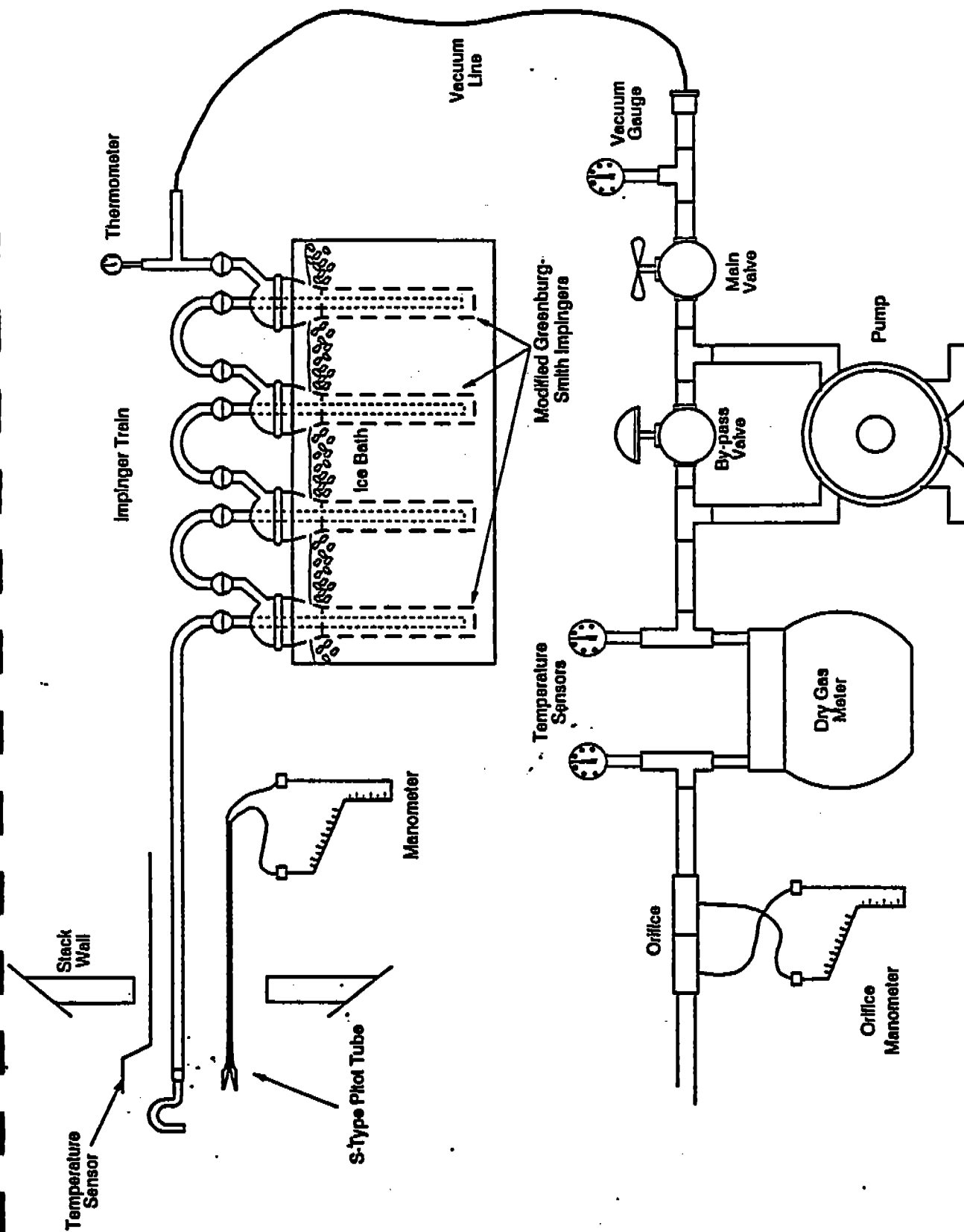
Table 3. Expected Method Performance for Formaldehyde

Parameter	Precision	¹ Accuracy ²	Detection Limit ³
Matrix: Dual trains	$\pm 15\%$ RPD	$\pm 20\%$	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



Schematic of Stack Cross Section

Pilot Tube Coefficient C_p[illegible]

Figure 2. Field Data Sheet

MDI

MDI concentration and emission rate (three (3) one-hour determinations) - Interpoll Labs Method II-8791 (Ver 1.2) based on NIOSH Method P&CAM 347 (N-p-nitrobenzyl-N-propylamine impregnated filters with analysis of the reaction product after solvent switch by reverse phase HPLC/UV).

7/90

C O N F I D E N T I A L

Version 1.1

Interpoll Laboratories

Method II-8791

Determination of 4,4'-Methylenebis
(phenyl isocyanate)(MDI) in
Wood Board Press Vent Exhausts

This method is a modification of NIOSH Method 347 in which a known volume of stack gas is drawn out of the stack through a glass-fiber filter impregnated with N-p-nitrobenzyl-N-propylamine to collect MDI. MDI reacts with this reagent to form a stable urea. The urea derivative is analyzed by HPLC. The modifications and the rationale therefor are enumerated below. The modifications used in this work were chosen expressly to accomodate the conditions normally encountered in board press exhaust gas stacks and may not be appropriate for other sources.

The method was modified by Interpoll Laboratories to 1) protect the urea derivative from exposure to high temperature; 2) to provide for isokinetic collection of samples, since some MDI will be associated with particles larger than 3 microns in diameter; 3) to make possible field recovery of samples, since stack testing requires repetitive determinations with large sophisticated sampling trains; 4) to increase the sensitivity of the determination; 5) and to more rigorously protect the collected samples since stack sampling normally requires transport of the samples by truck for extended periods of time.

The NIOSH was modified to meet the requirement of isokinetic collection by using a larger filter so that the same or a lower face velocity than that specified in the NIOSH Method is maintained, since the

superficial face velocity is the controlling parameter in analyte breakthrough.

A non-heated probe liner and out-stack filter holder assembly will be used to sample the vents since the gas is essentially ambient air (100-110 °F) with very low moisture content. The filter holder will be of the "out-stack" type to minimize the effect of increased temperature on breakthrough. Sampling will be isokinetic to ensure representative collection of particles which may have MDI adsorbed on their surfaces.

Sample recovery will be quantitative using methylene chloride as the recovery solvent. Samples will be recovered into amber jars with Teflon lids and stored on ice or in a refrigerator until analysis. The filter and probe rinse will be recovered into the same container to initiate extraction immediately upon recovery in the field.

Criteria used in developing stack procedure:

1. The method as conceived for OSHA work uses a filter with an effective filtering area diameter of 1 cm. A flow rate of 1 LPM is recommended. At this superficial velocity, the collection efficiency for MDI was found to be >99.3%.

If $t_{amb} \leq 18^{\circ}\text{C}$ then $\phi \leq 10$ HRS

$18 \leq t_{amb} \leq 29^{\circ}\text{C}$ then $\phi \leq 5.5$ HRS

$29 \leq t_{amb} \leq 40^{\circ}\text{C}$ then $\phi \leq 3$ HRS

where ϕ = total sampling time

2. Since some of the MDI or other diisocyanates (DIs) could and will be associated with particulate material, samples will be collected isokinetically.
3. Since breakthrough is temperature dependent, it is necessary to use an out-stack filter holder. The probe and filter holder should not be heated.
4. Since interferences form on long standing especially in the presence of light, samples are to be recovered into amber bottles and stored at 4 °C.
5. Methylene chloride should be used as the recovery solvent. The filter and the probe wash should be placed in the same container. The filter must be preweighed as well as the sample container. After the sample is recovered, the container is weighed again. The total volume of methylene chloride may then be calculated from the above weights and the density of methylene chloride.

Note: This method of recovery initiates extraction of the urea derivative immediately and probably increases the stability of the samples.

The total volume of CH_2Cl_2 should be about 35-50 ml. The aliquot for HPLC analysis may then be drawn directly from the sample container (after sonication).

Alternatively, the entire mixture may be filtered through a methylene chloride rinsed glass fiber filter, the filter

rinsed and combined with the filtrate and brought to a known volume. This method, however, results in some dilution and also increases the possibility of contamination.

6. A 2.5 inch glass fiber filter with an effective filtration diameter of 5.69 cm will allow sampling at a flow rate 32.4 times greater than the NIOSH procedure and still maintain the same superficial velocity. Thus a flow rate of up to 1.14 CFM can be used and still give a collection efficiency of $\geq 99.3\%$.
7. For an M5 sampling train, this means that an orifice pressure drop as high as 4.3 IN.WC. can be used without concern about reduction in the collection efficiency of MDI. At a temperature up to 104 °F (40 °C), sampling can be performed for a period up to three hours without concern of breakthrough.
8. Based on the above consideration, a normal MDI sampling will consist of three one-hour samplings at a flow rate not to exceed 1.14 CFM.

Note: $(\text{ppb v/v}) = 0.0978 \times (\text{ug/Nm}^3)$

4,4'-METHYLENEBIS(PHENYL ISOCYANATE) (MDI)

Methods Research Branch

Analytical Method
II-8791

Analyte:	A urea derivative of MDI	Method No:	P&CAM 347 <i>0.43 to 78 ppb</i>
Matrix:	Air	Range:	4.4 to 800 $\mu\text{g}/\text{m}^3$
Procedure:	Collection and derivatization on impregnated filter, HPLC	Precision:	0.078 <i>PPB = 0.0978 ($\mu\text{g}/\text{m}^3$)</i>
Date Issued:	8/31/81		
Date Revised:		Classification:	E (Proposed)

1. Synopsis

- 1.1 A known volume of air is drawn through a glass-fiber filter impregnated with a reagent, N-p-nitrobenzyl-N-propylamine, to collect MDI. MDI reacts with the reagent to form N,N'-(methylenedi-4,1-phenylene)bis[N'-[(4-nitrophenyl)methyl]-N'-propylurea] (MDIU) as a derivative. (Reference 11.1)
- 1.2 The impregnated filter is treated with dichloromethane to recover the urea derivative.
- 1.3 The dichloromethane solution is analyzed by high pressure liquid chromatography (HPLC) with an ultraviolet detector set at 254 nm to determine the concentration of MDIU.
- 1.4 The concentration of MDI in air is calculated from the quantity of MDIU on the filter and the volume of air sampled.

2. Working Range, Sensitivity and Detection Limit

- 2.1 MDI in air can be quantified at concentrations ranging from 4.4 to 800 $\mu\text{g}/\text{m}^3$ for 180-L air samples and at ceiling concentrations ranging from 80 to 1000 $\mu\text{g}/\text{m}^3$ for 10-L air samples. The range useful for quantitation of the urea derivative (MDIU) in solution is equivalent to 0.8 to more than 150 μg MDI per mL of solution when 50- μL aliquots are injected into the HPLC.

- 2.2 The impregnated filter can collect more than 298 μg of MDI (greater than 99.3% of the MDI) at a concentration of 500 $\mu\text{g}/\text{m}^3$ during a 10-hour sampling period at 1 L/min when the air temperature is 18 °C.
- 2.3 It has been estimated that MDI at a concentration of 0.6 $\mu\text{g}/\text{m}^3$ could be detected in a 180-L air sample. The detection limit of MDIU in solution is equivalent to approximately 0.1 μg of MDI per mL if a 50- μL aliquot is injected into the HPLC.

3. Interferences

- 3.1 When other compounds are known or suspected to be present in the air, such information, including their suspected identities, should be transmitted with the sample.
- 3.2 N-p-Nitrobenzyl-N-propylamine on glass fiber filters is unstable in the presence of light and is unstable to a smaller degree during storage in the dark at room temperature. Interference during HPLC analysis may result if impregnated filters in filter holders are exposed to light for an excessive period or are stored in the dark at room temperature for an excessive period. Exposure of two impregnated filters inside filter holders to fluorescent lighting for 25 hours gave rise to interferences during HPLC analysis which corresponded to roughly 2 μg of MDI per filter. Storage of three impregnated filters for 41 days in the dark (33 days at room temperature and 8 days at -21 °C) gave rise to interferences which corresponded to an average of roughly 0.4 μg MDI per filter. Storage of six impregnated filters for 42 days in the dark at -21 °C gave rise to no interferences during HPLC analysis.
- 3.3 The following compounds would not interfere with the analysis of MDI in this method: toluene-2,4-diisocyanate (2,4-TDI), toluene-2,6-diisocyanate (2,6-TDI), and hexamethylene diisocyanate (HDI).
- 3.4 Any compound which has the same retention time as that of MDIU and is detected under the HPLC conditions indicated in this method is an interference.

4. Precision and Accuracy

- 4.1 The pooled relative standard deviation for the sampling and analytical method in the approximate range from 170 to 800 $\mu\text{g}/\text{m}^3$ was 0.060 when critical orifices were used to maintain sampling rates near 1 L/min. The relative standard deviation for the sampling and analytical method in the same approximate range of concentrations would be 0.078 if a pump error of 0.05 is assumed for personal-sampling pumps.

4.2 Average recoveries of MDIU from impregnated filters ranged from 0.96 to 0.99 over the range 0.8 to 67 μ g of MDI per filter. The pooled relative standard deviation for the average recoveries was 0.030.

4.3 MDIU on impregnated filters is stable during storage at room temperature in the dark for at least 15 days.

5. Advantages and Disadvantages

5.1 Advantages of the method are: (a) the sampler is small, portable and convenient for personal sampling; (b) the sampler can collect MDI in both vapor and aerosol forms; and (c) the analytical method is specific for MDI.

5.2 Disadvantages of the method are: (a) a time limitation of approximately 21 days for storage of impregnated filters at room temperature in the dark because of the instability of the reagent, N-p-nitrobenzyl-N-propylamine; (b) a need to protect impregnated filters from light; and (c) a need to wash the HPLC column when N-p-nitrobenzyl-N-propylamine causes a large detector response (see Sections 3.2 and 8.3.6).

6. Apparatus

6.1 Sampling Equipment

6.1.1 Samplers. Each sampler contains a glass-fiber filter, 13 mm in diameter, which has been impregnated with N-p-nitrobenzyl-N-propylamine. The impregnated filter is housed in a 13-mm filter holder (Catalogue No. SX00 013 00, Millipore Corporation, Bedford, MA, or equivalent). The internal diameter of the inlet of the filter holder is 4 mm. The filter holders may be wrapped with black tape in order to help protect the impregnated filters from light. Seal the inlets and outlets of the filter holders with plastic tape for storage. The samplers may be stored at -21 °C in the dark for at least 6 weeks. Limit the storage time of the samplers at room temperature in the dark to approximately 21 days (see Section 3.2).

6.1.2 Impregnated Filters. Place 300 mg (0.0013 mole) of N-p-nitrobenzyl-N-propylamine hydrochloride into a 125-mL separatory funnel. Add 25 mL of deionized water and shake the mixture until all of the hydrochloride has dissolved. Cause free amine to separate from the solution by adding 15 mL of 1 N NaOH solution and shaking the mixture. Extract the N-p-nitrobenzyl-N-propylamine with 50 mL of hexane.

Place six glass-fiber filters which are free of binders and 6 mL of the hexane solution into a 50-mL beaker. In dim light, allow hexane to evaporate from the beaker with the aid of a stream of nitrogen. Occasionally swirl the mixture. The filters are sufficiently dry when they no longer cling to the beaker. It has been estimated that there is 4.5 mg of N-p-nitrobenzyl-N-propylamine on each impregnated filter.

- 6.1.3 Calibrated Personal-Sampling Pump. The personal sampling pump should be calibrated for the recommended flow rate of 1 L/min with a representative sampler in line.
- 6.1.4 Stopwatch.
- 6.1.5 Thermometer.
- 6.2 High pressure liquid chromatograph with an ultraviolet detector set at 254 nm.
- 6.3 HPLC column, 25-cm x 4.6-mm internal diameter, packed with Partisil 10 (a porous silica packing; diameter, 10 μ m; surface area, 400 m²/g; Whatman, Inc., Clifton, NJ).
- 6.4 Frits, 0.5-micrometer pore diameter, for use in front of the packing in the HPLC column.
- 6.5 Partisil 10 or other silica packing for use in replacing packing which may be lost from the HPLC column (see Section 8.3.7).
- 6.6 Spectrophotometer set at 555 nm.
- 6.7 Quartz cells for spectrophotometer, 5-cm path length.
- 6.8 Glass vials, 1-mL, with caps lined with polytetrafluoroethylene.
- 6.9 Volumetric flasks, 5-mL and other convenient sizes.
- 6.10 Graduated cylinders, 10-, 25-, 100-, and 1000-mL.
- 6.11 Tweezers.

7. Reagents

Except where otherwise indicated, each reagent should be of ACS reagent grade or better.

- 7.1 4,4'-Methylenebis(phenyl isocyanate) (MDI), practical grade or better.

- 7.2 N-p-Nitrobenzyl-N-propylamine hydrochloride.
- 7.3 Dichloromethane, distilled in glass.
- 7.4 Solution of MDI in dichloromethane. Mix 2.0 g of MDI with 200 mL of dichloromethane. Filter the solution with a glass frit of fine porosity. Determine the concentration of MDI according to Section 9.1.
- 7.5 Water, deionized.
- 7.6 MDIU. Mix 1.500 g (0.00650 mole) of N-p-nitrobenzyl-N-propylamine hydrochloride with 25 mL of deionized water in a 125-mL separatory funnel. Cause free amine to separate from the solution by adding 15 mL of 1 N NaOH and shaking the mixture. Extract the N-p-nitrobenzyl-N-propylamine with 50 mL of hexane. Determine the volume of the solution prepared according to Section 7.4 which would contain 577 mg (0.00231 mole) of MDI, and add 577 mg of MDI in solution to 40 mL of the hexane solution. Reduce the volume of the mixture to approximately 25 mL with a rotary evaporator. Collect the solid by filtration. Wash the solid with several portions of hexane. Recrystallize the product from benzene by dissolving the product in hot benzene, filtering the solution quickly, and allowing the filtrate to cool. Collect the crystals in a Buchner funnel, and dry the product in vacuo at 80 °C. Melting point = 161-162 °C. (Reference 11.2)

NOTE: Benzene is a carcinogen and should be handled with care in a ventilated fume hood.

- 7.7 4,4'-Methylenedianiline, high purity.
- 7.8 Acetic acid, glacial.
- 7.9 Standard solution of 4,4'-methylenedianiline. Dissolve 238 mg of 4,4'-methylenedianiline in 700 mL of glacial acetic acid. Dilute the solution to 1 liter with deionized water.
- 7.10 Hydrochloric acid, 12 M.
- 7.11 Hydrochloric acid-acetic acid solution. Add 35 mL of 12 M hydrochloric acid and 22 mL of glacial acetic acid to 600 mL of deionized water. Dilute the solution to 1 liter with deionized water.
- 7.12 Sodium nitrite-sodium bromide solution. Dissolve 3.0 g of sodium nitrite and 5.0 g of sodium bromide in deionized water and dilute the solution to 100 mL. Discard the solution after 1 week.

- 7.13 Sulfamic acid solution. Dissolve 10.0 g of sulfamic acid in 100 mL of deionized water.
- 7.14 Sodium carbonate solution. Dissolve 16.0 g of anhydrous sodium carbonate in deionized water and dilute the solution to 100 mL. Discard the solution after 1 week.
- 7.15 N-(1-Naphthyl)ethylenediamine dihydrochloride solution. Dissolve 1.0 g of N-(1-naphthyl)ethylenediamine dihydrochloride in 50 mL of deionized water, add 2 mL of 12 M hydrochloric acid, and dilute the solution to 100 mL. Discard the solution after 1 week.
- 7.16 N,N-Dimethylformamide-hydrochloric acid solution. Mix 90 mL of N,N-dimethylformamide with 10 mL of 6 M hydrochloric acid. Discard the solution after 1 week.
- 7.17 2-Propanol, distilled in glass.
8. Procedure
- 8.1 Cleaning of Equipment. All glassware to be used for laboratory analysis should be washed with detergent and rinsed thoroughly with tap water and deionized water.
- 8.2 Collection and Shipping of Samples
- 8.2.1 In each set of samplers consisting of six or fewer samplers, label two samplers as "blank" samplers. The "blank" samplers and the corresponding samplers used in actual air sampling should contain impregnated filters from the same batch (Section 6.1.2).
- 8.2.2 Handle the "blank" samplers and other samplers under the same conditions of temperature, light exposure and storage time. Do not unseal and do not draw air through the "blank" samplers.
- 8.2.3 Immediately before sampling, unseal the inlet and outlet of the sampler.
- 8.2.4 Connect the sampler to a calibrated personal-sampling pump with flexible tubing.
- 8.2.5 Sample at a flow rate of 1 L/min for 10 hours or less if the maximum air temperature will be 18 °C or less. (Experiments were performed at air temperatures near 18 °C, and 12 hours of sampling was borderline for breakthrough to occur. Breakthrough volumes would be expected to decrease with increases in concentration

of MDI vapor, and the maximum vapor concentration of MDI would increase with temperature. Maximum sampling periods should be decreased with increases in air temperature.) Sample at 1 L/min for 5.5 hours or less if the maximum air temperature will be between 18 °C and 29 °C. Sample at 1 L/min for 3 hours or less if the maximum air temperature will be between 29 °C and 40 °C.

8.2.6 Record pertinent data in regard to sampling including sampling time, air temperatures, and atmospheric pressures. If pressure data are not available, record the elevation.

8.2.7 After sampling, seal the inlets and outlets of the samplers with plastic tape. Store these samplers and the "blank" samplers in the dark and, if practical, at -21 °C until analyses are performed. If the samplers are stored at room temperature, limit the total storage time at room temperature to approximately 21 days. Consider storage time before sampling as part of the total storage time. The samplers may be stored in the dark at -21 °C for at least 6 weeks.

8.2.8 If a bulk sample of material suspected to contain MDI is to be submitted to the laboratory, place the bulk sample into a glass container, and seal it with a cap lined with polytetrafluoroethylene. Secure the cap in place with tape.

8.2.9 Do not transport the bulk sample and the air samples in the same container.

8.3 Analysis of Samples

8.3.1 Preparation of Samples. Remove the impregnated filter from the filter holder with tweezers, and place the filter into a 1-mL glass vial. Place 1 mL of dichloromethane into the vial. Seal the vial with a cap lined with polytetrafluoroethylene. Shake the vial vigorously for approximately 1 minute.

8.3.2 HPLC Conditions. Operating conditions for high pressure liquid chromatography are:

Column temperature:	Room temperature
Mobile phase:	1.4:98.6 2-Propanol-dichloromethane (v/v)
Flow rate:	2.0 mL/min
Detector:	UV (254 nm)

Injection volume: 50 μ L
 Column efficiency: Approximately 300
 theoretical plates
 for MDIU

Compound*	Adjusted Retention Volume (V_R')	Capacity Factor (k')
MDIU	4.1 mL	1.9
2,4-TDIU	11.1 mL	5.0
2,6-TDIU	>18.4 mL	>8.3
HDIU	>30 mL	>13.6

*2,4-TDIU, 2,6-TDIU, and HDIU are the corresponding urea derivatives of toluene-2,4-diisocyanate (2,4-TDI), toluene-2,6-diisocyanate (2,6-TDI), and hexamethylene diisocyanate (HDI), respectively.

NOTE: If HPLC conditions are employed which are different from those mentioned for this method, "blank" impregnated filters should be analyzed after storage of such filters and after exposure of such filters to light in order to help determine possibilities of interference.

- 8.3.3 Inject a 50- μ L aliquot of sample solution into the high pressure liquid chromatograph, and determine the size of the peak corresponding to MDIU.
- 8.3.4 If the quantity of MDIU is above the lower quantitation limit, analyze another aliquot of the sample solution with two standards at concentrations above and below that of the MDIU in the sample solution. Precede and follow an injection of sample solution with an injection of standard solution.
- 8.3.5 Analyze the "blank" samples with the field samples.
- 8.3.6 After an aliquot of sample solution has been injected into the liquid chromatograph, N-p-nitrobenzyl-N-propylamine will emerge eventually from the HPLC column and cause a large response in the detector. Wash the column periodically to remove excess N-p-nitrobenzyl-N-propylamine by pumping 50:50 2-propanol-dichloromethane (v/v) at 2 mL/min through the column for at least 1 minute. Then pump 1.4:98.6

2-propanol-dichloromethane (v/v) at 2 mL/min through the column for 15 minutes before the next injection.

- 8.3.7 Replace the frit in front of the column packing when pressure becomes excessive (see Section 6.4). If a small quantity of packing is lost, replace the lost packing with fresh Partisil 10 or other silica packing.
- 8.3.8 Measure either peak heights or peak areas.
- 8.3.9 Construct a calibration curve for each sample based on the two adjacent standards (see Section 8.3.4).

8.4 Determination of Analytical-Method Recovery

- 8.4.1 Significance of Determination. The determination of analytical-method recovery may provide information which would aid in correcting for bias, if any, in the analytical method. Analytical-method recoveries should be determined at three levels of MDI which span the range of interest.

- 8.4.2 Procedure. Prepare three solutions of MDI in dichloromethane at concentrations appropriate for the application of approximately 10- μ L aliquots to filters (a solution at a concentration of 0.08 μ g/ μ L would be appropriate for the application of 0.8 μ g of MDI per filter). Determine the concentrations of MDI according to Section 9.2. Place 18 impregnated filters (six filters for each level of MDI) into separate 1-mL glass vials, and add a known quantity of MDI in approximately 10 μ L of dichloromethane solution to each filter. Seal each vial with a cap lined with polytetrafluoroethylene, and store each vial at room temperature in the dark for several hours. Analyze the samples and nine "blanks" (three "blanks" for each level) according to Section 8.3.

The analytical-method recovery for a level of MDI equals the average quantity of MDIU found in the samples corrected for the average blank and divided by the quantity of MDIU corresponding to the quantity of MDI applied.

Construct a curve of recovery versus average quantity of MDIU found.

9. Calibration and Standardization

9.1 Determination of Concentration of MDI in Dichloromethane Solution by a Colorimetric Method. (Reference 11.3)

- 9.1.1 Mix 10 mL of the standard solution of 4,4'-methylenedianiline (Section 7.9) with 35 mL of 12 M hydrochloric acid and 15 mL of glacial acetic acid, and dilute the solution to 1 liter with deionized water.
- 9.1.2 Prepare a series of standards in the range from 1.2 to 12 μ g 4,4'-methylenedianiline per 15 mL of solution by diluting aliquots of the diluted standard solution (Section 9.1.1) with hydrochloric acid-acetic acid solution (Section 7.11).
- 9.1.3 Take 15 mL of hydrochloric acid-acetic acid solution (Section 7.11) as a blank.
- 9.1.4 Mix 0.5 mL of sodium nitrite-sodium bromide solution with 15 mL of each standard solution prepared according to Section 9.1.2 and with the blank (Section 9.1.3).
- 9.1.5 Add 1 mL of sulfamic acid solution to each mixture, stir each mixture for 0.5 minute, and allow each mixture to stand for 2 minutes.
- 9.1.6 Add 1.5 mL of sodium carbonate solution to each mixture, and stir each mixture.
- 9.1.7 Add 1 mL of N-(1-naphthyl)ethylenediamine dihydrochloride solution to each mixture, and stir each mixture.
- 9.1.8 Transfer a portion of each solution to a 5-cm cell 15 minutes after the addition of N-(1-naphthyl)ethylenediamine dihydrochloride solution, and measure the absorbance of each solution within 15 minutes after transfer. Water may be placed into the reference cell.
- 9.1.9 Construct a calibration curve of absorbance versus quantity of 4,4'-methylenedianiline in μ g per 15 mL of solution.
- 9.1.10 Mix four 0.5-mL samples of the solution of MDI in dichloromethane with quantities of N,N-dimethylformamide-hydrochloric acid solution

(Section 7.16) in 10-mL graduated cylinders sufficient to make 9.5 mL of solution for each sample.

- 9.1.11 Add 10 μ L of each solution prepared according to Section 9.1.10 to a separate 14-mL quantity of hydrochloric acid-acetic acid solution (Section 7.11), and dilute each solution to 15 mL with hydrochloric acid-acetic acid solution.
- 9.1.12 Analyze each sample solution according to Sections 9.1.3 through 9.1.8.
- 9.1.13 Determine the quantity of 4,4'-methylenedianiline in each 15-mL quantity of the sample solution (Section 9.1.11) from the calibration curve.
- 9.1.14 Calculate the concentration, D, of MDI in each sample of dichloromethane solution in mg/mL according to the following equation:

$$D = 2.39 \times B$$

where: 2.39 = a value based on three volumes (9.5 mL, 10 μ L and 0.5 mL) specified in Sections 9.1.10 and 9.1.11 and the molecular weights of MDI and 4,4'-methylenedianiline (250.26 and 198.27, respectively)
B = quantity of 4,4'-methylenedianiline in μ g in 15 mL of solution according to the calibration curve (see Section 9.1.13).

- 9.1.15 Calculate the average concentration of MDI.

9.2 Determination of Concentration of MDI in Dichloromethane Solution by an HPLC Method.

- 9.2.1 Mix four 10- μ L aliquots of the solution of MDI in dichloromethane with separate volumes of a solution of N-p-nitrobenzyl-N-propylamine in hexane sufficient to make 1-mL quantities of solution (see Section 6.1.2 for preparation of a solution of N-p-nitrobenzyl-N-propylamine in hexane).
- 9.2.2 Analyze each solution according to Section 8.3.
- 9.2.3 Determine each concentration of MDIU from a calibration curve (see Section 8.3.9).

- 9.2.4 Calculate the concentration of MDI in each sample of dichloromethane solution, D' , in $\mu\text{g}/\mu\text{L}$ according to the following equation:

$$D' = 0.0392 \times J$$

where: 0.0392 = a value based on the 10- μL aliquot of solution of MDI and the molecular weights of MDI and MDIU (250.26 and 638.73, respectively)

J = the concentration of MDIU in $\mu\text{g}/\text{mL}$.

- 9.2.5 Calculate the average concentration of MDI.

- 9.3 Construction of Calibration Curve. A calibration curve will be an aid in selecting standards to be analyzed with samples. Prepare 5 mL of a dichloromethane solution containing 50 mg of MDIU. Prepare a series of standard solutions at concentrations ranging from 0.3 to 380 μg MDIU per mL of solution. Analyze 50- μL aliquots of the standards according to the HPLC conditions indicated in Section 8.3. Construct a calibration curve of either peak height or peak area versus concentration of MDIU.

10. Calculations

- 10.1 Determine the quantity of MDIU in μg found on the impregnated filter from the appropriate calibration curve (see Section 8.3.9).
- 10.2 Correct the quantity of MDIU for the corresponding "blank" value.
- 10.3 Determine the value of the recovery, R , from the recovery curve (see Section 8.4.2).
- 10.4 Correct the quantity of MDIU for recovery by dividing the quantity by R .
- 10.5 Calculate the concentration of MDI, C , in $\mu\text{g}/\text{m}^3$ in the air sample according to the following equation:

$$C = \frac{392 \times Q}{V}$$

where: 392 = a value based on 1000 liters/ m^3 and the molecular weights of MDI and MDIU (250.26 and 638.73, respectively)

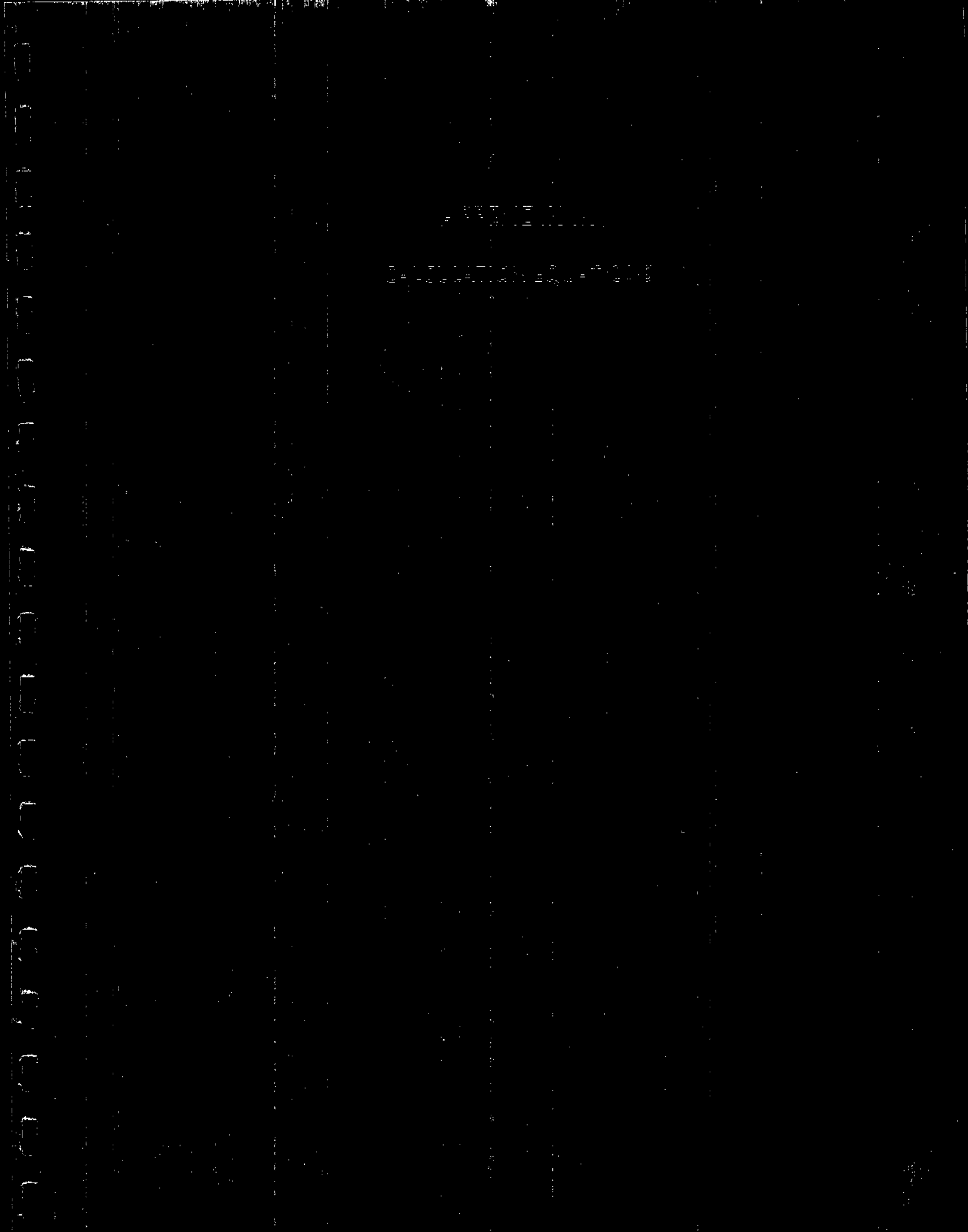
Q = the corrected quantity of MDIU in μg

V = the volume of air sampled in liters.

11. References

- 11.1 Tucker, S. P., and J. E. Arnold, "Sampling and Analytical Methods for Toluene-2,4-diisocyanate and 4,4'-Methylenebis(phenyl isocyanate) in Air" (report in preparation).
- 11.2 Hastings Vogt, C. R., C. Y. Ko and T. R. Ryan, "Simple Ureas Derived from Diisocyanates and Their Liquid Chromatography on a 5-cm Column," J. Chromatogr., 134, 451-458 (1977).
- 11.3 Method No. P&CAM 142, "p,p- Diphenylmethane Diisocyanate (MDI) in Air," in NIOSH Manual of Analytical Methods, Vol. 1, Second Ed., D. G. Taylor, Ed., National Institute for Occupational Safety and Health, Cincinnati, Ohio, 1977. DHEW (NIOSH) Publication No. 77-157-A.

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SURFACE DRYER

M202.TEM

EPA Method 202 Calculations

3-1060.LP

Job: LP Dawson Creek

Date: September 21, 1993

RUN	Vic (ml)	Sulfate (mg/ml)	Mc (mg)	Mr (mg)	Mi (mg)	Mo (mg)	Mb (mg)	CPM (mg)
1	440	0.000909	0.07	136	135.93	47.8	1.2	182.53
2	415	0.000376	0.03	110.8	110.77	31.4	1.2	140.97
3	435	0.000427	0.03	130.3	130.27	38.3	1.2	167.37

EPA Method 5/202 Totals

RUN	Probe W (mg)	Filter (mg)	CPM (mg)	Total (mg)
1	116.5	354.2	182.53	653.2264
2	126.6	289.4	140.97	556.9713
3	105.6	337.4	167.37	610.3658

EPA Method 202 Calculations

3-1060.LP

Job: LP Dawson Creek

No. 1 Konus

Date: September 23, 1993

RUN	Vic (ml)	Sulfate (mg/ml)	Mc (mg)	Mr (mg)	Mi (mg)	Mo (mg)	Mb (mg)	CPM (mg)
1	290	0.000118	0.01	6.9	6.89	3.9	1.2	9.59
2	350	0.000025	0.00	7	7.00	3.2	1.2	9.00
3	340	0.000025	0.00	3.4	3.40	2.4	1.2	4.60

EPA Method 5/202 Totals

RUN	Probe W (mg)	Filter (mg)	CPM (mg)	Total (mg)
1	260	368.5	9.59	638.0937
2	754.6	588	9.00	1351.598
3	414	553.8	4.60	972.3984

CALCULATION EQUATIONS

METHOD 2

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

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

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

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

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

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

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

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

P_s	= Absolute pressure of stack gas, IN.HG.
P_{std}	= Standard absolute pressure, 29.92 IN. HG.
A_a	= Actual volumetric stack gas flow rate, ACFM
$Q_{s,d}$	= Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM
RH	= Relative humidity, %
T_{db}	= Dry bulb temperature of stack gas, °F
T_{wb}	= Wet bulb temperature of stack gas, °F
$T_m(avg)$	= Absolute average dry gas meter temperature, °R
$T_s(avg)$	= Absolute average stack temperature, °F
T_{std}	= Standard absolute temperature, 528 °F (68 °F)
θ	= Total sampling time, min.
V_{lc}	= Total volume of liquid collected in impingers and silica gel, ml
V_m	= Volume of gas sample as measured by dry gas meter, CF
$V_m(std)$	= Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF
$V_w(std)$	= Volume of water vapor in the gas sample corrected to standard conditions, SCF
$\bar{V}_s$	= Average actual stack gas velocity, FT/SEC
v_{Ptdb}	= Vapor pressure at T_{db} , IN. HG.

$v_{p_{twb}}$ = Vapor pressure at T_{wb} , IN. HG

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

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

γ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

CALCULATION EQUATIONS

METHOD 3

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

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

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

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

CALCULATION EQUATIONS

METHOD 5

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

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

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

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

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

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

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

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

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

SYMBOLS

A	= Cross sectional area of stack, SQ. FT.
A_n	= Cross sectional area of nozzle, SQ. FT.
B_{ws}	= Water vapor in gas stream, proportion by volume
C_p	= Pitot tube coefficient, dimensionless
C_a	= Concentration of particulate matter in stack gas, wet basis, GR/ACF
C_s	= Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF
EA	= Excess air, percent by volume
γ	= Dry test meter correction factor, dimensionless
G_d	= Specific gravity (relative to air), dimensionless
I	= Isokinetic variation, percent by volume
M_d	= Molecular weight of stack gas, dry basis, g/g - mole.
$\dot{m}_g$	= Mass flow of wet flue gas, LB/HR
$\dot{m}_p$	= Particulate mass flow, LB/HR
M_s	= Molecular weight of stack gas, wet basis, g/g, mole.
M_p	= Total amount of particulate matter collected, g
P_{bar}	= Atmospheric pressure, IN. HG. (uncompensated)
P_g	= Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN.HG.
 P_{std} = Standard absolute pressure, 29.92 IN. HG.
 A_a = Actual volumetric stack gas flow rate, ACFM
 $Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM
 RH = Relative humidity, %
 T_{db} = Dry bulb temperature of stack gas, °F
 T_{wb} = Wet bulb temperature of stack gas, °F
 $T_m(avg)$ = Absolute average dry gas meter temperature, °R
 $T_s(avg)$ = Absolute average stack temperature, °F
 T_{std} = Standard absolute temperature, 528 °F (68 °F)
 θ = Total sampling time, min.
 V_{lc} = Total volume of liquid collected in impingers and silica gel, ml
 V_m = Volume of gas sample as measured by dry gas meter, CF
 $V_m(std)$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF
 $V_w(std)$ = Volume of water vapor in the gas sample corrected to standard conditions, SCF
 $\bar{V}_s$ = Average actual stack gas velocity, FT/SEC
 $v_{p_{tdb}}$ = Vapor pressure at T_{db} , IN. HG.

Method 25A

... Total Gaseous Organics Calculation Equations

$$\text{GR C/SCF} = 2.180 \times 10^{-4} (\text{ppm,w})$$

$$\text{GR C/DSCF} = 2.180 \times 10^{-4} (\text{ppm,w}) / (1 - \text{MC}/100)$$

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

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 standard cubic foot

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

Note 1: The Ratfisch Model RS 55 Heated FID Analyzer as normally operated with a heated filter, sample line and heated detector oven gives ppm,w.

Note 2: ppm,C = ppm as carbon = 3(ppm propane)

LOUISIANA PACIFIC - DAWSON CREEK

Total HydroCarbons Calculations

Surface Dryer Stack

TEST #	RUN	MC%	CONC (ppmC,w)	GASFLOW (DSCFM)	MASSRATE (LB/HR)	AVERAGE (ppmC,w)	(LB/HR)	(GR/DSCF)
4	1	19.33	270	32189	20.13			0.0729639
	2	17.81	178.9	32225	13.11			0.0474513
	3	19.83	206.9	32501	15.67			0.0562607
						218.6	16.30361	

Press Vent Stack

TEST #	RUN	MC%	CONC (ppmC,w)	GASFLOW (DSCFM)	MASSRATE (LB/HR)	AVERAGE (ppmC,w)	(LB/HR)	(GR/DSCF)
8	1	1.64	28.5	98269	5.32			0.0063166
	2	1.65	22.5	97565	4.17			0.0049873
	3	1.82	25.8	94495	4.64			0.0057287
						25.6	4.710384	

No. 1 Konus Stack

TEST #	RUN	MC%	CONC (ppmC,w)	GASFLOW (DSCFM)	MASSRATE (LB/HR)	AVERAGE (ppmC,w)	(LB/HR)	(GR/DSCF)
10	1	11.05	41.1	9828	0.85			0.0100728
	2	14.75	52.3	7893	0.90			0.0133741
	3	12.86	78.2	8316	1.39			0.0195635
						57.2	1.049274	

CALCULATION EQUATIONS

Chromotropic Acid Method for Formaldehyde

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

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

$$\text{PPM} \cdot \text{DRY} = \frac{.0283 m_t}{V_{\text{std}}}$$

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

$$\text{GR/DSCF} = 5.45 \times 10^{-4} (\text{PPM} \cdot \text{DRY})$$

$$\text{mg/dscm} = 1.249 (\text{PPM} \cdot \text{DRY})$$

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

where $\text{PPM} \cdot \text{DRY}$ = concentration of formaldehyde in parts per million by volume on a dry basis
 $\text{PPM} \cdot \text{WET}$ = 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 on a grains per dry standard cubic foot basis (68°F, 29.92 IN.HG.)
 m = emission or mass rate of formaldehyde in pounds per hour (LB/HR)

INTERPOLL LABORATORIES, INC

Concentration Calculation Equations for Cyanide as HCN

1. Structure:

HCN

2. Molecular weight:

27 g/g-mole

3. Mass/volume Concentration:

$$\text{Cug/Nm}^3 = \frac{35.314 \left(\frac{m}{\text{CN}^-} \right) \frac{27}{26}}{V_{\text{std}}} = \frac{36.67 m_{\text{CN}^-}}{V_{\text{std}}}$$

where m = Total mass of cyanide
in sample in micrograms (μg), and

V_{std} = Total volume of exhaust gas or air
sampled in dry standard cubic feet
(DSCF).

4. Volume/volume Concentration:

$$\text{Cppmv} = \left(\frac{\mu\text{g HCN}}{M^3} \right) \times \frac{M^3}{1000 L} \times \frac{24.05 \mu\text{L}}{27 \mu\text{g}}$$

$$\text{Cppmv} = 8.907 \times 10^{-4} (\text{Cug/Nm}^3)$$

5. Notes:

*All cyanide tests whether total or gaseous
are reported as "hydrogen cyanide"*

Derived by: P. LONNES

Date: 11-10-93

Emission species: HCN

Analytical species: CN (reported by lab)

Form S-511

HYDROGEN CYANIDE

LOUISIANA PACIFIC CORPORATION DAWSON CREEK

SURFACE DRYER STACK 9-21-93

TEST 2

RUN	Vstd (DSCF)	MASS (ug)	CONC (ug/Nm3)	CONC (ppmv)	FLOW (DSCFM)	MASS RATE (LB/HR)
1	43.69	400	323.3143	0.2880	32535	0.039404
2	44.48	390	309.6326	0.2758	32636	0.037854
3	44.43	385	306.0070	0.2726	32567	0.037332

CALCULATION EQUATIONS

Gas Chromatographic Method for Phenol in Air

$$\text{PPM} \cdot \text{DRY} = \frac{9.03 \times 10^{-3} m_t}{V_{\text{std}}}$$

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

$$\text{GR/DSCF} = 1.709 \times 10^{-3} (\text{PPM} \cdot \text{DRY})$$

$$\text{mg/dscm} = 3.913 (\text{PPM} \cdot \text{DRY})$$

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

- where
- PPM·DRY = concentration of phenol in gas in parts per million by volume on a dry basis
- PPM·WET = concentration of phenol in gas 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 phenol in gas on a grains per dry standard cubic foot basis (68°F, 29.92 IN.HG.)
- $\dot{m}$ = emission or mass rate of phenol in pounds per hour (LB/HR)
- $Q_{s,d}$ = volumetric flow rate of stack gas in dry standard cubic feet per minute (DSCFM)

CALCULATION EQUATIONS

Gas Chromatographic Method for Phenol in Air

$$\text{PPM-DRY} = \frac{9.03 \times 10^{-3} m_t}{V_{\text{std}}}$$

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

$$\text{GR/DSCF} = 1.709 \times 10^{-3} (\text{PPM-DRY})$$

$$\text{mg/dscm} = 3.913 (\text{PPM-DRY})$$

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

- where
- PPM-DRY = concentration of phenol in gas in parts per million by volume on a dry basis
 - PPM-WET = concentration of phenol in gas 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 phenol in gas on a grains per dry standard cubic foot basis (68°F, 29.92 IN.HG.)
 - $\dot{m}$ = emission or mass rate of phenol in pounds per hour (LB/HR)
 - $Q_{s,d}$ = volumetric flow rate of stack gas in dry standard cubic feet per minute (DSCFM)

PHENOL RESULTS FOR LOUISIANA PACIFIC

 MASS OF ANALYTE (mg) IN SAMPLE |

M-16

INTERPOLL LABORATORIES, INC

Concentration Calculation Equations for 4,4-Methylenebis (MDI)
(phenyl isocyanate)

1. Structure:	2. Molecular weight: <u>250.27</u> g/g-mole
3. Mass/volume Concentration: $C_{ug/Nm^3} = \frac{35.314 \text{ m}}{V_{std}}$ where m = Total mass of <u>MDI</u> in sample in micrograms (ug), and Vstd = Total volume of exhaust gas or air sampled in dry standard cubic feet (DSCF).	
4. Volume/volume Concentration: $C_{ppmv} = \frac{\mu g}{Nm^3} \left[\frac{Nm^3}{1000 L} \times \frac{24.46 \mu L}{250.27 \mu g} \right]$ $C_{ppmv} = 0.0978 \times 10^{-3} C_{ug/Nm^3}$	
5. Notes: $C_{ppbv} = 0.0978 \frac{\mu g}{Nm^3}$	
Derived by: <u>DJD/PL</u>	Date: <u>1/15/93</u>

			LOUISIANA PACIFIC			REPORT 3-1060	
			DAWSON CREEK				
PRESS VENT STACK							
9/22/93							
			MDI CALCULATIONS				
	TIME		Mass	Flow	Conc	Conc	Mass Rate
RUN #	(HRS)	Vstd	(ug)	DSCFM	(mg/Nm3)	ppm	(LB/HR)
1	1608-1718	42.52	129	98269	0.107	0.0103	0.039435
2	1736-1845	42.11	128	97565	0.107	0.0103	0.039227
3	1856-2004	40.69	128	94495	0.111	0.0107	0.039318

ALBERTA

AMERICAN TRAIL CALIFORNIA RAIL

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

Job L.P. / Dawson Creek, B.C.

Date 9-21-93

Operator M. Kachler

Module No. 5

Instructions: Operate the control module at a flow rate equal to $\dot{V}_H$ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 27.76 in. Hg. $\tau =$.9980 $\dot{V}_H$ 187 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(697.70)		
2.5	699.60	42	38
5.0	701.48	44	39
7.5	703.39	47	39
10	705.25	48	39
	$V_m = 7.55$	Avg(t_m) = 42.00 °F	

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(.9980)(7.55)} \left[\frac{(42.00) + 460}{(27.76)} \right]^{0.5}$$

$$Y_{cn} = \underline{1.008}$$

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

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

S-432

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

Job L.P. / Dawson Creek, B.C.

Date 9-22-93

Operator M. Saehler

Module No. 5

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 27.61 in. Hg. $\tau =$.9980 $\Delta H =$ 1.77 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(2.80)		
2.5	4.70	47	45
5.0	6.60	48	45
7.5	8.50	49	46
10	10.37	51	46
	$V_m = 7.57$	$Avg(t_m) = 47.13^\circ F$	

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(.9980)(7.57)} \left[\frac{(47.13) + 460}{(27.61)} \right]^{0.5}$$

$$Y_{cn} = \underline{1.013}$$

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

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

S-432

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

Job L.P. / Dawson Creek, B.C.
 Operator M. Kaehler

Date 9-21-93
 Module No. 9

Instructions: Operate the control module at a flow rate equal to ΔH_0 for 10 minutes before attaching the umbilical. Record the following data:

Bar press 27.76 in. Hg. $\tau =$.9967 ΔH_0 1.72 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(787.00)		
2.5	788.90	41	40
5.0	790.97	42	40
7.5	792.66	44	41
10	794.55	45	41
	$V_m = 7.55$	Avg(t_m) = 41.75 °F	

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(.9967)(7.55)} \left[\frac{(41.75) + 460}{(27.76)} \right]^{0.5}$$

$$Y_{cn} = \underline{1.009}$$

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

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

S-432

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

Job L.P. / Dawson Creek, B.C.

Date 9-22-93

Operator M. Kachler

Module No. 9

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 27.61 in. Hg. $T =$.9967 $\Delta H =$ 1.77 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(953.50)		
2.5	957.42	49	48
5.0	959.34	51	49
7.5	961.26	52	49
10	963.18	53	49
	$V_m = 7.68$	Avg(t_m) = 50.00 °F	

5' 9"
 2" per"
 13 = 26"
 14 = 30"

Calculate Y_{on} as follows:

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

$$Y_{on} = \frac{1.786}{(.9967)(7.68)} \left[\frac{(50.00) + 460}{(27.61)} \right]^{0.5}$$

$$Y_{on} = \underline{1.003}$$

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

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

S-432

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

Job L.P. / Dawson Creek, B.C.
 Operator M. Kaehler

Date 9-23-93
 Module No. 9

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

Bar press 27.58 in. Hg. $\tau =$.9967 ΔH_e 1.77 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(264.90)		
2.5	266.90	59	59
5.0	268.80	61	58
7.5	270.76	62	59
10	272.67	64	59
	$V_m = 7.77$	Avg(t_m) = 60.13 °F	

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(.9967)(7.77)} \left[\frac{(60.13) + 460}{(27.58)} \right]^{0.5}$$

$$Y_{cn} = \underline{1.00}$$

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

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

S-432

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: October 6, 1993

Meter Box No.: 5 (Rockwell Dry Test Meter Serial No. 949230)

Date of Last Calibration: September 13, 1993

Calibration Technician: D. Brennan

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.)
September 21, 1993	3-1060	697.70	1150.55	452.85	452.85

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: October 6, 1993

Meter Box No. : 9 (Rockwell Dry Test Meter Serial No. 949231)

Date of Last Calibration: September 13, 1993

Calibration Technician: E. Trowbridge

Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
September 21, 1993	3-1060	787.00	1406.68	619.68	619.68

* Total volume through meter since last calibration.

Date 9/13/93
Bar. Press. 29.17 in. Hg

INTERPOL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 5

Serial No. DTM 949 230

Wet Test Meter No, AL-20

Technician D. Breen

[illegible]

Positive leak check performed by D. BRENNAN
Water was in tolerance

Meter was not in tolerance ☒; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Approved by Kimberly H. Carr Date 9/13/93

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

S0702RR 11/91

Bar. Press. 28.70 in. Hg

INTERPOL LABORATORIES, INC.
METER CALIBRATION SHEET

EPA METHOD 5

Control Module No.

Serial No. DTH

Hot Test Water No. **AL-20**

Technician

[illegible]

Positive leak check performed by
 Water was in tolerance ☒
 Water was not in tolerance ☐; readjusted linkage
 Water was not in tolerance ☐; changed dry test meters

Approved by Kenneth K. Lynn Date 9/13/93

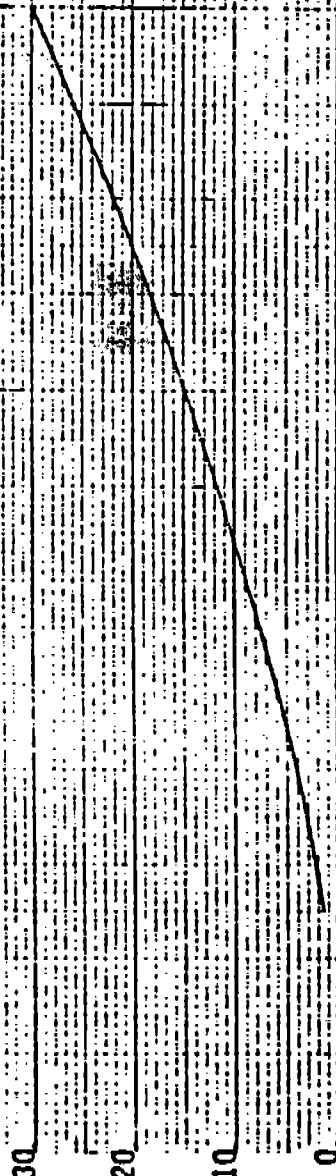
* Based on AL-20 wet test meter calibration in Nov. 1991 against Bell Prover (NBS Traceable) - Carl Poe Co.

S0102RR 11/91

WET TEST METER

PULSATION RANGE

DIFFERENTIAL - INCHES H₂O



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-117

Stainless Steel w/Removable Back

Calibrated w/Saturated Air

Water Temp. 74° F.

Air Temp. 74° F.

Inlet Pressure 2" H₂O Constant

Calibration Rate: 60 CFH Per/Hr.

Capacity Rate: 120 CFH Per/Hr.

Restricted Outlet for Rate Deviation



CORRECT VOLUME + INDEX READING x PROOF + 100

20 40 60 80 100 120

FLOW RATE - CUBIC FEET OF AIR PER HOUR

DAVID BANKS

November, 1991

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 9-21-93

Nozzle Number 8-4

Technician: Mark Kaehler

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

Position	Diameter (inches)
1	.238
2	.239
3	.239
Average:	.239

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 9-23-93

Nozzle Number 8-8

Technician: Mark Kaehler

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

Position	Diameter (inches)
1	.489
2	.489
3	.491
Average:	.490

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 9-23-93

Nozzle Number 8-10

Technician: Mark Kaehler

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

Position	Diameter (inches)
1	.646
2	.652
3	.650
Average:	.649

Interpoll Laboratories, Inc.

Temperature Measurement Device
Calibration Sheet

Unit under test:

Vendor ATKINS
 Model # 39058-K Serial Number PDT #1
 Range -112.0 - 1999 °F Thermocouple Type K
 Date of Calibration 7-31-92 Technician JEFF BERGSTROM

Method of Calibration:

- ☐ Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.
- ☒ Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is $\pm 0.1\%$ 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)	(%)
0	0	-3.8	3.8	.82
100	100	94	6	1.07
200	200	197	3	.45
300	300	296	4	.52
400	400	393	7	.81
500	500	492	8	.83
600	600	594	6	.56
700	700	694	6	.51
800	800	799	1	.07
900	900	900	0	0
1000	1000	1004	4	.27
1100	1100	1107	7	.44
1200	1200	1211	11	.66
1300	1300	1311	11	.62
1400	1400	1415	15	.80
1500	1500	1511	11	.56
1600	1600	1611	11	.53
1700	1700	1704	4	.18
1800	1800	1800	0	0
1900	1900	1892	8	.33
2000	2000	1985	15	.60
2100	2100	N/A		
		Averages:	6.7	.50

OF = off scale response by unit under test (°F)
 % dev = $100 \Delta t / (460 + t)$

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

Interpoll Laboratories, Inc.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 29-4

Pitot tube dimensions:

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

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0
6. B₁ < 5° 2
7. B₂ < 5° 1
8. Z < .125" .02
9. W < .0625" .01

Distance from Pitot to Probe Components:

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

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

Date of Inspection:

4-7-93

Inspected by:

E. J. [Signature]

Interpoll Laboratories, Inc.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 29-5

Pitot tube dimensions:

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

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0
6. B_1 < 5° 0
7. B_2 < 5° 0
8. Z < .125" .03
9. W < .0625" .02

Distance from Pitot to Probe Components:

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

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

Date of Inspection:

4-7-93

Inspected by:

[Signature]

Interpoll Laboratories, Inc.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 29-6

Pitot tube dimensions:

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

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0

6. B₁ < 5° 1
7. B₂ < 5° 1

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

Distance from Pitot to Probe Components:

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

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

Date of Inspection:

4-7-93

Inspected by:

E. Newkirk

INTERPOLL LABORATORIES
(612)786-6020
Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 9-13-93
Technician Mark Baehler
Mercury Column Barometer No. LAB-1
Aneroid Barometer No. 560815

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P _{ba} -P _{bm})
28.720	72	.114	28.656	28.760	.104

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

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

***Note**

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

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