Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

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Particulate Emissions Test

Asphalt Plant

Carl Rose and Sons

May 20, 1992

Elkin, North Carolina

Reviewed by:
PACE, INC.
Charlotte, North Carolina

W. Quentin Best
May 1992

Performed by:
PACE, INC.
Charlotte, North Carolina

Tom Wynn
May 1992

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A. Summary of Results

B. Field Data

C. Process Data

D. Laboratory Results

E. Test Participants

F. Sampling and Analytical Procedures

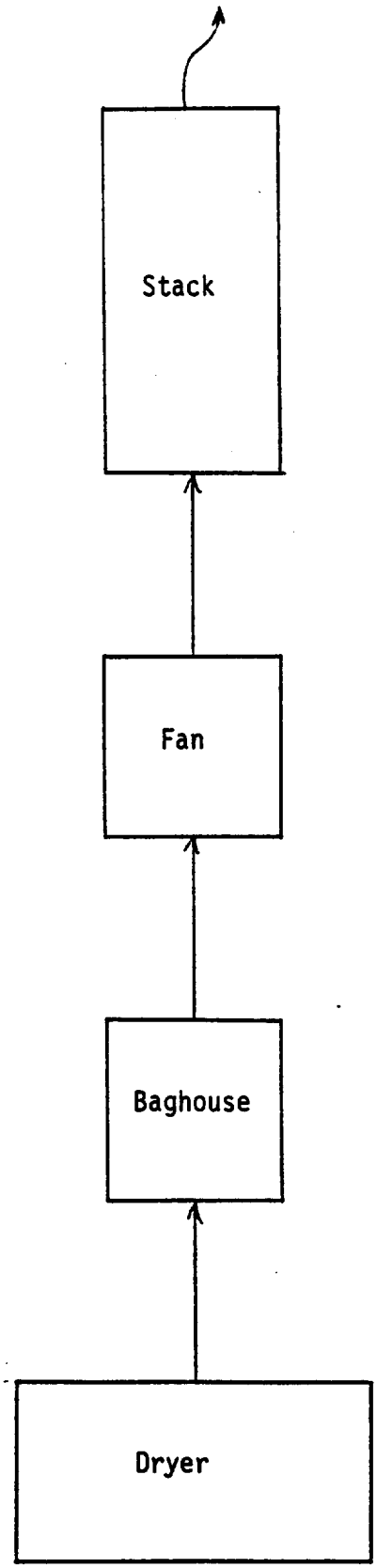
G. Calibration Data

Introduction

Source sampling was performed on an asphalt plant located at Carl Rose and Sons, Elkin, North Carolina on May 20, 1992. The purpose of the sampling was to determine compliance with the permit limitations of 0.04 pounds per dry standard cubic foot as required by the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR).

The measurements of stack gas flow rate and pollutant concentrations were made according to U.S. Environmental Protection Agency and the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR). Randy Oakley, of the NCDEHNR, was present to observe testing procedures. Quentin Best, Tom Wynn, and Dale Mace were test participants representing PACE, Inc.

The following sections of the report includes the summary of results, the process and its operation, the location of the sampling points and the sampling and analytical procedures used.



Stack Flow

Summary of Results

Table 1 presents the summary of results from the Carl Rose and Sons asphalt plant in Elkin, North Carolina for particulate sampling. The mean particulate concentration was 0.1234 grains per dry standard cubic foot. The mean particulate emission rate was 19.506 pounds per hour.

Visible emissions were taken on the baghouse during the particulate test. The highest six-minute average was 6.0 percent opacity on run Number 1 and 7.1 percent opacity on run Numbers 2 and 3.

Based on the results of the particulate sampling, the Carl Rose and Sons, Elkin, North Carolina asphalt facility was not in compliance with the North Carolina Department of Environment, Health, and Natural Resources permit limitation of 0.04 grains per dry standard cubic foot.

Table 1

Carl Rose and Sons, Elkin North Carolina

Summary of Results - Particulate Sampling

Run Number	1	2	3	Averages
Date	05/20/92	05/20/92	05/20/92	05/20/92
% Isokinetic	101.95	101.33	102.09	
Volume of Gas Sampled, SCF * Dry	38.044	36.953	37.430	
Stack Gas Flow Rate, SCFM * Dry	18699.7	18274.8	18372.3	
Stack Gas Flow Rate, ACFM	35306.7	34489.9	34667.3	
Particulate:				
Catch, mgrams	305.05	290.45	305.20	300.23
Concentration, grains/ SCF * Dry	0.1235	0.1210	0.1256	0.1234
Emission Rate, lbs/hr	19.789	18.957	19.771	19.506

*68'F, 29.92 in. Hg
**Nozzle, probe, filter

Process Description and Operation

The Carl Rose and Sons asphalt plant in Elkin, North Carolina is a continuous drum type plant. It produces hot mix asphalt made with asphalt cement, sand, granite screenings and granite aggregates. The materials are dried in a rotary dryer fired with No. 2 fuel oil. The material mix was conveyed to a storage silo. Air was introduced at the burner and passed through the dryer, baghouse, fan and stack to the atmosphere. The plant was rated at 241 tons per hour.

Location of Sampling Points

The dimensions of the stack and the location of the sampling points are shown in Figure 2. The stack cross section for baghouse was divided into twelve equal parts. Each point was sampled for a period of 2.5 minutes per point which yielded a total test time of 60 minutes per run. The number of sampling points was determined by the distance from the last disturbance in the gas flow as outlined in Method 1, Code of Federal Regulations, Title 40, Part 60, Appendix A (July 1, 1991).

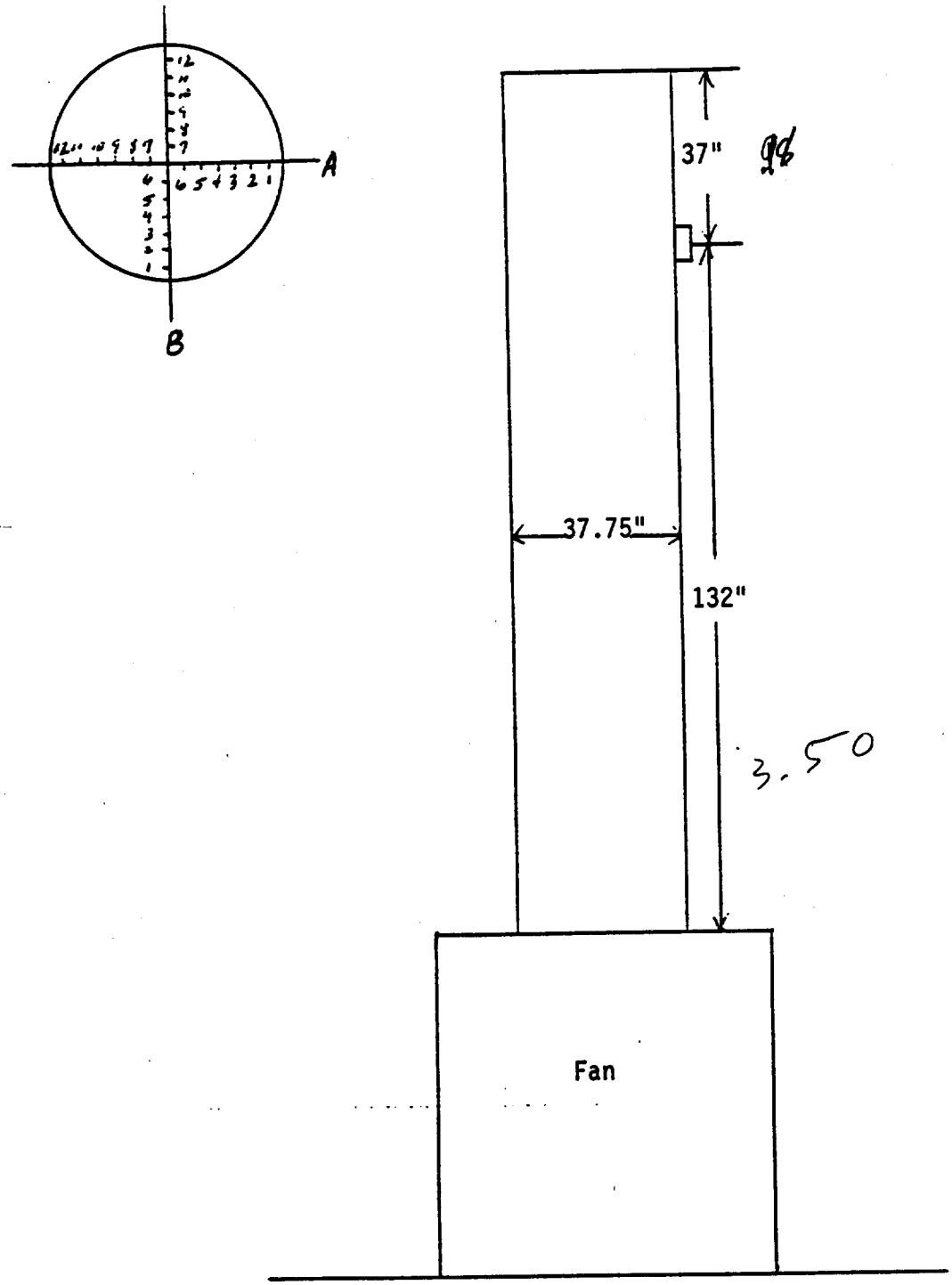


Figure 2

Sampling and Analytical Procedures

All sampling and analytical procedures used were those recommended by the U.S. Environmental Protection Agency and the North Carolina Department of Environment, Health and Natural Resources (NCDEHNR). Complete details are found in Appendix F which is a copy of the Code of the Federal Regulations, Title 40, Part 60, Appendix A, Methods 1 through 5 and 9 (July 1, 1991).

Sample point locations and velocity measurements were made by Methods 1 and 2. Gas composition was determined by Fyrite and Method 3 on continuous bag samples. Method 5 was used for the particulate determination. Method 9 was used for visual emission determination.

Appendices

Appendix A

Summary of Results

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Appendix A

Summary of Method 5 Particulate Results

Carl Rose & Sons Inc. Baghouse Stack Elkin NC

Run Number		1	2	3
Date		5/20/92	5/20/92	5/20/92
DN	Sample nozzle dia., in.	0.208	0.208	0.208
TT	Net time of test	60	60	60
PB	Barometric pressure, in. Hg.	29.17	29.17	29.17
PM	Average orifice pressure drop, in. H2O	1.501	1.418	1.427
VM	Volume of dry gas sampled, cu. ft. at meter conditions	39.38	39.00	40.17
TM	Average gas meter temp. in degrees F.	74.65	85.00	94.21
VMSTD	Volume of dry gas sampled at standard conditions*, SCF	38.044	36.953	37.430
VW	Total water collected in impingers + silica gel, ML.	253.0	237.0	239.0
VMV	Volume of water vapor at standard conditions*, SCF	11.914	11.160	11.255
PMV	Percent moisture by volume	23.848	23.196	23.117
MD	Mole fraction dry gas	0.7615	0.7680	0.7688
PCO2	Percent CO2 by volume, dry	4.90	5.00	4.90
PO2	Percent O2 by volume, dry	14.00	13.90	13.97
PCO	Percent CO by volume, dry	0.00	0.00	0.00
PN2	Percent N2 by volume, dry	81.10	81.10	81.13
MWD	Molecular weight-dry stack gas	29.344	29.356	29.343
MW	Molecular weight-stack gas	26.639	26.722	26.721
CP	Pitot tube coefficient	0.84	0.84	0.84
DPS	Average velocity head of stack gas, inches water	1.1841	1.1530	1.1584
TS	Average stack temperature, F	278.92	283.79	284.42

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PSI	Static pressure of stack gas, inches Hg.	-0.081	-0.081	-0.081
PS	Stack pressure, absolute	29.089	29.089	29.089
VS	Average stack velocity, FPM	4982.2	4859.5	4884.5
AS	Stack area, inches sqrd.	1017.9	1017.9	1017.9
QS	Stack flow rate, dry, standard conditions, DSCFM	18699.7	18274.8	18372.2
QSW	Stack flow rate, wet, standard conditions, WSCFM	24555.7	23794.0	23896.4
QA	Actual stack flow rate, ACFM	35360.7	34489.9	34667.3
PERI	Percent isokinetic	101.95	101.33	102.09
FMF	Particulate, Mg., front	305.05	290.45	305.20
CAN	Particulate, GR/DSCF front	0.1235	0.1210	0.1256
CAM	Particulate, GR/WSCF front	0.1622	0.1576	0.1633
CAT	Particulate, GR/ACF front	0.0653	0.0641	0.0665
CAW	Particulate, LB/HR front	19.789	18.957	19.771
FNP	Net sampling points	24	24	24

*68 Degrees F. 29.92 Inches Hg.

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Method 5 Particulate Calculations Test Number 1

Carl Rose & Sons Inc. Baghouse Stack Elkin NC

Volume of Dry Gas Sampled at Standard Conditions

$$VMSTD = \frac{17.64 * VM * (PB + PM / 13.6)}{TM + 460} = 38.044$$

Volume of Water Vapor at Standard Conditions

$$VMV = 0.04709 * VW = 11.914$$

Percent Moisture in Stack Gas

$$PMV = \frac{100 * VMV}{VMSTD + VMV} = 23.848$$

Mole Fraction of Dry Gas

$$MD = \frac{100 - PMV}{100} = 0.7615$$

Average Molecular Weight of Dry Stack Gas

$$MWD = 0.44 * PCO2 + 0.32 * PO2 + 0.28 * (PN2+PCO) = 29.344$$

Molecular Weight of Stack Gas

$$MW = MWD * MD + 18 * (1-MD) = 26.639$$

Stack Gas Velocity at Stack Conditions

$$VS = 5129.4 * CP * DPS * SQRT(TS + 460)/(PS * MW) = 4982.2$$

Stack Gas Volumetric Flow at Standard Conditions, Dry

$$QS = \frac{0.123 * VS * AS * PS * MD}{TS + 460} = 18699.7$$

Stack Gas Volumetric Flow at Stack Conditions

$$QA = \frac{QS * (TS + 460)}{17.64 * PS * MD} = 35360.7$$

Percent Isokinetic

$$PERI = \frac{1039 * (TS + 460) * VMSTD}{VS * TT * PS * MD * DN * DN} = 101.95$$

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Particulate Loading -- Probe, Cyclone, Filter
(At Standard Conditions)
CAN = 0.0154 * FMF / VMSTD = 0.1235

Particulate Loading -- Probe, Cyclone, Filter
(At Stack Conditions)

$$CAT = \frac{17.64 * CAN * PS * MD}{TS + 460} = 0.0653$$

Particulate Lb/Hr -- Probe, Cyclone, Filter
(At Standard Conditions)
CAW = 0.00857 * CAN * QS = 19.789

Visible Emissions

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EPA Method 9 Field Data Sheet

Project CARL ROSE
Source No. 1 I.D. BAGHOUSE STACK
Source No. 2 I.D.
Test No. 1

Evaluation Date 5-20-92
Observer DALE M MACE
Certification Date 3-18-92

Source No. 1
Type of Source STACK Control Device BAGHOUSE
Fuel Type NAT. GAS Load

Source No. 2
Type of Source Control Device
Fuel Type Load

Source Height(s) 30' Outlet Dimensions 5'

Plume Description:
Type ☒ Coning ☐ Fanning ☐ Looping ☐ Lofting ☐ Fumigating
Color WHITE Length 15'
Steam Plume ☐ Attached ☐ Detached ☒ No Visible Steam

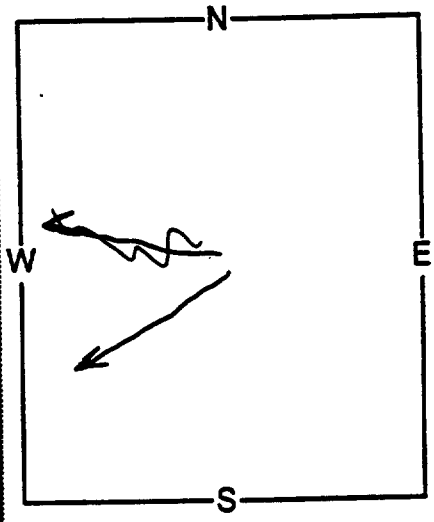
Background Description (Type, color) GRAY CLOUDS

Meteorological Conditions (clear, % cloudy, etc.) OVERCAST
Wind Direction N Speed 0-5 mph
Ambient Temp. 55 °F

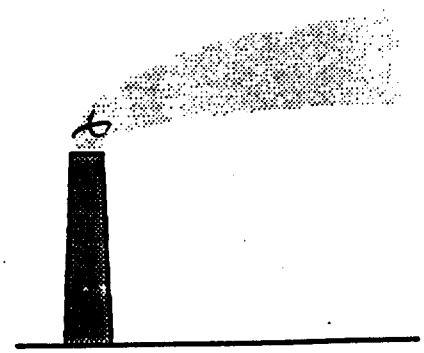
Location of Observer (direction and distance) EASTWS SOUTH WEST 75'

Personnel Present During Observation DMM, TEW, WOB

Show Observer's Position In Relation to the Source, Plume and Lighting



Show Point Where Readings Were Evaluated In Relation to the Source Outlet and the Steam Plume



Comments (include any changes to the above during evaluation) CHANGED TO MOSTLY CLOUDY 55°

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EPA Method 9 Field Data Sheet
Page 2

Source No. 1
Time Start 1049 Time Stop 1149

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

Source No. 2
Time Start _____ Time Stop _____

Sec. / Min.	0	15	30	45	Sec. / Min.	0	15	30	45
0					30				
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				

Observer Signature Rob M Mace

AS 109

Carl Rose & Sons Visual Emmissions Run 1
Actuals, Six Minute Sums, and Six Minute Averages

5		
5		
0		
0		
0		
0		
0		
0		
0		
0		
0		
0		
0		
0		
0		
5		
5		
5		
0		
5		
5		
0		
5		
0	40	1.7
0	35	1.5
5	35	1.5
0	35	1.5
0	35	1.5
0	35	1.5
0	35	1.5
0	35	1.5
0	35	1.5
5	40	1.7
5	45	1.9
5	50	2.1
0	50	2.1
5	55	2.3
5	60	2.5
5	65	2.7
0	60	2.5
0	55	2.3
0	50	2.1
5	55	2.3
10	60	2.5
5	60	2.5
0	60	2.5
5	60	2.5
5	65	2.7
5	70	2.9
5	70	2.9
5	75	3.1
0	75	3.1
5	80	3.3
5	85	3.5
5	90	3.8
10	100	4.2

Carl Rose & Sons Visual Emmissions Run 1
Actuals, Six Minute Sums, and Six Minute Averages

5	100	4.2
5	100	4.2
0	95	4.0
0	95	4.0
0	90	3.8
0	85	3.5
0	80	3.3
0	80	3.3
0	80	3.3
0	80	3.3
10	85	3.5
5	80	3.3
5	80	3.3
0	80	3.3
5	80	3.3
0	75	3.1
5	75	3.1
5	75	3.1
5	75	3.1
5	80	3.3
0	75	3.1
5	75	3.1
5	75	3.1
0	65	2.7
5	65	2.7
0	60	2.5
5	65	2.7
5	70	2.9
0	70	2.9
0	70	2.9
0	70	2.9
0	70	2.9
5	75	3.1
0	75	3.1
5	70	2.9
5	70	2.9
0	65	2.7
0	65	2.7
0	60	2.5
0	60	2.5
0	55	2.3
0	50	2.1
0	45	1.9
0	40	1.7
5	45	1.9
5	45	1.9
0	40	1.7
0	40	1.7
0	35	1.5
5	40	1.7
0	35	1.5
0	30	1.3
0	30	1.3
0	30	1.3
0	30	1.3
5	35	1.5

Carl Rose & Sons Visual Emmissions Run 1
Actuals, Six Minute Sums, and Six Minute Averages

0	30	1.3
5	35	1.5
0	30	1.3
0	25	1.0
0	25	1.0
0	25	1.0
0	25	1.0
0	25	1.0
0	25	1.0
0	25	1.0
0	25	1.0
5	30	1.3
5	30	1.3
5	30	1.3
0	30	1.3
0	30	1.3
5	35	1.5
0	30	1.3
5	35	1.5
5	40	1.7
5	45	1.9
5	50	2.1
0	50	2.1
5	50	2.1
0	50	2.1
0	45	1.9
0	45	1.9
0	45	1.9
5	50	2.1
0	50	2.1
0	50	2.1
5	55	2.3
5	60	2.5
5	65	2.7
5	70	2.9
5	70	2.9
5	70	2.9
5	70	2.9
0	70	2.9
5	75	3.1
0	70	2.9
0	70	2.9
0	65	2.7
0	60	2.5
0	55	2.3
5	55	2.3
0	55	2.3
0	50	2.1
10	60	2.5
5	65	2.7
5	70	2.9
5	75	3.1
5	75	3.1
0	75	3.1
0	75	3.1
5	75	3.1

Carl Rose & Sons Visual Emmissions Run 1
Actuals, Six Minute Sums, and Six Minute Averages

5	75	3.1
5	75	3.1
5	75	3.1
0	70	2.9
0	65	2.7
5	65	2.7
5	70	2.9
10	75	3.1
5	80	3.3
5	85	3.5
0	85	3.5
5	90	3.8
5	95	4.0
5	95	4.0
0	95	4.0
0	95	4.0
5	90	3.8
5	90	3.8
5	90	3.8
5	90	3.8
10	95	4.0
5	100	4.2
5	105	4.4
5	105	4.4
5	105	4.4
5	105	4.4
5	105	4.4
10	115	4.8
5	120	5.0
5	120	5.0
0	115	4.8
5	110	4.6
0	105	4.4
5	105	4.4
5	110	4.6
5	110	4.6
5	110	4.6
5	110	4.6
5	115	4.8
10	125	5.2
10	130	5.4
5	130	5.4
10	135	5.6
5	135	5.6
10	135	5.6
5	135	5.6
5	135	5.6
10	140	5.8
5	140	5.8
5	140	5.8
5	140	5.8
5	135	5.6
10	140	5.8
0	135	5.6
5	140	5.8
5	140	5.8

Carl Rose & Sons Visual Emmissions Run 1
Actuals, Six Minute Sums, and Six Minute Averages

5	145	6.0
5	145	6.0
5	145	6.0
0	140	5.8
5	140	5.8
0	135	5.6
0	130	5.4
0	120	5.0
5	115	4.8
5	115	4.8
5	110	4.6
5	110	4.6
5	105	4.4
5	105	4.4
5	105	4.4
5	100	4.2

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EPA Method 9 Field Data Sheet

Project: CARL ROSE
Source No. 1 I.D.: BAGHOUSE STACK
Source No. 2 I.D.:
Test No.: 2

Evaluation Date: 5-20-92
Observer: DAVE M MACE
Certification Date: 3-18-92

Source No. 1

Type of Source: STACK Control Device: BAG HOUSE
Fuel Type: NAT. GAS Load:

Source No. 2

Type of Source: Control Device:
Fuel Type: Load:

Source Height(s): 30' Outlet Dimensions: 5'

Plume Description:

Type: ☒ Coning ☐ Fanning ☐ Looping ☐ Lofting ☐ Fumigating

Color: WHITE Length: 15'

Steam Plume: ☐ Attached ☐ Detached ☐ No Visible Steam

Background Description (Type, color): ~~GRAY MAPLE LEAF~~ BLUE SKY

Meteorological Conditions (clear, % cloudy, etc.): 20% CLOUD COVERAGE

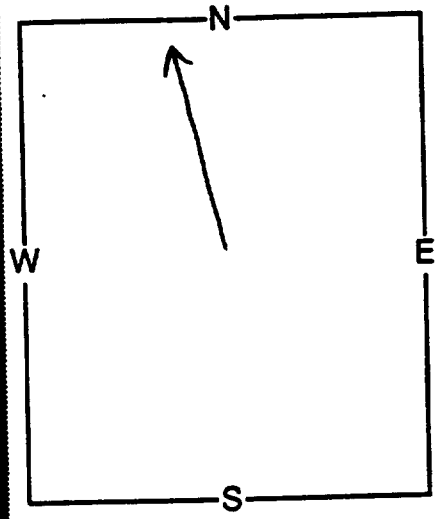
Wind Direction: NE Speed: 0-3 mph

Ambient Temp.: 75° °F

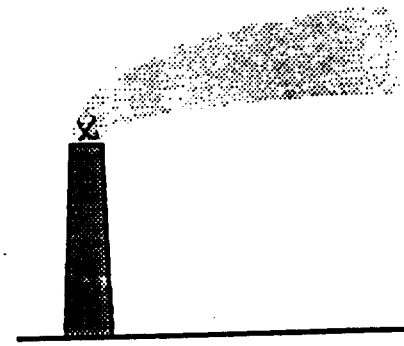
Location of Observer (direction and distance): FACING NORTH-NORTHWEST 50'

Personnel Present During Observation: DMM, WQR, TEW

Show Observer's Position In Relation to the Source, Plume and Lighting



Show Point Where Readings Were Evaluated In Relation to the Source Outlet and the Steam Plume



Comments (include any changes to the above during evaluation):

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EPA Method 9 Field Data Sheet
Page 2

Source No. 1

Time Start 13:5 Time Stop 1421

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

STOP 1353
START 1355

Source No. 2

Time Start _____ Time Stop _____

Min. \ Sec.	0	15	30	45	Min. \ Sec.	0	15	30	45
0					30				
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				

Observer Signature Rob M Moss

AS 109

Carl Rose & Sons Visual Emmissions Run 2
Actuals, Six Minute Sums, and Six Minute Averages

5		
5		
0		
0		
5		
5		
5		
10		
5		
0		
0		
5		
10		
5		
5		
0		
5		
10		
5		
5		
5		
5		
10		
5	115	4.8
0	110	4.6
0	105	4.4
0	105	4.4
10	115	4.8
0	110	4.6
0	105	4.4
5	105	4.4
5	100	4.2
5	100	4.2
0	100	4.2
5	105	4.4
5	105	4.4
5	100	4.2
0	95	4.0
0	90	3.8
0	90	3.8
0	85	3.5
0	75	3.1
0	70	2.9
5	70	2.9
5	70	2.9
0	65	2.7
5	60	2.5
0	55	2.3
5	60	2.5
0	60	2.5
0	60	2.5
0	50	2.1
5	55	2.3
10	65	2.7
5	65	2.7
5	65	2.7

Carl Rose & Sons Visual Emmissions Run 2
Actuals, Six Minute Sums, and Six Minute Averages

0	60	2.5
0	60	2.5
0	55	2.3
0	50	2.1
0	45	1.9
0	45	1.9
0	45	1.9
5	50	2.1
5	55	2.3
5	60	2.5
5	65	2.7
5	65	2.7
0	60	2.5
0	60	2.5
0	55	2.3
0	55	2.3
0	50	2.1
0	50	2.1
0	50	2.1
0	50	2.1
0	45	1.9
0	35	1.5
0	30	1.3
0	25	1.0
5	30	1.3
10	40	1.7
10	50	2.1
10	60	2.5
5	65	2.7
5	70	2.9
5	75	3.1
5	75	3.1
5	75	3.1
5	75	3.1
5	75	3.1
5	75	3.1
0	75	3.1
0	75	3.1
5	80	3.3
0	80	3.3
5	85	3.5
10	95	4.0
5	100	4.2
5	105	4.4
0	105	4.4
0	105	4.4
0	105	4.4
5	110	4.6
0	105	4.4
0	95	4.0
0	85	3.5
0	75	3.1
5	75	3.1
5	75	3.1
0	70	2.9
0	65	2.7

Carl Rose & Sons Visual Emmissions Run 2
Actuals, Six Minute Sums, and Six Minute Averages

0	60	2.5
5	60	2.5
0	55	2.3
0	50	2.1
0	50	2.1
0	50	2.1
0	45	1.9
5	50	2.1
0	45	1.9
5	40	1.7
0	35	1.5
0	30	1.3
0	30	1.3
0	30	1.3
0	30	1.3
0	25	1.0
0	25	1.0
0	25	1.0
0	25	1.0
0	25	1.0
0	20	0.8
5	20	0.8
5	25	1.0
5	30	1.3
0	30	1.3
5	30	1.3
5	35	1.5
5	40	1.7
5	45	1.9
5	50	2.1
5	55	2.3
5	55	2.3
5	60	2.5
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	50	2.1
0	45	1.9
0	40	1.7
5	45	1.9
0	40	1.7
0	35	1.5
0	30	1.3
0	25	1.0
0	20	0.8
0	15	0.6
0	10	0.4

Carl Rose & Sons Visual Emmissions Run 2
Actuals, Six Minute Sums, and Six Minute Averages

5	10	0.4
0	10	0.4
0	10	0.4
5	15	0.6
5	20	0.8
0	20	0.8
0	20	0.8
0	20	0.8
0	20	0.8
0	20	0.8
0	20	0.8
0	20	0.8
0	20	0.8
5	25	1.0
5	30	1.3
5	35	1.5
0	30	1.3
0	30	1.3
0	30	1.3
0	30	1.3
5	35	1.5
0	35	1.5
0	35	1.5
0	35	1.5
5	35	1.5
0	35	1.5
5	40	1.7
5	40	1.7
5	40	1.7
0	40	1.7
0	40	1.7
0	40	1.7
0	40	1.7
0	40	1.7
0	40	1.7
0	40	1.7
0	40	1.7
5	40	1.7
5	40	1.7
0	35	1.5
5	40	1.7
5	45	1.9
5	50	2.1
5	55	2.3
0	50	2.1
10	60	2.5
5	65	2.7
0	65	2.7
0	60	2.5
0	60	2.5
10	65	2.7
5	65	2.7
0	60	2.5
0	60	2.5
0	60	2.5
5	65	2.7

Carl Rose & Sons Visual Emmissions Run 2
Actuals, Six Minute Sums, and Six Minute Averages

5	70	2.9
5	75	3.1
10	85	3.5
10	95	4.0
10	105	4.4
5	105	4.4
10	110	4.6
10	120	5.0
10	125	5.3
15	135	5.6
10	140	5.8
10	145	6.0
10	155	6.5
10	155	6.5
15	165	6.9
5	170	7.1

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EPA Method 9 Field Data Sheet

Project CARL ROSE
Source No. 1 I.D. BAGHOUSE STACK
Source No. 2 I.D.
Test No. 3

Evaluation Date 5-20-92
Observer DALE M. MACE
Certification Date 3-18-92

Source No. 1
Type of Source STACK Control Device BAGHOUSE
Fuel Type Load

Source No. 2
Type of Source Control Device
Fuel Type Load

Source Height(s) 25' Outlet Dimensions 5'

Plume Description:
Type ☒ Coning ☐ Fanning ☐ Looping ☐ Lofting ☐ Fumigating
Color WHITE Length 30
Steam Plume ☐ Attached ☐ Detached ☒ No Visible Steam

Background Description (Type, color) BLUE SKY

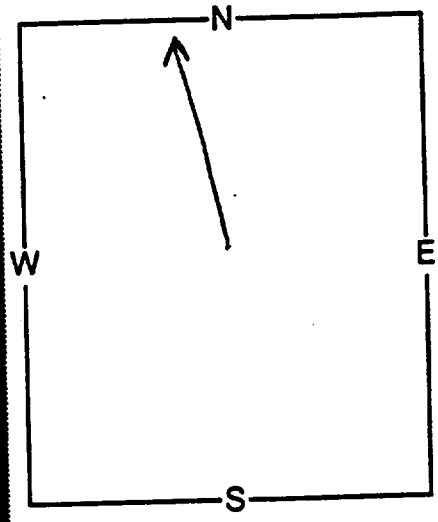
Meteorological Conditions (clear, % cloudy, etc.) 20% CLOUDY

Wind Direction NE Speed 0-5 mph
Ambient Temp. 75 °F

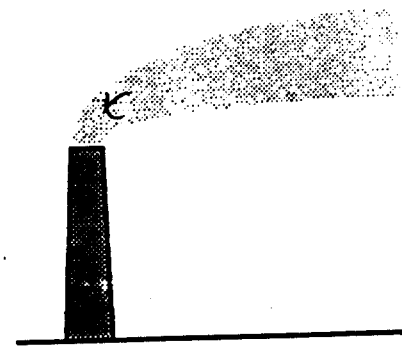
Location of Observer (direction and distance) NNW @ 50'

Personnel Present During Observation DMM, WRB, TEW

Show Observer's Position In Relation to the Source, Plume and Lighting



Show Point Where Readings Were Evaluated In Relation to the Source Outlet and the Steam Plume



Comments (include any changes to the above during evaluation)

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EPA Method 9 Field Data Sheet

Page 2

Source No. 1

Time Start 1432 Time Stop 1533

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

STOP 1444
START 1447

Source No. 2

Time Start _____ Time Stop _____

Sec. / Min.	0	15	30	45	Sec. / Min.	0	15	30	45
0					30				
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				

Observer Signature [signature]

AS 109

Carl Rose & Sons Visual Emmissions Run 3
Actuals, Six Minute Sums and Six Minute Averages

5		
5		
10		
5		
5		
5		
0		
10		
5		
10		
10		
10		
15		
5		
5		
5		
5		
15		
5		
5		
5		
5		
10		
5	165	6.9
5	165	6.9
5	165	6.9
5	160	6.7
10	165	6.9
5	165	6.9
5	165	6.9
5	170	7.1
5	165	6.9
10	170	7.1
0	160	6.7
5	155	6.5
0	145	6.0
5	135	5.6
10	140	5.8
10	145	6.0
5	145	6.0
5	145	6.0
5	135	5.6
15	145	6.0
5	145	6.0
5	145	6.0
5	145	6.0
5	140	5.8
10	145	6.0
5	145	6.0
5	145	6.0
10	150	6.3
5	145	6.0
5	145	6.0
5	145	6.0
0	140	5.8
5	140	5.8

Carl Rose & Sons Visual Emmissions Run 3
Actuals, Six Minute Sums and Six Minute Averages

5	135	5.6
10	145	6.0
5	145	6.0
0	145	6.0
0	140	5.8
5	135	5.6
10	135	5.6
0	130	5.4
0	125	5.2
10	130	5.4
5	120	5.0
10	125	5.2
5	125	5.2
10	130	5.4
5	130	5.4
5	125	5.2
5	125	5.2
5	125	5.2
5	120	5.0
0	115	4.8
0	110	4.6
10	115	4.8
5	120	5.0
5	120	5.0
5	120	5.0
0	110	4.6
15	120	5.0
5	125	5.2
5	130	5.4
5	130	5.4
0	120	5.0
5	125	5.2
0	125	5.2
0	115	4.8
0	110	4.6
0	100	4.2
10	105	4.4
5	100	4.2
5	100	4.2
0	95	4.0
5	95	4.0
5	95	4.0
0	90	3.8
5	95	4.0
10	105	4.4
10	105	4.4
15	115	4.8
10	120	5.0
10	125	5.2
10	135	5.6
5	125	5.2
0	120	5.0
5	120	5.0
0	115	4.8
5	120	5.0
0	115	4.8

Carl Rose & Sons Visual Emmissions Run 3
Actuals, Six Minute Sums and Six Minute Averages

5	120	5.0
5	125	5.2
5	130	5.4
5	135	5.6
5	130	5.4
5	130	5.4
5	130	5.4
5	135	5.6
0	130	5.4
0	125	5.2
0	125	5.2
0	120	5.0
5	115	4.8
0	105	4.4
0	90	3.8
0	80	3.3
0	70	2.9
0	60	2.5
5	60	2.5
5	65	2.7
0	60	2.5
0	60	2.5
0	55	2.3
0	55	2.3
5	55	2.3
5	55	2.3
0	50	2.1
0	45	1.9
0	40	1.7
0	35	1.5
5	35	1.5
5	35	1.5
5	40	1.7
5	45	1.9
0	45	1.9
5	50	2.1
5	50	2.1
5	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
0	55	2.3
5	55	2.3
5	55	2.3
5	60	2.5
0	60	2.5
0	60	2.5
0	60	2.5
5	60	2.5
0	55	2.3
0	55	2.3
5	60	2.5
5	65	2.7
5	70	2.9
5	70	2.9
0	65	2.7

Carl Rose & Sons Visual Emmissions Run 3
Actuals, Six Minute Sums and Six Minute Averages

0	60	2.5
5	60	2.5
5	65	2.7
0	60	2.5
5	60	2.5
0	55	2.3
0	55	2.3
0	55	2.3
5	60	2.5
0	60	2.5
0	55	2.3
0	50	2.1
5	50	2.1
0	50	2.1
0	50	2.1
0	50	2.1
0	45	1.9
0	45	1.9
0	45	1.9
0	40	1.7
0	35	1.5
0	30	1.3
0	25	1.0
0	25	1.0
5	30	1.3
5	30	1.3
5	30	1.3
5	35	1.5
0	30	1.3
5	35	1.5
0	35	1.5
5	40	1.7
0	35	1.5
0	35	1.5
0	35	1.5
0	35	1.5
0	30	1.3
0	30	1.3
5	35	1.5
0	35	1.5
5	40	1.7
0	40	1.7
5	45	1.9
5	50	2.1
0	50	2.1
5	55	2.3
5	60	2.5
5	65	2.7
5	65	2.7
5	65	2.7
0	60	2.5
0	55	2.3
0	55	2.3
5	55	2.3
5	60	2.5
5	60	2.5

Carl Rose & Sons Visual Emmissions Run 3
Actuals, Six Minute Sums and Six Minute Averages

0	60	2.5
5	65	2.7
0	65	2.7
0	65	2.7
0	65	2.7
5	70	2.9
5	70	2.9
5	75	3.1
0	70	2.9
0	70	2.9
5	70	2.9
0	65	2.7
0	65	2.7
0	60	2.5
0	55	2.3
0	50	2.1

Appendix B

Field Data Sheets

pace INCORPORATED THE ASSURANCE OF QUALITY

AIR SAMPLING DEPARTMENT

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

Plant Carl Rose & Sons, Inc.

Date 5-20-92

Sampling location Baghouse Stack

Inside of far wall to outside of sampling port (X) 41"

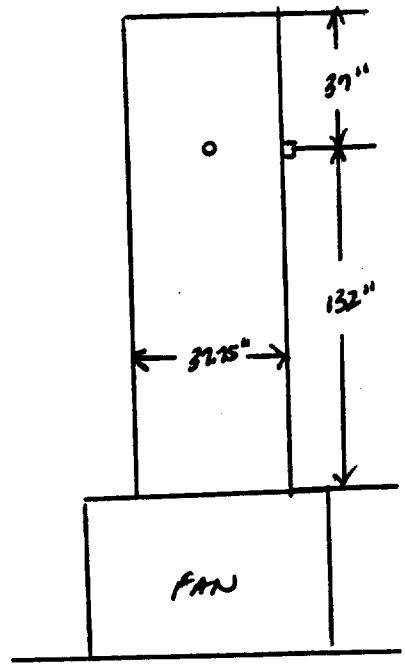
Inside of near wall to outside of sampling port (Y) 3.25"

Stack inside diameter (X-Y) 37.75"

Nearest upstream disturbance 0.98 DD 37"

Nearest downstream disturbance 3.50 DD 132"

Calculated by TEW



Traverse Point Number	Fraction Of Stack ID	Stack ID	Product of Columns 2 & 3 To Nearest .1	Nipple Length	Traverse Point Location From Outside of Nipple (Sum of Columns 4 & 5)
1	0.021	37.75	0.79	3.25	4.04
2	0.067	37.75	2.53	3.25	5.78
3	0.118	37.75	4.45	3.25	7.70
4	0.177	37.75	6.68	3.25	9.93
5	0.250	37.75	9.44	3.25	12.69
6	0.356	37.75	13.44	3.25	16.69
7	0.644	37.75	24.31	3.25	27.56
8	0.750	37.75	28.31	3.25	31.56
9	0.823	37.75	31.07	3.25	34.32
10	0.882	37.75	33.30	3.25	36.55
11	0.933	37.75	35.22	3.25	38.47
12	0.979	37.75	36.96	3.25	40.21

pace

METHOD 2 GAS VELOCITY AND CYCLONIC FLOW DETERMINATION

Plant and City Carl Rose & Sons, Inc. Run Date 5-20-92

Sampling Location Baghouse Stack Clock Time 0715

Run Number 1 Operator TEW/WRB Amb. Temp., °F 57

Bar. Press., in. Hg 29.17 Static Press., in. H_2O -1.10

Stack Press., in. Hg 29.089 Static Press., in. Hg -0.0809

Stack Dimension, in. - Diam. or side 1 36" side 2 —

Pitot Tube (C_p) .84 Pitot Tube Leak Check <0.1 @ 3.8 in. H_2O

Field data

Traverse point number	Position, in.	Velocity head (Δp_s), in. H_2O		Stack temp., °F		Cyclonic flow determination: Δp_s at 0° reference		Cyclonic flow determination: Angle (α) which yields a null Δp	
1	4.04	.97	1.05	258	280				
2	5.78	1.00	1.10	263	284				
3	7.70	1.20	1.15	269	283				
4	9.43	1.40	1.20	271	285				
5	12.69	1.50	1.30	275	285				
6	16.69	1.70	1.40	278	286				
7	22.56	1.70	1.70	280	288				
8	26.55	1.6	1.50	280	286				
9	34.55	1.5	1.40	278	285				
10	36.47	1.4	1.30	280	284				
11	38.47	1.3	1.10	280	284				
12	40.21	1.1	.95	270	280				
								Average angle (α)[a]	

[a] Average of (α) must be < 10 degrees to be acceptable.

NOMAGRAPH DATA

$\Delta H_@$ 1.90 T_m 85 %M 27 P_s/P_m 0.997 C 0.67 D_b 330 304 337 637

$\overline{\Delta p}$ 1.313 T_s 340 DN_c .232 DN_a .250 Ref. Δp 0.99 W_b 171 108 165 160

Db 340 287
Wb 160 150

pace

METHOD 5 PARTICULATE FIELD DATA

Plant: Carl Rose / Sonoco
Run No.: 1
Location: Baghouse Stack
Date: 5-20-92
Operator: TEW / WOA
Sample Box No.: 4
Meter Box No.: 1965
Filter No.: 1861
Probe No.: 4
Pilot Tube Cp: 0.84

Very Important — Fill In All Blanks
Leak Checks. Beg. @ 15" 0.002
End @ 8.0 0.002
Pilot Tube: 40.1 @ 6.3 "H2O
50.1 @ 5.2 "H2O
Static Pressure: -1.10 "H2O
Start: 1047
Finish: 1149
Observer: Randy Oakley, Agency: ACRETHOR

Bar. Press. "Hg: 29.17
Meter Box ΔH@: 1.90 Y = 1.00
Assumed Tm, °F: 85
Dry Bulb, °F: 280
Wet Bulb, °F: 160
Db - Wb, °F: 130
Assumed Moisture %: 22
Ps/Pm: 0.997
C Factor: 0.76

Ambient Temp., °F: 58
Heater Box Setting, °F: 250
Probe Tip Dia., in.: .205
Probe Length: 5 pyrex
Probe Heater Setting: 85%
Average Δp: 1.31 Δp: ~~0.76~~ 1.72
Average ΔH: ~~1.55~~ ΔH: Rel
Process Weight: 178.25
Steam Load: NA
Steam Pressure: NA

Point	Clock Time	Dry Gas Meter, Cu Ft	Pitot Manometer (Δp) in H2O	Orifice Manometer (ΔH) in H2O Desired	Orifice Manometer (ΔH) in H2O Actual	Dry Gas Temp °F Inlet	Dry Gas Temp °F Outlet	Pump Vacuum in Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Temp °F	% CO2	% O2
1	0	491.58	0.75	0.83	0.83	62	64	2.5	235	52	258		
2	2½	493.25	1.30	1.41	1.41	63	64	3.2	235	52	263		
3	5	494.80	1.40	1.52	1.52	65	64	3.5	250	52	269		
4	7½	496.49	2.10	2.35	2.35	68	64	5.5	250	52	271		
5	10	498.45	1.60	1.71	1.71	72	64	4.5	255	44	275		
6	12½	500.17	1.80	1.911	1.94	76	65	5.0	255	44	279		
7	15	502.03	1.80	1.94	1.94	77	66	5.0	255	44	280		
8	17½	504.11	1.60	1.71	1.71	80	66	4.5	265	46	280		
9	20	505.62	1.40	1.52	1.52	81	67	4.0	270	46	279		
10	22½	507.48	1.20	1.30	1.30	82	68	3.8	270	46	280		
11	25	508.81	1.05	1.14	1.14	84	69	3.2	225	48	280		
12	27½	510.79	0.95	1.03	1.03	82	70	3.0	225	48	270		
1	30/0	511.76	1.20	1.25	1.25	78	70	3.5	260	56	280		
2	2½	513.21	1.48	1.46	1.46	80	71	4.0	260	52	284		
3	5	514.80	1.50	1.53	1.53	81	71	4.2	260	52	283		
4	7½	516.47	1.45	1.48	1.48	83	72	4.2	270	52	285		
5	10	518.23	1.60	1.65	1.65	84	72	5.0	270	52	285		
6	12½	519.86	1.70	1.77	1.77	87	73	5.0	270	52	286		
7	15	521.65	1.70	1.77	1.77	87	74	5.0	270	52	288		
8	17½	523.47	1.50	1.53	1.53	87	74	4.8	270	52	286		
9	20	525.15	1.50	1.53	1.53	86	75	4.8	270	56	285		
10	22½	526.79	1.35	1.39	1.39	88	75	4.5	270	56	284		
11	25	528.46	1.10	1.13	1.13	88	76	4.0	270	58	284		
12	27½	529.91	1.10	1.13	1.13	90	76	4.0	270	58	280		
	30/60	531.36									278.9		
		37.38	27.63	28.34	1.50	74.65							

nomograph change 25% m 0.72 RAP 1.41

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METHOD 5 PARTICULATE FIELD DATA

Plant: Carl Rose & Sons, Inc
Run No.: 2
Location: Baghouse Stack
Date: 5-20-92
Operator: TEW/WRB
Sample Box No.: 1
Meter Box No.: 1965
Filter No.: 178
Probe No.: 1
Pilot Tube Cp: .84

Very Important — Fill In All Blanks
Leak Checks. Beg. @ 15": <0.002
End @ 10": 0.002
Pilot Tube: <0.1 @ 6.0 "H₂O
<0.1 @ 4.4 "H₂O
Static Pressure: -1.10 "H₂O
Start: 1317
Finish: 1421
Observer: Randy OAQ Agency: OAQ DEHNR

Bar. Press. "Hg: 29.17
Meter Box ΔH@: 1.90 Y = 1.00
Assumed Tm, °F: 85
Dry Bulb, °F: 280
Wet Bulb, °F: 155
Db - Wb, °F: 125
Assumed Moisture %: 23
Ps/Pm: 0.997
C Factor: 0.24

Ambient Temp., °F: 68
Heater Box Setting, °F: 250
Probe Tip Dia., in.: .308
Probe Length: 5' pyrex
Probe Heater Setting: 85%
Average ΔP: 1.31 ΔP: 1.77
Average ΔH: 1.40 ΔH: Rel
Process Weight: 179.85 tons
Steam Load: NA
Steam Pressure: NA

Point	Clock Time	Dry Gas Meter, Cu Ft	Pilot Manometer (Δp) In H₂O	Orifice Manometer (ΔH) In H₂O Desired	Orifice Manometer (ΔH) In H₂O Actual	Dry Gas Temp °F Inlet	Dry Gas Temp °F Outlet	Pump Vacuum In Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Temp °F	% CO_2	% O_2
A 1	0	531.55	~~1.60~~ 1.78	~~1.68~~ 0.83	~~1.68~~ 0.83	72	72	4.0	230	54	279		
2	2½	533.00	1.50	1.57	1.57	75	74	5.0	230	54	281		
3	5	534.36	1.70	1.80	1.80	76	74	6.0	235	54	282		
4	7½	535.99	1.80	1.90	1.90	78	74	6.2	240	54	282		
5	10	537.98	1.80	1.90	1.90	82	75	6.5	255	56	283		
6	12½	539.83	1.50	1.57	1.57	86	75	6.8	265	56	284		
7	15	541.61	1.55	1.63	1.63	86	76	6.2	275	56	285		
8	17½	543.27	1.40	1.49	1.49	90	76	6.0	275	56	284		
9	20	544.94	1.30	1.38	1.38	92	77	6.0	270	58	285		
10	22½	546.53	1.15	1.21	1.21	94	78	5.5	270	58	285		
11	25	548.06	1.00	1.06	1.06	95	79	5.0	250	58	281		
12	27½	549.43	0.95	1.00	1.00	92	80	5.0	250	58	281		
B 1	30/0	550.79	0.97	1.03	1.03	90	80	5.0	245	56	282	stop 1351	1½ min
2	2½	552.23	1.20	1.27	1.27	90	81	5.0	270	54	280		
3	5	553.72	1.20	1.27	1.27	92	81	5.5	270	54	281		
4	7½	555.29	1.30	1.38	1.38	93	81	6.0	250	48	287		
5	10	556.97	1.40	1.49	1.49	94	82	6.0	250	48	287		
6	12½	558.66	1.50	1.57	1.57	95	82	6.2	250	48	287		
7	15	560.71	1.65	1.73	1.73	100	83	6.8	250	50	289		
8	17½	562.26	1.60	1.68	1.68	101	84	6.8	250	50	289		
9	20	564.08	1.50	1.57	1.57	102	84	6.5	250	50	286		
10	22½	565.85	1.30	1.38	1.38	100	84	6.5	250	50	285		
11	25	567.55	1.10	1.16	1.16	101	85	5.8	250	52	284		
12	27½	569.15	1.10	1.16	1.16	102	85	5.8	250	52	282		
	30/60	570.55									283.8		
		~~568.8~~ 39.00	27.67	51	1.42	85							

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METHOD 5 PARTICULATE FIELD DATA

Plant: Carl Rose + Sons, Inc.
Run No.: 3
Location: Baghouse Stack
Date: 5-20-92
Operator: TEW / WRB
Sample Box No.: 7
Meter Box No.: 1965
Filter No.: 182
Probe No.: 2
Pitot Tube Cp: .84

Very Important — Fill In All Blanks
Leak Checks. Beg. @ 15": 0.002
End @ 6": 0.010
Pitot Tube: <0.1 @ 5.2 "H₂O
<0.1 @ 6.0 "H₂O
Static Pressure: -1.10 "H₂O
Start: 1452
Finish: 1555
Observer: Randy Oakley Agency: DCDEHR

Bar. Press. "Hg: 29.17
Meter Box ΔH@: 1.80 Y = 1.00
Assumed Tm, °F: 85
Dry Bulb, °F: 250
Wet Bulb, °F: 155
Db - Wb, °F: 125
Assumed Moisture %: 23
Ps/Pm: 0.997
C Factor: 0.74

Ambient Temp., °F: 75
Heater Box Setting, °F: 250
Probe Tip Dia., in.: 0.298
Probe Length: 5' pyrex
Probe Heater Setting: 85%
Average ΔP: 1.31 ΔP: 1.77
Average ΔH: 1.40 ΔH: Rel
Process Weight: 181.81 tons
Steam Load: NA
Steam Pressure: NA

Point	Clock Time	Dry Gas Meter, Cu Ft	Pitot Manometer (ΔP) in H₂O	Orifice Manometer (ΔH) in H₂O Desired	Orifice Manometer (ΔH) in H₂O Actual	Dry Gas Temp °F Inlet	Dry Gas Temp °F Outlet	Pump Vacuum in Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Temp °F	% CO_2	% O_2
A 1	0	580.67	1.10	1.16	1.16	90	88	3.0	225	60	283		
2	2½	582.25	1.30	1.38	1.38	92	88	3.0	230	55	285	down	3½
3	5	583.82	1.40	1.49	1.49	94	88	3.5	240	50	279		
4	7½	585.49	1.40	1.49	1.49	97	88	3.5	240	50	283		
5	10	587.21	1.50	1.57	1.57	98	88	3.8	240	50	282		
6	12½	588.92	1.65	1.73	1.73	97	88	4.5	250	52	285		
7	15	590.76	1.70	1.80	1.80	96	88	4.5	250	52	285		
8	17½	592.75	1.65	1.73	1.73	98	88	5.0	250	54	288		
9	20	594.47	1.40	1.49	1.49	102	88	4.2	265	54	287		
10	22½	596.18	1.30	1.38	1.38	101	88	4.0	265	56	289		
11	25	597.84	1.05	1.11	1.11	101	88	3.5	265	58	282		
12	27½	599.33	1.05	1.11	1.11	101	88	3.5	275	58	281		
B 1	30/0	600.79	1.10	1.16	1.16	98	87	3.5	250	56	284		
2	2½	602.27	1.20	1.27	1.27	98	88	3.5	250	56	283		
3	5	603.82	1.30	1.38	1.38	98	88	4.5	250	56	284		
4	7½	605.61	1.30	1.38	1.38	100	88	4.5	265	54	283		
5	10	607.21	1.40	1.49	1.49	102	89	4.8	265	54	289		
6	12½	608.95	1.60	1.68	1.68	103	89	5.5	265	54	288		
7	15	610.78	1.60	1.68	1.68	106	90	5.5	260	54	287		
8	17½	612.59	1.60	1.68	1.68	108	90	5.5	260	56	283		
9	20	614.39	1.40	1.49	1.49	107	90	5.2	240	56	284		
10	22½	616.35	1.30	1.38	1.38	105	90	5.0	255	58	285		
11	25	617.28	1.05	1.11	1.11	102	90	4.5	255	58	282		
12	27½	619.34	1.05	1.11	1.11	102	91	4.5	255	60	281		
	30/60	~~620.84~~ 40.17	27.8012		1.43		93.5				284.4		

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METHOD 3 - ORSAT AND DRY MOLECULAR WEIGHT DETERMINATION

Plant Carl Rose & Sons Inc. Sample Location Baghouse Stack

Sample Type - Continuous ✓ Pump Leakfree @ 10" ? ✓

Oxygen Check 20.9% ± 0.1% 20.8 Fuel Type No. 2 Fuel Oil

Orsat Leak Check @ 4 min.: Pipet Levels - Leakfree ? ✓

Buret 14.0 - 14.0 = <0.2 ml ? ✓

Run No. 1 Sample Date 5-20-92 Ambient Temp. °F 60

Sampling Time (24 - hr clock) 1047-1149 Analysis By TEW

Gas \ Run	1 Actual	1 Net	2 Actual	2 Net	3 Actual	3 Net	Avg. %	Mult.	Molecular Wt. Dry lb/lb mole
CO_2	4.9	4.9	4.9	4.9	4.9	4.9	4.90	.44	2.156
O_2	18.9	14.0	18.9	14.0	18.9	14.0	14.00	.32	4.480
CO	18.9	0.0	18.9	0.0	18.9	0.0	0.00	.28	0.000
N_2	100	81.1	100	81.1	100	81.1	81.10	.28	22.708
								Total	29.344

$F_o = \frac{20.9 - \%O_2}{\%CO_2}$ = NA

Run No. 2 Sample Date 5-20-92 Ambient Temp. °F 65

Sampling Time (24 - hr clock) 1317-1421 Analysis By TEW

Gas \ Run	1 Actual	1 Net	2 Actual	2 Net	3 Actual	3 Net	Avg. %	Mult.	Molecular Wt. Dry lb/lb mole
CO_2	5.0	5.0	5.0	5.0	5.0	5.0	5.00	.44	2.200
O_2	18.9	13.9	18.9	13.9	18.9	13.9	13.90	.32	4.448
CO	18.9	0.0	18.9	0.0	18.9	0.0	0.00	.28	0.000
N_2	100	81.1	100	81.1	100	81.1	81.10	.28	22.708
								Total	29.356

$F_o = \frac{20.9 - \%O_2}{\%CO_2}$ = NA

Run No. 3 Sample Date 5-20-92 Ambient Temp. °F 70

Sampling Time (24 - hr clock) 1452-1555 Analysis By TEW

Gas \ Run	1 Actual	1 Net	2 Actual	2 Net	3 Actual	3 Net	Avg. %	Mult.	Molecular Wt. Dry lb/lb mole
CO_2	4.9	4.9	4.9	4.9	4.9	4.9	4.90	.44	2.156
O_2	18.8	13.9	18.9	14.0	18.9	14.0	13.97	.32	4.470
CO	18.8	0.0	18.9	0.0	18.9	0.0	0.00	.28	0.000
N_2	100	81.2	100	81.1	100	81.1	81.13	.28	22.716
								Total	29.342

$F_o = \frac{20.9 - \%O_2}{\%CO_2}$ = NA

Fuel type	F_o range
Coal:	
Anthracite and lignite	1.016-1.130
Bituminous	1.083-1.230
Wood	1.000-1.120
Wood bark	1.003-1.130

METHOD 5 SAMPLE RECOVERY AND INTEGRITY SHEET

Plant Carl Rose & Sons, Inc.
Sample Location Baghouse Stack

Recovered By WGB
Recovered Date 5-21-92

Run Number	1	2	3
Sample Date	5-20-92	5-20-92	5-20-92
Sample Box Number	4	1	7
Probe Number	4	1	2
Filter Number	181	178	182

MOISTURE RECOVERY

Impingers Cont. Number	1	2	3
Description of Water	cloudy	cloudy	cloudy
Liquid Level Marked	✓	✓	✓
Final Volume (wt.), ml	438	426	420
Initial Volume (wt.), ml	200	200	200
Net Volume (wt.), ml (g)	238	226	220
Silica Gel Cont. Number	1-1	1-2	1-3
Silica Gel % Spent	20	20	20
Final Weight, g	315.0	311.0	319.0
Initial Weight, g	300.0	300.0	300.0
Net Volume (wt.), ml (g)	15.0	11.0	19.0
Total Moisture, g	253.0	237.0	239.0

PARTICULATE RECOVERY

Filter Cont. Number	181	178	182
Particulate Description	Heavy Tan	Heavy Tan	Heavy Tan
Filter Cont. Sealed	✓	✓	✓
Final Weight, mg	706.3	716.6	726.2
Final Weight Audit, mg	705.8	716.6	726.4
Initial Weight, mg	494.4	493.4	490.3
Initial Weight Audit, mg	494.5	493.5	490.0
Filter Blank, mg	-0.60	-0.60	-0.60
Filter Catch, mg	211.0	222.55	235.55
Probe Rinse Cont. Number	13	16	23
Liquid Level Marked	✓	✓	✓
Final Weight, mg	102421.2	110920.6	106039.4
Final Weight Audit, mg	102421.4	110920.6	106039.5
Initial Weight, mg	102326.7	110852.4	106017.3
Initial Weight Audit, mg	102326.8	110852.0	106017.3
Less Acetone Blank, mg	0.5	0.5	0.5
Acetone Rinse Catch, mg	94.05	67.90	69.45
Total Particulate, mg	305.05	290.45	305.20
Acetone Blank Number	D		
Final Weight, mg	103861.6		
Final Weight Audit, mg	103861.6		
Initial Weight, mg	103861.2		
Initial Weight Audit, mg	103861.0		
Acetone Residue, mg	0.5		
Acetone Volume, ml	150		
Concentration, mg/mg	4.2E-6		

LABORATORY CUSTODY

Received By: T. Wyan
Date Received: 5-21-92
Stored & Locked: ✓
Remarks: none

Appendix C

Process Data

Carl Rose and Sons Production Weights

Run 1	178.25 tons
Run 2	179.35 tons
Run 3	181.81 tons

Ave 179.80 TPH

74.6% capacity

Appendix D

Laboratory Results

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REPORT OF LABORATORY ANALYSIS

Carl Rose & Son, Inc.
P.O. Box 786
Elkin, NC 28621

May 28, 1992
PACE Project Number: 620520590

Attn: Mr. Dean Rose

Client Reference: Air Analyses

PACE Sample Number:			92 0059492	
Date Collected:			05/20/92	
Date Received:			05/21/92	
Client Sample ID:			Run 1	
Parameter	Units	MDL		DATE ANALYZED
INORGANIC ANALYSIS				
PARTICULATES				
Filter				
Front Half	mg	0.1	211.00	05/27/92
Total Particulate	mg	0.1	94.05	05/27/92
	mg	0.1	305.05	05/27/92

MDL Method Detection Limit

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REPORT OF LABORATORY ANALYSIS

Mr. Dean Rose
Page 2

May 28, 1992
PACE Project Number: 620520590

Client Reference: Air Analyses

PACE Sample Number:			92 0059506	
Date Collected:			05/20/92	
Date Received:			05/21/92	
Client Sample ID:			Run 2	
Parameter	Units	MDL		DATE ANALYZED
INORGANIC ANALYSIS				
PARTICULATES				
Filter				
Front Half	mg	0.1	222.55	05/27/92
Total Particulate	mg	0.1	67.90	05/27/92
	mg	0.1	290.45	05/27/92

PACE Sample Number:			92 0059514	
Date Collected:			05/20/92	
Date Received:			05/21/92	
Client Sample ID:			Run 3	
Parameter	Units	MDL		DATE ANALYZED
INORGANIC ANALYSIS				
PARTICULATES				
Filter				
Front Half	mg	0.1	235.55	05/27/92
Total Particulate	mg	0.1	69.65	05/27/92
	mg	0.1	305.20	05/27/92

MDL Method Detection Limit

These data have been reviewed and are approved for release.

Charles M. Cabaniss
Manager, Inorganic Chemistry

9800 Kincey Avenue, Suite 100
Huntersville, NC 28078
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Appendix E

Test Participants

Quentin Best Manager, Field and Air	PACE, Incorporated
Tom Wynn Project Manager	PACE, Incorporated
Dale Mace Air Sampling Technician	PACE, Incorporated

Appendix F

Sampling and Analytical Procedures

Appendix G

Calibration Data

pace, INCORPORATED THE ASSURANCE OF QUALITY

CALIBRATION INFORMATION

NOZZLES

Each new set of nozzles purchased by PACE are first machined and calibrated before being put into field use. Thereafter, whenever it becomes apparent that a nozzle has been damaged, it is again machined and recalibrated. A set of three is matched to within 0.002 inches (Difference between high and low readings). Nozzles are checked prior to each source test.

PILOT TUBES

All pitot tubes used by PACE whether separate or attached to a sampling probe were made by PACE personnel. Prior to being put into field use, they are calibrated. In general, if a type "S" pitot tube is constructed properly, and not positioned too closely to the probe nozzle or any other obstruction, it will have a Cp of 0.83 - 0.87. As long as the pitot tube is not damaged its calibration should not change. All PACE pitot tubes are made to have a Cp of 0.84. If a pitot tube does not initially have a Cp of 84, it is altered until a reading of 0.84 is obtained. Pitot tubes are checked before each source test and receive a complete calibration once a year.

DRY GAS METER AND ORIFICE METER

Complete meter box calibrations are performed annually. One point calibrations at the average orifice meter and maximum vacuum readings encountered during the compliance test are performed after each source test. If the dry gas meter calibration factor differs from 1.00 by more than + - 0.02 then the dry gas meter is repaired and given an annual calibration.

THERMOMETERS, FYRITES, ORSAT AND ORSAT BAGS

Each new thermometer, pyrometer and thermocouple purchased or manufactured by PACE is checked and calibrated before being put into field use. After each source test each temperature sensing device used on the test receives a one point calibration check according to U.S. EPA guidelines.

LABORATORY EQUIPMENT

PACE has a written quality assurance document that covers calibration and maintenance of laboratory equipment. This includes calibration of the analytical balance against Class S weights, and service contracts to maintain traceability to N.B.S. Calibration of thermometers, barometers, stopwatches and wet test meters are traceable to N.B.S. A copy of our quality assurance document may be obtained by written request.

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PRETEST - POSTEST CALIBRATION CHECKS

Plant Carl Rose & Sons, Inc. Calibrated by TEW
Meter box number 1965 Date 5-19-92

Dry Gas Meter

Pretest meter calibration factor, Y = 1.00 (within ± 2%)
Postest meter calibration factor, Y = 1.04 (within ± 5% of pretest)
Recalibration required? Circle one: yes or no If yes new Y = —
Lower cal. factor, Y = — for calculations (pretest or postest)

Dry Gas Meter Thermometers

Was a pretest temperature correction used? Circle one: yes or no If yes temperature correction — (within ± 5.4°F over range)
Postest comparison with mercury-in-glass thermometer? (within ±10.8°F at ambient temperature) Recalibration required? Circle one: yes or no
Recalibration temperature correction? — (within ±5.4°F over range
If yes, no correction necessary for calculations if meter thermometer temperature is higher; if calibration temperature is higher, add correction to average meter temperature for calculations

Stack Temperature Sensor

Was a pretest temperature correction used? Circle one: yes or no If yes temperature correction — °F (within ±1.5% in °R over range)
Average stack temperature of compliance test, 742.38 °R
Temperature of ref. thermometer for recalibration #1 740 #2 — °R
(within ± 10% of the average stack temperature)
Temperature of stack thermometer for recalibration #1 739 #2 — °R
Diff. between ref. and stack thermometer temps. #1 1 #2 — °R
Do the ref. and stack values agree within ±1.5%? Circle one: yes or no
If yes, no correction is necessary for calculations
If no, calculations must be done twice—once with the recorded values and once with the average stack temperature corrected to correspond to the reference temperature differential; both final result values must be reported since there is no way to determine which is correct

Barometer

Was the pretest field barometer reading correct? Circle one: yes or no
Postest comparison? 0.00 in. Hg (±0.1 in. Hg) Recalibration required? Circle one: yes or no If yes, no correction necessary for calculations when the field barometer has a lower reading; if the mercury-in-glass reading is lower, subtract the difference from the field data readings for the calculations.

	Pretest	Postest
Hg in glass	29.55	29.27
Field	29.54	29.24
Difference	0.01	0.01

Nozzle

Was the nozzle calibrated to the nearest .001 in.? Circle one: yes or no

Nozzle #1:	0.207	0.208	0.208	0.207	0.209	: Average .208
Nozzle #2:	0.207	0.208	0.208	0.207	0.209	: Average .208
Nozzle #3:	0.207	0.208	0.208	0.207	0.209	: Average .208

Impinger Thermometer

Was a pretest temperature correction used? Circle one: yes or no If yes temperature correction — (within ±5.4°F over range)

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PRETEST - POSTEST THERMOMETER CALIBRATION

Client Carl Rose & Sons Date 5-19-92

Location Baghouse Stack Ref. Thermometer 5

Thermometer	Pretest Temp., °F	Pretest Ref. Temp., °F	Postest Temp., °F	Postest Ref. Temp., °F
DGM # 1965 IN	74	74	73	73
DGM # 1965 OUT	74	74	74	73
DGM # 1709 IN	74	74	73	73
DGM # 1709 OUT	74	74	73	73
Impinger #1	74	74	73	73
Impinger #2	74	74	74	73
Impinger #3	74	74	72	73
Impinger #4	—	—	—	—
Impinger #5	—	—	—	—
WB #	—	—	—	—
DB #	—	—	—	—
Box #1	74	74	73	73
Box #2	—	—	—	—
Box #3	—	—	—	—
Box #4	74	74	73	73
Box #5	—	—	—	—
Box #B7	73	74	72	73
WB Omega 873	74	74	73	73
DB Omega 873	74	74	73	73
WB Omega #HH-2	74	74	73	73
DB Omega #HH-2	74	74	73	73
Probe 5' #1	73	74	73	73
Probe 5' #2	—	—	—	—
Probe ' #1	—	—	—	—
Probe ' #2	—	—	—	—

pace

POSTEST DRY GAS METER CALIBRATION DATA FORM (English Units)

Test Number 1 Date 5-21-92 Meter Box No. 1965 Plant Carl Rose & Sons Inc.

Barometric Pressure, P_b = 29.22 in. Hg Dry Gas Meter No. 1965 Pretest Y 1.00

Orifice manometer setting, inches H_2O ΔH	Gas Volume: Wet test meter, ft³ V_w	Gas Volume: Dry gas meter, ft³ V_d	Temperature: Wet test meter, °F t_w	Temperature: Dry Gas Meter: Inlet °F t_{d_i}	Temperature: Dry Gas Meter: Outlet °F t_{d_o}	Temperature: Dry Gas Meter: Average °F t_d	Time min. θ	Vacuum setting in. Hg	Y_i	Y_i $\frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$
1.45	10	10.18	74	114.5	90.5	102.5	14.94	5.9	1.03	$\frac{10(29.22)(102.5+460)}{10.18(29.22+1.45/13.6)(74+460)}$
1.45	10	10.19	74	117.5	94.5	106.0	15.28	5.9	1.04	$\frac{10(29.22)(106.0+460)}{10.19(29.22+1.45/13.6)(74+460)}$
1.45	10	10.17	74	118.0	95.5	106.75	15.33	5.9	1.04	$\frac{10(29.22)(106.75+460)}{10.17(29.22+1.45/13.6)(74+460)}$

$\bar{Y}$ = 1.04

V_w = Gas volume passing through the wet test meter, ft.³

V_d = Gas volume passing throught the dry gas meter, ft.³

t_w = Temperature of the gas in the wet test meter, °F

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F

ΔH = Pressure differential across orifice, in. H_2O

Y_i = Ratio of acturacy of wet test meter to dry gas meter for each run

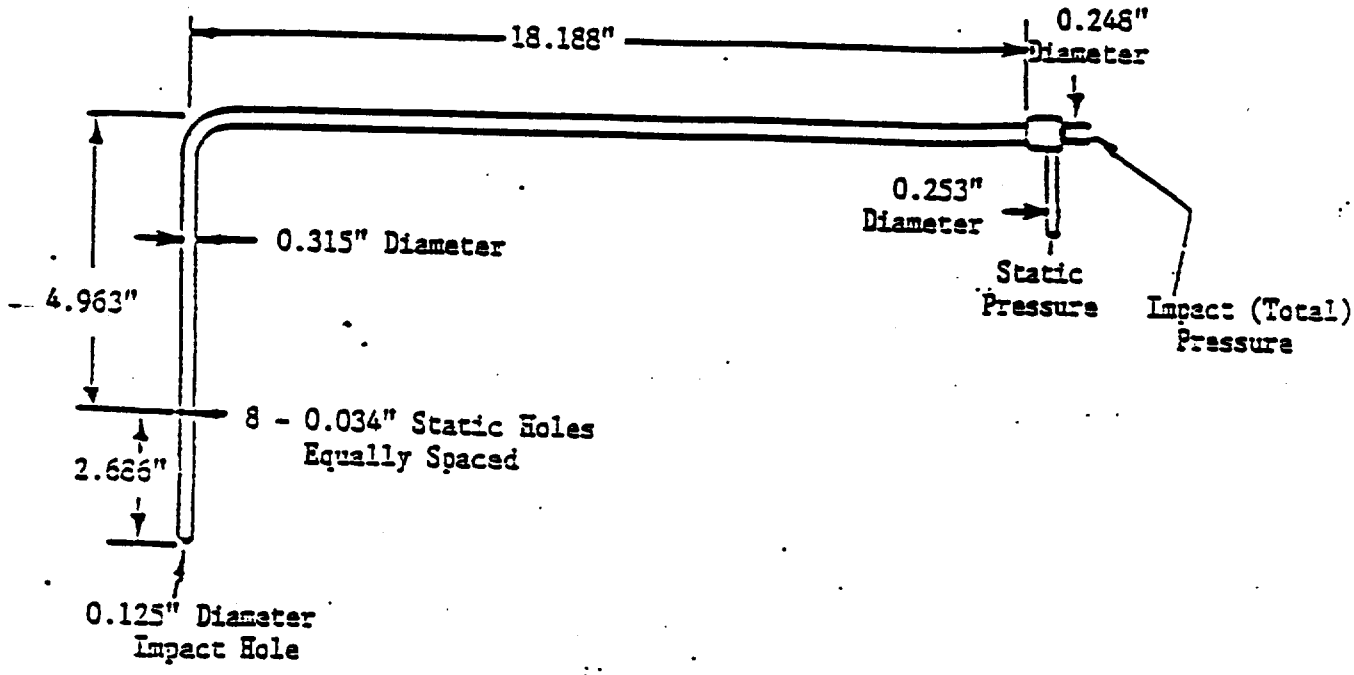
Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest $Y \pm 0.05Y$

P_b = Barometric pressure, in. Hg

θ = Time of calibration run, min.

Standard Pitot Tube Calibration

Serial # 160 - 18 - 1



2.7.1	Hemispherical Tip
2.7.2	8.53 Diameters
2.7.3	15.76 Diameters
2.7.4	0.034"
2.7.5	90° curved bend

pace. INCORPORATED

RAC STAKSAMPLR CALIBRATION SHEET

Meter Box Serial Number: 1965 Barometric Pressure (P_b): 29.370

Leak Check @ 6.7 in. H_2O: OK
Pump: OK
Manometers: OK
Lights: OK
Vacuum Gauge: OK

Date: 11-08-91
Pump Oil: OK
Dry Test Meter: OK
Electrical Check: OK
Leak Check @ 27" Hg.: <0.001 CFM

Calibrated by: TEW
Clean Quick Connects: OK
Thermometers: OK
Variac: OK

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d ave.	Time t
0.5	5	5.25	70.5	106.5	94.0	100.25	12.83
1.0	5	5.31	70.5	108.0	94.0	101.00	9.30
1.5	10	10.67	70.5	112.0	94.0	103.00	15.27
2.0	10	10.71	70.5	115.0	95.0	105.00	13.40
3.0	10	10.72	70.5	117.0	96.0	106.50	11.04
4.0	10	10.72	70.5	119.0	97.0	108.00	9.62

Calculate Y and $\Delta H_@$ as follows:

$$Y = \frac{CF_w P_b (T_{d\ ave.} + 460)}{CF_d (P_b + \Delta H/13.6)(T_w + 460)} = 1.00 \qquad \Delta H_@ = \frac{0.0317\ \Delta H}{P_b (T_d + 460)} \left(\frac{(T_w + 460)\ t}{CF_w}\right)^2 = 1.90$$

Tolerances: $Y = 0.90 - \underline{1.00} - 1.10\ Y +/- 0.02Y$ $\quad \Delta H_@ = 1.6 - \underline{1.85} - 2.1$ $\quad \Delta H_{@i} +/- 0.15$ in.

CALIBRATION CALCULATIONS PUMP AND ORIFICE METER

Manometer Delta H 0.5 in. H_2O

$$Y = \frac{5 \times 29.370\ (100.25 + 460)}{5.25\ (29.370 + 0.0368)(70.5 + 460)} = 1.004 \qquad \Delta H_@ = \frac{0.01585}{29.370\ (100.25 + 460)} \left(\frac{(70.5 + 460)\ 12.83}{5}\right)^2 = 1.784$$

Manometer Delta H 1.0 in. H_2O

$$Y = \frac{5 \times 29.370\ (101.00 + 460)}{5.31\ (29.370 + 0.0737)(70.5 + 460)} = 0.994 \qquad \Delta H_@ = \frac{0.03170}{29.370\ (101.25 + 460)} \left(\frac{(70.5 + 460)\ 9.30}{5}\right)^2 = 1.873$$

Manometer Delta H 1.5 in. H_2O

$$Y = \frac{10 \times 29.370\ (103.00 + 460)}{10.67\ (29.370 + 0.1103)(70.5 + 460)} = 0.993 \qquad \Delta H_@ = \frac{0.04755}{29.370\ (103.00 + 460)} \left(\frac{(70.5 + 460)\ 15.27}{10}\right)^2 = 1.887$$

Manometer Delta H 2.0 in. H_2O

$$Y = \frac{10 \times 29.370\ (105.00 + 460)}{10.71\ (29.370 + 0.1471)(70.5 + 460)} = 0.993 \qquad \Delta H_@ = \frac{0.06340}{29.370\ (105.00 + 460)} \left(\frac{(70.5 + 460)\ 13.40}{10}\right)^2 = 1.931$$

Manometer Delta H 3.0 in. H_2O

$$Y = \frac{10 \times 29.370\ (106.50 + 460)}{10.72\ (29.370 + 0.2206)(70.5 + 460)} = 0.995 \qquad \Delta H_@ = \frac{0.09510}{29.370\ (106.50 + 460)} \left(\frac{(70.5 + 460)\ 11.04}{10}\right)^2 = 1.961$$

Manometer Delta H 4.0 in. H_2O

$$Y = \frac{10 \times 29.370\ (108.00 + 460)}{10.72\ (29.370 + 0.2941)(70.5 + 460)} = 0.997 \qquad \Delta H_@ = \frac{0.12680}{29.370\ (108.00 + 460)} \left(\frac{(70.5 + 460)\ 9.62}{10}\right)^2 = 1.980$$

pace. INCORPORATED THE ASSURANCE OF QUALITY

TYPE S PITOT INSPECTION DATA FORM

Date: 12-05-91
By: DMM

Specifications:

1.) Pitot tube assembly must be level.
2.) If pitot tube is damaged explain under comments section.
3.) z = A sin Y (<0.125) and w = A sin O (<0.03125)
4.) a <10° and B <5°

I.D.	a_1°	a_2°	B_1°	B_2°	Y°	O°	A, in.	z, in.	w, in.	P_A, in.	P_B, in.	D_t, in.
32"- 1	1.5	2.0	4.5	3.0	6.0	1.0	0.687	0.072	0.01199	0.343	0.344	0.349
36"- 1	2.0	2.0	2.0	1.5	1.5	1.5	1.148	0.030	0.03005	0.574	0.574	0.378
36"- 2	8.0	3.0	0.5	1.5	2.5	0.5	1.442	0.063	0.01258	0.721	0.721	0.381
54"- 1	3.5	3.5	3.5	3.5	0.5	0.5	0.920	0.008	0.01287	0.460	0.460	0.370
66"- 1	3.0	1.0	3.0	1.5	0.5	1.0	1.040	0.009	0.01815	0.520	0.520	0.357
92"- 1	3.5	1.5	0.0	4.5	4.5	0.0	0.865	0.067	0.00000	0.432	0.433	0.366
3'- 1	0.5	2.0	0.0	2.5	1.0	0.5	1.052	0.018	0.00918	0.526	0.526	0.375
3'- 2	1.0	3.5	1.5	2.5	0.0	0.5	1.045	0.000	0.00912	0.523	0.522	0.379
3'- 3	0.5	0.5	1.0	0.5	0.5	1.0	1.044	0.009	0.01822	0.522	0.522	0.378
4'- 1	2.0	3.5	4.0	1.0	2.5	1.5	0.929	0.041	0.02087	0.464	0.465	0.381
4'- 2	3.5	1.5	0.5	2.5	1.5	0.5	0.912	0.024	0.00796	0.456	0.456	0.383
4'- 3	3.0	0.0	0.0	3.5	0.5	0.5	0.858	0.007	0.00749	0.429	0.429	0.381
4'- 4	2.0	7.0	4.5	3.5	1.5	1.5	0.834	0.022	0.01497	0.417	0.417	0.379
4'- 5	3.5	3.5	0.0	3.0	0.0	1.0	0.859	0.000	0.01494	0.438	0.438	0.380
4'- 6	2.5	1.5	3.5	1.0	0.5	0.5	0.952	0.008	0.00831	0.476	0.476	0.383
5'- 1	3.0	1.5	2.0	2.0	2.0	1.0	1.003	0.035	0.01751	0.501	0.502	0.376
5'- 2	1.0	1.0	1.5	2.0	1.5	0.5	1.056	0.027	0.00922	0.528	0.528	0.378
5'- 3	0.5	1.0	1.5	2.5	2.5	1.0	1.048	0.046	0.01829	0.524	0.524	0.377
5'- 4	2.0	0.0	0.5	2.5	3.0	0.5	1.032	0.054	0.00904	0.516	0.516	0.378
6'- 1	3.0	0.5	1.5	1.0	1.0	0.5	0.998	0.017	0.00871	0.499	0.499	0.377
6'- 2	0.5	0.5	2.5	0.5	1.5	1.0	1.013	0.029	0.01768	0.506	0.507	0.378
6'- 3	3.0	1.0	2.5	2.0	1.0	0.5	1.008	0.018	0.00880	0.504	0.504	0.379
6'- 4	1.5	0.0	0.0	0.0	1.5	1.5	1.004	0.026	0.02618	0.502	0.502	0.377
8'- 1	1.5	2.5	3.0	3.0	3.0	1.5	0.834	0.044	0.02183	0.417	0.417	0.359
8'- 2	5.5	1.5	1.5	3.0	0.0	2.5	0.981	0.000	0.04279	0.490	0.491	0.384
8'- 3	0.5	1.5	1.5	3.5	0.0	2.5	0.935	0.000	0.04078	0.467	0.468	0.380
8'- 4	0.0	4.5	1.5	1.5	2.0	1.0	1.014	0.035	0.01769	0.507	0.507	0.381
8'- 5	3.0	1.0	4.5	1.5	2.0	0.5	0.873	0.030	0.00762	0.436	0.437	0.369
8'- 6	3.5	2.0	2.5	2.0	2.0	0.0	0.922	0.032	0.00000	0.461	0.461	0.373
8'9"	1.0	0.5	1.5	2.0	3.0	0.5	0.894	0.047	0.00780	0.447	0.447	0.378
9'7"-1	1.5	2.5	1.5	1.5	0.0	0.0	0.927	0.000	0.00000	0.463	0.464	0.383
9'7"-2	2.0	5.5	2.5	4.0	0.0	2.0	0.935	0.000	0.04078	0.467	0.468	0.381
12'6"	1.5	1.5	2.5	2.5	0.0	0.5	0.809	0.000	0.00705	0.405	0.404	0.377

Comments: Only minor filing and cleaning needed.

Pitot tubes requiring furthering calibration: None.

pace. INCORPORATED

SAMPLE BOX
TEMPERATURE SENSOR CALIBRATION DATA FORM
TOLERANCE: +/- 5.4 F

DATE: 05/29/91
AMBIENT TEMPERATURE, F : 72
CALIBRATOR: DMM

BAROMETRIC PRESSURE: 29.32
REFERENCE THERMOMETER # 5

REFERENCE POINT #		SOURCE	REFERENCE THERMOMETER TEMPERATURE,F	THERMOCOUPLE POTENTIOMETER TEMPERATURE,F	TEMPERATURE DIFFERENCE, %
SAMPLE BOX					
#1	A.	oil bath	150	152	-.33
	B.	oil bath	200	202	-.30
	C.	oil bath	220	222	-.29
	D.	oil bath	260	268	%-1.11
	E.	oil bath	280	285	-.68
#2	A.	oil bath	150	150	0.00
	B.	oil bath	200	201	-.15
	C.	oil bath	220	225	-.74
	D.	oil bath	260	270	%-1.39
	E.	oil bath	280	278	0.27
#3	A.	oil bath	150	150	0.00
	B.	oil bath	200	200	0.00
	C.	oil bath	220	223	-.44
	D.	oil bath	260	270	%-1.39
	E.	oil bath	280	283	-.41
#4	A.	oil bath	150	145	0.82
	B.	oil bath	200	195	0.76
	C.	oil bath	220	220	0.00
	D.	oil bath	260	255	0.69
	E.	oil bath	280	278	0.27
#5	A.	oil bath	150	148	0.33
	B.	oil bath	200	190	1.52
	C.	oil bath	220	210	1.47
	D.	oil bath	260	250	1.39
	E.	oil bath	280	270	1.35
#6	A.	oil bath	150	147	0.49
	B.	oil bath	200	200	0.00
	C.	oil bath	220	221	-.15
	D.	oil bath	260	260	0.00
	E.	oil bath	280	285	-.68
#7	A.	oil bath	150	150	0.00
	B.	oil bath	200	195	0.76
	C.	oil bath	220	220	0.00
	D.	oil bath	260	260	0.00
	E.	oil bath	280	280	0.00

pace. INCORPORATED

PROBE THERMOCOUPLE
TEMPERATURE SENSOR CALIBRATION DATA FORM
TOLERANCE: +/- 5.4 F

DATE: 05/29/91
AMBIENT TEMPERATURE, F : 72
CALIBRATOR: TEW

BAROMETRIC PRESSURE: 29.31
REFERENCE THERMOMETER # 5

REFERENCE POINT #		SOURCE	REFERENCE THERMOMETER TEMPERATURE,F	THERMOCOUPLE POTENTIOMETER TEMPERATURE,F	TEMPERATURE DIFFERENCE, %
	PROBE #				
4'1	A.	oil bath	110	110	0.00
	B.	oil bath	204	205	-.15
	C.	oil bath	350	351	-.12
4'2	A.	oil bath	110	110	0.00
	B.	oil bath	204	204	0.00
	C.	oil bath	350	351	-.12
5'1	A.	oil bath	100	101	-.18
	B.	oil bath	200	203	-.45
	C.	oil bath	345	353	-.99
5'2	A.	oil bath	100	101	-.18
	B.	oil bath	200	203	-.45
	C.	oil bath	345	350	-.62
6'1	A.	102	102	101	0.18
	B.	oil bath	201	203	-.30
	C.	oil bath	348	351	-.37
6'2	A.	oil bath	102	103	-.18
	B.	201	205	205	0.00
	C.	oil bath	348	355	-.87
8'1	A.	oil bath	102	104	-.36
	B.	oil bath	202	205	-.45
	C.	oil bath	350	358	-.99
8'2	A.	oil bath	104	109	-.89
	B.	oil bath	202	204	-.30
	C.	oil bath	350	354	-.49
8'3	A.	oil bath	102	102	0.00
	B.	oil bath	202	205	-.45
	C.	oil bath	350	351	-.12
8'9"	A.	oil bath	104	106	-.35
	B.	oil bath	204	207	-.45
	C.	oil bath	351	356	-.62
9'7"	A.	oil bath	104	107	-.53
	B.	oil bath	204	207	-.45
	C.	oil bath	351	351	0.00
12'6"	A.	oil bath	124	123	0.17
	B.	oil bath	249	249	0.00
	C.	oil bath	352	353	-.12

$$\text{TEMPERATURE DIFFERENCE} = \frac{(\text{REF TEMP, F} + 460) - (\text{TEST TEMP, F} + 460)}{\text{REF TEMP, F} + 460} \times 100 <= 1.5\%$$

pace INCORPORATED

IMPINGER
TEMPERATURE SENSOR CALIBRATION DATA FORM
TOLERANCE: +/- 5.4 F

DATE: 05/29/91
AMBIENT TEMPERATURE, F : 72
CALIBRATOR: DMM

BAROMETRIC PRESSURE: 29.32
REFERENCE THERMOMETER # 22

REFERENCE POINT #		SOURCE	REFERENCE THERMOMETER TEMPERATURE, F	THERMOCOUPLE POTENTIOMETER TEMPERATURE, F	TEMPERATURE DIFFERENCE, %
IMPINGER					
#1	A.	ice bath	36	38	-.40
	B.	water bath	72	74	-.38
	C.	water bath	110	106	0.70
	D.	water bath	100	102	-.36
#2	A.	ice bath	36	34	0.40
	B.	water bath	72	72	0.00
	C.	water bath	110	107	0.53
	D.	water bath	100	103	-.54
#3	A.	ice bath	36	36	0.00
	B.	water bath	72	72	0.00
	C.	water bath	110	109	0.18
	D.	water bath	100	107	%-1.25
#4	A.	ice bath	36	38	-.40
	B.	water bath	72	68	0.75
	C.	water bath	110	103	1.23
	D.	water bath	100	98	0.36
#5	A.	ice bath	36	36	0.00
	B.	water bath	72	72	0.00
	C.	water bath	110	108	0.35
	D.	water bath	100	101	-.18

$$\text{TEMPERATURE DIFFERENCE} = \frac{(\text{REF TEMP, F} + 460) - (\text{TEST TEMP, F} + 460)}{\text{REF TEMP, F} + 460} \times 100 <= 1.5\%$$

pace INCORPORATED

METER BOX
TEMPERATURE SENSOR CALIBRATION DATA FORM
TOLERANCE: +/- 5.4 F

DATE: 05/29/91
AMBIENT TEMPERATURE, F : 72
CALIBRATOR: DMM

BAROMETRIC PRESSURE: 29.32
REFERENCE THERMOMETER # 5

REFERENCE POINT #		SOURCE	REFERENCE THERMOMETER TEMPERATURE, F	THERMOCOUPLE POTENTIOMETER TEMPERATURE, F	TEMPERATURE DIFFERENCE, %
METER BOX					
1264A	A.	ice bath	35	36	-.20
	B.	water bath	70	69	0.19
	C.	oil bath	122	120	0.34
	D.	oil bath	170	169	0..16
1264B	A.	ice bath	35	36	-.20
	B.	water bath	70	70	0.00
	C.	oil bath	123	124	-.17
	D.	oil bath	171	172	-.16
1348A	A.	ice bath	35	34	0.20
	B.	water bath	70	70	0.00
	C.	oil bath	125	127	-.34
	D.	oil bath	171	171	0.00
1348B	A.	ice bath	35	36	-.20
	B.	water bath	70	70	0.00
	C.	oil bath	126	128	-.34
	D.	oil bath	171	170	0.16
1401A	A.	ice bath	35	36	-.20
	B.	water bath	70	70	0.00
	C.	oil bath	128	128	0.00
	D.	oil bath	172	173	-.16
1401B	A.	ice bath	35	34	0.20
	B.	water bath	70	71	-.19
	C.	oil bath	129	131	-.34
	D.	oil bath	172	172	0.00
1965A	A.	ice bath	35	34	0.20
	B.	water bath	70	69	0.19
	C.	oil bath	130	130	0.00
	D.	oil bath	172	174	-.32
1965B	A.	ice bath	35	35	0.00
	B.	water bath	70	70	0.00
	C.	oil bath	134	136	-.34
	D.	oil bath	172	173	-.16

$$\text{TEMPERATURE DIFFERENCE} = \frac{(\text{REF TEMP, F} + 460) - (\text{TEST TEMP, F} + 460)}{\text{REF TEMP, F} + 460} \times 100 <= 1.5\%$$

WALTER H. KESSLER COMPANY, INC.

THERMOMETERS KESSLER HYDROMETERS

ONE-SIXTY HICKS STREET • WESTBURY, LONG ISLAND, NEW YORK • 516 EDGEWOOD 4-4064

MANUFACTURERS CERTIFICATE OF CALIBRATION

This is to certify that the instrument listed below has been tested in our temperature calibration laboratory in accordance with the latest procedures in the finest constant temperature equipment available, against National Bureau of Standards certified master standards.

Certified for: Fisher Scientific Company

Description: Thermometer #15-041D -1/201°C in 0.2° Div Total Immersion

Instrument Serial No. 811 007 Date Certified: January 30, 1981

Reading of This Instrument	Reading of N.B.S. Standard (True Temperature)
+0.02C	0.00C
20.00C	20.00C
40.00C	40.00C
59.96C	60.00C
79.98C	80.00C
100.02C	100.00C
119.92C	120.00C
139.98C	140.00C
160.00C	160.00C
180.00C	180.00C
199.86C	200.00C

The tabulated readings apply provided the ice-point reading taken after exposure for not less than 3 days to a temperature of about 25° C (77° F) is +0.02C . If the ice-point reading is found to be higher (or lower) than stated, all other readings will be higher (or lower) by the same amount.

Serial & Test numbers of National Bureau of Standards certified instruments referenced in certification of the thermometer listed above:

NBS Standard M44165,78A-227,M44451,78A-220,78A-601/602

NBS Test No 176240,219883,176240,219883,219606

WALTER H. KESSLER COMPANY, INC.

Irene Ciulla

KIMBLE GLASS INC.
a unit of Owens-Illinois

June 21, 1991

Mr. Paul R. Jenkins
PACE, Incorporated
1700 University Commercial Place
Charlotte, North Carolina 28212

REF: CALIBRATION OF VOLUMETRIC GLASSWARE

Dear Mr. Jenkins,

Volumetric standards, utilized by Kimble for calibration of class A and B laboratory glassware, are designed to meet applicable calibration requirements of ASTM Standard E 542.

Accuracy of balances, weights and thermometers employed for calibration of volumetric standards is traceable to National Bureau of Standards.

Sincerely,

Lew Horan

Lew Horan
Standards Dept.

cc: Mr. N. DeBello - Q.A.

Crystal Avenue Vineland, New Jersey 08360-0230 (609) 692-3600
Fax Numbers: 609-794-8762 (Lab Sales/Main Office)
609-692-6447 (Manufacturing & Service)
609-696-8075 (Corporate)

Corning Incorporated
Science Products Division
Corning, New York 14831
USA
607.974.9000

CORNING

June 12, 1991

Mr. Paul Jenkins
Pace, Inc.
1700 University Commercial Place
Charlotte, NC 28213

Dear Mr. Jenkins:

This is to confirm that our volumetric apparatus is calibrated in conformance with ASTM Standard E 542.

Very truly yours,

Allen R. Fuller
Product Engineering Supervisor
Senior Associate

Whatman

Whatman

Laboratory Division

Whatman inc
9 Bridewell Place,
Clifton, New Jersey 07014
Telephone: 201-773-5800
Fax: 201-472-6949 Telex: 133425
Cable: WHATMAN

CERTIFICATE OF CONFORMITY

GRADE : EPM 2000

This is to certify that the above product conforms to Whatman Standard Specifications.

J A Gilbert
QC Inspector

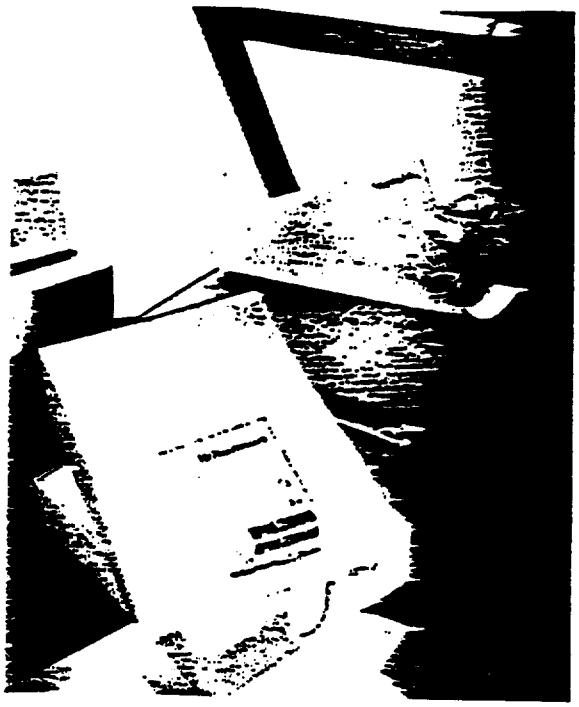
M C Lacey
Divisional Quality Manager - Europe

25th June 1991

Whatman
AIR POLLUTION FILTERS

TECHNICAL DATA ON

EPM 2000 AIR SAMPLING FILTERS



SELECTED AS THE EPA STANDARD

EPM 2000 is the new Whatman filter which has been specifically developed for use in high volume air samplers, and has been chosen by the EPA for its technical excellence and overall suitability for use in the nationwide network of Hi-Vol air samplers. The high air flow rate and excellent particle retention characteristics make EPM 2000 the filter of choice for high volume sampling.

- Specifically developed for use with high volume air samplers.
- Chosen by the EPA for their National Air Surveillence Network (Contract No. 68-02-3709).
- Manufactured from 100% borosilicate glass microfibres under strictly controlled conditions.
- Retention efficiency 99.999% for NaCl particles, mass median 0.6 microns
- Heat-treated after manufacture to remove organic traces.
- No binder used in manufacture for maximum purity.
- Each sheet individually numbered for rapid identification and recording

EPM 2000 – THE STATE OF THE ART FILTER MEDIUM FOR HI-VOL AIR SAMPLING

Today, more than ever before, concern over the potential effects on human life of toxic particulates in the air, is running high. The sampling and analytical methods employed in the monitoring of air quality are becoming ever more sophisticated.

EPM 2000, as successor to the popular EPM 1000, has been developed to complement these methods as a technically advanced air filtration medium, suitable for both quantitative and qualitative measurements.

HIGH PURITY – HIGH PERFORMANCE

The EPA place specific requirements on the purity and performance of the glass microfibre filters which are used throughout their National Air Surveillence Network of pollution monitoring stations.

EPM 2000 is manufactured from 100% pure borosilicate glass microfibres, with no added binder, under strictly controlled conditions. Maximum purity is ensured by the use of heat treatment after manufacture to remove any traces of organic material which may interfere with subsequent analyses, and closely monitored quality assurance methods are employed. Detailed chemical analyses of trace pollutants can thus be carried out with utmost accuracy and minimum background interference.

EPM 2000 offers high flow rates while simultaneously providing exceptionally high particle retention efficiencies. Complete reliance can be placed on EPM 2000 to provide optimum results in airborne particulate collection.

Each 8" × 10" sheet of EPM 2000 is individually numbered for rapid identification and recording.

AVAILABILITY

Two sizes are available as standard

8" x 10" sheets (packs of 100) Cat. No. 1882 866

4.7 cm circles (packs of 100) Cat. No. 1882 047

PUBLICATION NO 888 EPM A

PROCEDURES

Air pollution monitoring is normally carried out by measurement at two stages to determine the general level of airborne pollution, and then to analyse the specific types and amounts of pollutants. The internationally standardized technique is to pass a high volume (approx 2000 m^3) of air through a filter for up to 24 hours. The filter is weighed before and after exposure to give the mass of particulate for a known volume of air and a calculated value for air pollution levels in $\mu g/m^3$ of air.

CONTROL TECHNIQUES

Before weighing each filter should be conditioned for 24 hours in a specific environment between 15°C and 35°C (± 1°C) and of relative humidity below 50%.

EPM 2000 is suited to all commercial high volume sampling apparatus and the usual sample of 2000 m^3 over 24 hours at an average flow rate of 1.7 m^3/min (60 ft^3/min) through the approximate 400 cm^2 area of filter exposed is well within the capability of the filter. It is recommended that the 8" × 10" filter should be installed rough side uppermost in the holder and handled carefully by the edges only. After sampling under carefully monitored air flow and time, the filter should be removed with care to prevent loss of particulate. It is usual to fold it in half lengthwise, the exposed sides together, for transport. The filter should be conditioned again for 24 hours before reweighing to determine the total weight of captured particulate.

Analyses most frequently carried out on the collected particulate are for metals (especially heavy and toxic elements), ammonium ions, fluoride ions, nitrate and sulfate, organic materials including hydrocarbons, and Beta activity.

TECHNICAL CHARACTERISTICS

(Typical values – subject to normal manufacturing tolerances)

Thickness (mean value in microns) 430

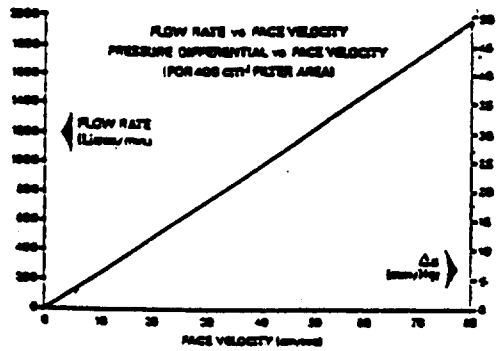
Retention efficiency (Sodium flame penetrometer at 5cm/sec fce velocity) .. 99.999%

Approx. equivalent DOP retention efficiency 99.99%

Tensile strength (1.5 cm strip – gms.) 700

Weight loss on ignition 0.2%

EPM 2000 FILTER FLOW RATE



CHEMICAL CHARACTERISTICS

Trace Element	Typical level* (micrograms per sheet)	Trace Element	Typical level* (micrograms per sheet)
Arsenic	5	Manganese	2
Beryllium	0.5	Molybdenum	2
Bismuth	20	Nickel	5
Cadmium	2	Lead	10
Cobalt	5	Antimony	2
Chromium	5	Tin	5
Copper	10	Titanium	2
Iron	50	Vanadium	2
		Zinc	100

*Typical values subject to manufacturing tolerances

Whatman

PAPER DIVISION

Whatman Laboratory Products Inc 9 Bridewell Place, Clifton, New Jersey 07014 USA Tel: (201) 773-5800 Telex: 133428

METTLER

Weight Traceability Certificate

To: PACE LABORATORY INC.
CHARLOTTE, NC.
28213

The balances listed below have been serviced by our representative on
DECEMBER 7, 1990

This is to certify that the test weights used are traceable to the National Institute of Standards and Technology.

	Analytical	Precision
METTLER identification number of test weights used:	389	123
METTLER calibration date of test weights used:	2-23-90	3-21-90
National Institute of Standards and Technology test number:	737/0620-MET49	737/0620-MET50

Model and serial number of balances serviced:

AK 160 # A44922	SARTORIUS # 3210437
AE 163 # C57742	SARTORIUS # 370704291
H54 # 677277	

METTLER Service Representative

12-7-90
Date of issue

OMEGA
PROCESS CONTROLS, INC.
A Division of OMEGA ENGINEERING, Inc.

One Omega Circle
Pureland Industrial Park
P.O. Box 336
Bridgeport, NJ 08014
(609) 467-4200

C E R T I F I C A T E O F C A L I B R A T I O N

f o r

PACE INCORPORATED
9800 KINCEY AVE, STE 100
HUNTERVILLE AL 28078

Cust PO# 922498
Omega WO# 205938207

Model# HH-2
Serial# 11756

C A L - 3

OMEGA Process Controls Inc. certify that the above instrumentation has been calibrated to meet or exceed the published specifications. This calibration was performed using instrumentation and standards that are traceable to the U.S. National Institute of Standards and Technology, and conforms to MIL-STD-45662A.

Readings Observed In: Deg F

STANDARD	AS RECEIVED	FINAL CAL
32	31	32
450	448	450
900	897	900

TEST EQUIPMENT	DATE LAST CAL'D	NIST TRACEABILITY
Reference DMM, S/N 3335019	05/06/92	245516
Decade Resistor, S/N 591	11/21/90	241457
Std Thermometer, S/N 1N756	04/15/92	248798

TEST CONDITIONS
Standard

CERTIFIED BY
Instrumentation Supervisor _____ Date: 5/13/92
John L. Howard

OMEGA PROCESS CONTROLS, INC.
A Division of OMEGA ENGINEERING, Inc.

One Omega Circle
Pureland Industrial Park
P.O. Box 336
Bridgeport, NJ 08014
(609) 467-4200

CERTIFICATE OF CALIBRATION

for

PACE INCORPORATED
9800 KINCEY AVE, STE 100
HUNTERVILLE AL 28078

Cust PO# 922498
Omega WO# 205938207

Model# 873F
Serial# 274307

CAL-3

OMEGA Process Controls Inc. certify that the above instrumentation has been calibrated to meet or exceed the published specifications. This calibration was performed using instrumentation and standards that are traceable to the U.S. National Institute of Standards and Technology, and conforms to MIL-STD-45662A.

Readings Observed In: Deg F

STANDARD	AS RECEIVED	FINAL CAL
0	01.6	00.0
190	191.8	190.0
1990	1992	1990

TEST EQUIPMENT	DATE LAST CAL'D	NIST TRACEABILITY
Reference DMM, S/N 3335019	05/06/92	245516
Decade Resistor, S/N 591	11/21/90	241457
Std Thermometer, S/N 1N756	04/15/92	248798

TEST CONDITIONS
Standard

CERTIFIED BY
Instrumentation Supervisor _____ Date: 5/13/92
John L. Howard

CERTIFICATE OF ACCURACY

AMERICAN METER

"DATA OBTAINED ON PROVER #1201 CERTIFIED ACCURATE USING ONE CUBIC FOOT BOTTLE AMCO #119 (NBS #4199)."

Customer Order Number PACE, INC.

Meter LARGE WET TEST s/n 63123

Working Pressure 14"WC psig

Mfg. Number 63123 thru

Test Pressure (air) psig

Accuracy @ 26 CFH 99.9% %

Accuracy @ 35 CFH 100.0 %

Accuracy @ 78 CFH 100.0 %

Accuracy @ 164 CFH 100.1 %

Bell Prover Number 1201

By Jerry Kamalich
Resident Engineer

Dated 4/17/92

AMERICAN METER COMPANY
Measurement Engineers Since 1836
WYUKA ROAD, NEBRASKA CITY, NEBRASKA
A SUBSIDIARY OF THE SINGER COMPANY