Background Report Reference

AP-42 Section Number: 10.6.1

Background Report Section: 4

Reference Number: 21

Title: Source Test Report Weyerhaeuser Company Elkin Structurwood Facility Dryer/IWS System 1 Particulate Emissions and Visual Opacity, June 29, 1987, Weyerhaeuser Company,Elkin, NC

Environmental Source Samplers, Inc

June 1987

(ESS)

ENVIRONMENTAL SOURCE SAMPLERS, INC. — AIR QUALITY CONSULTANTS

(21)

B

SOURCE TEST REPORT
WEYERHAEUSER COMPANY
ELKIN STRUCTURWOOD FACILITY
DRYER/IWS SYSTEM 1

PARTICULATE ~~EMISSIONS~~ & VISUAL OPACITY
JUNE 29, 1987

- NO DESC. OF FRONT-HALF METHOD
- N/D BACK-HALF METHOD
- NO WOOD SPECIES
- QUESTIONABLE PROCESS RATE

FILT DRY ONLY

Prepared for:

WEYERHAEUSER COMPANY
Elkin, North Carolina

Prepared by:

ENVIRONMENTAL SOURCE SAMPLERS, INC.
Charlotte, North Carolina

1409 EAST BOULEVARD • CHARLOTTE, N.C. 28203 • Phone 704/334-3380

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ENVIRONMENTAL
SOURCE SAMPLERS

1.0 INTRODUCTION

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1.0 INTRODUCTION

On June 29, 1987, Environmental Source Samplers, Inc. (ESS) conducted particulate emission and visual opacity testing for the Weyerhaeuser Company. Testing was conducted at the Structurwood Plant located in Elkin, North Carolina. Testing was performed on the Unit 1 Wood Dryer/Ionizing Wet Scrubber (IWS) system.

Three (3) particulate emission test runs were performed in the stack serving the Unit 1 system. Particulate emission testing was conducted in accordance with procedures outlined in U.S. Environmental Protection Agency (EPA) Method 5. EPA Methods 1 through 4 were used in support of EPA Method 5. In addition, particulate matter collected in the 'back half' or condenser were included in the emission calculation. Visual opacity was observed in accordance with EPA Method 9 procedures.

The purpose of the particulate emission and visual opacity test series was to determine compliance with appropriate regulations of the North Carolina Department of Natural Resources and Community Development.

Personnel present during the testing included:

Mr. Bob Brummel, Weyerhaeuser
Mr. Ken Cox, Weyerhaeuser
Mr. Brian Preston, Weyerhaeuser
Mr. Glen Woods, Weyerhaeuser
Mr. Hugh Jernigan, Jr., N.C. Dept. of Natural Resources
Mr. Robert Hamlin, Jr., Environmental Source Samplers
Mr. Dayne Loy, Environmental Source Samplers
Mr. John Salkill, Environmental Source Samplers

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2.0 SUMMARY AND DISCUSSION OF RESULTS

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2.0 SUMMARY AND DISCUSSION OF RESULTS

The test results are summarized on the following page. Field data sheets are included in Appendix A; calculations in Appendix B; operational data in Appendix C; laboratory data in Appendix D; and calibration data in Appendix E.

Particulate emissions were measured at 14.7, 12.4, and 12.8 pounds per hour, resulting in an average emission rate of 13.3 pounds per hour. These results include the particulate contribution of the impinger train. Particulate emissions measured in the 'front half' only were 14.2, 11.8, and 12.1 pounds per hour, for an average emission rate of 12.7 pounds per hour. These emission rates compare with the limit of 15 pounds per hour established for the Unit 1 Dryer/IWS system by the North Carolina Department of Natural Resources and Community Development.

Visual opacity was observed at 10.4, 9.6, and 7.9 percent, for an average of 9.3 percent visual opacity. Each observation consisted of 240 readings over a one (1) hour period concurrent with the particulate testing. These observations are compared with the limit of 20 percent established by the North Carolina Department of Natural Resources and Community Development.

The dryer operated at a bottom belt speed rate of 45 percent during the test period. This equates to aproximately 22,000 pounds per hour of oven dried wood product, which is equivalent to the unit's design capacity. During the final test run, the wet wood flake supply to the dryer was exhausted during the final minutes of testing.

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ENVIRONMENTAL
SOURCE SAMPLERS

3.0 PROCESS DESCRIPTION AND OPERATION

3.0 PROCESS DESCRIPTION AND OPERATION

The Elkin Structurwood facility consists of two (2) dryers with separate primary cyclone collectors and secondary Ceilcote ionizing wet scrubber systems. Each dryer may be heated with oil, the McConnell dust burner, or with heat from the wet cell furnace. The dryers may operate with a combination of these heat sources.

Each dryer has a maximum design capacity of 22,000 lbs/hr of oven dried wood product. The dryer rate reported in this report is based on the belt speed supplying the dryer. Depending on wood quality and moisture content, maximum belt speed will vary. The belt speed of 45 percent maintained during the test period was considered equal to the maximum design capacity of the system.

The Ceilcote IWS consists of a venturri scrubber operating with a 5 inch water gauge pressure drop, followed by a particle charging section. Ionizer elements are controlled by two (2) independent transformer-rectifiers, and are continuously flushed to prevent solids build up. Tellerette packing is used as the collecting material, and is washed at four (4) hour intervals for a five (5) minute period.

A block diagram of the process/collection system appears on the following page. A schematic of the IWS appears on the next page. Operational data was collected during each test run, and appears in Appendix C.

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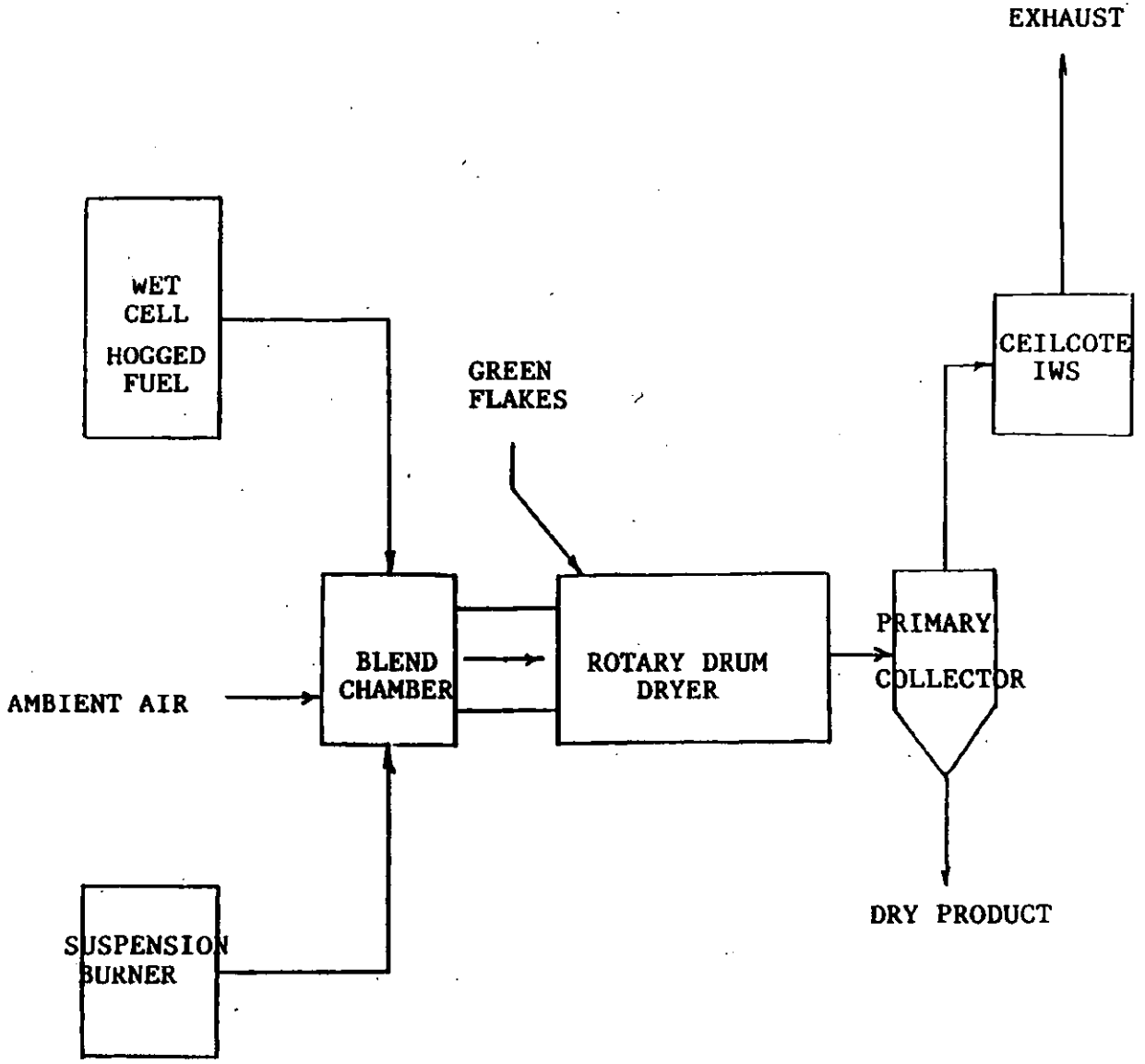
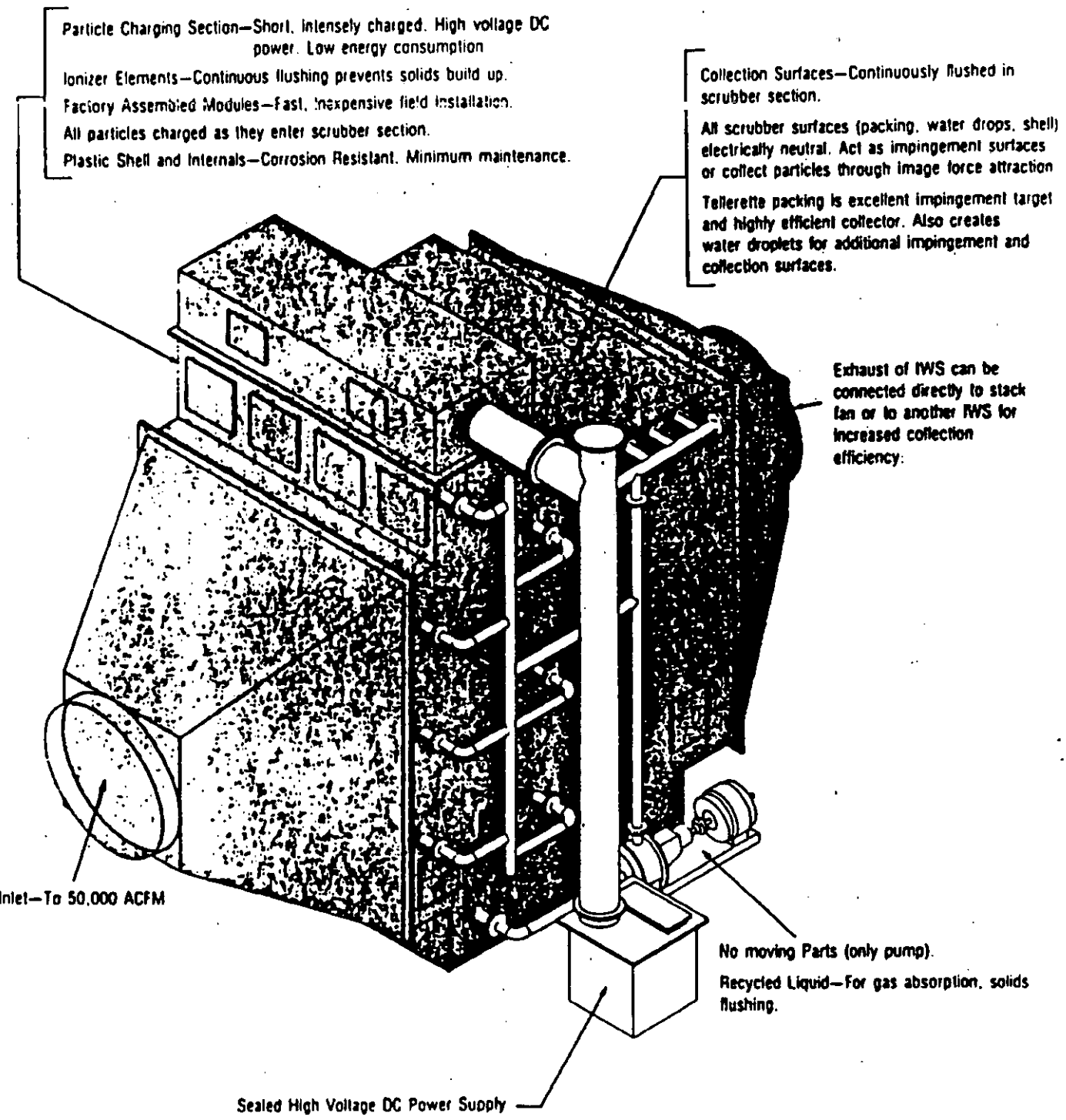
WEYERHAEUSER - ELKIN, N.C.
DRYER/COLLECTOR SYSTEM



WEYERHAEUSER - ELKIN, N.C.

CEILCOTE IONIZING WET SCRUBBER



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4.0 SAMPLING POINT LOCATION

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SOURCE SAMPLERS

4.0 SAMPLING POINT LOCATION

The MTV/IWS outlet test ports were located in the stack serving the system. The test ports were located in a steel stack having an inside diameter of 5'-3". Two (2) test ports were located 55 feet or 10.5 stack diameters downstream of the IWS exit, and 25 feet or 4.8 stack diameters upstream of the stack exit.

According to the procedures of EPA Methods 1 and 2, six (6) test points were selected at each of the two (2) test ports. Each point was sampled for five (5) minutes, resulting in 60 minute test runs.

The test site is diagrammed on the following page.

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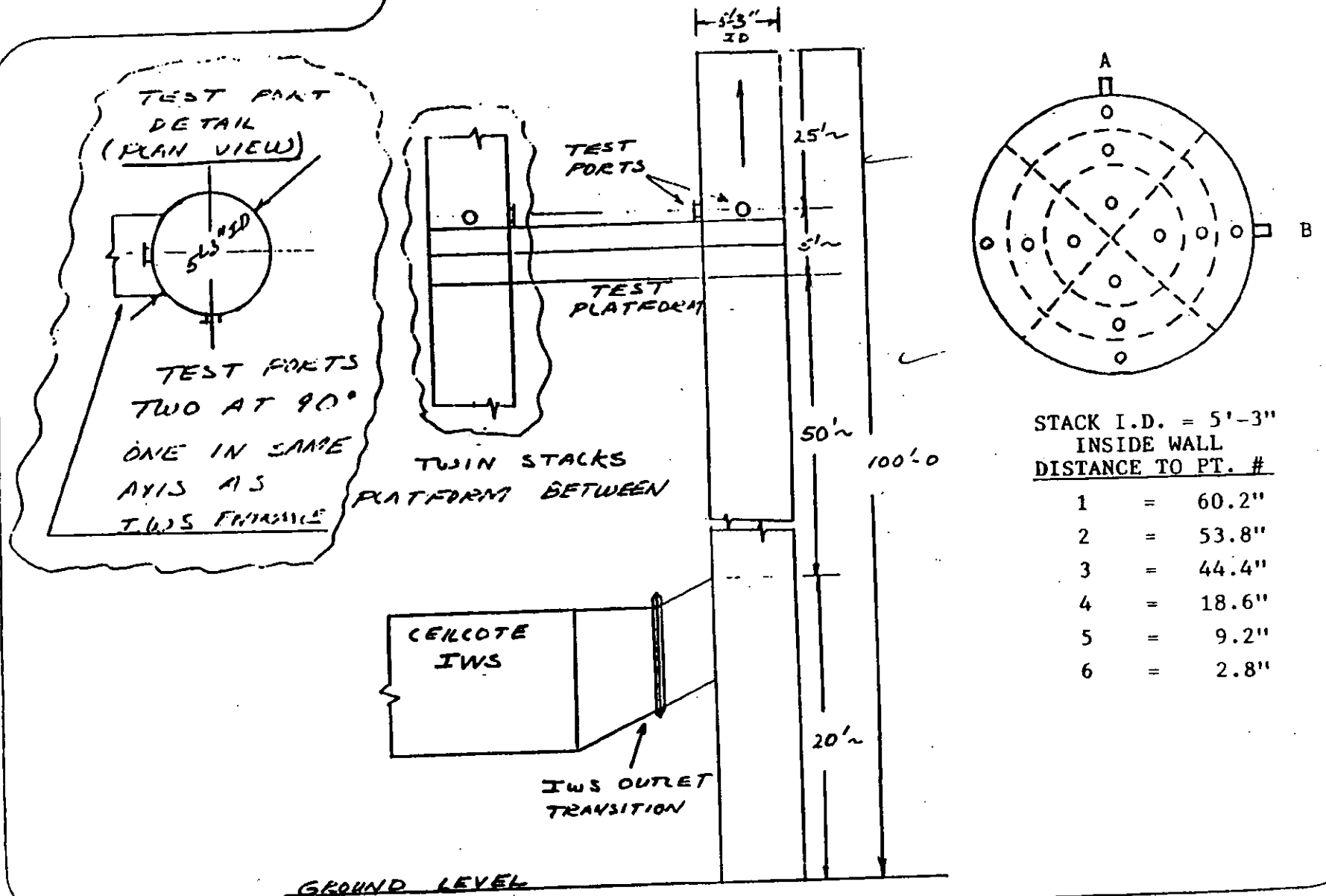
SOURCE SAMPLERS

WEYERHAEUSER - ELKIN, N.C.
IONIZING WET SCRUBBERS 1 & 2
OUTLET PARTICULATE SAMPLING LOCATION



STACK I.D. = 5'-3"
INSIDE WALL
DISTANCE TO PT. #

1	=	60.2"
2	=	53.8"
3	=	44.4"
4	=	18.6"
5	=	9.2"
6	=	2.8"

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ENVIRONMENTAL
SOURCE SAMPLERS

PARTICULATE FIELD DATA

Plant Weyerhaeuser - Elkin
Run Number 1
Location Unit Outlet
Date 6/29/97
Operator Loy - Smith
Sample case number B-5
Monitor Unit number 5-5
Time start: 10:00
Time complete: 11:07

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ENVIRONMENTAL SOURCE SAMPLERS

bag # - 1

Ambient temperature, °F 76
Barometric pressure, in. Hg 29.49
Assumed moisture, % 20
Heater box setting, °F 250
Nozzle tip diameter, in. 0.268
Pitobe length, ft. 5
Pitobe heater setting 250

Point	Clock Time	Dry Gas Meter ft³	Pitot, in. H_2O ΔP	Orifice ΔH, in. H_2O Desired	Orifice ΔH, in. H_2O Actual	Dry gas temperature, °F		Pump Vacuum in. Hg Gauge	Sample Case Temperature, °F	Impinger Temperature, °F	Stack Pressure, in. H_2O	Stack Temperature, °F
A 1	0	776.895	0.30	1.08	1.08	82		2	250	64	-2.20	139
2	5	780.250	0.35	1.26	1.26	84		2	260	56		140
3	10	783.685	0.30	1.08	1.09	86		2	265	52		139
4	15	786.890	0.25	0.90	0.90	86		2	265	48		140
5	20	789.755	0.30	0.72	0.72	88		1	265	50		139
6	25	792.180	0.30	0.72	0.72	90		1	265	50		138
B 1	30	794.650	0.25	0.90	0.90	89		1	270	50		140
2	35	797.535	0.35	0.90	0.90	92		1	270	52		140
3	40	800.290	0.30	1.08	1.08	92		2	270	52	-6.20	140
4	45	803.910	0.35	1.26	1.26	92		2	265	52		141
5	50	806.815	0.30	1.08	1.08	92		2	265	54		140
6	55	810.040	0.25	0.90	0.93	92		2	263	56		140
	60	812.930										
	TOTAL	36.035										
		AVG.	0.273		0.990	88.8					-0.20	139.3

Leak rate: Start 0.000 cfm; Finish 0.000 cfm.
P 15 lbs. P 8 lbs.

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ENVIRONMENTAL
SOURCE SAMPLERS

ORSAT GAS ANALYSIS

PLANT Weyerhaeuser 1 DATE 6-29-87 TEST # 1

	TIME	% CO_2	% O_2	% CO	% N_2
RUN 1		3.0	20.4 17.4	22.4 0.0	79.6
RUN 2		3.2	20.6 17.4	22.6 0.0	79.4
RUN 3					
AVG.		3.1	17.4	0.0	79.5

GAS DENSITY CORRECTION FACTOR

COMPONENT	VOLUME PERCENT/100	MOISTURE CORRECTION	MOL. WT.	WEIGHT PER MOLE = WET BASIS
WATER	0.208	1.0	18.0	3.744
CARBON DIOXIDE	0.031 DRY BASIS	0.792	44.0	1.080
CARBON MONOXIDE	0.0 DRY BASIS		28.0	
OXYGEN	0.174 DRY BASIS	0.792	32.0	4.410
NITROGEN & INERTS	0.795 DRY BASIS	0.792	28.2	17.756
			AVERAGE MOLECULAR WEIGHT	26.99

Plant [illegible] E/K IV
Run Number 2
Location [illegible]
Date 6/29/87
Operator [illegible]
Sample case number 6-5
Monitor Unit number 5-5
Time start: 11:15
Time complete: 12:20

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ENVIRONMENTAL SOURCE SAMPLERS

bag 2

Ambient temperature, °F 80
Barometric pressure, in. Hg 29.99
Assumed moisture, % 20
Heater box setting, °F 250
Nozzle tip diameter, in. 0.268
Pitobe length, ft. S
Pitobe heater setting [illegible]

Point	Clock Time	Dry Gas Meter ft³	Pitot, in. H_2O ΔP	Orifice ΔH, in. H_2O Desired	Orifice ΔH, in. H_2O Actual	Dry gas temperature, °F		Pump Vacuum in. Hg Gauge	Sample Case Temperature, °F	Impinger Temperature, °F	Stack Pressure, in. H_2O	Stack Temperature, °F
A 1	0	813.100	0.25	1.26	1.26	90		2	250	64	-0.20	134
2	5	816.520	0.35	1.26	1.26	92		2	260	62		140
3	10	819.950	0.30	1.08	1.04	92		3	265	58		134
4	15	823.145	0.25	0.90	0.90	93		1	265	58		136
5	20	826.110	0.20	0.72	0.72	94		1	265	56		136
1	25	828.565	0.20	0.72	0.72	94		1	265	56		132
B 1	30	831.225	0.35	0.90	0.90	94		1	265	58	-0.22	134
2	35	834.230	0.30	1.08	1.08	95		2	265	58		139
3	40	837.510	0.30	1.08	1.08	96		2	270	56		136
4	45	840.670	0.35	1.26	1.26	96		3	270	56		138
5	50	844.125	0.30	1.08	1.08	96		4	265	58		138
C	55	847.440	0.25	0.90	0.90	99		3	265	60		137
	60	850.420										
	TOTAL	37.320										
		AVG	0.281		1.020	94.11					-0.21	137.8

Leak rate: Start 0.000 cfm; Finish 0.000 cfm.

[illegible] @ 12 Hg

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ENVIRONMENTAL
SOURCE SAMPLERS

ORSAT GAS ANALYSIS

PLANT Weyerhaeuser 1 DATE 6-29-87 TEST # 2

	TIME	% CO_2	% O_2	% CO	% N_2
RUN 1		2.6	20.4 17.8	20.4 0.0	79.6
RUN 2		2.6	20.2 17.6	20.2 0.0	79.8
RUN 3					
AVG.		2.6	17.7	0.0	79.7

GAS DENSITY CORRECTION FACTOR

COMPONENT	VOLUME PERCENT/100	MOISTURE CORRECTION	MOL. WT.	WEIGHT PER MOLE = WET BASIS
WATER	0.212	1.0	18.0	3.816
CARBON DIOXIDE	0.026 DRY BASIS	0.788	44.0	0.901
CARBON MONOXIDE	— DRY BASIS		28.0	
OXYGEN	0.177 DRY BASIS	0.788	32.0	4.463
NITROGEN & INERTS	0.797 DRY BASIS	0.788	28.2	17.711
			AVERAGE MOLECULAR WEIGHT	26.89

Plant Weyerhaeuser
Run Number 3
Location Unit 1 IWS
Date 6/29/87
Operator LOY - SA/K.11
Sample case number 65
Monitor Unit number 5-5
Time start: 12:40
Time complete: 13:45

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ENVIRONMENTAL SOURCE SAMPLERS

bag # 4

Ambient temperature, °F 86
Barometric pressure, in. Hg 29.49
Assumed moisture, % 20
Heater box setting, °F 250
Nozzle tip diameter, in. 0.268
Pitobe length, ft. 5
Pitobe heater setting 250

Point	Clock Time	Dry Gas Meter ft³	Pitot, in. H_2O ΔP	Orifice ΔH, in. H_2O Desired	Orifice ΔH, in. H_2O Actual	Dry gas temperature, °F		Pump Vacuum in. Hg Gauge	Sample Case Temperature, °F	Impinger Temperature, °F	Stack Pressure, in. H_2O	Stack Temperature, °F
A 1	0	850.615	0.30	1.08	1.08	94		2	255	64	-0.22	136
2	5	853.920	0.35	1.26	1.26	94		2	260	62		137
3	10	857.455	0.30	1.08	1.08	96		2	265	58		138
4	15	860.810	0.35	1.26	1.26	96		2	265	58		134
5	20	864.375	0.20	0.72	0.72	96		1	265	56		133
6	25	867.010	0.20	0.72	0.72	96		1	265	56		133
B 1	30	869.730	0.25	0.90	0.90	94		1	268	58	-0.20	138
2	35	872.795	0.25	0.90	0.90	95		1	270	58		138
3	40	875.850	0.30	1.08	1.08	96		2	270	60		139
4	45	879.290	0.35	1.26	1.26	98		2	270	60		134
5	50	882.805	0.30	1.08	1.08	98		2	265	62		134
6	55	886.280	0.25	0.90	0.90	98		1	263	62		132
		888.355										
	TOTAL	38.740										
		AVG	0.281		1.020	95.9					-0.21	136.3

Leak rate: Start 0.000 cfm; Finish 0.000 cfm.

@ 10 lbs

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ENVIRONMENTAL
SOURCE SAMPLERS

ORSAT GAS ANALYSIS

PLANT Weyerhaeuser 1 DATE 6-29-87 TEST # 3

	TIME	% CO_2	% O_2	% CO	% N_2
RUN 1		3.2	20.4 17.2	2.4 0.0	79.6
RUN 2		3.4	20.6 17.2	20.6 0.0	79.4
RUN 3					
AVG.		3.3	17.2	0.0	79.5

GAS DENSITY CORRECTION FACTOR

COMPONENT	VOLUME PERCENT/100	MOISTURE CORRECTION	MOL. WT.	WEIGHT PER MOLE = WET BASIS
WATER	0.205	1.0	18.0	3.690
CARBON DIOXIDE	0.032 DRY BASIS	0.795	44.0	1.119
CARBON MONOXIDE	— DRY BASIS		28.0	
OXYGEN	0.172 DRY BASIS	0.795	32.0	4.374
NITROGEN & INERTS	0.795 DRY BASIS	0.795	28.2	17.823
			AVERAGE MOLECULAR WEIGHT	27.01

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SOURCE SAMPLERS

VISUAL OPACITY FIELD DATA

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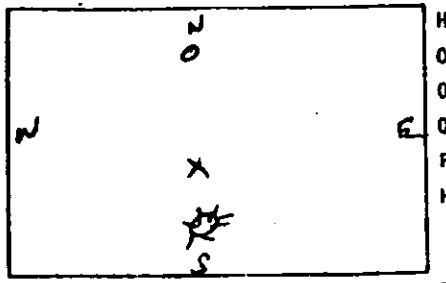
ENVIRONMENTAL
SOURCE SAMPLERS

EPA METHOD 9 VISUAL OPACITY

COMPANY Weyerhaeuser
LOCATION ELKIN NC
TEST NUMBER 1
DATE 6-29-87
TYPE FACILITY WOOD DRYER
CONTROL DEVICE IWS



HOURS OF OBSERVATION 1000 - 1100
OBSERVER R. Hamlin
OBSERVER CERTIFICATION DATE 3/4/87
OBSERVER AFFILIATION ESS
POINT OF EMISSIONS STACK
HEIGHT OF DISCHARGE POINT 100'

	Initial			Final
CLOCK TIME	1000			1100
OBSERVER LOCATION Distance to Discharge	100'			100'
Direction from Discharge	S			S
Height of Observation Point	50'			50'
BACKGROUND DESCRIPTION	Blue Sky			Blue Sky
WEATHER CONDITIONS Wind Direction	NA			SW
Wind Speed	0			5
Ambient Temperature	80°			82
SKY CONDITIONS (clear, overcast, % clouds, etc.)	clear			clear
PLUME DESCRIPTION Color	white			white
Distance Visible	100'			100'
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time Start--End	Opacity Sum	Opacity Average
1	1000 - 1006	255	10.6
2	1006 - 1012	265	11.0
3	1012 - 1018	280	11.7
4	1018 - 1024	250	10.4
5	1024 - 1030	245	10.2
6	1030 - 1036	250	10.4
7	1036 - 1042	240	10.0
8	1042 - 1048	225	9.4
9	1048 - 1054	235	9.8
10	1054 - 1100	250	10.4

Readings ranged from 5 to 15 % opacity

The source was/was not in compliance with ___ at the time evaluation was made.

24 reading Avg = 10.4 %

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ENVIRONMENTAL
SOURCE SAMPLERS

EPA METHOD 9 VISUAL OPACITY

Company: Weyerhaeuser
Location: Elkin NC
Test Number: 1
Date: 6-24-87

Observer: R. Hamlin
Type facility: DRYER / 2ws
Point of emissions: STACK

Hr	Min.	0	15	30	45	Steam plume Attached	Steam plume Detached	Comments
	0	10	10	10	10	✓		Reading after
	1	10	10	10	10	✓		steam dissipat-
	2	15	15	15	10	✓		
	3	10	10	10	10	✓		
	4	10	10	10	10	✓		
	5	10	10	10	10	✓		
	6	10	10	10	10	✓		
	7	15	15	15	15	✓		
	8	15	10	10	10	✓		
	9	10	10	10	10	✓		
	10	10	10	10	10	✓		
	11	10	10	10	10	✓		
	12	10	15	10	10	✓		
	13	10	10	15	15	✓		
	14	10	10	10	10	✓		
	15	10	10	10	10	✓		
	16	15	15	15	15	✓		
	17	15	10	10	10	✓		
	18	10	10	10	10	✓		
	19	10	15	15	10	✓		
	20	10	10	10	10	✓		
	21	10	10	10	10	✓		
	22	10	10	10	10	✓		
	23	10	10	10	10	✓		
	24	10	10	10	10	✓		
	25	10	10	10	10	✓		
	26	10	10	15	10	✓		
	27	10	10	10	10	✓		
	28	10	10	10	10	✓		
	29	[illegible]	[illegible]	10	10	✓		

Hr	Min.	0	15	30	45	Steam plume Attached	Steam plume Detached	Comments
	30	10	10	10	10	✓		
	31	10	10	10	10	✓		
	32	10	10	15	15	✓		
	33	10	10	10	10	✓		
	34	10	10	10	10	✓		
	35	10	10	10	10	✓		
	36	10	10	10	10	✓		
	37	10	10	10	10	✓		
	38	10	10	10	10	✓		
	39	10	10	10	10	✓		
	40	10	10	10	10	✓		
	41	10	10	10	10	✓		
	42	10	10	10	10	✓		
	43	10	10	10	10	✓		
	44	10	10	10	10	✓		
	45	10	10	10	10	✓		
	46	10	10	5	5	✓		
	47	5	10	10	10	✓		
	48	10	10	10	10	✓		
	49	10	10	5	10	✓		
	50	10	10	10	10	✓		
	51	10	10	10	10	✓		
	52	10	10	10	10	✓		
	53	10	10	10	10	✓		
	54	10	10	10	10	✓		
	55	10	10	10	10	✓		
	56	10	10	10	10	✓		
	57	10	10	10	15	✓		
	58	15	10	10	10	✓		
	59	10	10	10	10	✓		

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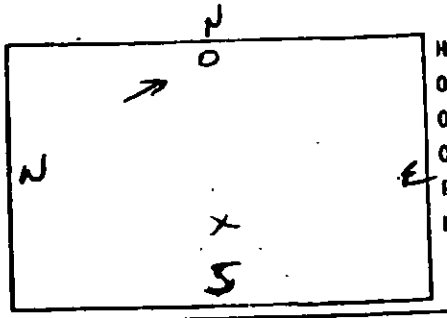
ENVIRONMENTAL SOURCE SAMPLERS

EPA METHOD 9 VISUAL OPACITY

COMPANY Weyerhaeuser
LOCATION Elkin NC
TEST NUMBER 2
DATE 6-29-87
TYPE FACILITY WOOD DRYER / IWS
CONTROL DEVICE IWS



HOURS OF OBSERVATION 1130 - 1230
OBSERVER R. Hamlin
OBSERVER CERTIFICATION DATE 3/4/87
OBSERVER AFFILIATION ESS
POINT OF EMISSIONS STACK
HEIGHT OF DISCHARGE POINT 100'

	Initial			Final
CLOCK TIME	1130			1230
OBSERVER LOCATION Distance to Discharge	100'			100'
Direction from Discharge	S			S
Height of Observation Point	50'			50'
BACKGROUND DESCRIPTION	BLUE SKY			BLUE SKY
WEATHER CONDITIONS Wind Direction	SW			SW
Wind Speed	5			5
Ambient Temperature	85			85
SKY CONDITIONS (clear, overcast, % clouds, etc.)	clear			clear
PLUME DESCRIPTION Color	white			white
Distance Visible	100'			75'
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time Start--End	Opacity Sum	Opacity Average
1	1130 - 1136	250	10.4
2	1136 - 1142	255	10.6
3	1142 - 1148	250	10.4
4	1148 - 1154	260	10.8
5	1154 - 1200	245	10.2
6	1200 - 1206	205	8.5
7	1206 - 1212	225	9.4
8	1212 - 1218	200	8.3
9	1218 - 1224	215	9.0
10	1224 - 1230	230	9.6

Readings ranged from 5 to 15 % opacity

The source was/was not in compliance with ___ at the time evaluation was made.

2nd Reading Avg = 9.6%

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ENVIRONMENTAL
SOURCE SAMPLERS

EPA METHOD 9 VISUAL OPACITY

Company: Weyerhaeuser
Location: Elkton, OR
Test Number: 2
Date: 6-29-95

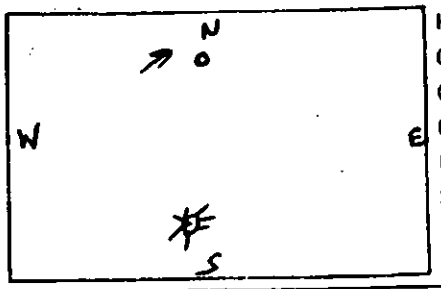
Observer: R. Hamlin
Type facility: Wood Waste / Pulp
Point of emissions: Stack

Hr	Min.	Seconds 0	15	30	45	Steam plume (check if applicable) Attached	Detached	Comments
	0	10	10	10	10	✓		
	1	10	10	10	10	✓		
	2	10	15	15	10	✓		
	3	10	10	10	10	✓		
	4	10	10	10	10	✓		
	5	10	10	10	10	✓		
	6	10	10	10	10	✓		
	7	10	10	10	10	✓		
	8	10	10	10	10	✓		
	9	10	10	10	15	✓		
	10	15	15	10	10	✓		
	11	10	10	10	10	✓		
	12	10	10	10	10	✓		
	13	10	15	15	10	✓		
	14	10	10	10	10	✓		
	15	10	10	10	10	✓		
	16	10	10	10	10	✓		
	17	10	10	10	10	✓		
	18	10	10	10	10	✓		
	19	10	10	10	10	✓		
	20	10	10	15	15	✓		
	21	15	10	10	10	✓		
	22	10	10	10	10	✓		
	23	15	10	10	10	✓		
	24	10	10	10	10	✓		
	25	10	10	10	10	✓		
	26	15	10	10	10	✓		
	27	10	10	10	10	✓		
	28	10	10	10	10	✓		
	29	10	10	10	10	✓		
	30	10	10	10	10	✓		
	31	5	5	10	5	✓		
	32	10	5	5	5	✓		
	33	5	10	10	10	✓		
	34	10	10	10	10	✓		
	35	10	10	10	10	✓		
	36	10	10	5	5	✓		
	37	10	10	5	10	✓		
	38	10	10	10	10	✓		
	39	10	10	10	10	✓		
	40	10	10	10	10	✓		
	41	10	10	10	10	✓		
	42	10	10	10	10	✓		
	43	5	5	5	5	✓		
	44	5	10	10	10	✓		
	45	10	5	5	5	✓		
	46	10	10	10	10	✓		
	47	10	10	10	10	✓		
	48	10	10	10	10	✓		
	49	10	10	10	10	✓		
	50	5	5	5	5	✓		
	51	5	10	10	10	✓		
	52	10	10	10	10	✓		
	53	10	10	10	10	✓		
	54	10	10	10	10	✓		
	55	10	10	10	10	✓		
	56	10	10	10	10	✓		
	57	5	5	10	10	✓		
	58	10	10	10	10	✓		
	59		10	10	10	10	✓	

ESS
ENVIRONMENTAL
SOURCE SAMPLERS

EPA METHOD 9 VISUAL OPACITY

COMPANY Weyerhaeuser
LOCATION Elkin NC
TEST NUMBER 3
DATE 6-29-87
TYPE FACILITY WOOD DRYER
CONTROL DEVICE INS



HOURS OF OBSERVATION 1245 - 1345
OBSERVER R Hamlin
OBSERVER CERTIFICATION DATE 3/4/87
OBSERVER AFFILIATION ESS
POINT OF EMISSIONS STACK
HEIGHT OF DISCHARGE POINT 100'

	Initial			Final
CLOCK TIME	1245			1345
OBSERVER LOCATION Distance to Discharge	100'			100'
Direction from Discharge	S			S
Height of Observation Point	50'			50'
BACKGROUND DESCRIPTION	BLUE SKY			BLUE SKY
WEATHER CONDITIONS Wind Direction	SW			SW
Wind Speed	5			5
Ambient Temperature	88			90
SKY CONDITIONS (clear, overcast, % clouds, etc.)	clear			clear
PLUME DESCRIPTION Color	white			white
Distance Visible	75'			75'
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time Start--End	Opacity Sum	Opacity Average
1	1245 - 1251	200	8.3
2	1251 - 1257	190	7.9
3	1257 - 1303	190	7.9
4	1303 - 1309	205	8.5
5	1309 - 1315	205	8.5
6	1315 - 1321	210	8.8
7	1321 - 1327	185	7.7
8	1327 - 1333	160	6.7
9	1333 - 1339	190	7.9
10	1339 - 1345	160	6.7

Readings ranged from 5 to 15 % opacity

The source was/was not in compliance with ___ at the time evaluation was made.

24 readings Avg = 7.9%

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

EPA METHOD 9 VISUAL OPACITY

Company: Weyerhaeuser
Location: Elgin, NC
Test Number: 3
Date: 6-29-87

Observer: B. Hamlin
Type facility: Wood Waste
Point of emissions: Stack

Hr	Min	Seconds 0	15	30	45	Steam plume (check if applicable) Attached	Detached	Comments
	0	10	5	5	10			
	1	10	10	10	5			
	2	5	5	10	10			
	3	10	5	5	5			
	4	10	10	10	10			
	5	10	10	10	10			
	6	10	10	10	10			
	7	10	5	5	5			
	8	5	10	10	10			
	9	10	5	5	5			
	10	5	10	10	10			
	11	10	10	5	5			
	12	5	5	10	10			
	13	10	10	5	5			
	14	5	5	5	5			
	15	10	10	10	10			
	16	10	5	5	10			
	17	10	10	10	10			
	18	10	5	5	5			
	19	5	10	10	10			
	20	10	10	10	10			
	21	10	10	5	5			
	22	5	10	10	10			
	23	10	10	10	10			
	24	10	10	10	5			
	25	5	5	10	10			
	26	10	10	10	10			
	27	10	10	10	5			
	28	5	5	5	10			
	29	10	10	10	10			
	30	10	10	10	5			
	31	5	5	10	10			
	32	10	10	5	5			
	33	5	10	10	10			
	34	10	10	10	10			
	35	10	10	10	10			
	36	10	10	10	10			
	37	10	5	5	5			
	38	5	10	10	10			
	39	10	5	5	5			
	40	5	10	10	10			
	41	10	5	5	5			
	42	5	5	5	5			
	43	10	10	5	5			
	44	5	10	10	10			
	45	10	10	10	5			
	46	5	5	5	5			
	47	5	5	5	5			
	48	5	5	5	10			
	49	10	10	10	10			
	50	5	5	5	5			
	51	10	10	5	5			
	52	5	10	10	10			
	53	10	10	10	10			
	54	5	5	5	5			
	55	5	10	10	5			
	56	5	5	10	10			
	57	10	5	5	5			
	58	5	10	10	10			
	59	5	5	5	5			

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

APPENDIX B - CALCULATIONS

ESS
ENVIRONMENTAL
SOURCE SAMPLERS

TEST CALCULATIONS

ACCOUNT: Weyerhaeuser DATE: 6-29-87
STATION: Elk. UNIT NO.: 1 TEST NO.: 1

① Sample Volume (ft^3)	36.035 x 0.933 = 33.621	⑨ M_s	26.99
② Barr. Pressure (in. Hg.)	29.49	⑩ Nozzle Dia. (in.)	0.268
③ Avg. ΔH(in.W.C.)	0.990	⑪ Stack Pressure (in.Hg.)	29.47
④ Avg. T_m (°F)	88.8	⑫ Sampling Time (min.)	60
⑤ Condensed H_2O (ml)	178.5	⑬ Total Weight (g)	0.
⑥ Avg. ΔP (in.W.C.)	0.273	⑭ Stack Area (ft^3)	21.65
⑦ Pitot Factor (C_p)	0.84	⑮ % O_2	17.4
⑧ Avg. T_s (°F)	139.3		

DRY GAS VOLUME

$$V_M \text{ STD} = \frac{17.65\ (①\ 33.621)\left[(②\ 29.49) + \left(\frac{③\ 0.990}{13.6}\right)\right]}{(④\ 88.8 + 460)} = (A)\ 31.966\ ft^3$$

VOLUME OF WATER VAPOR

$$V_W \text{ STD} = 0.0471\ (⑤\ 178.5) = (B)\ 8.407\ ft^3$$

MOISTURE CONTENT

$$B_{WO} = \frac{((B)\ 8.407)}{((B)\ 8.407) + ((A)\ 31.966)} = (C)\ 0.208$$

VELOCITY

$$V(fps) = (2.9)\ (⑦\ 0.84)\sqrt{(⑥\ .273)(⑧\ 139.3 + 460)\left(\frac{28.93}{⑨\ 26.99}\right)\left(\frac{29.92}{⑪\ 29.47}\right)} = (D)\ 32.52\ fps$$

% ISOKINETIC

$$\%I = \frac{17.313\ ((A)\ 31.966)(⑧\ 139.3 + 460)}{(⑩\ 0.268)^2\ (⑪\ 29.47)\ (1-((C)\ 0.208))\ ((D)\ 32.52)\ (⑫\ 60)} = (E)\ 101.4\ \%$$

EMISSIONS

$$GR/SCF = \frac{(⑬\ 0.1225)\ (15.43)}{((A)\ 31.966)} = (F)\ 0.0591\ GR/SCF$$

$$LBS/HR = \frac{9.08\ ((F)\ 0.0591)(⑭\ 21.65)((D)\ 32.52)(⑪\ 29.47)(1-((C)\ 0.208))}{(⑧\ 139.3 + 460)} = (G)\ 14.7$$

$$LBS/MMBTU = \frac{29.32\ ((F\ \ \ )}{(20.9-(⑮\ \ \ ))} = \frac{NA}{}\ LBS/MMBTU$$

ACFM = 32.52 fps x 60 s/m x 21.65 ft^2 = 42,243 ACFM
DSCFM = 29,033 DSCFM

FRONT HALF ONLY = $\frac{(0.1178)(15.43)}{31.966} = 0.0569$ GR/SCFD

$\frac{(0.0569)}{(0.0591)} \times 14.7\ lb/hr = 14.2\ lb/hr.$

ESS
ENVIRONMENTAL
SOURCE SAMPLERS

TEST CALCULATIONS

ACCOUNT: Weyerhaeuser DATE: 6-29-87

STATION: Filer UNIT NO.: INS 1 TEST NO.: 2

① Sample Volume (ft^3)	37.320 x 0.933 = 34.820	⑨ M_s	26.81
② Barr. Pressure (in. Hg.)	29.49	⑩ Nozzle Dia. (in.)	0.268
③ Avg. ΔH(in.W.C.)	1.020	⑪ Stack Pressure (in.Hg.)	29.47
④ Avg. T_m (°F)	94.1	⑫ Sampling Time (min.)	60
⑤ Condensed H_2O (ml)	187.5	⑬ Total Weight (g)	0.1046
⑥ Avg. ΔP (in.W.C.)	0.281	⑭ Stack Area (ft^3)	21.65
⑦ Pitot Factor (C_p)	0.84	⑮ % O_2	17.7
⑧ Avg. T_s (°F)	137.8		

DRY GAS VOLUME

$$V_M \text{ STD} = \frac{17.65\ (①\ 34.820)\left[(②\ 29.49) + \left(\frac{③\ 1.020}{13.6}\right)\right]}{(④\ 94.1 + 460)} = \text{(A) } 32.792\ ft^3$$

VOLUME OF WATER VAPOR

$$V_W \text{ STD} = 0.0471\ (⑤\ 187.5) = \text{(B) } 8.831\ ft^3$$

MOISTURE CONTENT

$$B_{WO} = \frac{((B)\ 8.831)}{((B)\ 8.831) + ((A)\ 32.792)} = \text{(C) } 0.212$$

VELOCITY

$$V(fps) = (2.9)(⑦\ 0.84)\sqrt{(⑥\ 0.281)(⑧\ 137.8 + 460)\left(\frac{28.95}{⑨\ 26.81}\right)\left(\frac{29.92}{⑪\ 29.47}\right)} = \text{(D) } 33.06\ fps$$

% ISOKINETIC

$$\%I = \frac{17.313\ ((A)\ 32.792)(⑧\ 137.8 + 460)}{(⑩\ 0.268)^2\ (⑪\ 29.47)\ (1-((C)\ 0.212))\ ((D)\ 33.06)\ (⑫\ 60)} = \text{(E) } 102.6\ \%$$

EMISSIONS

$$GR/SCF = \frac{(⑬\ 0.1046)\ (15.43)}{((A)\ 32.792)} = \text{(F) } 0.0492\ GR/SCFD$$

$$LBS/HR = \frac{9.08\ ((F)\ 0.0492)(⑭\ 21.65)((D)\ 33.06)(⑪\ 29.47)(1-((C)\ 0.212))}{(⑧\ 137.8 + 460)} = \text{(G) } 12.4$$

$$LBS/MMBTU = \frac{29.32\ ((F\ \ \ )}{(20.9-(⑮\ \ \ ))} = NA\ LBS/MMBTU$$

ACFM = 33.06 fps x 60 s/m x 21.65 ft^2 = 42,945 ACFM

x 29,443 DSCFM

DSCPM =

FRONT HALF ONLY = $\frac{(0.0999)(15.43)}{32.792}$ = 0.0470 GR/SCFD

$\frac{(0.0470)}{(0.0492)}$ (12.4 lbs/hr.) = 11.8 lbs/hr.

ESS
ENVIRONMENTAL
SOURCE SAMPLERS

TEST CALCULATIONS

ACCOUNT: Weyerhaeuser DATE: 6-22-87
STATION: Elk. UNIT NO.: 1 INS TEST NO.: 3

① Sample Volume (ft^3)	38.740 x 0.933 = 36.14	⑨ M_s	27.01
② Barr. Pressure (in. Hg.)	29.49	⑩ Nozzle Dia. (in.)	0.268
③ Avg. ΔH(in.W.C.)	1.020	⑪ Stack Pressure (in.Hg.)	29.47
④ Avg. T_m (°F)	95.9	⑫ Sampling Time (min.)	60
⑤ Condensed H_2O (ml)	186.0	⑬ Total Weight (g)	0.1107
⑥ Avg. ΔP (in.W.C.)	0.281	⑭ Stack Area (ft^3)	21.65
⑦ Pitot Factor (C_p)	0.84	⑮ % O_2	17.2
⑧ Avg. T_s (°F)	136.3		

DRY GAS VOLUME

$$V_M \text{ STD} = \frac{17.65\ (①\ 36.144)\left[(②\ 29.49) + \left(\frac{③\ 1.020}{13.6}\right)\right]}{(④\ 95.9 + 460)} = \text{(A) } 33.928\ ft^3$$

VOLUME OF WATER VAPOR

$$V_W \text{ STD} = 0.0471\ (⑤\ 186.0) = \text{(B) } 8.761\ ft^3$$

MOISTURE CONTENT

$$B_{WO} = \frac{(\text{(B) } 8.761)}{(\text{(B) } 8.761) + (\text{(A) } 33.928)} = \text{(C) } 0.205$$

VELOCITY

$$V(fps) = (2.9)(⑦\ 0.84)\sqrt{(⑥\ 0.281)(⑧\ 136.3 + 460)\left(\frac{28.95}{⑨\ 27.01}\right)\left(\frac{29.92}{⑪\ 29.47}\right)} = \text{(D) } 32.91\ fps$$

% ISOKINETIC

$$\%I = \frac{17.313\ (\text{(A) } 33.928)(⑧\ 136.3 + 460)}{(⑩\ 0.268)^2\ (⑪\ 29.47)\ (1 - (\text{(C) } 0.205))\ (\text{(D) } 32.91)\ (⑫\ 60)} = \text{(E) } 105.4\ \%$$

EMISSIONS

$$GR/SCF = \frac{(⑬\ 0.1107)(15.43)}{(\text{(A) } 33.928)} = \text{(F) } 0.0503\ GR/SCFD$$

$$LBS/HR = \frac{9.08\ (\text{(F) } 0.0503)(⑭\ 21.65)(\text{(D) } 32.91)(⑪\ 29.47)(1 - (\text{(C) } 0.205))}{(⑧\ 136.3 + 460)} = \text{(G) } 12.8$$

$$LBS/MMBTU = \frac{29.32\ ((F\ \ \ )}{(20.9 - (⑮\ \ \ ))} = NA\ LBS/MMBTU$$

ACFM = 32.91 fps x 60 s/m x 21.65 ft^2 = 42,750 ACFM
= 29,641 DSCFM
DSCFM =

FRONT HALF ONLY: $\frac{(0.1048)(15.43)}{33.928} = 0.0477$ GR/SCFD

$\left(\frac{0.0477}{0.0503}\right) \times 12.8\ lbs/hr = 12.1\ lbs/hr$

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

APPENDIX C - OPERATIONAL DATA

ESS
ENVIRONMENTAL
SOURCE SAMPLERS

WEYERHAEUSER - ELKIN, NORTH CAROLINA
OPERATIONAL DATA - DRYER/IONIZED WET SCRUBBER

UNIT #	1	1	1				
RUN #	1	2	3				
DATE	6-29-87	6-29-87	6-29-87				
TIME	1000	1130	1300				
DRYER RATE (%)	45	45	45				
DRYER INLET TEMP (°F)	700	700	650				
DRYER OUTLET TEMP (°F)	215	215	215				
WET CELL w/c to Damper	90 90	65 90	75 90				
wc dmp. BURNER DAMPER (%)	75	75	65				
VENTURRI PRESSURE DROP (IN. H2O)	4.8	5.0	5.0				
IWS PRESSURE DROP (IN. H2O)	0.0	0.0	0.0				
PRIMARY VOLTS, AMPS (A) MAX (B)	280, 17 260, 15	260, 15 270, 15	260, 16 280, 18				
SECONDARY KV, MA (A) MAX (B)	25, 130 25, 120	26, 170 25, 140	25, 140 26, 160				

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ENVIRONMENTAL
SOURCE SAMPLERS

APPENDIX D - LABORATORY DATA

ESS
ENVIRONMENTAL
SOURCE SAMPLERS

ANALYTICAL DATA

Plant Wisconsin Electric Unit 1 Oak Creek

Date 6/27/07

Run No. 1

Filter No. 785

Amount liquid lost during transport 0

Acetone blank volume, ml 200

Acetone wash volume, ml 380

Acetone blank concentration, mg/mg (equation 5-4) 0.001

Acetone wash blank, mg (equation 5-5) 0.4

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED, g		
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1 785	0.4545	0.3459	0.1086
2 IMP	70.8278	70.8227	0.0051
WASH	68.6082	68.5990	0.0092
TOTAL			0.1229
		Less acetone blank	0.0004
		Weight of particulate matter	0.1225

	VOLUME OF LIQUID WATER COLLECTED	
	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	346	2820
INITIAL	200	2495
LIQUID COLLECTED	146	325
TOTAL VOLUME COLLECTED	178.5	g* ml

* CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1g/ml):

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

ANALYTICAL DATA

Plant [illegible]

Date 6/2?/77

Run No. 2

Filter No. 789

Amount liquid lost during transport 0

Acetone blank volume, ml 200

Acetone wash volume, ml 400

Acetone blank concentration, mg/g (equation 5-4) 0.001

Acetone wash blank, mg (equation 5-5) 0.4

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED, g		
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1 789	0.4344	0.3467	0.0877
2 IMP	72.2762	72.2715	0.0047
WASH	69.8939	69.8813	0.0126
TOTAL			0.1050
		Less acetone blank	0.0004
		Weight of particulate matter	0.1046

	VOLUME OF LIQUID WATER COLLECTED		
	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g	
FINAL	368	271.5	
INITIAL	200	252.0	
LIQUID COLLECTED	168	19.5	
TOTAL VOLUME COLLECTED	187.5	g*	ml

* CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1g/ml):

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

ESS
ENVIRONMENTAL SOURCE SAMPLERS

ANALYTICAL DATA

Plant Wyandotte Elec. Unit 1
Date 6/21/77
Run No. 3
Filter No. 790
Amount liquid lost during transport 0
Acetone blank volume, ml 200
Acetone wash volume, ml 410
Acetone blank concentration, mg/mg (equation 5-4) 0.001
Acetone wash blank, mg (equation 5-5) 0.4

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED, g		
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1	0.4414	0.3472	0.0942
2 IMP	71.1385	71.1326	0.0059
WASH	69.8633	69.8523	0.0110
TOTAL			0.1111
		Less acetone blank	0.0004
		Weight of particulate matter	0.1107

	VOLUME OF LIQUID WATER COLLECTED	
	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL	366	256.0
INITIAL	200	236.0
LIQUID COLLECTED	166	20.0
TOTAL VOLUME COLLECTED	186.0	g* ml

* CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1g/ml).

$$\frac{\text{INCREASE, g}}{\text{1 g/ml}} = \text{VOLUME WATER, ml}$$

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

CHAIN OF CUSTODY

PLANT: Weyerhaeuser - ELKIN NC SOURCE: UNIT 1 IWS/IMIV

SAMPLE RECOVERY

CONTAINER	DESCRIPTION
As MARKED	EPA M-5 Filters 788-789-790
As MARKED	IMPINGER WATER CATCHES (x3)
As MARKED	ACETONE PROBE/NOZZLE WASHES (x3)
As MARKED	ACETONE BLANK (x1)
As MARKED	SILICA GEL CONTAINERS (x3)

SAMPLE RECOVERY PERSON: D. Loy

RECOVERY LOCATION: on-site

TIME AND DATE: 6-29-87

LABORATORY ANALYSIS

LABORATORY ANALYSIS PERSON: Robert Hamlin

SAMPLE	ANALYSIS	DATE
M-5 filters, silica gel	preweight	6-25-87
M-5 filters, silica gel	final weight	7-2-87
acetone probe/nozzle washes, blank	Final weight	7-2-87
impinger water	extraction/weigh	7-2-87

OTHER PERSON(S) HANDLING SAMPLES (INCLUDE DATES AND REASONS):

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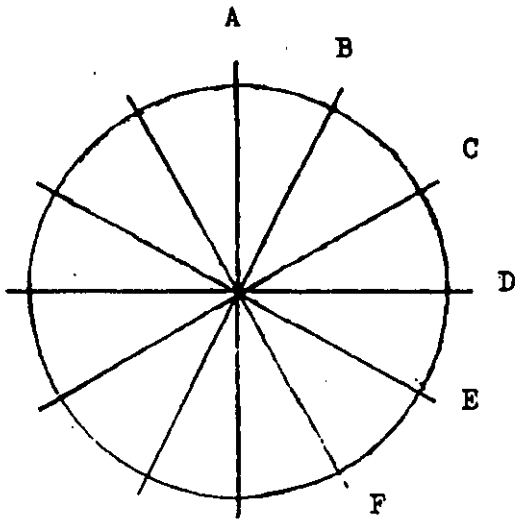
ENVIRONMENTAL
SOURCE SAMPLERS

APPENDIX E - CALIBRATION DATA

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

NOZZLE MEASUREMENT DATA



A 0.266

B 0.267

C 0.268

D 0.269

E 0.269

F 0.268

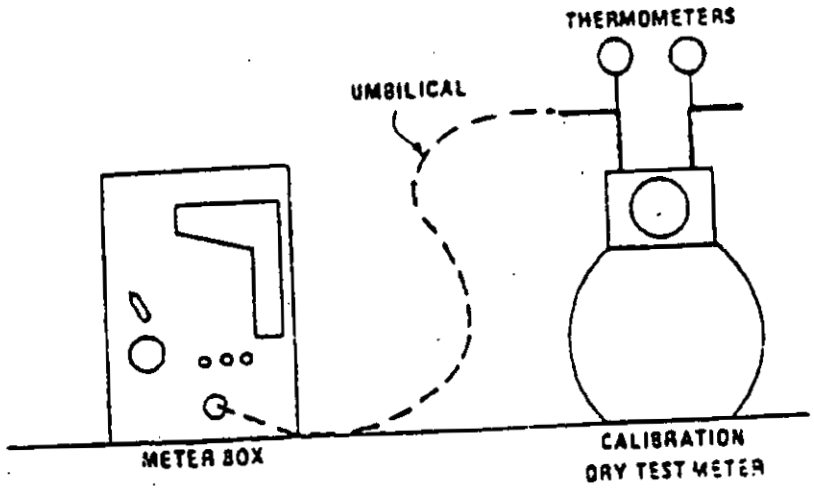
AVG. 0.268

DATE 6.29.87

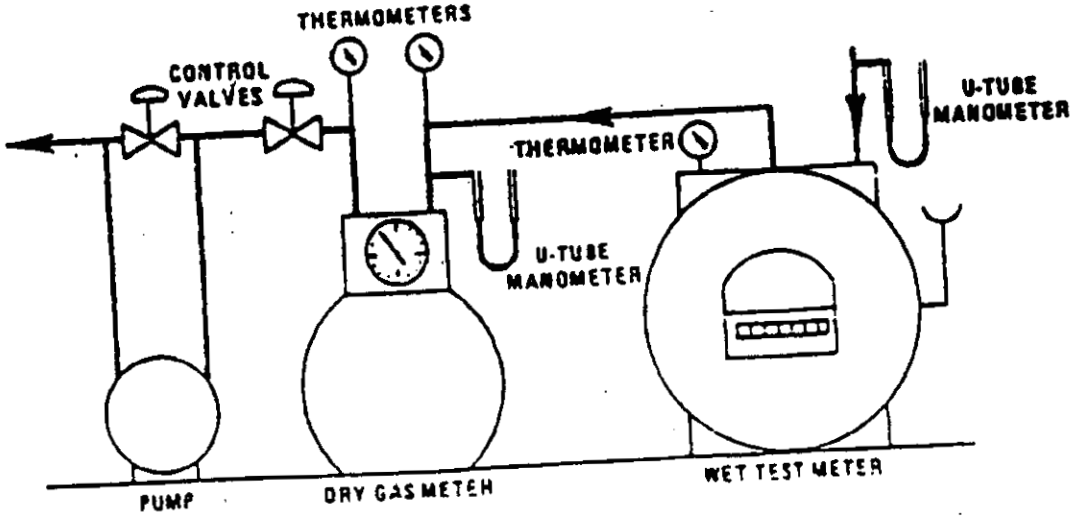
MEASURED BY R. Hawk

ESS

ENVIRONMENTAL
SOURCE SAMPLERS



Meter box calibration set-up.



Equipment arrangement for dry-gas meter calibration.

ESS

ENVIRONMENTAL SOURCE SAMPLERS

Received 14 Sept 87

DRY GAS METER CALIBRATION

Date 7-17-87

Metering System Identification: S-5

Barometric pressure, P_b = 29.40 in. Hg

Orifice manometer setting ΔH in. H_2O	Spirometer (wet meter) gas volume (V_w) ft^3	Dry gas meter volume (V_m) ft^3	Temperatures: Spirometer (wet meter) (t_w) °F	Temperatures: Dry Gas Meter Inlet (t_{d_i}) °F	Temperatures: Dry Gas Meter Outlet (t_{d_o}) °F	Temperatures: Dry Gas Meter Average (t_m) °F	Time (θ) min
1.0	6.449	6.811	74	—	—	84	12
2.5	6.733	7.135	75	—	—	91	8
4.0	6.386	6.813	75	—	—	98	6

Calculations

ΔH in. H_2O	Y: $\frac{V_w P_b (t_m + 460)}{V_m (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H_@$: $\frac{0.0317\ \Delta H}{P_b (t_m + 460)} \left[\frac{(t_w + 460)_@}{V_w}\right]^2$
1.0	0.962	1.957
2.5	0.966	1.977
4.0	0.968	1.946
Average	0.965	1.960

Y = Ratio of reading of wet test meter to dry test meter; tolerance for individual values ±0.02 from average.

$\Delta H_@$ = Orifice pressure differential that equates to 0.75 cfm of air @ 68°F and 29.92 inches of mercury, in. H_2O; tolerance for individual values ±0.20 from average.

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

DRY GAS METER CALIBRATION

Date 6-25-87

Metering System Identification: 5-5

Barometric pressure, P_b = 29.45 in. Hg

Orifice manometer setting ΔH in. H_2O	Spirometer (wet meter) gas volume (V_w) ft^3	Dry gas meter volume (V_m) ft^3	Temperatures: Spirometer (wet meter) (t_w) °F	Temperatures: Dry Gas Meter Inlet (t_o) °F	Temperatures: Dry Gas Meter Outlet (t_f) °F	Temperatures: Dry Gas Meter Average (t_m) °F	Time (θ) min
1.0	6920	7.552	75	—	—	85	12
2.5	7.233	7.918	75	—	—	90	8
4.0	6873	7.569	75	—	—	96	6

Calculations

ΔH in. H_2O	Y: $\frac{V_w P_b (t_m + 460)}{V_m (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	ΔH_θ: $\frac{0.0317\ \Delta H}{P_b (t_m + 460)} \left[\frac{(t_w + 460)\theta}{V_w}\right]^2$
1.0	0.931	1.700
2.5	0.933	1.713
4.0	0.934	1.689
Average	0.933	1.701

Y = Ratio of reading of wet test meter to dry test meter; tolerance for individual values ±0.02 from average.

ΔH_θ = Orifice pressure differential that equates to 0.75 cfm of air @ 68°F and 29.92 inches of mercury, in. H_2O; tolerance for individual values ±0.20 from average.

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

TEMPERATURE SENSOR CALIBRATION DATA

Date 6-12-87 Thermocouple identification S-5 DGM

Ambient temperature 69 Signature R. Hankel

Calibration Source	Reference[1] Temperature, °F	Thermocouple Temperature, °F	Temperature[2] Difference (%)
ICE BATH	32	33	0.2
ROOM TEMP	69	70	0.2
WARM WATER	120	122	0.3

[1] mercury in glass ASTM thermometer

[2] $\frac{(\text{ref temp, °R} + 460) - (\text{test thermo. temp, °F} + 460)}{\text{ref temp, °R} + 460}$

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

TEMPERATURE SENSOR CALIBRATION DATA

Date 6-12-87 Thermocouple identification S-S STACK

Ambient temperature 69 Signature R Howland

Calibration Source	Reference[1] Temperature, °F	Thermocouple Temperature, °F	Temperature[2] Difference (%)
ROOM TEMP	69	69	0.0
BOILING WATER	212	212	0.0
HOT OIL	406	404	0.2

[1] mercury in glass ASTM thermometer

$$\frac{(\text{ref temp, °F} + 460) - (\text{test thermo. temp, °F} + 460)}{\text{ref temp, °F} + 460} \times 100$$

ESS

ENVIRONMENTAL
SOURCE SAMPLERS

TEMPERATURE SENSOR CALIBRATION DATA

Date 6-12-87 Thermocouple identification B-S Imp

Ambient temperature 67 Signature R. Hamlet

Calibration Source	Reference[1] Temperature, °F	Thermocouple Temperature, °F	Temperature[2] Difference (%)
ICE BATH	32	35	0.6
COOLWATER	57	60	0.4
ROOMTEMP	69	70	0.2

[1] mercury in glass ASTM thermometer

[2] $\frac{\text{ref temp, °F} + 460}{\text{test temp, °F} + 460} = \text{test temp, °F}$

ESS

ENVIRONMENTAL SOURCE SAMPLERS

TEMPERATURE SENSOR CALIBRATION DATA

Date 5-15-87 Thermocouple identification E-3 [illegible]

Ambient temperature 82 Signature [illegible]

Calibration Source	Reference Temperature,[1] °F	Thermocouple Temperature, °F	Temperature Difference (%)[2]
Room Temp	82	85	0.6
Boiling water	212	215	0.4
Hot oil	390	395	0.6

[1] mercury in glass ASTM thermometer

[2] [illegible]

ENVIRONMENTAL SOURCE SAMPLERS

TYPE S PITOT TUBE INSPECTION

PITOT TUBE IDENTIFICATION G-1 DATE 1-17-87

PITOT TUBE ASSEMBLY LEVEL? Yes

PITOT TUBE OPENINGS DAMAGED? No

α_1 = 2.0° (<10°) α_2 = 4.0° (<10°)

β_1 = 4.0° (<5°) β_2 = 4.0° (<5°)

γ = 1.5° θ = 1.0° A = 1.122 in.

z = A sin γ = 0.0294 in. (<1/8 in.)

w = A sin θ = 0.0196 in. (<1/32 in.)

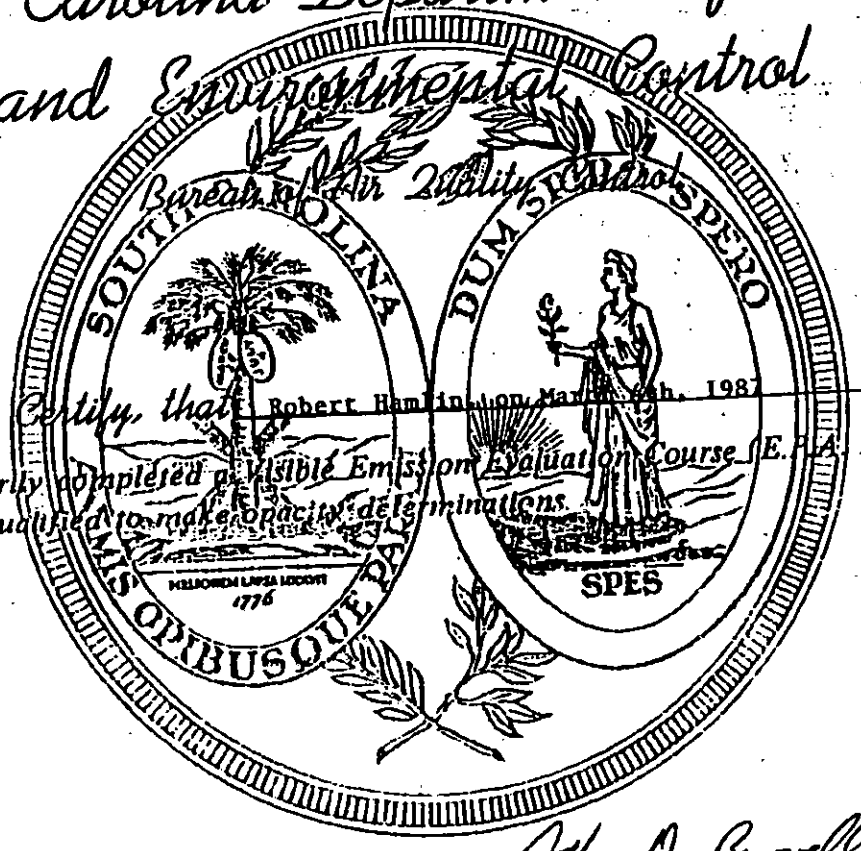
P_A 0.571 in.: P_b 0.516 in.

D_t = 0.382 in.

CALIBRATION REQUIRED? No

South Carolina Department of Health and Environmental Control

Bureau of Air Quality Control



This is to Certify, that Robert Hamlin on March 6th, 1987

satisfactorily completed a Visible Emission Evaluation Course (E.P.A. Method 9)

and is duly qualified to make opacity determinations.

Arthur O. Braswell

BUREAU OF AIR QUALITY CONTROL

NAME [illegible] JR. RUN# 1W SUNGLASSES NO
COURSE LOCATION Columbia, SC
DATE [illegible]/87 SKY BLUE - Cloudy WIND 5-10 NW/NE
DISTANCE AND DIRECTION TO STACK 80' [illegible]

VISIBLE EMISSIONS TEST SHEET

READING NUMBER — VALUE — ERROR

																					ERROR
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	2 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	3 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	4 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	5
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	6
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	7 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	8 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	9 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	10 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	11 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	12
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	13
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	14 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	15 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	16
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0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	20 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	21 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	22 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	23 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	24 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	25

DEVIATION 21

0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	26
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	27
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	28 1
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0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	30
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	31 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	32 1
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0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	34 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	35 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	36 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	37
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	38 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	39
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	40 3
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	41 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	42 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	43 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	44
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0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	46 1
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	47 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	48 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	49 2
0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	50

CERTIFIED
DATE [illegible] INITIAL

TOTAL DEVIATION

DEVIATION 28

I affirm the observed readings are my own X [illegible] Jr.

STATE OF NORTH CAROLINA

DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

CERTIFICATE OF COMPETENCY TO DETERMINE VISIBLE EMISSIONS

THIS CERTIFICATE, Issued by the Division of Environmental Management of the North Carolina Department of Natural Resources and Community Development evidences the successful completion by

ROBERT G. HAMLIN

of a course of instruction and of demonstrated competency in performing visible emission evaluations.

IN WITNESS WHEREOF, I hereto set my hand and seal this 25TH *day of* AUGUST , 1980

Certificate Number 03467-05-00

D. L. Coleman

Division of Environmental Management

(Initial N.C. certification; renewal on following page