Georgia-Pacific Corporation
Suite 200
2310 Parklake Drive, N. E.
Atlanta, Georgia 30345
Telephone (404) 491-1244

U.S.E.P.A.
REGION 9
COMM CNTR
JUL 2 11 43 AM '79

Letter Postmarked 6/29/79
D. Harvey

June 29, 1979

Mr. Clyde Eller
Enforcement Division Director
U.S. Environmental Protection Agency
Region IX
215 Freemont Street
San Francisco, CA 94105

Subject: Georgia-Pacific Corporation
Fort Bragg Boiler

Dear Mr. Eller:

Georgia-Pacific wishes to apply to EPA for a New Source Review Approval to Construct under Section 40 CFR 52.233 (g) for construction of a hog fuel boiler at the Georgia-Pacific facility in Fort Bragg, California. Norwest-Pacific Corporation has acted on our behalf as designers of the boiler to obtain the necessary permits needed for construction. Please consider information submitted by them to the County of Mendiceno and directly to Mr. Don Harvey of the EPA as a part of this permit application.

As part of this application, Georgia-Pacific certifies that all major sources owned and operated by them in California are in compliance with all applicable emission limitations and standards under the Clean Air Act.

If you have any questions regarding this submission, please contact me at (404) 491-6550.

Sincerely,

VJ Tretter Jr.

V. J. Tretter, Jr.
Chief Engineer, Energy & Environment

VJT/jl

A

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RECEIVED Reply to: Seattle
E.P.A. REGION IX

DEC 31 11 09 AM '79

NSR 4-4-1
NC 79-07

NWPC

NOR'WEST-PACIFIC CORPORATION

December 28, 1979

Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

NWPC 2678

Subject: New Hog-fuel Boiler, Air Pollution Discharge Permit for Georgia-Pacific Corp., Ft. Bragg, California

Attention: Mr. Don Harvey, Mr. Ray Sied

Ref: Our letter of December 14, 1979

Gentlemen:

We have just received some data verifying performance of a pollution control system similar to the one we would like to employ at the subject project. We are forwarding this information with the stipulation given to us by Mead Paperboard that it not be used for any other purpose than to qualify a similar application (G.P. Ft. Bragg) in the State of California.

This report shows that under stable conditions (Test #3) that this wood fired boiler produced .015 gr/DSCF at about a 156,100 pph steaming rate with load swings between 150,000 and 160,000 pph during the test. The average of two startup condition tests and the one stable condition test was .031 gr/DSCF at 50% excess air. Twelve percent CO_2 is about 58% excess air so that would reduce the concentration to about .0294 gr/DSCF.

Please expedite approval of this application for permit and call if you question any data sent to you.

Very truly yours,

Norm Waggoner

NORMAN E. WAGGONER

NEW/fp

Enclosure: Mead Paperboard Test Data

Home Office: PLAZA 600 BLDG. SEATTLE, WASHINGTON 98101
(206) 623-7224

54779-01

TECHNICAL REPORT

PARTICULATE EMISSION RATE STUDY ON A WASTE FUEL-FIRED BOILER'S VENTURI SCRUBBER POLLUTION CONTROL SYSTEM

Prepared For:

MEAD PAPERBOARD
P. O. BOX H
STEVENSON, ALABAMA 35722

SEPTEMBER 1979

HARMON ENGINEERING AND TESTING
SCIENTISTS ■ ENGINEERS ■ SURVEYORS
AUBURN INDUSTRIAL PARK/AUBURN, ALA. 36830/(205) 821-9250

54779-01

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Prepared By

HARMON ENGINEERING & TESTING
AUBURN INDUSTRIAL PARK
AUBURN, ALABAMA 36830

Approved for Transmittal _____

TABLE OF CONTENTS

		PAGE
INTRODUCTION	.....	1
RESULTS	.....	2
PROCESS DESCRIPTION & OPERATION	.....	4
SAMPLING AND ANALYTICAL PROCEDURES	.....	6

APPENDICES

APPENDIX I	ABBREVIATIONS, FORMULAE AND CALCULATIONS	I-1
APPENDIX II	FIELD TEST DATA	II-1
APPENDIX III	CHAIN OF CUSTODY AND LABORATORY DATA	III-1
APPENDIX IV	CALIBRATION DATA	IV-1
APPENDIX V	OPERATING DATA	V-1
APPENDIX VI	SUMMARY OF EPA METHOD NUMBER 5	VI-1

INTRODUCTION

The waste fuel boiler at the Mead Paperboard mill, located in Stevenson, Alabama, was tested for particulate emissions on October 4 and 5, 1979. The waste fuel boiler was tested for compliance with the new source performance standards as specified in the Federal Register.

The field testing was conducted by Mr. Wayne Daughtry and Mr. Benny Andrews of Harmon Engineering and Testing. Messrs. Jerry Akins and Marvin Gregory represented Mead during the testing. Mr. John Hughes of the Alabama Air Pollution Commission observed the first run.

RESULTS

Table 1 summarizes the results of the particulate emission testing. The average of the particulate concentrations are within the allowable limits specified for the new source performance standards. All supporting data is contained in the appendices.

Appendix I lists all the abbreviations and formulae used in the particulate calculations, which are also included within the appendix. Appendix II contains copies of the field data sheets used. The laboratory data sheet and chain of custody sheets are included in Appendix III.

Copies of calibration data are contained in Appendix IV. The waste fuel boilers operating data is included in Appendix V.

PARTICULATE EMISSION TEST RESULTS

PARAMETER	TEST NUMBER 1	TEST NUMBER 2	TEST NUMBER 3	AVERAGE
Date	10/4/79	10/4/79	10/5/79	--
Time Began	10:14	16:52	9:28	--
Time End	12:57	19:15	12:03	--
Net Time of Test, Minutes	120	120	120	--
Volume of Gas Sampled @ STP, Cubic Feet	57.4	51.5	56.2	55.0
Stack Gas Temperature, °F	145	147	140	144
Stack Gas Moisture Content, % (Volume)	16	17	14	16
Stack Gas Velocity, Feet per Second	33	28	31	31
Stack Gas Flow Rate @ Stack Conditions, Cubic Feet per Minute	98,300	85,500	94,700	92,800
Stack Gas Flow Rate @ STP, Cubic Feet per Minute	71,200	61,500	71,900	68,200
Isokinetic Sampling Rate, %	96	100	93	96
Particulate Concentration @ STP, Grains per Cubic Foot *	0.042	0.036	0.015	0.031
Particulate Emission Rate, Pounds per Hour	23.7	17.5	9.5	17.0
Particulate Emission Rate, Pounds/10^6 BTU	--	--	--	--
Oil Burning Rate X 10^6 BTU/Hour	--	--	--	--
Allowable Particulate Emission Rate *	--	--	--	0.0375

STP (STANDARD CONDITION): Dry 68°F, 29.92" Hg

* Corrected to 50% excess air

PROCESS DESCRIPTION & OPERATION

A schematic diagram of the waste boiler and pollution control system tested is shown in Figure 1. The boiler was burning waste wood products and operating at normal conditions during the testing.

Test run number 1 was conducted as the boiler was being brought up to load, test number 2 was conducted after it was down for several hours to make adjustments to a faulty feed conveyor. Test number 3 was conducted the following day with boiler condition stable and no problems were encountered.

The operating data in Appendix V was supplied by Mr. Marvin Gregory of Mead. Mr. Gregory collected and recorded all operating parameters through the testing.

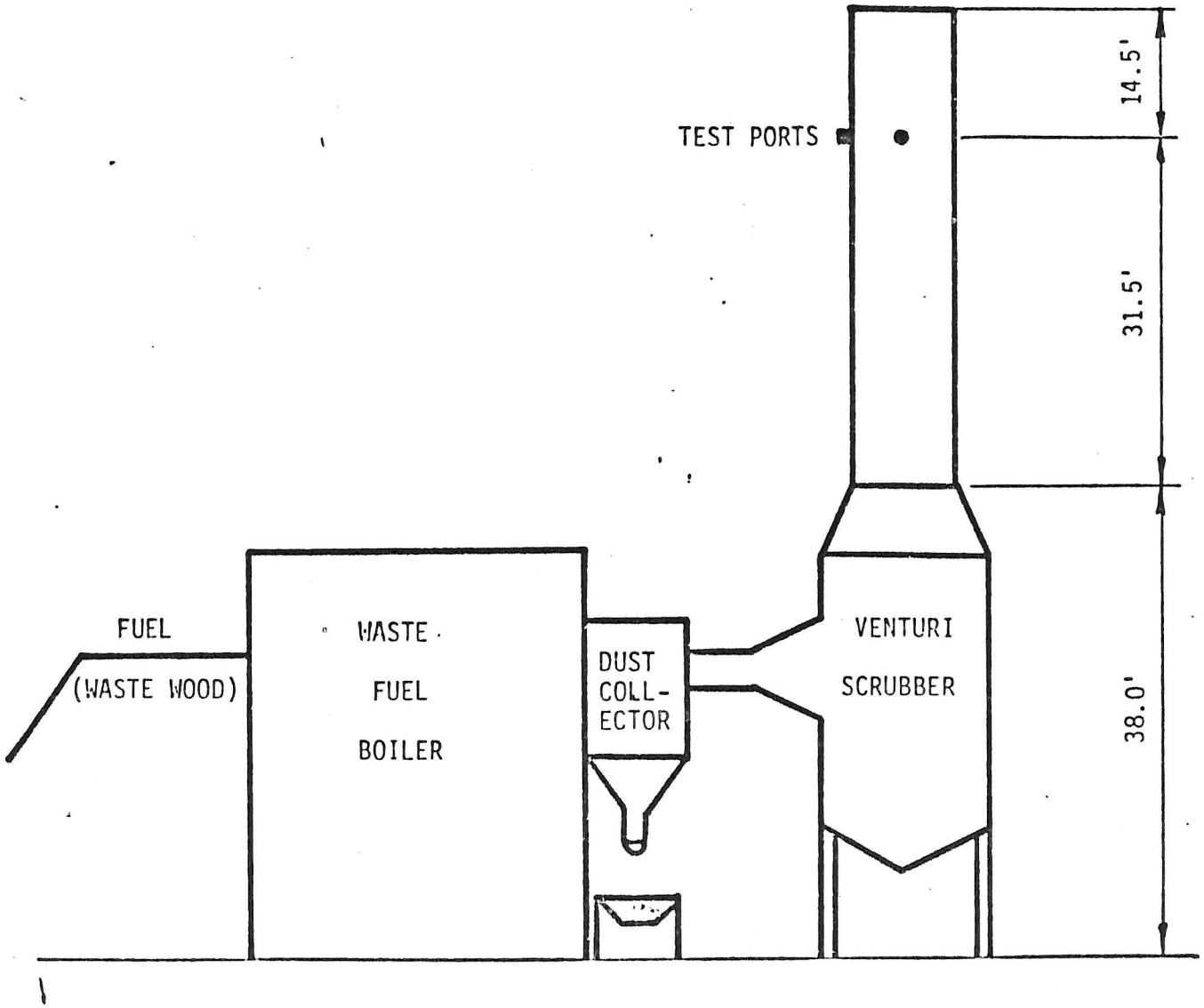

FIGURE 1: SCHEMATIC DRAWING OF WASTE WOOD BOILER

SAMPLING AND ANALYTICAL PROCEDURES

Test methods published in the Federal Register, (Vol. 42, Thursday, August 18, 1977) were used as guidelines in the performance of this emission study. EPA Method Numbers 1 - 5 were used to obtain the required data.

The sampling traverse points were selected in accordance with EPA Method No. 2, so that a representative sample was extracted from the source gas stream. A total of forty (40) traverse points were sampled (2 ports, 20 points each).

The velocity of the gas stream was determined according to EPA Method No. 2 by measuring the velocity head at each traverse point with a calibrated S-type pitot and inclined manometer. The stack gas pressure was measured with the static pressure side of a standard pitot tube. The temperature of the gas stream was measured with a calibrated Pyrometer.

The gas density was determined by using the grab method as specified in EPA Reference Method 3. Gas Analyses were performed using Orsat. The primary moisture content was determined by previous test data. The final moisture content used for calculating gas stream flow rates and emission rates was determined by measuring the volume of condensed moisture in the sample impinger.

The particulate emission testing was conducted using EPA Method No. 5. Appendix VI summarizes the method and shows a sketch of the train used. A S-type pitot tube was connected adjacent to the sample nozzle so that an instantaneous velocity head was determined at each traverse point during each test run. The stack temperature was also obtained at each traverse point. An isokinetic calculator was used to calculate the isokinetic sampling rate for each traverse point during each test run.

APPENDIX I

ABBREVIATIONS, FORMULAE AND CALCULATIONS

FORMULAE USED FOR CALCULATIONS

VWSTD = (4.71×10^{-2}) (VLC)

VMSTD = $\left(\frac{17.65}{TM}\right)$ (VM) (MCF) $\left(PB + \frac{\Delta H}{13.6}\right)$

VT = (VWSTD) + (VMSTD)

BWS = $\frac{(VWSTD)}{(VT)}$

FDA = 1 - (BWS)

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

MS = (MD) (FDA) + 18 (BWS)

GS = $\frac{(MS)}{29.0}$

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

VS = $85.5\ (CP)\ (\sqrt{\Delta P})_{ave} \sqrt{\frac{TS}{MS(PS)}}$

QA = 60 (AS) (VS)

QS = $\left(\frac{17.65}{TS}\right)$ (QA) (FDA) (PS)

VN = $2.67 \times 10^{-3} \frac{(VLC)\ (TS)}{(PS)} + \left(\frac{VM}{TM}\right) \left(PB + \frac{\Delta H}{13.6}\right)$

%I = $\frac{9.45 \times 10^{-2}\ (TS)\ (VMSTD)}{(PS)\ (VS)\ (AN)\ (\theta)\ (FDA)}$

CS = $\frac{15.4\ (grams)}{(VMSTD)}$

CA = $\frac{17.65\ (CS)\ (PS)\ (FDA)}{TS}$

C12 = $\frac{12\ (CS)}{(\%CO_2)}$

C50 = $\frac{21\ (CS)}{21 - 1.5\ (\%O_2) + 0.133\ (\%N_2) + 0.75\ (\%CO)}$

PMR = 8.57×10^{-3} (CS) (QS)

ABBREVIATIONS

ACFM = Actual cubic feet per minute

AN = Cross-sectional area of nozzle, ft^2

AS = Area of stack, ft^2

BWS = Water vapor in the gas stream, proportion by volume (dimensionless)

CP = Pitot tube coefficient (dimensionless)

CS = Particulate concentration, grains/SDCF

C50 = Particulate concentration (CS adjusted to 12% CO_2), grains/SDCF

EA = Excess air, %

FDA = Fraction of dry air (1 - BWS)

%I = Percent of isokinetic sampling

MCF = Dry gas meter correction factor, dimensionless

GRAMS = Total amount of particulate matter collected, mg

MD = Molecular weight of stack gas; dry basis, lb/lb-mole

MS = Molecular weight of stack gas; wet basis lb/lb-mole

PB = Barometric pressure at the sampling site, in. Hg

PM = Meter pressure, in. Hg

PS = Absolute stack pressure, in. Hg

PMR = Particulate mass rate, lb/hr

QA = Volumetric flow rate, SDCFM

SCF = Standard cubic feet

SDCF = Standard dry cubic feet

SDCFM = Standard dry cubic feet per minute

TM = Average temperature of meter, °R

TS = Average temperature of stack, °R

VS = Average stack gas velocity, ft/sec

VLC = Total volume of liquid collected in impingers and silica gel, ml

VM = Volume of gas sample as measured by the dry gas meter, ACF

VMC = Volume of gas sample, corrected for leak, ACF

VMSTD = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, SDCF

VT = Volume of gas drawn through filter, corrected to STP, SDCF

VWSTD = Volume of water vapor in the gas sample, corrected to standard conditions, SCF

VN = Volume collected at stack conditions through nozzle, ACF

ΔH = Average pressure difference of orifice, in. H_2O

Δp = Velocity head of stack gas, in. H_2O

$\sqrt{\Delta p}$ = Average of the square roots of the velocity pressure, in. H_2O

θ = Total sampling time, minutes

% CO_2, % O_2, % N_2, % CO = Number % by volume, dry basis from gas analysis

Standard Conditions = 68° F. and 29.92 in. Hg

SOURCE TEST PARTICULATE CALCULATIONS

Plant Mead

Stack Venturi Scrubber

Date 10/4/79

Time Began 10:14

Time Ended 12:57

INPUT DATA		DATA	
Run Number	RUN NO. = 1.	VWSTD = 10.826	
Sample Time (min)	TIME (MIN) = 120.	VMSTD = 57.370	
Barometric Pressure (in Hg)	PB = 29.5.	VT = 68.197	
Stack Pressure (in Hg)	PS = 29.5	BWS = 0.159	
Stack Area (ft^2)	STACK AREA = 50.27	FDA = 0.841	
C_p (dimensionless)	CP = 0.82	MD = 29.480	
Av. Stack Temperature (°F)	TS = 144.5	MS = 27.658	
Av. Meter Temperature (°F)	TM = 82.	GS = 0.954	
Av. sq. RT Pressure (in H_2O)	SQ RT P = 0.54	EA = 62.5	
Av. ΔH (in H_2O)	H = 0.43	VS = 32.6	
Meter Volume (ft^3)	VM = 59.69	QA = 98279.6	
MCF (dimensionless)	MCF = 1.	QS = 71201.2	
Moisture Collected (ml)	VLC = 230.	VN = 79.2	
Nozzle Diameter (in)	NOZ DIA = 0.254	%I = 96.0	
CO_2 (percent)	CO2 = 7.1	CS = 0.039	
O_2 (percent)	O2 = 8.6	CA = 0.028	
CO (percent)	CO = 0.1	C12 = 0.066	
Particulate weight (g)	GRAMS = 0.1445	C50 = 0.042	0.0375
		PMR = 23.668	

See Appendix 1 for definition of terms and formulae used.

SOURCE TEST PARTICULATE CALCULATIONS

Plant: Mead

Stack: Venturi Scrubber

Date: 10/4/79

Time Began: 16:52

Time Ended: 19:15

INPUT DATA		DATA	
Run Number	RUN NO. = 2.000	VWSTD =	10.153
Sample Time (min)	TIME (MIN) = 120.000	VMSTD =	51.507
Barometric Pressure (in Hg)	PB = 29.600	VT =	61.660
Stack Pressure (in Hg)	PS = 29.610	BWS =	0.165
Stack Area (ft^2)	STACK AREA = 50.270	FDA =	0.835
C_p (dimensionless)	CP = 0.820	MD =	29.588
Av. Stack Temperature (°F)	TS = 146.500	MS =	27.680
Av. Meter Temperature (°F)	TM = 84.300	GS =	0.955
Av. sq. RT Pressure (in H_2O)	SQ RT P = 0.470	EA =	62.5
Av. ΔH (in H_2O)	H = 0.320	VS =	28.3
Meter Volume (ft^3)	VM = 53.650	QA =	85437.2
MCF (dimensionless)	MCF = 1.000	QS =	61523.9
Moisture Collected (ml)	VLC = 215.700	VM =	71.6
Nozzle Diameter (in)	NOZ DIA = 0.254	%I =	99.7
CO_2 (percent)	CO2 = 7.800	CS =	0.033
O_2 (percent)	O2 = 8.500	CA =	0.024
CO (percent)	CO = 0.000	C12 =	0.051
Particulate weight (g)	GRAMS = 0.111	C50 =	0.036
		PMR =	17.562

See Appendix 1 for definition of terms and formulae used.

SOURCE TEST PARTICULATE CALCULATIONS

Plant: Mead

Date: 10/5/79

Stack: Venturi Scrubber

Time Began: 9:28

Time Ended: 12:03

INPUT DATA		DATA
Run Number	RUN NO. = 3.000	VWSTD = 9.037
Sample Time (min)	TIME (MIN) = 120.000	VMSTD = 56.216
Barometric Pressure (in Hg)	PB = 29.960	VT = 65.254
Stack Pressure (in Hg)	PS = 29.970	BWS = 0.138
Stack Area (ft^2)	STACK AREA = 50.270	FDA = 0.862
C_p (dimensionless)	CP = 0.820	MD = 29.632
Av. Stack Temperature (°F)	TS = 140.000	MS = 28.021
Av. Meter Temperature (°F)	TM = 78.000	GS = 0.967
Av. sq. RT Pressure (in H_2O)	SQ RT P = 0.530	EA = 49.9
Av. ΔH (in H_2O)	H = 0.410	VS = 31.4
Meter Volume (ft^3)	VM = 57.170	QA = 94723.0
MCF (dimensionless)	MCF = 1.000	QS = 71931.7
Moisture Collected (ml)	VLC = 192.000	VH = 74.1
Nozzle Diameter (in)	NOZ DIA = 0.254	%I = 93.1
CO_2 (percent)	CO2 = 8.300	CS = 0.015
O_2 (percent)	O2 = 7.600	CA = 0.012
CO (percent)	CO = 0.500	C12 = 0.022
Particulate weight (g)	GRAMS = 0.056	C50 = 0.015
		PMR = 9.457

See Appendix 1 for definition of terms and formulae used.

APPENDIX II

FIELD TEST DATA

HARMON ENGINEERING & TESTING

PARTICULATE FIELD DATA SHEET

Client MEAD PAPERBOARD

Date 10/4/79

Plant Site

Type Control Collector/Venturi Scrubber

Sampling Location WASTE Boiler

Run Number 1-C

Starting Time _____ Ending Time _____

Sample Box No. JO4-1

Sampling Type EPA-5

Weather Cloudy

Ambient Temp. _____ Wind Direction _____

Wind Speed _____

HE&T Test Personnel Daughtey/Andrews

Test Observed By John Hughes

Remarks

Sketch of Stack

Baro. pressure (in Hg) 29.5

Leak Check 0.005

Stack pressure (in Hg)

Pitot tube no. JO4-8

Stack temp. DB (°F) —

Pitot tube correction factor .82

Stack temp. WB (°F) —

Nozzle ID no. JO4 250

Assumed moisture (%) 19

Nozzle diameter before test (in) .254, .254, .255, .254

Gas density factor

Stack dimensions 8'-0"

Nozzle diameter after test (in.)

Stack height

Sample time (min/Pt) 3

Average nozzle diameter (in.) .254

Net sample time (min) 120

Final gas meter reading 3894.14

Probe length 8'-0 ea.

Probe liner material SS

Initial gas meter reading 3834.45

Heater setting (%)

Nomograph Cf

Δ Meter reading 59.69

Silica gel no. 16 +52 ml distilled (218-)

Orifice Δ 1.0

ΔCondensate 500 =230

Filter type GF

Filter no. 000886

ORSAT DATA: Method of sample collection was by GRAB

	1	2	3	Average
% CO_2	8.2	7.4	5.8	7.1
% O_2	8.6	8.8	8.4	8.6
% CO	.2	.2	.0	.1

3.5 up

#1 #2

PARTICULATE FIELD DATA SHEET

Client Mead Paperboard Date 10/4/79 Source Waste Boiler Run Number 1-Compl.

Port and Traverse Point No.	Distance From Inside Stack Wall Inches	Clock Time	Gas Meter Volume Cu. Feet (V_m)	Stack Velocity Head In. H_2O (Δp)	Meter Orifice Pressure Differential Inches H_2O (ΔH)	Gas Meter Temperature In °F (T_m)	Gas Meter Temperature Out °F	Stack Temperature °F (T_s)	Last Impinger Temperature °F	Sample Box Temperature °F	Sample Train Vacuum In. Hg
#1-1		10:14	3836.0	0.28	0.40	65	65	140	45	180	2.0
2			3837.4	0.28	0.40	65	65	140	45	185	2.0
3			3839.0	0.30	0.43	70	65	145	50	200	2.0
4			3840.5	0.30	0.43	70	65	145	50	205	2.0
5			3842.1	0.30	0.43	75	65	145	55	210	2.0
6			3843.4	0.28	0.40	75	65	140	60	225	2.0
7			3845.0	0.30	0.43	75	65	140	60	230	2.0
8			3846.5	0.30	0.43	80	70	130	–	235	–
9			3848.0	0.30	0.43	80	70	140	85	240	2.0
10			3849.5	0.32	0.45	80	70	140	75	250	2.0
11			3851.0	0.24	0.35	80	70	140	70	260	2.0
12				0.28	0.40	85	75	140	65	260	2.0
13			3853.74	0.24	0.35	85	75	140	60	260	2.0
14			3855.2	0.26	0.40	85	75	140	65	260	2.0
15			3856.6	0.28	0.43	85	75	145	70	260	2.0
16			3858.0	0.24	0.36	85	75	145	70	260	2.0
17			3859.4	0.24	0.40	90	80	150	70	260	2.0
18			3861.	0.24	0.36	90	80	150	75	260	2.0
19			3862.2	0.26	0.40	90	80	150	75	260	2.0
20		11:14	3863	0.24	0.36	90	80	150	75	260	2.0

REMARKS: 3863.66 3863.78 144.5

Leak check ½ run ≥.005

HE&T

PARTICULATE FIELD DATA SHEET

Client Mead Paperboard Date 10-4-79 Source Waste Wood Run Number 1

Port and Traverse Point No.	Distance From Inside Stack Wall Inches	Clock Time	Gas Meter Volume Cu. Feet (V_m)	Stack Velocity Head In. H_2O (Δp)	Meter Orifice Pressure Differential Inches H_2O (ΔH)	Gas Meter Temperature In °F (T_m)	Gas Meter Temperature Out °F	Stack Temperature °F (T_s)	Last Impinger Temperature °F	Sample Box Temperature °F	Sample Train Vacuum In. Hg
2-1		11:57	3863.78	0.28	0.40	70	70	140	50	210	2.0
2			3865.2	0.30	0.43	75	70	140	55	225	2.0
3			3866.	0.30	0.43	75	75	150	55	230	2.0
4			3868.2	0.30	0.43	80	75	150	55	230	2.0
5			3869.65	0.30	0.43	80	75	150	55	240	2.0
6			3871.2	0.30	0.43	80	75	150	60	250	2.0
7			3872.	0.32	0.46	80	75	150	60	250	2.0
8			3874.15	0.32	0.46	85	75	150	60	260	2.0
9			3875.6	0.34	0.50	85	80	150	65	260	2.0
10			3877.2	0.34	0.50	85	80	150	65	260	2.0
11			3879.0	0.34	0.50	85	80	150	65	260	2.0
12			3880.5	0.36	0.54	90	85	145	70	260	2.0
13			—	0.34	0.50	90	85	145	70	265	2.0
14			388	0.30	0.40	90	80	145	70	265	2.0
15			3885.05	0.34	0.50	90	80	145	70	265	2.0
16			388	0.32	0.46	90	80	150	75	265	3.0
17			3888.1	0.34	0.50	90	80	145	75	270	3.0
18			3889	0.30	0.40	90	80	140	75	270	3.0
19			3891.25	0.30	0.40	90	80	140	75	270	3.0
20			3892	0.24	0.35	90	80	140	75	270	

REMARKS: Page 2 of 2 Run 1 C .342 .43 82 144.5

HE&T

H MON ENGINEERING & TESTING

PARTICULATE FIELD DATA SHEET

Client MEAD PAPERBOARD

Date 10/4/79

Plant Site

Type Control Collector/Venturi Scrubber

Sampling Location WASTE Boiler

Run Number 2-C

Starting Time 1652 Ending Time 1915

Sample Box No. J04-1

Sampling Type EPA-5

Weather Clearing

Ambient Temp. 70 Wind Direction NW

Wind Speed 5-15

HE&T Test Personnel Daughtry/Andrews

Test Observed By

Remarks

Sketch of Stack

Baro. pressure (in Hg)	29.6	Leak Check	>.005
Stack pressure (in Hg)		Pitot tube no.	504 8
Stack temp. DB (°F)	—	Pitot tube correction factor	.82
Stack temp. WB (°F)	—	Nozzle ID no.	504 250
Assumed moisture (%)	20	Nozzle diameter before test (in)	
Gas density factor	—		
Stack dimensions	8'-0	Nozzle diameter after test (in)	
Stack height			
Sample time (min/Pt)	3	Average nozzle diameter (in)	.254
Net sample time (min)	120		
Final gas meter reading	3948.39	Probe length	8'-0
		Probe liner material	SS
Initial gas meter reading	3894.74	Heater setting (%)	70
		Nomograph C_f	—
Δ Meter reading	53.65	Silica gel no.	15 201
Orifice Δ	1.008	Δ Condensate	215.7 292
Filter type	GF	Filter no.	000863

ORSAT DATA: Method of sample collection was by GRAB

	1	2	3	Average
% CO_2	8.2	7.4	7.8	7.8
% O_2	8.0	8.6	8.8	8.5
% CO	.0	.0	.0	.0

PARTICULATE FIELD DATA SHEET

Client MEAD PAPER Date 10-2-79 Source WASTE BOILER Run Number 2 C

Port and Traverse Point No.	Distance From Inside Stack Wall Inches	Clock Time	Gas Meter Volume Cu. Feet (V_m)	Stack Velocity Head In. H_2O (Δp)	Meter Orifice Pressure Differential Inches H_2O (ΔH)	Gas Meter Temperature In °F (T_m)	Gas Meter Temperature Out °F	Stack Temperature °F (T_s)	Last Impinger Temperature °F	Sample Box Temperature °F	Sample Train Vacuum In. Hg
1	*	452	3895.9	0.22	0.32	75	70	150	50	200	2.0
2				0.10	0.15	75	70	150	50	200	2.0
3				0.10	0.15	80	70	150	50	200	2.0
4		5:07	3899.4	0.26	0.38	80	70	150	55	210	2.0
5			3900.	0.24	0.35	85	80	150	55	210	2.0
6			3902.	0.22	0.32	90	85	150	55	225	2.0
7				0.20	0.29	90	85	150	60	230	2.0
8			3903.3	0.22	0.32	90	80	150	65	230	2.0
9			3905.96	0.24	0.35	90	80	150	65	220	2.0
10			3907.3	0.26	0.38	90	80	150	70	220	2.0
11			3908	0.24	0.35	90	80	150	70	220	2.0
12			3910.1	0.24	0.35	90	85	150	70	235	2.0
13			3911.5	0.24	0.35	95	85	145	70	230	2.0
14			3912.9	0.24	0.35	95	85	145	70	235	2.0
15			3914.	0.22	0.32	95	85	145	70	245	2.0
16			3915.6	0.22	0.32	95	85	145	70	250	2.0
17			3916.9	0.20	0.29	95	85	145	70	250	2.0
18			3918.2	0.20	0.29	95	85	145	70	250	2.0
19			3919.3	0.18	0.27	95	85	145	70	250	2.0
20		5:55	3920.7	0.14	0.20	95	85	145	70	250	2.0

REMARKS: * Having to check out pitot tubes ΔP much lower than # 1 run pitot tubes check out ok.

HF&T

PARTICULATE FIELD DATA SHEET

Client Mead Paperboard Date 10/4/79 Source Waste Boiler Run Number 2

Port and Traverse Point No.	Distance From Inside Stack Wall Inches	Clock Time	Gas Meter Volume Cu. Feet (V_m)	Stack Velocity Head In. H_2O (Δp)	Meter Orifice Pressure Differential Inches H_2O (ΔH)	Gas Meter Temperature In °F (T_m)	Gas Meter Temperature Out °F	Stack Temperature °F (T_s)	Last Impinger Temperature °F	Sample Box Temperature °F	Sample Train Vacuum In. Hg
#1-1		18:15	3922.14	0.20	0.29	80	80	145	60	270	2.0
2			3923.5	0.22	0.32	80	80	145	65	270	2.0
3			3924.5	0.22	0.32	80	80	145	70	270	2.0
4			3926.3	0.22	0.32	85	80	145	70	270	2.0
5			3927.6	0.22	0.32	85	80	145	70	270	2.0
6			3929.1	0.24	0.35	85	80	145	70	265	2.0
7			3930.4	0.22	0.32	85	80	145	70	265	2.0
8			3931.8	0.22	0.32	85	80	145	70	260	2.0
9			3933.2	0.24	0.35	90	80	145	70	260	2.0
10			3934.	0.24	0.35	90	80	145	70	265	2.0
11			3936.	0.24	0.35	90	80	145	60	265	2.0
12				0.26	0.40	90	80	145	60	265	2.0
13			3938.8	0.26	0.40	90	80	145	55	260	2.0
14			3940.2	0.24	0.35	90	80	145	55	250	2.0
15			3941.6	0.24	0.35	90	80	145	55	250	2.0
16			3943	0.24	0.35	90	80	145	55	250	2.0
17			3944.4	0.24	0.35	90	80	145	55	250	2.0
18			3945.	0.20	0.29	90	80	145	55	250	2.0
19			3947.0	0.20	0.29	90	80	145	55	250	2.0
20		19:15	3948.29	0.20	0.29	90	80	145	55	250	2.0

REMARKS: 1 .465 .32 84.3 146.5

HF&T

H[illegible]MON ENGINEERING & TESTING

PARTICULATE FIELD DATA SHEET

Client MEAD PAPERBOARD

Date 10/5/78

Plant Site

Type Control Collector/Venturi Scrubber

Sampling Location Waste Boiler

Run Number 3-C

Starting Time 9:28 AM Ending Time 12:03 PM

Sample Box No. B09-1

Sampling Type EPA-5

Weather Clearing

Ambient Temp. 50 Wind Direction NW

Wind Speed 5-15

HE&T Test Personnel Daughtry/Andrews

Test Observed By MEAD

Remarks

Sketch of Stack

Baro. pressure (in Hg) 29.96

Stack pressure (in Hg)

Stack temp. DB (°F) 145

Stack temp. WB (°F) —

Assumed moisture (%) 20

Gas density factor —

Stack dimensions 8'-0

Stack height 46' straight run+

Sample time (min/Pt) 3

Net sample time (min) 120

Final gas meter reading 4005.87

Initial gas meter reading 3948.70

Δ Meter reading 57.17

Orifice Δ .98

Filter type GF

Leak Check >.005

Pitot tube no. J09-8

Pitot tube correction factor .82

Nozzle ID no. J09 250

Nozzle diameter before test (in) .254

Nozzle diameter after test (in.)

Average nozzle diameter (in.)

Probe length 8'-0 EFF.

Probe liner material SS

Heater setting (%) 70%

Nomograph Cf —

Silica gel no. ~~[illegible]~~ 7 (212.2)

Δ Condensate 164

Filter no. 000862

ORSAT DATA: Method of sample collection was by GRAB

	1	2	3	Average
% CO_2	7.4	8.1	9.0	8.3
% O_2	7.0/ ~~[illegible]~~	~~10.0~~ 7.0	~~10.2~~ 8.9	7.6
% CO	.6	.6	.2	.5

9.2 8.8 .4
9.4 10.2 .2

PARTICULATE FIELD DATA SHEET

Client MEAD PAPERBOARD Date 10/5/79 Source Waste boiler Run Number 3-C

Port and Traverse Point No.	Distance From Inside Stack Wall Inches	Clock Time	Gas Meter Volume Cu. Feet (V_m)	Stack Velocity Head In. H_2O (Δp)	Meter Orifice Pressure Differential Inches H_2O (ΔH)	Gas Meter Temperature In °F (T_m)	Gas Meter Temperature Out °F	Stack Temperature °F (T_s)	Last Impinger Temperature °F	Sample Box Temperature °F	Sample Train Vacuum In. Hg
1-1		9:28	3950.0	0.26	0.39	60	55	140	50	150	1.5
2			3951.0	0.26	0.39	60	55	140	50	160	1.5
3			3952.5	0.25	0.38	65	60	140	50	170	1.5
4			3954.9	0.26	0.38	70	60	140	50	180	1.5
5			—	0.28	0.43	70	60	140	50	190	1.5
6			3956.8	0.28	0.43	75	65	140	50	200	2.0
7			3957	0.28	0.43	75	65	140	55	210	2.0
8			3958.6	0.28	0.43	75	65	140	55	220	2.0
9			3960.2	0.30	0.45	80	70	140	55	220	2.0
10			3961.9	0.30	0.45	80	70	140	55	225	2.0
11			3963.	0.30	0.45	85	75	140	60	230	2.0
12			3964.8	0.32	0.47	90	80	140	60	240	2.0
13			3966.4	0.32	0.47	90	80	140	60	240	2.0
14		10:24		0.34	0.50	90	85	140	70	260	2.
15			3969.6	0.32	0.47	90	85	140	70	260	2.0
16				0.32	0.47	90	85	140	70	270	2.0
17			3972.64	0.32	0.47	90	85	140	70	270	2.0
18			3974	0.28	0.43	90	85	140	70	270	2.0
19				0.20	0.30	85	80	140	70	270	2.0
20		10:38		0.18	0.27	85	80	140	70	270	2.0

REMARKS: down 5 min for orsat check

10/7.0

Client Mead Paper Board Date 10/5/79 Source Waste Boiler Run Number 3-C

Port and Traverse Point No.	Distance From Inside Stack Wall Inches	Clock Time	Gas Meter Volume Cu. Feet (V_m)	Stack Velocity Head In. H_2O (Δp)	Meter Orifice Pressure Differential Inches H_2O (ΔH)	Gas Meter Temperature In °F (T_m)	Gas Meter Temperature Out °F	Stack Temperature °F (T_s)	Last Impinger Temperature °F	Sample Box Temperature °F	Sample Train Vacuum In. Hg
1		11:00		0.26	0.38	75	75	140	50	230	2.0
2			3979.4	0.28	0.43	75	75	140	50	230	2.0
3			3981.17	0.28	0.43	75	75	140	50	230	2.0
4			3982.7	0.28	0.43	80	75	140	50	230	2.0
5			3984.25	0.30	0.45	80	75	140	50	230	2.0
6			3985.7	0.30	0.45	85	75	140	55	240	2.0
7			3987.3	0.28	0.43	85	75	140	55	245	2.0
8			3988.9	0.28	0.43	85	75	140	60	240	2.0
9			3990.45	0.28	0.43	85	75	140	60	240	2.0
10			3992.0	0.30	0.45	85	75	140	60	240	2.0
11			3993.8	0.30	0.45	85	80	140	60	245	2.0
12			3995.2	0.28	0.43	85	80	140	60	245	2.0
13			3996.55	0.26	0.38	85	80	140	60	240	2.0
14			3997.9	0.26	0.38	85	80	140	60	240	2.0
15			3999.3	0.26	0.38	85	80	140	60	240	2.0
16			4000.7	0.24	0.36	85	80	140	60	240	2.0
17			4002.1	0.24	0.36	85	80	140	60	240	2.0
18			4003.5	0.22	0.33	85	80	140	60	240	2.0
19				0.20	0.30	85	80	140	60	240	2.0
20				0.20	0.30	85	80	140	60	240	2.0

REMARKS:

.527 .41 78 140

CO_2	O_2	CO
8.2	11.0/CO 9.0	.2
1.4	8.6	.2
5.8	8.8	0

APPENDIX III

CHAIN OF CUSTODY AND LABORATORY DATA

HARMON ENGINEERING & TESTING
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AUBURN INDUSTRIAL PARK BOX 2249 AUBURN, ALA. 36830
205 821-9250

SAMPLE CHAIN OF CUSTODY

Plant MEAD PAPER BOARD

Date Sampled 10/4, 10/5/79 Test Number 1
Run Number 1, 2 & 3

Sample Recovery

Container Code	Description
2068	Run #1 Probe wash & FILTER
2069	Run #2 Probe wash & FILTER
2070	Run #3 Probe wash & FILTER
BLK	Acetone BLK.

Person engaged in Sample Recovery

Signature Wayne Daughtry
Title Project Supervisor
Location at which Recovery
Was done Control Room & plt site
Date and Time of Recovery 10/4/79 10/5/79 a/AR each test.

Sample(s) recipient, upon recovery if not Recovery person

Signature Same
Title
Date and Time of Recovery Same as test
Sample Storage Sample Container in HE&T VAN

Laboratory person receiving Sample

Signature [illegible]
Title Laboratory Director
Date and time of Receipt 10-9-79
Sample storage HE&T Laboratory

Analysis

Container Code	Method of Analysis	Date & Time of Analysis	Signature of Analyst
2068	EPA-5	10/9/79	
2069	"	10/9/79	
2070	"	10/9/79	
#68	"	10/9/79	

PeGGY

Plant: MEAD Source: Waste Boiler Analyst: WADE

Sample Identification Beaker #/Liquid Vol. Run # Filter #	Initial weight #1 Initial weight #2 Initial weight #3	Final weight #1 Final weight #2 Final weight #3	△ weight - filter weight - blank	net particulate	Silica gel #	Final weight Initial weight Weight increase
Fin Waste Boiler / 2068 Beaker #63 / 650 ml #1-C # 000866	104.6660 ~~[illegible]~~ not in oven 104.6648 104.6640	105.5405 ~~[illegible]~~ 1055407	.8767 .7323 -0	.1444	Silica gel 16	300.0 218.0 82.0
Waste Boiler / 2069 #35 / 300ml #2-C # 000863	93.8384 ~~93.8385~~ not in oven 93.8366 93.8356	94.6867 94.6823 94.6833	.8467 .7353	.1114	Silica gel 15	224.7 201.0 23.7
Waste Boiler / 2070 #26 / 250ml #3-C 000862	101.3245 ~~101.3249~~ not in oven 101.3241 101.3218 101.3208	102.1172 102.1148 102.1150	.7940 .7380	.0560	Silica gel 7	239.8 212.2 27.6
Blank #69 / 100 ml.	105.8771 ~~105.8771~~ not in oven 105.8761 105.8718 105.8751 105.8743	105.8716 105.8698 105.8706	0 0 0	0	Silica gel	— — —

August 1979

DRY GAS METER AND ORIFICE CALIBRATION DATA

Meter Box No. J04 Date 10/12/79 Bar. Pressure, Pb 30.1 "Hg Calibrated By Daughtey

ΔH	ΔW	V_w Initial	V_w Final	V_w Net	V_m Initial	V_m Final	V_m Net	t_w	t_m In	t_m Out	t_m Avg.	θ	MCF	ΔH@
0.5		~~335.905~~			~~4226.0~~							~~4~~		
2.0		430.3	446.77	16.47	4307.5	4324.2	16.7	76	100	90	95	15.7"	1.01	.90
1.0		414.150	425.575	11.425	4291.0	4302.7	11.7	75	95	90	92.5	15	1.004	.94
3.0		~~335.905~~	~~407.458~~	~~[illegible]~~	~~4226.0~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~90~~		~~15~~	1.02	.91
3.0		449.12	469.273	20.153	4326.5	4346.73	20.23	76	100	90	95	Average	1.01	.92

ΔH = Orifice Manometer Setting ("H_2O)
ΔW = Negative Pressure on Wet Test Meter ("H_2O)
V_w = Gas Volume of Wet Test Meter (cu.ft.)
V_m = Gas Volume of Dry Gas Meter (cu.ft.)
t_w = Temperature of Wet Test Meter (°F)
t_m = Temperature of Dry Gas Meter (°F)
θ = Calibration Time (minutes)
MCF = Meter Correction Factor, tolerance of 1.00±0.01
ΔH@ = Orifice Pressure Differential that gives 0.75 cfm of dry air at 68°F, 29.92"Hg ("H_2O)

$$MCF = \frac{(V_w)(t_m + 460)(P_b - \frac{\Delta W}{13.6})}{(V_m)(t_w + 460)(P_b + \frac{\Delta H}{13.6})}$$

$$\Delta H@ = \left[\frac{(0.0317)(\Delta H)}{(P_b)(t_m + 460)}\right]\left[\frac{(t_w + 460)(\theta)}{V_w}\right]^2$$

4"hg

15.7

APPENDIX IV

CALIBRATION DATA

CALIBRATION FORM

Gauge	Average Test Condition Temperature	Gauge Reading	Reference Reading	Difference
Impinger (Pre)	80	80	80	0°F
Meter In (Pre)	80	80	80	0°F
Meter Out (Pre)	80	80	78	2°F
Filter Heated Area (Pre)	265	265	260	5°F
Stack (Post)				

Post Test	Run 1	Run 2	Run 3
Train Leak Rate	✓	✓	✓

Pre Test (Answer Yes ✓ or No)

Pitot Leak Check	✓	✓	✓
Orsat Leak Check	✓		
Metering System Leak Check	✓		
Barometer Calibrated			
Sample Bag Leak Check (if used)			

Signature Wayne Daughtry Title Field Supervisor Date 10/5/78

DRY GAS METER AND ORIFICE CALIBRATION DATA

Meter Box No. J04-1 Date 9/25/79 Bar. Pressure, P_b 30.1 "Hg Calibrated By [illegible]

ΔH	ΔW	V_w Initial	V_w Final	V_w Net	V_m Initial	V_m Final	V_m Net	t_w	t_m In	t_m Out	t_m Avg.	θ	MCF	ΔH@
0.5		833.055	845.162	12.107	3580.00	3593.11	13.11	72	95	90	92.5	24	.96	1.06
1.0		812.885	832.769	19.884	3558.5	3579.66	21.16	72	95	90	92.5	27	.97	.99
2.0		773.515	811.575	38.06	3517.5	3557.14	39.64	72	95	90	92.5	36	.99	.97
3.01		744.735	771.755	27.02	3488.5	3515.67	27.17	72	100	90	95	20	1.02	.91
												Average	.99	.98

ΔH = Orifice Manometer Setting ("H_2O)
ΔW = Negative Pressure on Wet Test Meter ("H_2O)
V_w = Gas Volume of Wet Test Meter (cu.ft.)
V_m = Gas Volume of Dry Gas Meter (cu.ft.)
t_w = Temperature of Wet Test Meter (°F)
t_m = Temperature of Dry Gas Meter (°F)
θ = Calibration Time (minutes)
MCF = Meter Correction Factor, tolerance of 1.00±0.01
ΔH@ = Orifice Pressure Differential that gives 0.75 cfm of dry air at 70°F, 29.92"Hg ("H_2O)

$$MCF = \frac{(V_w)(t_m + 460)(P_b - \frac{\Delta W}{13.6})}{(V_m)(t_w + 460)(P_b + \frac{\Delta H}{13.6})}$$

$$\Delta H@ = \left[\frac{(0.0317)(\Delta H)}{(P_b)(t_m + 460)}\right]\left[\frac{(t_w + 460)(\theta)}{V_w}\right]^2$$

RMON ENGINEERING
NTISTS • ENGINEERS • SURVEYORS
N INDUSTRIAL PARK / BOX 2249 AUBURN ALA 36830 / (205) 821 9810
[illegible] HARMON & ASSOCIATES, INC.

PITOT CALIBRATION DATA

Type-S Pitot Tube No. JOY-1, Bar. Pres. _____ "Hg, Date 7-3-79

Standard Pitot Tube No. HE-1, Coefficient of Std. Pitot Tube, Cp(std) 1.00

Calibrated By DAUGHTRY

ΔP_{std} ("H_2O)	Type-S Pitot Tube Legs	ΔP_{test} ("H_2O) *	ΔP_{test} ("H_2O) **	Cp (s) *	Cp (s) **	Deviation *	Deviation **
.60	A		.89		.821		
	B		.89		.821		
.60	A		.89		.821		
	B		.90		.82		
.60	A		.90		.82		
	B						
	A						
	B						

* Pitot tube calibrated alone.
** Pitot tube calibrated with a 3/8" diameter nozzle attached 1/4" apart from the pitot tube end.

$$\text{Cp of Type-S} = \text{Cp (std)} \times \sqrt{\frac{\Delta P_{std}}{\Delta P_{test}}}$$

	*	**
Average Cp (s) of "A"		
Average Cp (s) of "B"		
Average Cp (s) of "A" & "B"		

Cp Difference = $A_{avg} - B_{avg}$

Nomograph "C" Adjustment = $C \frac{[Cp\ (s)]^2}{[0.85]^2}$

Deviation = Cp (s) - $Cp\ (s)_{avg}$

APPENDIX V

OPERATING DATA

Test 1
Run 1 10/4/79

HOG FUEL BOILER DATA SHEET

	Time	Furnace Draft	Boiler Outlet	A.H. Outlet	Pri OC Outlet	Scrubber Inlet	Fan Outlet	Under-Grate	Area Left	Distrib
1	10:15A	[illegible]	[illegible]	3.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	10:45A	[illegible]	[illegible]	2.0	[illegible]	7.5	2.0	[illegible]	[illegible]	[illegible]
3	11:15A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	11:45A	[illegible]	[illegible]	[illegible]	[illegible]	8.0	2.5	[illegible]	[illegible]	[illegible]
5	12:15P	[illegible]	[illegible]	1.5	[illegible]	[illegible]	4.0	2.0	13.0	[illegible]
6	12:45P	[illegible]	3.6	1.5	[illegible]	[illegible]	[illegible]	2.0	12.5	[illegible]
7	1:00P	-0.5	3.6	2.0	8.3	9.2	4.0	2.0	12.5	15.4
8										
9										
10										
11										
12										
13										
14										
15										

6. EFFICIENCY, LINE NO 636-P

	Time	OFA Right	Air Ratio	F.D. Fan	Air Temp	I.D Fan	Distribute	Feeder No 1	Feeder No 2	Feeder No
16										
17										
18	10:15A	20.0	2.35	77	68	8.0	95	20	34	4
19	10:45A	21.0	2.35	77	69	10.0	97	20	34	4
20	11:15A	21.0	2.35	77	66	15.0	97	20	34	4
21	11:45A	21.0	2.35	80	67	9.0	97	20	34	4
22	12:15P	22.0	2.35	85	67	15.0	97	20	34	4
23	12:45P	22.0	2.35	85	67	20.0	97	20	34	4
24	1:00P	22.0	2.35	85	66	15.0	97	20	34	4
25										
26										
27										
28										
29										
30										
31										
32										

	Time	Feeder No 4	Feeder No 5	Gas to A.H. °F	Leaving Air Htr	Air Ld Stm Coil	Air Ld A.H. °F	Stm Flow	O_2
33									
34									
35	10:15A	0	0	630	400	60	490	140	7.0
36	10:45A	0	0	600	380	65	470	120	10.0
37	11:15A	0	0	620	375	65	470	167	4.0
38	11:45A	0	0	610	390	65	490	145	7.6
39	12:15P	0	0	630	390	65	490	170	6.2
40	12:45P	0	0	630	390	65	480	170	6.7
41	1:00P	0	0	630	390	65	480	168	6.8
42									
43									
44									
45									
46									
47									
48									
49									
50									

Steam Integrator

Ending 2003994 1:02 P

Beginning 1996513 10:16 A

12:62
10:16
2:46 = 2.7667 hrs

7481 × 60 / 2.7667 = 162,237 lbs/hr.

Test 1 4/79
Run 2

HOG FUEL BOILER DATA SHEET

	Time	Furnace Draft	Boiler Outlet	AH Outlet	Primary Outlet	Secondary Inlet	Fan Outlet	Blower-Grate	OFA Left	Dist.
1	4:50 P	0.25	2.5	3.7	5.0	7.7	.4	0	12	10
2	5:20 P	-1.0	3.5	2.5	5.6	7.1	1.0	0	11.5	10
3	5:50 P	-1.0	3.5	2.7	6.6	7.0	1.2	0	11.7	15
4	6:20 P	-0.9	3.5	3.0	6.5	6.7	1.2	0	11.7	15
5	6:50 P	-1.0	3.0	2.5	6.5	6.7	1.0	0	11.7	15
6	7:20 P	-1.4	2.0	3.5	7.4	6.5	0.4	0	160	15
7										
8										
9										
10										
11										
12										
13										
14										
15										

	Time	OFA Right	Air Ratio	F.D. Fan	Air Temp	I.D. Fan	Distribute	Feeder No 1	Feeder No 2	Feeder No 3
16										
17										
18	4:50 P	21	2.35	73	66	14	97	-30	+26	-2
19	5:20 P	20	2.35	73	67	9.5	97	-30	+20	-26
20	5:50 P	20	2.35	73	67	10.0	97	-32	+20	-26
21	6:20 P	20	2.35	73	66	9.5	97	-32	+20	-26
22	6:50 P	20	2.35	73	66	9.5	97	-32	+20	-26
23	7:20 P									
24										
25										
26										
27										
28										
29										
30										
31										
32										

	Time	Feeder No 4	Feeder No 5	Gas to A.H. °F	Leaving Air Htr	Air Lo Stm Coil	Air Lo A.H. °F	Stm Flow	O_2
33									
34									
35	4:50 P	-30	-26	610	380	65	480	160	6.2
36	5:20 P	-36	-32	610	385	65	480	150	7.5
37	5:50 P	-36	-32	610	390	65	480	150	8.0
38	6:20 P	-36	-32	610	385	60	475	154	7.5
39	6:50 P	-36	-32	610	380	60	475	156	7.6
40	7:20 P								
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

Steam Integrator

Ending 2021399 7:20 PM 6:80

Beginning 2015077 4:58 P.M. 4:58

2:22 = 2.3667 hrs

$$\frac{6322 \times 60}{2.3667} = \boxed{160{,}274 \text{ lbs/hr.}}$$

Test 1
Run 3 10/5/79

HOG FUEL BOILER DATA SHEET

	Time	Furnace Draft	Boiler Outlet	Air Outlet	Pri OC Outlet	Scrubber Inlet	Fan Outlet	Under-Grate	OFA Left	Dis
1	9:00A	-0.4	4.5	2.0	6.2	7.5	4.0	2.0	12.6	15
2	10:10A	-0.5	4.0	2.5	7.5	8.2	4.3	2.0	12.8	15
3	10:40A	0.2	4.0	2.0	7.2	8.6	4.4	2.0	12.8	15
4	11:10A									
5	11:40A	-0.5	4.8	2.5	7.5	8.4	4.2	2.0	12.8	+2
6	12:10P	-0.6	4.0	2.5	6.5	7.4	2.7	0.8	12.5	15
7										
8										
9										
10										
11										
12										
13										
14										
15										

	Time	OFA Right	Air Ratio	F.D. Fan	Air Temp	I.D. Fan	Distribute	Feeder No 1	Feeder No 2	Feeder No 3
16	9:40A	~~21.0~~	2.35	85	62	18.0	97	-2	+30	-2
17	10:10A	~~21.0~~	2.35	89	~~66~~	15.0	97	-4	+28	-4
18	10:40A	~~21.0~~	2.35	89	63	16.0	97	-4	+28	-4
19	11:40A	12.8	2.3	85	63	16	97%	0	30	0
20	12:10P	21.5	2.35	77	63	14	97	-4	+28	-4
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										

	Time	Feeder No 4	Feeder No 5	Gas To A.H. °F	Leaving Air Htr	Air Ld Stm Coil	Air Ld A.H. °F	Stm Flow	O_2
33	9:40A	-20	0	630	360	50	460	142	5.0
34	10:10A	-22	0	620	370	55	460	144	7.6
35	10:40A	-22	0	620	370	57	455	150	6.8
36	11:40A	-1	-10	600	365	60	450	145	8.0
37	12:10P	-12	-12	600	370	65	460	140	7.8
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

Steam Integrator

Ending 2053324 12:16 PM 11:76

Beginning 2046603 9:41 AM 9:41

2:35 = 2.5833 hr

$\frac{6721 \times 60}{2.5833}$ = [redacted]

156,103 lbs/hr.

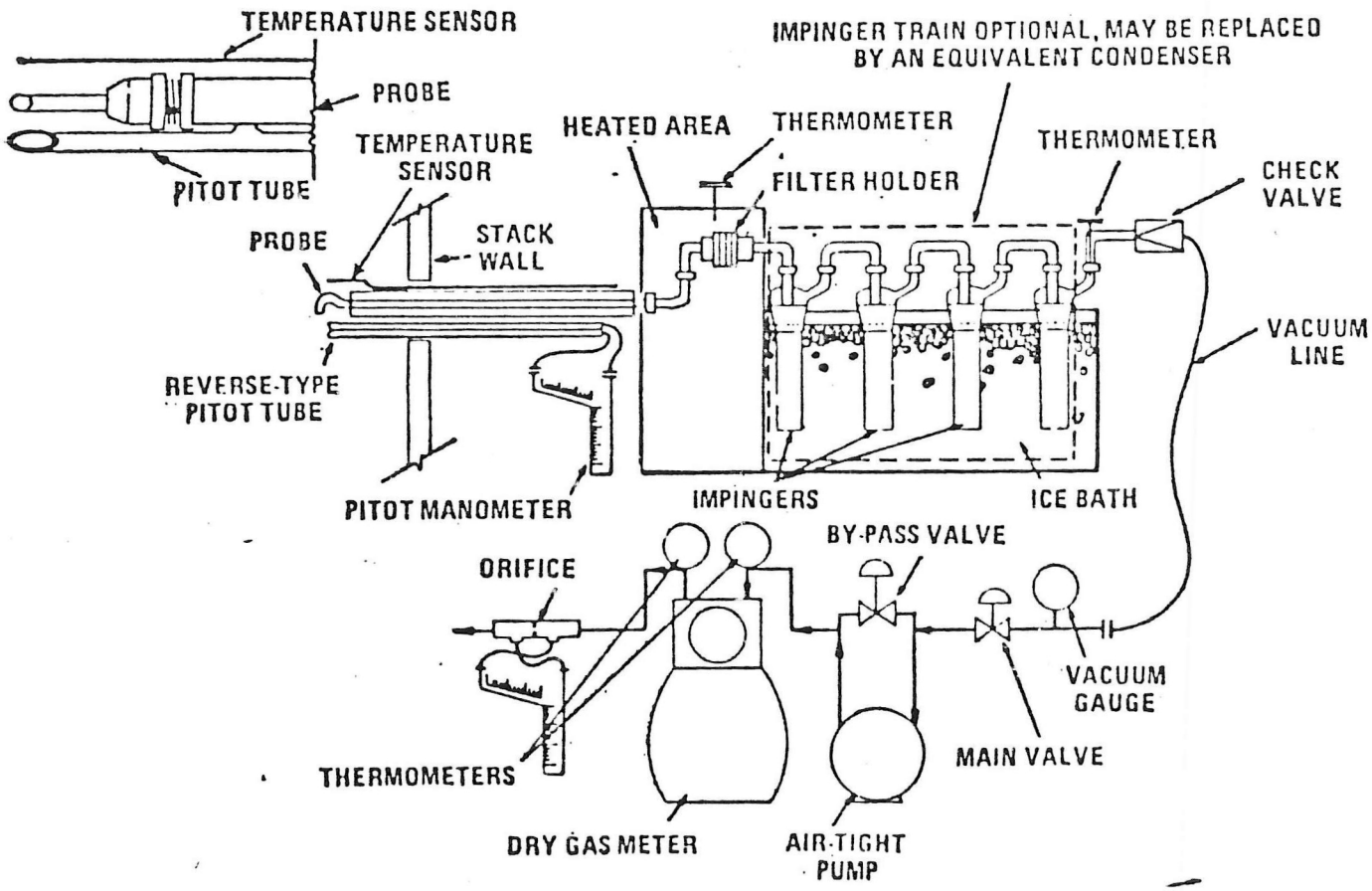
SUMMARY OF EPA METHOD 5

DETERMINATION OF PARTICULATE EMISSIONS

FROM STATIONARY SOURCES

Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at 120°C. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal from uncombined water.

A schematic drawing of the sampling apparatus is shown below.



Schematic of Particulate Sampling Train

Prior to testing, all components are maintained and calibrated in accordance with the procedure described in APTD-0576 unless otherwise specified. The silica gel is dried and weighed. Filters are checked for obvious irregularities, flaws, or pinholes. The filters are dessicated and preweighed. All flow equipment is cleaned, inspected and calibrated before each test.

Preliminary determinations are made on site prior to the actual sampling. The sampling site and the minimum number of sample points are determined according to EPA Method 1. The stack pressure, temperature, the range of velocity heads, and leak checks are determined as specified in EPA Method 2. The moisture content is determined using the EPA Approximation Method 4 or from dew point data. The dry gas molecular weight is determined using EPA Method 2 or 3 as appropriate. The nozzle size, probe liner and length, sampling time, sampling rate, and other variables are selected based upon the above determinations.

The sampling train is set up in accordance with the schematic on the preceding page. Sampling is begun and an isokinetic flow (± 10%) is maintained throughout the run. Data is recorded throughout the sampling period to insure the maintenance of isokinetic conditions.

The data is calculated using equations that correct all volumes and concentrations to standard conditions. The equations are all based on ideal gas behavior and the ideal gas law. All equations and procedures are given in the Federal Register, Vol. 42, No. 160, pp. 41776-41782.

CE Manual
TIS 2743

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227 Park Ave NY 10017
Glenn R. Fryling
1967

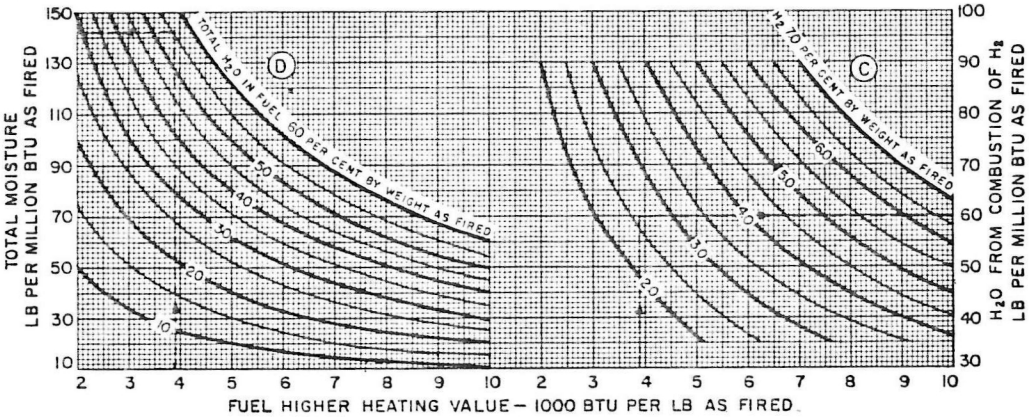
Appendix A

Combustion Calculation Charts

THIS APPENDIX supplements information on graphical combustion methods appearing in Chapter 21, Combustion and Boiler Calculations. More detailed information can be found in the First Edition of *Combustion Engineering*, Otto de Lorenzi, editor, Chapter 25, Performance Calculations, Section on Heat Balance, pp. 25–18 through 25–39.

These and related charts originally appeared in a series of articles by W. S. Patterson and A. L. Nicolai published in *Combustion* in 1941, 1942 and 1944. They are available in slightly revised form from the General Offices of Combustion Engineering, Inc. Windsor, Conn., under the title "Combustion Calculations by Graphical Methods."

203-688-1811



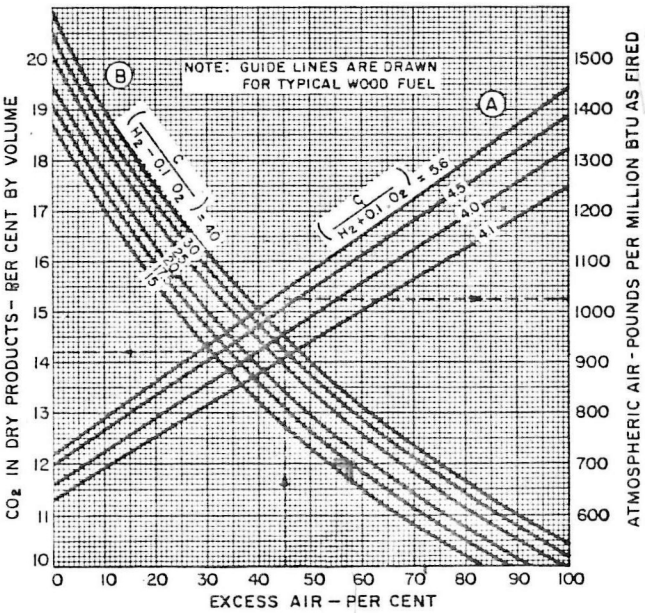


Figure A–1. Chart for wood and bagasse.

Pine (bdb)
Carbon 52%
Hydrogen 7%
Oxygen 40

$\frac{C}{H_2 - 0.1 O_2} = 17.33$

W. Lenk
15553

58% Excess Air.