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RESULTS OF THE NOVEMBER 9 - 11, 1993 AIR EMISSION TESTING OF PROCESS SOURCES AT THE AMERICAN CRYSTAL SUGAR EAST GRAND FORKS PLANT

Submitted to:

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Attention:

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Approved by:

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SP/slp

ABBREVIATIONS

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

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

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1 INTRODUCTION

During November 9 - 11, 1993 Interpoll Laboratories Personnel conducted State Air Emission Compliance Tests on the following sources at the American Crystal Sugar (ACS) Plant in East Grand Forks, Minnesota:

SOURCE	POLLUTANT	EMISSION POINT NO.
"A" Pulp Dryer Stack	PM,SO2,NOx,CO,THC's	3
"B" Pulp Dryer Stack	PM,SO2,NOx,CO,THC's	4
"C" Pulp Dryer Stack	PM,SO2,NOx,CO,THC's	5
No. 1 Boiler Stack	PM,NOx,CO	1
No. 2 Boiler Stack	PM,NOx,CO	2
"E" Pellet Cooler Stack	PM	6
"W" Pellet Cooler Stack	PM	7
Pellet Loadout Stack	PM	8

Scott Bainville, Jeff Bergstrom, Mark Kaehler, Eugene Brennan, Dan Despen, and Ken Nuessmeier performed the on-site portion of the test. Coordination between testing activities and plant operation was provided by Bruce Keifenheim of ACS. A member of the Minnesota Pollution Control Agency did not witness the test.

Particulate evaluations were performed in accordance with EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1992). Preliminary determinations of the gas linear velocity profile was made before the first particulate determination at each site to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to extract particulate samples by means of a glass-lined probe. Wet catch samples were collected in the back half of the Method 5 sampling train and analyzed as per Minnesota Rules, Part 7005.0500. In the case of the Pulp Dryer Stacks, sulfur dioxide samples were collected in the back half of the Method 5 Sampling Train in accordance with the large impinger version of EPA Method 6.

The oxides of nitrogen samples were collected during the particulate determinations using an all-glass Method 7 sampling train. A heated stainless steel probe was used to extract the samples from the exhaust stream. A plug of glass-wool was used in the end of the probe to remove particulate material.

The NO_x samples were collected in volume-calibrated two-liter all-glass flasks. An aliquot of 25 cc of absorbing solution was added to each flask on-site; the flask was closed; inserted into the sampling train; and evacuated. The probe was then purged and the sample collected over a 15 second interval. The flask was then closed; the flask removed from the sampling train; shook for two minutes and then secured for transport to the laboratory.

Upon arrival at the laboratory, the NO_x samples are logged in, placed in a designated area and maintained at 72 °F for 24 hours to allow completion of the conversion of NO to NO_2 and absorption in the acidified peroxide reagent. The flasks are then shook to complete absorption; attached to a mercury manometer and the static pressure and temperature recorded. The samples are then recovered and analyzed by ion 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.

An integrated flue gas sample was extracted simultaneously with each particulate sample 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 returned to the laboratory for Orsat analysis. Prior to sampling, the Tedlar bags are leak checked at 15 IN.HG. vacuum with an in-line rotameter. Bags with any detectable inleakage are discarded. The integrated flue gas samples on the A, B, and C Pulp Dryers and the No. 1 and 2 Boilers were also analyzed for carbon monoxide in accordance with EPA Method 10 (NDIR).

Testing on the "A" Pulp Dryer Stack was conducted from 2 test ports oriented at 90 degrees on the stack. The test ports are located diameters 2 downstream and 5.5 diameters

upstream of the nearest flow disturbances. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run. Visible emission determinations were unable to be performed due to converging plumes.

Testing on the "B" Pulp Dryer Stack was conducted from 2 test ports oriented at 90 degrees on the stack. The test ports are located 2 diameters downstream of a flow straightener and 2 diameters upstream of the nearest flow disturbances. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run. Visible emission determinations were unable to be performed due to converging plumes.

Testing on the "C" Pulp Dryer Stack was conducted from 2 test ports oriented at 90 degrees on the stack. The test ports are located 2 diameters downstream and 2 diameters upstream of the nearest flow disturbances. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run. Visible emission determinations were unable to be performed due to converging plumes.

Testing on the No. 1 Boiler Stack was conducted from 4 test ports oriented at 90 degrees on the stack. The test ports are located 4.5 diameters downstream and 2.4 diameters upstream of the nearest flow disturbances. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run.

Testing on the No. 2 Boiler Stack was conducted from 4 test ports oriented at 90 degrees on the stack. The test ports are located 4.5 diameters downstream and 2.4 diameters upstream of the nearest flow disturbances. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run.

Testing on the "E" Pellet Cooler Stack was conducted from 2 test ports oriented at 90 degrees on the stack. The test ports are located 4.2 diameters downstream and 2.1 diameters upstream of the nearest flow disturbances. A 12-point traverse was used to collect

representative particulate samples. Each traverse point was sampled 5 minutes to give a total sampling time of 60 minutes per run.

Testing on the "W" Pellet Cooler Stack was conducted from 2 test ports oriented at 90 degrees on the stack. The test ports are located 4.2 diameters downstream and 2.1 diameters upstream of the nearest flow disturbances. A 12-point traverse was used to collect representative particulate samples. Each traverse point was sampled 5 minutes to give a total sampling time of 60 minutes per run.

Testing on the Pellet Loadout Stack was conducted from 2 test ports oriented at 90 degrees on the stack. The test ports are located approximately 7.9 diameters downstream and 2.3 diameters upstream of the nearest flow disturbances. A 16-point traverse was used to collect representative particulate samples. Each traverse point was sampled 4 minutes to give a total sampling time of 64 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 results of the air emission tests are summarized in Tables 1 - 13. The compliance status of each source in each parameter is presented in the tables below.

PARTICULATE COMPLIANCE STATUS

EMISSION POINT Number	SOURCE NAME	*PM Emission Limit* (LB/HR)	PM Emission Rate (LB/HR)
3	"A" Pulp Dryer	15.94	16.12
4	"B" Pulp Dryer	17.94	21.02
5	"C" Pulp Dryer	14.62	14.51
1	No. 1 Boiler	14.6	35.9
2	No. 2 Boiler	14.6	47.9
6	"E" Pellet Cooler	15.94	3.5
7	"W" Pellet Cooler	15.94	11.2
8	Pellet Loadout	8.22	0.077

SULFUR DIOXIDE COMPLIANCE STATUS

EMISSION POINT Number	SOURCE NAME	*SO_2 Emission Limit* (LB/HR)	SO_2 Emission Rate (LB/HR)
3	"A" Pulp Dryer	8.84	4.19
4	"B" Pulp Dryer	11.16	7.02
5	"C" Pulp Dryer	8.84	4.58

OXIDES OF NITROGEN COMPLIANCE STATUS

EMISSION POINT Number	SOURCE NAME	NO_x *Emission Limit* (LB/HR)	NO_x Emission Rate (LB/HR)
3	"A" Pulp Dryer	13.04	16.6
4	"B" Pulp Dryer	14.79	21.2
5	"C" Pulp Dryer	13.04	16.7
1	No. 1 Boiler	233.6	181
2	No. 2 Boiler	233.6	193

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

Table 1a. Summary of the Results of the November 11, 1993 Particulate Emission Test on the A - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	930/1037	1100/1208	1230/1334
* Process rate			
Volumetric flow			
actual (ACFM)	50585	51776	51507
standard (DSCFM)	22618	24090	24043
Gas temperature (DEG-F)	214	214	215
Moisture content (%V/V)	41.60	39.20	38.96
Gas composition (%V/V,dry)			
carbon dioxide	6.60	3.30	6.30
oxygen	13.60	13.80	13.90
nitrogen	79.80	82.90	79.80
Isokinetic variation (%)	105.1	101.1	102.0
Particulate concentration			
actual (GR/ACF)	.0425	.0328	.0347
standard (GR/DSCF)	.0950	.0706	.0745
Part. emission rate (LB/HR)	18.43	14.58	15.35

Note: Dry + Organic Wet Catch

* For Process Rate Information - See Appendix E.

Table 1b. Summary of the Results of the November 11, 1993 Particulate Emission Test on the A - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	930/1037	1100/1208	1230/1334
* Process rate			
Volumetric flow			
actual (ACFM)	50585	51776	51507
standard (DSCFM)	22618	24090	24043
Gas temperature (DEG-F)	214	214	215
Moisture content (%V/V)	41.60	39.20	38.96
Gas composition (%V/V,dry)			
carbon dioxide	6.60	3.30	6.30
oxygen	13.60	13.80	13.90
nitrogen	79.80	82.90	79.80
Isokinetic variation (%)	105.1	101.1	102.0
Particulate concentration			
actual (GR/ACF)	.0370	.0295	.0320
standard (GR/DSCF)	.0827	.0634	.0685
Part. emission rate (LB/HR)	16.03	13.09	14.12

* For Process Rate Information, See Appendix E

Note: Dry Catch Only

Table 2a. Summary of the Results of the November 10, 1993 Particulate Emission Test on the B - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-10-93	11-10-93	11-10-93
Time runs were done	(HRS)	905/1106	1130/1332	1350/1551
* Process rate				
Volumetric flow				
actual	(ACFM)	76428	76312	74513
standard	(DSCFM)	43382	44674	43695
Gas temperature	(DEG-F)	243	234	232
Moisture content	(%V/V)	23.30	21.92	21.97
Gas composition	(%V/V,dry)			
carbon dioxide		3.40	3.00	3.30
oxygen		17.10	17.50	17.20
nitrogen		79.50	79.50	79.50
Isokinetic variation	(%)	103.9	96.0	99.6
Particulate concentration				
actual	(GR/ACF)	.0283	.0365	.0323
standard	(GR/DSCF)	.0498	.0624	.0551
Part. emission rate	(LB/HR)	18.53	23.89	20.63

Note: Dry + Organic Wet Catch

* For Process Rate Information - See Appendix E.

Table 2b, Summary of the Results of the November 10, 1993 Particulate Emission Test on the B - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-10-93	11-10-93	11-10-93
Time runs were done (HRS)	905/1106	1130/1332	1350/1551
* Process rate			
Volumetric flow			
actual (ACFM)	76428	76312	74513
standard (DSCFM)	43382	44674	43695
Gas temperature (DEG-F)	243	234	232
Moisture content (%V/V)	23.30	21.92	21.97
Gas composition (%V/V,dry)			
carbon dioxide	3.40	3.00	3.30
oxygen	17.10	17.50	17.20 17.27
nitrogen	79.50	79.50	79.50
Isokinetic variation (%)	103.9	96.0	99.6
Particulate concentration			
actual (GR/ACF)	.0257	.0350	.0313
standard (GR/DSCF)	.0454	.0599	.0533
Part. emission rate (LB/HR)	16.87	22.92	19.97

* For Process Rate Information, See Appendix E

Note: Dry Catch Only

Table 3a. Summary of the Results of the November 9, 1993 Particulate Emission Test on the C - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-09-93	11-09-93	11-09-93
Time runs were done	(HRS)	1030/1235	1315/1517	1535/1738
* Process rate				
Volumetric flow				
actual	(ACFM)	48759	47866	48553
standard	(DSCFM)	24867	25356	23446
Gas temperature	(DEG-F)	216	215	216
Moisture content	(%V/V)	33.61	31.13	37.16
Gas composition	(%V/V,dry)			
carbon dioxide		5.20	5.60	5.60
oxygen		15.20	14.70	14.70 14.87
nitrogen		79.60	79.70	79.70
Isokinetic variation	(%)	108.1	96.4	106.8
Particulate concentration				
actual	(GR/ACF)	.0309	.0366	.0375
standard	(GR/DSCF)	.0606	.0690	.0776
Part. emission rate	(LB/HR)	12.93	15.00	15.60

Note: Dry + Organic Wet Catch

* For Process Rate Information - See Appendix E.

Table 3b. Summary of the Results of the November 9, 1993 Particulate Emission Test on the C - Pulp Dryer Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-09-93	11-09-93	11-09-93
Time runs were done (HRS)	1030/1235	1315/1517	1535/1738
* Process rate			
Volumetric flow			
actual (ACFM)	48759	47866	48553
standard (DSCFM)	24867	25356	23446
Gas temperature (DEG-F)	216	215	216
Moisture content (%V/V)	33.61	31.13	37.16
Gas composition (%V/V,dry)			
carbon dioxide	5.20	5.60	5.60
oxygen	15.20	14.70	14.70
nitrogen	79.60	79.70	79.70
Isokinetic variation (%)	108.1	96.4	106.8
Particulate concentration			
actual (GR/ACF)	.0274	.0330	.0347
standard (GR/DSCF)	.0538	.0624	.0718
Part. emission rate (LB/HR)	11.47	13.55	14.44

* For Process Rate Information, See Appendix E

Note: Dry Catch Only

Table 4a. Summary of the Results of the November 10, 1993 Particulate Emission Test on the No. 1 Boiler Stack at the American Crystal Sugar Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-10-93	11-10-93	11-10-93
Time runs were done	(HRS)	810/ 917	948/1053	1115/1220
Steam flow	(KLB/HR)	236.0	237.0	234.0
Volumetric flow				
actual	(ACFM)	159168	163082	163459
standard	(DSCFM)	91671	91495	90081
Gas temperature	(DEG-F)	369	389	388
Moisture content	(%V/V)	8.34	8.59	10.34
Gas composition	(%V/V,dry)			
carbon dioxide		11.00	11.00	11.20
oxygen		8.50	8.50	8.30
nitrogen		80.50	80.50	80.50
Isokinetic variation	(%)	99.6	100.0	101.3
Particulate concentration				
actual	(GR/ACF)	.0241	.0229	.0305
standard	(GR/DSCF)	.0419	.0408	.0554
Part. emission rate	(LB/HR)	32.92	31.99	42.76
Emission factor	(LB/MMBTU)	0.099	0.096	0.128

Note: Dry + Organic Wet Catch

Table 4b. Summary of the Results of the November 10, 1993 Particulate Emission Test on the No. 1 Boiler Stack at the American Crystal Sugar Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-10-93	11-10-93	11-10-93
Time runs were done (HRS)	810/ 917	948/1053	1115/1220
Steam flow (KLB/HR)	236.0	237.0	234.0
Volumetric flow			
actual (ACFM)	159168	163082	163459
standard (DSCFM)	91671	91495	90081
Gas temperature (DEG-F)	369	389	388
Moisture content (%V/V)	8.34	8.59	10.34
Gas composition (%V/V,dry)			
carbon dioxide	11.00	11.00	11.20
oxygen	8.50	8.50	8.30
nitrogen	80.50	80.50	80.50
Isokinetic variation (%)	99.6	100.0	101.3
Particulate concentration			
actual (GR/ACF)	.0235	.0225	.0298
standard (GR/DSCF)	.0409	.0401	.0541
Part. emission rate (LB/HR)	32.10	31.42	41.80
Emission factor (LB/MMBTU)	0.096	0.094	0.125

Note: Dry Catch Only

Table 5a. Summary of the Results of the November 11, 1993 Particulate Emission Test on the No. 2 Boiler Stack at the American Crystal Sugar Company Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	830/ 947	1011/1124	1146/1257
Steam flow (KLB/HR)	232.0	239.0	233.0
Volumetric flow			
actual (ACFM)	145560	147112	147782
standard (DSCFM)	81388	83248	81731
Gas temperature (DEG-F)	377	376	373
Moisture content (%V/V)	9.39	9.17	10.88
Gas composition (%V/V,dry)			
carbon dioxide	11.80	12.10	12.30
oxygen	7.60	7.50	7.20
nitrogen	80.60	80.40	80.50
Isokinetic variation (%)	100.8	100.0	101.7
Particulate concentration			
actual (GR/ACF)	.0289	.0321	.0529
standard (GR/DSCF)	.0518	.0568	.0957
Part. emission rate (LB/HR)	36.12	40.54	67.04
Emission factor (LB/MMBTU)	0.114	0.124	0.204

Note: Dry + Organic Wet Catch

Table 5b. Summary of the Results of the November 11, 1993 Particulate Emission Test on the No. 2 Boiler Stack at the American Crystal Sugar Company Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-11-93	11-11-93	11-11-93
Time runs were done	(HRS)	830/ 947	1011/1124	1146/1257
Steam flow	(KLB/HR)	232.0	239.0	233.0
Volumetric flow				
actual	(ACFM)	145560	147112	147782
standard	(DSCFM)	81388	83248	81731
Gas temperature	(DEG-F)	377	376	373
Moisture content	(%V/V)	9.39	9.17	10.88
Gas composition	(%V/V,dry)			
carbon dioxide		11.80	12.10	12.30
oxygen		7.60	7.50	7.20
nitrogen		80.60	80.40	80.50
Isokinetic variation	(%)	100.8	100.0	101.7
Particulate concentration				
actual	(GR/ACF)	.0282	.0312	.0522
standard	(GR/DSCF)	.0504	.0552	.0944
Part. emission rate	(LB/HR)	35.15	39.40	66.11
Emission factor	(LB/MMBTU)	0.111	0.120	0.201

Note: Dry Catch Only

Table 6a. Summary of the Results of the November 11, 1993 Particulate Emission Test on the East Pellet Cooler Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	1415/1517	1545/1648	1705/1808
* Process rate			
Volumetric flow			
actual (ACFM)	14158	14278	14238
standard (DSCFM)	11849	11920	12073
Gas temperature (DEG-F)	134	134	128
Moisture content (%V/V)	3.54	3.89	3.40
Gas composition (%V/V,dry)			
carbon dioxide	0.03	0.03	0.03
oxygen	20.90	20.90	20.90
nitrogen	79.07	79.07	79.07
Isokinetic variation (%)	100.0	100.0	99.6
Particulate concentration			
actual (GR/ACF)	.0278	.0308	.0275
standard (GR/DSCF)	.0332	.0369	.0324
Part. emission rate (LB/HR)	3.37	3.77	3.36

Note: Dry + Organic Wet Catch

* For Process Rate Information - See Appendix E.

Table 6b. Summary of the Results of the November 11, 1993 Particulate Emission Test on the East Pellet Cooler Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	1415/1517	1545/1648	1705/1808
* Process rate			
Volumetric flow			
actual (ACFM)	14158	14278	14238
standard (DSCFM)	11849	11920	12073
Gas temperature (DEG-F)	134	134	128
Moisture content (%V/V)	3.54	3.89	3.40
Gas composition (%V/V,dry)			
carbon dioxide	0.03	0.03	0.03
oxygen	20.90	20.90	20.90
nitrogen	79.07	79.07	79.07
Isokinetic variation (%)	100.0	100.0	99.6
Particulate concentration			
actual (GR/ACF)	.0270	.0304	.0270
standard (GR/DSCF)	.0323	.0364	.0319
Part. emission rate (LB/HR)	3.28	3.72	3.30

* For Process Rate Information, See Appendix E

Note: Dry Catch Only

Table 7a. Summary of the Results of the November 11, 1993 Particulate Emission Test on the West Pellet Cooler Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	935/1038	1103/1205	1245/1348
*Process rate			
Volumetric flow			
actual (ACFM)	15063	15396	15555
standard (DSCFM)	12908	12779	13123
Gas temperature (DEG-F)	124	138	135
Moisture content (%V/V)	2.92	3.70	2.65
Gas composition (%V/V,dry)			
carbon dioxide	0.03	0.03	0.03
oxygen	20.90	20.90	20.90
nitrogen	79.07	79.07	79.07
Isokinetic variation (%)	100.1	100.6	98.8
Particulate concentration			
actual (GR/ACF)	.0796	.0773	.0979
standard (GR/DSCF)	.0929	.0932	0.116
Part. emission rate (LB/HR)	10.28	10.21	13.06

Note: Dry + Organic Wet Catch

* For Process Rate Information - See Appendix E.

Table 7b. Summary of the Results of the November 11, 1993 Particulate Emission Test on the West Pellet Cooler Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-11-93	11-11-93	11-11-93
Time runs were done	(HRS)	935/1038	1103/1205	1245/1348
* Process rate				
Volumetric flow				
actual	(ACFM)	15063	15396	15555
standard	(DSCFM)	12908	12779	13123
Gas temperature	(DEG-F)	124	138	135
Moisture content	(%V/V)	2.92	3.70	2.65
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	100.1	100.6	98.8
Particulate concentration				
actual	(GR/ACF)	.0792	.0765	.0974
standard	(GR/DSCF)	.0925	.0922	0.115
Part. emission rate	(LB/HR)	10.23	10.10	12.99

* For Process Rate Information, See Appendix E
Note: Dry Catch Only

Table 8a. Summary of the Results of the November 11, 1993 Particulate Emission Test on the Pellet Loadout Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM	Run 1	Run 2	Run 3
Date of test	11-11-93	11-11-93	11-11-93
Time runs were done (HRS)	1445/1549	1620/1721	1755/1856
*Process rate			
Volumetric flow			
actual (ACFM)	4204	4211	4240
standard (DSCFM)	4344	4364	4436
Gas temperature (DEG-F)	37	35	31
Moisture content (%V/V)	0.74	0.70	0.60
Gas composition (%V/V,dry)			
carbon dioxide	0.03	0.03	0.03
oxygen	20.90	20.90	20.90
nitrogen	79.07	79.07	79.07
Isokinetic variation (%)	99.5	100.0	100.0
Particulate concentration			
actual (GR/ACF)	.00346	.00182	.00110
standard (GR/DSCF)	.00335	.00175	.00105
Part. emission rate (LB/HR)	0.125	0.066	0.040

Note: Dry + Organic Wet Catch

*For Process Rate Information - See Appendix E.

Table 8b. Summary of the Results of the November 11, 1993 Particulate Emission Test on the Pellet Loadout Stack at the American Crystal Sugar Plant Located in East Grand Forks, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-11-93	11-11-93	11-11-93
Time runs were done	(HRS)	1445/1549	1620/1721	1755/1856
* Process rate				
Volumetric flow				
actual	(ACFM)	4204	4211	4240
standard	(DSCFM)	4344	4364	4436
Gas temperature	(DEG-F)	37	35	31
Moisture content	(%V/V)	0.74	0.70	0.60
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	99.5	100.0	100.0
Particulate concentration				
actual	(GR/ACF)	.00195	.00103	.00071
standard	(GR/DSCF)	.00189	.00099	.00068
Part. emission rate	(LB/HR)	0.070	0.037	0.026

* For Process Rate Information, See Appendix E
Note: Dry Catch Only

Table 9. Summary of the Results of the November 9 - 11, 1993 **Sulfur Dioxide** Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppm,d)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	21	4.73
11-11-93	1100-1208	16	3.92
11-11-93	1230-1334	16	3.91
Average		18	4.19
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	18	7.76
11-10-93	1130-1332	16	7.32
11-10-93	1350-1551	14	5.99
Average		16	7.02
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	19	4.80
11-09-93	1315-1517	12	3.08
11-09-93	1535-1738	25	5.87
Average		19	4.58

Table 10. Summary of the Results of the November 9 - 11, 1993 **Oxides of Nitrogen** Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppm,d)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	95	15.3
11-11-93	1100-1208	99	17.2
11-11-93	1230-1334	100	17.2
Average		98	16.6
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	69	21.3
11-10-93	1130-1332	67	21.5
11-10-93	1350-1551	66	20.8
Average		67	21.2
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	97	17.2
11-09-93	1315-1517	98	17.8
11-09-93	1535-1738	90	15.1
Average		95	16.7
(No. 1 Boiler Stack)			
11-10-93	0810-0917	284	186
11-10-93	0948-1053	273	179
11-10-93	1115-1220	278	179
Average		278	181
(No. 2 Boiler Stack)			
11-11-93	0830-0947	319	186
11-11-93	1011-1124	335	200
11-11-93	1146-1257	329	192
Average		328	193

Table 11. Summary of the Results of the November 9 - 11, 1993 **Total Hydrocarbon** Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppmC,w)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	310	22.4
11-11-93	1100-1208	264	19.6
11-11-93	1230-1334	246	18.1
Average		273	20.0
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	106	11.2
11-10-93	1130-1332	72	7.70
11-10-93	1350-1551	65	6.80
Average		81	8.57
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	123	8.61
11-09-93	1315-1517	177	12.2
11-09-93	1535-1738	172	12.0
Average		157	10.9

Table 12. Summary of the Results of the November 9 - 11, 1993 **Carbon Monoxide** Emission Compliance Tests at the American Crystal Sugar Plant in East Grand Forks, Minnesota.

Date	Time	Concentration (ppm,d)	Emission Rate (LB/HR)
(A - Pulp Dryer Stack)			
11-11-93	0930-1037	540	53.3
11-11-93	1100-1208	500	52.5
11-11-93	1230-1334	450	47.2
Average		497	51.0
(B - Pulp Dryer Stack)			
11-10-93	0905-1106	750	142
11-10-93	1130-1332	830	162
11-10-93	1350-1551	590	112
Average		723	139
(C - Pulp Dryer Stack)			
11-09-93	1030-1235	240	26.0
11-09-93	1315-1517	260	28.8
11-09-93	1535-1738	290	29.7
Average		263	28.2
(No. 1 Boiler Stack)			
11-10-93	0810-0917	319	128
11-10-93	0948-1053	336	134
11-10-93	1115-1220	330	130
Average		328	131
(No. 2 Boiler Stack)			
11-11-93	0830-0947	580	206
11-11-93	1011-1124	535	194
11-11-93	1146-1257	375	134
Average		497	178

Table 13. Summary of the **Flow Rate Determinations** performed in Association with the November 9 - 11, 1993 Tests at the American Crystal Sugar East Grand Forks Plant.

DATE	Time (HRS)	Volumetric Flow Rate (ACFM)	(DSCFM)
(Test 1 - C Recycle Duct)			
11-09-93	0918	4537	2550
(Test 1 - C Pulp Dryer Stack)			
11-09-93	0927	47667	24354
(Test 1 - C Hopper Filter Inlet)			
11-10-93	0900	7024	3942
(Test 5 - B Recycle Duct)			
11-10-93	0828	6709	3981
(Test 5 - B Pulp Dryer Stack)			
11-10-93	0807	72162	41655
(Test 5 - B Hopper Filter Inlet)			
11-10-93	0840	9120	5375
(Test 9 - A Recycle Duct)			
11-11-93	0835	5173	2607
(Test 9 - A Hopper Filter Inlet)			
11-11-93	0830	10635	5342
(Test 10 - East Pellet Cooler Stack)			
11-11-93	1400	14197	11987
(Test 12 - Pellet Loadout Stack)			
11-11-93	1430	4099	4573
(Test 13 - West Pellet Cooler Stack)			
11-11-93	0905	15169	12800

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas moisture is presented first followed by the computer printout of the particulate 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 particulate emission rate has been calculated using the product of the concentration times flow method.

3.1 Results of Volumetric Flow Rate Determinations

Test No. 1
C - Recycle Duct

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

Date of Determination.....	11-09-93
Time of Determination.....(HRS)	918
Barometric pressure.....(IN.HG)	29.51
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	19.5
Duct area.....(SQ.FT)	2.07
Direction of flow.....	DOWN
Static pressure.....(IN.WC)	-.53
Avg. gas temp.....(DEG-F)	208
Moisture content.....(% V/V)	27.79
Avg. linear velocity.....(FT/SEC)	36.5
Gas density.....(LB/ACF)	.05312
Molecular weight.....(LB/LBMOLE)	29.46
Mass flow of gas.....(LB/HR)	14460
Volumetric flow rate.....	
actual.....(ACFM)	4537
dry standard.....(DSCFM)	2550

Test No. 1
C - Pulp Dryer Stack

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

Date of Determination.....	11-09-93
Time of Determination.....(HRS)	927
Barometric pressure.....(IN.HG)	29.51
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	48
Duct area.....(SQ.FT)	12.57
Direction of flow.....	UP
Static pressure.....(IN.WC)	-1.02
Avg. gas temp.....(DEG-F)	215
Moisture content.....(% V/V)	33.61
Avg. linear velocity.....(FT/SEC)	63.2
Gas density.....(LB/ACF)	.05115
Molecular weight.....(LB/LBMOLE)	29.44
Mass flow of gas.....(LB/HR)	146290
Volumetric flow rate.....	
actual.....(ACFM)	47667
dry standard.....(DSCFM)	24354

Test No. 1
C - Hopper Filter Inlet

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

Date of Determination.....	11-09-93
Time of Determination.....(HRS)	900
Barometric pressure.....(IN.HG)	29.51
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	16
Shape of duct.....	Round
Stack diameter.....(IN)	29.5
Duct area.....(SQ.FT)	4.75
Direction of flow.....	DOWN
Static pressure.....(IN.WC)	-.11
Avg. gas temp.....(DEG-F)	210
Moisture content.....(% V/V)	27.76
Avg. linear velocity.....(FT/SEC)	24.7
Gas density.....(LB/ACF)	.05302
Molecular weight.....(LB/LBMOLE)	29.46
Mass flow of gas.....(LB/HR)	22345
Volumetric flow rate.....	
actual.....(ACFM)	7024
dry standard.....(DSCFM)	3942

Test No. 5
B - Recycle Duct

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

Date of Determination.....	11-10-93
Time of Determination.....(HRS)	828
Barometric pressure.....(IN.HG)	29.55
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	24
Duct area.....(SQ.FT)	3.14
Direction of flow.....	DOWN
Static pressure.....(IN.WC)	-.78
Avg. gas temp.....(DEG-F)	231
Moisture content.....(% V/V)	21.23
Avg. linear velocity.....(FT/SEC)	35.6
Gas density.....(LB/ACF)	.05248
Molecular weight.....(LB/LBMOLE)	29.20
Mass flow of gas.....(LB/HR)	21123
Volumetric flow rate.....	
actual.....(ACFM)	6709
dry standard.....(DSCFM)	3981

Test No. 5
B - Pulp Dryer Stack

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

Date of Determination.....	11-10-93
Time of Determination.....(HRS)	807
Barometric pressure.....(IN.HG)	29.55
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	59
Duct area.....(SQ.FT)	18.99
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.98
Avg. gas temp.....(DEG-F)	231
Moisture content.....(% V/V)	23.30
Avg. linear velocity.....(FT/SEC)	63.3
Gas density.....(LB/ACF)	.05201
Molecular weight.....(LB/LBMOLE)	29.23
Mass flow of gas.....(LB/HR)	225180
Volumetric flow rate.....	
actual.....(ACFM)	72162
dry standard.....(DSCFM)	41655

Test No. 5
B - Hopper Filter Inlet

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

Date of Determination.....	11-10-93
Time of Determination.....(HRS)	840
Barometric pressure.....(IN.HG)	29.55
Pitot tube coefficient.....	.84
Number of sampling ports.....	1
Total number of points.....	8
Shape of duct.....	Round
Stack diameter.....(IN)	20
Duct area.....(SQ.FT)	2.18
Direction of flow.....	HORIZONTAL
Static pressure.....(IN.WC)	-.7
Avg. gas temp.....(DEG-F)	236
Moisture content.....(% V/V)	21.22
Avg. linear velocity.....(FT/SEC)	69.7
Gas density.....(LB/ACF)	.05212
Molecular weight.....(LB/LBMOLE)	29.20
Mass flow of gas.....(LB/HR)	28521
Volumetric flow rate.....	
actual.....(ACFM)	9120
dry standard.....(DSCFM)	5375

Test No. 9
A - Recycle Duct

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

Date of Determination.....	11-11-93
Time of Determination.....(HRS)	835
Barometric pressure.....(IN.HG)	29.3
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	16
Shape of duct.....	Round
Stack diameter.....(IN)	18
Duct area.....(SQ.FT)	1.77
Direction of flow.....	DOWN
Static pressure.....(IN.WC)	-2.8
Avg. gas temp.....(DEG-F)	215
Moisture content.....(% V/V)	33.74
Avg. linear velocity.....(FT/SEC)	48.8
Gas density.....(LB/ACF)	.05070
Molecular weight.....(LB/LBMOLE)	29.57
Mass flow of gas.....(LB/HR)	15735
Volumetric flow rate.....	
actual.....(ACFM)	5173
dry standard.....(DSCFM)	2607

Test No. 9
A - Hopper Filter Inlet

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

Date of Determination.....	11-11-93
Time of Determination.....(HRS)	830
Barometric pressure.....(IN.HG)	29.3
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	16
Shape of duct.....	Round
Stack diameter.....(IN)	20
Duct area.....(SQ.FT)	2.18
Direction of flow.....	HORIZONTAL
Static pressure.....(IN.WC)	.28
Avg. gas temp.....(DEG-F)	217
Moisture content.....(% V/V)	34.27
Avg. linear velocity.....(FT/SEC)	81.2
Gas density.....(LB/ACF)	.05082
Molecular weight.....(LB/LBMOLE)	29.57
Mass flow of gas.....(LB/HR)	32429
Volumetric flow rate.....	
actual.....(ACFM)	10635
dry standard.....(DSCFM)	5342

Test No. 10
East Pellet Cooler Stack

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

Date of Determination.....	11-11-93
Time of Determination.....(HRS)	1400
Barometric pressure.....(IN.HG)	29.26
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	23
Duct area.....(SQ.FT)	2.89
Direction of flow.....	DOWN
Static pressure.....(IN.WC)	-.46
Avg. gas temp.....(DEG-F)	129
Moisture content.....(% V/V)	3.54
Avg. linear velocity.....(FT/SEC)	82.0
Gas density.....(LB/ACF)	.06469
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	55103
Volumetric flow rate.....	
actual.....(ACFM)	14197
dry standard.....(DSCFM)	11987

Test No. 12
Pellet Loadout Stack

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

Date of Determination.....	11-11-93
Time of Determination.....(HRS)	1430
Barometric pressure.....(IN.HG)	29.3
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	16
Shape of duct.....	Round
Stack diameter.....(IN)	25.75
Duct area.....(SQ.FT)	3.62
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.062
Avg. gas temp.....(DEG-F)	0
Moisture content.....(% V/V)	0.74
Avg. linear velocity.....(FT/SEC)	18.9
Gas density.....(LB/ACF)	.08394
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	20643
Volumetric flow rate.....	
actual.....(ACFM)	4099
dry standard.....(DSCFM)	4573

Test No. 13
West Pellet Cooler Stack

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

Date of Determination.....	11-11-93
Time of Determination.....(HRS)	905
Barometric pressure.....(IN.HG)	29.26
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	23
Duct area.....(SQ.FT)	2.89
Direction of flow.....	DOWN
Static pressure.....(IN.WC)	-.5
Avg. gas temp.....(DEG-F)	133
Moisture content.....(% V/V)	2.92
Avg. linear velocity.....(FT/SEC)	87.6
Gas density.....(LB/ACF)	.06438
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	58599
Volumetric flow rate.....	
actual.....(ACFM)	15169
dry standard.....(DSCFM)	12800

3.2 Results of the Orsat & Moisture Analyses

Test No. 1
C - Pulp Dryer Stack

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

Date of run	Run 1 11-09-93	Run 2 11-09-93	Run 3 11-09-93
Dry basis (orsat)			
carbon dioxide.....	5.20	5.60	5.60
oxygen.....	15.20	14.70	14.70
nitrogen.....	79.60	79.70	79.70
Wet basis (orsat)			
carbon dioxide.....	3.45	3.86	3.52
oxygen.....	10.09	10.12	9.24
nitrogen.....	52.85	54.89	50.08
water vapor.....	33.61	31.13	37.16
Dry molecular weight.....	29.44	29.48	29.48
Wet molecular weight.....	25.60	25.91	25.22
Specific gravity.....	0.884	0.895	0.871
Water mass flow.....(LB/HR)	35310	32147	38896
FO	1.096	1.107	1.107

Test No. 2
No. 1 Boiler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-10-93	11-10-93	11-10-93
Dry basis (orsat)			
carbon dioxide.....	11.00	11.00	11.20
oxygen.....	8.50	8.50	8.30
nitrogen.....	80.50	80.50	80.50
Wet basis (orsat)			
carbon dioxide.....	10.08	10.06	10.04
oxygen.....	7.79	7.77	7.44
nitrogen.....	73.79	73.59	72.17
water vapor.....	8.34	8.59	10.34
Dry molecular weight.....	30.10	30.10	30.12
Wet molecular weight.....	29.09	29.06	28.87
Specific gravity.....	1.005	1.004	0.997
Water mass flow.....(LB/HR)	23399	24105	29149
FO	1.127	1.127	1.125

Test No. 5
B - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-10-93	11-10-93	11-10-93
Dry basis (orsat)			
carbon dioxide.....	3.40	3.00	3.30
oxygen.....	17.10	17.50	17.20
nitrogen.....	79.50	79.50	79.50
Wet basis (orsat)			
carbon dioxide.....	2.61	2.34	2.57
oxygen.....	13.12	13.66	13.42
nitrogen.....	60.98	62.07	62.03
water vapor.....	23.30	21.92	21.97
Dry molecular weight.....	29.23	29.18	29.22
Wet molecular weight.....	26.61	26.73	26.75
Specific gravity.....	0.919	0.923	0.924
Water mass flow.....(LB/HR)	36957	35176	34517
FO	1.118	1.133	1.121

Test No. 7
No. 2 Boiler Stack

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

Date of run	Run 1 11-11-93	Run 2 11-11-93	Run 3 11-11-93
Dry basis (orsat)			
carbon dioxide.....	11.80	12.10	12.30
oxygen.....	7.60	7.50	7.20
nitrogen.....	80.60	80.40	80.50
Wet basis (orsat)			
carbon dioxide.....	10.69	10.99	10.96
oxygen.....	6.89	6.81	6.42
nitrogen.....	73.03	73.03	71.74
water vapor.....	9.39	9.17	10.88
Dry molecular weight.....	30.19	30.24	30.26
Wet molecular weight.....	29.05	29.11	28.92
Specific gravity.....	1.003	1.006	0.999
Water mass flow.....(LB/HR)	23648	23574	27978
FO	1.127	1.107	1.114

Test No. 9
A - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Dry basis (orsat)			
carbon dioxide.....	6.60	3.30	6.30
oxygen.....	13.60	13.80	13.90
nitrogen.....	79.80	82.90	79.80
Wet basis (orsat)			
carbon dioxide.....	3.85	2.01	3.85
oxygen.....	7.94	8.39	8.48
nitrogen.....	46.60	50.40	48.71
water vapor.....	41.60	39.20	38.96
Dry molecular weight.....	29.60	29.08	29.56
Wet molecular weight.....	24.77	24.74	25.06
Specific gravity.....	0.856	0.854	0.866
Water mass flow.....(LB/HR)	45191	43571	43051
FO	1.106	2.152	1.111

Test No. 10
East Pellet Cooler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
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.....	20.16	20.09	20.19
nitrogen.....	76.27	75.99	76.38
water vapor.....	3.54	3.89	3.40
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.46	28.42	28.47
Specific gravity.....	0.983	0.982	0.983
Water mass flow.....(LB/HR)	1221	1353	1194

Test No. 12
Pellet Loadout Stack

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

Date of run	Run 1 11-11-93	Run 2 11-11-93	Run 3 11-11-93
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.....	20.75	20.75	20.78
nitrogen.....	78.49	78.51	78.60
water vapor.....	0.74*	0.70*	0.60*
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.76	28.76	28.78
Specific gravity.....	0.993	0.994	0.994
Water mass flow.....(LB/HR)	186	128	114

* Free or condensed water in the gas stream.

Test No. 13
West Pellet Cooler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
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.....	20.29	20.13	20.35
nitrogen.....	76.76	76.14	76.97
water vapor.....	2.92	3.70	2.65
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.52	28.44	28.55
Specific gravity.....	0.985	0.982	0.986
Water mass flow.....(LB/HR)	1089	1378	1002

3.3 Results of Particulate Loading Determinations

Test No. 1
C - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-09-93	11-09-93	11-09-93
Time run start/end.....(HRS)	1030/1235	1315/1517	1535/1738
Static pressure.....(IN.WC)	-1.02	-1.02	-1.02
Cross sectional area (SQ.FT)	12.57	12.57	12.57
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	578.0	468.0	631.0
desiccant.....(GRAMS)	11.0	10.0	10.0
total.....(GRAMS)	589.0	478.0	641.0
Total particulate material..			
.....collected(grams)	0.2156	0.2231	0.2571
Gas meter coefficient.....	0.9975	0.9975	0.9975
Barometric pressure..(IN.HG)	29.51	29.51	29.51
Avg. orif.pres.drop..(IN.WC)	0.70	0.57	0.61
Avg. gas meter temp..(DEF-F)	79.5	78.0	82.1
Volume through gas meter....			
at meter conditions...(CF)	56.90	51.59	53.27
standard conditions.(DSCF)	54.86	49.86	51.10
Total sampling time....(MIN)	120.00	120.00	120.00
Nozzle diameter.....(IN)	.198	.198	.198
Avg.stack gas temp ..(DEG-F)	216	215	216
Volumetric flow rate.....			
actual.....(ACFM)	48759	47866	48553
dry standard.....(DSCFM)	24867	25356	23446
Isokinetic variation.....(%)	108.1	96.4	106.8
Particulate concentration...			
actual.....(GR/ACF)	0.03091	0.03656	0.03747
dry standard.....(GR/DSCF)	0.06064	0.06904	0.07763
Particle mass rate...(LB/HR)	12.925	15.004	15.601

Test No. 2
No. 1 Boiler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-10-93	11-10-93	11-10-93
Time run start/end.....(HRS)	810/ 917	948/1053	1115/1220
Static pressure.....(IN.WC)	-0.22	-0.22	-0.22
Cross sectional area (SQ.FT)	60.71	60.71	60.71
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	73.0	73.0	93.0
desiccant.....(GRAMS)	13.0	16.0	16.0
total.....(GRAMS)	86.0	89.0	109.0
Total particulate material..			
.....collected(grams)	0.1210	0.1181	0.1599
Gas meter coefficient.....	1.0042	1.0042	1.0042
Barometric pressure..(IN.HG)	29.55	29.55	29.55
Avg. orif.pres.drop..(IN.WC)	1.76	1.82	1.85
Avg. gas meter temp..(DEF-F)	70.8	86.9	93.0
Volume through gas meter....			
at meter conditions...(CF)	44.99	46.47	46.85
standard conditions.(DSCF)	44.56	44.68	44.55
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.301	.301	.301
Avg.stack gas temp ..(DEG-F)	369	389	388
Volumetric flow rate.....			
actual.....(ACFM)	159168	163082	163459
dry standard.....(DSCFM)	91671	91495	90081
Isokinetic variation.....(%)	99.6	100.0	101.3
Particulate concentration...			
actual.....(GR/ACF)	0.02412	0.02287	0.03051
dry standard.....(GR/DSCF)	0.04190	0.04079	0.05538
Particle mass rate...(LB/HR)	32.921	31.986	42.761
F-factor .....(DSCF/MMBTU)	9780	9780	9780
Emission factor...(LB/MMBTU)	0.099	0.096	0.128

Test No. 5
B - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-10-93	11-10-93	11-10-93
Time run start/end.....(HRS)	905/1106	1130/1332	1350/1551
Static pressure.....(IN.WC)	-0.98	-0.98	-0.98
Cross sectional area (SQ.FT)	18.99	18.99	18.99
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	379.0	334.0	336.0
desiccant.....(GRAMS)	13.0	11.0	15.0
total.....(GRAMS)	392.0	345.0	351.0
Total particulate material..			
.....collected(grams)	0.1965	0.2343	0.2098
Gas meter coefficient.....	0.9975	0.9975	0.9975
Barometric pressure..(IN.HG)	29.55	29.55	29.55
Avg. orif.pres.drop..(IN.WC)	0.84	0.79	0.80
Avg. gas meter temp..(DEF-F)	72.7	85.0	80.0
Volume through gas meter....			
at meter conditions...(CF)	62.22	60.62	60.91
standard conditions.(DSCF)	60.86	57.95	58.77
Total sampling time....(MIN)	120.00	120.00	120.00
Nozzle diameter.....(IN)	.198	.198	.198
Avg.stack gas temp ..(DEG-F)	243	234	232
Volumetric flow rate.....			
actual.....(ACFM)	76428	76312	74513
dry standard.....(DSCFM)	43382	44674	43695
Isokinetic variation.....(%)	103.9	96.0	99.6
Particulate concentration...			
actual.....(GR/ACF)	0.02827	0.03651	0.03229
dry standard.....(GR/DSCF)	0.04982	0.06239	0.05509
Particle mass rate...(LB/HR)	18.526	23.889	20.631

Test No. 7
No. 2 Boiler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	830/ 947	1011/1124	1146/1257
Static pressure.....(IN.WC)	-0.35	-0.35	-0.35
Cross sectional area (SQ.FT)	60.71	60.71	60.71
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	73.0	73.0	90.0
desiccant.....(GRAMS)	15.0	14.0	15.0
total.....(GRAMS)	88.0	87.0	105.0
Total particulate material..			
.....collected(grams)	0.1344	0.1496	0.2516
Gas meter coefficient.....	1.0042	1.0042	1.0042
Barometric pressure..(IN.HG)	29.30	29.55	29.30
Avg. orif.pres.drop..(IN.WC)	1.45	1.50	1.50
Avg. gas meter temp..(DEF-F)	77.1	87.1	84.0
Volume through gas meter....			
at meter conditions...(CF)	41.30	42.31	42.36
standard conditions.(DSCF)	40.06	40.63	40.57
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.301	.301	.301
Avg.stack gas temp ..(DEG-F)	377	376	373
Volumetric flow rate.....			
actual.....(ACFM)	145560	147112	147782
dry standard.....(DSCFM)	81388	83248	81731
Isokinetic variation.....(%)	100.8	100.0	101.7
Particulate concentration...			
actual.....(GR/ACF)	0.02894	0.03213	0.05290
dry standard.....(GR/DSCF)	0.05177	0.05681	0.09570
Particle mass rate...(LB/HR)	36.118	40.537	67.041
F-factor .....(DSCF/MMBTU)	9780	9780	9780
Emission factor...(LB/MMBTU)	0.114	0.124	0.204

Test No. 9
A - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	930/1037	1100/1208	1230/1334
Static pressure.....(IN.WC)	-0.70	-0.70	-0.70
Cross sectional area (SQ.FT)	12.05	12.05	12.05
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	617.0	575.0	574.0
desiccant.....(GRAMS)	17.0	13.0	12.0
total.....(GRAMS)	634.0	588.0	586.0
Total particulate material..			
.....collected(grams)	0.2585	0.1968	0.2089
Gas meter coefficient.....	0.9985	0.9975	0.9975
Barometric pressure..(IN.HG)	29.30	29.30	29.30
Avg. orif.pres.drop..(IN.WC)	1.78	1.74	1.72
Avg. gas meter temp..(DEF-F)	77.2	78.8	78.2
Volume through gas meter....			
at meter conditions...(CF)	43.49	44.74	44.99
standard conditions.(DSCF)	41.97	43.00	43.28
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.255	.255	.255
Avg.stack gas temp ..(DEG-F)	214	214	215
Volumetric flow rate.....			
actual.....(ACFM)	50585	51776	51507
dry standard.....(DSCFM)	22618	24090	24043
Isokinetic variation.....(%)	105.1	101.1	102.0
Particulate concentration...			
actual.....(GR/ACF)	0.04248	0.03285	0.03475
dry standard.....(GR/DSCF)	0.09504	0.07062	0.07447
Particle mass rate...(LB/HR)	18.426	14.583	15.347

Test No. 10
East Pellet Cooler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	1415/1517	1545/1648	1705/1808
Static pressure.....(IN.WC)	-0.46	-0.46	-0.46
Cross sectional area (SQ.FT)	2.89	2.89	2.89
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	25.0	27.0	23.0
desiccant.....(GRAMS)	12.0	14.0	13.0
total.....(GRAMS)	37.0	41.0	36.0
Total particulate material..			
.....collected(grams)	0.1021	0.1142	0.1012
Gas meter coefficient.....	0.9965	0.9965	0.9965
Barometric pressure..(IN.HG)	29.26	29.26	29.26
Avg. orif.pres.drop..(IN.WC)	2.23	2.28	2.32
Avg. gas meter temp..(DEF-F)	65.5	71.5	71.8
Volume through gas meter....			
at meter conditions...(CF)	48.24	49.08	49.51
standard conditions.(DSCF)	47.48	47.77	48.16
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.188	.188	.188
Avg.stack gas temp ..(DEG-F)	134	134	128
Volumetric flow rate.....			
actual.....(ACFM)	14158	14278	14238
dry standard.....(DSCFM)	11849	11920	12073
Isokinetic variation.....(%)	100.0	100.0	99.6
Particulate concentration...			
actual.....(GR/ACF)	0.02776	0.03078	0.02748
dry standard.....(GR/DSCF)	0.03318	0.03689	0.03242
Particle mass rate...(LB/HR)	3.370	3.769	3.355

Test No. 12
Pellet Loadout Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	1445/1549	1620/1721	1755/1856
Static pressure.....(IN.WC)	-0.06	-0.06	-0.06
Cross sectional area (SQ.FT)	3.62	3.62	3.62
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	0.0	0.0	0.0
desiccant.....(GRAMS)	13.0	9.0	8.0
total.....(GRAMS)	13.0	9.0	8.0
Total particulate material..			
.....collected(grams)	0.0087	0.0046	0.0028
Gas meter coefficient.....	0.9975	0.9975	0.9975
Barometric pressure..(IN.HG)	29.30	29.30	29.30
Avg. orif.pres.drop..(IN.WC)	1.29	1.35	1.40
Avg. gas meter temp..(DEF-F)	71.6	86.2	89.1
Volume through gas meter....			
at meter conditions...(CF)	41.19	42.71	43.66
standard conditions.(DSCF)	40.08	40.45	41.14
Total sampling time....(MIN)	64.00	64.00	64.00
Nozzle diameter.....(IN)	.310	.310	.310
Avg.stack gas temp ..(DEG-F)	37	35	31
Volumetric flow rate.....			
actual.....(ACFM)	4204	4211	4240
dry standard.....(DSCFM)	4344	4364	4436
Isokinetic variation.....(%)	99.5	100.0	100.0
Particulate concentration...			
actual.....(GR/ACF)	0.00346	0.00182	0.00110
dry standard.....(GR/DSCF)	0.00335	0.00175	0.00105
Particle mass rate...(LB/HR)	0.125	0.066	0.040

Test No. 13
West Pellet Cooler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	935/1038	1103/1205	1245/1348
Static pressure.....(IN.WC)	-0.50	-0.50	-0.50
Cross sectional area (SQ.FT)	2.89	2.89	2.89
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	17.0	27.0	22.0
desiccant.....(GRAMS)	16.0	15.0	8.0
total.....(GRAMS)	33.0	42.0	30.0
Total particulate material..			
.....collected(grams)	0.3116	0.3111	0.3909
Gas meter coefficient.....	0.9965	0.9965	0.9965
Barometric pressure..(IN.HG)	29.26	29.26	29.26
Avg. orif.pres.drop..(IN.WC)	2.63	2.63	2.66
Avg. gas meter temp..(DEF-F)	61.4	64.5	63.9
Volume through gas meter....			
at meter conditions...(CF)	52.11	52.18	52.58
standard conditions.(DSCF)	51.74	51.51	51.97
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.188	.188	.188
Avg.stack gas temp ..(DEG-F)	124	138	135
Volumetric flow rate.....			
actual.....(ACFM)	15063	15396	15555
dry standard.....(DSCFM)	12908	12779	13123
Isokinetic variation.....(%)	100.1	100.6	98.8
Particulate concentration...			
actual.....(GR/ACF)	0.07960	0.07732	0.09788
dry standard.....(GR/DSCF)	0.09293	0.09319	0.11606
Particle mass rate...(LB/HR)	10.281	10.207	13.055

3.4 Results of Sulfur Dioxide Determinations

Test No. 1
C - Pulp Dryer Stack

Results of Sulfur Dioxide Determinations----------Method 6

	Run 1	Run 2	Run 3
Date of run	11-09-93	11-09-93	11-09-93
Time run start/end.....(HRS)	1030-1235	1315-1517	1535-1738
Barometric pressure..(IN.HG)	29.51	29.51	29.51
Meter temperature....(DEG-F)	79.50	78.00	82.10
Meter correction coefficient	0.9975	0.9975	0.9975
Volume through gas meter....			
at meter conditions...(CF)	56.900	51.590	53.270
standard conditions..(SCF)	54.860	49.863	51.103
Total sampling time....(MIN)	120.0	120.0	120.0
Moisture content.....(%V/V)	33.61	31.13	37.16
Oxygen content....(%V/V DRY)	15.20	14.70	14.70
Milliequivalents of SO4 in..			
gas sample.....	2.5000	1.4300	3.0200
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.0225	0.0142	0.0292
(MG/DSCM).....	52	32	67
(PPM-DRY).....	19	12	25
(PPM-WET).....	13	8	16
SO2 Emission rate....(LB/HR)	4.80	3.08	5.87

Test No. 5
B - Pulp Dryer Stack

Results of Sulfur Dioxide Determinations----------Method 6

	Run 1	Run 2	Run 3
Date of run	11-10-93	11-10-93	11-10-93
Time run start/end.....(HRS)	0905-1106	1130-1332	1350-1551
Barometric pressure..(IN.HG)	29.55	29.55	29.55
Meter temperature....(DEG-F)	72.70	85.00	80.00
Meter correction coefficient	0.9975	0.9975	0.9975
Volume through gas meter....			
at meter conditions...(CF)	62.220	60.620	60.910
standard conditions..(SCF)	60.859	57.948	58.766
Total sampling time....(MIN)	120.0	120.0	120.0
Moisture content.....(%V/V)	23.30	21.92	21.97
Oxygen content....(%V/V DRY)	17.10	17.50	17.20
Milliequivalents of SO4 in..			
gas sample.....	2.5700	2.2400	1.9000
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.0209	0.0191	0.0160
(MG/DSCM).....	48	44	37
(PPM-DRY).....	18	16	14
(PPM-WET).....	14	13	11
SO2 Emission rate....(LB/HR)	7.76	7.32	5.99

Test No. 9
A - Pulp Dryer Stack

Results of Sulfur Dioxide Determinations----------Method 6

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	0930-1037	1100-1208	1230-1334
Barometric pressure..(IN.HG)	29.30	29.30	29.30
Meter temperature....(DEG-F)	77.20	78.80	78.20
Meter correction coefficient	0.9985	0.9975	0.9975
Volume through gas meter....			
at meter conditions...(CF)	43.490	44.740	44.990
standard conditions..(SCF)	41.967	42.997	43.283
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	41.60	39.20	38.96
Oxygen content....(%V/V DRY)	13.60	13.80	13.90
Milliequivalents of SO4 in..			
gas sample.....	2.0700	1.6500	1.6600
<u>Sulfur dioxide concentration</u>			
(GR/DSCF).....	0.0244	0.0190	0.0190
(MG/DSCM).....	56	43	43
(PPM-DRY).....	21	16	16
(PPM-WET).....	12	10	10
SO2 Emission rate....(LB/HR)	4.73	3.92	3.91

3.5 Results of Oxides of Nitrogen Determinations

Test No. 9
A - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	930	945	1000	1015
Flask number.....	13	14	15	16
Volume of flask.....(ML)	2060	2048	2045	2067
Data: time of sampling				
flask temperature..(DEG-F)	40.00	40.00	38.00	37.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.65	27.60	27.65	27.60
flask abs. press...(IN.HG)	1.65	1.70	1.65	1.70
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-0.40	0.20	-0.20	-0.10
flask abs. press...(IN.HG)	28.76	29.36	28.96	29.06
Volume gas sampled....(DSML)	1822	1848	1822	1844
Moisture content.....(%V/V)	41.59	41.59	41.59	41.59
Oxygen content....(%V/V,DRY)	13.60	13.60	13.60	13.60
Nitrate in gas sample...(JG)	443.0	460.0	441.0	445.0
NO2 in gas sample.....(JG)	328.7	341.3	327.2	330.2
NOx Concentration				
(GR/DSCF).....	0.0788	0.0807	0.0785	0.0782
(MG/DSCM).....	180	185	180	179
(PPM-DRY).....	94	97	94	94
(PPM-WET).....	55	56	55	55
NOX Emission rate....(LB/HR)	15.28	15.65	15.22	15.17
NOx emission factor..... .....(LB/MMBTU)*	0.315	0.323	0.314	0.313

* F = 9780 DSCF/MMBTU

Test No. 9
A - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	1105	1130	1145	1155
Flask number.....	17	18	73	74
Volume of flask.....(ML)	2054	2045	2065	2071
Data: time of sampling				
flask temperature..(DEG-F)	37.00	38.00	40.00	39.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.65	27.65	27.60	27.60
flask abs. press...(IN.HG)	1.65	1.65	1.70	1.70
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.30	0.10	0.10	-0.60
flask abs. press...(IN.HG)	29.46	29.26	29.26	28.56
Volume gas sampled....(DSML)	1863	1842	1857	1815
Moisture content.....(%V/V)	39.20	39.20	39.20	39.20
Oxygen content....(%V/V,DRY)	13.80	13.80	13.80	13.80
Nitrate in gas sample...(JG)	455.0	458.0	500.0	479.0
NO2 in gas sample.....(JG)	337.6	339.8	371.0	355.4
NOx Concentration				
(GR/DSCF).....	0.0792	0.0806	0.0873	0.0856
(MG/DSCM).....	181	185	200	196
(PPM-DRY).....	95	96	104	102
(PPM-WET).....	58	59	64	62
NOX Emission rate....(LB/HR)	16.35	16.65	18.03	17.67
NOx emission factor..... .....(LB/MMBTU)*	0.326	0.332	0.359	0.352

* F = 9780 DSCF/MMBTU

Test No. 9
A - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	1235	1255	1310	1325
Flask number.....	75	76	77	78
Volume of flask.....(ML)	2066	2093	2104	2077
Data: time of sampling				
flask temperature..(DEG-F)	40.00	40.00	40.00	40.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.60	27.60	27.60	27.60
flask abs. press...(IN.HG)	1.70	1.70	1.70	1.70
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.20	1.50	0.40	0.70
flask abs. press...(IN.HG)	29.36	30.66	29.56	29.86
Volume gas sampled....(DSML)	1865	1978	1913	1909
Moisture content.....(%V/V)	38.96	38.96	38.96	38.96
Oxygen content....(%V/V,DRY)	13.90	13.90	13.90	13.90
Nitrate in gas sample...(JG)	487.0	489.0	499.0	499.0
NO2 in gas sample.....(JG)	361.3	362.8	370.2	370.2
NOx Concentration				
(GR/DSCF).....	0.0847	0.0801	0.0846	0.0848
(MG/DSCM).....	194	183	194	194
(PPM-DRY).....	101	96	101	101
(PPM-WET).....	62	59	62	62
NOX Emission rate....(LB/HR)	17.45	16.52	17.43	17.47
NOx emission factor..... .....(LB/MMBTU)*	0.353	0.334	0.353	0.354

* F = 9780 DSCF/MMBTU

Test No. 5
B - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	11-10-93	11-10-93	11-10-93	11-10-93
Time of run.....(HRS)	905	935	1005	1055
Flask number.....	25	26	27	28
Volume of flask.....(ML)	2100	2035	2054	2031
Data: time of sampling				
flask temperature..(DEG-F)	57.00	48.00	46.00	40.00
bar. press.....(IN.HG)	29.55	29.55	29.55	29.55
flask vacuum.....(IN.HG)	27.65	27.65	27.70	27.70
flask abs. press...(IN.HG)	1.90	1.90	1.85	1.85
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-1.30	-0.10	-0.50	-0.30
flask abs. press...(IN.HG)	27.86	29.06	28.66	28.86
Volume gas sampled....(DSML)	1782	1804	1797	1789
Moisture content.....(%V/V)	23.42	23.42	23.42	23.42
Oxygen content....(%V/V,DRY)	17.10	17.10	17.10	17.10
Nitrate in gas sample...(JG)	370.0	333.0	282.0	280.0
NO2 in gas sample.....(JG)	274.5	247.1	209.2	207.8
NOx Concentration				
(GR/DSCF).....	0.0673	0.0598	0.0509	0.0508
(MG/DSCM).....	154	137	116	116
(PPM-DRY).....	81	72	61	61
(PPM-WET).....	62	55	47	47
NOX Emission rate....(LB/HR)	25.03	22.25	18.92	18.87
NOx emission factor..... .....(LB/MMBTU)*	0.517	0.460	0.391	0.390

* F = 9780 DSCF/MMBTU

Test No. 5
B - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	11-10-93	11-10-93	11-10-93	11-10-93
Time of run.....(HRS)	1130	1205	1235	1310
Flask number.....	29	30	31	32
Volume of flask.....(ML)	2068	2071	2009	2092
Data: time of sampling				
flask temperature..(DEG-F)	55.00	52.00	58.00	56.00
bar. press.....(IN.HG)	29.55	29.55	29.55	29.55
flask vacuum.....(IN.HG)	27.45	27.50	27.45	27.50
flask abs. press...(IN.HG)	2.10	2.05	2.10	2.05
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.50	-0.30	-2.30	-0.30
flask abs. press...(IN.HG)	29.66	28.86	26.86	28.86
Volume gas sampled....(DSML)	1862	1813	1625	1833
Moisture content.....(%V/V)	21.88	21.88	21.88	21.88
Oxygen content....(%V/V,DRY)	17.50	17.50	17.50	17.50
Nitrate in gas sample...(JG)	319.0	301.0	300.0	310.0
NO2 in gas sample.....(JG)	236.7	223.3	222.6	230.0
NOx Concentration				
(GR/DSCF).....	0.0555	0.0538	0.0599	0.0548
(MG/DSCM).....	127	123	137	125
(PPM-DRY).....	66	64	72	66
(PPM-WET).....	52	50	56	51
NOX Emission rate....(LB/HR)	21.27	20.61	22.92	21.00
NOx emission factor..... .....(LB/MMBTU)*	0.477	0.462	0.514	0.471

* F = 9780 DSCF/MMBTU

Test No. 5
B - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	11-10-93	11-10-93	11-10-93	11-10-93
Time of run.....(HRS)	1400	1430	1455	1534
Flask number.....	33	34	35	36
Volume of flask.....(ML)	2088	2071	2071	2127
Data: time of sampling				
flask temperature..(DEG-F)	50.00	48.00	45.00	42.00
bar. press.....(IN.HG)	29.55	29.55	29.55	29.55
flask vacuum.....(IN.HG)	27.50	27.50	27.45	27.55
flask abs. press...(IN.HG)	2.05	2.05	2.10	2.00
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.00	-0.70	-2.00	-2.10
flask abs. press...(IN.HG)	29.16	28.46	27.16	27.06
Volume gas sampled....(DSML)	1848	1785	1692	1738
Moisture content.....(%V/V)	21.93	21.93	21.93	21.93
Oxygen content....(%V/V,DRY)	17.20	17.20	17.20	17.20
Nitrate in gas sample...(JG)	297.0	305.0	286.0	318.0
NO2 in gas sample.....(JG)	220.4	226.3	212.2	235.9
NOx Concentration				
(GR/DSCF).....	0.0521	0.0554	0.0548	0.0593
(MG/DSCM).....	119	127	125	136
(PPM-DRY).....	62	66	66	71
(PPM-WET).....	49	52	51	55
NOX Emission rate....(LB/HR)	19.51	20.75	20.52	22.22
NOx emission factor..... .....(LB/MMBTU)*	0.411	0.437	0.432	0.468

* F = 9780 DSCF/MMBTU

Test No. 1
C - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	11-09-93	11-09-93	11-09-93	11-09-93
Time of run.....(HRS)	1030	1055	1125	1155
Flask number.....	37	38	39	40
Volume of flask.....(ML)	2054	2056	2062	2093
Data: time of sampling				
flask temperature..(DEG-F)	60.00	59.00	56.00	55.00
bar. press.....(IN.HG)	29.51	29.51	29.51	29.51
flask vacuum.....(IN.HG)	27.80	27.70	27.80	27.85
flask abs. press...(IN.HG)	1.71	1.81	1.71	1.66
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.00	1.10	0.00	-1.40
flask abs. press...(IN.HG)	29.16	30.26	29.16	27.76
Volume gas sampled....(DSML)	1844	1913	1850	1786
Moisture content.....(%V/V)	33.61	33.61	33.61	33.61
Oxygen content....(%V/V,DRY)	15.20	15.20	15.20	15.20
Nitrate in gas sample...(JG)	438.0	465.0	466.0	470.0
NO2 in gas sample.....(JG)	325.0	345.0	345.8	348.7
NOx Concentration				
(GR/DSCF).....	0.0770	0.0788	0.0817	0.0853
(MG/DSCM).....	176	180	187	195
(PPM-DRY).....	92	94	98	102
(PPM-WET).....	61	63	65	68
NOX Emission rate....(LB/HR)	16.42	16.80	17.40	18.19
NOx emission factor..... .....(LB/MMBTU)*	0.395	0.404	0.418	0.437

* F = 9780 DSCF/MMBTU

Test No. 1
C - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	11-09-93	11-09-93	11-09-93	11-09-93
Time of run.....(HRS)	1320	1345	1415	1445
Flask number.....	41	42	79	80
Volume of flask.....(ML)	2076	2094	2085	2105
Data: time of sampling				
flask temperature..(DEG-F)	46.00	44.00	68.00	68.00
bar. press.....(IN.HG)	29.51	29.51	29.51	29.51
flask vacuum.....(IN.HG)	27.80	27.80	27.80	27.80
flask abs. press...(IN.HG)	1.71	1.71	1.71	1.71
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-1.30	-1.50	0.30	0.90
flask abs. press...(IN.HG)	27.86	27.66	29.46	30.06
Volume gas sampled....(DSML)	1772	1774	1895	1954
Moisture content.....(%V/V)	31.13	31.13	31.13	31.13
Oxygen content....(%V/V,DRY)	14.70	14.70	14.70	14.70
Nitrate in gas sample...(JG)	482.0	487.0	440.0	447.0
NO2 in gas sample.....(JG)	357.6	361.3	326.5	331.7
NOx Concentration				
(GR/DSCF).....	0.0882	0.0890	0.0753	0.0742
(MG/DSCM).....	202	204	172	170
(PPM-DRY).....	106	107	90	89
(PPM-WET).....	73	73	62	61
NOX Emission rate....(LB/HR)	19.16	19.35	16.37	16.12
NOx emission factor..... .....(LB/MMBTU)*	0.415	0.419	0.355	0.349

* F = 9780 DSCF/MMBTU

Test No. 1
C - Pulp Dryer Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	11-09-93	11-09-93	11-09-93	11-09-93
Time of run.....(HRS)	1540	1625	1650	1720
Flask number.....	81	82	83	84
Volume of flask.....(ML)	2093	2090	2060	2089
Data: time of sampling				
flask temperature..(DEG-F)	79.00	76.00	75.00	70.00
bar. press.....(IN.HG)	29.51	29.51	29.51	29.51
flask vacuum.....(IN.HG)	27.75	27.80	27.80	27.80
flask abs. press...(IN.HG)	1.76	1.71	1.71	1.71
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	0.80	-1.10	-1.60	1.80
flask abs. press...(IN.HG)	29.96	28.06	27.56	30.96
Volume gas sampled....(DSML)	1935	1805	1745	2001
Moisture content.....(%V/V)	37.16	37.16	37.16	37.16
Oxygen content....(%V/V,DRY)	14.70	14.70	14.70	14.70
Nitrate in gas sample...(JG)	401.0	445.0	454.0	423.0
NO2 in gas sample.....(JG)	297.5	330.2	336.9	313.9
NOx Concentration				
(GR/DSCF).....	0.0672	0.0799	0.0844	0.0685
(MG/DSCM).....	154	183	193	157
(PPM-DRY).....	80	96	101	82
(PPM-WET).....	51	60	63	52
NOX Emission rate....(LB/HR)	13.50	16.06	16.95	13.77
NOx emission factor..... .....(LB/MMBTU)*	0.316	0.376	0.397	0.323

* F = 9780 DSCF/MMBTU

Test No. 2
No. 1 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	11-10-93	11-10-93	11-10-93	11-10-93
Time of run.....(HRS)	812	820	843	909
Flask number.....	61	62	63	64
Volume of flask.....(ML)	2100	2079	2067	2087
Data: time of sampling				
flask temperature..(DEG-F)	45.00	45.00	45.00	45.00
bar. press.....(IN.HG)	29.55	29.55	29.55	29.55
flask vacuum.....(IN.HG)	27.30	27.25	27.20	27.30
flask abs. press...(IN.HG)	2.25	2.30	2.35	2.25
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-0.30	-1.30	0.00	-0.10
flask abs. press...(IN.HG)	28.86	27.86	29.16	29.06
Volume gas sampled....(DSML)	1823	1732	1807	1825
Moisture content.....(%V/V)	8.34	8.34	8.34	8.34
Oxygen content....(%V/V,DRY)	8.50	8.50	8.50	8.50
Nitrate in gas sample...(JG)	1320.0	1280.0	1360.0	1290.0
NO2 in gas sample.....(JG)	979.4	949.7	1009.1	957.2
NOx Concentration				
(GR/DSCF).....	0.2348	0.2396	0.2441	0.2292
(MG/DSCM).....	537	548	559	525
(PPM-DRY).....	281	287	292	274
(PPM-WET).....	258	263	268	251
NOX Emission rate....(LB/HR)	184.53	188.24	191.78	180.11
NOx emission factor..... .....(LB/MMBTU)*	0.553	0.564	0.575	0.540

* F = 9780 DSCF/MMBTU

Test No. 2
No. 1 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	11-10-93	11-10-93	11-10-93	11-10-93
Time of run.....(HRS)	952	959	1040	1050
Flask number.....	65	66	67	68
Volume of flask.....(ML)	2068	2096	2073	2101
Data: time of sampling				
flask temperature..(DEG-F)	45.00	45.00	45.00	45.00
bar. press.....(IN.HG)	29.55	29.55	29.55	29.55
flask vacuum.....(IN.HG)	27.20	27.30	27.15	27.25
flask abs. press...(IN.HG)	2.35	2.25	2.40	2.30
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-1.00	0.50	-0.40	-1.30
flask abs. press...(IN.HG)	28.16	29.66	28.76	27.86
Volume gas sampled....(DSML)	1740	1874	1781	1751
Moisture content.....(%V/V)	8.59	8.59	8.59	8.59
Oxygen content....(%V/V,DRY)	8.50	8.50	8.50	8.50
Nitrate in gas sample...(JG)	1290.0	1210.0	1290.0	1230.0
NO2 in gas sample.....(JG)	957.2	897.8	957.2	912.6
NOx Concentration				
(GR/DSCF).....	0.2404	0.2094	0.2348	0.2278
(MG/DSCM).....	550	479	537	521
(PPM-DRY).....	288	251	281	273
(PPM-WET).....	263	229	257	249
NOX Emission rate....(LB/HR)	188.54	164.19	184.15	178.63
NOx emission factor..... .....(LB/MMBTU)*	0.566	0.493	0.553	0.536

* F = 9780 DSCF/MMBTU

Test No. 2
No. 1 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	11-10-93	11-10-93	11-10-93	11-10-93
Time of run.....(HRS)	1120	1135	1158	1215
Flask number.....	69	70	71	72
Volume of flask.....(ML)	2069	2071	2038	2092
Data: time of sampling				
flask temperature..(DEG-F)	45.00	45.00	45.00	45.00
bar. press.....(IN.HG)	29.55	29.55	29.55	29.55
flask vacuum.....(IN.HG)	27.10	27.20	27.20	27.25
flask abs. press...(IN.HG)	2.45	2.35	2.35	2.30
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-1.40	-1.90	-1.00	-1.20
flask abs. press...(IN.HG)	27.76	27.26	28.16	27.96
Volume gas sampled....(DSML)	1707	1681	1714	1750
Moisture content.....(%V/V)	10.34	10.34	10.34	10.34
Oxygen content....(%V/V,DRY)	8.30	8.30	8.30	8.30
Nitrate in gas sample...(JG)	1240.0	1220.0	1150.0	1290.0
NO2 in gas sample.....(JG)	920.1	905.2	853.3	957.2
NOx Concentration				
(GR/DSCF).....	0.2356	0.2353	0.2175	0.2390
(MG/DSCM).....	539	538	498	547
(PPM-DRY).....	282	282	260	286
(PPM-WET).....	253	252	233	256
NOX Emission rate....(LB/HR)	181.92	181.66	167.94	184.53
NOx emission factor..... .....(LB/MMBTU)*	0.546	0.545	0.504	0.554

* F = 9780 DSCF/MMBTU

Test No. 7
No. 2 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 1A	Run 1B	Run 1C	Run 1D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	837	900	930	941
Flask number.....	43	44	45	46
Volume of flask.....(ML)	2088	2090	2086	2090
Data: time of sampling				
flask temperature..(DEG-F)	45.00	45.00	45.00	45.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.00	27.10	27.25	27.15
flask abs. press...(IN.HG)	2.30	2.20	2.05	2.15
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-1.40	-0.20	-1.00	-2.80
flask abs. press...(IN.HG)	27.76	28.96	28.16	26.36
Volume gas sampled....(DSML)	1733	1824	1777	1650
Moisture content.....(%V/V)	9.39	9.39	9.39	9.39
Oxygen content....(%V/V,DRY)	7.60	7.60	7.60	7.60
Nitrate in gas sample...(JG)	1310.0	1400.0	1570.0	1450.0
NO2 in gas sample.....(JG)	972.0	1038.8	1164.9	1075.9
NOx Concentration				
(GR/DSCF).....	0.2451	0.2488	0.2865	0.2850
(MG/DSCM).....	561	569	656	652
(PPM-DRY).....	293	298	343	341
(PPM-WET).....	266	270	311	309
NOX Emission rate....(LB/HR)	170.97	173.60	199.87	198.81
NOx emission factor..... .....(LB/MMBTU)*	0.538	0.546	0.629	0.626

* F = 9780 DSCF/MMBTU

Test No. 7
No. 2 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	1017	1026	1052	1100
Flask number.....	47	48	49	50
Volume of flask.....(ML)	2074	2102	2088	2084
Data: time of sampling				
flask temperature..(DEG-F)	50.00	50.00	50.00	50.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.10	27.20	27.20	27.25
flask abs. press...(IN.HG)	2.20	2.10	2.10	2.05
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-2.30	-2.00	-1.80	-1.30
flask abs. press...(IN.HG)	26.86	27.16	27.36	27.86
Volume gas sampled....(DSML)	1669	1720	1722	1756
Moisture content.....(%V/V)	9.17	9.17	9.17	9.17
Oxygen content....(%V/V,DRY)	7.50	7.50	7.50	7.50
Nitrate in gas sample...(JG)	1510.0	1430.0	1420.0	1560.0
NO2 in gas sample.....(JG)	1120.4	1061.0	1053.6	1157.5
NOx Concentration				
(GR/DSCF).....	0.2934	0.2696	0.2674	0.2880
(MG/DSCM).....	671	617	612	659
(PPM-DRY).....	351	323	320	345
(PPM-WET).....	319	293	291	313
NOX Emission rate....(LB/HR)	209.33	192.40	190.83	205.54
NOx emission factor..... .....(LB/MMBTU)*	0.639	0.588	0.583	0.628

* F = 9780 DSCF/MMBTU

Test No. 7
No. 2 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	11-11-93	11-11-93	11-11-93	11-11-93
Time of run.....(HRS)	1200	1217	1230	1250
Flask number.....	51	52	53	54
Volume of flask.....(ML)	2064	1985	2083	2064
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	60.00
bar. press.....(IN.HG)	29.30	29.30	29.30	29.30
flask vacuum.....(IN.HG)	27.25	27.20	27.30	27.30
flask abs. press...(IN.HG)	2.05	2.10	2.00	2.00
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.16	29.16	29.16	29.16
flask static press.(IN.HG)	-3.20	-1.40	0.90	-1.10
flask abs. press...(IN.HG)	25.96	27.76	30.06	28.06
Volume gas sampled....(DSML)	1613	1664	1912	1759
Moisture content.....(%V/V)	10.88	10.88	10.88	10.88
Oxygen content....(%V/V,DRY)	7.20	7.20	7.20	7.20
Nitrate in gas sample...(JG)	1450.0	1400.0	1520.0	1500.0
NO2 in gas sample.....(JG)	1075.9	1038.8	1127.8	1113.0
<u>NOx Concentration</u>				
(GR/DSCF).....	0.2914	0.2727	0.2578	0.2765
(MG/DSCM).....	667	624	590	633
(PPM-DRY).....	349	326	308	331
(PPM-WET).....	311	291	275	295
NOX Emission rate....(LB/HR)	204.16	191.06	180.62	193.73
NOx emission factor..... .....(LB/MMBTU)*	0.621	0.581	0.550	0.589

* F = 9780 DSCF/MMBTU

3.6 Results of Opacity Observations

Interpoll Labs Report No. 3-1636
American Crystal Sugar Company
East Grand Forks, Minnesota

Test No. 1
C - Pulp Dryer Stack

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

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

Observer: Jeff Bergstrom
Cert. Date: 10-07-93
Date of Observation: 11-9-93
Time of Observation: 1030-

* Could not read visible emissions due to interference from other sources.

Test No. 5
B - Pulp Dryer Stack

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

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

Observer: Jeff Bergstrom
Cert. Date: 10-07-93
Date of Observation: 11-10-93
Time of Observation: 0905-

* Could not read visible emissions due to interference from other sources.

Test No. 9
A - Pulp Dryer Stack

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

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

Observer: Jeff Bergstrom
Cert. Date: 10-07-93
Date of Observation: 11-11-93
Time of Observation: 0930-

* Could not read visible emissions due to interference from other sources.

3.7 Results of Carbon Monoxide Determinations

Test No. 1
C - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-09-93	11-09-93	11-09-93
Time run start/end.....(HRS)	1030/1235	1315/1517	1535/1738
Total sampling time....(MIN)	120.0	120.0	120.0
Moisture content.....(%V/V)	33.61	31.13	37.16
O2 Concentration.....(%V/V)	15.20	14.70	14.70
Volumetric flow rate (DSCFM)	24867	25356	23446
CO concentration.....			
(GR/DSCF).....	0.1221	0.1323	0.1476
(MG/DSCM).....	279.60	302.90	337.85
(PPM-WET).....	159.34	179.06	182.24
(PPM-DRY).....	240.00	260.00	290.00
(PPM-DRY @ 7% O2).....	579.31	577.78	644.44
CO emission rate.....(LB/HR)	26.029	28.752	29.654

CO = Carbon monoxide

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

Test No. 5
B - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-10-93	11-10-93	11-10-93
Time run start/end.....(HRS)	0905/1106	1130/1332	1350/1551
Total sampling time....(MIN)	120.0	120.0	120.0
Moisture content.....(%V/V)	23.30	21.92	21.97
O2 Concentration.....(%V/V)	17.10	17.50	17.20
Volumetric flow rate (DSCFM)	43382	44674	43695
CO concentration.....			
(GR/DSCF).....	0.3816	0.4223	0.3002
(MG/DSCM).....	873.75	966.95	687.35
(PPM-WET).....	575.25	648.06	460.38
(PPM-DRY).....	750.00	830.00	590.00
(PPM-DRY @ 7% O2).....	2692.	3320.	2173.
CO emission rate.....(LB/HR)	141.903	161.716	112.436

CO = Carbon monoxide

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

Test No. 9
A - Pulp Dryer Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	0930/1037	1100/1208	1230/1334
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	41.60	39.20	38.96
O2 Concentration.....(%V/V)	13.60	13.80	13.90
Volumetric flow rate (DSCFM)	22618	24090	24043
CO concentration.....			
(GR/DSCF).....	0.2748	0.2544	0.2290
(MG/DSCM).....	629.10	582.50	524.25
(PPM-WET).....	315.36	304.00	274.68
(PPM-DRY).....	540.00	500.00	450.00
(PPM-DRY @ 7% O2).....	1021.	972.22	887.32
CO emission rate.....(LB/HR)	53.268	52.532	47.187

CO = Carbon monoxide

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

Test No. 2
No. 1 Boiler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-10-93	11-10-93	11-10-93
Time run start/end.....(HRS)	0810-0917	0948-1053	1115-1220
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	8.34	8.59	10.34
O2 Concentration.....(%V/V)	8.50	8.50	8.30
Volumetric flow rate (DSCFM)	91671	91495	90081
CO concentration.....			
(GR/DSCF).....	0.1623	0.1710	0.1679
(MG/DSCM).....	371.63	391.44	384.45
(PPM-WET).....	292.40	307.14	295.88
(PPM-DRY).....	319.00	336.00	330.00
(PPM-DRY @ 7% O2).....	357.28	376.32	363.78
CO emission rate.....(LB/HR)	127.539	134.078	129.649

CO = Carbon monoxide

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

Test No. 7
No. 2 Boiler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-11-93	11-11-93	11-11-93
Time run start/end.....(HRS)	0830/0947	1011/1124	1146/1257
Total sampling time....(MIN)	60.0	60.0	60.0
Moisture content.....(%V/V)	9.39	9.17	10.88
O2 Concentration.....(%V/V)	7.60	7.50	7.20
Volumetric flow rate (DSCFM)	81388	83248	81731
CO concentration.....			
(GR/DSCF).....	0.2951	0.2722	0.1908
(MG/DSCM).....	675.70	623.27	436.88
(PPM-WET).....	525.54	485.94	334.20
(PPM-DRY).....	580.00	535.00	375.00
(PPM-DRY @ 7% O2).....	605.97	554.81	380.43
CO emission rate.....(LB/HR)	205.878	194.245	133.672

CO = Carbon monoxide

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

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

Job ACS / E. Grand Forks, MN Date 11-10-93

Operator M. Kaehler Module No. 9

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

Bar press 29.55 in. Hg. $_T$ = 1.0042 ^H@ 1.74 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(525.20)	[redacted]	
2.5	527.05	51	50
5.0	528.91	52	50
7.5	530.80	54	51
10	532.69	56	51
[redacted]	V_m= 7.49	Avg(t_m)= 51.87 °F	

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(1.0042)(7.49)}\left[\frac{(51.87) + 460}{(29.55)}\right]^{0.5}$$

Y_{cn} = .988

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 ACS / E. Grand Forks, MN Date 11-9-93

Operator M. Kaehler Module No. 9

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

Bar press 29.56 in. Hg. Y_T = 1.0042 ^H@ 1.74 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(365.90)	[redacted]	
2.5	367.75	62	62
5.0	369.70	63	62
7.5	371.55	66	64
10	373.48	67	64
[redacted]	V_m= 7.68	Avg(t_m)=63.75	°F

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(1.0042)(7.68)}\left[\frac{(63.75) + 460}{(29.56)}\right]^{0.5}$$

Y_{cn} = .975

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 ACS - EC-F Date 11-9-93

Operator SCB Module No. 8

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

Bar press 29.51 in. Hg. $_T$ = .9975 ^H@ 1.80 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(280.40)	[redacted]	
2.5	283.35	60	58
5.0	286.51	63	59
7.5	289.90	64	59
10	293.74	65	60
[redacted]	V_m= 7.34	Avg(t_m)=	61 °F

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(.9975)(7.34)}\left[\frac{(61) + 460}{(29.51)}\right]^{0.5}$$

$$Y_{cn} = 1025$$

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 ACS / E. Grand Forks, MN Date 11-11-93

Operator M. Kaebler Module No. 9

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

Bar press 29.30 in. Hg. $_T$ = 1.0042 ^H@ 1.24 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(836.70)	[redacted]	
2.5	838.57	56	55
5.0	840.45	56	56
7.5	842.33	58	56
10	844.22	59	57
[redacted]	V_m= 7.52	Avg(t_m)= 56.63	°F

Calculate Y_{cn} as follows:

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

$$Y_{cn} = \frac{1.786}{(1.0042)(7.52)}\left[\frac{(56.63) + 460}{(29.30)}\right]^{0.5}$$

$$Y_{cn} = .993$$

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 ACS / EGF Date 11/11/93

Operator DUKE [illegible] Module No. 6

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

Bar press 29.26 in. Hg. $_T$ = .9965 ^H@ 1.97 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(642.000)	[redacted]	
2.5	643.89	56	51
5.0	645.79	56	52
7.5	647.68	57	52
10	649.559	57	52
[redacted]	V_m= 7.559	Avg(t_m)= 54.125 °F	

135° #13 #10

Calculate Y_{cn} as follows:

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

(.2371) $$Y_{cn} = \frac{1.786}{(7.559)(.9965)}\left[\frac{(54.125) + 460}{(29.26)}\right]^{0.5}$$

Y_{cn} = .9939

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: November 19, 1993

Meter Box No. : 4 (Rockwell Dry Test Meter Serial No. 964553)

Date of Last Calibration: November 1, 1993
Calibration Technician: D. Brennan
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
November 11, 1993	3-1636	887.65	931.14	43.49	43.49

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: November 16, 1993

Meter Box No. : 6 (Rockwell Dry Test Meter Serial No. 712852)

Date of Last Calibration: October 14, 1993
Calibration Technician: D. Brennan
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
October 21, 1993	3-1398	109.00	265.55	156.55	156.55
November 9, 1993	3-1638	285.00	569.573	284.57	441.12
November 9, 1993	3-1636	649.3	955.306	306.006	747.126

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-620

Meter Box Calibration and Usage Status

Date of Report: November 16, 1993

Meter Box No. : 8 (Rockwell Dry Test Meter Serial No. 964547)

Date of Last Calibration: October 13, 1993
Calibration Technician: D. Brennan
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
November 2, 1993	3-1569	683.0	1279.8	596.8	596.8
November 9, 1993	3-1636	1288.10	1906.06	617.96	1214.76

* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: November 16, 1993

Meter Box No. : 9 (Rockwell Dry Test Meter Serial No. 949231)

Date of Last Calibration: November 1, 1993
Calibration Technician: D. Brennan
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
November 9, 1993	3-1636 & 3-1637	373.9	1116.05	742.15	742.15

* Total volume through meter since last calibration.

Date 11/1/93

Bar. Press. 29.18 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 4
Serial No. DTH 961552
Wet Test Meter No. AL-20
Technician D. BRENNAN

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index ♦ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔHθ	C_f
nominal	actual				V_{di}	V_{df}	Wet Test t_w (°F)	Dry Test t_{di} (°F)	Dry Test t_{do} (°F)				
0.5	.50	2	99.85	0.01	882.000	884.057	63°	81	73	5:12	.9955	1.87	
1.2	1.2	3	99.91	0.025	884.500	887.597	63°	83	74	5:03	.9934	1.88	
2.0	2.0	3	99.93	0.055	867.000	870.015	63°	79	69	3:58	1.0000	1.95	
3.3	3.3	5	100.00	0.09	870.500	875.570	63°	83	72	5:09	1.0049	1.94	
4.7	4.7	5	100.02	0.12	876.500	881.600	63°	85	73	4:23	.9985	1.99	
3		4	5	6	7		8	9	10	11/12 Avg.	.9985	1.93	

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

Approved by Daniel R. Dupre Date 11/12/93

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

SO102RR 11/91

Date 10/14/93

Bar. Press. 29.04 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 6

Serial No. DTM 712 852

Wet Test Meter No. AL-20

Technician DUKE BRENNAN

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index Φ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔHθ	C_f
							Wet Test	Dry Test					
nominal	actual				V_{d1}	V_{df}	t_w (°F)	t_{d1} (°F)	t_{do} (°F)				
0.5	.50	2	99.85	0.01	90.500	92.564	66	82	76	5:21	.9902	2.01	
1.2	1.2	3	99.91	0.025	93.000	96.067	66	85	79	5:06	1.0020	1.94	
2.0	2.0	3	99.93	0.055	76.000	79.056	66	79	73	3:57	.9945	1.96	
3.3	3.3	5	100.00	0.09	79.500	84.597	66	84	75	5:09	.9976	1.96	
4.7	4.7	5	100.02	0.12	85.000	90.101	66	87	77	4:21	.9980	1.93	
										11/13 Avg.	.9965	1.97	

Positive leak check performed by D. BRENNAN

Meter was in tolerance ■

Meter was not in tolerance ☐; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Approved by Daniel L Dyer Date 10/18/93

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

S0102RR 11/91

Date 10/13/93

Bar. Press. 29.27 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 8
Serial No. DTM 964 547
Wet Test Meter No. AL-20
Technician D. BRENNAN

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index ♦ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ	Meter Coeff.	Orifice Const.	C_f
							Wet Test	Dry Test					
nominal	actual				V_{d1}	V_{df}	t_w (°F)	t_{d1} (°F)	t_{do} (°F)	(min/sec)	Y	ΔH@	
0.5	.50	2	99.85	0.01	668.500	670.54	61°	77	68	5:01	.9925	1.74	
1.2	1.2	3	99.91	0.025	671.000	674.065	61°	79	69	4:52	.9924	1.74	
2.0	2.0	3	99.93	0.055	654.000	657.024	61°	73	65	3:49	.9995	1.80	
3.3	3.3	5	100.00	0.09	657.500	662.552	61°	78	66	5:01	1.0021	1.83	
4.7	4.7	5	100.02	0.12	663.000	668.064	61°	81	68	4:17	1.0010	1.90	
1	2	3	4	5	6	7	8	9	10	11/12 Avg.	.9975	1.80	

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

Approved by [signature] Date 10/18/93

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

S0102RR 11/91

Date 11/1/93

Bar. Press. 29.18 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 5

Control Module No. 9--
Serial No. DTM 949 231
Wet Test Meter No. AL-20
Technician D. BRENNAN

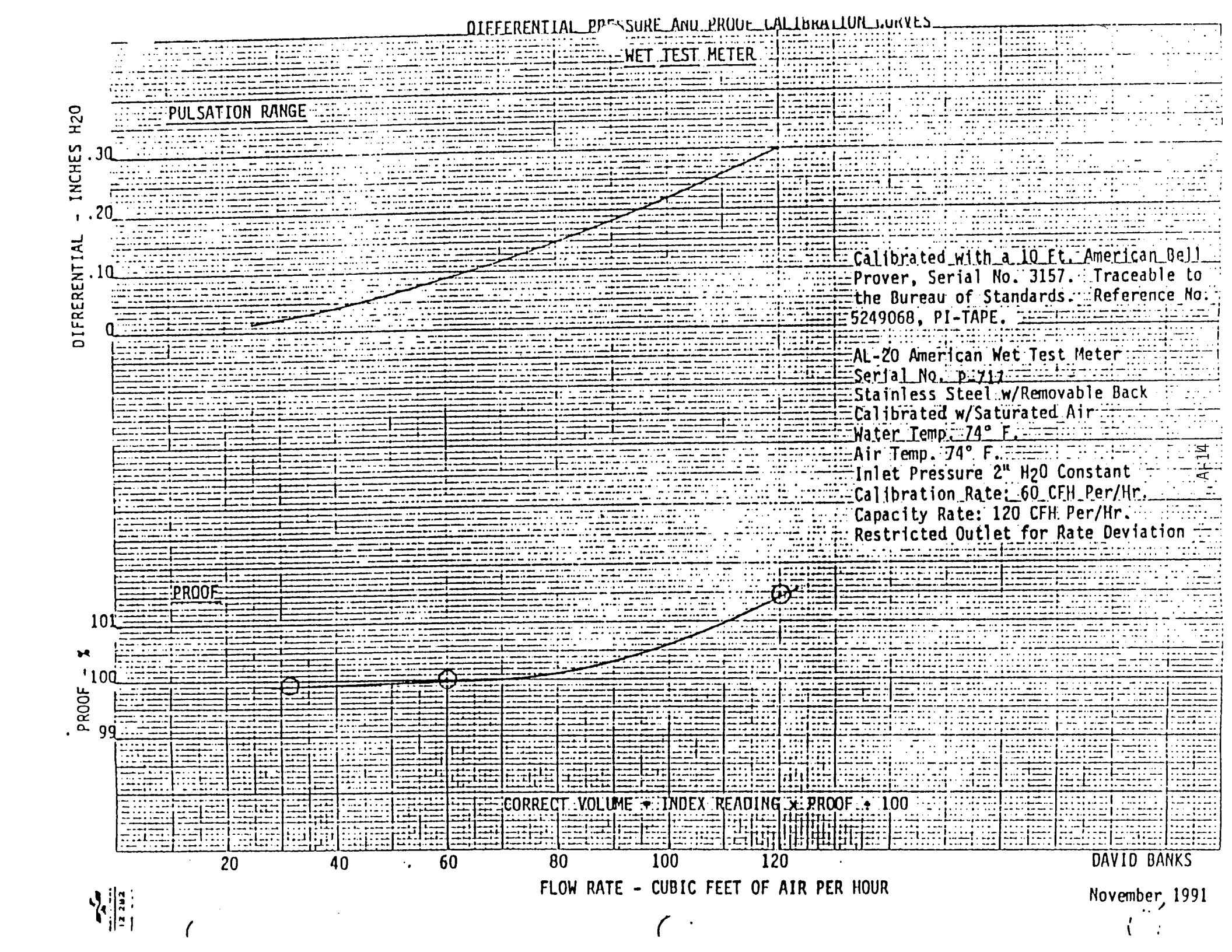
ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index ♦ (%)	* Diff. Wet Test Meter ΔP_w (in.WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔHθ	C_f
							Wet Test	Dry Test					
nominal	actual				V_{di}	V_{df}	t_w (°F)	t_{di} (°F)	t_{do} (°F)				
0.5	.50	2	99.85	0.01	946.500	948.538	62.5	79	71	5:02	1.0020	1.76	
1.2	1.2	3	99.91	0.025	949.000	952.053	62.5	81	72	4:48	1.0050	1.70	
2.0	2.0	3	99.93	0.055	932.000	935.035	62.5	79	69	3:44	1.0043	1.72	
3.3	3.3	5	100.00	0.09	935.500	940.560	62.5	82	71	4:54	1.0060	1.75	
4.7	4.7	5	100.02	0.12	941.000	946.07	62.5	84	72	4:09	1.0035	1.78	
										11/13 AVG	1.0042	1.74	
	3	3	4	5	6	7	8	9	10				

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

Approved by Daniel J. Dey Date 11/2/93

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

S0102RR 11/91


DIFFERENTIAL PRESSURE AND PROOF CALIBRATION CURVES
WET TEST METER
PULSATION RANGE
DIFRENTIAL - INCHES H20
.30
.20
.10
0
Calibrated with a 10 Ft. American Bell Prover, Serial No. 3157. Traceable to the Bureau of Standards. Reference No. 5249068, PI-TAPE.
AL-20 American Wet Test Meter
Serial No. P.717
Stainless Steel w/Removable Back
Calibrated w/Saturated Air
Water Temp. 74° F.
Air Temp. 74° F.
Inlet Pressure 2" H2O Constant
Calibration Rate: 60 CFH Per/Hr.
Capacity Rate: 120 CFH Per/Hr.
Restricted Outlet for Rate Deviation
AF14
PROOF
101
100
99
PROOF - %
CORRECT VOLUME = INDEX READING x PROOF ÷ 100
20
40
60
80
100
120
DAVID BANKS
FLOW RATE - CUBIC FEET OF AIR PER HOUR
November, 1991

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 11-11-93 Nozzle Number 1-3
Technician: Eugene Brennen

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

Position	Diameter (inches)
1	.190
2	.186
3	.188
Average:	.188

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 11-09-93 Nozzle Number 4-3
Technician: Scott Bainville

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	.198
2	.198
3	.198
Average:	.198

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 11-11-93 Nozzle Number 4-4
Technician: Scott Bainville

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	.255
2	.254
3	.256
Average:	.255

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 11-11-93 Nozzle Number 4-5
Technician: Scott Bainville

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	.310
2	.309
3	.311
Average:	.310

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 11-10-93 Nozzle Number 8-5
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	.302
2	.302
3	.3
Average:	.301

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 11-10-93 Nozzle Number 8-6
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	.363
2	.363
3	.361
Average:	.362

Interpoll Laboratories, Inc.

Temperature Measurement Device
Calibration Sheet

Unit under test:

Vendor Beckman

Model HD 110T Serial Number 10913005

Range 0-2000 °F Thermocouple Type K

Date of Calibration 9-13-93 Technician Mark Baehler

Method of Calibration:

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

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

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation	
			Δt (°F)	(%)
0	0	3	3	.65
100	100	93	7	1.25
200	200	197	3	.45
300	300	295	5	.66
400	400	392	8	.93
500	500	492	8	.83
600	600	594	6	.57
700	700	695	5	.43
800	800	800	0	0
900	900	902	2	.15
1000	1000	1007	7	.48
1100	1100	1111	11	.71
1200	1200	1217	17	1.02
1300	1300	1317	17	.97
1400	1400	1422	22	1.18
1500	1500	1520	20	1.02
1600	1600	1621	21	1.02
1700	1700	1716	16	.74
1800	1800	1814	14	.62
1900	1900	1907	7	.30
2000	2000	OL	-	-
2100	2100	OL	-	-
		Averages:	9.45	.70

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

% dev = 100 Δt / (460 + t)

☒ Unit in tolerance

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

Interpoll Laboratories. Inc.

Temperature Measurement Device
Calibration Sheet

Unit under test:
Vendor BECKMAN INDUSTRIAL (PDT-23)
Model HO110T Serial Number 20109031
Range 0-2000 °F Thermocouple Type K
Date of Calibration 10/6/93 Technician DUKE BRENNAN

Method of Calibration:

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

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

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation	
			Δt (°F)	(%)
0	0	+2	2	.0043
100	100	99	1	.178
200	200	203	3	.454
300	300	301	1	.132
400	400	398	2	.232
500	500	498	2	.208
600	600	601	1	.094
700	700	701	1	.086
800	800	807	7	.555
900	900	909	9	.662
1000	1000	1014	14	.959
1100	1100	1117	17	1.04
1200	1200	1224	24	1.446
1300	1300	1324	24	1.364
1400	1400	1429	29	1.559
1500	1500	1527	27	1.379
1600	1600	1628	28	1.359
1700	1700	1723	23	1.065
1800	1800	1822	22	.973
1900	1900	1914	14	.593
2000				
2100				
		Averages:	12.55	.7195

OF = off scale response by unit under test (°F)
% dev = 100 Δt / (460 + t)

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

S-433

Interpoll Laboratories, Inc.

Temperature Measurement Device
Calibration Sheet

Unit under test:
Vendor Omega PDT-29
Model HH21 Serial Number T-97106
Range 0 - 2100 °F Thermocouple Type K
Date of Calibration 10-14-93 Technician SLB

Method of Calibration:

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

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

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation Δt (°F)	Deviation (%)
0	0	-0.7	0.7	0.00
100	100	98.6	1.4	0.01
200	200	200.6	0.6	0.09
300	300	298.8	1.2	0.14
400	400	398.1	1.9	0.19
500	500	498.8	1.2	0.13
600	600	600.7	0.7	0.07
700	700	698.9	1.1	0.09
800	800	800.9	0.9	0.07
900	900	898.9	1.1	0.08
1000	1000	999.9	0.1	0.01
1100	1100	1098.6	1.4	0.09
1200	1200	1201.0	1.0	0.06
1300	1300	1298.7	1.3	0.07
1400	1400	1401.1	1.1	0.06
1500	1500	1498.4	1.6	0.08
1600	1600	1599.8	0.2	0.01
1700	1700	1697.8	2.2	0.10
1800	1800	1799.7	0.3	0.01
1900	1900	1897.0	3.0	0.13
2000	2000	1998.6	1.4	0.06
2100	2100	2097.0	3.0	0.12
		Averages:	1.22	0.09

OF = Scale response by unit under test (°F)
% dev = t / (460 + t)

☐ In tolerance
☐ Not in tolerance: recalibrated - See new calibration sheet.

S-433

(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 22-2 1/2

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .462 IN.

Alignment:

4. α_1 <10° /
5. α_2 <10° /

6. B_1 <5° /
7. B_2 < 5° /

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

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .755"
11. Pitot to probe sheath 3.00"
12. Pitot to thermocouple (parallel to probe) 3.00"
13. Pitot to thermocouple (perpendicular to probe) .76"

☒ Meets all EPA design criteria thus C_p = 0.84

☐ Does not meet EPA design criteria - thus calibrate in unnel
C_p = _____

Date of Inspection: 4-9-93

Inspected by: [signature]

CFR Title 40 Part 60 Appendix A Method 2

(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 22-6

Pitot tube dimensions:

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

Alignment:

4. α_1 <10° 0
5. α_2 <10° 0

6. B_1 <5° 1
7. B_2 < 5° 1

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

Distance from Pitot to Probe Components:

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

☒ 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: 4-9-93

Inspected by: [signature]

CFR Title 40 Part 60 Appendix A Method 2

(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 23-4

Pitot tube dimensions:

1. External tubing diameter (D_t) .314 IN.
2. Base to Side A opening plane (P_A) .400 IN.
3. Base to Side B opening plane (P_B) .460 IN.

Alignment:

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

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

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

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .755 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 IN.
13. Pitot to thermocouple (perpendicular to probe) .760 IN.

☒ 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]

CFR Title 40 Part 60 Appendix A Method 2

Interpoll Laboratories, Inc.
(612) 786-6020

S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 24-4

Pitot tube dimensions:

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

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0

6. B_1 < 5° 0
7. B_2 < 5° 1

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

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .750 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 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: G Thornhill

CFR Title 40 Part 60 Appenidix A Method 2

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

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 10-15-93
Technician SCOTT L BAINVILLE
Mercury Column Barometer No. 1
Aneroid Barometer No. S60209

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
29.10	76	.134	28.97	29.16	0.19
29.13	73	.124	29.01	29.19	0.18

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

Has problem been alleviated? Yes/No. How? N/A

*Note

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

S-312

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 10/6/93

Technician DUKE BRENNAN

Mercury Column Barometer No. LAB 1

Aneroid Barometer No. 9022200

Actual Mercury Barometer Read	Ambient Temp.	Temperature Correction Factor	Adjsted Mercury Barometer Read	Initial Aneriod Barometer Read	Difference (P_{ba}-P_{bm})
29.08	74	.119	28.961	28.99	.03

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

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

*Note

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

S-312

INTERPOLL LABORATORIES
(612)786-6020

Stack Sampling Department - QA
Aneroid Barometer Calibration Sheet

Date 9-13-93

Technician Mark Bachler

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})
28.770	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? _____

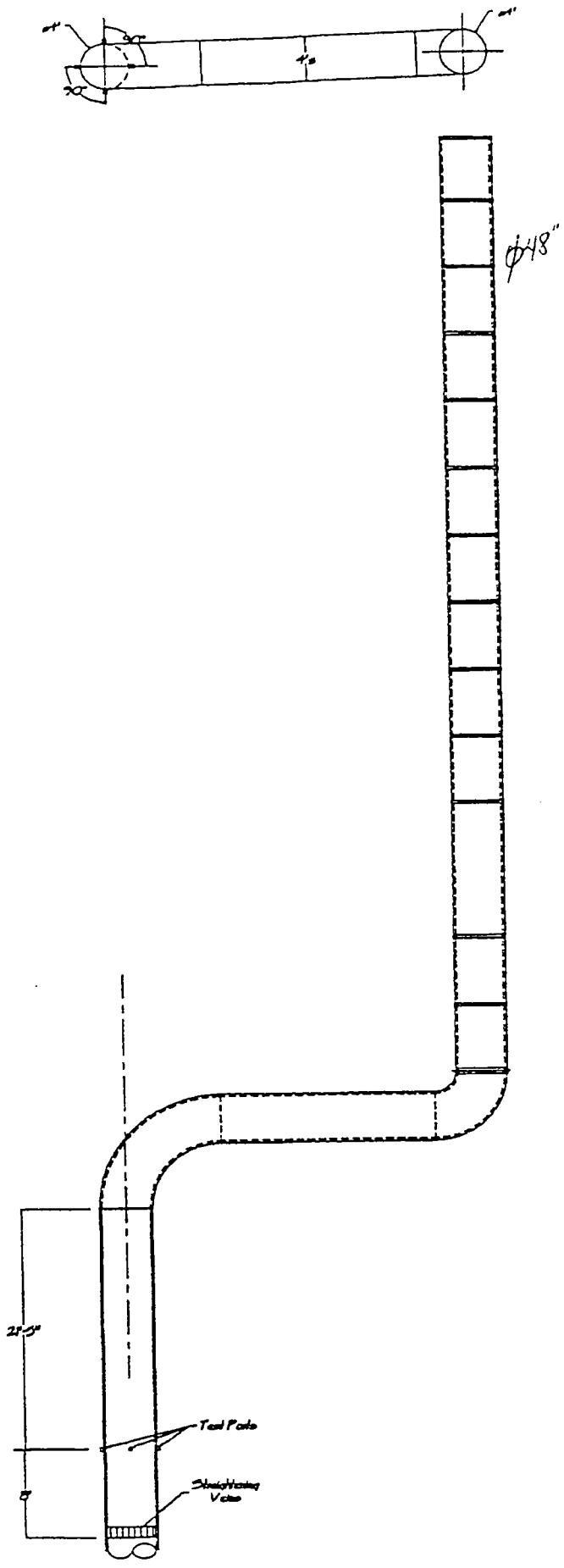
*Note

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.

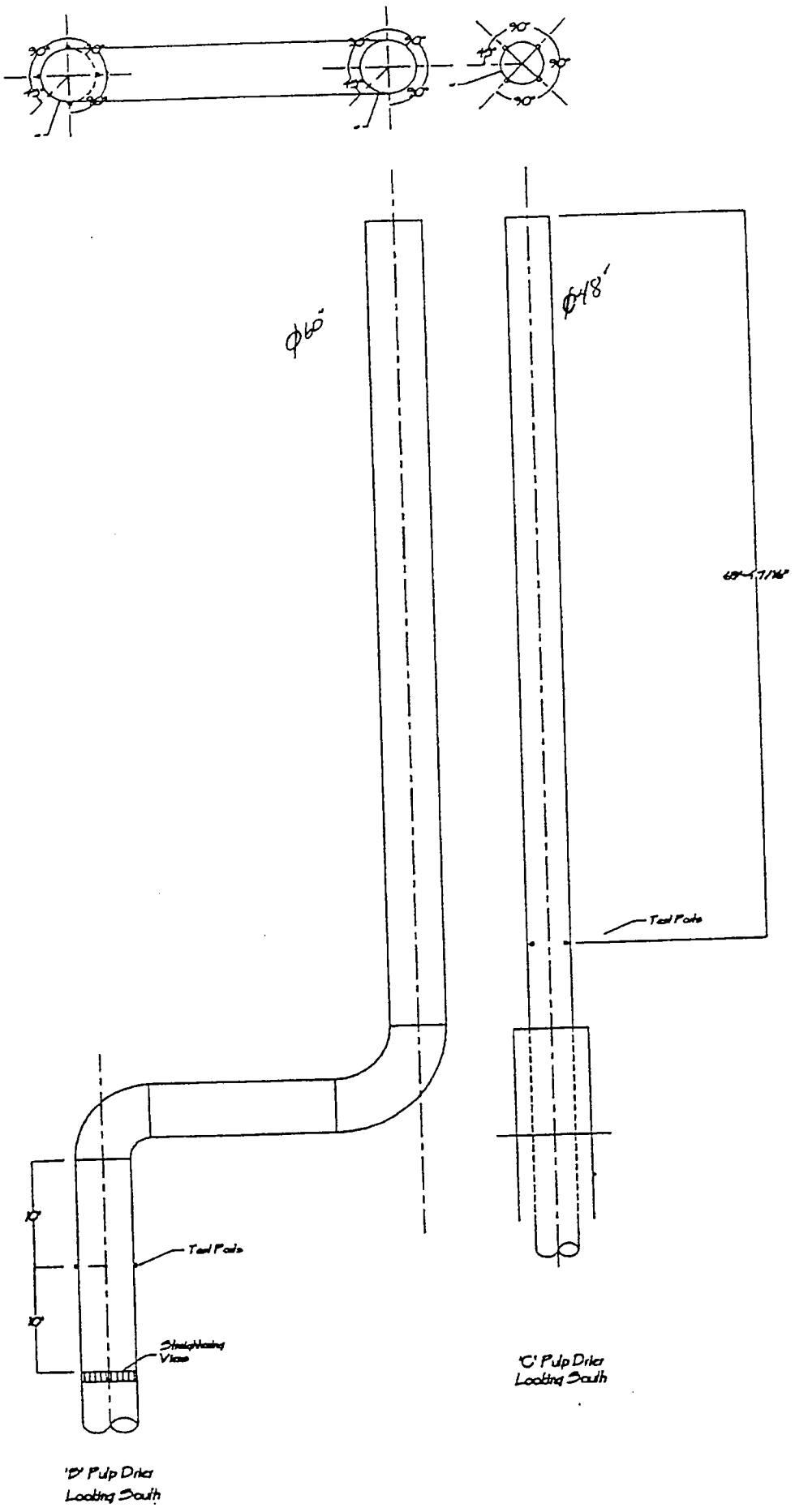
S-312

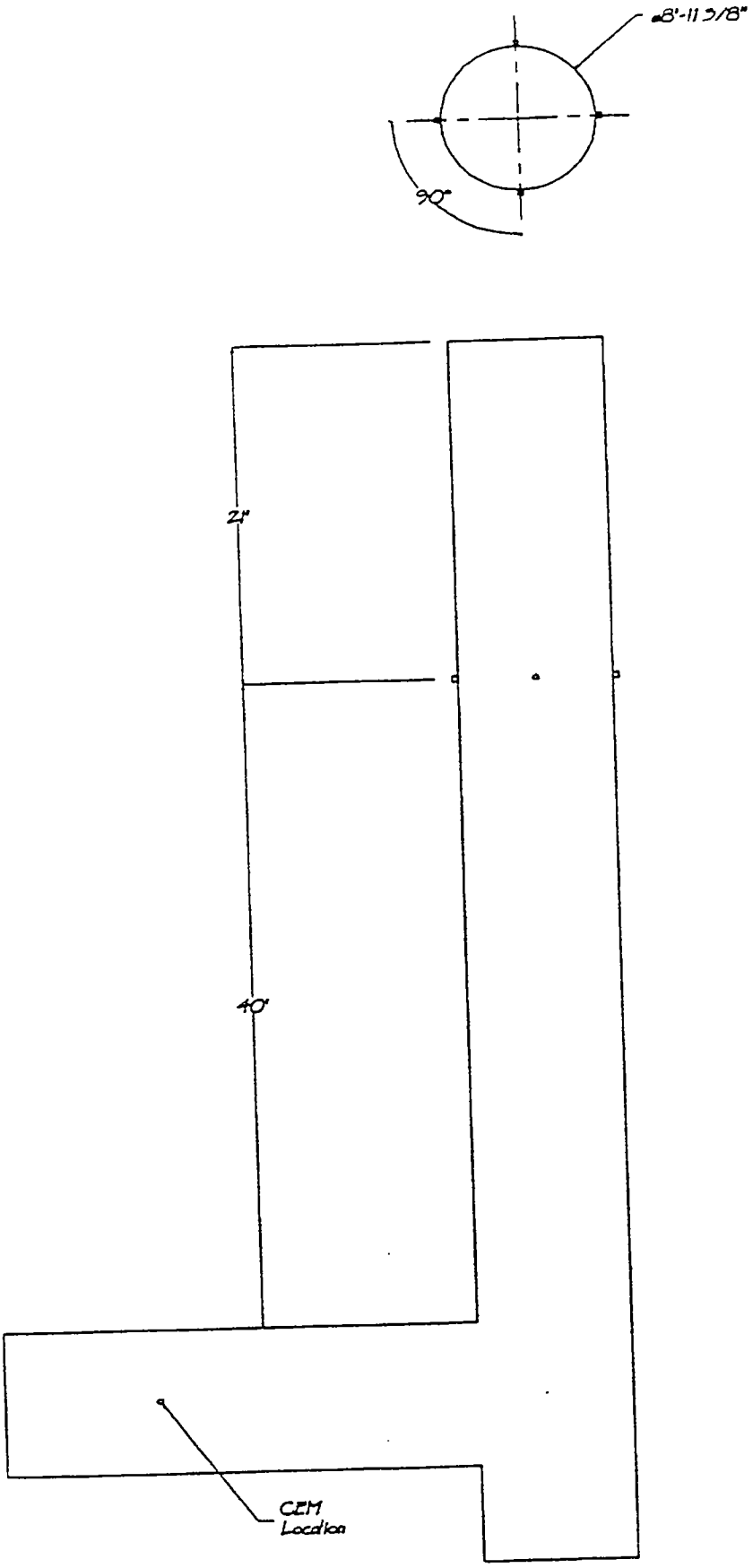
APPENDIX B

LOCATION OF TEST PORTS

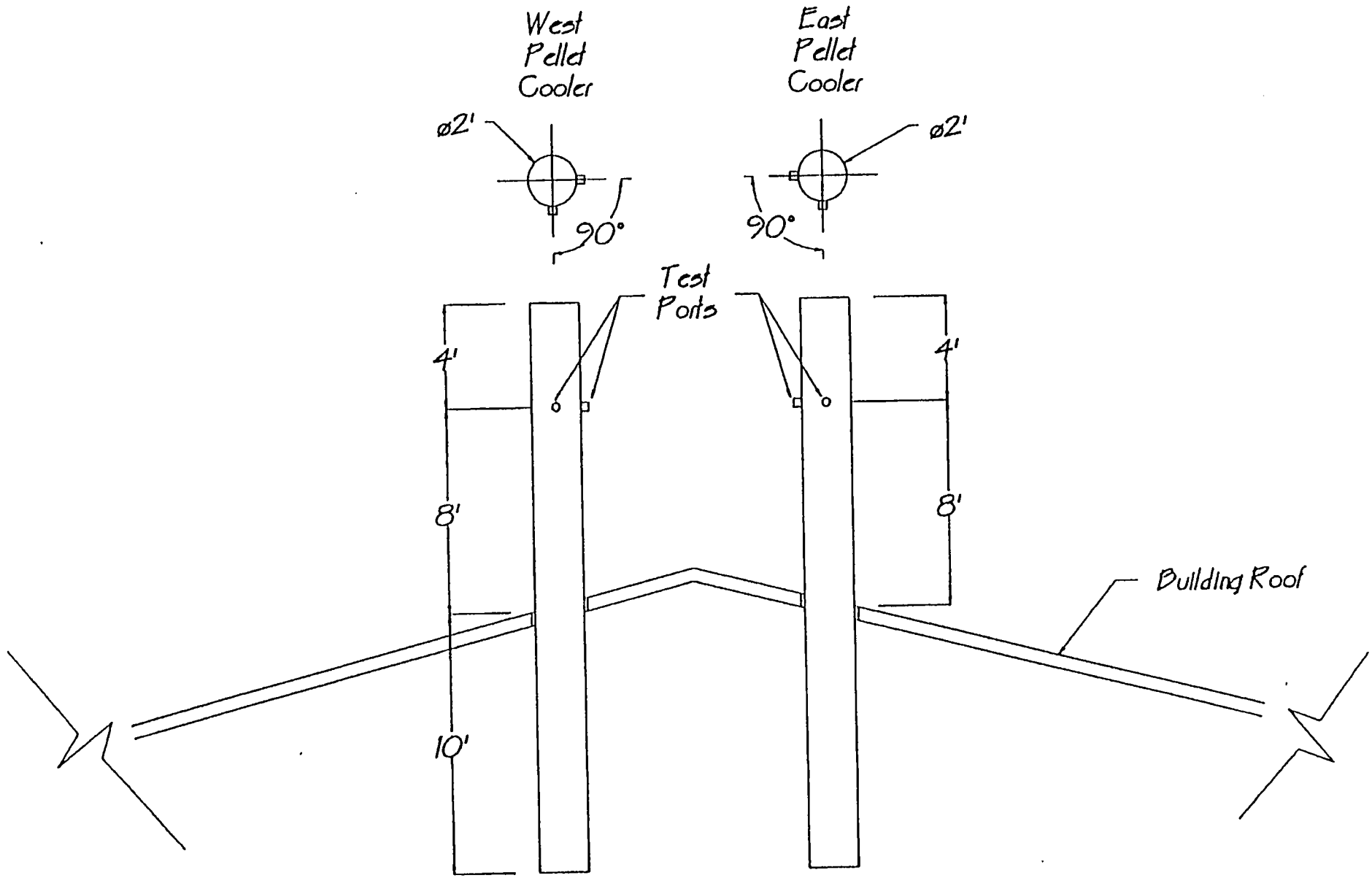


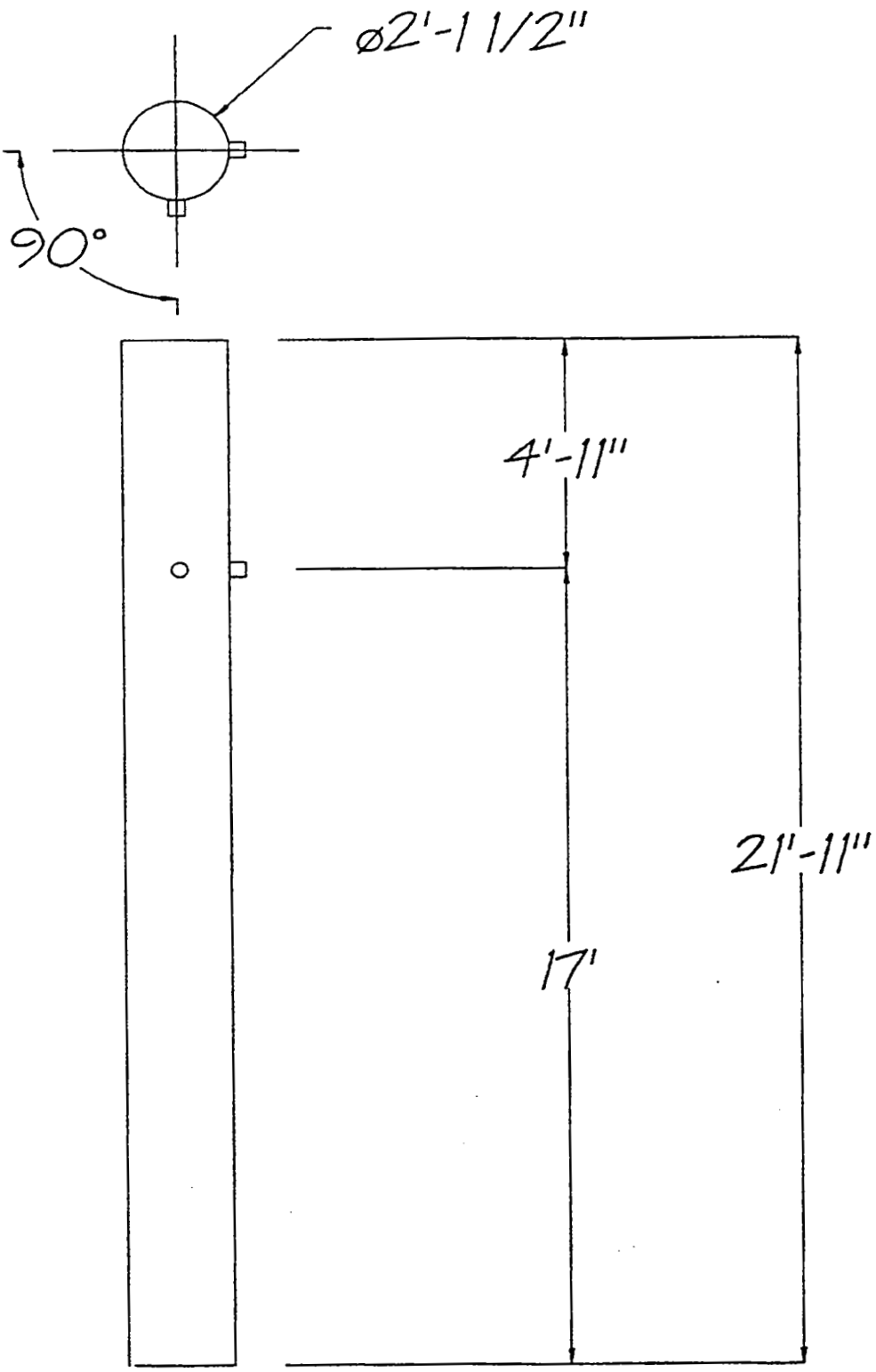
'A' Pulp Dilution Stock


Ø66"
Ø48"
Tool Pads
10"
10"
Tool Pads
Straightening Vane
'D' Pulp Drier
Looking South
'C' Pulp Drier
Looking South



Boilerhouse Stack(s)
2 - Typical


West
Pelled
Cooler
East
Pellet
Cooler
ø2'
ø2'
90°
90°
Test
Ports
4'
4'
8'
8'
10'
Building Roof



Pellet
Loadout

View Looking North

APPENDIX C

FIELD DATA SHEETS

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS - FCF

Source SMALL DRYER STACK

Test 1 Run 0 Date 11-9-93

Stack dimen. 6/8 IN.

Dry bulb 215 °F Wet bulb 157 °F

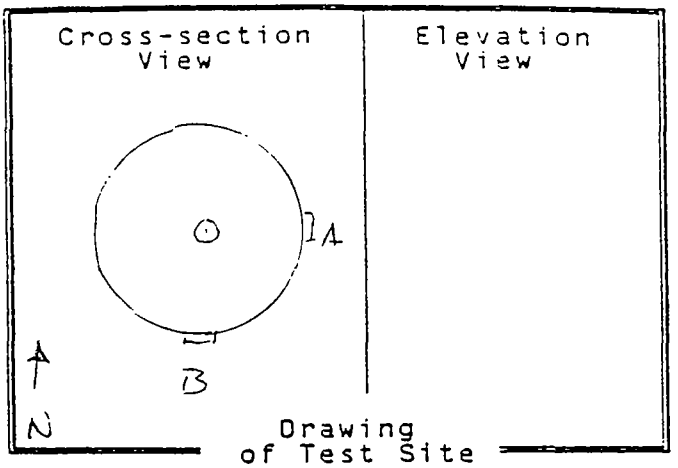
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.51 in Hg

Static pressure - 1.02 in WC

Operators SLB + JB

Pitot No. 220-6 C_p .840



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: 25.5 in.		Time start: 0927 hrs	
A	1	.021	1.01	26.51	0.57	215
	2	.067	3.22	28.72	0.75	215
	3	.118	5.66	31.16	0.87	215
	4	.177	8.50	34.00	1.02	215
	5	.250	12.00	37.50	1.08	215
	6	.356	17.09	42.59	1.10	215
	7	.644	30.91	56.41	1.13	214
	8	.750	36.00	61.50	1.10	214
	9	.823	39.50	65.00	1.02	214
	10	.882	42.34	67.84	0.91	214
	11	.933	44.78	70.28	0.83	214
	12	.979	46.99	72.49	0.76	215
B	1				0.72	215
	2				0.76	215
	3				0.86	215
	4				1.00	215
	5		64.24		1.05	215
	6	≈	48.437		1.10	215
	7		26.236		0.94	215
	8				0.86	211
	9				0.74	215
	10				0.66	215
	11				0.60	214
	12				0.52	211
Temp. meas. device & S/N: DIGITAL TC - PPP29					Time end: 0935 hrs	

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

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AMS - FCF Date [illegible] Test 1 Run 1
Source CFB2 Discharge Stack No. of traverse points 12
Method 1-5.6 Filter holder: Glass Filter type: Glass Fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ■
Postest: 0.00 cfm at 5 in. Hg. (vac) ■

Particulate Catch Data:

No.s of filters used: 5952

Recovery solvent(s)
■ acetone
□ other(s)

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	776	384	392
Impinger No. 2	687	506	181
Impinger No. 3	507	502	5
Condenser			
Desiccant	1418	1407	11
Total			589

Integrated Gas Sampling Data:

Bag Pump No. 22A Box No. 26 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 1030 (HRS) Time end: 1235 (HRS)
Sampling rate: 200 cc/min Operator: SCB
S/N of O_2 Analyzer used to monitor train outlet: 8

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS: Ecat
Source C PDCO Dryer Stack
Date 11-9-93 Test 1 Run 1

Operators SCB / JD
Meter Box No. 5 Y@ 1.00 ΔH@ 1.70
Barometer cont: 9975

Pitot No. 220-6 Dp 1.670
Bar. Press. 29.57 inHg H2O .37 x
Nozzle No. 6-3 Nozzle Dia .198 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xv/v)
	(10:30)	(288.10)											
B-12	5	290.15	.72	.54	0.18	2	214	250	249	40	70	70	15.8
11	10	292.30	.79	.59	2.36	2	216	250	249	40	72	69	15.7
10	15	294.64	.90	.67	4.68	2	217	251	248	40	73	70	15.6
9	20	297.02	1.02	.77	7.17	3	217	250	251	46	74	70	15.5
8	25	299.70	1.10	.83	9.75	4	217	251	256	47	75	72	15.3
7	30	302.49	1.35	1.02	2.61	4	216	251	254	43	77	72	15.3
6	35	305.02	1.10	.83	5.21	4	217	250	252	41	81	75	15.4
5	40	307.55	1.05	.80	7.76	4	216	250	251	40	82	74	15.2
4	45	310.10	1.00	.76	0.25	3	216	251	248	39	83	76	15.4
3	50	312.80	1.20	.92	2.98	5	216	250	249	38	85	77	15.2
2	55	315.32	.78	.60	5.20	4	215	250	249	38	85	77	15.2
1	60	317.10	.57	.44	7.09	3	214	248	248	37	86	78	15.3
A-12	65	319.20	.72	.55	9.22	3	215	248	249	37	86	78	15.3
11	70	321.46	.78	.60	1.44	3	215	248	248	36	84	79	15.4
10	75	323.70	.82	.63	3.71	3	215	247	247	35	86	80	15.5
9	80	326.00	1.02	.78	6.25	4	217	245	247	35	84	80	15.4
8	85	328.90	1.08	.83	8.86	5	218	247	248	34	86	80	15.7
7	90	331.43	1.08	.83	1.46	4	218	247	247	34	87	80	15.8
6	95	334.14	1.10	.84	4.10	5	218	246	246	34	89	84	16.0
5	100	336.62	.98	.76	6.60	4	217	246	247	35	87	80	16.0
4	105	338.94	.86	.66	8.93	4	216	247	249	36	87	82	16.1
3	110	341.02	.74	.57	1.10	4	217	248	251	37	86	80	16.1
2	115	343.20	.66	.51	3.15	4	215	248	251	37	85	81	16.2
1	120	345.00	.54	.41	5.00	4	215	247	250	37	85	80	16.4
	(1235)												
	θ = 120	Vm = 56.90		^H = .70							Avg. = 79.5		

C-3

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AES - ECF | Date 11-9-93 | Test 1 | Run 2
Source C Pulp Dryer Stack | No. of traverse points 24
Method 1-5/6 | Filter holder: Glass | Filter type: Glass Fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0.00 cfm at 3 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5972

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	714	500	214
Impinger No. 2	653	399	254
Impinger No. 3	499	499	0
Condenser			
Desiccant	1398	1388	10
Total			478

Integrated Gas Sampling Data:

Bag Pump No. 22A Box No. 26 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 1315 (HRS) Time end: 1517 (HRS)
Sampling rate: 200 cc/min Operator: SCB
S/N of O_2 Analyzer used to monitor train outlet: 8

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS - EC4F — Operators SCB & DTB — Pitot No. 220-6 — Dp .872

Source C - DUCT VERTICAL STACK — Meter Box No. 5 ΔH 1.90 TN WC — Bar. Press. 25.51 inHg H2O 3" x

Date 11.9.93 — Test 1 — Run 2 — Counter coeff. .9955 — Nozzle No. 4-3 — Nozzle Dia .192 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1315)	(345.35)											
A - 12	5	347.20	0.70	.615	7.27	2	215	252	251	44	73	73	15.7
11	10	349.34	0.76	.618	9.24	2	217	252	251	44	77	73	15.0
10	15	351.33	6.81	.52	1.29	2	217	252	251	46	78	74	15.4
9	20	353.49	.98	.63	3.54	3	216	251	251	44	78	74	15.6
8	25	355.92	1.07	.68	5.90	3	216	250	252	44	81	74	15.5
7	30	358.20	1.09	.70	8.29	3	216	251	250	40	80	74	15.2
6	35	360.66	1.07	.69	0.65	3	216	250	252	42	80	74	15.1
5	40	362.80	1.00	.64	2.93	3	214	251	254	41	82	75	15.2
4	45	365.00	.87	.56	5.07	3	214	250	254	40	81	74	15.2
3	50	367.00	.74	.47	7.04	3	214	251	249	46	80	74	15.2
2	55	368.89	.64	.42	8.90	2	214	250	248	47	80	73	14.9
1	60	370.68	.61	.39	0.68	2	214	251	249	46	79	73	14.8
B - 12	65	372.70	.76	.49	2.67	2	214	251	248	48	77	73	15.0
11	70	374.70	.82	.52	4.74	3	214	251	248	46	77	73	15.0
10	75	376.90	.90	.58	6.90	3	215	250	251	46	81	76	15.4
9	80	379.16	.95	.61	9.13	4	214	250	251	50	82	76	15.0
8	85	381.50	1.11	.72	1.55	4	214	251	252	31	82	75	15.0
7	90	383.99	1.12	.74	3.97	4	216	251	252	41	82	76	14.8
6	95	386.30	1.08	.69	6.35	4	216	251	251	49	84	78	14.9
5	100	388.70	1.02	.66	8.68	4	216	251	251	49	86	79	14.9
4	105	390.91	.96	.62	0.53	4	217	252	251	49	85	79	15.0
3	110	393.00	.83	.54	3.03	4	217	250	254	48	85	78	15.4
2	115	395.02	.76	.49	5.04	4	216	250	254	48	85	77	15.2
1	120	396.94	.68	.44	6.94	3	216	250	254	48	86	79	15.6
	(1517)												
	θ = 120	Vm = 51.59		ΔH = .57							Avg. = 78.0		

C-5

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AES - ECF
Source C Duct 2004 Stack
Method 5/17 Filter holder: Glass

Date 11-9-93 Test 1 Run 3
No. of traverse points 24
Filter type: Glass Fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ■
Postest: 0.00 cfm at 6 in. Hg. (vac) ■

Particulate Catch Data:

No.s of filters used: 6015

Recovery solvent(s)
■ acetone
□ other(s)

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	723	500	223
Impinger No. 2	655	293	362
Impinger No. 3	550	504	46
Condenser			
Desiccant	1438	1428	10
Total			641

Integrated Gas Sampling Data:

Bag Pump No. 22A Box No. 26 Bag No. 3

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

Pretest leak check: 00 cc/min at 15 in. Hg.

Time start: 1535 (HRS) Time end: 1738 (HRS)

Sampling rate: 200 cc/min Operator: SCB

S/N of O_2 Analyzer used to monitor train outlet: 8

CF-023

CF-011

INTERPOLL LABORATORIES PA METHOD 5 FIELD DATA SHEET

Job ACS - EGR
Source C PUMP DRIVER STACK
Date 11-4-93 Test 1 Run 3

Operators SCB + JB
Meter Box No. 8 ΔH 1.80 TN WC
Coeff. .9935

Pitot No. 2A-6 Cp .840
Bar. Press. 29.51 inHg H2O 36 X
Nozzle No. #5 Nozzle Dia .247 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas In	Gas Out	Oxygen (xx/x)
	(1535	(397.17											
B - 12	5	399.08	.78	.53	9.24	2	215	251	260	49	78	77	10.0
11	10	401.38	.80	.54	1.34	2	215	251	258	49	79	77	10.1
10	15	403.65	.93	.63	3.60	2	210	251	256	49	80	77	10.1
9	20	406.90	1.03	.69	5.98	2	213	251	256	49	81	77	10.2
8	25	408.35	1.12	.76	8.46	3	217	251	256	48	82	77	15.3
7	30	411.00	1.18	.80	1.02	3	217	252	256	47	83	77	15.5
6	35	413.25	1.09	.74	3.47	3	217	252	256	46	84	77	15.5
5	40	415.79	1.05	.71	5.89	3	216	252	256	45	86	79	15.6
4	45	418.35	1.02	.70	8.38	4	216	251	256	44	84	77	15.4
3	50	420.21	.80	.54	0.37	3	215	250	256	45	85	78	15.4
2	55	422.40	.73	.50	2.41	3	214	251	256	44	86	79	15.2
1	60	424.27	.62	.42	4.27	3	214	252	254	43	87	80	15.3
A - 12	65	426.30	.78	.53	6.37	3	214	251	254	44	85	81	15.5
11	70	428.50	.78	.53	8.47	3	214	251	254	43	86	80	16.2
10	75	430.65	.85	.58	065	4	214	252	254	44	86	80	16.0
9	80	433.00	1.00	.69	3.03	4	213	251	255	43	88	83	15.9
8	85	435.52	1.08	.74	5.49	4	214	251	254	44	87	80	15.0
7	90	437.75	1.06	.72	7.93	4	217	254	254	43	87	80	13.5
6	95	440.23	1.06	.72	0.37	5	219	255	256	44	88	81	14.2
5	100	442.62	.97	.66	2.70	4	219	254	256	44	88	81	14.6
4	105	444.94	.90	.61	4.95	4	219	255	256	43	88	80	14.5
3	110	446.99	.74	.50	6.98	4	218	251	251	40	88	81	15.0
2	115	448.86	.64	.44	8.88	3	217	251	252	39	88	81	15.2
1	120	450.94	.43	.29	0.44	3	214	250	252	38	88	82	15.4
	(1738												
	θ = 120	Vm = 53.27		ΔH = .61							Avg. =	80.1	

C-7

S-000370

Interpoll Laboratories
(612)786-6020

EPA Method 7 Sample Collection
Field Data Sheet

Job ACS / Grand Forks Date 11-9-93 Bar. Pressure 29.51 IN.HG.

Test Location C Pulp Dryer stack Fuel Type COAL Sample Train No. 1

Technician JEFF BERGSTROM Pump No. 9

No.	Test Run Point	Flask No.	Time (HRS)	Vacuum (IN.HG.)	Flask Temp. (°F)	Leak Rate <0.4 IN.HG./MIN.
1	1-1-1	37	1030	27.80	60	☒ Yes ☐ No
2	1-1-2	38	1055	27.70	59	☒ Yes ☐ No
3	1-1-3	39	1125	27.80	56	☒ Yes ☐ No
4	1-1-1	40	1155	27.85	55	☒ Yes ☐ No
5	1-2-2	41	1320	27.80	46	☒ Yes ☐ No
6	1-2-3	42	1345	27.80	44	☒ Yes ☐ No
7	1-2-1	79	1415	27.80	68	☒ Yes ☐ No
8	1-2-2	80	1445	27.80	68	☒ Yes ☐ No
9	1-3-3	81	1540	27.75	79	☒ Yes ☐ No
10	1-3-1	82	1625	27.80	76	☒ Yes ☐ No
11	1-3-2	83	1650	27.80	75	☒ Yes ☐ No
12	1-3-3	84	1720	27.80	70	☒ Yes ☐ No
13						☐ Yes ☐ No
14						☐ Yes ☐ No
15						☐ Yes ☐ No
16						☐ Yes ☐ No
17						☐ Yes ☐ No
18						☐ Yes ☐ No
19						☐ Yes ☐ No
20						☐ Yes ☐ No
21						☐ Yes ☐ No
22						☐ Yes ☐ No
23						☐ Yes ☐ No
24						☐ Yes ☐ No
25						☐ Yes ☐ No
26						☐ Yes ☐ No
27						☐ Yes ☐ No

S-263R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job AIS RDF

Source [illegible] Duct

Test 1 Run 2 Date 1-8-03

Stack dimen. 19.5 IN.

Dry bulb 210 °F Wet bulb 156 °F

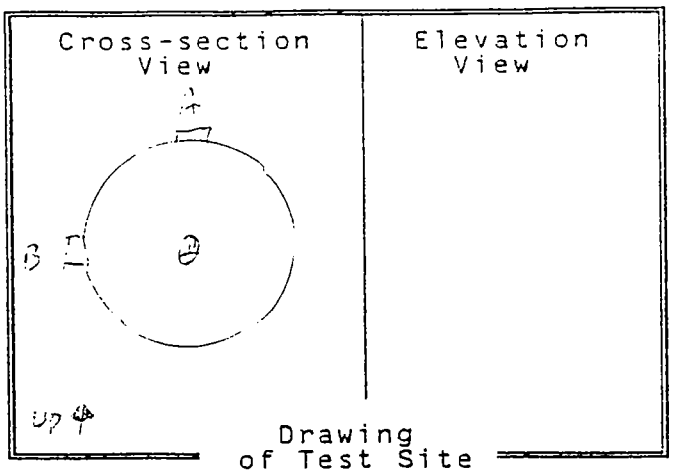
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.51 in Hg

Static pressure -0.53 in WC

Operators SCB + JB

Pitot No. 220-4 C_p .840



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: 4.375 in.		Time start: 0918 hrs	
A	1	.044	0.86	5.32	.29	204
	2	.146	2.85	7.22	.30	204
	3	.296	5.77	10.15	.27	204
	4	.704	13.73	18.10	.27	208
	5	.854	16.65	21.03	.28	208
	6	.956	18.64	23.02	.30	208
B	1				.29	208
	2				.31	208
	3				.30	208
	4				.32	208
	5				.33	207
	6				.33	207
		36.59	FT/SEC			
		2785	ACFM			
		1513	DSCFM			
Temp. meas. device & S/N: [illegible]					Time end: 0924 hrs	

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

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job AES - ECAF

Source C HOPPER FILTER OUTLET

Test 1 Run 2 Date 11-9-93

Stack dimen. 29.5 IN.

Dry bulb 21C °F Wet bulb 15C °F

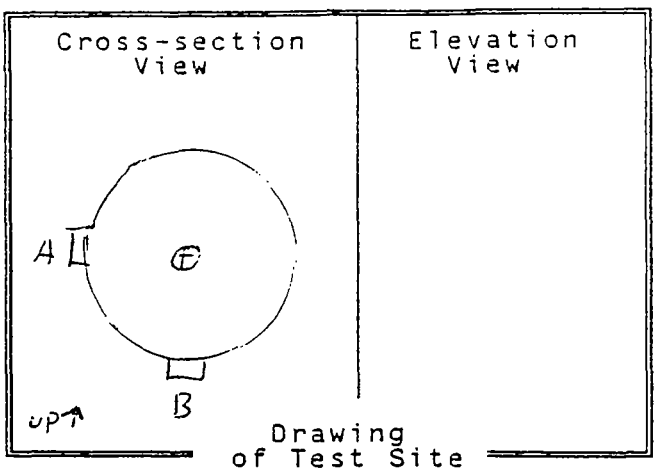
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.51 in Hg

Static pressure -0.11 in WC

Operators SCB RJB

Pitot No DV-49 C_p .840



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: 4.00 in.		Time start: 0900 hrs	
	1	.032	1.93	4.93	0.12	210
	2	.105	3.05	7.05	0.15	210
	3	.194	5.63	9.63	0.18	210
	4	.323	9.37	13.37	0.19	210
	5	.677	19.63	23.63	0.14	210
	6	.806	23.37	27.37	0.16	211
	7	.895	25.96	29.96	0.25	211
	8	.968	28.07	32.07	0.20	211
	1				0.12	209
	2				0.14	209
	3				0.15	209
	4				0.14	210
	5				0.13	211
	6				0.09	210
	7				0.08	210
	8				0.08	210
			74.71	FT/SE		
			7038	ACTUAL		
			3878	DSCFM		
Temp. meas. device & S/N: DIGITAL T/C - PDT-29					Time end: 0915 hrs	

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

Interpoll Laboratories
(612)786-6020

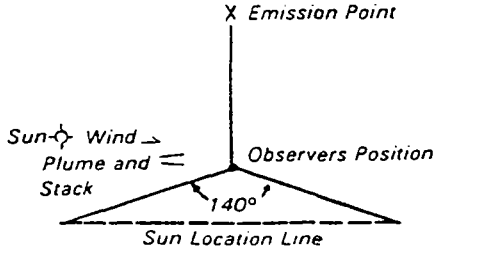
Visible Emissions Form

Test 1

SOURCE NAME: A.C.S. / Grand Forks	OBSERVATION DATE: 11-9-93	START TIME / STOP TIME
ADDRESS		
CITY: East Grand Forks	STATE: MN	ZIP
PHONE	SOURCE ID NUMBER	
PROCESS EQUIPMENT: C Pulp Dryer Stack	OPERATING MODE	
CONTROL EQUIPMENT	OPERATING MODE	
DESCRIBE EMISSION POINT: START	STOP	
HEIGHT ABOVE GROUND LEVEL: START	STOP	HEIGHT RELATIVE TO OBSERVER: START	STOP
DISTANCE FROM OBSERVER: START	STOP	DIRECTION FROM OBSERVER: START	STOP
DESCRIBE EMISSIONS: START	STOP	
EMISSION COLOR: START	STOP	PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☐ YES ☐	IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐	
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START	STOP	
DESCRIBE BACKGROUND: START	STOP	
BACKGROUND COLOR: START	STOP	SKY CONDITIONS: START	STOP
WIND SPEED: START	STOP	WIND DIRECTION: START	STOP
AMBIENT TEMP.: START	STOP	WET BULB TEMP.	RH, percent

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

Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS: MINIMUM	MAXIMUM
OBSERVER'S NAME (PRINT): JEFF BERGSTROM	
COMMENTS: Could not read, Snow	OBSERVER'S SIGNATURE: Jeff Bergstrom — DATE: 11-9-93
and Interference from other Stacks	ORGANIZATION: Interpoll Labs
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS — SIGNATURE	CERTIFIED BY: E.T.A. Minneapolis — DATE: 10-7-93
TITLE — DATE	VERIFIED BY — DATE

S-0079R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS/ E. Grand Forks, MN

Source NO. 1 BOILER STACK

Test 2 Run 0 Date 11-10-93

Stack dimen. 105.5 IN.

Dry bulb 321 °F Wet bulb ___ °F

Manometer: ☐ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.56 in Hg

Static pressure -.22 in WC

Operators MK, DD

Pitot No. 23V-4 C_p .84

Compliance

Cross-section View	Elevation View

Drawing of Test Site

Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length: in.		Time start: hrs	
			Refer to	Test 2		
			Runs 1 thru 3			
Temp. meas. device & S/N:					Time end: hrs	

R or nothing = reg. manometer; S= expanded; E=electronic S-3921

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ACS / E. Grand Forks, MN Date 11-10-93 Test 2 Run 4
Source No. 1 Boiler / Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 5980

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	573	500	73
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1450	1487	43
Total			86

Integrated Gas Sampling Data:

Bag Pump No. 294 Box No. 28 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 0810 (HRS) Time end: 0917 (HRS)
Sampling rate: 400 cc/min Operator: M. Kaechler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS / E. Grand Forks, MN — Operators M. Kuehlert D. Despain — Pitot No. 23V-4 — Cp .84
Source No. 1 Boiler / Stack — Meter Box No. 9 — ΔH 1.74 IN WC — Bar. Press. 29.55 inHg — H2O 8 %
Date 11-10-93 — Test 2 — Run 4 — Counter coeff. 1.0042 — Nozzle No. 8.5 — Nozzle Dia .301 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (xx/v)
	0810	532.80											
D-6	2.5	534.82	.44	1.91	4.74	7	383	233	258	33	61	55	9.7
5	5	536.77	.43	1.90	6.68	6.5	372				63	56	8.5
4	7.5	538.59	.37	1.66	8.50	5	362	241	255	33	64	56	8.3
3	10	540.33	.36	1.63	0.30	5	358				65	57	8.1
2	12.5	542.07	.35	1.58	2.07	5	360	244	259	33	67	59	8.5
1	15	543.77	.28	1.28	3.68	3.5	351				68	60	8.7
C-6	17.5	545.77	.50	2.25	5.80	8	367	249	263	33	69	61	8.7
5	20	548.02	.56	2.50	8.04	9	375				71	61	[illegible]
4	22.5	550.40	.61	2.74	0.39	10	371	246	260	34	72	62	[illegible]
3	25	552.53	.53	2.40	2.54	9	366				73	63	[illegible]
2	27.5	554.75	.52	2.36	4.77	9	368	249	264	34	75	65	[illegible]
1	30	556.73	.42	1.92	6.74	7	362				76	66	[illegible]
B-6	32.5	558.60	.37	1.70	8.60	6	363	245	264	34	76	68	[illegible]
5	35	560.64	.42	1.88	0.56	6.5	386				79	69	[illegible]
4	37.5	562.50	.38	1.71	2.43	6	383	243	260	34	80	70	[illegible]
3	40	564.30	.36	1.63	4.26	6	379				81	71	[illegible]
2	42.5	566.10	.36	1.63	6.09	6	380	248	257	34	81	71	8.5
1	45	567.85	.33	1.51	2.85	5	371				82	72	8.2
A-6	47.5	569.61	.34	1.55	9.64	5	375	253	255	34	82	73	9.0
5	50	571.31	.30	1.35	1.31	5	386				83	74	7.9
4	52.5	573.07	.32	1.45	3.04	5	384	250	261	34	84	75	7.8
3	55	574.71	.24	1.32	4.69	5	384				85	76	7.9
2	57.5	576.27	.26	1.19	6.26	4.5	382	247	263	34	85	76	7.9
1	60	577.79	.24	1.10	7.77	4	379				86	76	7.8
	(0917)												
	θ = 60	Vm = 44.99		ΔH @ 1.76							Avg. = 70.8		

C-14

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AES / E. Grand Forks, ... Date 4/20/93 Test 2 Run 5
Source No. 1 Boiler / Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 5981

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

No. of probe wash bottles: 1
Sample recovered by: M. Kuehler + D. Doepen

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	573	500	73
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1444	1428	16
Total			89

Integrated Gas Sampling Data:

Bag Pump No. 294 Box No. 28 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 30 in. Hg.
Time start: 0948 (HRS) Time end: _____ (HRS)
Sampling rate: 400 cc/min Operator: M. Kuehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS / E. Grand Forks, MN Operators W. Kuehler & D. Deepen Pitot No. 23V-41 Cp .84
Source No. 1 Boiler / Stack Meter Box No. 9 ΔH 1.74 IN WC Bar. Press. 29.55 inHg H2O 3.3 x
Date 11-10-93 Test 2 Run 5 Counter coeff. 1.0042 Nozzle No. 8.5 Nozzle Dia .367 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	(0948)	578.20											
A-6	2.5	580.10	.37	1.64	0.02	5	385	235	263	34	80	77	8.6
5	5	581.92	.34	1.53	1.80	5	390				82	78	2.8
4	7.5	583.42	.26	1.17	3.36	4	385	243	260	34	84	79	7.9
3	10	585.11	.30	1.36	5.04	5	385				86	80	8.0
2	12.5	586.67	.25	1.14	6.58	3.5	392	245	257	34	86	80	8.3
1	15	588.05	.21	.97	8.01	3	373				87	81	8.0
B-6	17.5	590.06	.42	1.91	0.00	6	384	251	261	34	86	81	8.1
5	20	591.96	.39	1.75	1.91	5.5	394				88	82	8.1
4	22.5	593.85	.40	1.80	3.85	6	395	248	264	35	90	83	7.8
3	25	595.74	.36	1.63	5.70	5.5	392				90	83	7.8
2	27.5	597.60	.35	1.59	7.53	5.5	388	248	257	35	91	83	8.1
1	30	599.29	.31	1.41	9.25	5	388				91	84	8.1
C-6	32.5	601.58	.54	2.45	1.52	8.5	393	244	260	34	92	84	8.4
5	35	603.84	.53	2.41	3.76	8.5	393				92	85	8.2
4	37.5	606.12	.55	2.51	6.05	9	390	247	255	34	93	85	7.8
3	40	608.40	.58	2.65	8.41	9	389				93	85	7.6
2	42.5	610.82	.61	2.77	0.82	10	394	242	257	35	94	86	8.4
1	45	613.10	.55	2.50	3.11	9.5	396				94	86	7.9
D-6	47.5	615.31	.50	2.27	5.29	8	395	248	264	36	93	86	8.4
5	50	617.43	.48	2.19	7.44	7.5	392				94	86	8.1
4	52.5	619.44	.40	1.82	9.39	6	395	252	266	36	94	87	8.4
3	55	621.35	.38	1.74	1.31	6	391				95	88	8.1
2	57.5	623.09	.32	1.47	3.07	5	388	247	263	36	95	88	8.4
1	60	624.67	.23	1.06	4.57	4	384				95	88	7.9
	(1053)												
	θ = 60	Vm = 46.47		ΔH 7.82							Avg. = 86.9		

C-16

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ACS / E. Grand Forks, MN — Date 11-10-93 — Test 2 — Run 6
Source No. 1 Boiler / Stack — No. of traverse points 24
Method 5 — Filter holder: 4" Glass — Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: ≤ 0.02 cfm at 14 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5992

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

No. of probe wash bottles: 1
Sample recovered by: M. Kuehler + D. Deyerle

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	594	501	93
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1466	1450	16
Total			109

Integrated Gas Sampling Data:

Bag Pump No. 294 — Box No. 28 — Bag No. 3
Bag Material: 5-layer Aluminized Tedlar — Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 1115 (HRS) — Time end: 1220 (HRS)
Sampling rate: 400 cc/min — Operator: M. Kuehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS / E. Grand Forks, MN
Source No. 1 Boiler / Stack
Date 11-10-93 Test 2 Run 6

Operators M. Koehler + D. Dexon
Meter Box No. 9 ΔH 2.74 IN WC
Cosmeter coeff. 1.0042

Pitot No. 230-4 Cp .84
Bar. Press. 29.55 inHg H2O 0.6 x
Nozzle No. 2-5 Nozzle Dia. .501 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	1115	625.20											
D-6	2.5	627.37	.47	2.14	7.31	7	386	230	256	37	90	87	7.8
5	5	629.50	.49	2.18	9.45	7	408				92	88	8.0
4	7.5	631.45	.41	1.85	1.42	6	395	239	261	37	93	88	8.0
3	10	633.37	.37	1.68	3.30	5	394				95	89	7.9
2	12.5	635.12	.32	1.46	5.06	5	391	244	263	37	96	89	8.1
1	15	636.84	.26	1.29	6.71	4	384				96	89	8.1
C-6	17.5	639.22	.54	2.69	9.10	9	392	251	260	36	97	90	8.1
5	20	641.51	.56	2.50	1.39	9	411				97	90	7.8
4	22.5	643.78	.55	2.48	3.68	9	402	245	264	36	97	91	7.5
3	25	646.28	.72	3.28	6.32	13	343				97	91	8.1
2	27.5	648.84	.64	2.44	8.81	12	388	249	258	37	96	91	7.8
1	30	651.29	.61	2.81	1.24	11	384				96	90	7.7
B-6	32.5	653.21	.37	1.71	3.15	6	383	253	254	37	94	90	7.7
5	35	655.11	.37	1.68	5.03	6	394				95	90	7.1
4	37.5	656.95	.35	1.59	6.87	5.5	393	253	257	38	97	91	7.4
3	40	658.88	.38	1.75	8.79	6	388				97	91	7.7
2	42.5	660.66	.36	1.68	0.68	6	376	250	255	38	97	91	8.1
1	45	662.41	.28	1.31	2.35	5	373				97	91	7.8
A-6	47.5	664.34	.38	1.75	4.28	6	386	244	259	38	97	90	8.1
5	50	665.47	.28	1.29	5.93	5	385				98	91	7.8
4	52.5	667.67	.28	1.30	7.60	5	380	247	259	38	97	91	7.9
3	55	669.18	.24	1.12	9.14	4	374				98	91	7.9
2	57.5	670.76	.25	1.16	0.71	4	378	242	262	38	97	91	8.1
1	60	672.05	.18	.84	2.06	3	372				97	91	8.2
	(1220)												
	θ = 60	Vm = 46.85		ΔH x .91							Avg. = 93.0		

Interpoll Laboratories
(612)786-6020

EPA Method 7 Sample Collection
Field Data Sheet

Job ACS / E6F Date 11-10-93 Bar. Pressure 29.55 IN.HG.
Test Location Stack Fuel Type Bituminous Coal Sample Train No. Blue
No. 1 Boiler (Cont.) Technician D. D. Pump No. 29 B

No.	Test Run Point	Flask No.	Time (HRS)	Vacuum (IN.HG.)	Flask Temp. (°F)	Leak Rate <0.4 IN.HG./MIN.
1	2-1-A	61	0812	27.30	45	☒ Yes ☐ No
2	2-1-B	62	0920	27.25	45	☒ Yes ☐ No
3	2-1-C	63	0943	27.20	45	☒ Yes ☐ No
4	2-1-D	64	0909	27.30	45	☒ Yes ☐ No
5	2-2-A	65	0952	27.20	45	☒ Yes ☐ No
6	2-2-B	66	0959	27.30	45	☒ Yes ☐ No
7	2-2-C	67	1040	27.15	45	☒ Yes ☐ No
8	2-2-D	68	1050	27.25	45	☒ Yes ☐ No
9	2-3-A	69	1120	27.10	45	☒ Yes ☐ No
10	2-3-B	70	1135	27.20	45	☒ Yes ☐ No
11	2-3-C	71	1159	27.40	45	☒ Yes ☐ No
12	2-3-D	72	1215	27.25	45	☒ Yes ☐ No
13						☐ Yes ☐ No
14						☐ Yes ☐ No
15						☐ Yes ☐ No
16						☐ Yes ☐ No
17						☐ Yes ☐ No
18						☐ Yes ☐ No
19						☐ Yes ☐ No
20						☐ Yes ☐ No
21						☐ Yes ☐ No
22						☐ Yes ☐ No
23						☐ Yes ☐ No
24						☐ Yes ☐ No
25						☐ Yes ☐ No
26						☐ Yes ☐ No
27						☐ Yes ☐ No

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job MCS - AGF

Source B - Main Drive Stack

Test 5 Run 0 Date 11-10-93

Stack dimen. 59 IN.

Dry bulb 245 °F Wet bulb 137 °F

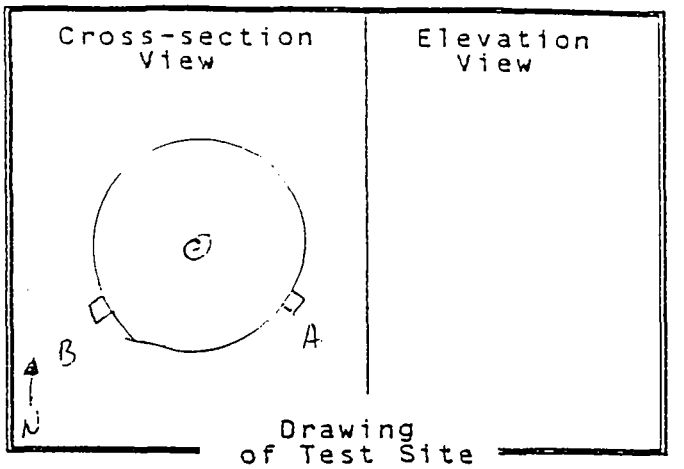
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.55 in Hg

Static pressure - .98 in WC

Operators SLB & JR

Pitot No. 22U - 6 C_p .840



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: 4.25 in.		Time start 0907 hrs	
A	1	.021	1.24	5.49	.63	230
	2	.067	3.95	8.20	.92	230
	3	.118	6.96	11.21	.96	230
	4	.177	10.44	14.69	.94	230
	5	.250	14.75	19.00	.97	231
	6	.356	21.00	25.25	.95	232
	7	.644	38.00	42.25	1.15	232
	8	.750	44.25	48.50	1.12	235
	9	.823	48.56	52.81	1.08	235
	10	.882	52.04	56.29	1.02	235
	11	.933	55.05	59.30	.86	230
	12	.979	57.76	62.01	.76	230
B	1				.90	230
	2				.95	230
	3				.95	230
	4				1.00	230
	5				1.00	231
	6				1.20	231
	7		65.99		.90	231
	8		75,157	ACFM	.88	231
	9		41,592	DSCFM	.70	231
	10				.60	231
	11				.52	231
	12				.44	233
						Avg = 231.25
Temp. meas. device & S/N: DIGITAL TK-DDT-29					Time end: 0810 hrs	

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

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AMS - EGF Date 1-10 93 Test 5 Run 1
Source D duct Bypass stack No. of traverse points 24
Method 5, c Filter holder: Glass Filter type: Glass Fiber

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 6012

Recovery solvent(s)
■ acetone
□ other(s)

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	468	291	177
Impinger No. 2	513	506	7
Impinger No. 3	694	499	195
Condenser			
Desiccant	1411	1398	13
Total			392

Integrated Gas Sampling Data:

Bag Pump No. 22A Box No. 9 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 0905 (HRS) Time end: 1106 (HRS)
Sampling rate: 200 cc/min Operator: SLB
S/N of O_2 Analyzer used to monitor train outlet: 8

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS - EGF
Source B POLO DRYER STACK
Date 11-10-93 Test 5 Run 1

Operators SCB / TG
Meter Box No. 9 ΔH@ 1.80 IN WC
Coeff: .9975

Pitot No. 220-6 Cp .840
Bar. Press. 29.55 inHg H2O 20 X
Nozzle No. 6-7 Nozzle Dia .193 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xx/v)
	(0905)	(450.97)											
A 12	5	453.10	.76	.63	3.12	3	244	254	251	40	67	67	17.1
11	10	455.50	.82	.68	5.52	3	244	250	250	40	68	68	17.0
10	16	457.92	.88	.74	7.94	3	243	250	250	41	70	67	16.9
9	20	460.58	1.08	.91	0.63	4	244	248	250	42	75	68	16.7
8	25	463.50	1.25	1.05	3.54	4	244	248	250	40	74	69	16.4
7	30	466.62	1.45	1.23	6.67	5	244	248	250	38	76	69	16.1
6	35	469.38	1.10	.93	9.40	5	243	243	249	37	79	71	16.2
5	40	472.10	1.10	.93	2.14	4	249	243	248	36	80	72	16.4
4	45	474.84	1.06	.90	4.83	4	247	247	248	36	80	72	16.7
3	50	477.40	1.02	.87	7.48	4	243	246	248	35	80	73	17.2
2	55	479.80	.83	.71	9.88	4	240	247	248	35	82	74	17.5
1	60	482.00	.65	.56	0.01	3	240	246	247	35	82	74	17.6
B 12	65	484.63	1.05	.90	4.71	4	240	246	247	35	83	75	17.3
11	70	487.42	1.08	.93	7.46	4	241	247	247	36	81	76	17.1
10	75	490.20	1.09	.93	0.21	4	246	247	246	35	84	77	16.7
9	80	493.00	1.15	.98	3.04	4	245	247	2218	35	84	77	16.6
8	85	495.78	1.19	1.02	5.92	5	248	247	248	35	86	78	16.6
7	90	498.77	1.22	1.05	8.84	5	245	247	248	35	86	78	16.4
6	95	501.50	1.06	.91	1.57	5	245	246	247	29	87	79	16.6
5	100	504.17	.88	.76	4.01	4	242	247	247	32	87	80	16.8
4	105	506.53	.84	.73	6.57	4	240	248	247	36	88	81	16.7
3	110	508.99	.81	.70	8.92	4	239	248	246	35	88	81	16.1
2	115	511.82	.79	.69	1.30	4	239	248	246	35	88	81	16.7
1	120	513.19	.50	.43	3.19	3	239	248	246	35	88	82	16.4
	(1206)												
	θ = 120	Vm = 62.22		ΔH = .84							Avg. = 77		

C-22

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job DTE - ECH Date 1-10-03 Test 5 Run 2
Source B BOILER MAIN STACK No. of traverse points 20
Method 1-5 6 Filter holder: GLASS Filter type: GLASS FIBER

Sample Train Leak Check:

Pretest: (0.02 cfm at 15 in. Hg. (vac) ■
Postest: 0.00 cfm at 10 in. Hg. (vac) ■

Particulate Catch Data:

No.s of filters used: 6013

Recovery solvent(s)
■ acetone
□ other(s)

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	704	506	198
Impinger No. 2	513	507	6
Impinger No. 3	430	300	130
Condenser			
Desiccant	1400	1389	11
Total			345

Integrated Gas Sampling Data:

Bag Pump No. 33A Box No. 9 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 1130 (HRS) Time end: 1332 (HRS)
Sampling rate: 200 cc/min Operator: SCB
S/N of O_2 Analyzer used to monitor train outlet: 8

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS - Plant
Source B Pulp Dryer Stack
Date 11.12.93 Test 5 Run 2

Operators SCIS & JTS
Meter Box No. 2 ΔH 1.80 IN WC
Cassette conft. .9955

Pitot No. 226-C Cp .870
Bar. Press. 22.55 inHg H2O .25 X
Nozzle No. 17-3 Nozzle Dia .192 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xx/x)
	(1130)	(513.37)											
B-12	5	515.74	1.00	.77	5.84	3	244	246	246	52	82	82	17.9
11	10	518.40	1.04	.82	8.45	3	240	246	246	50	84	80	17.9
10	15	521.10	1.15	.90	1.16	3	237	246	247	48	86	80	17.5
9	20	523.90	1.18	.92	3.91	3	237	247	247	47	87	82	17.7
8	25	526.60	1.15	.90	6.63	3	238	247	246	46	89	82	17.4
7	30	529.58	1.25	.98	9.47	4	237	247	247	47	89	83	17.7
6	35	532.02	1.06	.84	2.11	3	235	246	248	45	89	83	17.8
5	40	534.30	.75	.59	4.33	3	232	247	251	46	90	82	17.9
4	45	536.57	.68	.54	6.44	3	231	248	251	43	90	83	17.8
3	50	538.56	.68	.54	8.55	3	230	248	251	45	89	83	17.7
2	55	540.64	.66	52	0.63	2	230	245	252	40	89	83	17.6
1	60	542.50	.51	.43	2.52	2	230	245	250	40	89	84	17.4
A-12	65	544.95	.95	.75	4.92	2	231	246	251	42	89	82	17.4
11	70	547.56	1.05	83	7.63	3	231	247	251	42	88	82	17.5
10	75	550.32	1.10	.87	0.30	4	234	251	252	40	88	82	17.5
9	80	552.84	1.25	.92	2.95	4	235	250	253	39	89	84	17.4
8	85	555.90	1.40	1.11	5.97	5	234	251	254	40	90	84	17.6
7	90	559.00	1.50	1.19	9.09	5	234	252	254	42	90	84	17.6
6	95	561.70	1.05	.83	1.71	5	234	252	254	41	90	85	17.4
5	100	564.40	1.08	.85	4.36	4	234	251	252	42	93	86	17.7
4	105	566.99	1.02	.81	6.96	4	234	251	256	40	93	86	17.7
3	110	569.51	.94	.77	9.42	4	230	251	250	38	93	86	17.6
2	115	571.80	.84	.67	1.84	4	230	252	254	38	93	87	17.6
1	120	573.99	.70	.56	3.99	3	230	256	254	37	93	87	17.4
	(1332)												
	θ = 120	Vm = 60.62		ΔH = .79							Avg. = 85.0		

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ACS - FGC
Source 17 Duct Diagonal South
Method 5.6 Filter holder: Glass

Date 10-9-97 Test 5 Run 5
No. of traverse points 24
Filter type: Glass Fiber

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0.00 cfm at 10 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5997

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	677	498	179
Impinger No. 2	509	500	9
Impinger No. 3	446	298	148
Condenser			
Desiccant	1477	1462	15
Total			351

Integrated Gas Sampling Data:

Bag Pump No. 22A Box No. 9 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 1350 (HRS) Time end: 1551 (HRS)
Sampling rate: 200 cc/min Operator: SCB
S/N of O_2 Analyzer used to monitor train outlet: 8

CF-033

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS - ECF
Source B PULP DRYER STACK
Date 11-10-97 Test 5 Run 3

Operators SCD & JB
Meter Box No. 8 ΔH 1.80 TN WC
Coefficient coeff. .9975

Pitot No. 22V 6 Cp .840
Bar. Press. 29.55 inHg H2O 22 %
Nozzle No. 9-3 Nozzle Dia .198 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1350)	(574.30)											
A-12	5	576.76	.89	.75	6.78	3	230	242	241	46	83	82	18.0
11	10	579.30	.94	.79	9.33	3	231	244	241	48	84	82	18.0
10	15	582.00	1.05	.88	2.01	3	232	244	241	49	86	82	18.0
9	20	584.52	.93	.78	4.51	3	230	241	242	50	86	83	18.1
8	25	587.48	1.27	1.08	7.53	4	226	242	241	50	84	81	17.9
7	30	590.44	1.23	1.03	0.44	4	231	241	246	51	84	80	17.6
6	35	593.10	1.08	.90	3.13	4	234	250	248	52	83	80	17.3
5	40	595.87	1.05	.88	5.83	4	234	251	254	50	83	79	17.1
4	45	598.32	.94	.78	8.35	4	238	254	256	50	84	81	17.2
3	50	600.75	.83	.70	0.75	4	230	251	254	50	83	80	17.5
2	55	603.00	.77	.65	3.05	5	230	250	251	48	82	80	18.0
1	60	605.28	.73	.61	5.28	4	230	247	249	46	81	78	18.4
B-12	65	607.44	1.10	.92	7.42	4	229	247	250	47	81	78	18.3
11	70	610.76	1.10	.91	0.75	5	237	248	251	46	79	78	18.3
10	75	613.40	1.05	.88	3.42	4	229	247	252	44	77	76	18.3
9	80	616.22	1.15	.96	6.20	4	229	249	250	43	79	76	17.8
8	85	619.15	1.20	1.00	9.05	4	229	251	251	40	80	75	17.6
7	90	621.98	1.28	1.06	1.99	4	232	251	251	40	80	75	17.6
6	95	624.60	.93	.77	4.49	3	236	251	251	40	83	75	17.2
5	100	627.60	.75	.62	6.74	3	237	252	251	42	80	75	17.4
4	105	628.84	.68	.56	8.81	3	235	251	251	35	80	75	17.7
3	110	631.02	.70	.58	1.04	3	235	251	251	35	80	75	17.7
2	115	633.15	.66	.55	3.15	3	234	251	251	35	81	75	17.7
1	120	635.21	.63	.52	5.21	3	234	252	250	34	81	75	17.7
	(1551)												
	θ = 120	Vm = 60.91		ΔH = .80							Avg. = 80.0		

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EPA Method 7 Sample Collection
Field Data Sheet

Job ACS / Grand Forks Date 11-10-93 Bar. Pressure 29.55 IN.HG.
Test Location B Pulp Fuel Type COAL Sample Train No. 1
Dryer stack Technician JEFF BERGSTROM Pump No. 9

No.	Test Run Point	Flask No.	Time (HRS)	Vacuum (IN.HG.)	Flask Temp. (°F)	Leak Rate <0.4 IN.HG./MIN.
1	5-1-1	25	0905	27.65	57	☒ Yes ☐ No
2	5-1-2	26	0935	27.65	48	☒ Yes ☐ No
3	5-1-3	27	1005	27.70	46	☒ Yes ☐ No
4	5-1-1A	28	1055	27.70	40	☒ Yes ☐ No
5	5-2-2	29	1130	27.45	55	☒ Yes ☐ No
6	5-2-3	30	1205	27.50	52	☒ Yes ☐ No
7	5-2-1	31	1235	27.45	58	☒ Yes ☐ No
8	5-2-2A	32	1310	27.50	56	☒ Yes ☐ No
9	5-3-3	33	1400	27.50	50	☒ Yes ☐ No
10	5-3-1	34	1430	27.50	48	☒ Yes ☐ No
11	5-3-2	35	1455	27.45	45	☒ Yes ☐ No
12	5-3-3	36	1535	27.55	42	☒ Yes ☐ No
13						☐ Yes ☐ No
14						☐ Yes ☐ No
15						☐ Yes ☐ No
16						☐ Yes ☐ No
17						☐ Yes ☐ No
18						☐ Yes ☐ No
19						☐ Yes ☐ No
20						☐ Yes ☐ No
21						☐ Yes ☐ No
22						☐ Yes ☐ No
23						☐ Yes ☐ No
24						☐ Yes ☐ No
25						☐ Yes ☐ No
26						☐ Yes ☐ No
27						☐ Yes ☐ No

S-263R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS - ECF

Source B Recycle Duct

Test 6 Run C Date 11/10/93

Stack dimen. 24 IN.

Dry bulb 136 °F Wet bulb 148 °F

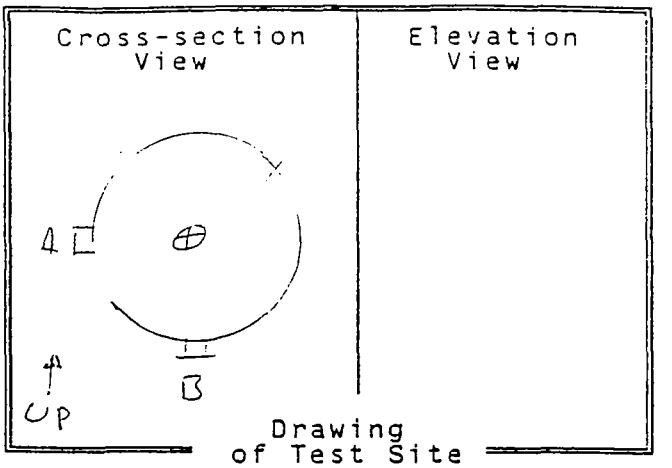
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.55 in Hg

Static pressure -.78 in WC

Operators SCB & JTB

Pitot No. 226-4 C_p .840



Drawing of Test Site

Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length: 4.00 in.		Time start: 0829 hrs	
A	1	.044	1.05	5.05	.23	231
	2	.146	3.50	7.50	.27	231
	3	.296	7.10	11.10	.28	231
	4	.704	16.89	20.89	.32	231
	5	.854	20.49	24.49	.34	231
	6	.956	22.94	26.94	.29	231
B	1				.18	232
	2				.24	232
	3				.29	231
	4				.31	230
	5				.32	230
	6				.34	230
			36.06	Ft/sec		
			6797	ACFM		
			3763	DSCFM		
Temp. meas. device & S/N: DIGITAL PC-PDT59					Time end: 0832 hrs	

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

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job RCS - EOF

Source R-4 ROOF-TOP FILTRAL INLET

Test 5 Run 0 Date 11-10 93

Stack dimen. 20 IN.

Dry bulb 236 °F Wet bulb 145 °F

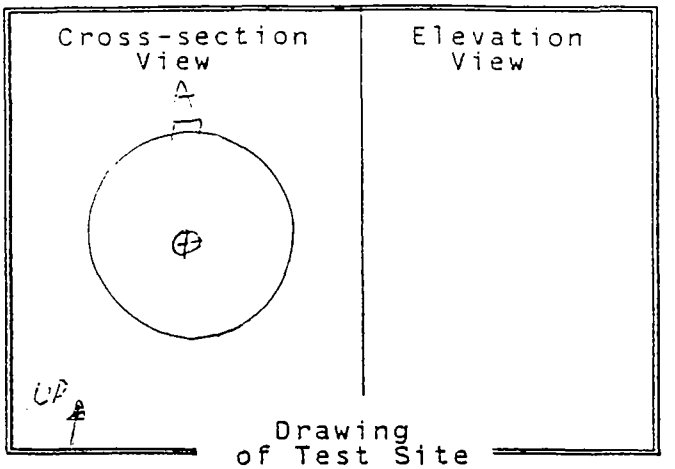
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.55 in Hg

Static pressure - .70 in WC

Operators SB + JB

Pitot No. 226-4 C_p .840



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: 4.0 in.		Time start: 0840 hrs	
1	.032	1.64	4.64	1.23	236
2	.105	2.10	6.10	1.30	236
3	.194	3.88	7.88	1.30	236
4	.323	6.46	10.46	1.28	236
5	.677	13.54	17.54	.91	236
6	.806	16.12	20.12	.84	236
7	.895	17.90	21.90	.85	235
8	.968	19.39	23.39	.93	235
		70.34	FT/Sec		
		9208	ACFM		
		5299	DSCFM		
Temp. meas. device & S/N: DIGITAL T/C - 00124				Time end: 0844 hrs	

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

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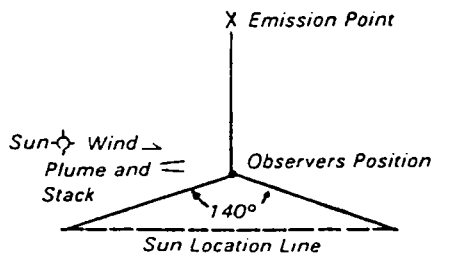
Visible Emissions Form

Test 5

SOURCE NAME: A.C.S. / East Grand Forks		OBSERVATION DATE: 11-10-93	START TIME / STOP TIME
ADDRESS			
CITY: East Grand Forks	STATE: MN	ZIP	
PHONE	SOURCE ID NUMBER		
PROCESS EQUIPMENT: B-Pulp Dryer Stack	OPERATING MODE		
CONTROL EQUIPMENT	OPERATING MODE		
DESCRIBE EMISSION POINT: START	STOP		
HEIGHT ABOVE GROUND LEVEL: START STOP	HEIGHT RELATIVE TO OBSERVER: START STOP		
DISTANCE FROM OBSERVER: START STOP	DIRECTION FROM OBSERVER: START STOP		
DESCRIBE EMISSIONS: START	STOP		
EMISSION COLOR: START STOP	PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐		
WATER DROPLETS PRESENT: NO ☐ YES ☐	IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐		
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START	STOP		
DESCRIBE BACKGROUND: START	STOP		
BACKGROUND COLOR: START STOP	SKY CONDITIONS: START STOP		
WIND SPEED: START STOP	WIND DIRECTION: START STOP		
AMBIENT TEMP.: START STOP	WET BULB TEMP.	RH.percent	

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

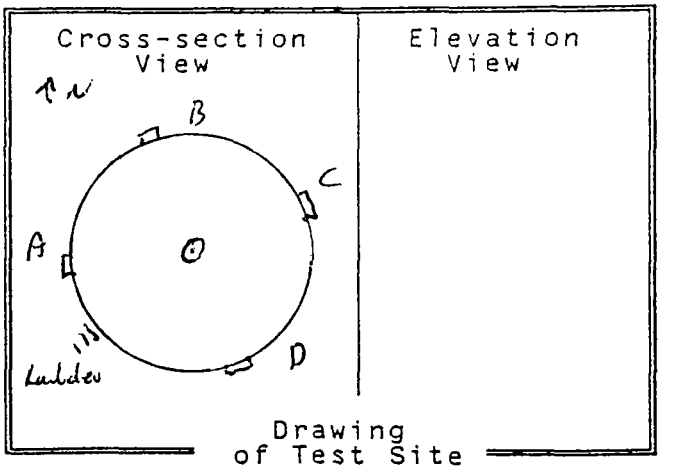
Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS: MINIMUM	MAXIMUM
OBSERVER'S NAME (PRINT): JEFF BERESTROM	
COMMENTS: could not read, other plums interfering	OBSERVER'S SIGNATURE: [signature] DATE: 11-10-93
	ORGANIZATION: Interpoll Lab
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS SIGNATURE	CERTIFIED BY: ETP Mineapolis DATE: 12-7-93
TITLE / DATE	VERIFIED BY / DATE

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS JE. Grand Forks, N.D.
Source No. 2 Boiler / Stack
Test 2 Run C Date 11/1/93
Stack dimen. 105.5 IN.
Dry bulb 39? °F Wet bulb ___ °F
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.
Barometric pressure 29.30 in Hg
Static pressure -.35 in WC
Operators M. Kaehlon & D. Despain
Pitot No. 23V-4 C_p .84



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 3.5 in.		Time start: 0920 hrs	
A-1	.021	2.22	5.72		
2	.067	7.07	10.57		
3	.118	12.45	15.95		
4	.177	18.67	22.17		
5	.250	26.38	29.88		
6	.356	37.56	41.06		
B-1					
2					
3					
4					
5					
6					
C-1					
2					
3					
4					
5					
6					
D-1					
2					
3					
4					
5					
6					
Temp. meas. device & S/N: PDT-19 / TC				Time end: 0925 hrs	

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

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ADS / E. Grand Forks, MN Date 11-11-93 Test 2 Run 1
Source No. 2 Boiler / stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 6000

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	570	497	73
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1535	1520	15
Total			88

Integrated Gas Sampling Data:

Bag Pump No. 29A Box No. 2 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 0830 (HRS) Time end: 0947 (HRS)
Sampling rate: 400 cc/min Operator: M. Kaehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS / E. Grand Forks, MN
Source No. 2 Boiler / Stack
Date 11-11-93 Test 2 Run 1

Operators M. Kuehler + D. Deegan
Meter Box No. 9 ΔH 1.74 1N WC
Calibration coeff. 1.0042

Pitot No. 23V-4 Cp .84
Bar. Press. 29.30 inHg H2O 8 %
Nozzle No. B-5 Nozzle Dia .302 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas In	Gas Out	Oxygen (v/v)
	0830	844.50											
A-6	2.5	846.23	.33	1.45	6.20	5	381	263	235	36	67	65	8.6
5	5	847.99	.34	1.49	7.95	5	391				68	65	7.2
4	2.5	849.88	.37	1.62	9.76	5	396	260	247	36	71	66	7.4
3	10	851.63	.35	1.54	1.54	5	391				73	67	6.8
2	12.5	853.35	.35	1.55	3.32	5	388	264	255	36	74	67	6.8
1	15	855.08	.36	1.60	5.14	5	386				76	68	7.5
B-6	17.5	856.92	.34	1.52	6.90	5	386	257	261	36	74	69	7.3
5	20	858.82	.42	1.89	8.87	6	391				78	71	7.3
4	22.5	860.80	.41	1.97	0.83	6	374	254	258	37	81	72	7.1
3	25	862.84	.43	1.97	2.85	7	374				82	72	7.0
2	27.5	864.85	.45	2.07	4.92	7	370	257	260	37	84	74	7.4
1	30	866.90	.43	1.99	6.96	7	368				84	74	7.3
C-6	32.5	868.49	.24	1.11	8.48	4	369	255	263	37	82	75	6.8
5	35	870.02	.25	1.16	0.03	4	366				83	75	6.9
4	37.5	871.68	.31	1.45	1.77	5	360	252	259	37	85	76	7.3
3	40	873.40	.29	1.35	3.45	5	364				86	77	7.2
2	42.5	875.02	.25	1.16	5.01	4	367	249	264	37	86	77	6.9
1	45	876.44	.19	.89	6.38	3	360				86	78	6.8
D-6	47.5	877.99	.26	1.19	7.96	4	385	254	261	37	93	78	6.9
5	50	879.63	.28	1.27	9.59	4	386				85	78	6.9
4	52.5	881.24	.27	1.23	1.20	4	382	250	259	38	88	80	6.8
3	55	882.79	.28	1.28	2.84	4	388				88	80	7.0
2	57.5	884.29	.22	1.02	4.30	4	377	253	255	38	88	80	7.1
1	60	885.80	.23	1.08	5.81	4	363				88	80	6.8
	(0947)												
	θ = 60	Vm = 41.30		ΔH 1.45							Avg. = 72.1		

C-33

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ACS / E. Grand Forks, MN Date 11-11-93 Test 2 Run 2
Source No. 2 Boiler / Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 6001

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	576	503	73
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1414	1400	14
Total			87

Integrated Gas Sampling Data:

Bag Pump No. 294 Box No. 2 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 1011 (HRS) Time end: 1124 (HRS)
Sampling rate: 400 cc/min Operator: M. Kaebler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

INTERPOLL LABORATORIES — METHOD 5 FIELD DATA SHEET

Job ACS / E. Grand Forks, MN
Source No. 2 Boiler / Stack
Date 11-11-93 Test 2 Run 2

Operators M. Kuehler + D. Dexpen
Meter Box No. 9 ΔH 1.74 1N WC
Calculated coeff.: 1.0042

Pitot No. 23V-4 Cp .84
Bar. Press. 29.55 inHg H2O .94 x
Nozzle No. B-5 Nozzle Dia .352 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dry. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x/y)
	1011	886.10											
D-6	2.5	887.60	.26	1.15	7.64	3.5	385	244	263	38	81	79	8.2
5	5	889.21	.28	1.25	9.25	4	381				84	80	6.8
4	7.5	890.93	.26	1.17	0.82	4	373	249	260	39	85	80	6.7
3	10	892.45	.28	1.27	2.46	4	367				87	81	6.8
2	12.5	893.95	.24	1.09	3.98	3.5	369	249	265	40	87	81	6.8
1	15	895.56	.25	1.14	5.53	4	365				89	82	7.6
C-6	17.5	897.14	.26	1.17	7.10	4	384	254	259	39	87	82	7.4
5	20	898.37	.27	1.22	9.29	4	375				89	82	7.6
4	22.5	900.35	.27	1.24	0.32	4	363	257	255	39	90	83	7.2
3	25	901.91	.25	1.14	1.87	4	370				91	83	7.2
2	27.5	903.42	.24	1.09	3.39	3.5	375	252	258	40	91	84	7.1
1	30	904.98	.26	1.17	4.97	4	380				91	84	7.0
B-6	32.5	906.71	.31	1.42	6.71	4.5	370	249	257	40	89	84	6.9
5	35	908.58	.39	1.75	8.63	6	382				93	85	7.0
4	37.5	910.67	.44	2.01	0.70	7	372	245	263	41	93	85	6.9
3	40	912.71	.43	1.96	2.73	7	375				95	86	6.6
2	42.5	914.82	.48	2.21	4.90	8	367	247	265	41	95	86	7.2
1	45	916.80	.38	1.75	6.93	7	370				96	87	6.9
A-6	47.5	918.45	.27	1.20	8.43	5	400	250	260	41	91	85	6.8
5	50	920.35	.41	1.82	0.39	6	398				93	86	6.5
4	52.5	922.44	.46	2.05	2.47	7	386	255	258	41	93	86	6.9
3	55	924.38	.38	1.70	4.37	6.5	393				94	86	6.7
2	57.5	926.45	.43	1.98	6.42	7	369	255	255	41	94	86	6.9
1	60	928.41	.42	1.97	8.47	7	352				94	87	6.6
	(1124)												
	θ = 60	Vm = 42.31		ΔH = 1.50							Avg. = 87.1		

C-35

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ACS / E. Grand Forks, MN Date 11-11-93 Test 2 Run 3
Source No. 2 Boiler / Stack No. of traverse points 24
Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 6016

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	579	489	90
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1550	1535	15
Total			105

Integrated Gas Sampling Data:

Bag Pump No. 294 Box No. 2 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 0 cc/min at 20 in. Hg.
Time start: 1146 (HRS) Time end: _____ (HRS)
Sampling rate: 400 cc/min Operator: M. Kaehler
S/N of O_2 Analyzer used to monitor train outlet: 9

CF-023

S-0046RR

INTERPOLL LABORATORIES, METHOD 5 FIELD DATA SHEET

Job ACS / E. Grand Forks, MN
Source No. 2 Boiler / Stack
Date 11-11-93 Test 2 Run 3

Operators M. Kuehler & D. Dzapan
Meter Box No. 4 ΔH 1.24 IN WC
Counter coeff. 1.0042

Pitot No. 23V-4 Cp .84
Bar. Press. 29.30 inHg H2O 9.2 X
Nozzle No. B-5 Nozzle Dia .307 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (xv/v)
	1146	928.70											
A-6	2.5	930.60	.36	1.64	0.56	5	377	247	263	42	82	81	6.6
5	5	932.57	.42	1.88	2.54	6	382				84	81	6.9
4	7.5	934.60	.44	1.96	4.56	6	388	244	265	42	87	82	7.0
3	10	936.64	.47	2.09	6.66	7	392				88	82	7.1
2	12.5	938.62	.43	1.93	8.67	6	386	243	260	40	88	82	7.1
1	15	940.56	.41	1.86	0.65	6	374				89	82	6.4
B-6	17.5	942.40	.30	1.37	2.35	5	373	249	258	40	85	80	6.5
5	20	944.37	.40	1.82	4.30	6	368				88	81	6.5
4	22.5	946.30	.45	2.04	6.38	7	375	253	264	40	88	81	6.9
3	25	948.38	.44	1.99	8.42	7	378				89	81	6.7
2	27.5	950.38	.43	1.95	0.44	7	376	256	257	42	90	82	6.1
1	30	952.44	.42	1.95	2.47	7	360				90	82	6.7
C-6	32.5	953.95	.23	1.06	3.97	4	366	252	261	43	86	81	6.8
5	35	955.54	.24	1.09	5.48	4	372				87	80	7.2
4	37.5	957.14	.26	1.18	7.06	4	374	257	264	43	88	81	7.3
3	40	958.76	.28	1.27	8.69	4	377				88	81	7.1
2	42.5	960.42	.29	1.32	0.36	4	372	255	266	41	88	80	7.0
1	45	961.93	.23	1.06	1.85	4	364				88	80	7.2
D-6	47.5	963.38	.23	1.05	3.34	3.5	370	250	262	41	86	80	7.1
5	50	964.86	.24	1.10	4.86	4	363				87	80	7.2
4	52.5	966.42	.27	1.23	6.47	4	367	253	258	42	88	80	7.0
3	55	968.03	.25	1.14	8.03	4	367				87	80	7.0
2	57.5	969.57	.24	1.10	9.55	4	362	249	255	42	97	79	7.3
1	60	970.06	.21	.97	0.98	3	357				87	79	6.9
	(157)												
	θ = 60	Vm = 42.36		ΔH 1.50							Avg. = 86/80		

C-37

Interpoll Laboratories
(612)786-6020

EPA Method 7 Sample Collection
Field Data Sheet

Job ACS / E6F Date 11-11-93 Bar. Pressure 29.30 IN.HG.

Test Location No. 2 Boiler Fuel Type Bituminous Coal Sample Train No. Blue

Stack Technician DD Pump No. 293

No.	Test Run Point	Flask No.	Time (HRS)	Vacuum (IN.HG.)	Flask Temp. (°F)	Leak Rate <0.4 IN.HG./MIN.
1	7-1-A	43	0937	27.00	45	☑ Yes ☐ No
2	7-1-B	44	0900	27.10	45	☒ Yes ☐ No
3	7-1-C	45	0930	27.25	45	☒ Yes ☐ No
4	7-1-D	46	0941	27.15	45	☒ Yes ☐ No
5	7-2-A	47	1017	27.10	50	☒ Yes ☐ No
6	7-2-B	48	1026	27.20	50	☒ Yes ☐ No
7	7-2-C	49	1052	27.20	50	☒ Yes ☐ No
8	7-2-D	50	1100	27.25	50	☒ Yes ☐ No
9	7-3-A	51	1200	27.25	60	☒ Yes ☐ No
10	7-3-B	52	1217	27.20	60	☒ Yes ☐ No
11	7-3-C	53	1230	27.30	60	☒ Yes ☐ No
12	7-3-D	54	1250	27.30	60	☒ Yes ☐ No
13						☐ Yes ☐ No
14						☐ Yes ☐ No
15						☐ Yes ☐ No
16						☐ Yes ☐ No
17						☐ Yes ☐ No
18						☐ Yes ☐ No
19						☐ Yes ☐ No
20						☐ Yes ☐ No
21						☐ Yes ☐ No
22						☐ Yes ☐ No
23						☐ Yes ☐ No
24						☐ Yes ☐ No
25						☐ Yes ☐ No
26						☐ Yes ☐ No
27						☐ Yes ☐ No

S-263R

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS - EGF

Source A - BOP DUCT STACK

Test 2 Run C Date 11-11-93

Stack dimen. 417 IN.

Dry bulb 217 °F Wet bulb 165 °F

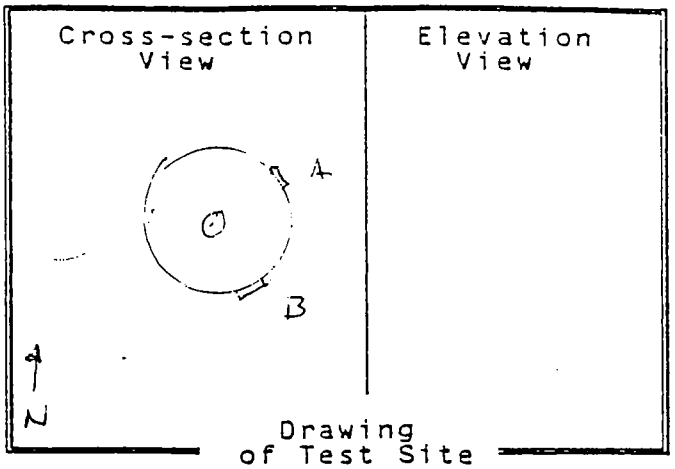
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.30 in Hg

Static pressure -.70 in WC

Operators SCB + JB

Pitot No. 22V-6 C_p .840



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: 4.25 in.		Time start: 0916 hrs	
A	1	.021	1.00	Need to	.70	217
	2	.067	3.15	ADD BURNER	1.05	217
	3	.119	5.55	LENGTH	1.25	216
	4	.177	8.32		1.45	217
	5	.250	11.75		1.40	217
	6	.356	16.73		1.42	217
	7	.644	30.27		.78	217
	8	.750	35.25		.60	216
	9	.823	38.68		.58	216
	10	.882	41.45		.54	216
	11	.933	43.85		.53	216
	12	.979	46.00		.53	216
B	1					216
	2					217
	3					217
	4	PTS	101-59			217
	5	ACFM	73 444			217
	6	DSCFM	39,196			217
	7					217
	8					217
	9					216
	10					216
	11					216
	12					217
Temp. meas. device & S/N: DIGITAL TC - PDT39					Time end: 0940 hrs	

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

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ACS - EGF Date 11-1-03 Test 9 Run 1
Source P. 200' DIGHT STACK No. of traverse points 24
Method 1-5, 6 Filter holder: GLASS Filter type: GLASS FIBER

Sample Train Leak Check:

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

Particulate Catch Data:

No.s of filters used: 6014

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	715	384	331
Impinger No. 2	748	495	253
Impinger No. 3	535	502	33
Condenser			
Desiccant	1417	1400	17
Total			634

Integrated Gas Sampling Data:

Bag Pump No. 22A Box No. 24 Bag No. 1
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 0930 (HRS) Time end: 1037 (HRS)
Sampling rate: 400 cc/min Operator: SCB
S/N of O_2 Analyzer used to monitor train outlet: 8

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S-0046RR

INTERPOLL LABORATORIES (METHOD 5 FIELD DATA SHEET

Job ACS - ECEF
Source A. PULP DRYER STACK
Date 11-11-93 Test 2 Run 1

Operators SB + JB
Meter Box No. 4 ΔH 1.93 IN WC
Coefficient coeff. .9985

Pitot No. 32V-6 Cp .840
Bar. Press. 25.30 inHg H2O 39 x
Nozzle No. 4-4 Nozzle Dia .253 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1430)	(887.65)											
A-12	2.5	889.06	.58	0.98	9.00	4	213	251	259	44	70	70	15.1
11	5	890.47	.62	1.05	0.40	4	215	251	258	44	75	71	14.9
10	7.5	891.83	.64	1.09	1.83	4	215	252	258	44	79	72	14.9
9	10	893.11	.60	.96	3.13	4	215	252	258	40	80	72	14.4
8	12.5	894.69	.68	1.14	4.61	4	215	251	258	40	81	72	14.4
7	15	896.49	.87	1.49	6.29	4	215	251	258	40	81	73	14.4
6	17.5	898.47	1.50	2.56	8.48	10	215	254	257	40	81	73	14.5
5	20	900.65	1.48	2.53	0.67	10	214	256	257	40	80	73	14.6
4	22.5	902.67	1.22	2.09	2.65	10	214	254	257	40	81	74	14.2
3	25	904.55	1.05	1.81	4.50	9	212	211	257	40	82	74	14.3
2	27.5	906.10	.89	1.53	6.19	8	215	253	257	40	83	74	14.0
1	30	907.83	.80	1.37	7.81	7	215	253	257	40	81	74	14.0
B-12	32.5	909.62	1.02	1.75	9.63	7	212	253	257	40	82	75	13.7
11	35	911.52	1.10	1.90	1.52	9	212	253	257	41	82	75	13.7
10	37.5	913.52	1.30	2.23	3.57	10	214	253	257	41	82	75	13.7
9	40	915.67	1.31	2.25	5.63	11	214	251	257	39	82	76	13.7
8	42.5	917.65	1.25	2.15	7.65	12	214	251	256	38	82	76	13.6
7	45	919.69	1.22	2.09	9.64	12	215	251	256	38	81	76	13.8
6	47.5	921.58	1.17	2.01	1.59	11	214	254	257	38	81	76	13.7
5	50	923.58	1.25	2.14	3.60	10	215	256	257	38	81	76	14.0
4	52.5	925.52	1.22	2.09	5.59	11	214	256	258	38	81	76	14.2
3	55	927.60	1.22	2.09	7.58	11	214	257	258	38	80	75	14.1
2	57.5	929.42	1.10	1.89	9.47	9	214	251	258	38	80	75	14.0
1	60	931.14	.87	1.49	1.14	7	215	258	258	38	81	76	14.0
	(1037)												
	θ = 60	Vm = 1709		ΔH = 1.78							Avg. = 77.2		

13.49

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AES-ECR Date 11-11-93 Test 9 Run 2
Source A-PUMP DIGGE STACK No. of traverse points 24
Method 17, 6 Filter holder: GLASS Filter type: GLASS FIBER

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0.00 cfm at 15 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5999

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	624	500	124
Impinger No. 2	729	298	431
Impinger No. 3	521	501	20
Condenser			
Desiccant	1490	1477	13
Total			588

Integrated Gas Sampling Data:

Bag Pump No. 224 Box No. 24 Bag No. 2
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 1100 (HRS) Time end: 1208 (HRS)
Sampling rate: 400 cc/min Operator: SCD
S/N of O_2 Analyzer used to monitor train outlet: 8

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INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: DCS - ECF
Source: B - DUCO DRYER STACK
Date: 11-11-92 Test 9 Run 2

Operators: KB & JB
Meter Box No: 83 ΔH: 1.80 TM WC
Counter coeff: .9925

Pitot No. 2DV-6 Cp .840
Bar. Press: 29.93 inHg H2O x
Nozzle No. 4-27 Nozzle Dia .257 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Cyc/In	Cyc/Out	Oxygen (xx/x)
	(1100)	(686.53)											
B-12	2.5	688.30	1.00	1.59	8.32	4	215	250	252	42	74	73	15.0
11	5	690.14	1.06	1.65	0.66	5	215	251	250	41	79	73	14.4
10	7.5	692.00	1.21	1.91	2.13	6	215	252	250	41	79	74	14.4
9	10	694.09	1.35	2.15	4.21	8	215	252	250	40	80	75	14.3
8	12.5	696.09	1.22	1.94	6.20	8	215	251	254	42	81	75	14.5
7	15	698.16	1.30	2.07	8.25	9	215	251	249	42	82	75	14.9
6	17.5	700.27	1.20	1.91	0.23	9	215	250	248	41	82	75	14.7
5	20	702.09	1.20	1.91	2.70	7	215	251	251	41	82	76	14.6
4	22.5	704.21	1.21	1.93	4.19	8	215	250	256	40	82	76	14.7
3	25	706.17	1.12	1.79	6.10	8	214	251	254	39	83	76	14.6
2	27.5	707.90	1.05	1.68	7.95	7	213	250	254	35	82	76	14.3
1	30	709.40	.67	1.07	9.43	6	214	251	252	39	82	76	14.2
A-12	32.5	710.80	.58	.93	6.81	4	214	250	251	38	82	75	14.0
11	35	712.31	.64	1.02	2.26	4	214	251	252	40	81	76	14.2
10	37.5	713.82	.67	1.07	3.74	4	213	252	251	40	82	76	14.4
9	40	715.15	.67	1.07	5.21	4	215	252	251	42	84	77	14.2
8	42.5	716.71	.68	1.09	6.72	5	215	251	254	38	83	77	14.4
7	45	718.86	1.40	2.24	8.85	8	215	256	254	38	83	77	14.3
6	47.5	721.02	1.42	2.27	1.00	10	215	254	251	37	84	78	14.5
5	50	723.20	1.50	2.41	3.22	10	214	254	251	37	84	78	14.1
4	52.5	725.30	1.40	2.25	5.34	10	214	254	252	38	85	78	14.2
3	55	727.42	1.26	2.01	7.39	11	214	254	252	37	85	78	14.1
2	57.5	729.36	1.20	1.93	9.38	10	214	254	254	37	84	76	14.
1	60	731.27	1.09	1.75	1.27	9	214	254	252	37	84	76	14.
	(1208)												
	θ = 60	Vm = 44.74		ΔH = 1.71							Avg. = 76.8		

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job WPS - EGF
Source D - Duct Exhaust Stack
Method 1-5/6 Filter holder: Glass
Date 11-11-03 Test 9 Run 3
No. of traverse points 24
Filter type: Glass Fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0.00 cfm at 15 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5953

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	534	505	29
Impinger No. 2	703	498	205
Impinger No. 3	639	299	340
Condenser			
Desiccant	1429	1417	12
Total			586

Integrated Gas Sampling Data:

Bag Pump No. 22A Box No. 24 Bag No. 3
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: 00 cc/min at 15 in. Hg.
Time start: 1230 (HRS) Time end: 1334 (HRS)
Sampling rate: 400 cc/min Operator: SCB
S/N of O_2 Analyzer used to monitor train outlet: 8

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INTERPOLL LABORATORIES PA METHOD 5 FIELD DATA SHEET

Job AIS - EGF
Source A - DUCT DIAM STACK
Date 11-4-97 Test 9 Run 3

Operators S-13 + 073
Meter Box No. 5 ΔH 1.50 TN WC
Counter coeff. 0.995

Pitot No. 020.4 Cp .840
Bar. Press. 29.30 inHg H2O 5% X
Nozzle No. 4.4 Nozzle Dia .251 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (xv/v)
	(1230)	(731.75)											
A-12	2.5	733.11	.58	.93	3.12	3	215	251	244	48	72	71	14.5
11	5	734.53	.68	1.07	4.59	3	214	251	248	47	75	72	14.5
10	7.5	736.14	.75	1.19	6.14	4	215	252	247	46	75	72	14.3
9	10	737.70	.68	1.07	7.62	4	215	252	247	44	76	72	14.3
8	12.5	739.10	.74	1.17	9.16	4	215	251	250	42	77	73	14.4
7	15	740.80	.83	1.32	0.79	5	215	251	251	42	77	73	14.4
6	17.5	742.90	1.40	2.22	2.91	7	215	252	251	42	77	72	14.4
5	20	744.92	1.35	2.14	4.99	8	215	251	252	41	79	73	14.4
4	22.5	747.02	1.40	2.22	7.11	8	215	250	251	40	79	73	14.5
3	25	749.04	1.35	2.14	9.19	8	215	251	252	40	79	73	14.6
2	27.5	751.15	1.22	1.94	1.17	8	215	252	254	42	79	73	14.7
1	30	753.60	1.08	1.72	3.84	7	215	251	255	50	79	74	14.9
B-12	32.5	754.80	1.00	1.59	4.84	7	215	251	254	52	79	73	14.2
11	35	756.80	1.06	1.68	6.68	7	215	250	251	51	79	73	14.1
10	37.5	758.77	1.28	2.03	8.71	7	215	251	254	50	79	73	14.1
9	40	760.82	1.35	2.14	0.80	9	215	251	250	49	78	73	14.2
8	42.5	762.82	1.30	2.06	2.84	9	215	251	256	48	79	73	14.2
7	45	764.80	1.25	1.98	4.85	9	218	251	254	47	78	73	14.3
6	47.5	766.79	1.22	1.94	6.83	8	215	251	250	42	78	73	14.4
5	50	768.77	1.15	1.82	8.75	9	215	250	252	43	79	73	14.4
4	52.5	770.75	1.20	1.91	0.71	9	215	251	254	40	78	73	14.3
3	55	772.72	1.25	1.98	2.72	9	215	254	256	40	78	73	14.2
2	57.5	774.90	1.20	1.90	4.68	9	218	254	254	38	78	73	14.3
1	60	776.74	.75	1.19	6.24	7	214	252	254	38	78	73	14.3
	(1334)												
	θ = 60	Vm = 44.99		ΔH = 1.72							Avg. = 78		

C-45

S-0037R

Interpoll Laboratories
(612)786-6020

EPA Method 7 Sample Collection
Field Data Sheet

Job ACS / Grand Forks Date 11-11-93 Bar. Pressure 29.30 IN.HG.
Test Location A Pulp Dryer Stack Fuel Type COAL Sample Train No. 1
Technician JEFF BERGSTROM Pump No. 9

No.	Test Run Point	Flask No.	Time (HRS)	Vacuum (IN.HG.)	Flask Temp. (°F)	Leak Rate <0.4 IN.HG./MIN.
1	9-1-1	13	0930	27.65	40	☒ Yes ☐ No
2	9-1-2	14	0945	27.60	40	☒ Yes ☐ No
3	9-1-3	15	1000	27.65	38	☒ Yes ☐ No
4	9-1-1A	16	1015	27.60	37	☒ Yes ☐ No
5	9-2-2	17	1105	27.65	37	☒ Yes ☐ No
6	9-2-3	18	1130	27.65	38	☒ Yes ☐ No
7	9-2-1	73	1145	27.60	40	☒ Yes ☐ No
8	9-2-2A	74	1155	27.60	39	☒ Yes ☐ No
9	9-3-3	75	1235	27.60	40	☒ Yes ☐ No
10	9-3-1	76	1255	27.60	40	☒ Yes ☐ No
11	9-3-2	77	1310	27.60	40	☒ Yes ☐ No
12	9-3-3	78	1325	27.60	40	☒ Yes ☐ No
13						☐ Yes ☐ No
14						☐ Yes ☐ No
15						☐ Yes ☐ No
16						☐ Yes ☐ No
17						☐ Yes ☐ No
18						☐ Yes ☐ No
19						☐ Yes ☐ No
20						☐ Yes ☐ No
21						☐ Yes ☐ No
22						☐ Yes ☐ No
23						☐ Yes ☐ No
24						☐ Yes ☐ No
25						☐ Yes ☐ No
26						☐ Yes ☐ No
27						☐ Yes ☐ No

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS -EGF

Source A - Recycle Duct

Test 9 Run 0 Date 11-11-93

Stack dimen. 18 IN.

Dry bulb 215 °F Wet bulb 163 °F

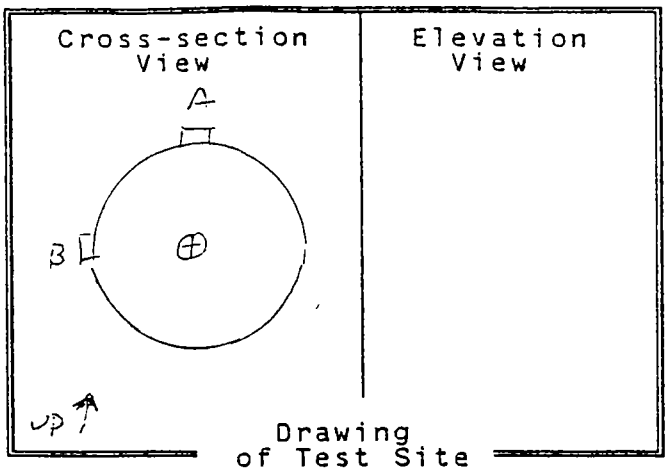
Manometer: ■ Reg. □ Exp. □ Elec.

Barometric pressure 29.30 in Hg

Static pressure -2.80 in WC

Operators SCD & JB

Pitot No. PV-4 C_p .840



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: 4.00 in.		Time start: 0835 hrs	
A	1	.032	0.58	4.58	.37	215
	2	.105	1.89	5.89	.49	215
	3	.194	3.49	7.49	.56	215
	4	.323	5.81	9.81	.56	215
	5	.677	12.19	16.19	.56	215
	6	.806	14.51	18.51	.55	215
	7	.895	16.11	20.11	.56	215
	8	.968	17.42	21.42	.55	215
B	1				.32	214
	2				.37	214
	3				.48	215
	4				.53	215
	5				.56	215
	6				.61	215
	7				.62	215
	8				.58	215
		FT/Sec	48.57			
		ACFM	5150			
		DSCFM	3742			

Temp. meas. device & S/N: DIGITAL TC-PDT-09

Time end: 0943 hrs

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

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS - FGF

Source A - Hopper Filter Inlet

Test 9 Run 0 Date 11-11-93

Stack dimen. 20 IN.

Dry bulb 217 °F Wet bulb 164 °F

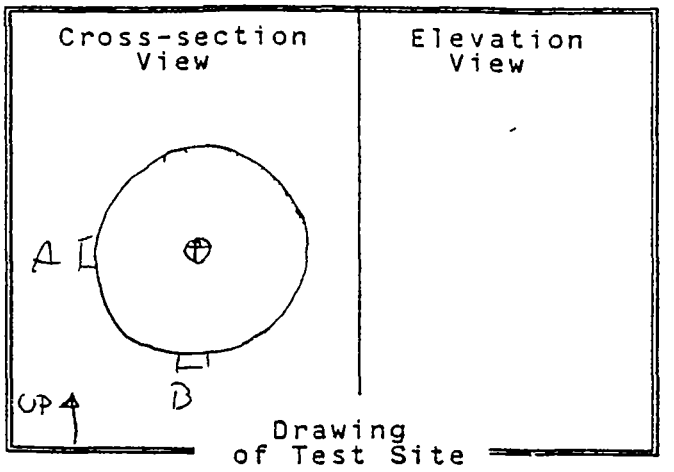
Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

Barometric pressure 29.30 in Hg

Static pressure + 0.28 in WC

Operators SLB + JB

Pitot No: 22U-4 C_p .840



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: 4.00 in.		Time start: 0830 hrs	
A	1	.032	0.64	4.64	1.12	217
	2	.105	2.10	6.10	1.52	217
	3	.194	3.88	7.88	1.00	217
	4	.323	6.46	10.46	1.02	217
	5	.677	13.54	17.54	1.45	217
	6	.806	16.12	20.12	1.45	217
	7	.895	17.90	21.90	1.65	217
	8	.968	19.36	23.36	1.40	214
B	9				1.60	217
	2				1.70	217
	3				1.65	217
	4				1.65	217
	5				1.25	217
	6				1.30	216
	7				1.60	216
	8				1.50	216
		FT/sec	80.49			
		ACFM	10,536			
		DSCFM	5,637			
Temp. meas. device & S/N: DIGITAL T/C - PDT29					Time end: 0935 hrs	

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

S-3921

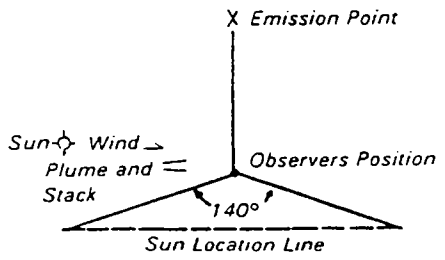
Interpoll Laboratories
(612)786-6020

Visible Emissions Form Test 9

SOURCE NAME: A. C. S. / East Grand Forks	OBSERVATION DATE: 11-11-93	START TIME / STOP TIME
ADDRESS		
CITY: East Grand Forks	STATE: MN	ZIP
PHONE	SOURCE ID NUMBER	
PROCESS EQUIPMENT: 4 Pulf Dryer Stack	OPERATING MODE	
CONTROL EQUIPMENT	OPERATING MODE	
DESCRIBE EMISSION POINT: START	STOP	
HEIGHT ABOVE GROUND LEVEL: START	STOP	HEIGHT RELATIVE TO OBSERVER: START STOP
DISTANCE FROM OBSERVER: START	STOP	DIRECTION FROM OBSERVER: START STOP
DESCRIBE EMISSIONS: START	STOP	
EMISSION COLOR: START	STOP	PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☐ YES ☐		IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START	STOP	
DESCRIBE BACKGROUND: START	STOP	
BACKGROUND COLOR: START	STOP	SKY CONDITIONS: START STOP
WIND SPEED: START	STOP	WIND DIRECTION: START STOP
AMBIENT TEMP. START	STOP	WET BULB TEMP. / RH, percent

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

Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD

NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS: MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): Jeff Bergstrom

COMMENTS: Could not read interference from other sources

OBSERVER'S SIGNATURE: [signature] DATE: 11-11-93

ORGANIZATION: Interpoll Lab

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE

CERTIFIED BY: EIA Minnesota DATE: 12-7-93

TITLE DATE

VERIFIED BY DATE

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job MCS SDF

Source COAL PELLET COOLER STACK

Test 10 Run 2 Date 11-7-95

Stack dimen. 23" IN.

Dry bulb ____ °F Wet bulb ____ °F

Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

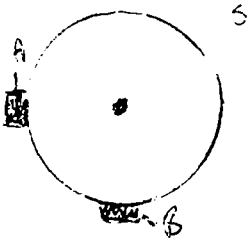
Barometric pressure 29.24 in Hg

Static pressure -.46 in WC

Operators MIKE BRENNAN + KEN NUESSMEIER

Pitot No. 24V4A' C_p .84

Cross-section View



Elevation View

SEE ATTACHED DRAWING

Drawing of Test Site

Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length: 4 in.		Time start: 1400 hrs	
A	1	.044	1.012	5.01	1.30	126
	2	.146	3.358	7.358	1.80	129
	3	.296	6.808	10.808	2.00	130
	4	.704	16.19	20.19	2.10	128
	5	.854	19.64	23.64	2.10	128
	6	.956	21.988	25.988	2.00	125
B	1				1.50	130
	2				1.80	131
	3				2.10	132
	4				2.00	132
	5				1.90	129
	6				1.60	130
Temp. meas. device & S/N:					Time end: 1708 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AMERICAN CRYSTAL SUGAR Date 11/11/93 Test 10 Run 1
Source EAST PELLET COOLER STACK No. of traverse points 12
Method 5 Filter holder: GLASS Filter type: 4"6.F.

Sample Train Leak Check:

Pretest: ☒ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .000 cfm at 15 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1, 5912

Recovery solvent(s)
☒ acetone PROBE + NOZZLE
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: D. BRENNAN

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	530	505	25.0
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1440	1428	12.0
Total			37.0

Integrated Gas Sampling Data: AMBIENT AIR

Bag Pump No. —— Box No. —— Bag No. ——
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: —— cc/min at —— in. Hg.
Time start: 1426 (1418) (HRS) Time end: (1517) (HRS)
Sampling rate: —— cc/min Operator: D. BRENNAN
S/N of O_2 Analyzer used to monitor train outlet: 12

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: AMERICAN CRYSTAL SUGAR
Source: EAST PELLET COOLER STACK
Date: 11/18/83 Test 10 Run 1

Operators: BRENNAN + NUISSMIER
Meter Box No: 6 ΔH 1.97 IN WC
Coefficient coeff.: .9965

Pitot No. 240-4 Cp .84
Bar. Press. 29.26 inHg H2O 3.5 x
Nozzle No. 1-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (x v/v)
	(1415)	807.800											
A-6	5	811.95	2.00	2.44	2.01	8.5	136	231	240	37	64	61	20.9
5	10	816.29	2.05	2.50	6.26	9.0	133	229	236	36	64	61	1
4	15	820.58	2.05	2.51	0.52	9.0	131	232	239	36	67	63	A
3	20	824.70	1.95	2.38	4.68	8.5	135	230	240	36	66	64	M
2	25	828.67	1.75	2.13	8.61	7.0	138	230	242	36	65	62	B
1	30	832.042	1.30	1.60	2.03	6.0	129	229	239	36	66	63	I
B-6	35	835.75	1.55	1.90	5.74	7.0	134	233	243	36	64	62	S
5	40	839.87	1.90	2.31	9.83	9.0	137	231	240	36	69	65	N
4	45	844.08	1.95	2.39	4.00	9.5	136	235	245	38	69	65	T
3	50	848.34	2.05	2.51	8.28	9.5	136	230	242	39	70	65	
2	55	852.51	2.00	2.45	2.51	9.5	137	234	249	42	72	68	A
1	60	856.038	1.35	1.68	6.02	6.5	131	232	254	43	70	67	I
													R
	(1517)												
	θ = 60	Vs = 48.238		ΔH 2.23							Avg. = 65.5		

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AMERICAN CRYSTAL SUGAR Date 11/11/93 Test 10 Run 2
Source EAST PELLET COOLER STACK No. of traverse points 12
Method 5 Filter holder: GLASS Filter type: 4"6.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac)
Postest: .006 cfm at 16 in. Hg. (vac)

Particulate Catch Data:

No.s of filters used: 1 (5913)

Recovery solvent(s)
☒ acetone PROBE & NOZZLE
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: D. BRENNAN

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	532	505	27.0
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1500	1486	14.0
Total			41.0

Integrated Gas Sampling Data: AMBIENT AIR

Bag Pump No. ——— Box No. ——— Bag No. ———
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: ——— cc/min at ——— in. Hg.
Time start: 1545 (HRS) Time end: 1618 (HRS)
Sampling rate: ——— cc/min Operator: D. BRENNAN
S/N of O_2 Analyzer used to monitor train outlet: 12

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: AMERICAN CRYSTAL SUGAR
Source: EAST PELLET COOLER STACK
Date: 11/11/93 Test 10 Run 2

Operators: BRENNAN & NUESSMEIER
Meter Box No. 6 ΔH 1.97 IN WC
Counter coeff.: .9965

Pitot No. 24V-10 Cp .84
Bar. Press. 29.20 inHg H2O 3.5 x
Nozzle No. 1-3 Nozzle Dia .192 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (xx/v)
	(1545)	856.300											
A- 6	5	860.37	1.95	2.37	0.45	8.0	135	236	231	44	73	71	20.9
5	10	864.75	2.10	2.59	4.82	9.0	134	233	239	43	74	71	1
4	15	869.05	2.05	2.53	9.13	9.0	135	232	240	42	73	71	A
3	20	873.44	2.10	2.58	3.49	9.0	136	229	238	39	71	70	M
2	25	877.53	1.85	2.23	7.59	8.0	132	231	243	36	69	69	B
1	30	881.078	1.30	1.62	1.03	6.0	127	233	241	34	69	69	1
B- 6	35	884.72	1.45	1.78	4.65	8.0	134	229	238	34	72	71	E
5	40	888.76	1.90	2.34	8.80	9.0	135	232	240	35	74	71	N
4	45	892.90	1.90	2.35	2.96	9.0	134	230	237	35	74	71	T
3	50	897.23	2.05	2.52	7.27	12.0	137	234	237	39	73	71	
2	55	901.52	1.95	2.40	1.47	11.5	136	233	235	42	74	71	A
1	60	905.384	1.65	2.05	5.36	9.5	130	229	231	46	74	71	1
													R
	(1648)												
	θ = 60	Vm = 49.084		ΔH 2.28							Avg. = 71.5		

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AMERICAN CRYSTAL SUGAR Date 11/11/93 Test 10 Run 3
Source EAST PELLET COOLER STACK No. of traverse points 12
Method 5 Filter holder: GLASS Filter type: 4"G.F.

Sample Train Leak Check:

Pretest: ☒ 0.02 cfm at 15 in. Hg. (vac)
Postest: .000 cfm at 15 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1, 5914

Recovery solvent(s)
☒ acetone PROBE + NOZZLE
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: D. BRENNAN

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	530	507	23.0
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1453	1440	13.0
Total			36.0

Integrated Gas Sampling Data: AMBIENT AIR

Bag Pump No. —— Box No. —— Bag No. ——

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

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

Time start: 1705 (HRS) Time end: 1808 (HRS)

Sampling rate: —— cc/min Operator: D. BRENNAN

S/N of O_2 Analyzer used to monitor train outlet: 12

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: AMERICAN CRYSTAL SUGAR — Operators: BROWN & NUESSMEIER — Pitot No. 24V-4 — Cp .84
Source: EAST PELLET COOLER STACK — Meter Box No. 6 — ΔH 1.97 IN WC — Bar. Press. 29.26 inHg — H2O 4 x
Date 11/14/83 — Test 10 — Run 3 — Coefficient coeff. .9965 — Nozzle No. 1-3 — Nozzle Dia .183 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1705)	905.800											
A- 6	5	910.15	2.00	2.49	0.08	8.5	126	231	246	43	70	70	20.9
5	10	914.48	2.05	2.55	4.40	9.0	125	228	243	42	69	69	1
4	15	918.86	2.15	2.66	8.81	9.5	127	230	237	42	69	69	A
3	20	923.10	2.10	2.60	3.17	9.5	126	229	238	45	70	70	M
2	25	927.24	1.85	2.30	7.28	7.5	125	234	241	46	74	73	B
1	30	931.018	1.45	1.85	0.98	6.5	116	232	245	44	75	72	1
B- 6	35	934.87	1.60	2.01	4.83	7.5	124	229	248	44	70	69	E
5	40	938.91	1.85	2.27	8.92	8.0	132	232	251	43	72	72	N
4	45	943.24	2.00	2.46	3.18	9.0	133	235	256	43	75	73	T
3	50	947.66	2.15	2.64	7.59	9.5	136	231	260	40	75	73	
2	55	951.70	1.80	2.23	1.66	8.5	131	229	259	40	75	72	A
1	60	955.306	1.40	1.74	5.25	7.0	129	230	254	38	76	73	1
													R
	(1808)												
	θ = 60	Vm = 49.506		ΔH = 2.32							Avg. = 71.8		

INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job ACS - ECyF

Source PELLET LOADOUT STACK

Test 12 Run 0 Date 11-1-93

Stack dimen. 25.75 IN.

Dry bulb 37 °F Wet bulb ___ °F

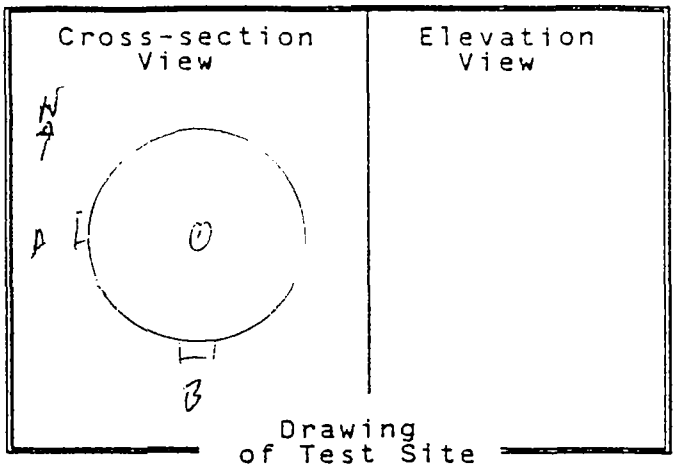
Manometer: ☐ Reg. ☒ Exp. ☐ Elec.

Barometric pressure 29.30 in Hg

Static pressure -.062 in WC

Operators SLB - JB

Pitot No. 22V-2.5 C_p .840



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: 3.25 in.		Time start: 1430 hrs	
A	1	.032	.82 - 1.00	4.07 - 4.25	.140	37
	2	.105	2.70	5.55	.137	37
	3	.194	5.00	8.25	.120	37
	4	.323	8.32	11.57	.120	37
	5	.677	17.43	20.68	.140	37
	6	.806	20.75	24.00	.145	37
	7	.895	23.05	26.30	.144	37
	8	.968	24.93 - 24.75	28.18 - 28.00	.142	37
B	1				.110	37
	2				.125	37
	3				.136	37
	4				.130	37
	5				.100	37
	6				.100	37
	7				.110	37
	8				.130	37
Temp. meas. device & S/N: DIGITAL T/C - PDT29					Time end: 1438 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AQS - FGF Date 11/11/93 Test #2 Run 1
Source Pellet LOADOUT STACK No. of traverse points 16
Method 17 Filter holder: Glass Filter type: Glass Fiber

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0.00 cfm at 6 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5964

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

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

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	498	498	0
Impinger No. 3			
Condenser			
Desiccant	1489	1476	13
Total			13

Integrated Gas Sampling Data: (AMBIENT AIR)

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

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

CF-023

S-0046RR

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS - ECTF
Source PELLET LOADOUT STACK
Date 11-11-93 Test 2 Run 1

Operators SLB + JB
Meter Box No. 8 ΔH@ 1.80 IN WC
Coefficient 1.9936

Pitot No. 22V-3.5 Cp .840
Bar. Press. 27.30 inHg H2O 1 X
Nozzle No. C-5 Nozzle Dia .310 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas In	Gas Out	Oxygen (xx/v)
	(1445)	(778.00)											
A - 8	1	780.50	.132	1.34	0.59	4	35	251	260	40	61	61	20.9
7	8	783.10	.126	1.29	3.15	4	36	254	261	40	61	56	
6	12	785.56	.115	1.17	5.58	4	37	252	262	40	66	59	A
5	16	787.92	.104	1.07	7.91	4	37	254	260	40	74	62	M
4	20	790.25	.131	1.36	0.55	4	37	251	260	40	72	64	B
3	24	793.10	.135	1.40	3.23	4	37	251	258	42	76	60	L
2	28	795.90	.130	1.35	5.86	4	37	251	257	41	74	65	E
1	32	798.40	.120	1.26	8.40	4	35	251	257	40	78	67	N
B - 8	36	801.18	.142	1.49	1.18	4	35	251	254	38	79	70	T
7	40	803.84	.132	1.39	3.84	4	35	250	253	38	77	68	
6	44	806.42	.110	1.15	6.31	4	37	250	251	40	81	70	A
5	48	808.82	.105	1.11	8.70	4	37	251	250	42	84	72	L
4	52	811.33	.125	1.32	1.33	4	37	251	252	41	85	74	R
3	56	814.00	.136	1.45	4.08	4	37	250	251	40	84	64	
2	60	816.72	.124	1.32	6.71	4	38	251	252	40	86	74	↓
1	64	819.19	.111	1.18	9.19	4	38	257	250	40	86	76	
	(1549)												
	θ = 64	Vm = 41.19		ΔH = 1.29							Avg. = 71.6		

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INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AQS-FGT Date 11-11-93 Test 12 Run 2
Source PELLET LOADOUT STACK No. of traverse points 16
Method 17 Filter holder: 4" GLASS Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: ☒ 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: 0.00 cfm at 10 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 5954

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

No. of probe wash bottles: 1
Sample recovered by: SLB & JB

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	507	507	0
Impinger No. 3			
Condenser			
Desiccant	1420	1411	9
Total			9

Integrated Gas Sampling Data: (AMBIENT AIR)

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

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

CF-023

CF-011

INTERPOLL LABORATORIES — A METHOD 5 FIELD DATA SHEET

Job ACS - EGT — Operators SCT + JB — Pitot No. 22V-25 — Cp .84

Source DELUXE LOADOUT STACK — Meter Box No. 8 ΔH 1.80 TN WC — Bar. Press. 27.70 inHg H2O .5 X

Date 11-11-93 — Test 12 — Run 2 — Counter coeff. .9975 — Nozzle No. 4-5 — Nozzle Dia .270 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1620)	(819.40)											
B - 8	4	822.29	.150	1.58	2.21	4	37	252	249	40	80	75	20.9
7	8	824.98	.132	1.41	4.96	4	36	251	249	40	84	76	
6	12	825.47	.112	1.20	5.47	4	36	251	252	40	87	78	A
5	16	829.98	.112	1.21	9.99	4	36	251	251	40	90	80	M
4	20	832.69	.130	1.41	2.72	4	36	251	254	41	90	80	B
3	24	835.40	.131	1.42	5.46	4	36	251	255	41	92	82	I
2	28	838.60	.125	1.36	8.14	4	34	251	254	40	94	84	E
1	32	840.70	.102	1.11	0.58	4	36	250	251	40	95	85	N
A - 8	36	843.40	.135	1.48	3.39	4	35	251	252	40	94	84	T
7	40	846.15	.132	1.44	6.16	4	35	251	252	38	92	84	
6	44	848.79	.112	1.22	8.71	4	35	252	252	38	92	84	A
5	48	851.27	.106	1.16	1.19	4	35	252	251	38	92	84	I
4	52	854.00	.137	1.50	4.01	4	34	251	251	38	92	85	R
3	56	856.70	.134	1.49	6.82	4	34	250	250	37	91	84	
2	60	859.47	.125	1.36	9.52	4	34	249	254	37	91	84	
1	64	862.11	.116	1.27	2.11	3	34	249	254	37	92	84	
	(1721)												
	θ = 1.7	Vm = 42.71		ΔH = 1.35							Avg. = 86.2		

C-61

S 000220

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AES - EGF Date 11-11-93 Test 12 Run 3
Source Pellet Loadout Stack No. of traverse points 16
Method 1-5 Filter holder: 4" Glass Filter type: 4" Q.F.

Sample Train Leak Check:

Pretest: ≤ 0.02 cfm at 15 in. Hg. (vac) ■
Postest: 0.00 cfm at 8 in. Hg. (vac) ■

Particulate Catch Data:

No.s of filters used: 5966

Recovery solvent(s)
■ acetone
□ other(s)

No. of probe wash bottles: 1
Sample recovered by: SCB & JB

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2	510	510	0
Impinger No. 3			
Condenser			
Desiccant	1497	1489	8
Total			8

Integrated Gas Sampling Data: (N/A AMBIENT AIR)

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

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

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

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

Sampling rate: _____ cc/min Operator: _____

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

CF-023

INTERPOLL LABORATORIES PA METHOD 5 FIELD DATA SHEET

Job ACS - ECyF
Source POWDER LOADOUT STACK
Date 11-11-93 Test 12 Run 3

Operators SCJ & TCB
Meter Box No. 8 ΔH@ 1.80 IN WC
Barometer coeff. 9975

Pitot No. PV-2.5 Cp .840
Bar. Press. 27.30 inHg H2O .5 x
Nozzle No. C-5 Nozzle Dia .251 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (x v/v)
	(1755)	(860.40)											
A-8	4	865.20	.132	1.44	5.14	4	34	251	252	40	79	79	20.9
7	8	867.92	.132	1.43	7.89	4	31	251	254	39	82	80	
6	12	870.64	.117	1.27	0.47	4	31	252	254	40	86	81	A
5	16	872.92	.110	1.20	2.99	4	31	252	254	41	87	81	M
4	20	875.75	.135	1.47	5.78	4	31	251	255	41	90	84	B
3	24	878.50	.135	1.48	8.58	4	31	251	255	40	94	86	I
2	28	881.40	.130	1.43	1.35	4	31	251	251	40	94	87	E
1	32	883.92	.115	1.27	3.96	4	31	250	256	34	95	87	N
B-8	36	886.92	.150	1.64	6.93	5	31	250	256	38	96	87	T
7	40	889.80	.148	1.64	9.89	4	31	249	256	38	92	89	
6	44	892.72	.135	1.49	2.70	4	31	248	257	38	94	85	A
5	48	895.27	.110	1.21	5.25	4	31	247	257	37	97	89	I
4	52	897.62	.100	1.11	7.69	4	31	247	257	37	100	91	R
3	56	900.44	.125	1.39	0.43	4	31	246	257	37	98	90	
2	60	903.28	.135	1.50	3.27	4	31	246	256	37	97	90	
1	64	906.06	.130	1.44	6.06	4	31	246	256	34	96	89	
	(1856)												
	θ = 64	V_m = 4366		ΔH 1.40							Avg. = 89.1		

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INTERPOLL LABORATORIES - EPA METHOD 2 FIELD DATA SHEET

Job AES / EBF

Source WEST PELLET COOLER STACK

Test 13 Run C Date 11/11/93

Stack dimen. 23" IN.

Dry bulb ____ °F Wet bulb ____ °F

Manometer: ☒ Reg. ☐ Exp. ☐ Elec.

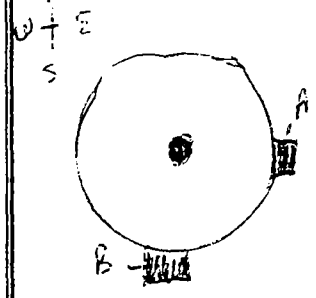
Barometric pressure 29.26 in Hg

Static pressure -.50 in WC

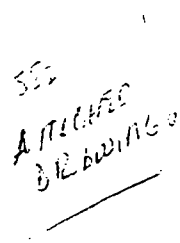
Operators DUKE BIENNIAN & KEN MOSSMILLER

Pitot No. 248-41 C_p .84

Cross-section View



Elevation View



Drawing of Test Site

Traverse Point No.		Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length: 4 in.		Time start: 0905 hrs	
A	1	.044	1.012	5.01	2.35	130
	2	.146	3.358	7.358	2.40	132
	3	.296	6.808	10.808	2.35	133
	4	.704	16.19	20.19	2.15	135
	5	.854	19.64	23.64	1.60	132
	6	.956	21.988	25.988	1.65	130
B	1				2.10	135
	2				2.25	134
	3				2.40	136
	4				2.50	136
	5				1.80	135
	6				1.70	132
Temp. meas. device & S/N: PDT-23					Time end: 0915 hrs	

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

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job ACS / EGF Date 11/11/93 Test 13 Run 1
Source ~~EGF~~ WEST FLUE GAS STACK No. of traverse points 12
Method 5 Filter holder: GLASS Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: ☒ 0.02 cfm at 15 in. Hg. (vac)
Postest: .000 cfm at 15 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1, 6007

Recovery solvent(s)
☒ acetone PROBE & NOZZLE
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: D. BRENNAN

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	517	500	17.0
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1478	1462	16.0
Total			33.0

Integrated Gas Sampling Data: AMBIENT AIR

Bag Pump No. — Box No. — Bag No. —
Bag Material: 5-layer Aluminized Tedlar Size: 44 L
Pretest leak check: — cc/min at — in. Hg.
Time start: 0935 (HRS) Time end: 1038 (HRS)
Sampling rate: — cc/min Operator: D BRENNAN
S/N of O_2 Analyzer used to monitor train outlet: 12

CF-023

S-0046RR

CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: ACS/EGF
Source: WEST PELLET COOLER STACK
Date: 11/11/93 Test 13A Run 1

Operators: BRENNAN & NUESSMEIER
Meter Box No. 6 ΔH 1.97 IN WC
Calibration coeff.: .9965

Pitot No. 240-4 Cp .84
Bar. Press. 29.26 inHg H2O 5.0 x
Nozzle No. 1-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dev. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (x v/v)
	(0935)	649.300											
A- 6	5	653.10	1.60	1.98	3.09	7.0	133	246	230	43	54	50	20.9
5	10	656.92	1.60	1.93	6.80	7.0	132	242	228	43	56	50	ı
4	15	661.30	2.30	2.80	1.25	9.5	129	243	233	42	59	50	A
3	20	665.92	2.45	2.98	5.84	11.0	133	240	231	42	61	52	m
2	25	670.56	2.45	2.97	0.45	11.0	134	238	232	42	66	58	B
1	30	674.943	2.20	2.71	4.89	10.0	132	244	229	40	69	62	ı
B- 6	35	678.93	1.75	2.17	8.84	8.0	133	251	230	40	65	61	E
5	40	682.93	1.80	2.24	2.87	8.0	126	258	228	37	67	61	N
4	45	687.75	2.50	3.20	7.68	11.5	110	262	235	39	70	63	T
3	50	692.58	2.50	3.24	2.54	11.5	106	259	247	43	70	64	
2	55	697.12	2.15	2.77	7.03	10.5	111	255	244	45	69	64	A
1	60	701.405	2.00	2.57	1.36	9.0	112	256	251	47	70	64	ı
													R
	(1038)												
	θ = 60	Vm = 52.105		ΔH 2.63							Avg. =	61.4	

C-66

S-00378

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AMERICAN CRYSTAL SUGAR /E6F Date 11/11/93 Test 13 Run 2
Source WEST PELLET COOLER STACK No. of traverse points 12
Method 5 Filter holder: GLASS Filter type: 4" 6 F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .000 cfm at 15 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1 (GLASS)

Recovery solvent(s)
☒ acetone PROBE & NOZZLE
☐ other(s)

No. of probe wash bottles: 1
Sample recovered by: D. BRENNAN

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	527	500	27.0
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1428	1413	15.0
Total			42.0

Integrated Gas Sampling Data: AMBIENT AIR

Bag Pump No. — Box No. — Bag No. —

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

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

Time start: 1103 (HRS) Time end: 1205 (HRS)

Sampling rate: — cc/min Operator: D. BRENNAN

S/N of O_2 Analyzer used to monitor train outlet: 12

CF-023

CF-011

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job ACS / E&F
Source WEST PELLET COOLER STACK
Date 11/11/93 Test 13 Run 2

Operators BRENNAN & NUSSMEIER
Meter Box No. 6 ΔH 1.97 IN WC
Cosmeter coeff: .9965

Pitot No. 240-4' Cp .84
Bar. Press. 29.20 inHg H2O 3 X
Nozzle No. 1-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (x y/v)
	(1103)	702.300											
A- 6	5	706.04	1.60	1.93	6.03	7.0	143	230	236	48	62	60	20.9
5	10	709.91	1.65	1.99	9.83	7.0	143	239	231	47	63	60	1
4	15	714.28	2.20	2.65	4.20	9.5	145	241	231	49	66	62	A
3	20	718.86	2.40	2.90	8.78	10.5	145	238	229	50	67	62	m
2	25	723.55	2.45	2.98	3.43	10.5	141	240	230	50	67	62	B
1	30	727.998	2.30	2.81	7.95	10.0	138	242	232	48	67	62	1
B- 6	35	731.70	1.50	1.85	1.62	7.0	133	248	235	45	66	63	E
5	40	735.87	2.00	2.46	5.85	9.0	135	257	232	44	68	64	N
4	45	740.39	2.35	2.90	0.44	10.5	134	263	231	43	70	64	T
3	50	745.09	2.45	3.03	5.14	12.0	135	261	229	42	69	64	
2	55	749.87	2.45	3.03	9.83	12.0	134	262	230	41	67	64	A
1	60	754.482	2.40	2.96	4.47	10.5	134	263	229	40	66	63	1
													R
	(1205)												
	θ = 60	Vm = 52.182		ΔH 2.63							Avg. = 64.5		

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S 00370

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job AMERICAN CRYSTAL SUGAR / EGF Date 11/11/93 Test 13 Run 3
Source WEST BOILER ROOM STACK No. of traverse points 12
Method 5 Filter holder: GLASS Filter type: 4" G.F.

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg. (vac) ☒
Postest: .000 cfm at 16 in. Hg. (vac) ☒

Particulate Catch Data:

No.s of filters used: 1 / 6009

Recovery solvent(s)
☒ acetone PROBE + NOZZLE
☐ other(s) _____

No. of probe wash bottles: 1
Sample recovered by: D. BRENNAN

Condensate Data:

Item	Weight(g)		
	Final	Tare	Difference
Impinger No. 1	523	501	22.0
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant	1486	1478	8.0
Total			30.0

Integrated Gas Sampling Data: AMBIENT AIR

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

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

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

Time start: 1245 (HRS) Time end: 1348 (HRS)

Sampling rate: ____ cc/min Operator: D. BRENNAN

S/N of O_2 Analyzer used to monitor train outlet: 12

CF-023

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

CF-011

Job: AMERICAN CRYSTAL SUGAR
Source: WEST PELLET COOLER STACK
Date: 11/19/93 Test 13 Run 3

Operators: BRENNAN & NUESSMEIER
Meter Box No: C ΔH 1.97 IN WC
Coeff: .9965

Pitot No. 24V-4 Cp .84
Bar. Press. 29.26 inHg H2O .4 x
Nozzle No. 1-3 Nozzle Dia .188 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Orifice Meter (inWC)	Dec. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impy.	Gas/In	Gas/Out	Oxygen (xx/xx)
	(1245)	754.900											
A- 6	5	758.83	1.75	2.12	8.82	7.0	135	229	246	44	58	58	20.9
5	10	763.15	2.15	2.57	3.11	9.0	134	232	251	42	61	59	1
4	15	767.54	2.20	2.64	7.47	9.0	134	230	245	43	64	60	A
3	20	772.10	2.40	2.89	2.04	10.0	134	233	246	42	65	61	M
2	25	776.67	2.40	2.87	6.60	10.0	139	231	241	43	66	63	B
1	30	781.082	2.25	2.73	1.05	9.5	134	229	239	43	66	62	1
B- 6	35	785.29	2.60	2.42	5.24	9.0	135	228	236	40	65	62	E
5	40	789.75	2.25	2.72	9.67	9.5	135	234	241	39	67	63	N
4	45	794.34	2.40	2.90	4.26	10.0	135	233	245	39	69	64	T
3	50	798.85	2.35	2.85	8.82	10.0	136	230	246	41	68	64	
2	55	803.40	2.30	2.78	3.31	10.0	137	232	243	42	70	65	A
1	60	807.482	1.95	2.38	7.48	9.0	133	230	237	42	69	65	1
													R
	(1348)												
	θ = 60	Vm = 52.582		ΔH 2.66							Avg. =	63.9	

C-70

S-00378

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Jeffery Bergstrom

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

Thomas Lore
President

Vice President

David B. Savage, Jr.
Program Manager

9407444
Certificate Number

Minneapolis
Location

October 7, 1993
Date of Issue

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APPENDIX D

INTERPOLL LABORATORIES ANALYTICAL DATA

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Interpoll Laboratories
(612) 786-6020

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Orsat Analysis

Job ACS EGF
Team Leader SLB
ate Submitted 11-12-93
est No. 9
Date of Analysis 11-12-93

Source A Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO$_2$ %v/v Dry	Conc. O$_2$ %v/v Dry	F_o
			Zero Pt.	After CO$_2$	After O$_2$			
9/1	1636-109	1	0.00	6.60	20.20	6.60	13.60	1.11
		2	0.00	6.60	20.20	6.60	13.60	1.11
	☑ B ☐ F	Avg				6.60	13.60	
9/2	-110	1	0.00	6.30	20.10	6.30	13.80	1.13
		2	0.00	6.30	20.10	6.30	13.80	1.13
	☑ B ☐ F	Avg				6.30	13.80	
9/3	-111	1	0.00	6.30	20.20	6.30	13.90	1.11
		2	0.00	6.30	20.20	6.30	13.90	1.11
	☑ B ☐ F	Avg				6.30	13.90	
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						

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

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

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

EPA Method 3 Guidelines

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

Interpoll Laboratories
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EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job ACS EGF
eam Leader SCB
ate Submitted 11-12-93
Test No. 1
Date of Analysis 11-12-93

Source C. Pulp Dryer
Test Site Stack
Date of Test 11-9-93
No. of Runs Completed 3
Technician C. Helgeson

Test/ Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO_2 %v/v Dry	Conc. O_2 %v/v Dry	F_o
			Zero Pt.	After CO_2	After O_2			
1/1	1636-85	1	0.00	5.20	20.40	5.20	15.20	1.10
		2	0.00	5.20	20.40	5.20	15.20	1.10
	☑ B ☐ F	Avg				5.20	15.20	
1/2	-86	1	0.00	5.60	20.30	5.60	14.70	1.11
		2	0.00	5.60	20.30	5.60	14.70	1.11
	☑ B ☐ F	Avg				5.60	14.70	
1/3	-87	1	0.00	5.60	20.30	5.60	14.70	1.11
		2	0.00	5.60	20.30	5.60	14.70	1.11
	☑ B ☐ F	Avg				5.60	14.70	
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						

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

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

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

EPA Method 3 Guidelines

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

Interpoll Laboratories
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EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job ACS / E. Grand Forks, MN
eam Leader M. Kaehler
ate Submitted 11-11-93
Test No. 7
Date of Analysis 11-11-93

Source No. 2 Boiler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
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			
7/1		1	0.00	11.80	19.40	11.80	7.60	1.130
		2	0.00	11.80	19.40	11.80	7.60	1.130
	☑ B ☐ F	Avg				11.80	7.60	
7/2		1	0.00	12.10	19.60	12.10	7.50	1.110
		2	0.00	12.10	19.60	12.10	7.50	1.110
	☑ B ☐ F	Avg				12.10	7.50	
7/3		1	0.00	12.30	19.50	12.30	7.20	1.110
		2	0.00	12.30	19.50	12.30	7.20	1.110
	☒ B ☐ F	Avg				12.30	7.20	
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						

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

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

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

EPA Method 3 Guidelines

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

INTERPOLL L. ORATORIES
(612) 786-6020

S-305(n)
(9/90)

EPA Method 10 NDIR Analysis

Job Name ACS EGF
Source B Pulp Dryer
Date of Analysis 11-12-93
Technician C. Helgeson

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

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

Pretest Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm	T.C.Ox	0693-31
Upscale gas:	40 ppm	40 ppm	Scott	ALM030329
Upscale gas:	144 ppm	144 ppm	National	CC114302
Upscale gas:	ppm	ppm		

Post-test Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm	T.C.Ox	0693-31
Upscale gas:	40 ppm	40 ppm	Scott	ALM030329
Upscale gas:	144 ppm	144 ppm	National	CC114302
Upscale gas:	ppm	ppm		

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry)		
		Dilution Factor	Reading	Actual ppm
5/1	1636-97	5	150.9	750
5/2	-98	5	165.1	830
5/3	-99	5	117.0	590

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

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

INTERPOLL LABORATORIES
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S-305RR
(9/90)

EPA Method 10 NDIR Analysis

Job Name ACS / E. Grand Forks, MN
Source Nat'l Boiler / Stack
Date of Analysis 11-10-93
Technician Mark Gabbert

NDIR Analyzer:
- [x] Fugi ACS Model 3300
- [ ] Mon. Lab Model 8310
- [ ] Dasibi Model 3003

Range: 0 - 500 ppm
Flow rate: 1000 cc/min

Pretest Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	0 ppm	0 ppm		7WH-630672
Upscale gas:	144.8 ppm	142 ppm		CC-114302
Upscale gas:	312 ppm	317 ppm		CC-104767
Upscale gas:	ppm	ppm		

Post-test Calibration

	Conc.	Reading	Vendor	Cyl. Number
Zero gas:	ppm	ppm		
Upscale gas:	ppm	ppm		
Upscale gas:	ppm	ppm		
Upscale gas:	ppm	ppm		

Sample Description Test/Run	Sample Log Number	CO Conc. (ppm, Dry)		
		Dilution Factor	Reading	Actual ppm
2/4		1	319	319
2/5		1	336	336
2/6		1	330	330

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

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

Interpoll Laboratories
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EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader SCB
Date Submitted 11-12-93
Test No. 9
Date of Analysis 11-24-93

Source A Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 9 Run 1 Log Number 1636-103 Comments ____	Dish No. 61A Dish Tare Wt. 51.4730 g Dish+Sample Wt. 51.5067 g Sample Wt. 0.0337 g
2	Test 9 Run 2 Log Number -105 Comments ____	Dish No. 62 Dish Tare Wt. 50.8880 g Dish+Sample Wt. 50.4082 g Sample Wt. 0.0202 g
3	Test 9 Run 3 Log Number -107 Comments ____	Dish No. 65 Dish Tare Wt. 44.6566 g Dish+Sample Wt. 44.6734 g Sample Wt. 0.0168 g
4	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

Blank Solvent Wt. 0.0001 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0336	0.0201	0.0167	D-11	

LSC-03.GR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader SCB
Date Submitted 11-12-93
Test No. 9
Date of Analysis 11-23-93
Transport Leakage [X] None [ ] _____ ml

Source A - Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0	Test ____ Run 0 Field Blank Log Number ____ Vol. of Solvent ____ ml *Solvent Residue 4.0 ug/ml	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 9 Run 1 Vol. of Solvent 100 ml Log Number 1636-100P Comments ____	Dish No. 46 Dish Tare Wt. 45.4233 g Dish+Sample Wt. 45.4402 g Sample Wt. 0.0169 g
2	Test 9 Run 2 Vol. of Solvent 110 ml Log Number -101P Comments ____	Dish No. 47 Dish Tare Wt. 48.4658 g Dish+Sample Wt. 48.4863 g Sample Wt. 0.0205 g
3	Test 9 Run 3 Vol. of Solvent 100 ml Log Number - 102P Comments ____	Dish No. 48 Dish Tare Wt. 47.8872 g Dish+Sample Wt. 47.9087 g Sample Wt. 0.0215 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

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

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0165	0.0201	0.0211		

D-12

SC_011VD

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader SLP
Date Submitted 11-12-93
Test No. 9
Date of Analysis 11-24-93

Source A-Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
1	Test 9 Run 1 Log Number 1636-100F Comments ____	Filter No. 6014 Filter Type 4" GF Filter Tare Wt. .8867 g Filter+Sample Wt. 1.0951 g Sample Wt. 0.2084 g
2	Test 9 Run 2 Log Number ~101F Comments ____	Filter No. 9999 Filter Type 4" GF Filter Tare Wt. .8785 g Filter+Sample Wt. 1.0351 g Sample Wt. 0.1566 g
3	Test 9 Run 3 Log Number ~102F Comments ____	Filter No. 5953 Filter Type 4" GF Filter Tare Wt. .9287 g Filter+Sample Wt. 1.0998 g Sample Wt. 0.1711 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
	0.2084	0.1566	0.1711		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2585	0.1968	0.2089		

LSC-02PR

Interpoll Laboratories
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EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader SLB
Date Submitted 11-12-93
Test No. 5
Date of Analysis 11-24-93

Source B Pulp Dryer
Test Site Stack
Date of Test 11-10-93
No. of Runs Completed 3
Technician C. Helgeson

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 5 Run 1 Log Number 1636-91 Comments ____	Dish No. 50 Dish Tare Wt. 45.4661 g Dish+Sample Wt. 45.4838 g Sample Wt. 0.0177 g
2	Test 5 Run 2 Log Number -93 Comments ____	Dish No. 51 Dish Tare Wt. 48.8511 g Dish+Sample Wt. 48.8607 g Sample Wt. 0.0096 g
3	Test 5 Run 3 Log Number -95 Comments ____	Dish No. 61 Dish Tare Wt. 44.5905 g Dish+Sample Wt. 44.5973 g Sample Wt. 0.0068 g
4	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

Blank Solvent Wt. 0.0001g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0176	0.0095	0.0067	D-14	

LSC-03.G

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EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader SLB
Date Submitted 11-12-93
Test No. 5
Date of Analysis 11-23-93
Transport Leakage ☐ None ☐ _____ ml

Source B Pulp Dryer
Test Site Stack
Date of Test 11-10-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0	Test _____ Run 0 Field Blank Log Number _____ Vol. of Solvent _____ ml *Solvent Residue 4.0 ug/ml	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test 5 Run 1 Vol. of Solvent 85 ml Log Number 636-88P Comments _____	Dish No. 2 Dish Tare Wt. 46.2283 g Dish+Sample Wt. 46.2533 g Sample Wt. 0.0250 g
2	Test 5 Run 2 Vol. of Solvent 90 ml Log Number 89P Comments _____	Dish No. 3A Dish Tare Wt. 57.8074 g Dish+Sample Wt. 57.8493 g Sample Wt. 0.0419 g
3	Test 5 Run 3 Vol. of Solvent 105 ml Log Number -90 P Comments _____	Dish No. 3 Dish Tare Wt. 52.1207 g Dish+Sample Wt. 52.1372 g Sample Wt. 0.0165 g
4	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

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

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0247	0.0415	0.0161	D-15	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader SLB
Date Submitted 11-12-93
Test No. 5
Date of Analysis 11-22-93

Source B-Pulp Dryer
Test Site Stack
Date of Test 11-10-93
No. of Runs Completed 3
Technician C. Helgeson

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
1	Test 5 Run 1 Log Number 1636-88F Comments ____	Filter No. 6012 Filter Type 4"6F Filter Tare Wt. .8620 g Filter+Sample Wt. 1.0162 g Sample Wt. 0.1542 g
2	Test 5 Run 2 Log Number ~89F Comments ____	Filter No. 6013 Filter Type 4"6F Filter Tare Wt. .8546 g Filter+Sample Wt. 1.0379 g Sample Wt. 0.1833 g
3	Test 5 Run 3 Log Number ~90F Comments ____	Filter No. 5897 Filter Type 4"6F Filter Tare Wt. .8615 g Filter+Sample Wt. 1.0485 g Sample Wt. 0.1870 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
	0.1542	0.1833	0.1870		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1965	0.2343	0.2098		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader SCB
Date Submitted 11-12-93
Test No. 1
Date of Analysis 11-22-93

Source C Pulp Dryer
Test Site Stack
Date of Test 11-9-93
No. of Runs Completed 3
Technician C. Nelson

0	Test 1 Run 0 Field Blank Log Number 1636-77 Comments	Dish No. 152 Dish Tare Wt. 49.8054 g Dish+Sample Wt. 49.80 g Sample Wt. 0.0001 g
1	Test 1 Run 1 Log Number -79 Comments	Dish No. 158 Dish Tare Wt. 50.2229 g Dish+Sample Wt. 50.2473 g Sample Wt. 0.0244 g
2	Test 1 Run 2 Log Number -81 Comments	Dish No. 161 Dish Tare Wt. 49.1345 g Dish+Sample Wt. 49.1562 g Sample Wt. 0.0217 g
3	Test 1 Run 3 Log Number -83 Comments	Dish No. 175 Dish Tare Wt. 53.0298 g Dish+Sample Wt. 53.0491 g Sample Wt. 0.0193 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0001 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0243	0.0216	0.0192	D-17	

LSC-03.GR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader SLB
Date Submitted 11-12-93
Test No. 1
Date of Analysis 11-19-93

Source C Pulp Dryer
Test Site Stack
Date of Test 11-9-93
No. of Runs Completed 3
Technician C. Helgeson

	Test 1 Run 0 Field Blank Log Number 1636-73F Comments	Filter No. 5996 Filter Type 4"GF Filter Tare Wt. .8744 g Filter+Sample Wt. .8747 g Sample Wt. 0.0003 g
1	Test 1 Run 1 Log Number -74F Comments	Filter No. 5952 Filter Type 4"GF Filter Tare Wt. .9246 g Filter+Sample Wt. 1.0944 g Sample Wt. 0.1698 g
2	Test 1 Run 2 Log Number -75F Comments	Filter No. 5972 Filter Type 4"GF Filter Tare Wt. .9328 g Filter+Sample Wt. 1.1090 g Sample Wt. 0.1762 g
3	Test 1 Run 3 Log Number -76F Comments	Filter No. 6015 Filter Type 4"GF Filter Tare Wt. .8727 g Filter+Sample Wt. 1.0816 g Sample Wt. 0.2089 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
	0.1698	0.1762	0.2089		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2156	0.2231	0.2571		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job: ACS
Team Leader: mk
Date Submitted: 11-12-93
Test No.: 2
Date of Analysis: 11-22-93

Source: #1 Boiler
Test Site: Stack
Date of Test: 11-9-93
No. of Runs Completed: 3
Technician: C. Helgeson

0	Test 2 Run 0 Field Blank Log Number 1636-123I Comments	Dish No. 106 Dish Tare Wt. 43.0162 g Dish+Sample Wt. 43.0163 g Sample Wt. 0.0001 g
1	Test 2 Run 4 Log Number 1636-131I Comments	Dish No. 403 Dish Tare Wt. 47.0965 g Dish+Sample Wt. 47.0996 g Sample Wt. 0.0031 g
2	Test 2 Run 5 Log Number -132I Comments	Dish No. 409 Dish Tare Wt. 46.1900 g Dish+Sample Wt. 46.1922 g Sample Wt. 0.0022 g
3	Test 2 Run 6 Log Number -133I Comments	Dish No. 411 Dish Tare Wt. 46.6857 g Dish+Sample Wt. 46.6894 g Sample Wt. 0.0037 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0001 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0030	0.0021	0.0036	D-20	

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EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader MK
Date Submitted 11-12-93
Test No. 2
Date of Analysis 11-22-93
Transport Leakage (X) None ( ) _____ ml

Source #1 Boiler
Test Site Stack
Date of Test 11-9-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

	Test ____ Run 0	Dish No. ____
	Field Blank	Dish Tare Wt. ____ g
0	Log Number ____	Dish+Sample Wt. ____ g
	Vol. of Solvent ____ ml	Sample Wt. ____ g
	*Solvent Residue 4.0 ug/ml	
	Test 2 Run 4	Dish No. 504
1	Vol. of Solvent 180 ml	Dish Tare Wt. 47.6201 g
	Log Number 1636-131P	Dish+Sample Wt. 47.6866 g
	Comments ____	Sample Wt. 0.0665 g
	Test 2 Run 5	Dish No. 512
2	Vol. of Solvent 180 ml	Dish Tare Wt. 49.3558 g
	Log Number -132P	Dish+Sample Wt. 49.4131 g
	Comments ____	Sample Wt. 0.0573 g
	Test 2 Run 6	Dish No. 519
3	Vol. of Solvent 180 ml	Dish Tare Wt. 44.0516 g
	Log Number -133P	Dish+Sample Wt. 44.1470 g
	Comments ____	Sample Wt. 0.0954 g
	Test ____ Run ____	Dish No. ____
4	Vol. of Solvent ____ ml	Dish Tare Wt. ____ g
	Log Number ____	Dish+Sample Wt. ____ g
	Comments ____	Sample Wt. ____ g
	Test ____ Run ____	Dish No. ____
5	Vol. of Solvent ____ ml	Dish Tare Wt. ____ g
	Log Number ____	Dish+Sample Wt. ____ g
	Comments ____	Sample Wt. ____ g

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

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0658	0.0566	0.0947		

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EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader MK
Date Submitted 11-12-93
Test No. 2
Date of Analysis 11-23-93

Source #1 Boiler
Test Site Stack
Date of Test 11-9 93
No. of Runs Completed 3
Technician C. Helgeson

0	Test ___ Run 0 Field Blank Log Number ___ Comments ___	Filter No. ___ Filter Type ___ Filter Tare Wt. ___ g Filter+Sample Wt. ___ g Sample Wt. ___ g
1	Test 2 Run 4 Log Number 1636-131F Comments ___	Filter No. 5980 Filter Type 4"GF Filter Tare Wt. .8946 g Filter+Sample Wt. .9468 g Sample Wt. 0.0522 g
2	Test 2 Run 5 Log Number -132F Comments ___	Filter No. 5981 Filter Type 4"GF Filter Tare Wt. .8990 g Filter+Sample Wt. .9584 g Sample Wt. 0.0594 g
3	Test 2 Run 6 Log Number -133F Comments ___	Filter No. 5982 Filter Type 4"GF Filter Tare Wt. .8950 g Filter+Sample Wt. .9566 g Sample Wt. 0.0616 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
	0.0522	0.0594	0.0616		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1210	0.1181	0.1599		

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EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader MK
Date Submitted 11-12-93
Test No. 7
Date of Analysis 11-22-93

Source #2 Boiler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Nelson

0	Test 7 Run 0 Field Blank Log Number 1636 - 138 I Comments	Dish No. 206 Dish Tare Wt. 47.8179 g Dish+Sample Wt. 47.8180 g Sample Wt. 0.0001 g
1	Test 7 Run 1 Log Number - 139 I Comments	Dish No. 208 Dish Tare Wt. 52.7955 g Dish+Sample Wt. 72.7992 g Sample Wt. 0.0037 g
2	Test 7 Run 2 Log Number -140 I Comments	Dish No. 209 Dish Tare Wt. 43.2094 g Dish+Sample Wt. 43.2137 g Sample Wt. 0.0043 g
3	Test 7 Run 3 Log Number -141 I Comments	Dish No. 212 Dish Tare Wt. 50.3561 g Dish+Sample Wt. 50.3597 g Sample Wt. 0.0036 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0001 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0036	0.0042	0.0035	D-23	

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EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader MK
Date Submitted 11-12-93
Test No. 7
Date of Analysis 11-23-93
Transport Leakage ~~None~~ [ ] _____ ml

Source #2 Boiler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Nelson
Solvent Acetone

0	Test 7 Run 0 Field Blank Log Number 1636-138P Vol. of Solvent 100 ml *Solvent Residue 4.0 ug/ml	Dish No. 4 Dish Tare Wt. 47.3800 g Dish+Sample Wt. 47.3804 g Sample Wt. 0.0004 g
1	Test 7 Run 1 Vol. of Solvent 190 ml Log Number -139P Comments	Dish No. 5 Dish Tare Wt. 50.6831 g Dish+Sample Wt 50.7497 g Sample Wt. 0.0666 g
2	Test 7 Run 2 Vol. of Solvent 190 ml Log Number -140P Comments	Dish No. 13 Dish Tare Wt. 45.7202 g Dish+Sample Wt. 45.8044 g Sample Wt. 0.0842 g
3	Test 7 Run 3 Vol. of Solvent 220 ml Log Number -141P Comments	Dish No. 39 Dish Tare Wt. 49.4371 g Dish+Sample Wt. 49.5974 g Sample Wt. 0.1603 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue 4.0 ug/ml = [(Sample Wt. 0.0004 g)(10^6)]/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
	0.0658	0.0834	0.1594	D-24	

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EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader MK
Date Submitted 11-12-93
Test No. 7
Date of Analysis 11-23-93

Source #2 Boiler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

	Test 7 Run 0	Filter No.	5923
	Field Blank	Filter Type	4"6F
0	Log Number 1636 - 138F	Filter Tare Wt.	.9506 g
	Comments	Filter+Sample Wt.	.9506 g
		Sample Wt.	0.0000 g
	Test 7 Run 1	Filter No.	6000
	Log Number - 139F	Filter Type	4"6F
1	Comments	Filter Tare Wt.	.8700 g
		Filter+Sample Wt.	.9350 g
		Sample Wt.	0.0650 g
	Test 7 Run 2	Filter No.	6001
	Log Number - 140F	Filter Type	4"6F
2	Comments	Filter Tare Wt.	.8617 g
		Filter+Sample Wt.	.9237 g
		Sample Wt.	0.0620 g
	Test 7 Run 3	Filter No.	6016
	Log Number - 141F	Filter Type	4"6F
3	Comments	Filter Tare Wt.	.8814 g
		Filter+Sample Wt.	.9701 g
		Sample Wt.	0.0887 g
	Test ____ Run ____	Filter No.	
	Log Number	Filter Type	
4	Comments	Filter Tare Wt.	g
		Filter+Sample Wt.	g
		Sample Wt.	g
	Test ____ Run ____	Filter No.	
	Log Number	Filter Type	
5	Comments	Filter Tare Wt.	g
		Filter+Sample Wt.	g
		Sample Wt.	g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0650	0.0620	0.0887		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1344	0.1496	0.2516		

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EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader DB
Date Submitted 11-12-93
Test No. 10
Date of Analysis 11-29-95

Source East Pellet Cooler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C-Helgeso

0	Test 10 Run 0 Field Blank Log Number 1636-112I Comments	Dish No. 1 Dish Tare Wt. 51.9699 g Dish+Sample Wt. 51.9700 g Sample Wt. 0.0001 g
1	Test 10 Run 1 Log Number ~113 I Comments	Dish No. 6 Dish Tare Wt. 48.2706 g Dish+Sample Wt. 48.2735 g Sample Wt. 0.0029 g
2	Test 10 Run 2 Log Number ~114 I Comments	Dish No. 7 Dish Tare Wt. 50.0142 g Dish+Sample Wt. 50.0158 g Sample Wt. 0.0016 g
3	Test 10 Run 3 Log Number ~115 I Comments	Dish No. 12 Dish Tare Wt. 48.1484 g Dish+Sample Wt. 48.1501 g Sample Wt. 0.0017 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0001g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0028	0.0015	0.0016		

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EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader DD
Date Submitted 11-12-93
Test No. 10
Date of Analysis 11-24-93
Transport Leakage [X] None [ ] _____ ml

Source Cast Pellet Cooler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0	Test _____ Run 0 Field Blank Log Number _____ Vol. of Solvent _____ ml *Solvent Residue 4.0 ug/ml	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test 10 Run 1 Vol. of Solvent 200 ml Log Number 1636-113P Comments _____	Dish No. 66 Dish Tare Wt. 48.3080 g Dish+Sample Wt. 48.3793 g Sample Wt. 0.0713 g
2	Test 10 Run 2 Vol. of Solvent 175 ml Log Number -114P Comments _____	Dish No. 67 Dish Tare Wt. 44.5345 g Dish+Sample Wt. 44.6005 g Sample Wt. 0.0660 g
3	Test 10 Run 3 Vol. of Solvent 220 ml Log Number -115P Comments _____	Dish No. 84 Dish Tare Wt. 49.0995 g Dish+Sample Wt. 49.1734 g Sample Wt. 0.0739 g
4	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

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

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0705	0.0653	0.0730	D-27	

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EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader DB
Date Submitted 11-12-93
Test No. 10
Date of Analysis 11-24-93

Source East Pellet Cooler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

	Test 10 Run 0 Field Blank Log Number 1636-112F Comments	Filter No. 5868 Filter Type 4"6F Filter Tare Wt. .9304 g Filter+Sample Wt. .9304 g Sample Wt. 0.0000 g
1	Test 10 Run 1 Log Number -113F Comments	Filter No. 5912 Filter Type 4"6F Filter Tare Wt. .9423 g Filter+Sample Wt. .9711 g Sample Wt. 0.0288 g
2	Test 10 Run 2 Log Number -114F Comments	Filter No. 5913 Filter Type 4"6F Filter Tare Wt. .9410 g Filter+Sample Wt. .9884 g Sample Wt. 0.0474 g
3	Test 10 Run 3 Log Number -115F Comments	Filter No. 5914 Filter Type 4"6F Filter Tare Wt. .9534 g Filter+Sample Wt. .9800 g Sample Wt. 0.0266 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
	0.0288	0.0474	0.0266		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1021	0.1142	0.1012		

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EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader DB
Date Submitted 11-12-93
Test No. 13
Date of Analysis 11-29-93

Source West Pellet Cooler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

0	Test ___ Run 0 Field Blank Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
1	Test 13 Run 1 Log Number 1636- 120 I Comments ___	Dish No. 31 Dish Tare Wt. 45.2710 g Dish+Sample Wt. 45.2725 g Sample Wt. 0.0015 g
2	Test 13 Run 2 Log Number -121 I Comments ___	Dish No. 35 Dish Tare Wt. 51.0912 g Dish+Sample Wt. 51.0947 g Sample Wt. 0.0035 g
3	Test 13 Run 3 Log Number -122I Comments ___	Dish No. 36 Dish Tare Wt. 43.5635 g Dish+Sample Wt. 43.5657 g Sample Wt. 0.0022 g
4	Test ___ Run ___ Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g
5	Test ___ Run ___ Log Number ___ Comments ___	Dish No. ___ Dish Tare Wt. ___ g Dish+Sample Wt. ___ g Sample Wt. ___ g

Blank Solvent Wt. 0.0001 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0014	0.0034	0.0021	D-29	

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EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader DB
Date Submitted 11-12-93
Test No. 13
Date of Analysis 11-24-93
Transport Leakage [X] None [ ] _____ ml

Source West Pellet Cooler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0	Test 13 Run 0 Field Blank Log Number 1636-119P Vol. of Solvent 100 ml *Solvent Residue 4.0 ug/ml	Dish No. 102 Dish Tare Wt. 44.3246 g Dish+Sample Wt 44.3250 g Sample Wt. 0.0004 g
1	Test 13 Run 1 Vol. of Solvent 250 ml Log Number -120P Comments	Dish No. 110 Dish Tare Wt. 49.7362 g Dish+Sample Wt. 49.9663 g Sample Wt. 0.2301 g
2	Test 13 Run 2 Vol. of Solvent 175 ml Log Number -121P Comments	Dish No. 410 Dish Tare Wt. 50.5571 g Dish+Sample Wt 50.8166 g Sample Wt. 0.2595 g
3	Test 13 Run 3 Vol. of Solvent 220 ml Log Number -122P Comments	Dish No. 616 Dish Tare Wt. 50.9283 g Dish+Sample Wt. 51.1760 g Sample Wt. 0.2477 g
4	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

*Solvent Residue 4.0 ug/ml = [(Sample Wt. 0.0004 g)(10^6)]/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
	0.2291	0.2588	0.2468	D-30	

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EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader DB
Date Submitted 11-12-93
Test No. 13
Date of Analysis 11-26-93

Source West Pellet cooler
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgesen

	Test 13 Run 0 Field Blank Log Number 1636-119F Comments	Filter No. 5867 Filter Type 4"GF Filter Tare Wt. .9320 g Filter+Sample Wt. .9320 g Sample Wt. 0.0000 g
1	Test 13 Run 1 Log Number -120F Comments	Filter No. 6007 Filter Type 4"GF Filter Tare Wt. .8505 g Filter+Sample Wt. .9316 g Sample Wt. 0.0811 g
2	Test 13 Run 2 Log Number -121F Comments	Filter No. 6008 Filter Type 4"GF Filter Tare Wt. .8542 g Filter+Sample Wt. .9031 g Sample Wt. 0.0489 g
3	Test 13 Run 3 Log Number -122F Comments	Filter No. 6009 Filter Type 4"GF Filter Tare Wt. .8629 g Filter+Sample Wt. 1.0049 g Sample Wt. 0.1420 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
	0.0811	0.0489	0.1420		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.3116	0.3111	0.3909		

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EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS
Team Leader SCB
Date Submitted 11-12-93
Test No. 12
Date of Analysis 11-29-93

Source Pellet Loadout
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Helgeson

0	Test 12 Run 0 Field Blank Log Number 1636-119 I Comments	Dish No. 14 Dish Tare Wt. 47.6594 g Dish+Sample Wt. 47.6595 g Sample Wt. 0.0001 g
1	Test 12 Run 1 Log Number -116 I Comments	Dish No. 16 Dish Tare Wt. 52.8212 g Dish+Sample Wt. 52.8251 g Sample Wt. 0.0039 g
2	Test 12 Run 2 Log Number -117 I Comments	Dish No. 17 Dish Tare Wt. 48.3905 g Dish+Sample Wt. 48.3926 g Sample Wt. 0.0021 g
3	Test 12 Run 3 Log Number -118 I Comments	Dish No. 18 Dish Tare Wt. 49.9879 g Dish+Sample Wt. 49.9890 g Sample Wt. 0.0011 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0001 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0038	0.0020	0.0010	D-32	

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EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job ACS
Team Leader SCB
Date Submitted 11-12-93
Test No. 12
Date of Analysis 11-24-93
Transport Leakage [X] None [ ] _____ ml

Source Pellet Loadout
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Hellesen
Solvent Acetone

0	Test ____ Run 0 Field Blank Log Number ____ Vol. of Solvent ____ ml *Solvent Residue 4.0 ug/ml	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 12 Run 1 Vol. of Solvent 70 ml Log Number 1636-116P Comments ____	Dish No. 93 Dish Tare Wt. 53.9827 g Dish+Sample Wt. 53.9874 g Sample Wt. 0.0047 g
2	Test 12 Run 2 Vol. of Solvent 85 ml Log Number -117P Comments ____	Dish No. 93A Dish Tare Wt. 49.1988 g Dish+Sample Wt. 49.2011 g Sample Wt. 0.0023 g
3	Test 12 Run 3 Vol. of Solvent 65 ml Log Number -118P Comments ____	Dish No. 100 Dish Tare Wt. 45.9676 g Dish+Sample Wt. 45.9688 g Sample Wt. 0.0012 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

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

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0044	0.0020	0.0009	D-33	

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EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job ACS
Team Leader S-B
Date Submitted 11-12-93
Test No. 12
Date of Analysis 11-24-93

Source Pellet Loadout
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Hazelton

	Test ____ Run 0	Filter No. ____
	Field Blank	Filter Type ____
0	Log Number ____	Filter Tare Wt. ____ g
	Comments ____	Filter+Sample Wt. ____ g
	____	**Sample Wt.** ____ g
	Test 12 Run 1	Filter No. 5964
	Log Number 1636-116F	Filter Type 4"6F
1	Comments ____	Filter Tare Wt. .9323 g
	____	Filter+Sample Wt. .9328 g
	____	**Sample Wt.** 0.0005 g
	Test 12 Run 2	Filter No. 5954
	Log Number -117F	Filter Type 4"6F
2	Comments ____	Filter Tare Wt. .9447 g
	____	Filter+Sample Wt. .9453 g
	____	**Sample Wt.** 0.0006 g
	Test 12 Run 3	Filter No. 5966
	Log Number -118F	Filter Type 4"6F
3	Comments ____	Filter Tare Wt. .9301 g
	____	Filter+Sample Wt. .9310 g
	____	**Sample Wt.** 0.0009 g
	Test ____ Run ____	Filter No. ____
	Log Number ____	Filter Type ____
4	Comments ____	Filter Tare Wt. ____ g
	____	Filter+Sample Wt. ____ g
	____	**Sample Wt.** ____ g
	Test ____ Run ____	Filter No. ____
	Log Number ____	Filter Type ____
5	Comments ____	Filter Tare Wt. ____ g
	____	Filter+Sample Wt. ____ g
	____	**Sample Wt.** ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0005	0.0006	0.0009		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0097	0.0046	0.0028		

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EPA Method 6 Sulfur Dioxide Calculation Data Sheet[1]

Job ACS
Team leader SLB
Date submitted 11-12-93
Test Number 9
Date of analysis 11-24-93

Source A Pulp Dryer
Test Site Stack
Date of Test 11-11-93
No. of Runs Completed 3
Technician C. Hellyson

MEQ Calculation

$$MEQ = \frac{DF\ N\ (V_s - V_b)\ V_s}{V_a}$$

DF = Dilution Factor
N = Normality of Titrant
V_s = Volume of Titrant Sample (ml)
V_b = Volume of Titrant Blank (ml)
V_s = Final Volume of sample (ml)
V_a = Volume of Aliquot (ml)

Water Catch

Test 9 Run 1 MEQ = $\frac{(1.0)(.0100)(1.90-.15)(1010)}{(20.0)}$ = 0.884 MEQ

Test 9 Run 2 MEQ = $\frac{(1.0)(.0100)(1.75-.15)(1010)}{(20.0)}$ = 0.808 MEQ

Test 9 Run 3 MEQ = $\frac{(1.0)(.0100)(1.75-.15)(1010)}{(20.0)}$ = 0.808 MEQ

3% Peroxide Catch

Test 9 Run 1 MEQ = $\frac{(1.0)(.0100)(4.90-.15)(500)}{(20.0)}$ = 1.19 MEQ

Test 9 Run 2 MEQ = $\frac{(1.0)(.0100)(3.50-.15)(500)}{(20.0)}$ = 0.838 MEQ

Test 9 Run 3 MEQ = $\frac{(1.0)(.0100)(3.55-.15)(500)}{(20.0)}$ = 0.850 MEQ

Total MEQ Per Run:

Test 9 Run 1 = 2.07 MEQ
Test 9 Run 2 = 1.65 MEQ
Test 9 Run 3 = 1.66 MEQ

Comments: _____

1 Form to be used in conjunction with combination method 5 and 6 train.

S-421A

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EPA Method 6 Sulfur Dioxide Calculation Data Sheet[1]

Job ACS
Team leader SLB
Date submitted 11-12-93
Test Number 5
Date of analysis 11-19-93

Source B Pulp Dryer
Test Site Stack
Date of Test 11-10-93
No. of Runs Completed 3
Technician C. Helgeson

MEQ Calculation

$$MEQ = \frac{DF\ N\ (V_s - V_b)\ V_s}{V_a}$$

DF = Dilution Factor
N = Normality of Titrant
V_s = Volume of Titrant Sample (ml)
V_b = Volume of Titrant Blank (ml)
V_s = Final Volume of sample (ml)
V_a = Volume of Aliquot (ml)

Water Catch

Test 5 Run 1 MEQ = $\frac{(1.0)(.0100)(2.60-.15)(1010)}{(20.0)}$ = 1.24 MEQ

Test 5 Run 2 MEQ = $\frac{(1.0)(.0100)(2.40-.15)(1010)}{(20.0)}$ = 1.14 MEQ

Test 5 Run 3 MEQ = $\frac{(1.0)(.0100)(2.10-.15)(1010)}{(20.0)}$ = 0.985 MEQ

3% Peroxide Catch

Test 5 Run 1 MEQ = $\frac{(1.0)(.0100)(5.45-.15)(500)}{(20.0)}$ = 1.33 MEQ

Test 5 Run 2 MEQ = $\frac{(1.0)(.0100)(4.55-.15)(500)}{(20.0)}$ = 1.10 MEQ

Test 5 Run 3 MEQ = $\frac{(1.0)(.0100)(3.80-.15)(500)}{(20.0)}$ = 0.913 MEQ

Total MEQ Per Run:

Test 5 Run 1 = 2.57 MEQ
Test 5 Run 2 = 2.24 MEQ
Test 5 Run 3 = 1.90 MEQ

Comments:

1 Form to be used in conjunction with combination method 5 and 6 train.
S-421A

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EPA Method 6 Sulfur Dioxide Calculation Data Sheet[1]

Job ACS
Team leader SLB
Date submitted 11-12-93
Test Number 1
Date of analysis 11-19-93

Source C Pulp Dryer
Test Site Stack
Date of Test 11-9-93
No. of Runs Completed 3
Technician C. Helgeson

MEQ Calculation

$$MEQ = \frac{DF\ N\ (V_s - V_b)\ V_s}{V_a}$$

DF = Dilution Factor
N = Normality of Titrant
V_s = Volume of Titrant Sample (ml)
V_b = Volume of Titrant Blank (ml)
V_s = Final Volume of sample (ml)
V_a = Volume of Aliquot (ml)

Water Catch

Test 1 Run 1 MEQ = $\frac{(1.0)(.0100)(2.95-.15)(1010)}{(20.0)}$ = 1.41 MEQ

Test 1 Run 2 MEQ = $\frac{(1.0)(.0100)(2.80-.15)(1010)}{(20.0)}$ = 1.34 MEQ

Test 1 Run 3 MEQ = $\frac{(1.0)(.0100)(3.10-.15)(1010)}{(20.0)}$ = 1.49 MEQ

3% Peroxide Catch

Test 1 Run 1 MEQ = $\frac{(1.0)(.0100)(4.50-.15)(500)}{(20.0)}$ = 1.09 MEQ

Test 1 Run 2 MEQ = $\frac{(1.0)(.0100)(0.50-.15)(500)}{(20.0)}$ = 0.088 MEQ

Test 1 Run 3 MEQ = $\frac{(1.0)(.0100)(0.25-.15)(500)}{(20.0)}$ = 1.53 MEQ

Total MEQ Per Run:

Test 1 Run 1 = 2.50 MEQ
Test 1 Run 2 = 1.43 MEQ
Test 1 Run 3 = 3.02 MEQ

Comments: _____

1 Form to be used in conjunction with combination method 5 and 6 train.

S-421A

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EPA Method 7A Recovery and Analysis Data Sheet (1)

**********SOURCE**********	**********RECOVERY**********	**********ANALYTICAL**********
Job ACS /E. Grand Forks	Date of Recovery 11-17-93	Date of Analysis 11-19-93
Source A Pulp Dryer Stack	Recovered by C. Helgeson	Analyst SMB
Date of Sampling 11-11-93	Recovery volume 500 ml	Eluent DIW
Test No(s) 9	Barometric at time 29.16 IN.HG.	Chromatograph: Dionex System 4000i

Samples collected in accordance with EPA Method 7, CFR Title 40, Part 60, Appendix A. Samples analyzed in accordance with EPA Method 7A by ion chromatography. Mercury manometers used to measure flask pressures/vacuums in sampling and in recovery. Thommen Model TX 19 jewel barometer calibrated against laboratory mercury in glass barometer used to measure field barometric pressure. Three field blanks are prepared and the average used to correct measured nitrate concentrations. All samples are analyzed as a batch using a Dionex Model 4270 Chromatograph Data Intergrator. The integrator is programmed to give the actual concentration of the 500 ml recovered sample even if a subsequent dilution was made. The dilution is indicated here as well as on the chromatogram.

$$C_{RS} = DF(C_{DS}) \qquad M_{NO_3} = (C_{RS} - \overline{C}_B)V_R \qquad \overline{C}_B = (C_{B1} + C_{B2} + C_{B3})/3$$

where:

C_{RS} = concentration of nitrate in 500 ml recovered sample in ug/ml

DF = dilution factor

C_{DS} = concentration of nitrate of a 500 ml recovered sample which has been diluted by a factor of DF to bring it into the proper range for the ion chromatograph. This value is an intermediate number and is not outputted by the electronic integrator which is programmed to output the concentration of the original undiluted 500 ml recovered sample.

M_{NO_3} = total mass of nitrate in micrograms in the 500 ml recovered sample and/or in the 2L flask.

C_B = average conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

C_{B1}, C_{B2}, C_{B3} = conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

V_R = recovery volume for samples and field blanks in ml

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EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	ΔP_g (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - C_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	1636-01	13	9-1-1	72								
2	-02	14	9-1-2									
3	-03	15	9-1-3									
4	-04	16	9-1-1									
5	-05	17	9-2-2									
6	-06	18	9-2-3									
7	-07	73	9-2-1		✓		0.1			1.00	1.00	500
8	-08	74	9-2-2			✓	0.6			0.958	0.958	479
9	-09	75	9-3-3		✓		0.2			0.973	0.973	487
10	-10	76	9-3-1			✓	1.5			0.978	0.978	489
11	-11	77	9-3-2			✓	0.4			0.998	0.998	499
12	-12	78	9-3-3			✓	0.7			0.997	0.997	499
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Blank 1									1	CB1		
Blank 2									1	CB2		$\bar{C}_B$ = _____
Blank 3									1	CB3		

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EPA Method 7A Recovery and Analysis Data Sheet (1)

**********SOURCE**********	**********RECOVERY**********	**********ANALYTICAL**********
Job ACS / E. Grand Forks	Date of Recovery 11-18-93	Date of Analysis 11-19-93
Source A Pulp Dryer Stack	Recovered by C. Heljeser	Analyst BMS
Date of Sampling 11-11-93	Recovery volume 500 ml	Eluent A34A
Test No(s) 9	Barometric at time ~~29.16~~ 29.056 IN.HG.	Chromatograph: Dionex System 4000i

Samples collected in accordance with EPA Method 7, CFR Title 40, Part 60, Appendix A. Samples analyzed in accordance with EPA Method 7A by ion chromatography. Mercury manometers used to measure flask pressures/vacuums in sampling and in recovery. Thommen Model TX 19 jewel barometer calibrated against laboratory mercury in glass barometer used to measure field barometric pressure. Three field blanks are prepared and the average used to correct measured nitrate concentrations. All samples are analyzed as a batch using a Dionex Model 4270 Chromatograph Data Intergrator. The integrator is programmed to give the actual concentration of the 500 ml recovered sample even if a subsequent dilution was made. The dilution is indicated here as well as on the chromatogram.

$$C_{RS} = DF(C_{DS}) \qquad M_{NO_3} = (C_{RS} - \overline{C}_B)V_R \qquad \overline{C}_B = (C_{B1} + C_{B2} + C_{B3})/3$$

where: C_{RS} = concentration of nitrate in 500 ml recovered sample in ug/ml

DF = dilution factor

C_{DS} = concentration of nitrate of a 500 ml recovered sample which has been diluted by a factor of DF to bring it into the proper range for the ion chromatograph. This value is an intermediate number and is not outputted by the electronic integrator which is programmed to output the concentration of the original undiluted 500 ml recovered sample.

M_{NO_3} = total mass of nitrate in micrograms in the 500 ml recovered sample and/or in the 2L flask.

C_B = average conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

C_{B1}, C_{B2}, C_{B3} = conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

V_R = recovery volume for samples and field blanks in ml

29.056 For Flask 13-18

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EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	Δ Pg (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - C_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	1636-01	13	9-1-1	72		✓	0.4		1	0.885	0.885	443
2	-02	14	9-1-2		✓		0.2		1	0.920	0.920	460
3	-03	15	9-1-3			✓	0.2		1	0.882	0.882	441
4	-04	16	9-1-1			✓	0.1		1	0.890	0.890	445
5	-05	17	9-2-2		✓		0.3		1	0.909	0.909	455
6	-06	18	9-2-3		✓		0.1		1	0.915	0.915	458
7	-07	73	9-2-1		✓		0.1		1			
8	-08	74	9-2-2			✓	0.6		1			
9	-09	75	9-3-3		✓		0.2		1			
10	-10	76	9-3-1			✓	1.5		1			
11	-11	77	9-3-2			✓	0.4		1			
12	-12	78	9-3-3			✓	0.7		1			
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Blank 1									1	CB1		
Blank 2									1	CB2		$\bar{C}_B$ = ____
Blank 3									1	CB3		

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EPA Method 7A Recovery and Analysis Data Sheet (1)

**********SOURCE**********	**********RECOVERY**********	**********ANALYTICAL**********
Job ACS / E. Grand Forks	Date of Recovery C. Helgeson	Date of Analysis 11-19-93
Source B Pulp Dryer stack	Recovered by 11-17-93	Analyst BMS
Date of Sampling 11-10-93	Recovery volume 500 ml	Eluent AS4A
Test No(s) 5	Barometric at time 29.16 IN.HG.	Chromatograph: Dionex System 4000i

Samples collected in accordance with EPA Method 7, CFR Title 40, Part 60, Appendix A. Samples analyzed in accordance with EPA Method 7A by ion chromatography. Mercury manometers used to measure flask pressures/vacuums in sampling and in recovery. Thommen Model TX 19 jewel barometer calibrated against laboratory mercury in glass barometer used to measure field barometric pressure. Three field blanks are prepared and the average used to correct measured nitrate concentrations. All samples are analyzed as a batch using a Dionex Model 4270 Chromatograph Data Intergrator. The integrator is programmed to give the actual concentration of the 500 ml recovered sample even if a subsequent dilution was made. The dilution is indicated here as well as on the chromatogram.

$$C_{RS} = DF(C_{DS}) \qquad M_{NO_3} = (C_{RS} - \overline{C}_B)V_R \qquad \overline{C}_B = (C_{B1} + C_{B2} + C_{B3})/3$$

where:

C_{RS} = concentration of nitrate in 500 ml recovered sample in ug/ml

DF = dilution factor

C_{DS} = concentration of nitrate of a 500 ml recovered sample which has been diluted by a factor of DF to bring it into the proper range for the ion chromatograph. This value is an intermediate number and is not outputted by the electronic integrator which is programmed to output the concentration of the original undiluted 500 ml recovered sample.

M_{NO_3} = total mass of nitrate in micrograms in the 500 ml recovered sample and/or in the 2L flask.

C_B = average conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

C_{B1}, C_{B2}, C_{B3} = conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

V_R = recovery volume for samples and field blanks in ml

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EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	Δ Pg (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - C_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	1636-13	25	5-1-1	72		✓	1.3		1	0.740	0.740	370
2	-14	26	5-1-2			✓	0.1		1	0.6666	0.6666	333
3	-15	27	5-1-3			✓	0.5		1	0.564	0.564	282
4	-16	28	5-1-1			✓	0.3		1	0.560	0.560	280
5	-17	29	5-2-2		✓		0.5		1	0.1037	0.1037	319
6	-18	30	5-2-3			✓	0.3		1	0.1001	0.1001	301
7	-19	31	5-2-1			✓	2.3		1	0.5000	0.1000	300
8	-20	32	5-2-2			✓	0.3		1	0.1020	0.1020	310
9	-21	33	5-3-3				0		1	0.594	0.594	~~318~~ 317
10	-22	34	5-3-1			✓	0.7		1	0.1010	0.1010	305
11	-23	35	5-3-2			✓	2.0		1	0.572	0.572	286
12	-24	36	5-3-3			✓	2.1		1	0.1035	0.1035	~~320~~ 318
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EPA Method 7A Recovery and Analysis Data Sheet (1)

**********SOURCE**********	**********RECOVERY**********	**********ANALYTICAL**********
Job ACS / E Grand Forks	Date of Recovery 11-17-93	Date of Analysis 11-19-93
Source C Pulp Dryer Stack	Recovered by C. Helgeson	Analyst BMS
Date of Sampling 11-9-93	Recovery volume 500 ml	Eluent AS4A
Test No(s) 1	Barometric at time 29.16 IN.HG.	Chromatograph: Dionex System 4000i

Samples collected in accordance with EPA Method 7, CFR Title 40, Part 60, Appendix A. Samples analyzed in accordance with EPA Method 7A by ion chromatography. Mercury manometers used to measure flask pressures/vacuums in sampling and in recovery. Thommen Model TX 19 jewel barometer calibrated against laboratory mercury in glass barometer used to measure field barometric pressure. Three field blanks are prepared and the average used to correct measured nitrate concentrations. All samples are analyzed as a batch using a Dionex Model 4270 Chromatograph Data Intergrator. The integrator is programmed to give the actual concentration of the 500 ml recovered sample even if a subsequent dilution was made. The dilution is indicated here as well as on the chromatogram.

$$C_{RS} = DF(C_{DS}) \qquad M_{NO_3} = (C_{RS} - \overline{C}_B)V_R \qquad \overline{C}_B = (C_{B1} + C_{B2} + C_{B3})/3$$

where: C_{RS} = concentration of nitrate in 500 ml recovered sample in ug/ml

DF = dilution factor

C_{DS} = concentration of nitrate of a 500 ml recovered sample which has been diluted by a factor of DF to bring it into the proper range for the ion chromatograph. This value is an intermediate number and is not outputted by the electronic integrator which is programmed to output the concentration of the original undiluted 500 ml recovered sample.

M_{NO_3} = total mass of nitrate in micrograms in the 500 ml recovered sample and/or in the 2L flask.

C_B = average conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

C_{B1}, C_{B2}, C_{B3} = conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

V_R = recovery volume for samples and field blanks in ml

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EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	Δ Pg (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - C_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	1636-25	37	1-1-1	72			0		1	0.876	0.876	438
2	-26	38	1-1-2	↓	✓		1.1		1	0.930	0.930	465
3	-27	39	1-1-3	↓	↓		0		1	0.932	0.932	466
4	-28	40	1-1-1	↓	↓	✓	1.4		1	0.939	0.939	470
5	-29	41	1-2-2	↓	↓	✓	1.3		1	0.964	0.964	482
6	-30	42	1-2-3	↓	↓	✓	1.5		1	0.974	0.974	487
7	-31	79	1-2-1	↓	✓	↓	0.3		1	0.879	0.879 ~~0.870~~	11-2693 440
8	-32	80	1-2-2	↓	✓	↓	0.9		1	0.894	0.894	447
9	-33	81	1-3-3	↓	✓	↓	0.8		1	0.802	0.802	401
10	-34	82	1-3-1	↓	↓	✓	1.1		1	0.890	0.890	445
11	-35	83	1-3-2	↓	↓	✓	1.6		1	0.907	0.907	454
12	-36	84	1-3-3	↓	✓	↓	1.8		1	0.846	0.846	423
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Blank 1									1	CB1		
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EPA Method 7A Recovery and Analysis Data Sheet (1)

**********SOURCE**********	**********RECOVERY**********	**********ANALYTICAL**********
Job ACS / E. Grand Forks	Date of Recovery 11-17-93	Date of Analysis 11-19-93
Source No.1 Boiler Stack	Recovered by C. Helseson	Analyst SMS
Date of Sampling 11-10-93	Recovery volume 500 ml	Eluent AS4A
Test No(s) 2	Barometric at time 29.16 IN.HG.	Chromatograph: Dionex System 4000i

Samples collected in accordance with EPA Method 7, CFR Title 40, Part 60, Appendix A. Samples analyzed in accordance with EPA Method 7A by ion chromatography. Mercury manometers used to measure flask pressures/vacuums in sampling and in recovery. Thommen Model TX 19 jewel barometer calibrated against laboratory mercury in glass barometer used to measure field barometric pressure. Three field blanks are prepared and the average used to correct measured nitrate concentrations. All samples are analyzed as a batch using a Dionex Model 4270 Chromatograph Data Intergrator. The integrator is programmed to give the actual concentration of the 500 ml recovered sample even if a subsequent dilution was made. The dilution is indicated here as well as on the chromatogram.

$$C_{RS} = DF(C_{DS}) \qquad M_{NO_3} = (C_{RS} - \overline{C}_B)V_R \qquad \overline{C}_B = (C_{B1} + C_{B2} + C_{B3})/3$$

where:

C_{RS} = concentration of nitrate in 500 ml recovered sample in ug/ml

DF = dilution factor

C_{DS} = concentration of nitrate of a 500 ml recovered sample which has been diluted by a factor of DF to bring it into the proper range for the ion chromatograph. This value is an intermediate number and is not outputted by the electronic integrator which is programmed to output the concentration of the original undiluted 500 ml recovered sample.

M_{NO_3} = total mass of nitrate in micrograms in the 500 ml recovered sample and/or in the 2L flask.

C_B = average conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

C_{B1}, C_{B2}, C_{B3} = conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

V_R = recovery volume for samples and field blanks in ml

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EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	Δ Pg (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - \bar{C}_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	1636-49	61	2-1-A	72		✓	0.3		1	2.63	2.63	1320
2	-50	62	2-1-B	1		✓	1.3		1	2.55	2.55	1280
3	-51	63	2-1-C	1			0		1	2.71	2.71	1360
4	-52	64	2-1-D	1		✓	0.1		1	2.58	2.58	1290
5	-53	65	2-2-A	1		✓	1.0		1	2.57	2.57	1290
6	-54	66	2-2-B	1	✓		0.5		1	2.42	2.42	1210
7	-55	67	2-2-C	1		✓	0.4		1	2.58	2.58	1290
8	-56	68	2-2-D	1		✓	1.3		1	2.46	2.46	1230
9	-57	69	2-3-A	1		✓	1.4		1	2.47	2.47	1240
10	-58	70	2-3-B	1		✓	1.9		1	2.44	2.44	1220
11	-59	71	2-3-C	1		✓	1.0		1	2.30	2.30	1150
12	-60	72	2-3-D	↓		✓	1.2		1	2.57	2.57	1290
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Blank 1									1	CB1		
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Blank 3									1	CB3		

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EPA Method 7A Recovery and Analysis Data Sheet (1)

**********SOURCE**********	**********RECOVERY**********	**********ANALYTICAL**********
Job ACS/E. Grand Forks	Date of Recovery 11-17-93	Date of Analysis 11-19-93
Source No. 2 Boiler Stack	Recovered by C. Helseson	Analyst BMS
Date of Sampling 11-11-93	Recovery volume 500 ml	Eluent AS4A
Test No(s) 7	Barometric at time 29.16 IN.HG.	Chromatograph: Dionex System 4000i

Samples collected in accordance with EPA Method 7, CFR Title 40, Part 60, Appendix A. Samples analyzed in accordance with EPA Method 7A by ion chromatography. Mercury manometers used to measure flask pressures/vacuums in sampling and in recovery. Thommen Model TX 19 jewel barometer calibrated against laboratory mercury in glass barometer used to measure field barometric pressure. Three field blanks are prepared and the average used to correct measured nitrate concentrations. All samples are analyzed as a batch using a Dionex Model 4270 Chromatograph Data Intergrator. The integrator is programmed to give the actual concentration of the 500 ml recovered sample even if a subsequent dilution was made. The dilution is indicated here as well as on the chromatogram.

$$C_{RS} = DF(C_{DS}) \qquad M_{NO_3} = (C_{RS} - \bar{C}_B)V_R \qquad \bar{C}_B = (C_{B1} + C_{B2} + C_{B3})/3$$

where:

C_{RS} = concentration of nitrate in 500 ml recovered sample in ug/ml

DF = dilution factor

C_{DS} = concentration of nitrate of a 500 ml recovered sample which has been diluted by a factor of DF to bring it into the proper range for the ion chromatograph. This value is an intermediate number and is not outputted by the electronic integrator which is programmed to output the concentration of the original undiluted 500 ml recovered sample.

M_{NO_3} = total mass of nitrate in micrograms in the 500 ml recovered sample and/or in the 2L flask.

C_B = average conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

C_{B1}, C_{B2}, C_{B3} = conc. of nitrate in 500 ml recovered samples from the three field blanks (ug/ml)

V_R = recovery volume for samples and field blanks in ml

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EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	Δ Pg (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - C_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	1636-61	43	7-1-A	72		✓	1.4		1	2.101	2.101	1310
2	-62	44	7-1-B	(		✓	0.2		1	2.79	2.79	1400
3	-63	45	7-1-C			✓	1.0		1	3.13	3.13	1570
4	-64	46	7-1-D			✓	2.8		1	2.89	2.89	1430
5	-65	47	7-2-A			✓	2.3		1	3.01	3.01	1510
6	-66	48	7-2-B			✓	2.0		1	2.85	2.85	1430
7	-67	49	7-2-C			✓	1.8		1	2.83	2.83	1420
8	-68	50	7-2-D			✓	1.3		1	3.11	3.11	1560
9	-69	51	7-3-A			✓	3.2		1	2.89	2.89	1450
10	-70	52	7-3-B			✓	1.4		1	2.79	2.79	1400
11	-71	53	7-3-C		✓		0.9		1	3.03	3.03	1520
12	-72	54	7-3-D	)		✓	1.1		1	2.99	2.99	1500
13												
14												
15												
16												
17												
18												
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20												
21												
22												
23												
24												
25												
26												
27												
Blank 1									1	CB1		
Blank 2									1	CB2		
Blank 3									1	CB3		

$\bar{C}_B$ = _____

S-340(2) R-9/85

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Sample Deposition

Job [illegible] Source [illegible]
Field Engineer [illegible] Test Site [illegible]
Date Submitted [illegible] Date of Test [illegible]
Test No. [illegible] No. 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 _____	
6 3	Impingers: ☒ DI Water ☒ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☒ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☒ As per EPA M-6/8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
3	Integrated Gas Sample ☒ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☒ As per EPA M-10 ☐ Other _____	CC1
C	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
C	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
C	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
C	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: FURNACE

Fuel Type:

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

9/93 1400 Received B.B. [illegible]

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Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job ACS - EGF
Field Engineer SCB
Date Submitted 11-12-93
Test No. 9

Source A - PULP DRYER
Test Site STACK
Date of Test 11-11-93
No. of Runs Completed 3

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

Type of Source: DRYER

Fuel Type:

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

11/13/93 1400 Rec'd from Scott ZC

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Interpoll Laboratories
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Sample Deposition

Job NIS - FLK
Field Engineer JJB
Date Submitted 11-12-93
Test No. 5

Source B - Fuel Dryer
Test Site STACK
Date of Test 11-10-93
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_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other_____	
	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other_____	
R	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: Furnace

Fuel Type:

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

11/13/93 1400 Received Betty from Author

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Interpoll Laboratories
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Sample Deposition

Job ____ Source ____
Field Engineer ____ Test Site ____
Date Submitted ____ Date of Test ____
Test No. 5 No. of Runs Completed ____

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 ____	
6 3	Impingers: ☒ DI Water ☒ 3% H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ ____ ☐ ____	☒ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☒ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other ____	
3	Integrated Gas Sample ☒ Tedlar Bag ☐ ____	☒ As per EPA M-3 ☒ As per EPA M-10 ☐ Other ____	
0	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other ____	
0	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
0	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other ____	
0	Misc Samples ☐ ____ ☐ ____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other ____	

Type of Source: Furnace

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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11/15/93 1400 Received BS from

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job ____ Source ____
Field Engineer ____ Test Site ____
Date Submitted ____ Date of Test ____
Test No. ____ No. of Runs Completed ____

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

Type of Source: FURNACE

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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11/3/93 1400 Bobby Received from [signature]

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job ACS - Ref F
Field Engineer SCAS
Date Submitted 11-12 [illegible]
Test No. 1

Source C. Pulp Dryer
Test Site STACK
Date of Test 11-9-93
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_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☐ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other_____	
	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other_____	
13	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: Furnace

Fuel Type:

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

11/10/93 1400 Received Bob Berg from Acme

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job ACS / E. Grand Forks, MN — Source No. 1 Boiler
Field Engineer M. Baeckler — Test Site Stack
Date Submitted 11-12-93 — Date of Test 11-10-93
Test No. 2 Continued — No. 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 ☐ $3\%H_2O_2$ ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☒ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
3	Integrated Gas Sample ☒ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☒ As per EPA M-10 ☐ Other _____	On-Site Analysis
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
1	☒ 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: Boiler

Fuel Type:

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

Received from Mark Baeckler
Bob Sorg 11/15/93 1500

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Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job ACS / E. Grand Forks, MN — Source No. 2 Boiler
Field Engineer M. Baehler — Test Site Stack
Date Submitted 11-22-93 — Date of Test 11-11-93
Test No. 7 — No. 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_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☒ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
3	Integrated Gas Sample ☒ Tedlar Bag ☐ _____	☒ As per EPA M-3 ☒ As per EPA M-10 ☐ Other _____	On-Site Analysis
12	Oxides of Nitrogen (NO_x)	☒ As per EPA M-7A ☐ Other _____	
1	☒ 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: Boiler

Fuel Type:

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

Received 1500 11/12/93 [signature]

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Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job AMERICAN CRYSTAL SUGAR
Field Engineer DUKE BRENNAN
Date Submitted 11/12/93
Test No. 10

Source EAST PELLET COOLER
Test Site STACK
Date of Test 11/11/93
No. 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 + BLANK	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 + BLANK	Impingers: ☒ DI Water ☐ 3%H_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	☒ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
0	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	AMBIENT AIR
0	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
0	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
0	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
0	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: PELLET COOLER

Fuel Type:

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

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11/93 B.B'ing Received from [illegible]

Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job AMERICAN CRYSTAL SUGAR
Field Engineer DUKE BRENNAN
Date Submitted 11/12/93
Test No. 13

Source WEST PELLET COOLER STACK
Test Site STACK
Date of Test 11/11/93
No. of Runs Completed 3

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

Type of Source: PELLET COOLER

Fuel Type:

Coal: ☐Bituminous ☐Anthracite ☐Lignite
Wood: ☐Wood Waste ☐Dust ☐Bark
Oil: ☐Waste Oil ☐No. 2 ☐No. 6
☐ Natural Gas ☐ RDF ■ Other NO FUEL

11/12/93 1400 Bob Barry Received from Greg Duke [illegible]

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Interpoll Laboratories
(612) 786-6020

Sample Deposition

Job ACS - EGF
Field Engineer SCB
Date Submitted 11-12-93
Test No. 12

Source PELLET LOADOUT
Test Site STACK
Date of Test 11-11-93
No. 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_2O_2 ☐ 1N NaOH ☐ KOH (Cr VI) ☐ H_2SO_4 (HCl) ☐ 2,4-DNPH ☐ _____ ☐ _____	■ MN Protocol ☐ WI Protocol ☐ As per EPA M-202 ☐ As per EPA M-6,8 ☐ Acid Gases ☐ Formaldehyde ☐ As per EPA M-29 ☐ As per EPA M-26 ☐ Other _____	
0	Integrated Gas Sample ☐ Tedlar Bag ☐ _____	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	AMBIENT AIR
0	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	
0	☐ Fuel Sample ☐ Aggregate	☐ Attached Form S-0163	
0	Particle Size	☐ X-Ray Sedigraph ☐ Cascade Impactor ☐ Other _____	
0	Misc Samples ☐ _____ ☐ _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Type of Source: Bag house

Fuel Type:

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

11/13/93 1400 Received Bldg From [illegible]

APPENDIX E

PROCESS INFORMATION

"A" Pulp Drier
11/11/93
Runs 1, 2 & 3

REQUIRED DATA
for
COMBUSTION SOURCES

Company Name American Crystal Sugar Co, EGF

C. Fuel Input

1. Itemize all fuels and materials that are added to the combustion process during the test period. Attach ultimate analysis of the fuel.

FUEL DESCRIPTION Coal:State, City, Mine Oil: Specify Grade	INPUT (LBS/HR) (GAL/HR)	& MOISTURE As Rec'd	As Rec'd (BTU/LB) (BTU/GAL)	HEAT INPUT (BTU/HR)
No. 1 Mt. Decker, Spring Creek;	5,000 ;	25 %	9,300	4.65 E7
No. 2				
No. 3				
			TOTAL	4.65 E7

2. Are the above fuels substantially the same as those normally burned? yes. If not, explain _____

3. Are the above fuels normally burned in the proportions shown above? N/A. If not, explain _____

4. Describe any changes anticipated for procurement of fuels within the next twelve (12) months.

Same mine but slightly lower Na + higher S spec.

D. Equipment & Operating Data

1. Furnace No. "A" Pulp Drier ; EP #3
2. Furnace Mfg. Combustion Engineering
3. Type of Firing Traveling Grate
4. Furnace operating under normal operating conditions: No _____; Yes ✓

5. Specify normal soot blowing frequency:

   a) source operating time blowing soot: 60 minutes/week ~~minutes/shift~~

   b) number of shifts per day N/A

6. Specify soot blowing time during the test: start 12:45 end 1:00. When was the last time before the test that you blew soot: (date & time) 11/8/93 ; Day shift.

7. Specify normal ash pulling frequency: → Continuous ash pulling

   a) source operating time ~~pulling ashes~~ sifting grate: 10 minutes/shift

   b) number of shifts per day 3 1

8. Specify ~~ash pulling~~ grate sifting time during the test: start 12:40 end 12:45. When was the last time before the test that you pulled ashes: (date & time) 11/10/93.

9. Date and procedures of last maintenance/cleaning of the boiler (please attach) Aug. 1993 - Summer maintenance

E. Instrument Data

1. Include a copy of chart records during test for the combustion efficiency indices (CO, O_2, CO_2, combustibles, steam flow, air flow, etc.)

F. Air Pollution Control Equipment

1. Type/model control equipment Multiclone ; 6UPEWHS #15-300 Wheelabrator 15% of flue: Baghouse ; 1515 RA ; Wheelabrator
2. Air pressure drop across the control equipment 5.9 ΔP ; 4.5 ΔP.
3. Air flow through the control equipment 60,000 ACFM Nominal.
4. Was the control equipment operating normally? YES.
5. Date and procedures of last maintenance/cleaning of control equipment.

   Aug. 1993 - Summer maintenance

Plant Operator's Certification

I certify that the information submitted herein is accurate and correct and that no information requested was withheld from the Division Manager.

By Brian Ghijsenhuis Position Engineer / North Region

Campaign Day: 1st

Date: [illegible]

PULP DRIER STACK TESTING

1 Drier Test # 3

☐ Engineering

☒ Compliance

Hr.	Slice Rate	Pre Heat F.D. Air		Heat Profile: Recycle Air		Heat Profile: Throat		Heat Profile: Drum Exit		Air/Fuel Ratio		Pressed Pulp Feed		Damper Position: FD	Damper Position: Recycle	Damper Position: ID	Coal Rate		Grate Speed		% Moistures: Pressed Pulp		% Moistures: Dried Pulp		Pressure Drop (Field Sensor): Multiclone		Pressure Drop (Field Sensor): Multiclone Inlet		Pressure Readings: Furnace	Pressure Readings: Drum Exit	Manometer Readings: Multiclone Inlet ΔP	Manometer Readings: FD Duct	Recycle Airflow (Control)	Hopper Filter D.P.	O_2 %	Methane
	Hr. TPH	Hr. °C	1/2 Hr. °C	Hr. °C	1/2 Hr. °C	Hr. °C	1/2 Hr. °C	Hr. °C	1/2 Hr. °C	Hr. %	1/2 Hr. %	Hr. TPH	1/2 Hr. TPH	Hr. % Open	Hr. % Open	Hr. % Open	Hr. TPH	1/2 Hr. TPH	Hr.	1/2 Hr.	Hr. %	1/2 Hr. %	Hr. %	1/2 Hr. %	Hr. "H_2O	1/2 Hr. "H_2O	Hr. "H_2O	1/2 Hr. "H_2O	Hr. "H_2O	Hr. "H_2O	Hr. "H_2O	Hr. "H_2O		"H_2O		
9:00	315	–	–	–	–	787	782	108	108	–	–	22.7	22.3	41.6	98.8	60	–	–	32.3	31.4	72	72.1	7.7	8.6	5.90	5.78	6.66	6.60	-.07	-.57	6.00	.2	3502		9.2	
9:30																																				Hr
10:00	316	–	–	–	–	777	774	108	108	–	–	21.8	20.1	34.7	94.4	60	–	–	31.9	28.3	72.8	73.5	8.5	7.6	5.94	5.84	6.67	6.65	-.15	-.42	6.00	.2	3502	4.80	9.4	11.55
10:30																																				1/2
11:00	314	–	–	–	–	775	801	107	107	–	–	22.9	24.4	41.6	91.6	60	–	–	32.0	34.1	73.3	73.5	8.1	10.2	5.80	5.91	6.64	6.64	-.07	-.59	6.00	.2	3488	4.80	9.6	11.55
11:30																																				1/2
12:00	317	–	–	–	–	796	797	108	108	–	–	21.5	22.4	41.2	93.9	60	–	–	31.6	30.9	73.5	72.7	10.3	8.6	5.84	5.77	6.61	6.64	-.13	-.61	6.00	.2	3506	4.31	9.2	11.55
12:30																																				1/2
1:00	315	–	–	–	–	802	804	107	108	–	–	23.2	22.5	43.1	96.4	60	–	–	33.6	30.6	72.7	72.9	9.1	8.6	5.78	5.86	6.64	6.64	-.11	-.60	6.0	.2	3502	4.68	9.27	11.78
1:30																															6.0	.2	3491	4.36	–	
2:00	321	–	–	–	–	775	806	107	107	–	–	22.6	21.9	43.0	94.8	60	–	–	31.2	31.8			8.5		5.76	5.67	6.64	6.64	-.15	-.60	6.0	.2	3503	4.31		
2:30																															6.0	.2	3506	4.67		9.01
		–	–	–	–					–	–					60	–	–																		Hr
																																			1/2
		–	–	–						–	–					60	–	–																		Hr
																																			1/2
		–	–	–						–	–					60	–	–																		Hr
																																			1/2
		–	–	–	–					–	–					60	–	–																		Hr
																																			1/2

E-3

Air Registers:

Run #1:
- Closed
- 25%
- 50%
- 75%
- 100%

Run #2:
- Closed
- 25%
- 50%
- 75%
- 100%

Run 1 Start: 9:20 a.m. End: 10:27 A.M.

Run 2 Start: 11:00 A.M. End:

Controller Name:	Ratio	Bias

NOTES: Run 1

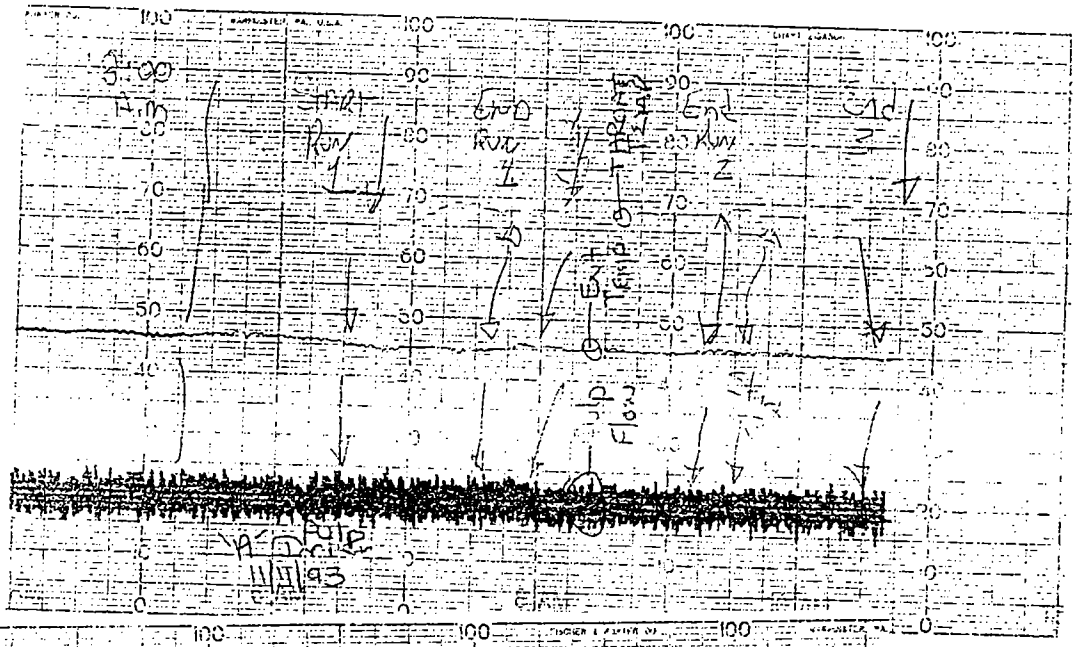
NOTES: Run 2

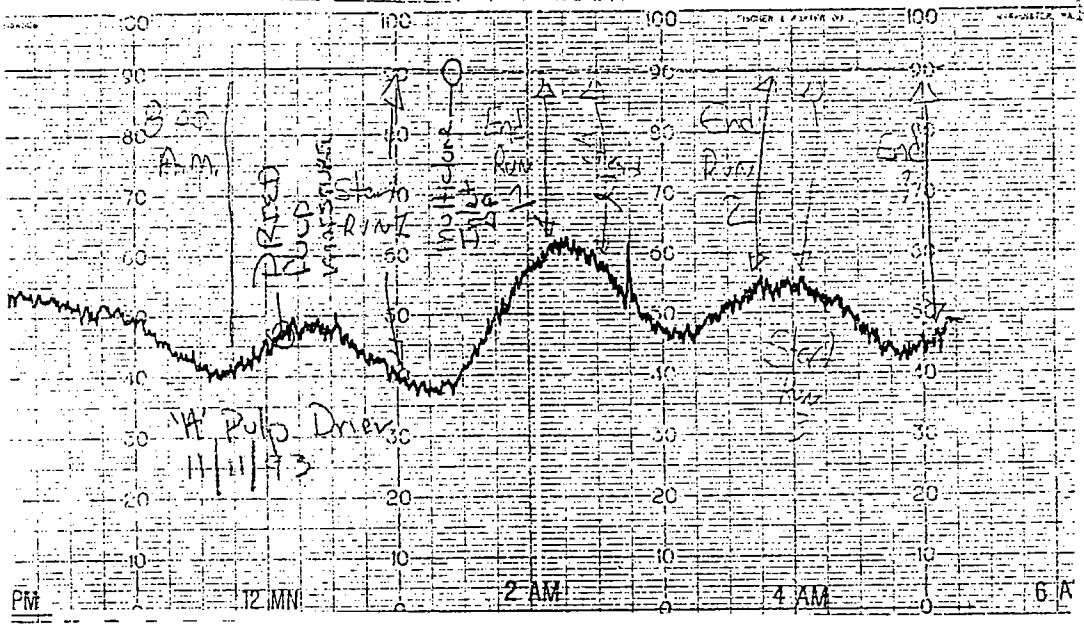
GENERAL NOTES: Run 3

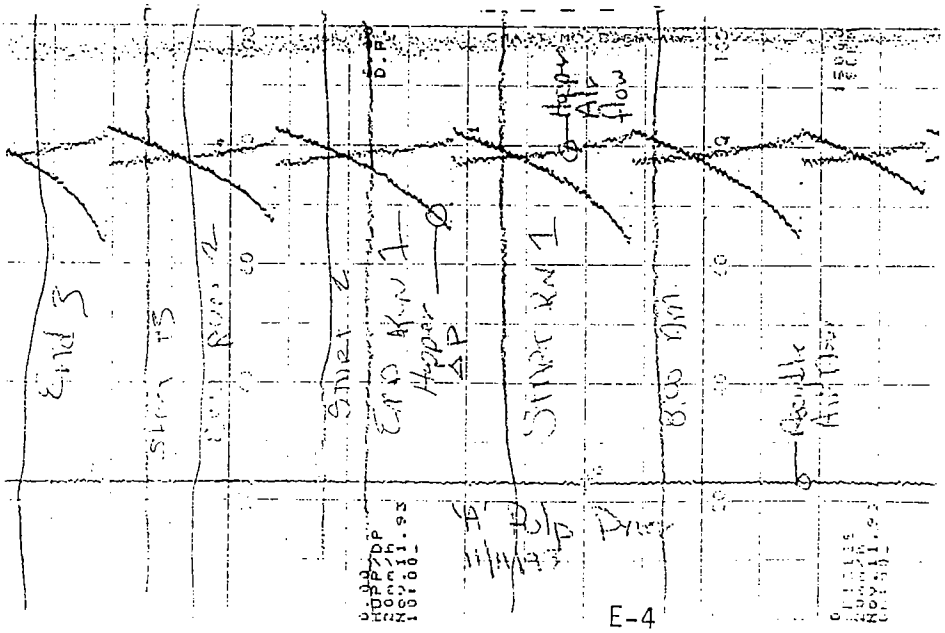
Sampling Duration: 12:40 - 12:45

Lancing: 12:45 - 1:00

CAD# E7111D01



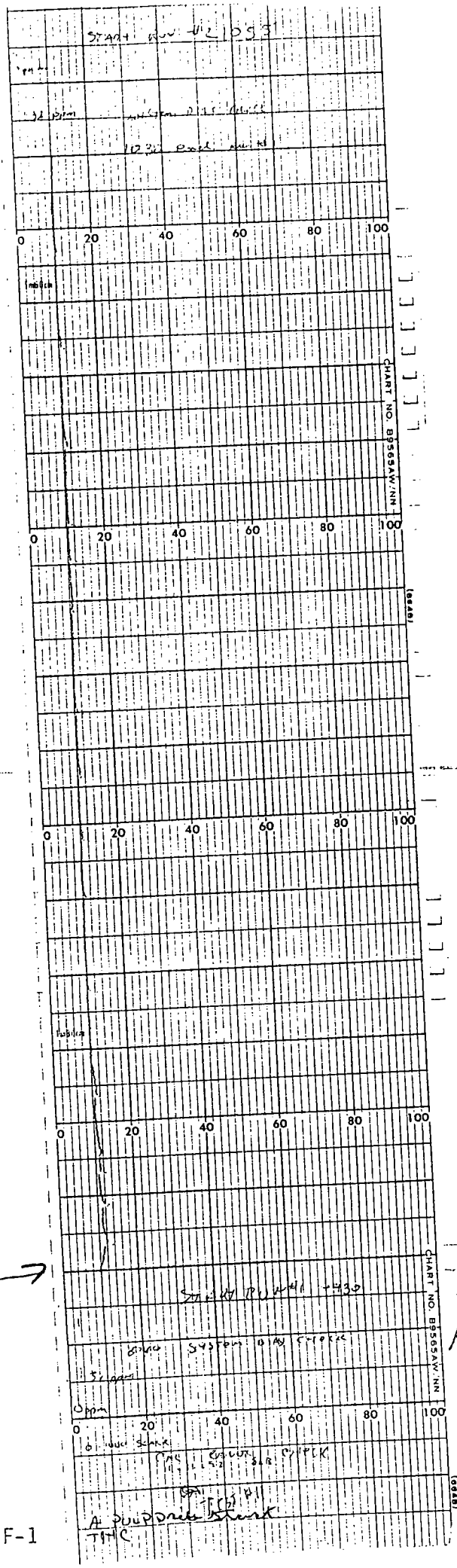

12 MN
2 AM
4 AM
6 A
PM



APPENDIX F

THC STRIPCHARTS

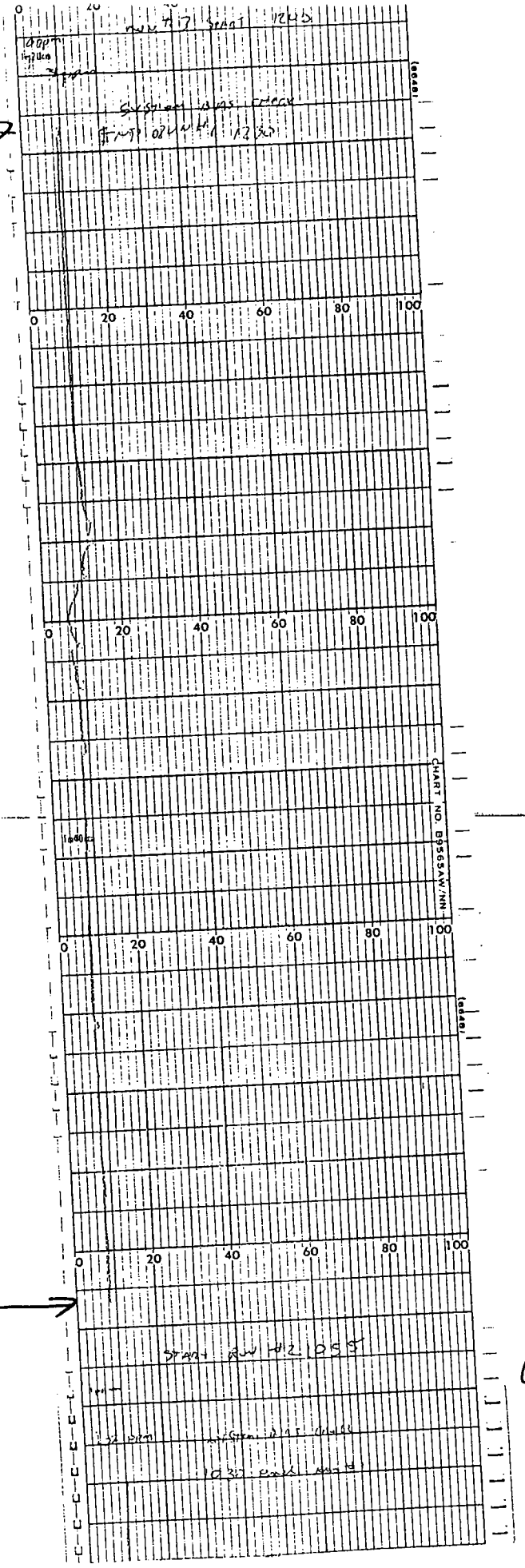
Run 1
END →

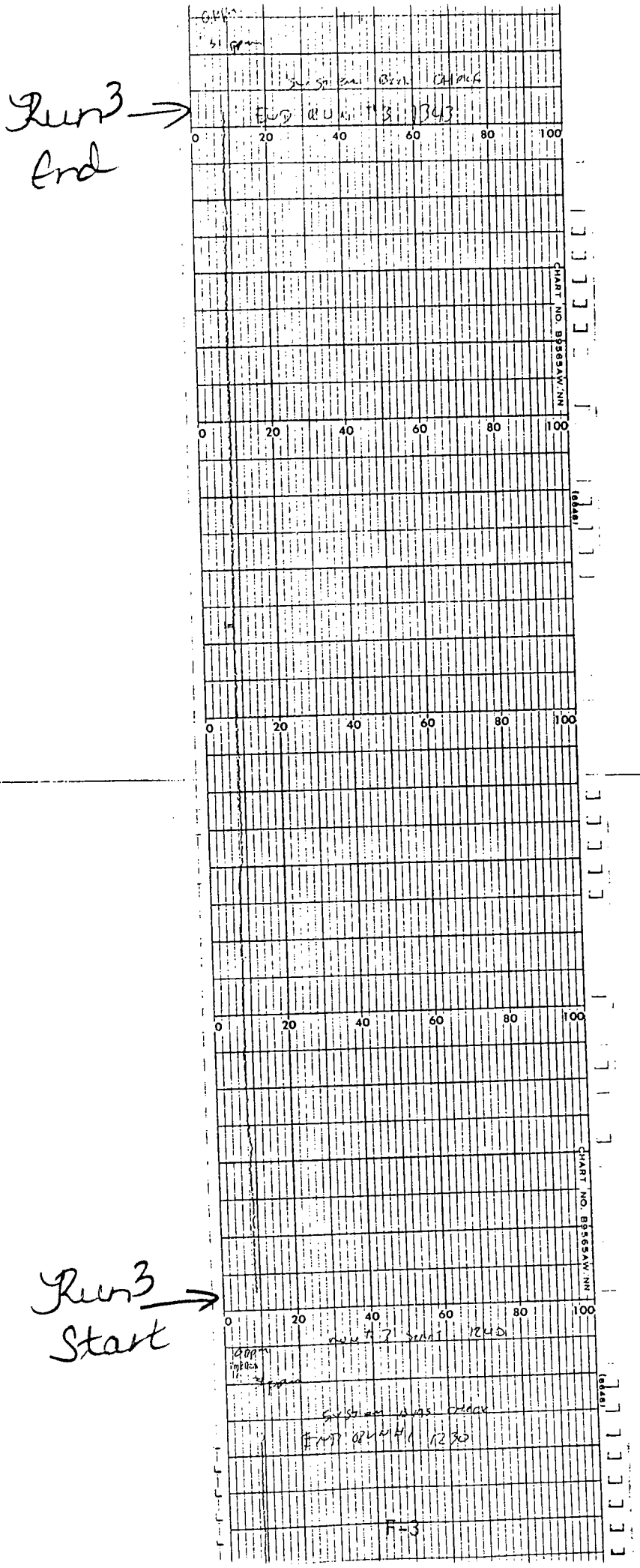


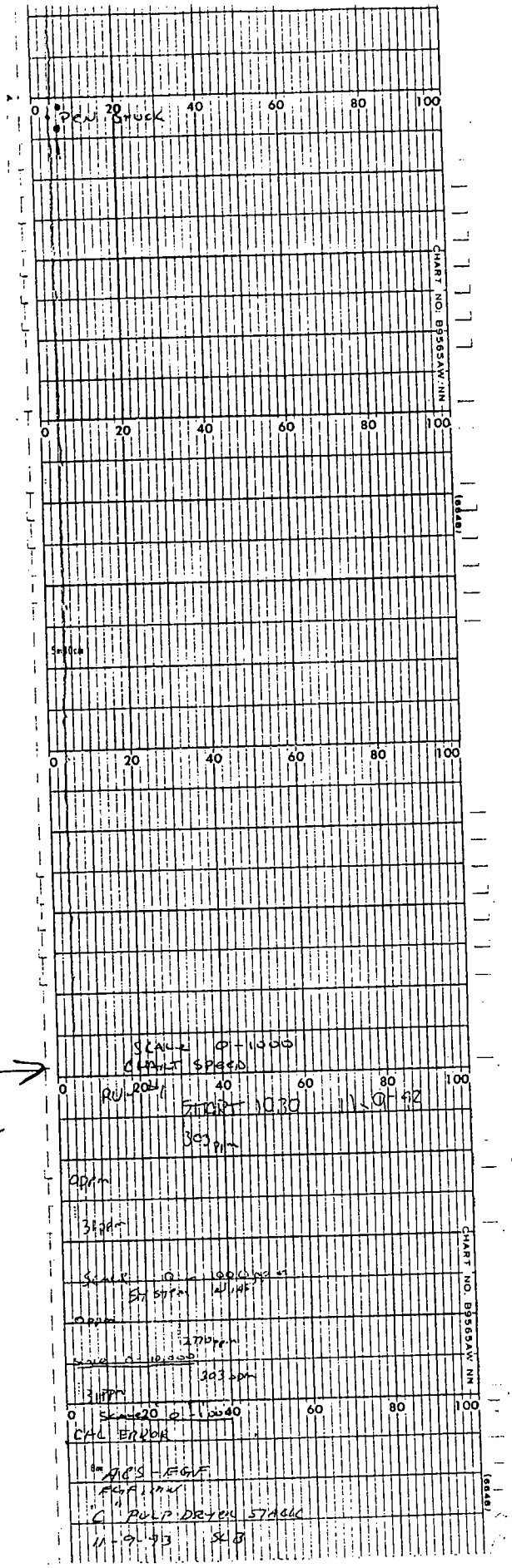
Run 1
START →

"A" Pulp
Dryer

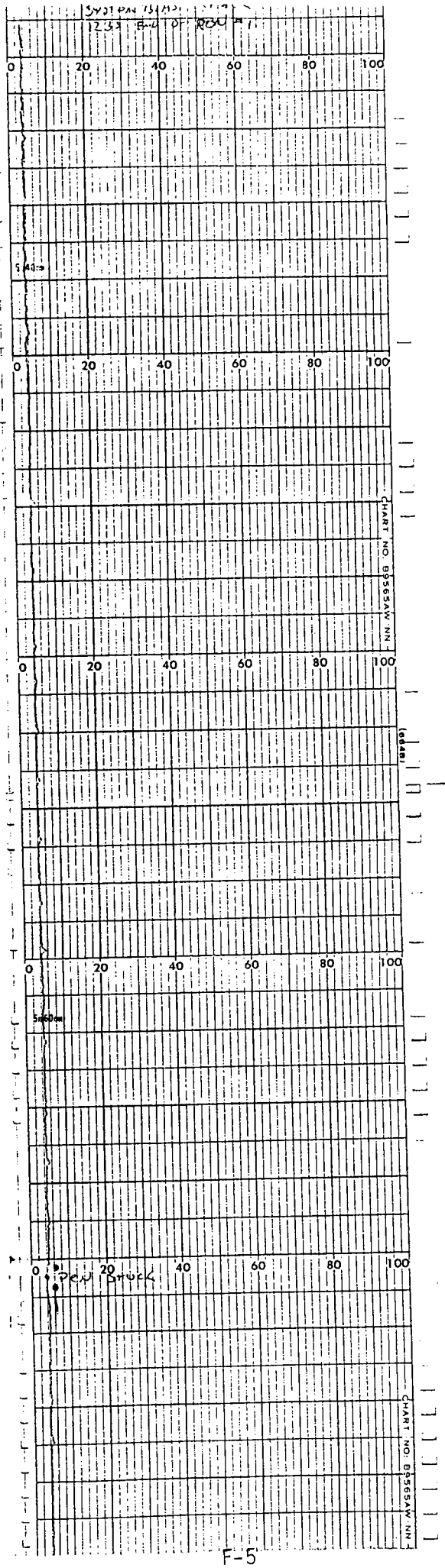
American
Crystal
Sugar
East Grand Forks


Run 2
End
Run 2
Start
"A" Pulp
Dryer
ACS
0-1000
Scale
CHART NO. B956SAW/NN
0
20
40
60
80
100

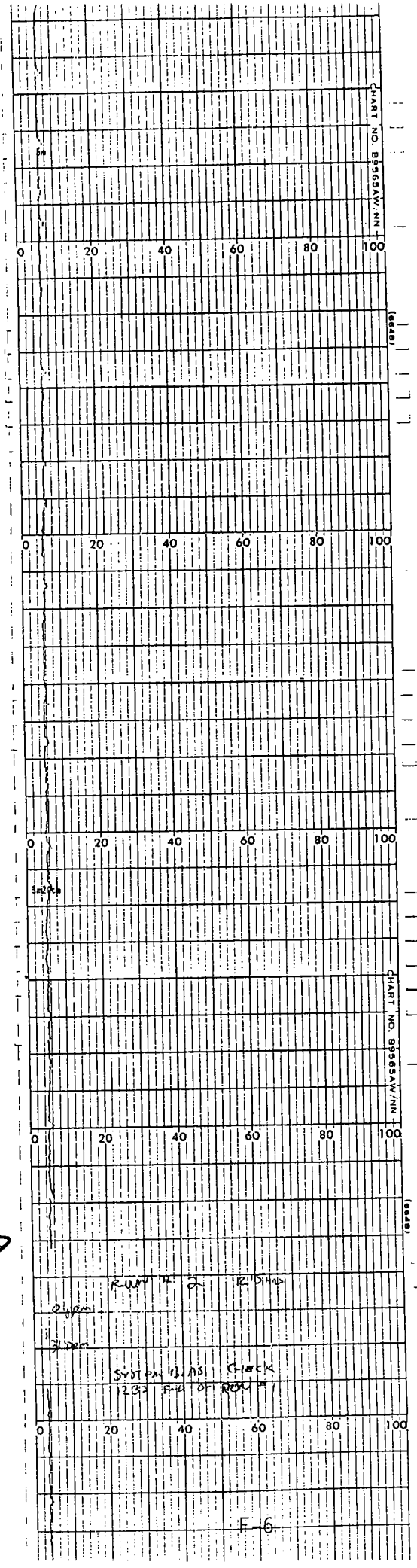

Run3
End
Run3
Start
CHART NO. B9565AW-NN
0
20
40
60
80
100
"A" Pulp Dryer
Stack
ACS
F-3


Run! Start
"C" Pulp Dryer Stack
CHART NO. B9565AW-NN
0 20 40 60 80 100
PCM Struck
SCALE 0-1000
CHART SPEED
RU-2021
FLIGHT 1030
11-9-93
303 ppm
CAL ERROR
"C" PULP DRYER STACK
11-9-93

Run 1 →
End



ACS
"C" Pulp
Dryer

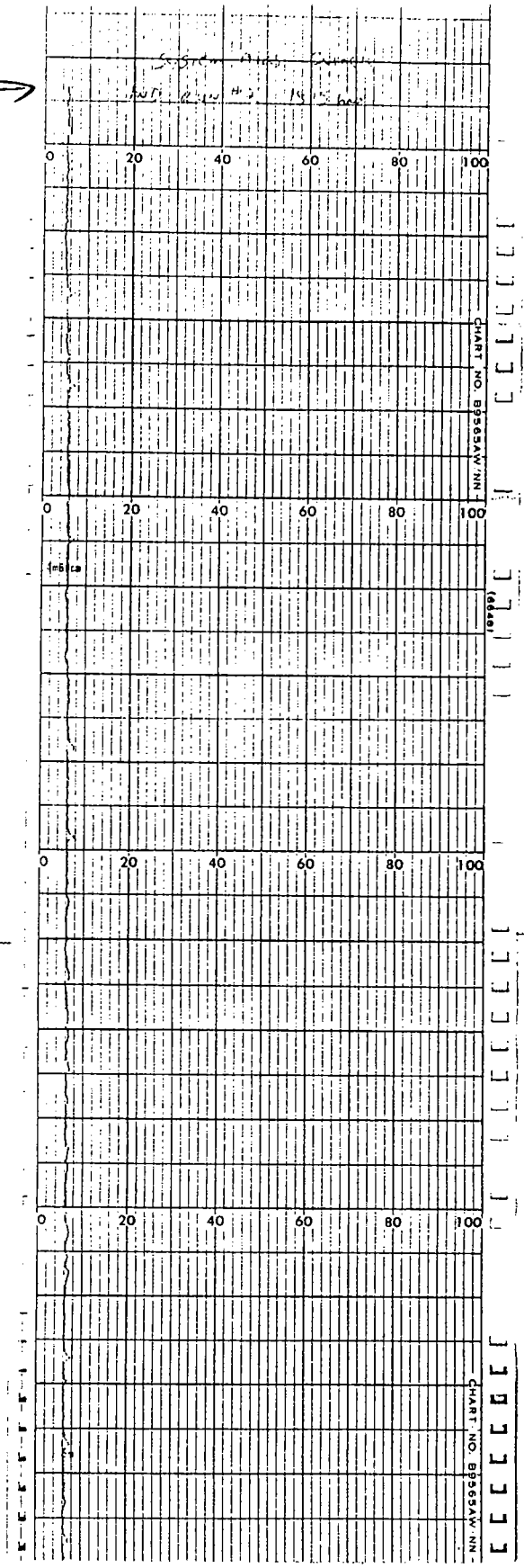


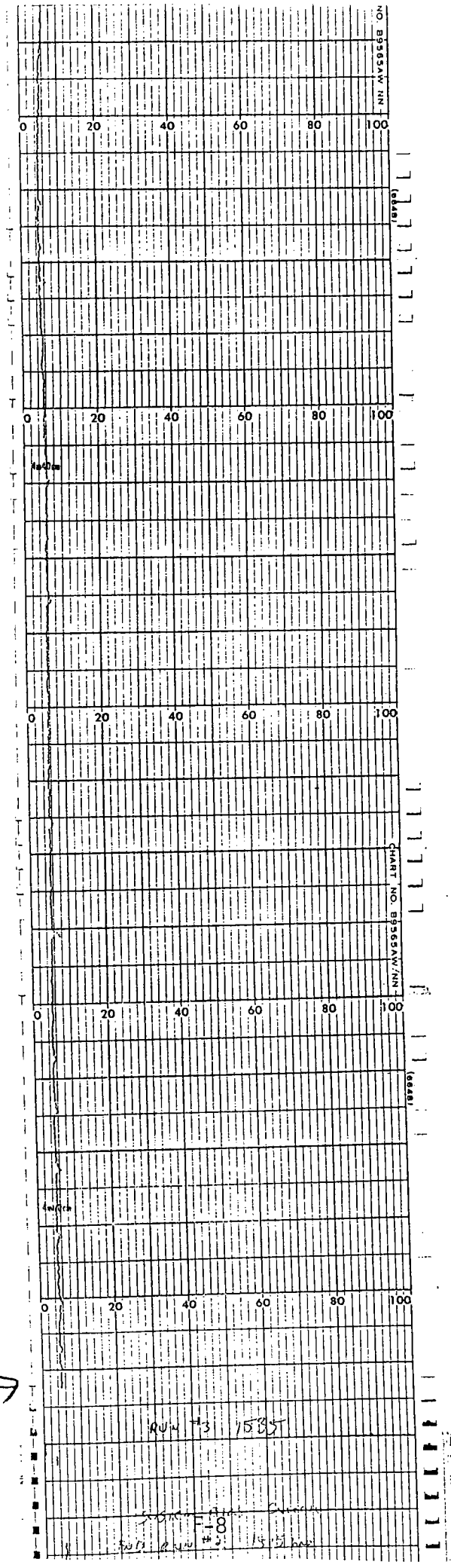
"C" Pulp Dryer Stack

Run 2 → End

ACS

"C" Pulp Dryer Stack

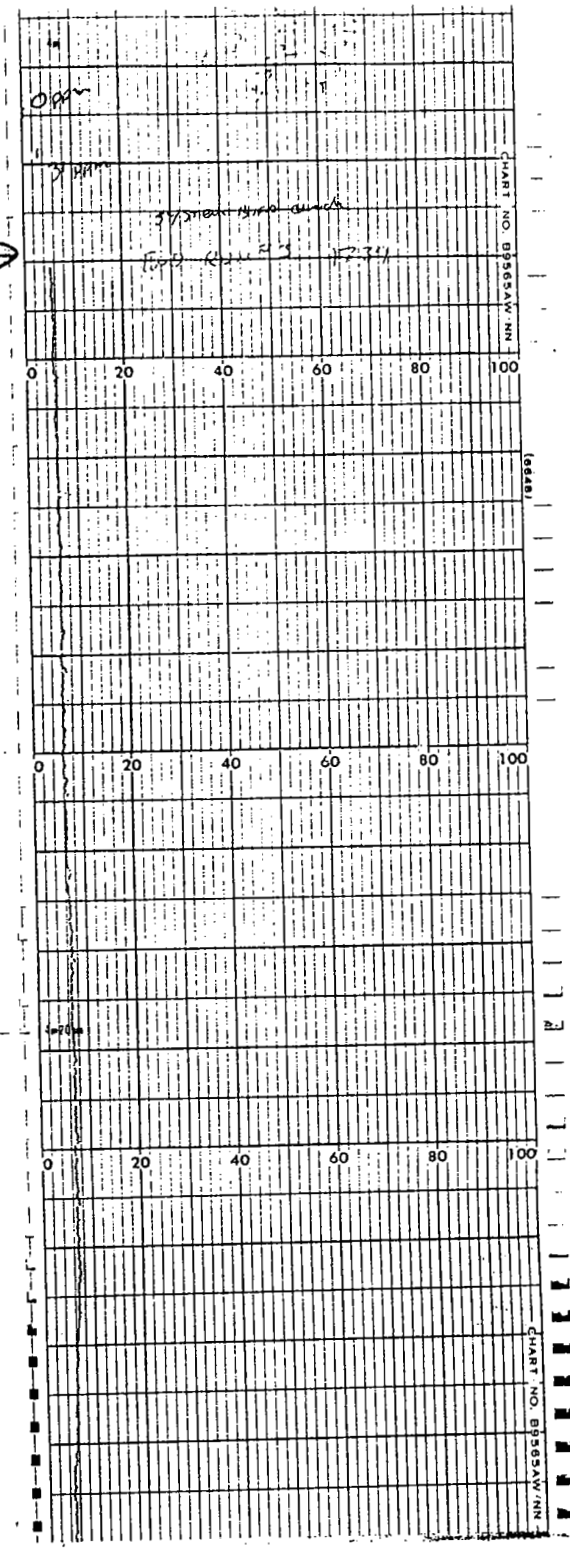




"C" Pulp Dryer Stack

ACS East Grand Forks

Run 3 Start →

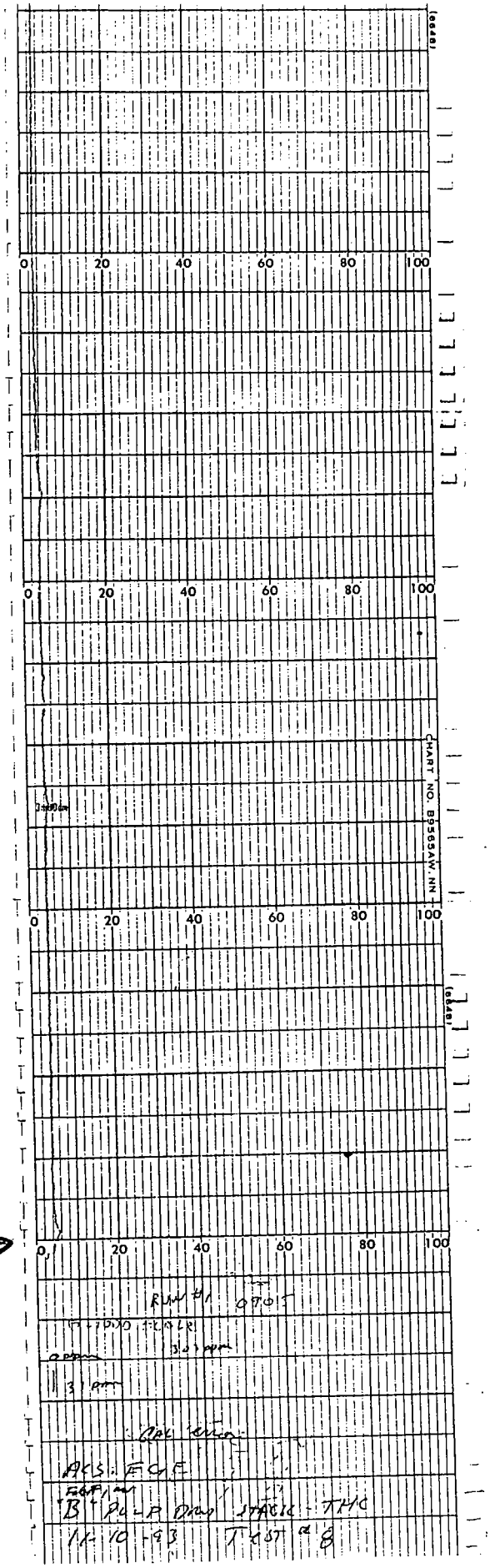


Gun 3 End →

ACS – East Transect Forks

"C" Pulp Dryer Stack

0-100 Scale



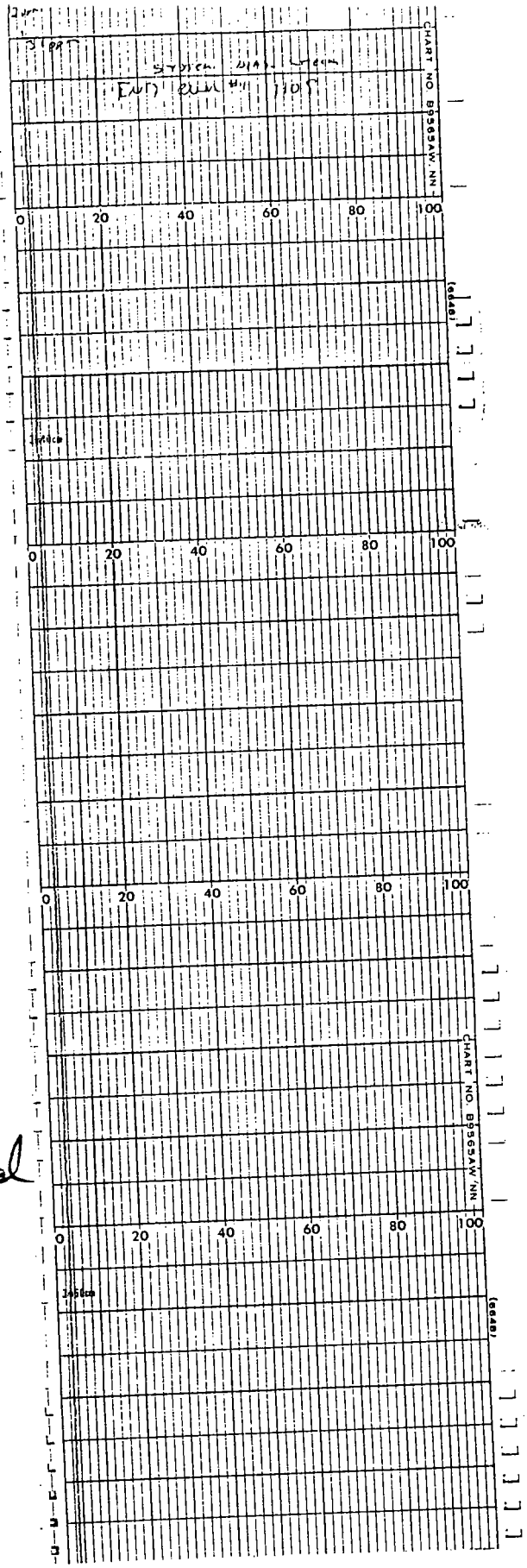
Run 1 →

ACS
East Yard
Yoke

"B" Pulp
Dryer Stack

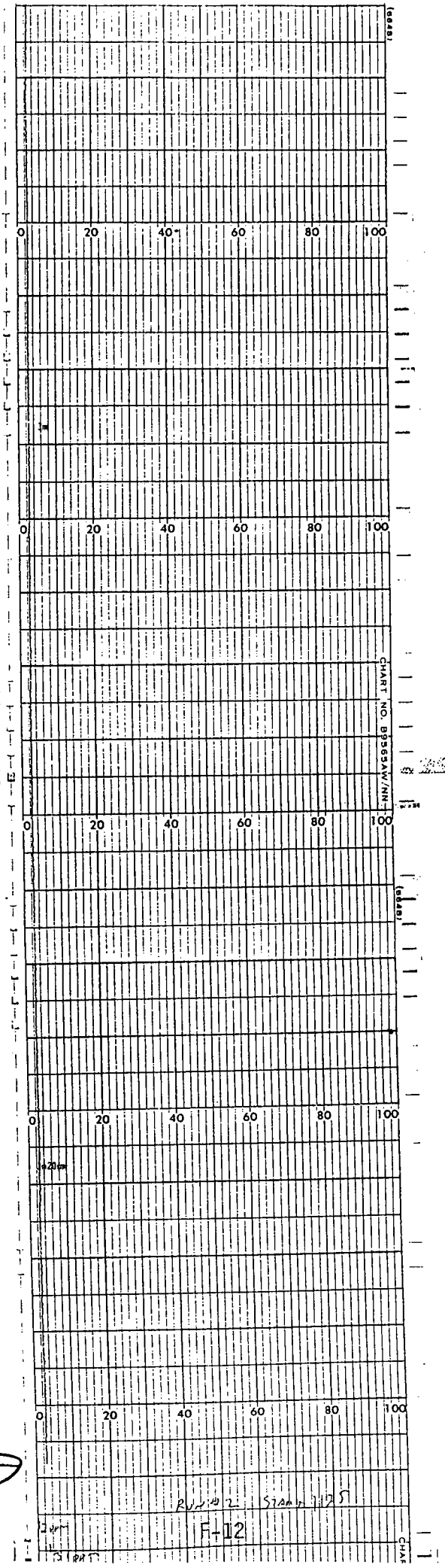
0-1000 scale

Run 1 →
End



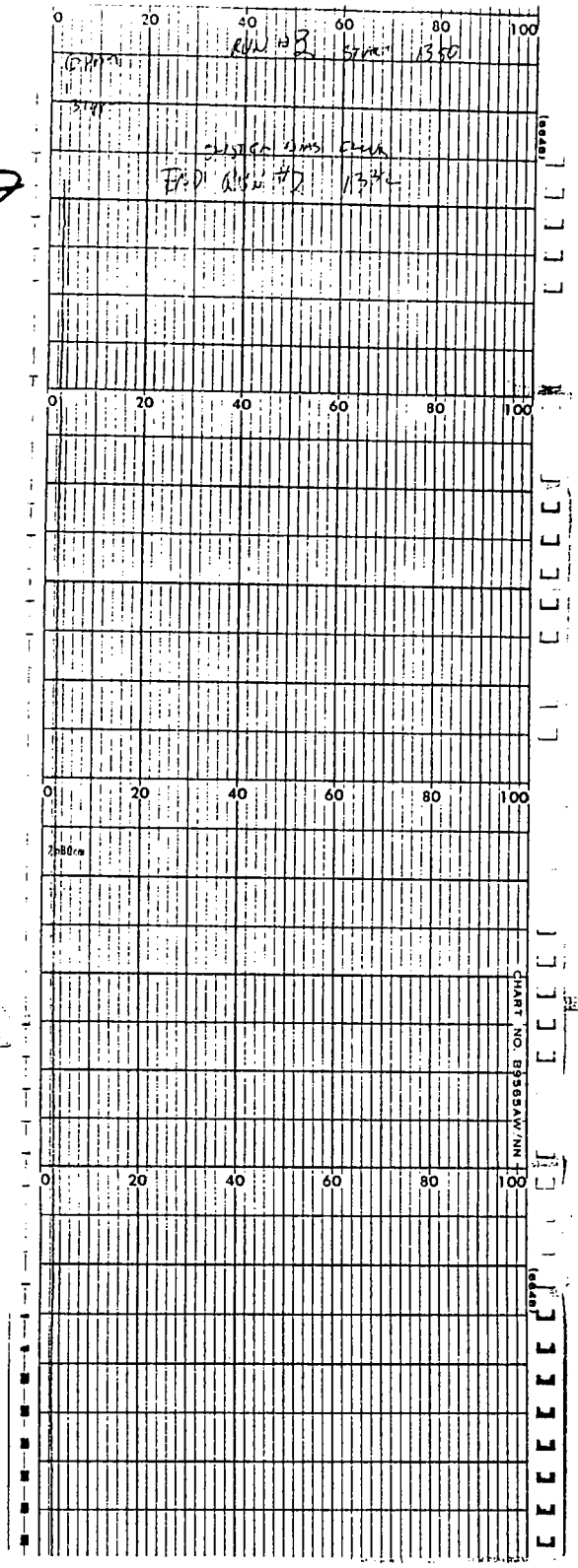
"B" Pulp
Drystack

ACS-
East Stack
Fork



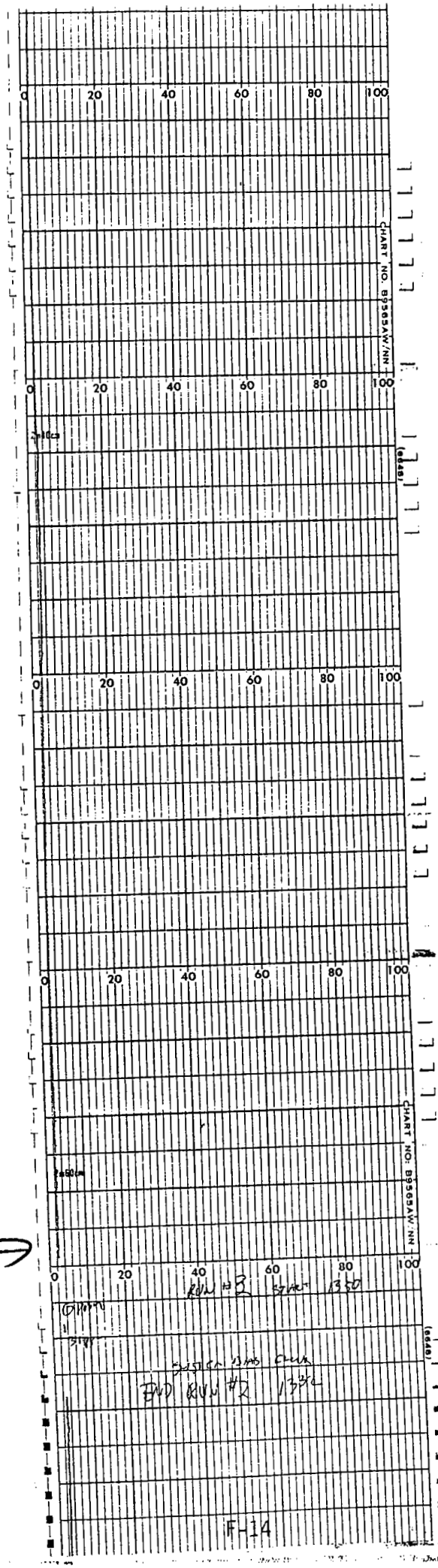
ACS - East Stack Yorke

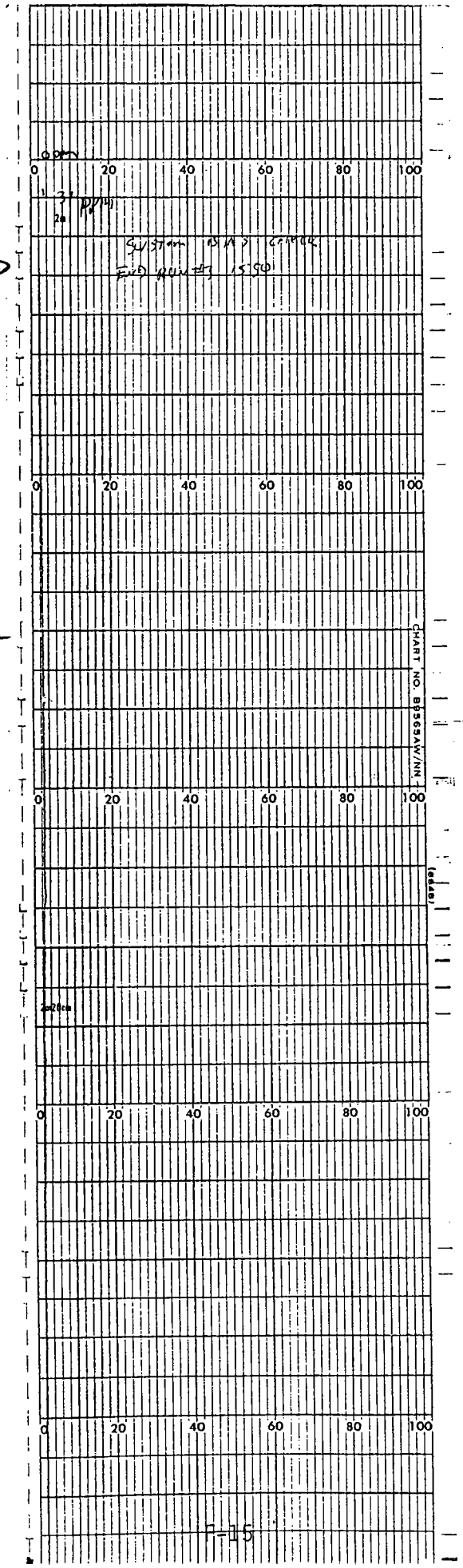
"B" Pulp Dryer Stack



Run 2 → End

ACS
East Stand
Forks
"B" Pulp
Drystack


0 20 40 60 80 100
CHART NO. B956SAW-NN
Run 3 Start
ACS-EGF
"B" Pulp Dryer Stack
F-14



Gun 3 → End

ACS - East Grand Forks

"B" Pulp Drystack"

APPENDIX G

MEASUREMENT SYSTEMS PERFORMANCE SPECIFICATIONS

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

Job FCS - EC-F

Test 3 Run C Date 11-9-93
Operator S.B

THC Calibration (Low Range): Time(HRS) 0730

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	1000	
Low level	3.2	3.1	0.2	1000	
Mid level	303	303	0	1000	
High level	2755	2770	50	10,000	

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

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

O_2 Calibration: Time(HRS) _____

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

CO_2 Calibration: Time(HRS) _____

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

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

INTERPOLL LABORATORIES
(612) 786-6020

THC System Bias Check

Job ACS ECF Source C POLD DRAW
Test 3 Run 123 Date 11-9-93 Site STACK
Operator SCB

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm) Cal Err	Sys Bias	Diff. CE-SB (ppm)	Span Val (PPM)	% of span
1	0930	Zero gas	0	0	0	0	1000	
		Upscale	31.2	31	31	0	1000	
2	1315	Zero gas	0	0	0	0	1000	
		Upscale	31.2	31	31	0	1000	
3		Zero gas	0	0	0	0	1000	
		Upscale	31.2	31	31	0	1000	
4		Zero gas	0					
		Upscale						
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 25A
Calibration Error Check & Drift Determination

Job AES - FGF

Test 3 Run 1 Date 1-10-93
Operator [illegible]

THC Calibration (Low Range): 0-10 ppm Time(HRS) [illegible]

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	10.0	
Low level	3.2	3.1	0.2	10.0	
Mid level	7.0	7.0	0	10.0	
High level					

THC Calibration (High Range): Time(HRS) 1315

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	10.0	
Span	7.50	7.40	10	10.0	

O_2 Calibration: Time(HRS) _____

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

CO_2 Calibration: Time(HRS) _____

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

Must be within 2% of the span for each calibration gas

S-420-14

INTERPOLL LABORATORIES
(612) 786-6020

THC System Bias Check

Job [illegible] Source [illegible]
Test [illegible] Run [illegible] Date [illegible] Site [illegible]
Operator [illegible]

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	0920	Zero gas	0	0	0	0	[illegible]	
		Upscale	3[illegible]	31	31	0	[illegible]	
2	1130	Zero gas	0	0	0	0	[illegible]	
		Upscale	31[illegible]	31	31	0	[illegible]	
3	1350	Zero gas	0	0	0	0	[illegible]	
		Upscale	31[illegible]	31	31	0	[illegible]	
4		Zero gas	0					
		Upscale						
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 25A
Calibration Error Check & Drift Determination

Job ACS - IGF

Test 11 Run 1 Date 11-11-93
Operator SCB

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

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	1000	
Low level	312	31	0.2	1000	
Mid level	303	303	0	1000	
High level					

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

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	10,000	
Span	7750	7750	0	10,000	

O_2 Calibration: Time(HRS) _____

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

CO_2 Calibration: Time(HRS) _____

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

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

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TAC System Bias Check

Job ACS - EGR Source A RUCP DRYER
Test 11 Run 1,2,3 Date 11-11-93 Site STACK
Operator SB

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	730	Zero gas	0	0	0	0	1000	
		Upscale	31	31	31	0	1000	
2	1030	Zero gas	0	0	0	0	1000	
		Upscale	31	31	31	0	1000	
3	1230	Zero gas	0	0	0	0	1000	
		Upscale	31	31	31	0	1000	
4		Zero gas	0					
		Upscale						
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

APPENDIX H

THC ANALYZER SPECIFICATIONS

Ratfisch INSTRUMENTE

TOTAL HYDROCARBON ANALYZER (FLAME IONIZATION)
Model RS 55

TECHNICAL DATES

MAINS : 115V/60H

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

MODEL: X Manual switching
__ Solenoid valves

HOUSING: __ Case, __ 19"-Rack

MEASURING RANGES:

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

SPECIAL OPTIONS:

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

ANALYZER CONDITIONS:

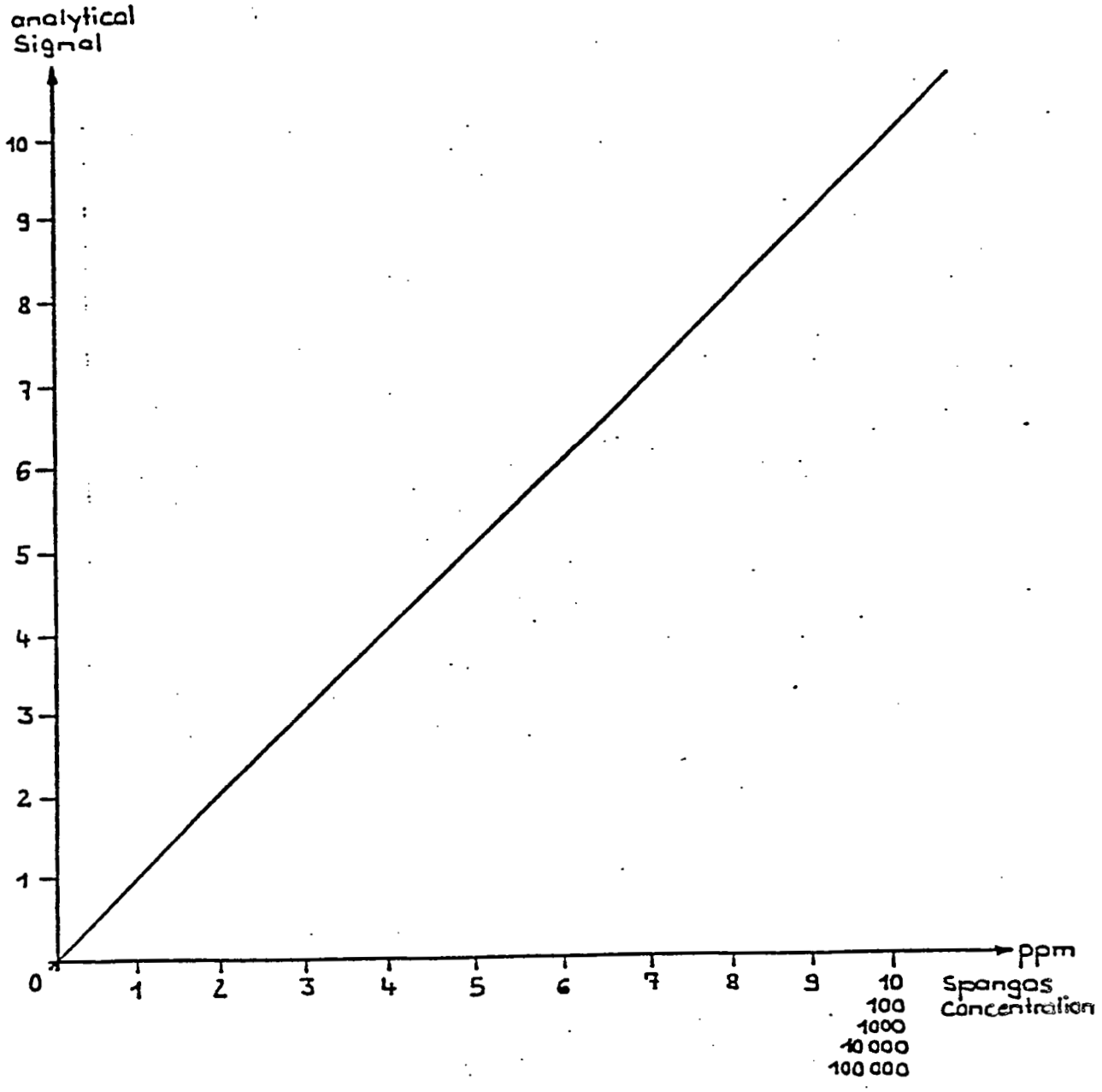
Temperature : 160 °C

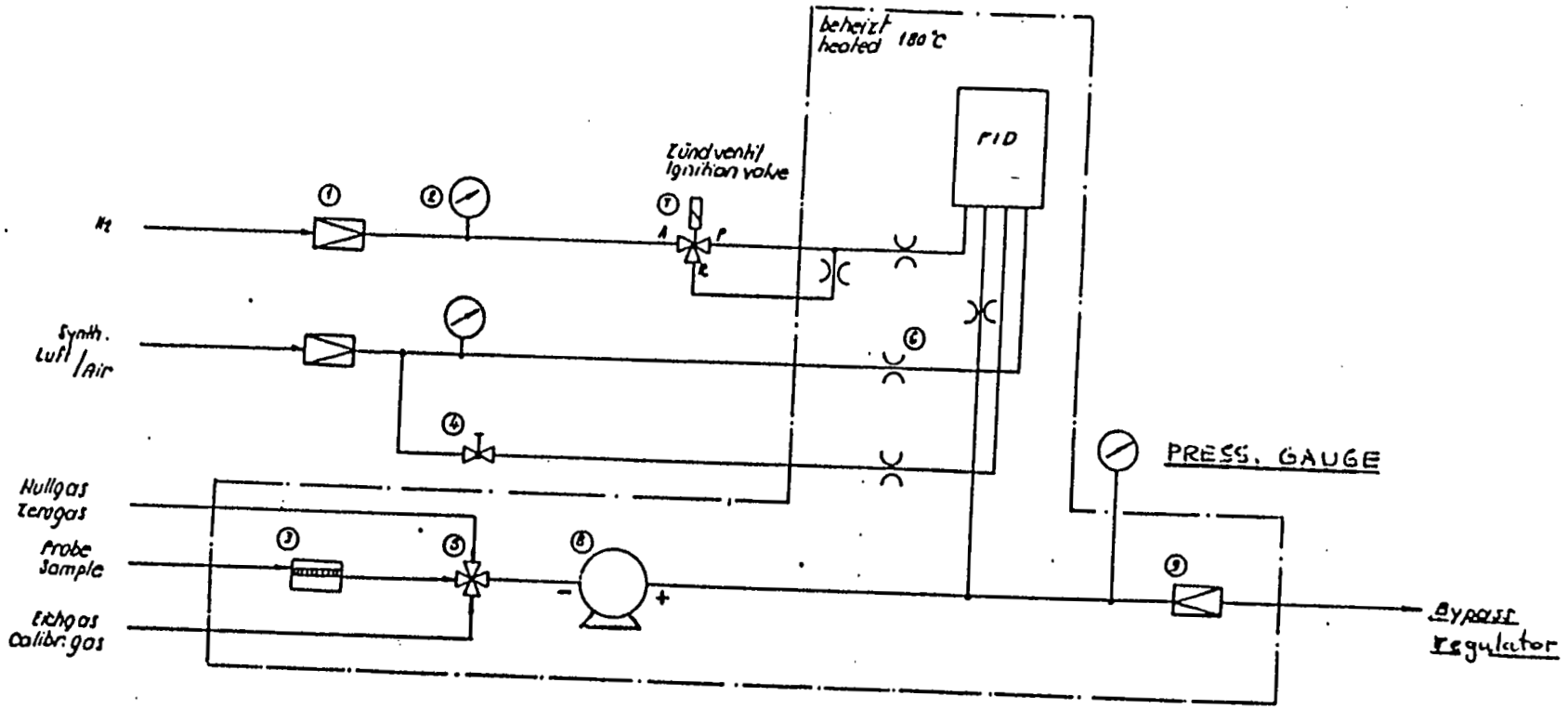
Zero Point : 3,90
Gain : 7,70

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

Span Gases : 300 ppm C_1
24.000 ppm C_1

CALIBRATION DIAGRAMM





1 Druckregler
Pressure regulator
2 Manometer
Gauge
3 Filter
4 Nadelventil
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 angezogen
energised
R-A stromlos
at rest

Handumschaltung
Manuel switching

Ratfisch Instrumente	FLAMMEN IONISATIONS DETEKTOR Flame Ionisation Detector
Fließplan Flowdiagram	RS 55 13.04.88 dk

APPENDIX I

CALIBRATION GAS CERTIFICATION SHEETS

NATIONAL SPECIALTY GASES
630 UNITED DRIVE
DURHAM, NC 27713
(919) 544-3772

CERTIFICATE OF ANALYSIS-EPA PROTOCOL MIXTURES

REFERENCE #: 88-26690 CYLINDER #:CC112056 CYL. PRESSURE:2000PSIG

EXPIRATION DATE: 9/15/96 LAST ANALYSIS DATE:9/15/93

CUSTOMER:TWIN CITY OXYGEN P.O.# 6422
METHOD: EPA PROTOCOL # 1 3.0.4. G-1

STANDARD:

SRM #:1667B

CYL #:CLM5046

CONC.:47.3PPM

INSTRUMENT:

COMPONENT: BECKMAN THC

MODEL #: 400

SERIAL #: 1003052

LAST CAL.: 9/1/93

COMPONENT:	PROPANE	REPLICATE CONC.	
MEAN CONC:	31.2PPM	DATE: 9/15/93	DATE:
		31.3PPM	
		31.1PPM	
		31.3PPM	

COMPONENT:	REPLICATE CONC.	
MEAN CONC:	DATE:	DATE:

COMPONENT:	REPLICATE CONC.	
MEAN CONC:	DATE:	DATE:

BALANCE GAS:AIR

NATIONAL SPECIALTY GASES
630 UNITED DRIVE
DURHAM, NC 27713
(919) 544-3772

CERTIFICATE OF ANALYSIS-EPA PROTOCOL MIXTURES

REFERENCE #: 88-26689 CYLINDER #:CC109652 CYL. PRESSURE:2000PSIG

EXPIRATION DATE: 9/15/96 LAST ANALYSIS DATE:9/15/93

CUSTOMER:TWIN CITY OXYGEN P.O.# 6422
METHOD: EPA PROTOCOL # 1 3.0.4. G-1

STANDARD:

SRM #:1669B

CYL #:CLM812

CONC.:464PPM

INSTRUMENT:

COMPONENT: BECKMAN THC

MODEL #: 400

SERIAL #: 1003052

LAST CAL.: 9/1/93

COMPONENT:	PROPANE	REPLICATE CONC.	
MEAN CONC:	303PPM	DATE: 9/15/93	DATE:
		303PPM	
		303PPM	
		304PPM	

COMPONENT:	REPLICATE CONC.	
MEAN CONC:	DATE:	DATE:

COMPONENT:	REPLICATE CONC.	
MEAN CONC:	DATE:	DATE:

BALANCE GAS:AIR

NATIONAL SPECIALTY GASES
630 UNITED DRIVE
DURHAM, NC 27713
(919) 544-3772

CERTIFICATE OF ANALYSIS-EPA PROTOCOL MIXTURES

REFERENCE #: 88-26688 CYLINDER #:CC117599 CYL. PRESSURE:2000PSIG

EXPIRATION DATE: 9/15/96 LAST ANALYSIS DATE:9/15/93

CUSTOMER:TWIN CITY OXYGEN P.O.# 6422
METHOD: EPA PROTOCOL # 1 3.0.4. G-1

STANDARD:

SRM #:2648A

CYL #:FF27174

CONC.:4892PPM

INSTRUMENT:

COMPONENT: BECKMAN THC

MODEL #: 400

SERIAL #: 1003052

LAST CAL.: 9/1/93

COMPONENT:	PROPANE	REPLICATE CONC.	
MEAN CONC:	2750PPM	DATE: 9/15/93	DATE:
		2751PPM	
		2749PPM	
		2748PPM	

COMPONENT:		REPLICATE CONC.	
MEAN CONC:		DATE:	DATE:

COMPONENT:		REPLICATE CONC.	
MEAN CONC:		DATE:	DATE:

BALANCE GAS:AIR

APPENDIX J

PROCEDURES

Particulate Loadings and Emission Rates

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

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

Particulate samples were collected as follows: The sample gas was drawn in through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter. The particulates were removed at this point and collected on the filter. The gases then passed through an ice-cooled impinger train and a desiccant-packed drying column which quantitatively 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).

Interpoll Laboratories
(612)786-6020

Condensible Organic Compounds Analysis

(State of Minnesota - MPCA Exhibit C)

Method II-8672-MN

Equipment: Separatory funnel - 500 cc with Teflon stopcock

Powder funnel - 75 mm ID with a 17 mm stem

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

Reagents: Diethyl ether - reagent grade

Chloroform - reagent grade

Sodium sulfate - (ACS) granular anhydrous

Toluene - (if 3% hydrogen peroxide is used to collect the samples)

Glass wool (Pyrex microfiber)

PREPARATION

1. Place 1 kg of granular anhydrous sodium sulfate in a shallow tray and heat to 200 ^{o}C for at least four hours. Store in a tightly sealed glass container.

2. Place a plug of clean glass wool in the stem of the powder funnel. The plug must be of sufficient size so that it is held snuggly in place by its own pressure. Add a one-inch layer of dry sodium sulfate.

ANALYSIS

I. Organics

Caution! Work in vented hood!!!

A. Organic Blank Determination

1. Pour 125 mL of ethyl ether and 125 mL of chloroform into a tared beaker.
2. Evaporate solvent in hood at 70 ^{o}F or less until no solvent remains.
3. Desiccate the sample in dish for two hours.
4. Weigh the sample to nearest 0.1 mg, record and report on Form LSC-036.

B. Organic Sample Determination

1. Test for peroxide in sample ether using KI strips. (If KI strip shows positive, contact your supervisor before proceeding.)
2. Transfer the sample solution quantitatively to a 500 mL separatory funnel. Use the first of three 25 mL chloroform aliquots to rinse the sample container.
3. Extract with three 25 mL portions of chloroform. (Shake and vent to release pressure about 4 to 5 times each.) Allow the phases to separate. (Bottom layer is chloroform.) Draw off the bottom layer, transferring the solvent with a funnel containing a plug of sodium sulfate into a tared beaker. (Do not draw off any of the aqueous layer.)

4. After the three chloroform extractions, use two 25 mL portions of chloroform to rinse the sodium sulfate, collecting the rinses in the same tared beaker as the extracts.

5. Next extract the sample three times with 25 mL aliquots of ethyl ether. (Shake and vent to release pressure about 4 to 5 times each.) Allow the phases to separate. (Top layer is ethyl ether.) Draw off the bottom layer (aqueous) into another separatory funnel taking less than 1 mL of the ethyl ether layer with. Decant the ethyl ether, passing it through sodium sulfate and collecting the ethyl ether in the same tared dish as the chloroform.

6. After the three ethyl ether extractions, take two 25 mL portions of ethyl ether and rinse the sodium sulfate collecting the rinses in the same tared beaker as the extracts.

7. Evaporate the solvents (chloroform and ethyl ether) in the tared beaker in the hood at 70 ^{o}F or less until no solvent remains. (Use no heat and have no sources of ignition in the hood when doing this procedure.) Do not evaporate so quickly as to allow evaporative cooling to lower the temperature of the container below the dew point of water, otherwise, water will be condensed out in the container.

8. Desiccate to constant weight (two hours). Record and report the final weight to the nearest 0.1 mg on Form LSC-036.

II. Inorganics

If inorganic residue information is required, the following procedure should be conducted:

A. Inorganic Blank Determination

1. Vent the remaining aqueous phase from the organic extraction in the hood to remove residual organic solvents (usually overnight).
2. Decant the impinger catch into a tared evaporating dish.
3. Evaporate all of the water in the sample in an oven at 100 ^{o}C. Take care not to boil to prevent bumping and loss of sample.
4. Cool the dried sample in the desiccator and desiccate until a constant weight is obtained.
5. Report the results to the nearest 0.1 mg on Form LSC-036.

B. Inorganic Sample Determination

Follow steps 1-5 in Section A above.

NOTES

1. For the organics determination, in the rare event that the impinger catch resulted from a Modified Method 6 determination (SO_2), whereby the solution contains dilute hydrogen peroxide ($\geq$ 3%), do not use ether as an extraction solvent. Substitute toluene for ethyl ether in Section I. (Ether in the presence of peroxide forms explosive hydroperoxide.)

2. In the organics determination, more than three extractions may be required to extract all of the organics. Additional extractions should be performed if the aqueous phase is still cloudy.

3. Special state requirements:

   Michigan - Total sample evaporated in tared evaporating dish on steam bath.

   Iowa - Organics and inorganics separately, as required.

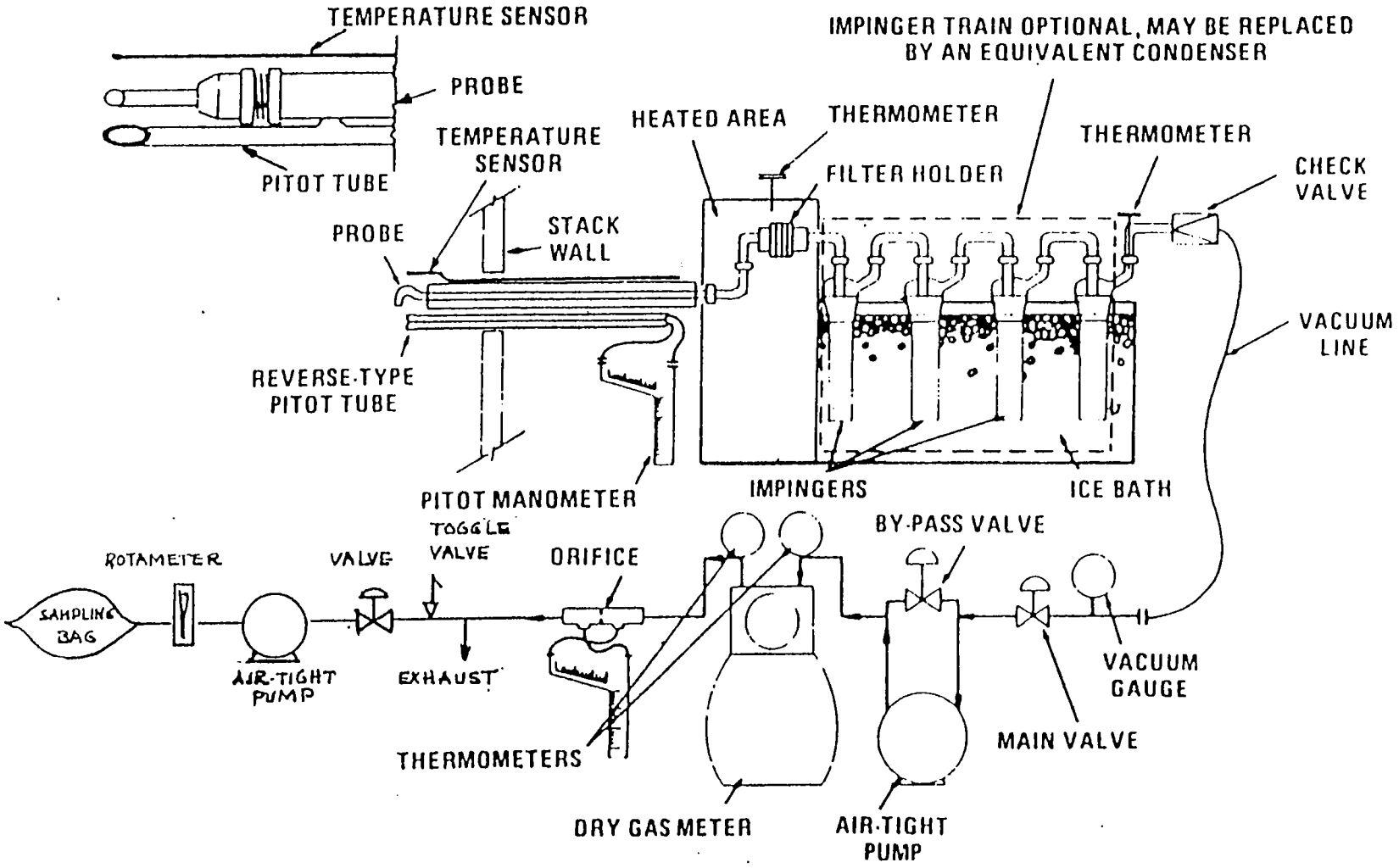
   Wisconsin - Use Method II-8672-WI.

   Rest of states - Organics only.

REFERENCES

Proposed Standards of Performance for New Stationary Sources, Federal Register 36(159) Part II, August 1, 1979.

Minnesota Pollution Control Agency, Exhibit C.



Particulate-sampling train.

Interpoll Laboratories, Inc.
(612)786-6020

Determination of Sulfur Dioxide From Stationary Source Samples

Interpoll Method Modified EPA 5-AIR
EPA Reference Methods 5 and 6

Version 1.0
July 17, 1991

Total Number of Revisions 0
Date of Last Revision July 17, 1991

1 APPLICATION

This method is applicable for the determination of sulfur dioxide emissions from stationary sources.

2 RANGE

The minimum detectable limit of the method has been determined to be 3.4 mg of SO_2/m^3. No upper limit has as of yet been established.

3 SAMPLE HANDLING AND PRESERVATION

No preservation requirements are necessary. If possible, keep samples cooled below 4 degrees celsius.

4 SUMMARY OF METHOD

A gas sample is extracted from the sampling point in the stack using a standard EPA method 5 sampling train equipped with 2 impingers containing deionized water which collect the condensible organics. For the collection of sulfur dioxide, the sampling train is modified by the addition of 2 impingers containing 3% peroxide. Each impinger solution is recovered separately in the field and returned to the laboratory for analysis.

5 INTERFERENCES

5.1 Cations and fluorides are interferents which should be removed by glass wool filters and an isopropanol bubbler, neither of which will affect the sulfur dioxide collection.

5.2 Free ammonia will interfere with the sulfur dioxide analysis by reacting with the sulfur dioxide to form particulate sulfite. This particulate consists of white particulate noticed in the probe and isopropanol bubbler. Alternative methods for this type of situation are required, however, they must first be approved by the EPA.

6 APPARATUS AND GLASSWARE

6.1 Sampling train (modified EPA method 5 set up).

6.2 Wash bottles, polyethylene, 100 mL. (2)

6.3 Storage bottles, polyethylene, 100 mL, to store impinger samples.

6.4 Pipettes, Volumetric type, 5 mL, 20 mL (one per sample), and 25 mL sizes.

6.5 Volumetric flasks, 100 mL (one per sample) and 1000 mL size.

6.6 Burettes, 5 and 50 mL sizes.

6.7 Erlenmeyer flasks, 250 mL (one for each sample, blank and standard).

6.8 Dropping bottle, 125 mL size.

6.9 Graduated cylinder, 100 mL size.

6.10 Spectrophotometer, capable of measuring absorbance at 352 nanometers.

7 REAGENTS

7.1 Water: deionized distilled to conform to ASTM Type III (D1193-77).

7.2 Isopropanol: (80%) mix 80 mL of isopropanol with 20 mL ASTM Type III water. Each lot of isopropanol must be checked prior to use as follows:

Shake 10 mL of isopropanol with 10 mL of freshly prepared 10% potassium iodide solution. Prepare a blank by similarly treating 10 mL of distilled water. After 1 minute, read the absorbance at 352 nm on the spectrophotometer. If absorbance exceeds 0.1, reject alcohol for use. Alcohol may be passed through activated alumina to remove peroxides, however, it may be more efficient to reject the lot and purchase a reagent grade isopropanol with low peroxides.

7.3 Hydrogen peroxide: (3%) Dilute 30% hydrogen peroxide 1:9 with ASTM Type III water. Prepare fresh daily.

7.4 Potassium iodide solution: (10%) Dissolve 10 grams KI in ASTM Type III water and dilute to 100 mL. Prepare as needed.

7.5 Isopropanol: (100%).

7.6 Thorin Indicator: Dissolve 0.2 grams in 100 mL ASTM Type III water.

7.7 Barium perchlorate solution: (0.010 N) Dissolve 1.95 grams of barium perchlorate trihydrate in 200 mL distilled water and dilute to 1 liter with isopropanol. Standardize as in Section 10.

7.8 Sulfuric Acid Standard: (0.010 N).

8 SAFETY

Normal, accepted stationary source testing safety practices should be followed during sampling. Good laboratory practics should be followed during the analysis. Caution should be excersized when working with hydrogen peroxide. There are no known carcinogens used in this method.

9 PROCEDURE

9.1 Follow EPA method 5 for sampling train set up, sampling procedures, and sample recovery.

9.2 Analysis of 3% Peroxide Catch Samples for Sulfate:

9.2.1 Note the level of fluid. Confirm whether any sample was lost during shipment. Record all necessary information on form S-421 (Figure 9-1).

9.2.2 Transfer contents of the bottle to a 100 mL volumetric flask and dilute to volume with ASTM Type III water.

9.2.3 Pipette a 20 mL aliquot of this solution into a 250 mL Erlenmeyer flask and add 80 mL of 100% isopropanol and approx. 2 drops of thorin indicator.

9.2.4 Titrate to a pink endpoint using 0.010 N barium perchlorate.

9.2.5 Repeat steps 9.5.3 and 9.5.4 and average the two results.

Figure 9-1. EPA Method 6 Sulfur Dioxide Titration Data Sheet

Interpoll Laboratories
(612) 786-6020

EPA Method 6 Sulfur Dioxide
Titration Data Sheet

Job ______________________ Source ______________________
Team Leader ______________________ Test Site ______________________
Date Submitted ______________________ Date of Test ______________________
Test No. ______________________ No. of Runs Completed ______________________
Date of Analysis ______________________ Technician ______________________

Test/ Run	Sample Log Number	pH of Original Sample *	Final Vol. (V_{soln})	Dilution Factor (DF)	Aliquot Titrated (V_a)	No. of An.	Start Vol. Buret (ml)	Final Vol. Buret (ml)	Volume of Tit. (V_t) (ml)
Field Blank		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			V_{tb}
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			
		☐ pH<3.5 ☐ pH_____	☐ 500 ml ☐ 250 ml ☐ 100 ml ☐ _____ml	☐ 1 DF ☐ 10 DF ☐ 25 DF ☐ 50 DF ☐ _____DF	☐ 1 ml ☐ 5 ml ☐ 10 ml ☐ 20 ml ☐ _____ml	1			
						2			
						Avg			

Normality of Titrant (N): ________N

☐ Ion Exchange
☐ EPA Audit(s)

Vol. Titrant for Field blank (V_{tb}): ________ml
Vol. Titrant for Method Blank: ________ml

Audit No. ____________
Audit No. ____________

** If pH >3.5 Adjust with conc. perchloric acid to pH~2.0*

S-421

9.3 Analysis of DI Water Catch Samples for Sulfate:

9.3.1 Transfer the contents of the bottle to a 500 mL volumetric flask and bring up to volume with ASTM Type III water. Use form S-421 (Figure 9-1) to record all necessary information.

9.3.2 Pipette a 100 mL aliquot into a 250 mL Erlenmeyer flask, add 100 uL of 30% peroxide. Test solution with KI paper. If paper turns purple, the solution is KI positive. If the paper stays white, continue adding 100 ul increments of 30% peroxide until positive KI paper indication is achieved.

9.3.3 Titrate sample according to steps 9.5.4 and 9.5.5.

9.4 Analysis of DI Water Catch Samples for Condensible Organics:

Using the 400 mL of sample left after step 4.6.2, check this sample with KI paper for evidence of possible peroxide contamination. If the KI paper turns purple, check with your supervisor before proceeding. If the KI paper stays white in color, proceed with standard Minnesota protocol extraction (Interpoll Method II-8672-MN).

10 CALCULATION

10.1 For the calculation of sulfur dioxide, use the information recorded on form S-421 (Figure 9-1), fill out form S-421A (Figure 10-1) and perform the required calculations.

10.2 For the calculation of condensible organics, follow standard Minnesota protocol (Interpoll Method II-8672-MN).

Figure 10-1. EPA Method 6 Sulfur Dioxide Calculation Data Sheet.

Interpoll Laboratories
(612) 786-6020

EPA Method 6 Sulfur Dioxide Calculation Data Sheet[1]

Job_____ Source_____
Team leader_____ Test Site_____
Date submitted_____ Date of Test_____
Test Number_____ No. of Runs Completed_____
Date of analysis_____ Technician_____

MEQ Calculation

$$MEQ = \frac{DF\ N\ (V_s - V_b)\ V_s}{V_a}$$

DF = Dilution Factor
N = Normality of Titrant
V_s = Volume of Titrant Sample (ml)
V_b = Volume of Titrant Blank (ml)
V_s = Final Volume of sample (ml)
V_a = Volume of Aliquot (ml)

Water Catch

Test___Run___ MEQ = (___)(___)(___ - ___)(___) / (___) = _____MEQ

Test___Run___ MEQ = (___)(___)(___ - ___)(___) / (___) = _____MEQ

Test___Run___ MEQ = (___)(___)(___ - ___)(___) / (___) = _____MEQ

3% Peroxide Catch

Test___Run___ MEQ = (___)(___)(___ - ___)(___) / (___) = _____MEQ

Test___Run___ MEQ = (___)(___)(___ - ___)(___) / (___) = _____MEQ

Test___Run___ MEQ = (___)(___)(___ - ___)(___) / (___) = _____MEQ

Total MEQ Per Run:

Test____Run____ = _____ MEQ

Test____Run____ = _____ MEQ

Test____Run____ = _____ MEQ

Comments:_____

1 Form to be used in conjunction with combination method 5 and 6 train.
S-421A

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Revision No. 0
Date July 17, 1991
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11 QUALITY CONTROL PROCEDURES

11.1 One blank must be titrated with each series of samples.

11.2 An acetone reagent blank will be used as the probe wash field blank. Samples will be blank corrected using the acetone reagent blank results.

11.3 Replicate titrations must meet the limits set in Section 12 of this method.

11.4 EPA supplied audit samples will be analyzed at each field site. These audit samples will follow the same procedures as all other samples. The results of the audit samples must meet the requirements set in Section 12 of the method.

11.5 All leak checks outlined in Section 9 - procedure, are quality control checks.

11.6 All calibration steps required in EPA Method 5 should be followed for correct usage of the sampling train.

12 ACCURACY AND PRECISION

12.1 The precision control limit for replicate titrations is 1 percent or 0.2 mL whichever is larger.

12.2 The concentrations of the audit samples obtained from the EPA shall agree within 5 percent of the actual concentrations. If the 5 percent specification is not met, reanalyze the compliance samples and audit samples, and include initial and reanalysis values in the test report.

13 REFERENCES

13.1 CFR Title 40 Part 60 Appendix A: EPA Method 5 (Revised July 1990).

13.2 CFR Title 40 Part 60 Appendix A: EPA Method 6 (Revised July 1990).

Flow

Flow determinations were carried out in accordance with EPA Method 2, CFR Title 40, Part 60, Appendix A (Revised July 1, 1987). A type S pitot was used to sense velocity pressure and an inclined manometer was used to measure velocity pressures. Gas temperatures were measured using a calibrated Type K thermocouple and digital temperature meter. Gas density (i.e. molecular weight) was calculated from the composition of the gas which was determined by Orsat.

Gas Flow Density

Gas compositions were determined as per Method 3 by Orsat analysis of an integrated gas sample collected from the stack during the oxides of nitrogen determinations. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen).

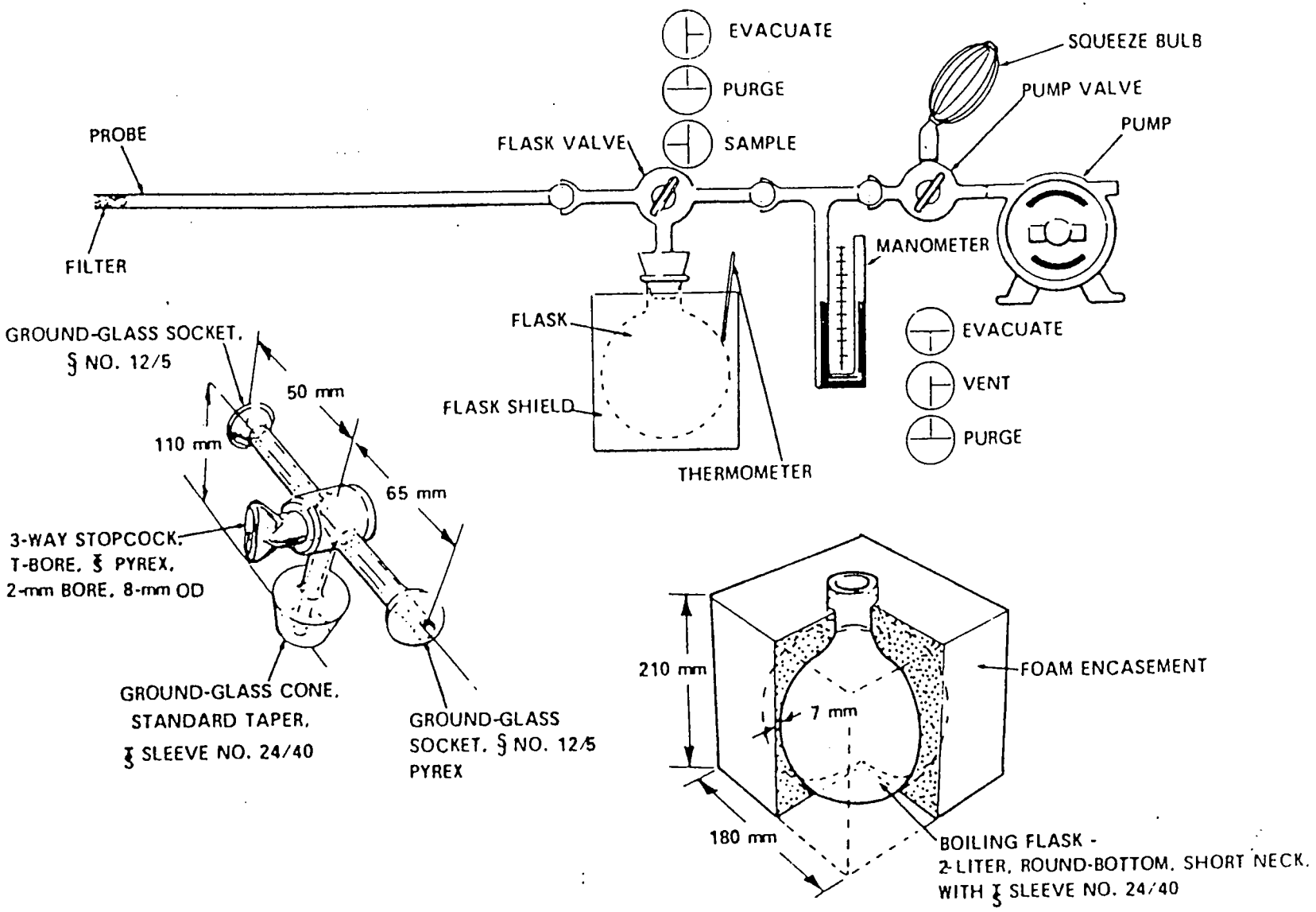
Oxides of Nitrogen

Oxides of nitrogen concentrations were collected in accordance with EPA Method 7 (see above-cited reference) with a specially designed all glass manifold and valving assembly and a heated stainless steel-lined probe. Samples were collected in two-liter evacuated insulated flasks which contained 25 cc of acidified peroxide solution (Method 7 reagent). Nine sets or more of three samples each were collected over a period of 4.5 to 5 hours.

The sampling train was leak checked through the probe at the beginning and end of the test and, in addition, the system leak checked at the time of evacuation of each flask. Before the samples were collected, the probe was purged to eliminate dead volume effects and to raise the temperature of the probe outlet and manifold assembly to minimize condensation of moisture. A plug of microfiber glass wool inserted in the probe inlet was used to prevent particulate material from entering into the flask. The temperature of the flask, vacuum in the

flask and barometric pressure at the time of sampling was recorded for each flask. After sampling was complete, as evidenced by the in-line vacuum gauge, the flask valve was closed, the flask assembly disconnected from the manifold/valve assembly and the flask shook for several minutes to promote oxidation and absorption. The recovered oxides of nitrogen samples were returned to the laboratory and analyzed immediately by ion chromatography as per EPA 7A.

The internal volume of each numbered flask assembly has been measured prior to initial use by filling with water, weighing before and after and then converting the weight of water to volume by means of the density of water at room temperature. Flask volumes are stored in the computer and recalled automatically in the computer calculation.



Sampling train, flask valve, and flask.

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

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

5. *References*

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

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

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

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

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

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

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

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

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

Method 10—Determination of Carbon Monoxide Emissions From Stationary Sources

1. *Principle and Applicability*

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

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

2. *Range and Sensitivity*

2.1 Range. 0 to 1,000 ppm.

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

3. *Interferences*

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

4. *Precision and Accuracy*

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

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

5. *Apparatus*

5.1 Continuous Sample (Figure 10-1).

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

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

5.2 Integrated Sample (Figure 10-2).

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

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

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

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

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

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

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

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

5.3 Analysis (Figure 10-3).

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

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

5.3.3 Calibration Gas. Refer to section 6.1.

5.3.4 Filter. As recommended by NDIR manufacturer.

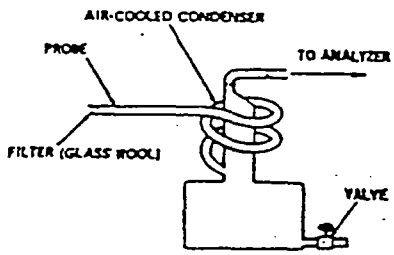


Figure 10-1. Continuous sampling train.

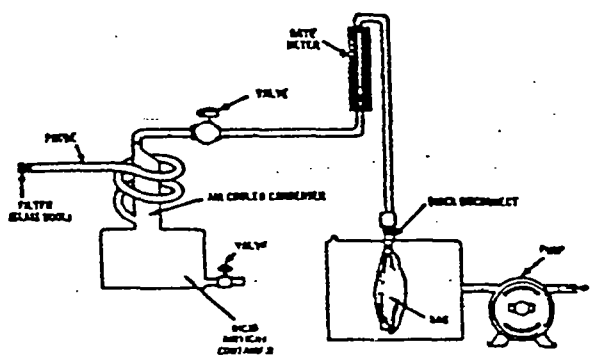


Figure 10-2. Integrated gas sampling train.

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

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

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

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

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

6. *Reagents*

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

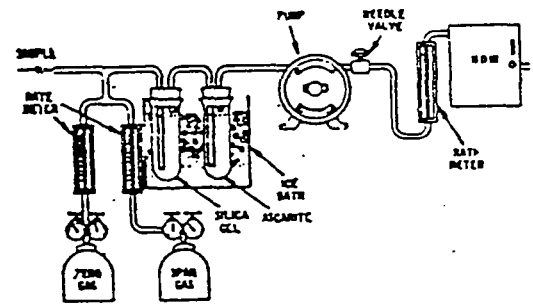


Figure 10-3. Analytical equipment.

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

6.3 Ascarite. Commercially available.

7. *Procedure*

7.1 Sampling.

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

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

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

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

8. *Calibration*

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

TABLE 10-1—FIELD DATA

	Comments
Location	
Test	
Date	
Operator	

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

9. *Calculation*

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

$$C_{CO\ stack} = C_{CO\ NDIR}(1 - F_{CO_2}) \qquad \text{Eq. 10-1}$$

Where:

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

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

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

10. Alternative Procedures

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

11. *Bibliography*

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

ADDENDA

A. PERFORMANCE SPECIFICATIONS FOR NDIR CARBON MONOXIDE ANALYZERS

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

B. *Definitions of Performance Specifications.*

Range—The minimum and maximum measurement limits.

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Applicability and Principle

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

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

1.3 Range and Sensitivity.

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

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

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

1.5 Precision, Accuracy, and Stability.

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

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

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

2. Apparatus

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

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

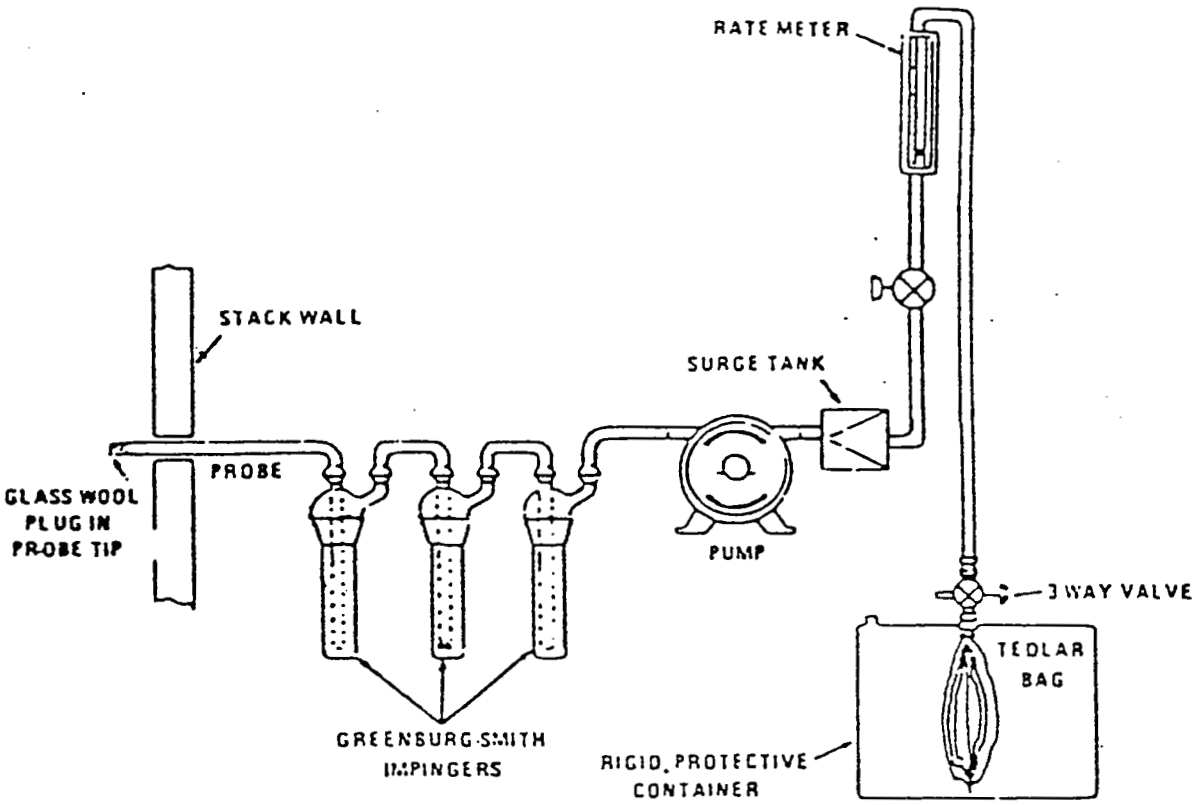


Figure 10A-1. Sampling train.

2.1.1 Probe. Stainless steel, sheathed Pyrex glass, or equivalent, equipped with a glass wool plug to remove particulate matter.

2.1.2 Sample Conditioning System. Three Greenburg-Smith impingers connected in series with leak-free connections.

2.1.3 Pump. Leak-free pump with stainless steel and Teflon parts to transport sample at a flow rate of 300 ml/min to the flexible bag.

2.1.4 Surge Tank. Installed between the pump and the rate meter to eliminate the pulsation effect of the pump on the rate meter.

2.1.5 Rate Meter. Rotameter, or equivalent, to measure flow rate at 300 ml/min. Calibrate according to Section 5.2.

2.1.6 Flexible Bag. Tedlar, or equivalent, with a capacity of 10 liters and equipped with a sealing quick-connect plug. The bag must be leak-free according to Section 4.1. For protection, it is recommened that the bag be enclosed with a rigid container.

2.1.7 Valves. Stainless-steel needle valve to adjust flow rate, and stainless-steel three-way valve, or equivalent.

2.1.8 CO_2 Analyzer. Method 3 or its approved alternative to measure CO_2 concentration to within 0.5 percent.

2.1.9 Volume Meter. Dry gas meter, calibrated and capable of measuring the sample volume under rotameter calibration conditions of 300 ml/min for 10 minutes

2.1.10 Pressure Gauge. A water filled U-tube manometer, or equivalent, of about 28 cm (12 in.) to leak-check the flexible bag.

2.2 Analysis.

2.2.1 Spectrophotometer. Single- or double-beam to measure absorbance at 425 and 600 nm. Slit width should not exceed 20 nm.

2.2.2 Spectrophotometer Cells. 1-cm pathlength.

2.2.3 Vacuum Gauge. U-tube mercury manometer, 1 meter (39 in.), with 1-mm divisions, or other gauge capable of measuring pressure to within 1 mm Hg.

2.2.4 Pump. Capable of evacuating the gas reaction bulb to a pressure equal to or less than 40 mm Hg absolute, equipped with coarse and fine flow control valves.

2.2.5 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 1 mm Hg.

2.2.6 Reaction Bulbs. Pyrex glass, 100.ml with Teflon stopcock (Figure 10A-2), leak-free at 40 mm Hg, designed so that 10 ml of the colorimetric reagent can be added and removed easily and accurately. Commercially available gas sample bulbs such as Supelco Catalog No. 2-2161 may also be used.

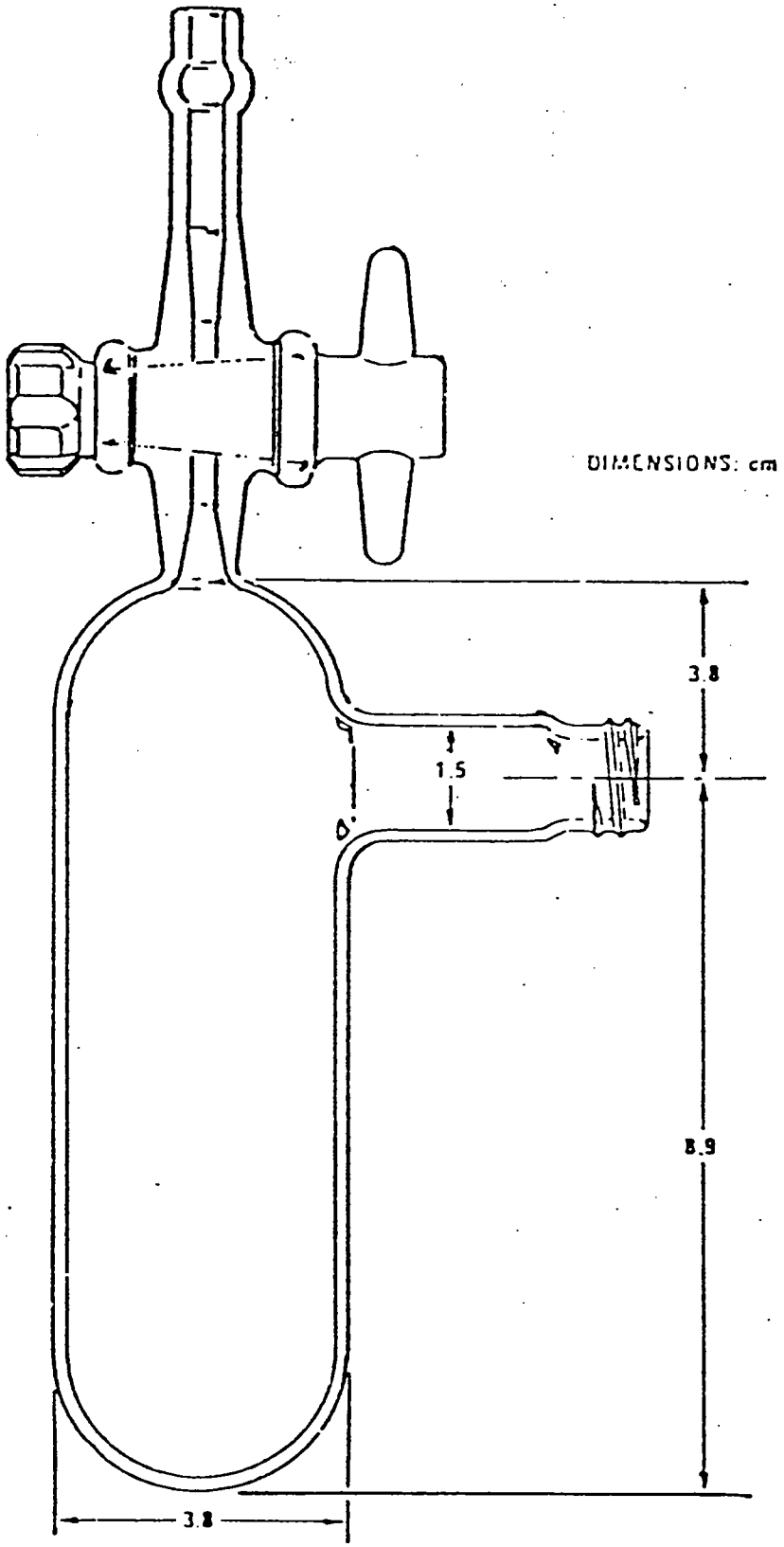


Figure 10A-2. Sample reaction bulbs.

2.2.7 Manifold. Stainless steel, with connections for three reaction bulbs and the appropriate connections for the manometer and sampling bag as shown in Figure 10A-3.

2.2.8 Pipets. Class A, 10-ml size.

2.2.9 Shaker Table. Reciprocating-stroke type such as Eberbach Corporation, Model 6015. A rocking arm or rotary-motion type shaker may also be used. The shaker must be large enough to accommodate at least six gas sample bulbs simultaneously. It may be necessary to construct a table top extension for most commercial shakers to provide sufficient space for the needed bulbs (Figure 10A-4).

2.2.10 Valve. Stainless steel shut-off valve.

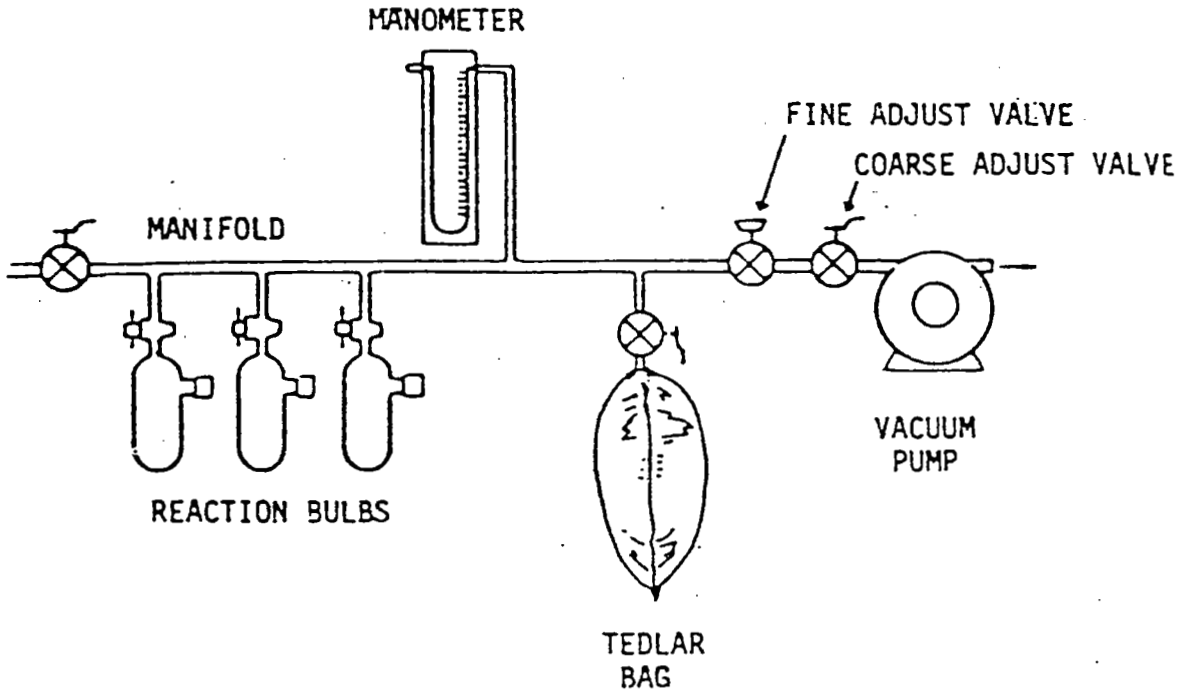


Figure 10A-3. Sample bulb filling system.

2.2.11 Analytical Balance. Capable of accurately weighing to 0.1 mg.

3. Reagents

Unless otherwise indicated, all reagents shall conform to the specifications estab-

lished by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available, otherwise, the best available grade shall be used.

3.1 Sampling.

3.1.1 Water. Deionized distilled, as described in Method 6, Section 3.1.1.

3.1.2 Alkaline Permanganate Solution, 0.25 M KMn0₄/1.5 M NaOH. Dissolve 40 g $KMnO_4$ and 60 g NaOH in water, and dilute to 1 liter.

3.2 Analysis.

3.2.1 Water. Same as in Section 3.1.1.

3.2.2 1 M Sodium Hydroxide (NaOH) Solution. Dissolve 40 g NaOH in approximately 900 ml of water, cool, and dilute to 1 liter.

3.2.3 0.1 M Silver Nitrate ($AgNO_3$) Solution. Dissolve 8.5 g $AgNO_3$ in water, and dilute to 500 ml.

3.2.4 0.1 M Para-Sulfaminobenzoic Acid (p-SABA) Solution. Dissolve 10.0 g p-SABA in 0.1 M NaOH (prepared by diluting 50 ml of 1 M NaOH to 500 ml), and dilute to 500 ml with 0.1 M NaOH.

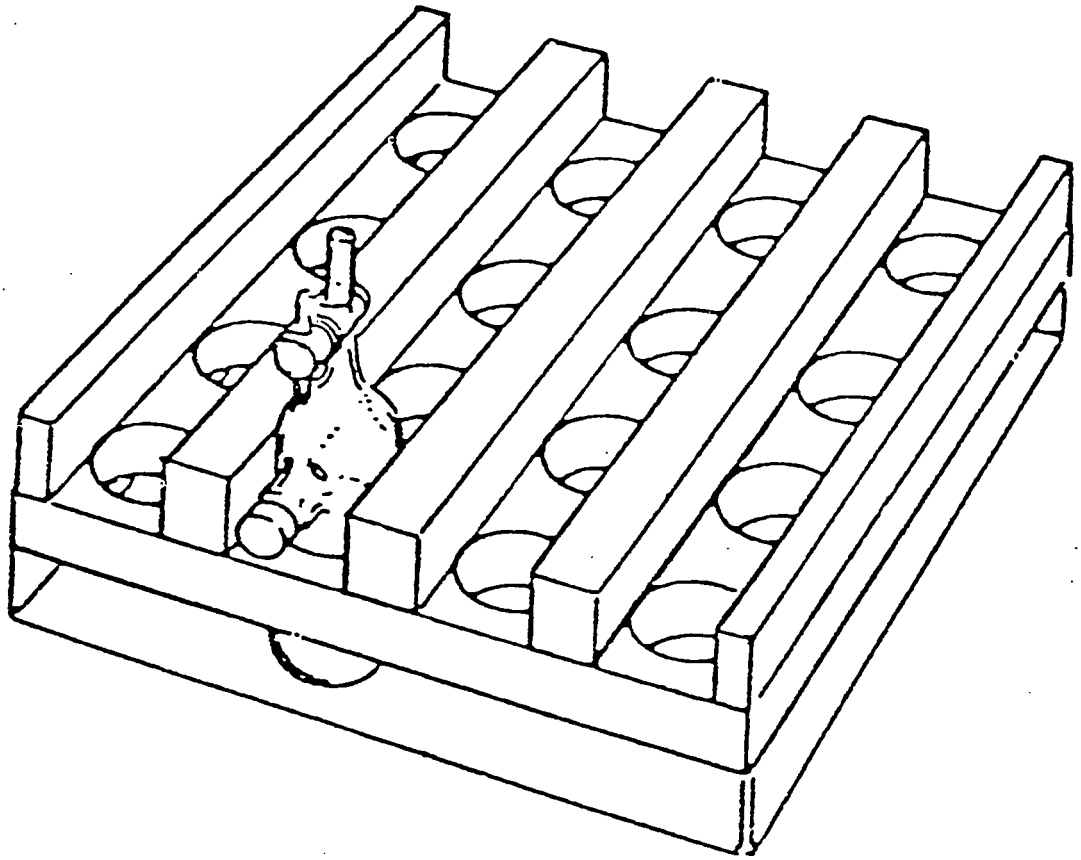


Figure 10A-4. Shaker table adapter.

3.2.5 Colorimetric Solution. To a flask, add 100 ml of p-SABA solution and 100 ml of $AgNO_3$ solution. Mix, and add 50 ml of 1 M NaOH with shaking. The resultant solution should be clear and colorless. This solution is acceptable for use for a period of 2 days.

3.2.6 Standard Gas Mixtures. Traceable to NBS standards and containing between 50 and 1000 ppm CO in nitrogen. At least two concentrations are needed to span each calibration range used (Section 5.3).

The calibration gases shall be certified by the manufacturer to be within 2 percent of the specified concentrations.

4. Procedure

4.1 Sample Bag Leak-checks. While a bag leak-check is required after bag use, it should also be done before the bag is used for sample collection. The bag should be leak-checked in the inflated and deflated condition according to the following procedures.

Connect the bag to a water manometer, and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O). Allow the bag to stand for 60 minutes. Any displacement in the water manometer indicates a leak. Now, evacuate the bag with a leakless pump that is connected on the downstream side of a flow-indicating device such as a 0-to 100-ml/min rotameter or an impinger containing water. When the bag is completely evacuated, no flow should be evident if the bag is leak-free.

4.2 Sampling. Evacuate the Tedlar bag completely using a vacuum pump. Assemble the apparatus as shown in Figure 10A-1. Loosely pack glass wool in the tip of the probe. Place 400 ml of alkaline permanganate solution in the first two impingers and 250 ml in the third. Connect the pump to the third impinger, and follow this with the surge tank, rate meter, and three-way valve. Do not connect the Tedlar bag to the system at this time.

Leak-check the sampling system by placing a vacuum gauge at or near the probe inlet, plugging the probe inlet, opening the three-way valve, and pulling a vacuum approximately 250 mm Hg on the syste while observing the rate meter for flow. flow is indicated on the rate meter, do r proceed further until the leak is found a corrected.

Purge the system with sample gas by serting the probe into the stack and drawi sample through the system at 300 ml/m ±10 percent for 5 minutes. Connect the eva uated Tedlar bag to the system, record t starting time, and sample at a rate of 3 ml/min for 30 minutes, or until the Tedl bag is nearly full. Record the sampling tim the barometric pressure, and the ambie temperature. Purge the system as describ above immediately before each sample.

The scrubbing solution is adequate for moving sulfur and nitrogen oxides from liters of stack gas when the concentration each is less than 1,000 ppm and the CO_2 co centration is less than 15 percent. Repla the scrubber solution after every fift sample.

4.3 Carbon Dioxide Measurement. Mea ure the CO_2 content in the stack to th nearest 0.5 percent each time a CO samp is collected. A simultaneous grab samp analyzed by the Fyrite analyzer is accept ble.

4.4 Analysis. Assemble the system show in Figure 10A-3, and record the informatic required in Table 10A-1 as it is obtaine Pipet 10.0 ml of the colorimetric reager into each gas reaction bulb, and attach th bulbs to the system. Open the stopcocks the reaction bulbs, but leave the valve the Tedlar bag closed. Turn on the pump, fully open the coarse-adjust flow valve, an slowly open the fine-adjust valve until th pressure is reduced to at least 40 mm H_2 Now close the coarse adjust valve, and ob serve the manometer to be certain that th system is leak-free. Wait a minimum of minutes. If the pressure has increased les than 1 mm, proceed as described below. If leak is present, find and correct it befor proceeding further.

TABLE 10A-1. DATA RECORDING SHEET FOR SAMPLES ANALYZED IN TRIPLICATE

Sample no./ Type	Room temp., °C	Stack % CO_2	Bulb no.	Bulb vol., liters	Reagent vol. in bulb, liter	Partial pressure of gas in bulb, mm Hg	P_{bar}, mm Hg	Shaking time, min	Abs versus water	A $-A_r$	A_s	Avg. A_s
Blank												
Std. 1												
Std. 2												
Sample 1												
Sample 2												
Sample 3												

Record the vacuum pressure (P_v) to the nearest 1 mm Hg, and close the reaction bulb stopcocks. Open the Tedlar bag valve, and allow the system to come to atmospheric pressure. Close the bag valve, open the pump coarse adjust valve, and evacuate the system again. Repeat this fill/evacuation procedure at least twice to flush the manifold completely. Close the pump coarse adjust valve, open the Tedlar bag valve, and let the system fill to atmospheric pressure. Open the stopcocks to the reaction bulbs, and let the entire system come to atmospheric pressure. Close the bulb stopcocks, remove the bulbs, record the room temperature and barametric pressure (P_{bar}, to nearest mm Hg), and place the bulbs on the shaker table with their main axis either parallel to or perpendicular to the plane of the table top. Purge the bulb-filling system with ambient air for several minutes between samples. Shake the samples for exactly 2 hours.

Immediately after shaking, measure the absorbance (A) of each bulb sample at 425 nm if the concentration is less than or equal to 400 ppm CO or at 600 nm if the concentration is above 400 ppm. This may be accomplished with multiple bulb sets by sequentially collecting sets and adding to the shaker at staggered intervals, followed by sequentially removing sets from the shaker for absorbance measurement after the two-hour designated intervals have elapsed.

Use a small portion of the sample to rinse a spectrophotometer cell several times before taking an aliquot for analysis. If one cell is used to analyze multiple samples, rinse the cell several times between samples with water.

Prepare and analyze standards and a reagent blank as described in Section 5.3. Use water as the reference. Reject the analysis if the blank absorbance is greater than 0.1. All conditions should be the same for analysis of samples and standards. Measure the absorbances as soon as possible after shaking is completed. Determine the CO concentration of each bag sample using the calibration curve for the appropriate concentration range as discussed in Section 5.3.

5. *Calibration*

5.1 *Bulb Calibration.* Weigh the empty bulb to the nearest 0.1 g. Fill the bulb to the stopcock with water, and again weigh to the nearest 0.1 g. Subtract the tare weight, and calculate the volume in liters to three significant figures using the density of water (at the measurement temperature). Record the volume on the bulb; alternatively, mark an identification number on the bulb, and record the volume in a notebook.

5.2 *Rate Meter Calibration.* Assemble the system as shown in Figure 10A-1 (the impingers may be removed), and attach a volume meter to the probe inlet. Set the ro-

tameter at 300 ml/min, record the volume meter reading, start the pump, and pull gas through the system for 10 minutes. Record the final volume meter reading. Repeat the procedure and average the results to determine the volume of gas that passed through the system.

5.3 Spectrophotometer Calibration Curve. The calibration curve is established by taking at least two sets of three bulbs of known CO collected from Tedlar bags through the analysis procedure. Reject the standard set where any of the individual bulb absorbances differ from the set mean by more than 10 percent. Collect the standards as described in Section 4.2. Prepare standards to span the 0- to 400- or 400- to 1000-ppm range. If any samples span both concentration ranges, prepare a calibration curve for each range. A set of three bulbs containing colorimetric reagent but no CO should serve as a reagent blank and be taken through the analysis procedure.

Calculate the average absorbance for each set (3 bulbs) of standards using Equation 10A-1 and Table 10A-1. Construct a graph of average absorbance for each standard against its corresponding concentration in ppm. Draw a smooth curve through the points. The curve should be linear over the two concentration ranges discussed in Section 1.3.1.

6. *Calculations*

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

6.1 Nomenclature.

A = Sample absorbance, uncorrected for the reagent blank.
A_r = Aborbance of the reagent blank.
A_s = Average sample absorbance per liter, units/liter.
B_w = Moisture content in the bag sample.
C = CO concentration in the stack gas, dry basis, ppm.
C_b = CO concentration of the bag sample, dry basis, ppm.
C_s = CO concentration from the calibration curve, ppm.
F = Volume fraction of CO_2 in the stack.
n = Number of reaction bulbs used per bag sample.
P_{bar} = Barometric pressure, mm Hg.
P_v = Residual pressure in the sample bulb after evacuation, mm Hg.
P_w = Vapor pressure of H_2O in the bag (from Table 10A-2), mm Hg.
V_b = Volume of the sample bulb, liters.
V_r = Volume of reagent added to the sample bulb, 0.0100 liter.

6.2 Average Sample Absorbance per Liter.

Average the three absorbance values for each bulb set. Then calculate A_s for each set of gas bulbs using Equation 10A-1. Use A_s to determine the CO concentration from the calibration curve (C_s).

$$A_s = \frac{(A - A_r)(P_{bar})}{(V_b - V_r)(P_{bar} - P_v)}$$

Eq. 10A-1

NOTE: A and A_r must be at the same wavelength.

6.3 CO Concentration in the Bag.

Calculate C_b using Equations 10A-2 and 10A-3. If condensate is visible in the Tedlar bag, calculate B_w using Table 10A-2 and the temperature and barometric pressure in the analysis room. If condensate is not visible, calculate B_w using the temperature and barometric pressure recorded at the sampling site.

$$B_w = \frac{P_w}{P_{bar}}$$

Eq. 10A-2

$$C_b = \frac{C_s}{(1 - B_w)}$$

Eq. 10A-3

6.4 CO Concentration in the Stack.

$$C = C_b(1 - F)$$

Eq. 10A-4

TABLE 10A-2. MOISTURE CORRECTION

Temperature, °C	Vapor pressure of H_2O, mm Hg	Temperature, °C	Vapor pressure of H_2O, mm Hg
4	6.1	18	15.5
6	7.0	20	17.5
8	8.0	22	19.8
10	9.2	24	22.4
12	10.5	26	25.2
14	12.0	28	28.3
16	13.6	30	31.8

7. BIBLIOGRAPHY

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METHOD 10B—DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

1. Applicability and Principle

1.1 Applicability. This method applies to the measurement of carbon monoxide (CO) emissions at petroleum refineries and from other sources when specified in an applicable subpart of the regulations.

1.2 Principle. An integrated gas sample is extracted from the sampling point and analyzed for CO. The sample is passed through a conditioning system to remove interferences and collected in a Tedlar bag. The CO is separated from the sample by gas chromatography (GC) and catalytically reduced to methane (CH_4) prior to analysis by flame ionization detection FID. The analytical portion of this method is identical to applicable sections in Method 25 detailing CO measurement. The oxidation catalyst re-

Total Hydrocarbons

The hydrocarbon (volatile organic compounds) concentrations were determined by collection in pre-cleaned virgin six-liter Tedlar bags and analysis by flame ionization using a Scott total hydrocarbon analyzer calibrated against methane in air standard gases. The bags were purged with hydrocarbon free zero gas prior to testing until the total hydrocarbon concentration in each bag was less then 1.0 ppm. The sampled bags (integrated sample over five minutes with Teflon probe) were analyzed on the same day as they were collected.

APPENDIX K

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 2

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

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

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

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

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

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

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

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

SYMBOLS

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

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

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

C_p = Pitot tube coefficient, dimensionless

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

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

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

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

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

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

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

M_p = Total amount of particulate matter collected, g

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

P_g = Stack static gas pressure, IN. WC.

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

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

A_a = Actual volumetric stack gas flow rate, ACFM

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

RH = Relative humidity, %

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

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

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

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

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

θ = Total sampling time, min.

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

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

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

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

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

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

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

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

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

γ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

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

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

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

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

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

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

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

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

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

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

SYMBOLS

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

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

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

C_p = Pitot tube coefficient, dimensionless

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

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

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

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

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

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

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

M_p = Total amount of particulate matter collected, g

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

P_g = Stack static gas pressure, IN. WC.

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

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

A_a = Actual volumetric stack gas flow rate, ACFM

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

RH = Relative humidity, %

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

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

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

$T_s(avg)$ = Absolute average stack temperature, ^oF

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

θ = Total sampling time, min.

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

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

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

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

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

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

CALCULATION EQUATIONS

METHOD 6

$$V_{std} = 17.64 \frac{V_m P_b \gamma}{T_m} \quad \text{(MIDGET IMPINGER VERSION)}$$

$$V_{std} = \frac{17.64\ V_m\ (P_b + \frac{\overline{\Delta H}}{13.6})\gamma}{T_m} \quad \text{(LARGE IMPINGER VERSION)}$$

$$\overline{MEQ} = (V_t - V_{tb})\ N\ (\frac{V_{soln}}{V_a})\ DF$$

$$C_s = \frac{7.06 \times 10^{-5}\ MEQ}{V_{std}}$$

$$E = \frac{20.90\ C_s F_d}{20.90 - \overline{B}'_{O_2}} = \frac{F_c C_s}{\overline{B}'_{CO_2}}$$

$$C_s\ (MG/DSCM) = 1.60186 \times 10^7\ C_s$$

$$C_s\ (GR/DSCF) = 7000\ C_s$$

$$C_s\ (ppm, dry) = 6.02119 \times 10^6\ C_s$$

$$C_s\ (ppm, wet) = 6.02119 \times 10^6\ C_s\ (1 - \frac{MC}{100})$$

SYMBOLS

$\overline{B}'O_2$	=	Average oxygen content in flue gas, % v/v, dry
$\overline{B}'CO_2$	=	Average carbon dioxide content in flue gas, % v/v, dry
C_s	=	Concentration of sulfur dioxide in flue gas, dry basis, corrected to standard conditions, LB/DSCF
C_s (GR/DSCF)	=	Concentration of sulfur dioxide in flue gas, dry basis, corrected to standard conditions, GR/DSCF
C_s (MG/DSCM)	=	Concentration of sulfur dioxide in flue gas, dry basis, corrected to standard conditions, MG/DSCM
DF	=	Dilution Factor
E	=	Emission factor, LB of $SO_2/10^6$BTU
F_d	=	Dry oxygen F-Factor for given fuel type, DSCF/10^6BTU
F_c	=	Carbon dioxide F-Factor for given fuel type, DSCF/10^6BTU
ΔH	=	Average pressure drop across calibrated orifice, IN. W.C.
γ	=	Dry test meter correction factor, dimensionless
MC	=	Moisture content of flue gas, % v/v
MEQ	=	Total milliequivalents of SO_2 in gas sample
N	=	Normality of barium perchlorate titrant
P_b	=	Barometric pressure at the dry gas meter, IN. HG.

C_s (ppm-dry) = Concentration of sulfur dioxide in flue gas, dry basis, (v/v), ppm

C_s (ppm-wet) = Concentration of sulfur dioxide in flue gas, wet basis, (v/v), ppm

T_m = Absolute average dry gas meter temperature, ^oR

V_a = Volume of sample aliquot titrated, cc

V_m = Dry gas volume as measured by the dry gas meter, DCF

V_{std} = Dry gas volume as measured by the dry gas meter, corrected to standard conditions (at 68 ^oF and 1 atmosphere), DSCF

V_{soln} = Total volume of the solution in which the sulfur dioxide sample is contained, cc

V_t = Volume of barium perchlorate titrant used for the sample, cc (average of replicate titrations)

V_{tb} = Volume of barium perchlorate titrant used for the blank, cc

METHOD 7

$$V_{m(std)} = 17.64\ (V_f - 25)\ \left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

$$C_s = 6.243 \times 10^{-5}\ \frac{M}{V_{m(std)}}$$

$$E = \frac{2090\ C_s F}{20.9 - \bar{B}'_{O_2}}$$

$$C_s\ (GR/DSCF) = 7000\ C_s$$

$$C_s\ (MG/DSCM) = 1.60186 \times 10^{7}\ C_s$$

$$C_s\ (ppm\text{-}dry) = 8.37552 \times 10^{6}\ C_s$$

$$C_s\ (ppm\text{-}3\%\ O_2) = 8.37552 \times 10^{6}\ C_s \left\{1 + \left[\frac{\bar{B}'_{O_2} - 3}{20.9 - B'_{O_2}}\right]\right\}$$

$$C_s\ (ppm\text{-}wet) = 8.37552 \times 10^{6}\ C_s \cdot \left(1 - \frac{MC}{100}\right)$$

CE6-1

SYMBOLS

$\bar{B}'_{O_2}$ = Average oxygen content in flue gas, % v/v

C_s = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, LB/DSCF

C_s (GR/DSCF) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, GR/DSCF

C_s (MG/DSCM) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, MG/DSCM

E = Emission factor, LB/10^6BTU

F = F-Factor for given fuel type, DSCF/10^4BTU

M = Mass of nitrogen oxides as nitrogen dioxide in gas sample, μg

MC = Moisture content of flue gas, %

P_f = Final absolute pressure in flask, IN. HG

P_i = Initial absolute pressure in flask, IN. HG

C_s (ppm-dry) = Concentration of nitrogen oxides in flue gas, dry basis, (v/v), ppm

C_s (ppm-3% O_2) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to 3% O_2 , (v/v) ppm

C_s (ppm-wet) = Concentration of nitrogen oxides in flue gas, wet basis, (v/v), ppm

T_f = Final absolute temperature in flask, ^{o}R

T_i = Initial absolute temperature in flask, ^{o}R

V_f = Volume of flask and valve, cc

$V_{m(std)}$ = Sample volume at standard conditions, dry basis, cc

CALCULATION EQUATIONS

METHOD 10

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

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

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

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

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

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

Where

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

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

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

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

Total Gaseous Organics Calculation Equations

$$GR\ C/SCF = 2.180 \times 10^{-4}\ (ppm,w)$$

$$GR\ C/DSCF = 2.180 \times 10^{-4}\ (ppm,w)/(1-MC/100)$$

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

where:

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

GR C/DSCF = grains of total gaseous organics as carbon per dry 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)

Report No. 3-1636

AMERICAN CRYSTAL SUGAR COMPANY

East Grand Forks, MN

Total HydroCarbons Calculations

Source	C-PULP DRYER STACK									
				CONC	GASFLOW	MASSRATE	AVERAGE			
	TEST #	RUN	MC%	(ppmC,w)	(DSCFM)	(LB/HR)	(ppmC,w)	(LB/HR)		(GR/DSCF)
	3	1	33.61	123	24867	8.61				0.0403886
		2	31.13	177	25356	12.18				0.0560273
		3	37.16	172	23446	11.99				0.059669
							157.33333	10.9256		

Source	B-PULP DRYER STACK									
				CONC	GASFLOW	MASSRATE	AVERAGE			
	TEST #	RUN	MC%	(ppmC,w)	(DSCFM)	(LB/HR)	(ppmC,w)	(LB/HR)		(GR/DSCF)
	8	1	23.3	106	43382	11.20				0.0301278
		2	21.92	72	44674	7.70				0.0201025
		3	21.97	65	43695	6.80				0.0181597
							81	8.56725		

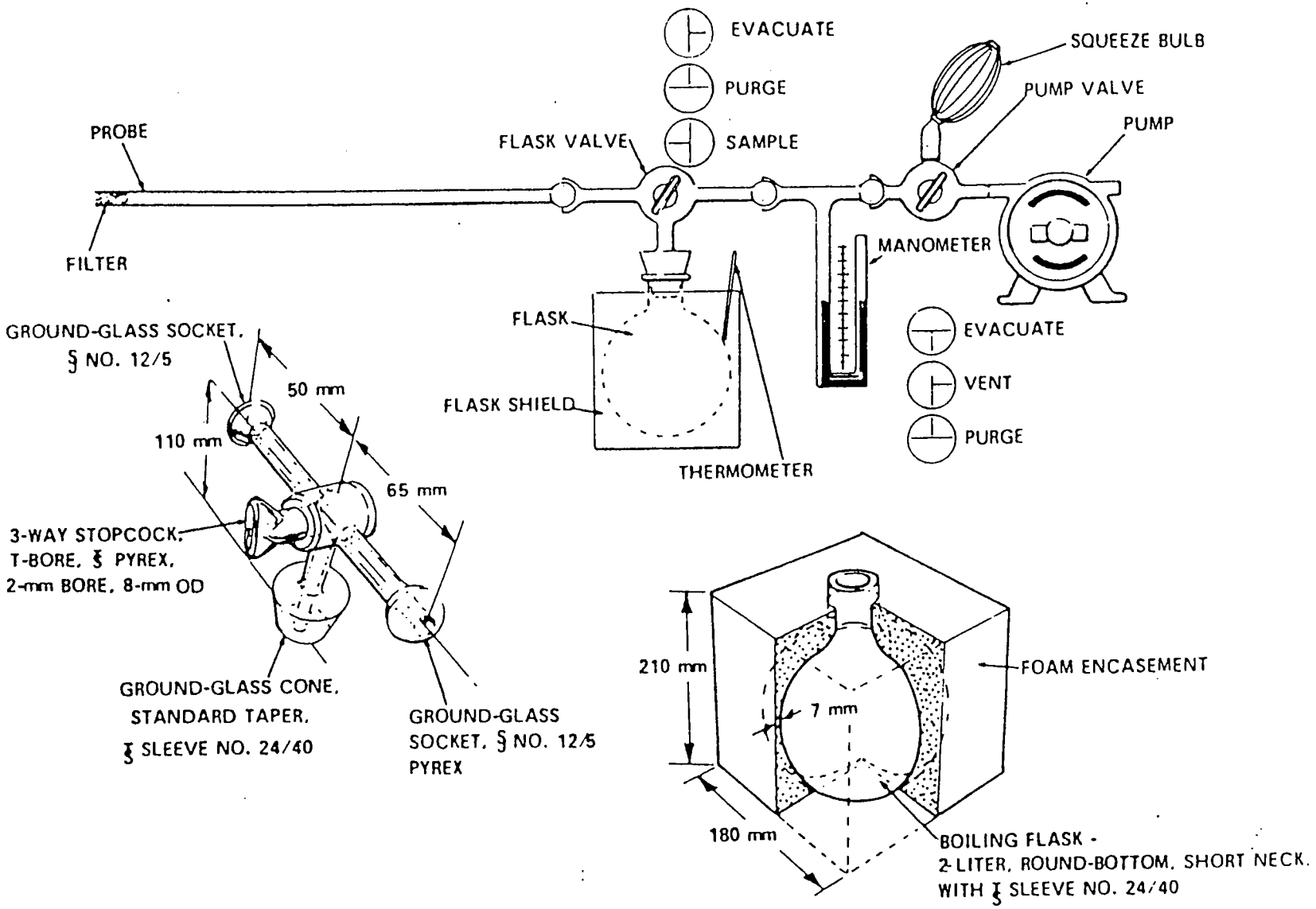
Source	A-PULP DRYER STACK									
				CONC	GASFLOW	MASSRATE	AVERAGE			
	TEST #	RUN	MC%	(ppmC,w)	(DSCFM)	(LB/HR)	(ppmC,w)	(LB/HR)		(GR/DSCF)
	11	1	41.6	310	22618	22.43				0.1157192
		2	39.2	264	24090	19.55				0.0946579
		3	38.96	246	24043	18.11				0.0878571
							273.33333	20.02849		

APPENDIX L

TEST PLAN & PROTOCOL

flask and barometric pressure at the time of sampling was recorded for each flask. After sampling was complete, as evidenced by the in-line vacuum gauge, the flask valve was closed, the flask assembly disconnected from the manifold/valve assembly and the flask shook for several minutes to promote oxidation and absorption. The recovered oxides of nitrogen samples were returned to the laboratory and analyzed immediately by ion chromatography as per EPA 7A.

The internal volume of each numbered flask assembly has been measured prior to initial use by filling with water, weighing before and after and then converting the weight of water to volume by means of the density of water at room temperature. Flask volumes are stored in the computer and recalled automatically in the computer calculation.



Sampling train, flask valve, and flask.

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

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

5. *References*

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

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

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

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

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

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

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

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

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

Method 10—Determination of Carbon Monoxide Emissions From Stationary Sources

1. *Principle and Applicability*

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

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

2. *Range and Sensitivity*

2.1 Range. 0 to 1,000 ppm.

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

3. *Interferences*

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

4. *Precision and Accuracy*

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

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

5. *Apparatus*

5.1 Continuous Sample (Figure 10-1).

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

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

5.2 Integrated Sample (Figure 10-2).

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

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

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

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

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

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

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

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

5.3 Analysis (Figure 10-3).

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

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

5.3.3 Calibration Gas. Refer to section 6.1.

5.3.4 Filter. As recommended by NDIR manufacturer.

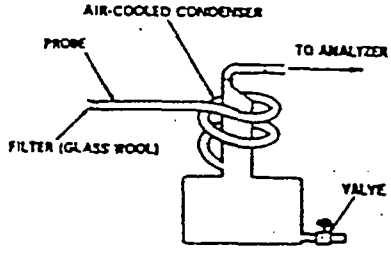


Figure 10-1. Continuous sampling train.

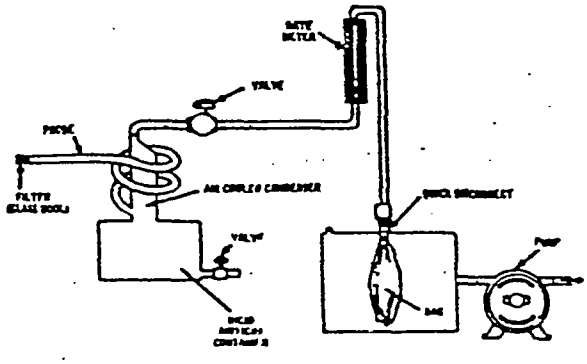


Figure 10-2. Integrated gas sampling train.

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

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

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

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

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

6. *Reagents*

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

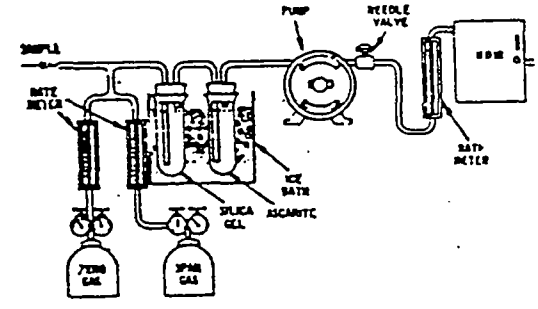


Figure 10-3. Analytical equipment.

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

6.3 Ascarite. Commercially available.

7. *Procedure*

7.1 Sampling.

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

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

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

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

8. *Calibration*

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

TABLE 10-1—FIELD DATA

	Comments
Location	
Test	
Date	
Operator	

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

9. *Calculation*

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

$$C_{CO\ stack} = C_{CO\ NDIR}(1 - F_{co_2})$$

Eq. 10-1

Where:

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

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

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

10. Alternative Procedures

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

11. *Bibliography*

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

ADDENDA

A. PERFORMANCE SPECIFICATIONS FOR NDIR CARBON MONOXIDE ANALYZERS

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

B. *Definitions of Performance Specifications.*

Range—The minimum and maximum measurement limits.

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Applicability and Principle

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

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

1.3 Range and Sensitivity.

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

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

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

1.5 Precision, Accuracy, and Stability.

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

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

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

2. Apparatus

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

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

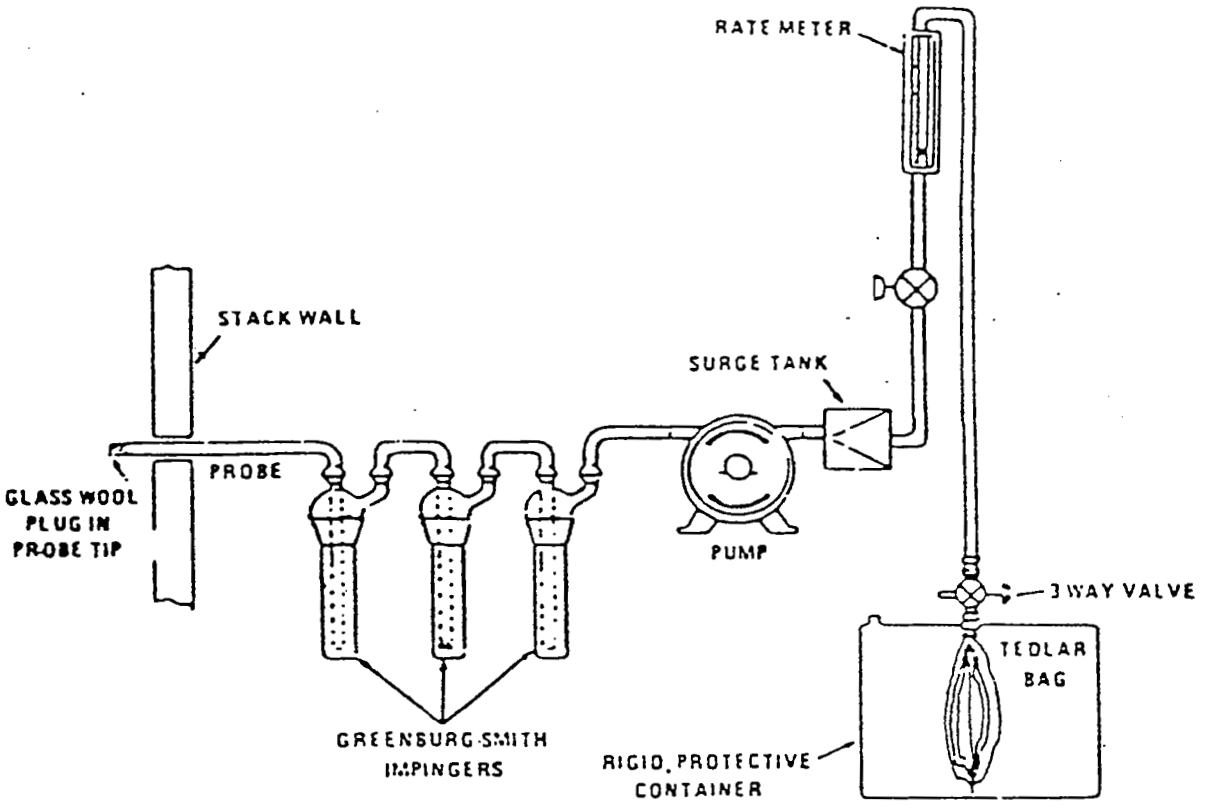


Figure 10A-1. Sampling train.

2.1.1 Probe. Stainless steel, sheathed Pyrex glass, or equivalent, equipped with a glass wool plug to remove particulate matter.

2.1.2 Sample Conditioning System. Three Greenburg-Smith impingers connected in series with leak-free connections.

2.1.3 Pump. Leak-free pump with stainless steel and Teflon parts to transport sample at a flow rate of 300 ml/min to the flexible bag.

2.1.4 Surge Tank. Installed between the pump and the rate meter to eliminate the pulsation effect of the pump on the rate meter.

2.1.5 Rate Meter. Rotameter, or equivalent, to measure flow rate at 300 ml/min. Calibrate according to Section 5.2.

2.1.6 Flexible Bag. Tedlar, or equivalent, with a capacity of 10 liters and equipped with a sealing quick-connect plug. The bag must be leak-free according to Section 4.1. For protection, it is recommened that the bag be enclosed with a rigid container.

2.1.7 Valves. Stainless-steel needle valve to adjust flow rate, and stainless-steel three-way valve, or equivalent.

2.1.8 CO_2 Analyzer. Method 3 or its approved alternative to measure CO_2 concentration to within 0.5 percent.

2.1.9 Volume Meter. Dry gas meter, calibrated and capable of measuring the sample volume under rotameter calibration conditions of 300 ml/min for 10 minutes

2.1.10 Pressure Gauge. A water filled U-tube manometer, or equivalent, of about 28 cm (12 in.) to leak-check the flexible bag.

2.2 Analysis.

2.2.1 Spectrophotometer. Single- or double-beam to measure absorbance at 425 and 600 nm. Slit width should not exceed 20 nm.

2.2.2 Spectrophotometer Cells. 1-cm pathlength.

2.2.3 Vacuum Gauge. U-tube mercury manometer, 1 meter (39 in.), with 1-mm divisions, or other gauge capable of measuring pressure to within 1 mm Hg.

2.2.4 Pump. Capable of evacuating the gas reaction bulb to a pressure equal to or less than 40 mm Hg absolute, equipped with coarse and fine flow control valves.

2.2.5 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 1 mm Hg.

2.2.6 Reaction Bulbs. Pyrex glass, 100.ml with Teflon stopcock (Figure 10A-2), leak-free at 40 mm Hg, designed so that 10 ml of the colorimetric reagent can be added and removed easily and accurately. Commercially available gas sample bulbs such as Supelco Catalog No. 2-2161 may also be used.

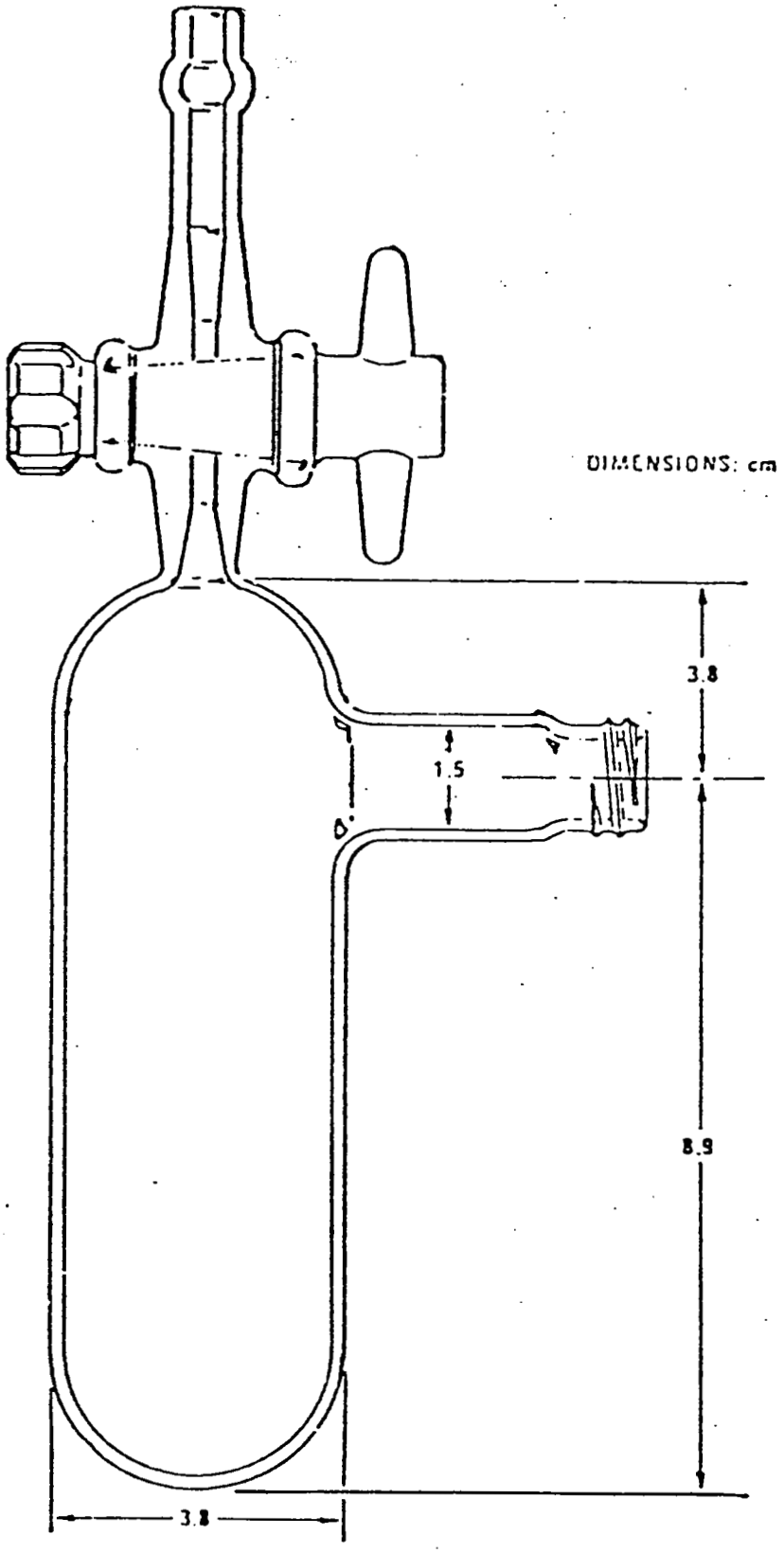


Figure 10A-2. Sample reaction bulbs.

2.2.7 Manifold. Stainless steel, with connections for three reaction bulbs and the appropriate connections for the manometer and sampling bag as shown in Figure 10A-3.

2.2.8 Pipets. Class A, 10-ml size.

2.2.9 Shaker Table. Reciprocating-stroke type such as Eberbach Corporation, Model 6015. A rocking arm or rotary-motion type shaker may also be used. The shaker must be large enough to accommodate at least six gas sample bulbs simultaneously. It may be necessary to construct a table top extension for most commercial shakers to provide sufficient space for the needed bulbs (Figure 10A-4).

2.2.10 Valve. Stainless steel shut-off valve.

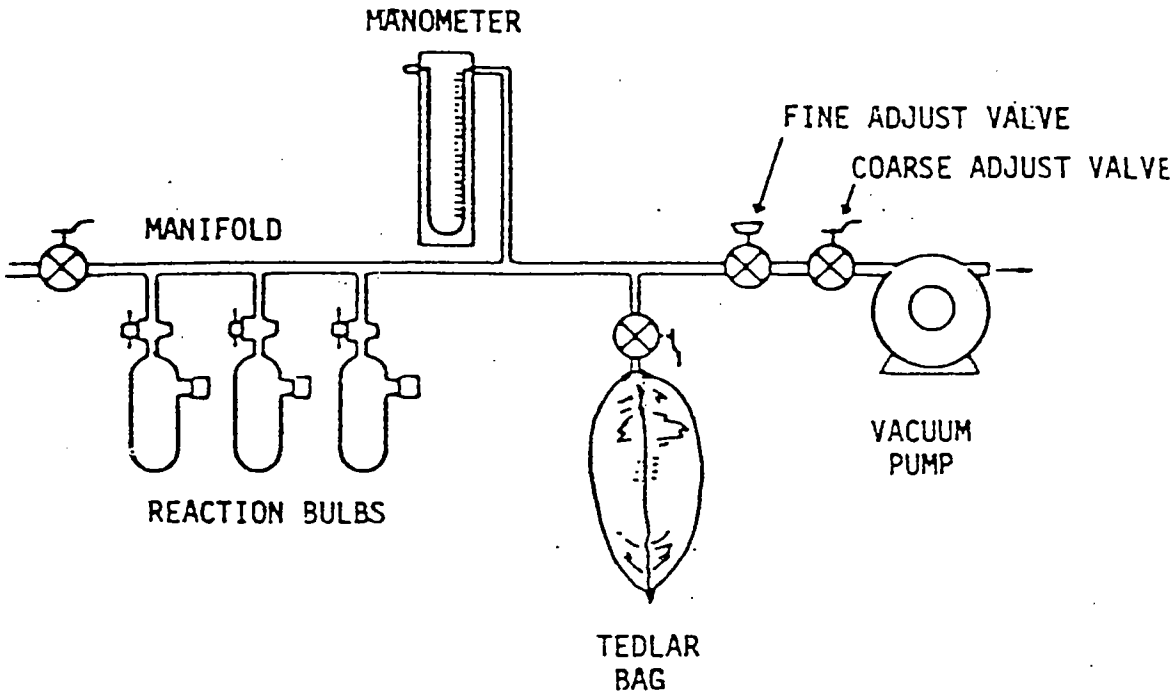


Figure 10A-3. Sample bulb filling system.

2.2.11 Analytical Balance. Capable of accurately weighing to 0.1 mg.

3. Reagents

Unless otherwise indicated, all reagents shall conform to the specifications estab-

lished by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available, otherwise, the best available grade shall be used.

3.1 Sampling.

3.1.1 Water. Deionized distilled, as described in Method 6, Section 3.1.1.

3.1.2 Alkaline Permanganate Solution, 0.25 M $KMnO_4$/1.5 M NaOH. Dissolve 40 g $KMnO_4$ and 60 g NaOH in water, and dilute to 1 liter.

3.2 Analysis.

3.2.1 Water. Same as in Section 3.1.1.

3.2.2 1 M Sodium Hydroxide (NaOH) Solution. Dissolve 40 g NaOH in approximately 900 ml of water, cool, and dilute to 1 liter.

3.2.3 0.1 M Silver Nitrate ($AgNO_3$) Solution. Dissolve 8.5 g $AgNO_3$ in water, and dilute to 500 ml.

3.2.4 0.1 M Para-Sulfaminobenzoic Acid (p-SABA) Solution. Dissolve 10.0 g p-SABA in 0.1 M NaOH (prepared by diluting 50 ml of 1 M NaOH to 500 ml), and dilute to 500 ml with 0.1 M NaOH.

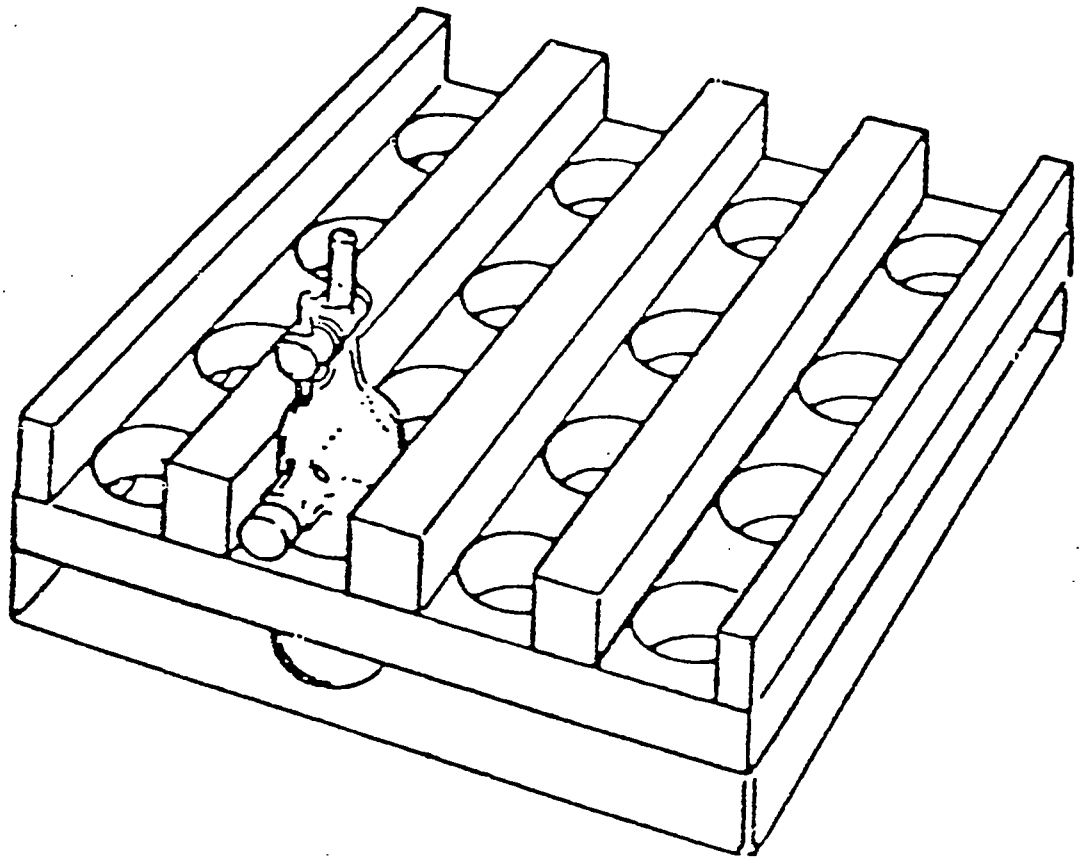


Figure 10A-4. Shaker table adapter.

3.2.5 Colorimetric Solution. To a flask, add 100 ml of p-SABA solution and 100 ml of $AgNO_3$ solution. Mix, and add 50 ml of 1 M NaOH with shaking. The resultant solution should be clear and colorless. This solution is acceptable for use for a period of 2 days.

3.2.6 Standard Gas Mixtures. Traceable to NBS standards and containing between 50 and 1000 ppm CO in nitrogen. At least two concentrations are needed to span each calibration range used (Section 5.3).

The calibration gases shall be certified by the manufacturer to be within 2 percent of the specified concentrations.

4. Procedure

4.1 Sample Bag Leak-checks. While a bag leak-check is required after bag use, it should also be done before the bag is used for sample collection. The bag should be leak-checked in the inflated and deflated condition according to the following procedures.

Connect the bag to a water manometer, and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O). Allow the bag to stand for 60 minutes. Any displacement in the water manometer indicates a leak. Now, evacuate the bag with a leakless pump that is connected on the downstream side of a flow-indicating device such as a 0-to 100-ml/min rotameter or an impinger containing water. When the bag is completely evacuated, no flow should be evident if the bag is leak-free.

4.2 Sampling. Evacuate the Tedlar bag completely using a vacuum pump. Assemble the apparatus as shown in Figure 10A-1. Loosely pack glass wool in the tip of the probe. Place 400 ml of alkaline permanganate solution in the first two impingers and 250 ml in the third. Connect the pump to the third impinger, and follow this with the surge tank, rate meter, and three-way valve. Do not connect the Tedlar bag to the system at this time.

Leak-check the sampling system by placing a vacuum gauge at or near the probe inlet, plugging the probe inlet, opening the three-way valve, and pulling a vacuum approximately 250 mm Hg on the syst while observing the rate meter for flow. flow is indicated on the rate meter, do r proceed further until the leak is found a corrected.

Purge the system with sample gas by serting the probe into the stack and drawi sample through the system at 300 ml/m =10 percent for 5 minutes. Connect the ev uated Tedlar bag to the system, record t starting time, and sample at a rate of 3 ml/min for 30 minutes, or until the Tedl bag is nearly full. Record the sampling tin the barometric pressure, and the ambie temperature. Purge the system as describ above immediately before each sample.

The scrubbing solution is adequate for moving sulfur and nitrogen oxides from liters of stack gas when the concentration each is less than 1,000 ppm and the CO_2 cc centration is less than 15 percent. Repla the scrubber solution after every fift sample.

4.3 Carbon Dioxide Measurement. Mea ure the CO_2 content in the stack to th nearest 0.5 percent each time a CO samp is collected. A simultaneous grab samp analyzed by the Fyrite analyzer is accept ble.

4.4 Analysis. Assemble the system show in Figure 10A-3, and record the informatic required in Table 10A-1 as it is obtaine Pipet 10.0 ml of the colorimetric reager into each gas reaction bulb, and attach th bulbs to the system. Open the stopcocks the reaction bulbs, but leave the valve t the Tedlar bag closed. Turn on the pum fully open the coarse-adjust flow valve, an slowly open the fine-adjust valve until th pressure is reduced to at least 40 mm H_g Now close the coarse adjust valve, and ob serve the manometer to be certain that th system is leak-free. Wait a minimum of minutes. If the pressure has increased les than 1 mm, proceed as described below. If leak is present, find and correct it befor proceeding further.

TABLE 10A-1. DATA RECORDING SHEET FOR SAMPLES ANALYZED IN TRIPLICATE

Sample no./ Type	Room temp., °C	Stack % CO_2	Bulb no.	Bulb vol., liters	Reagent vol. in bulb, liter	Partial pressure of gas in bulb, mm Hg	P_{bar}, mm Hg	Shaking time, min	Abs versus water	A - A_r	A_s	Avg. A_s
Blank												
Std. 1												
Std. 2												
Sample 1												
Sample 2												
Sample 3												

Record the vacuum pressure (P_v) to the nearest 1 mm Hg, and close the reaction bulb stopcocks. Open the Tedlar bag valve, and allow the system to come to atmospheric pressure. Close the bag valve, open the pump coarse adjust valve, and evacuate the system again. Repeat this fill/evacuation procedure at least twice to flush the manifold completely. Close the pump coarse adjust valve, open the Tedlar bag valve, and let the system fill to atmospheric pressure. Open the stopcocks to the reaction bulbs, and let the entire system come to atmospheric pressure. Close the bulb stopcocks, remove the bulbs, record the room temperature and barametric pressure (P_{bar}, to nearest mm Hg), and place the bulbs on the shaker table with their main axis either parallel to or perpendicular to the plane of the table top. Purge the bulb-filling system with ambient air for several minutes between samples. Shake the samples for exactly 2 hours.

Immediately after shaking, measure the absorbance (A) of each bulb sample at 425 nm if the concentration is less than or equal to 400 ppm CO or at 600 nm if the concentration is above 400 ppm. This may be accomplished with multiple bulb sets by sequentially collecting sets and adding to the shaker at staggered intervals, followed by sequentially removing sets from the shaker for absorbance measurement after the two-hour designated intervals have elapsed.

Use a small portion of the sample to rinse a spectrophotometer cell several times before taking an aliquot for analysis. If one cell is used to analyze multiple samples, rinse the cell several times between samples with water.

Prepare and analyze standards and a reagent blank as described in Section 5.3. Use water as the reference. Reject the analysis if the blank absorbance is greater than 0.1. All conditions should be the same for analysis of samples and standards. Measure the absorbances as soon as possible after shaking is completed. Determine the CO concentration of each bag sample using the calibration curve for the appropriate concentration range as discussed in Section 5.3.

5. *Calibration*

5.1 *Bulb Calibration.* Weigh the empty bulb to the nearest 0.1 g. Fill the bulb to the stopcock with water, and again weigh to the nearest 0.1 g. Subtract the tare weight, and calculate the volume in liters to three significant figures using the density of water (at the measurement temperature). Record the volume on the bulb; alternatively, mark an identification number on the bulb, and record the volume in a notebook.

5.2 *Rate Meter Calibration.* Assemble the system as shown in Figure 10A-1 (the impingers may be removed), and attach a volume meter to the probe inlet. Set the ro-

tameter at 300 ml/min, record the volume meter reading, start the pump, and pull gas through the system for 10 minutes. Record the final volume meter reading. Repeat the procedure and average the results to determine the volume of gas that passed through the system.

5.3 Spectrophotometer Calibration Curve. The calibration curve is established by taking at least two sets of three bulbs of known CO collected from Tedlar bags through the analysis procedure. Reject the standard set where any of the individual bulb absorbances differ from the set mean by more than 10 percent. Collect the standards as described in Section 4.2. Prepare standards to span the 0- to 400- or 400- to 1000-ppm range. If any samples span both concentration ranges, prepare a calibration curve for each range. A set of three bulbs containing colorimetric reagent but no CO should serve as a reagent blank and be taken through the analysis procedure.

Calculate the average absorbance for each set (3 bulbs) of standards using Equation 10A-1 and Table 10A-1. Construct a graph of average absorbance for each standard against its corresponding concentration in ppm. Draw a smooth curve through the points. The curve should be linear over the two concentration ranges discussed in Section 1.3.1.

6. Calculations

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

6.1 Nomenclature.

A = Sample absorbance, uncorrected for the reagent blank.
A_r = Aborbance of the reagent blank.
A_s = Average sample absorbance per liter, units/liter.
B_w = Moisture content in the bag sample.
C = CO concentration in the stack gas, dry basis, ppm.
C_b = CO concentration of the bag sample, dry basis, ppm.
C_s = CO concentration from the calibration curve, ppm.
F = Volume fraction of CO_2 in the stack.
n = Number of reaction bulbs used per bag sample.
P_{bar} = Barometric pressure, mm Hg.
P_r = Residual pressure in the sample bulb after evacuation, mm Hg.
P_w = Vapor pressure of H_2O in the bag (from Table 10A-2), mm Hg.
V_b = Volume of the sample bulb, liters.
V_r = Volume of reagent added to the sample bulb, 0.0100 liter.

6.2 Average Sample Absorbance per Liter.

Average the three absorbance values for each bulb set. Then calculate A_s for each set of gas bulbs using Equation 10A-1. Use A_s to determine the CO concentration from the calibration curve (C_s).

$$A_s = \frac{(A - A_r)(P_{bar})}{(V_b - V_r)(P_{bar} - P_r)}$$

Eq. 10A-1

NOTE: A and A_r must be at the same wavelength.

6.3 CO Concentration in the Bag.

Calculate C_b using Equations 10A-2 and 10A-3. If condensate is visible in the Tedlar bag, calculate B_w using Table 10A-2 and the temperature and barometric pressure in the analysis room. If condensate is not visible, calculate B_w using the temperature and barometric pressure recorded at the sampling site.

$$B_w = \frac{P_w}{P_{bar}}$$

Eq. 10A-2

$$C_b = \frac{C_s}{(1 - B_w)}$$

Eq. 10A-3

6.4 CO Concentration in the Stack.

$$C = C_b(1 - F)$$

Eq. 10A-4

TABLE 10A-2. MOISTURE CORRECTION

Temperature, °C	Vapor pressure of H_2O, mm Hg	Temperature, °C	Vapor pressure of H_2O, mm Hg
4	6.1	18	15.5
6	7.0	20	17.5
8	8.0	22	19.8
10	9.2	24	22.4
12	10.5	26	25.2
14	12.0	28	28.3
16	13.6	30	31.8

7. Bibliography

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3. Lambert, J.L., and R.E. Weins. Induced Colorimetric Method for Carbon Monoxide. Analytical Chemistry. *46*(7):929-930. June 1974.

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6. Smith, F., D.E. Wagoner, and R.P. Donovan. Guidelines for Development of a Quality Assurance Program: Volume VIII—Determination of CO Emissions from Stationary Sources by NDIR Spectrometry. U.S. Environmental Protection Agency. Research Triangle Park, NC. Publication No. EPA-650/4-74-005-h. Febraury 1975. 96 p.

Method 10B—Determination of Carbon Monoxide Emissions From Stationary Sources

1. Applicability and Principle

1.1 Applicability. This method applies to the measurement of carbon monoxide (CO) emissions at petroleum refineries and from other sources when specified in an applicable subpart of the regulations.

1.2 Principle. An integrated gas sample is extracted from the sampling point and analyzed for CO. The sample is passed through a conditioning system to remove interferences and collected in a Tedlar bag. The CO is separated from the sample by gas chromatography (GC) and catalytically reduced to methane (CH_4) prior to analysis by flame ionization detection FID. The analytical portion of this method is identical to applicable sections in Method 25 detailing CO measurement. The oxidation catalyst re-

Total Hydrocarbons

The hydrocarbon (volatile organic compounds) concentrations were determined by collection in pre-cleaned virgin six-liter Tedlar bags and analysis by flame ionization using a Scott total hydrocarbon analyzer calibrated against methane in air standard gases. The bags were purged with hydrocarbon free zero gas prior to testing until the total hydrocarbon concentration in each bag was less then 1.0 ppm. The sampled bags (integrated sample over five minutes with Teflon probe) were analyzed on the same day as they were collected.

APPENDIX K

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 2

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

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

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

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

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

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

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

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

SYMBOLS

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

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

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

C_p = Pitot tube coefficient, dimensionless

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

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

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

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

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

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

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

M_p = Total amount of particulate matter collected, g

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

P_g = Stack static gas pressure, IN. WC.

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

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

A_a = Actual volumetric stack gas flow rate, ACFM

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

RH = Relative humidity, %

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

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

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

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

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

θ = Total sampling time, min.

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

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

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

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

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

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

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

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

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

γ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

CALCULATION EQUATIONS

METHOD 3

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

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

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

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

CALCULATION EQUATIONS

METHOD 5

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

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

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

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

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

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

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

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

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

SYMBOLS

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

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

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

C_p = Pitot tube coefficient, dimensionless

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

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

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

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

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

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

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

M_p = Total amount of particulate matter collected, g

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

P_g = Stack static gas pressure, IN. WC.

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

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

A_a = Actual volumetric stack gas flow rate, ACFM

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

RH = Relative humidity, %

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

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

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

$T_s(avg)$ = Absolute average stack temperature, ^oF

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

θ = Total sampling time, min.

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

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

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

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

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

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

CALCULATION EQUATIONS

METHOD 6

$$V_{std} = 17.64 \frac{V_m P_b \gamma}{T_m} \quad \text{(MIDGET IMPINGER VERSION)}$$

$$V_{std} = \frac{17.64\ V_m\ (P_b + \frac{\overline{\Delta H}}{13.6})\gamma}{T_m} \quad \text{(LARGE IMPINGER VERSION)}$$

$$\overline{MEQ} = (V_t - V_{tb})\ N\ (\frac{V_{soln}}{V_a})\ DF$$

$$C_s = \frac{7.06 \times 10^{-5}\ MEQ}{V_{std}}$$

$$E = \frac{20.90\ C_s F_d}{20.90 - \overline{B}'_{O_2}} = \frac{F_c C_s}{\overline{B}'_{CO_2}}$$

$$C_s\ (MG/DSCM) = 1.60186 \times 10^7\ C_s$$

$$C_s\ (GR/DSCF) = 7000\ C_s$$

$$C_s\ (ppm, dry) = 6.02119 \times 10^6\ C_s$$

$$C_s\ (ppm, wet) = 6.02119 \times 10^6\ C_s\ (1 - \frac{MC}{100})$$

SYMBOLS

$\overline{B'}_{O_2}$	=	Average oxygen content in flue gas, % v/v, dry
$\overline{B'}_{CO_2}$	=	Average carbon dioxide content in flue gas, % v/v, dry
C_s	=	Concentration of sulfur dioxide in flue gas, dry basis, corrected to standard conditions, LB/DSCF
C_s (GR/DSCF)	=	Concentration of sulfur dioxide in flue gas, dry basis, corrected to standard conditions, GR/DSCF
C_s (MG/DSCM)	=	Concentration of sulfur dioxide in flue gas, dry basis, corrected to standard conditions, MG/DSCM
DF	=	Dilution Factor
E	=	Emission factor, LB of $SO_2/10^6$BTU
F_d	=	Dry oxygen F-Factor for given fuel type, DSCF/10^6BTU
F_c	=	Carbon dioxide F-Factor for given fuel type, DSCF/10^6BTU
ΔH	=	Average pressure drop across calibrated orifice, IN. W.C.
γ	=	Dry test meter correction factor, dimensionless
MC	=	Moisture content of flue gas, % v/v
MEQ	=	Total milliequivalents of SO_2 in gas sample
N	=	Normality of barium perchlorate titrant
P_b	=	Barometric pressure at the dry gas meter, IN. HG.

C_s (ppm-dry) = Concentration of sulfur dioxide in flue gas, dry basis, (v/v), ppm

C_s (ppm-wet) = Concentration of sulfur dioxide in flue gas, wet basis, (v/v), ppm

T_m = Absolute average dry gas meter temperature, ^oR

V_a = Volume of sample aliquot titrated, cc

V_m = Dry gas volume as measured by the dry gas meter, DCF

V_{std} = Dry gas volume as measured by the dry gas meter, corrected to standard conditions (at 68 ^oF and 1 atmosphere), DSCF

V_{soln} = Total volume of the solution in which the sulfur dioxide sample is contained, cc

V_t = Volume of barium perchlorate titrant used for the sample, cc (average of replicate titrations)

V_{tb} = Volume of barium perchlorate titrant used for the blank, cc

METHOD 7

$$V_{m(std)} = 17.64\ (V_f - 25)\ \left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

$$C_s = 6.243 \times 10^{-5}\ \frac{M}{V_{m(std)}}$$

$$E = \frac{2090\ C_s F}{20.9 - \bar{B}'_{O_2}}$$

$$C_s\ (GR/DSCF) = 7000\ C_s$$

$$C_s\ (MG/DSCM) = 1.60186 \times 10^{7}\ C_s$$

$$C_s\ (ppm\text{-}dry) = 8.37552 \times 10^{6}\ C_s$$

$$C_s\ (ppm\text{-}3\%\ O_2) = 8.37552 \times 10^{6}\ C_s \left\{1 + \left[\frac{\bar{B}'_{O_2} - 3}{20.9 - B'_{O_2}}\right]\right\}$$

$$C_s\ (ppm\text{-}wet) = 8.37552 \times 10^{6}\ C_s \cdot \left(1 - \frac{MC}{100}\right)$$

CE6-1

SYMBOLS

$\bar{B}'_{O_2}$ = Average oxygen content in flue gas, % v/v

C_s = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, LB/DSCF

C_s (GR/DSCF) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, GR/DSCF

C_s (MG/DSCM) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to standard conditions, MG/DSCM

E = Emission factor, LB/10^6BTU

F = F-Factor for given fuel type, DSCF/10^4BTU

M = Mass of nitrogen oxides as nitrogen dioxide in gas sample, µg

MC = Moisture content of flue gas, %

P_f = Final absolute pressure in flask, IN. HG

P_i = Initial absolute pressure in flask, IN. HG

C_s (ppm-dry) = Concentration of nitrogen oxides in flue gas, dry basis, (v/v), ppm

C_s (ppm-3% O_2) = Concentration of nitrogen oxides in flue gas, dry basis, corrected to 3% O_2 , (v/v) ppm

C_s (ppm-wet) = Concentration of nitrogen oxides in flue gas, wet basis, (v/v), ppm

T_f = Final absolute temperature in flask, ^{o}R

T_i = Initial absolute temperature in flask, ^{o}R

V_f = Volume of flask and valve, cc

$V_{m(std)}$ = Sample volume at standard conditions, dry basis, cc

CALCULATION EQUATIONS

METHOD 10

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

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

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

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

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

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

Where

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

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

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

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

Total Gaseous Organics Calculation Equations

$$GR\ C/SCF = 2.180 \times 10^{-4}\ (ppm,w)$$

$$GR\ C/DSCF = 2.180 \times 10^{-4}\ (ppm,w)/(1-MC/100)$$

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

where:

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

GR C/DSCF = grains of total gaseous organics as carbon per dry 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)

Report No. 3-1636

AMERICAN CRYSTAL SUGAR COMPANY

East Grand Forks, MN

Total HydroCarbons Calculations

Source	C-PULP DRYER STACK									
				CONC	GASFLOW	MASSRATE	AVERAGE			
	TEST #	RUN	MC%	(ppmC,w)	(DSCFM)	(LB/HR)	(ppmC,w)	(LB/HR)		(GR/DSCF)
	3	1	33.61	123	24867	8.61				0.0403886
		2	31.13	177	25356	12.18				0.0560273
		3	37.16	172	23446	11.99				0.059669
							157.33333	10.9256		

Source	B-PULP DRYER STACK									
				CONC	GASFLOW	MASSRATE	AVERAGE			
	TEST #	RUN	MC%	(ppmC,w)	(DSCFM)	(LB/HR)	(ppmC,w)	(LB/HR)		(GR/DSCF)
	8	1	23.3	106	43382	11.20				0.0301278
		2	21.92	72	44674	7.70				0.0201025
		3	21.97	65	43695	6.80				0.0181597
							81	8.56725		

Source	A-PULP DRYER STACK									
				CONC	GASFLOW	MASSRATE	AVERAGE			
	TEST #	RUN	MC%	(ppmC,w)	(DSCFM)	(LB/HR)	(ppmC,w)	(LB/HR)		(GR/DSCF)
	11	1	41.6	310	22618	22.43				0.1157192
		2	39.2	264	24090	19.55				0.0946579
		3	38.96	246	24043	18.11				0.0878571
							273.33333	20.02849		

APPENDIX L

TEST PLAN & PROTOCOL

COMPLIANCE TEST PLAN FOR MISCELANEOUS INDUSTRIAL SOURCES

AMERICAN CRYSTAL SUGAR COMPANY
EAST GRAND FORKS FACILITY

Permit No. 29B-92-OT-1

Permitee contact person: Bruce Keifenheim (218) 773-5114

MPCA Permit Engineer: Gregory Siems

Independent Testing Company: Interpoll Laboratories, Inc.

Sketches of each stack source point to be tested showing test port location, stack diameter, and other pertanent information are included with this plan.

1 WEEK #2 TESTS - NOV. 9,10,11, 1993

1.1 Tests are mandated by Table E, pg. 43 thru 44 of the referenced permit.

1.2 Tests will be performed on the below-listed sources:

- No. 1 Boiler	EP#1
- No. 2 Boiler	EP#2
- A Pulp Dryer	EP#3
- B Pulp Dryer	EP#4
- C Pulp Dryer	EP#5
- Pellet Cooler	EP#6
- Pellet Cooler	EP#7

2 No. 1 and No. 2 Boilers

2.1 Tests for PM, NO_x, and CO, and CEM certification for SO_2, CO, CO_2, and opacity meters.

Stack Tests

2.1 Three-one hour stack tests will be performed on each source.

2.2 Specified stack test determinations will consist of the following:

a. Volumetric flow rate and gas temperature determination - EPA Method 2.

b. Gas composition (three (3) one-hour integrated flue gas samplings with analysis for CO_2 and O_2 by Orsat on non-ambient sources only) - EPA Method 3.

c. Gas moisture content (three (3) one -hour determinations - EPA Method 4.

d. Particulate concentration and emission rate (three (3) one-hour determinations) - EPA Method 5. Condensible compounds will be collected during each determination and analyzed as per MN Rules Part 7005.0500.

e. Oxides of nitrogen concentration and emission rate (three (3) determinations; each determination: four 2-liter frab samples) - EPA Method 7A.

f. Carbon monoxide concentration and emission rate (three (3) one-hour determinations) - EPA Method 10.

CEM Tests

2.3 Each CEM Relative accuracy testing Audit (RATA) will consist of nine (9) determinations. Determinations will include moisture content if required.

2.4 Tests will be conducted in the manner specified in Exhibit B of the above referenced facility permit.

2.5 The following series of determinations will be performed at forty five (45) minute intervals on the No. 1 and No. 2 Boiler CEM Systems on each of two consecutive work days:

a. Gas composition (nine (9) 21-minute carbon dioxide determinations) -EPA Method 3A.
b. Gas moisture content (nine (9) 21-minute determinations if required) - EPA Method 4.
c. Sulfur dioxide concentration (nine (9) 21-minute determinations) - EPA Mehtod 6C.
d. Carbon monoxide concentrataion (nine (9) 21-minute monitoring) -EPA Method 10. The carbon monoxide concentration will be measured with a CO NDIR analyzer using the Meghod 10 Alternative Procedure Interference Trap (Section 10.1 - See also Method 10A Section 2.1.2 and 4.2). A slip stream of exhaust gas is passed through three Greenburg-Smith impingers, the first two of which contains 400 ml of alkaline permanganate and the third of which contains 250 ml. The sample is scrubbed at 300 ml/min. The carbon monoxide concentration in the scrubbed (CO_2-SO_2-and NOx-free) gas stream is read

with a carbon monoxide NDIR analyzer which is calibrated with 0, 30 and 60% f.s. CO in nitrogen standard gases with manufacturer specified accuracies of at least pluss or minus 2% of the stated values. The average CO_2 concentration from the Method 3A determination is then used to correct the measured CO_2-free CO concentrations back to actual CO_2 contents.

2.6 Transimissometer Audit will include:

a. Monitoring system check
b. Calibration error test
c. Response time test
d. Calculation of 24-hour zero drift and 24-hour span drift from records submitted by ACS.

2.7 CEM data recorded by the plant during each RATA shall be labeled with the Plant name, the CEM it was taken from, the serial number of the CEM, the date, as well as pollutant concentration and time units. The CEM recorded data must be submitted to the Interpoll Labs Field Engineer immediately after each RATA.

2.8 The autocalibrate mode will be deactivated during the RATA.

Boiler Tests-General

2.9 Unless otherwise noted, the determinations will be conducted according to the provisions of EPA Methods cited in CFR Title 40, Part 60, Appendix A (revised July 1, 1992) using equipment meeting the specifications therein.

2.10 The preliminary testing schedule is included with this report.

OPERATIONAL CONDITIONS OF BOILERS

2.11 Boilers will be under a normal load during testing.

2.12 Table I in Exhibit B page 8 and the table in Exhibit C (both in the facility permit) shall be included with the test report for CEM and stack tests.

2.13 Soot blowing (normal cycle) and ash pulling shall take place during one of the three one hour stack tests.

2.14 The test information submitted by ACS for inclusion in the test report shall include a description of any maintenance work done before the test and indicate how

frequent the maintenance is performed.

2.15 Data will be taken at half hour intervals during stack tests. Data shall include boiler temperatures, steam output rate, steam pressures, and CEM readings.

2.16 Data will be taken at half hour intervals on the Electrostatic Precipitator primary and secondary volts/amps, number of fields on line, and inlet flue gas temperature. Spark rate and rapping cycle will be recorded.

2.17 All continuous monitor strip charts for the boiler shall be submitted with the report. The charts will be dated, signed, and chart data will be explained.

2.18 Fuel samplig and analysis shall be performed according to ASTM Reference Methods. One sample will be taken for each test run consisting of coal taken from the stoker before and one half hour into each run. An independent testing laboratory will analyze samples for BTU/lb, sulfur, ash content, moisture content, and specific gravity.

3. PULP DRYERS

3.1 Three-two hour stack tests will be performed on each source.

3.2 Specified stack test determinations will consist of the following:

a. Volumetric flow rate and gas temperature determination - EPA Method 2.

b. Gas composition (three (3) two-hour integrated flue gas samplings with analysis for CO^2 and O_2 by Orsat - EPA Method 3.

c. Gas moisture content (three (3) two -hour determinations - EPA Method 4.

d. Particulate concentration and emission rate (three (3) two-hour determinations) - EPA Method 5. Condensible compounds will be collected during each determination and analyzed as per MN Rules Part 7005.0500.

e. Sulfur dioxide concentration and emission rate (three (3) two-hour determinations) - EPA Method 6 using the back half of the Method 5 sampling train.

f. Oxides of nitrogen concentration and emission rate (three (3) determinations; each determination: four

2-liter frab samples) - EPA Method 7A.

g. Visible emission - weather permitting (240 observations during a sixty minute period by an EPA-certified reader) -EPA Method 9.

h. Carbon monoxide concentration and emission rate (three (3) two-hour determinations) - EPA Method 10.

i. Total hydrocarbons (THC) concentration and emission rate (three (3) two-hour determinations) - EPA Method 25A using a Ratfisch Model RS55 HFID calibrated against propane in air standards.

3.3 Unless otherwise noted, the determinations will be conducted according to the provisions of EPA Methods cited in CFR Title 40, Part 60, Appendix A (revised July 1, 1992) using equipment meeting the specifications therein.

3.4 The preliminary testing schedule is included with this report.

OPERATIONAL CONDITIONS OF PULP DRYERS

3.5 Pulp dryers will be under a normal load during testing.

3.6 The table in Exhibit C in the facility permit shall be included with the test report for stack tests.

3.7 Soot blowing and ash pulling shall take place during one of the three two hour stack tests.

3.8 The test information submitted by ACS for inclusion in the test report shall include a description of any maintenance work done before the test and indicate how frequent the maintenance is performed.

3.9 Data will be taken at half hour intervals during stack tests. Data shall include pressed pulp input to dryer, FD, recycle, and ID damper positions, grate speedd, pressed pulp moisture, dryed pulp moisture, multiclone differential and inlet pressures, furnace and drum exit pressures, hopper filter differential pressure, and temperatures of the drum throat, exit, and recycle gas.

3.10 All continuous monitor strip charts for the boiler shall be submitted with the report. The charts will be dated, signed, and chart data will be explained.

3.11 Fuel samplig and analysis shall be performed according to

ASTM Reference Methods. One sample will be taken for each test run consisting of coal taken from the grate before and one half hour into each run. An independent testing laboratory will analyze samples for BTU/lb, sulfur, ash content, moisture content, and specific gravity.

4. PELLET COOLERS

4.1 Tests are mandated by Table E, pg. 44 of the referenced permit.

4.2 Tests will be performed on the below-listed sources:

- Pellet Cooler EP#6
- Pellet Cooler EP#7

4.3 Tests for particulate matter (PM) are required.

4.4 Three-one hour tests will be performed on each source.

4.5 PM determinations will consist of the following:

a. Volumetric flow rate and gas temperature determination - EPA Method 2.

b. Gas composition (three (3) one-hour integrated flue gas samplings with analysis for CO^2 and O_2 by Orsat - EPA Method 3.

c. Gas moisture content (three (3) one -hour determinations - EPA Method 4.

d. Particulate concentration and emission rate (three (3) one-hour determinations) - EPA Method 5. Condensible compounds will be collected during each determination and analyzed as per MN Rules Part 7005.0500.

4.6 Unless otherwise noted, the determinations will be conducted according to the provisions of EPA Methods cited in CFR Title 40, Part 60, Appendix A (revised July 1, 1992) using equipment meeting the specifications therein.

4.7 The preliminary testing schedule is included with this report

5. OPERATIONAL CONDITIONS OF SOURCES

Job: ACS/EGF Month/Year: Nov 93

Team: 4

SUN	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SAT
DATE	Nov 8	Nov 9	Nov 10	Nov 11	Nov 12	
TEAM A (2)	TRAVEL & SET UP	C PULP DRYER PM, SO_2, CO NO_x ~~SO_2~~ CEM test No. 2 Boiler	B PULP DRYER PM, SO_2, CO NO_x ~~SO_2~~ CEM test No. 1 Boiler	A PULP DRYER PM, SO_2, CO NO_x ~~SO_2~~	TRAVEL	
TEAM B (2)	TRAVEL & SET UP	AM: No 1. BOILER PM, CO, NO_x PM: C PULP DRYER VOCs, VE	AM: No 2 BOILER PM, CO, NO_x PM: PULP DRYER VOCs, VE ! visible emissions	AM: PELLET COOLER #6 PM PM: A PULP DRYER VOCs, VE	AM: PELLET COOLER #7 PM PM: TRAVEL	

Port size

( ) = # personnel

L-7

5.1 The source points are part of a near-steady state sugar byproduct refining operation. Tests will proceed only when normal throughput is observed as determined by the dry pulp weigh belt.

2.2 During the three (3) one hour tests, operating data will be recorded at half hour intervals. This information will be included with the final test result submittal.

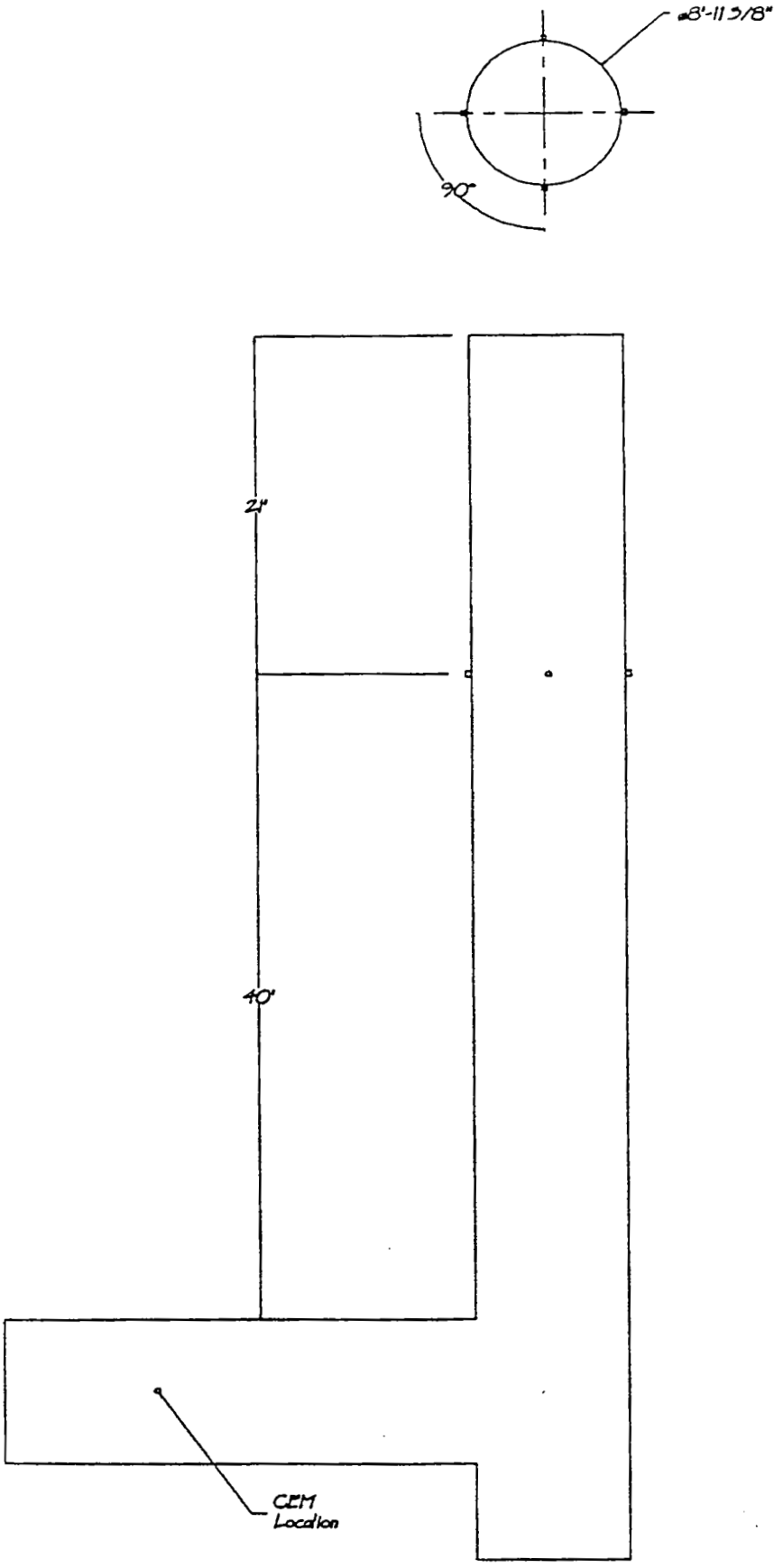
2.3 Process data will be recorded for pulp dryer total input, dry pulp output, and temperatures and pressures of the cooler.

2.4 Pollution Control operating conditions

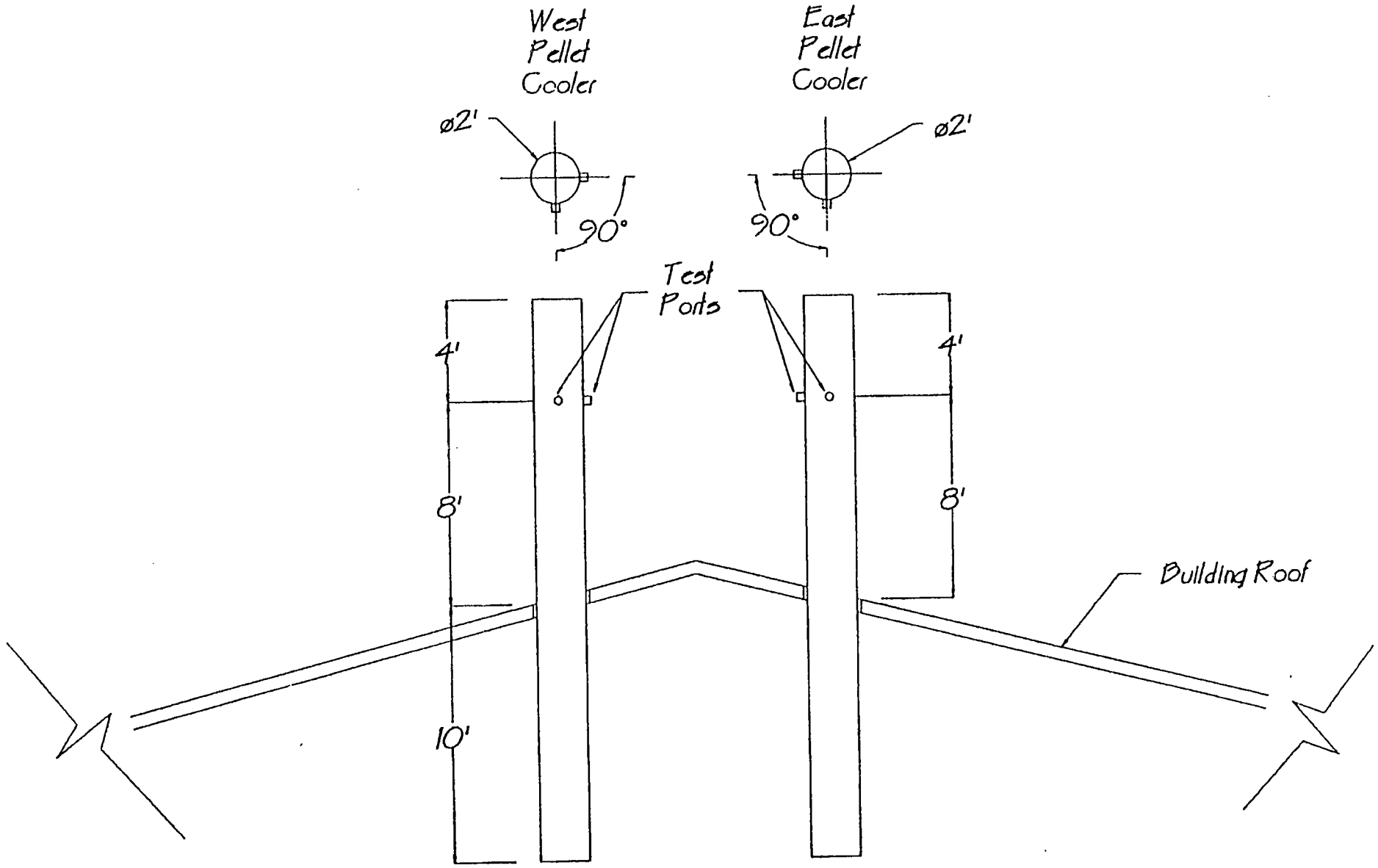
- Cyclones are in operation on the two coolers. Pressure differential data will be recorded during testing.

- The independent testing company will include physical data including stack temperatures and pressures.

2.5 Written comments will be included on the data sheets with refference to the overall condition of the operating and pollution control equipment, including last maintenance performed prior to the test, and the specific type of maintenance performed.



Boilerhouse Stack(s)
2 - Typical


West
Pellet
Cooler
East
Pellet
Cooler
ø2'
ø2'
90°
90°
Test
Ports
4'
4'
8'
8'
10'
Building Roof