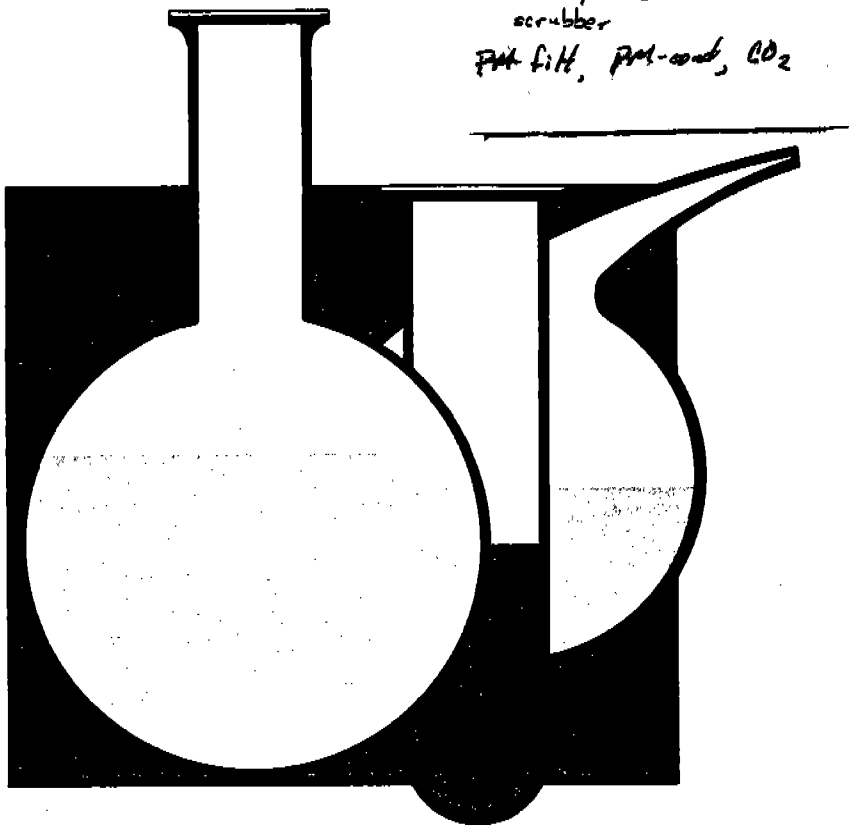
GUARDIAN SYSTEMS INC.

P.O. Box 300
Leeds, Alabama 35094
205/699-6647

3 runs on 1 coal-fired rotary kiln controlled by multicyclones and venturi scrubber
~~PM~~ filt, PM-cond, CO_2



Test Report

Allied Products Corporation
Lime kiln #2
Alabaster, Alabama
10/17-18/90
Compliance Test for State of Alabama

PARTICULATE EMISSION TESTS

CONDUCTED ON THE

UNIT #2 LIME KILN

IN

ALABASTER, ALABAMA

FOR

ALLIED PRODUCTS CORPORATION

ON

OCTOBER 17-18, 1990

APPROVED BY _____

Tom Lotz
Director, Field Services

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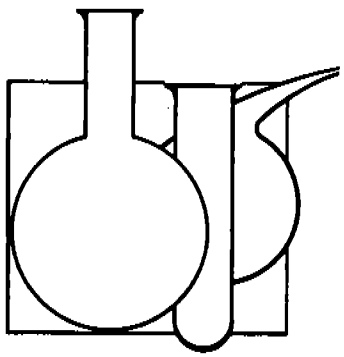
Introduction



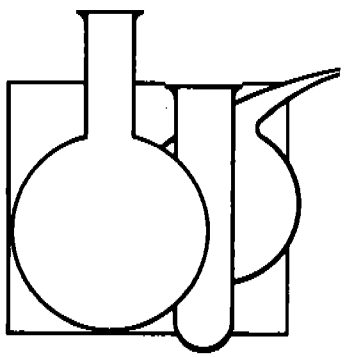
I. INTRODUCTION AND TEST DESCRIPTION

On October 17-18, 1990, Guardian Systems, Inc., performed a series of particulate emissions test on the #2 Rotary Lime Kiln Stack of Allied Products Company located near Alabaster, Alabama. These tests were conducted in accordance to the rules and regulations expressed in the Code of Federal Regulations, Title 40, Section 60, Reference Method 1-5 as amended.

Raw carbonate material moves through the heated revolving kiln to drive off carbon dioxide and form the lime product. The emissions from the kiln were passed through a multiclone to remove the larger particles, then through a venturi scrubber to remove the smaller ones prior to being vented to the atmosphere.

Mr. Joe Dial represented Allied Products Corporation, and is responsible for all production data. Mr. Mike Malaier of ADEM observed the first test. Mr. Johnny Morris and Mr. Lloyd Currin of Guardian Systems, Inc. performed these tests.

Test Results



II. SUMMARY OF TEST RESULTS

Table 1 is a summary of the test results on October 17-18, 1990 for the #2 Rotary Lime Kiln.. All production data was supplied by Allied Products personnel (See **Plant Operational Data**). The allowables were computed form the following formula found in 4-3 section 4.2.1 Class I counties of the Alabama Air Pollution Control Commission Rules and Regulations (ADEM).

$E = 3.59\ (P)^{.62}$ for P less than 30 tons/hour

Test Number	1	2	3	Composite
Process Weight, Tons/hr (Feed)	26.80	27.00	27.00	26.93
Particulate Mass Rate, #/hr	8.09	11.55	8.52	9.46
Allowable Mass Rate #/hr	27.58	27.70	27.70	27.66
% of Allowables	29	42	31	34

Process weight includes coal (~3 ton/h)

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Summarized Air Test Results for Allied Products

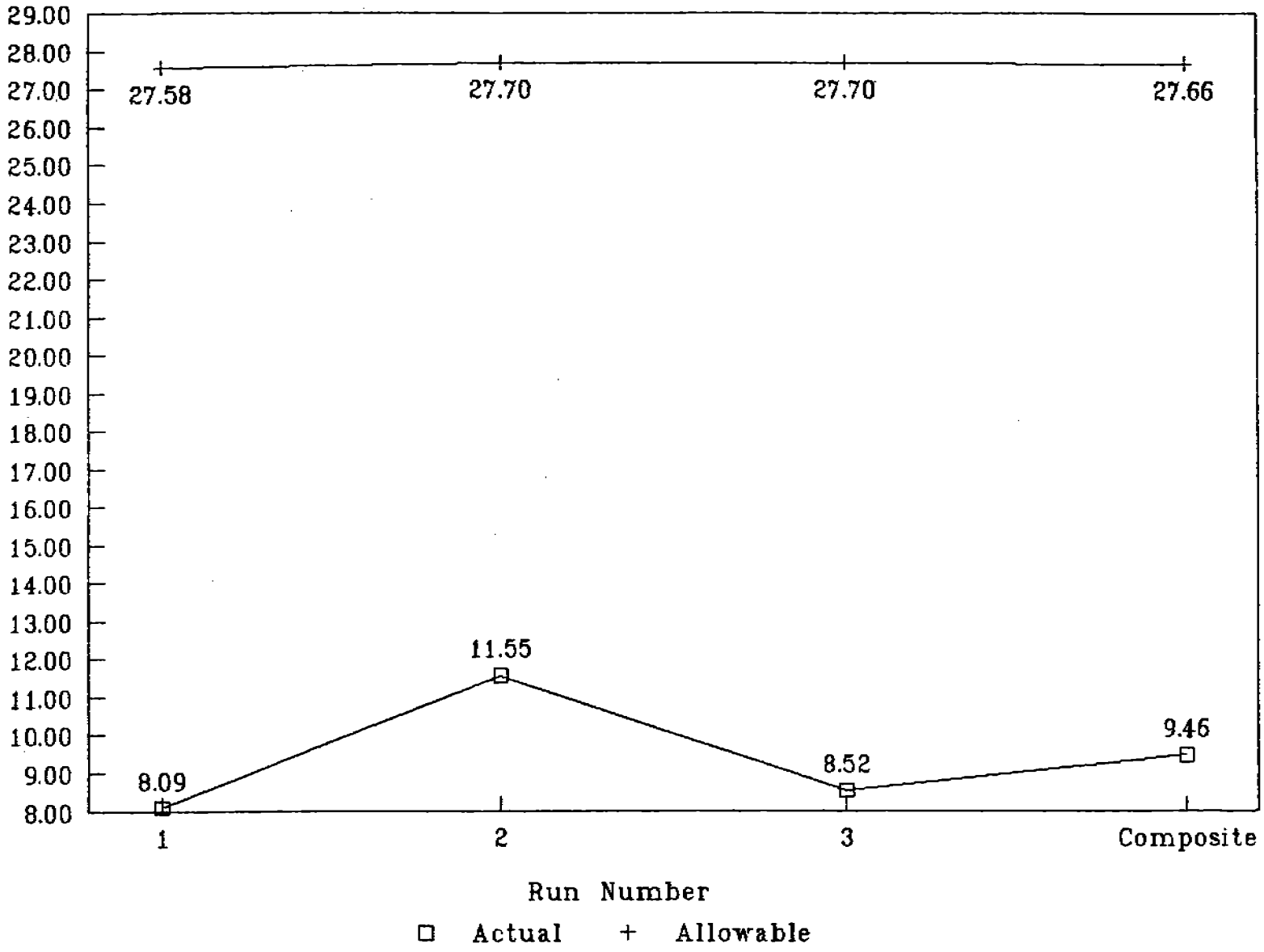
Run Number	1	2	3	Composite
Date	10/17/90	10/18/90	10/18/90	10/17-18/9
Location	Kiln #2	Kiln #2	Kiln #2	Kiln #2
Time	1238-1403	2138-2243	0957-1057	1238-1057
Stack Gas Temperature, F	137	140	144	140
Moisture Content, % v/v	16.50	18.28	17.81 ✓	17.54
Oxygen Content, % v/v	12.00	11.50	10.00	11.17
Carbon Dioxide Content, % v/v	13.00	14.00	14.00	13.67
Carbon Monoxide Content, % v/v	0.00	0.00	0.00	0.00
Excess Air, %	153.85	140.79	99.36	128.69
Stack Gas Velocity Feet per Second	42.88	43.18	42.41 ✓	43.13
Volumetric Flow Actual Cubic Feet per Minute	50,513	50,870	49,960 ✓	50,811
Volumetric Flow Dry Std Cubic Feet per Minute	36,979	36,278	35,592 ✓	36,536
Concentration Grains per Dry Std Cubic Ft	0.026	0.037	0.028 ✓	0.030
Concentration Grains per Actual Cubic Foot	0.019	0.026	0.020	0.022
Particulate Mass Rate, #/hr	8.09	11.55	8.52 ✓	9.46
Allowable Emission Rate, #/hr	27.58	27.70	27.70	27.66
% Isokinetic	101.08	104.72	103.61	102.38

10%
90 — 100 — 110

Table 1

ALLIED PRODUCTS KILN #2 EMISSIONS

On October 17-18, 1990



Particulate Emissions, #/hr

Graph 1

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Computer Input Parameters for Allied Products

Run Number	1	2	3	Composite
Date	10/17/90	10/18/90	10/18/90	10/17-18/9
Location	Kiln #2	Kiln #2	Kiln #2	Kiln #2
Time	1238-1403	2138-2243	0957-1057	1238-1057
Barometric Pressure, in Hg	29.69	29.70	29.70	29.70
Static Pressure, in H2O	-0.430	-0.410	-0.440	-0.427
Run Time, minutes	60.00	60.00	62.50	182.50
Meter Volume, CF	39.978	39.332	40.428	119.738
Meter Correction factor, MCF	1.0476	1.0476	1.0476	
Meter Volume (Corrected)	41.881	41.204	42.352	125.438
Stack Temperature, F	137	140	144	140
Meter Temperature, F	106	88	97	97
Meter Pressure, in H2O	1.68	1.64	1.58	1.63
Sqr Velocity Pressure	0.712	0.714	0.699	0.708
Mass of Particulate, mg	64.5	95.4	72.6	232.5
Ml of Water Collected	163.4	188.0	184.2	535.6
% Oxygen	12.00	11.50	10.00	11.17
% Carbon Dioxide	13.00	14.00	14.00	13.67
% Carbon Monoxide	0.00	0.00	0.00	0.00
Stack Area, Sq ft	19.635	19.635	19.635	19.635
Pitot Correction Factor	0.838	0.838	0.838	0.844
Nozzle Diameter, in	0.250	0.250	0.250	0.250
Feed Rate, Tons/hr	26.80	27.00	27.00	26.93
Venturi Pressure Drop, in H2O	17.5	17.5	17.5	17.5

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Computed Air Test Results for Allied Products

Run Number	1	2	3	Composite
Date	10/17/90	10/18/90	10/18/90	10/17-18/9
Location	Kiln #2	Kiln #2	Kiln #2	Kiln #2
Time	1238-1403	2138-2243	0957-1057	1238-1057
1. Stack Pressure				
Inches Hg	29.66	29.67	29.67	29.67
Millimeters Hg	753.32	753.61	753.56	753.50
2. Meter Pressure				
Inches Hg	29.81	29.82	29.82	29.82
Millimeters Hg	757.26	757.44	757.33	757.35
3. Meter Volume				
Dry Std Cubic Feet	38.930	39.568	40.008	118.496
Dry Std Cubic Meters	1.103	1.121	1.133	3.356
4. Water Volume				
Std Cubic Feet	7.691	8.849	8.670	25.211
Std Cubic Meters	0.218	0.251	0.246	0.714
5. Moisture Content, %	16.50	18.28	17.81	17.54
6. Molecular Weight Dry	30.56	30.70	30.64	30.63
7. Molecular Weight Wet	28.49	28.38	28.39	28.42
8. Stack Velocity				
Feet per Second	42.88	43.18	42.41	43.13
Meters per Second	13.07	13.16	12.93	13.15
9. Volumetric Flow				
Actual Cubic Ft per minute	50,513	50,870	49,960	50,811
Actual Cubic M per second	23.84	24.01	23.58	23.98
10. Volumetric Flow				
Dry Std Cubic Ft per minute	36,979	36,278	35,592	36,536
Dry Std Cubic M per second	17.45	17.12	16.80	17.24
11. Concentration				
Grains per Dry Std Cubic Ft	0.0255	0.0371	0.0279	0.0302
Grams per Dry Std Cubic M	0.0584	0.0850	0.0639	0.0691
12. Excess Air, %	153.85	140.79	99.36	128.69

G U A R D I A N * S Y S T E M S * I N C O R P O R A T E D
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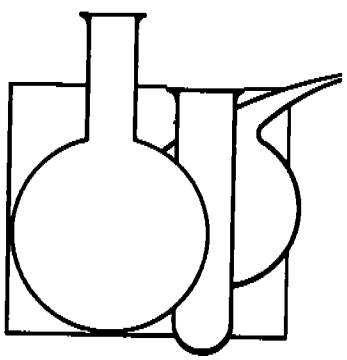
Computed Air Test Results for Allied Products

Run Number	1	2	3	Composite
Date	10/17/90	10/18/90	10/18/90	10/17-18/9
Location	Kiln #2	Kiln #2	Kiln #2	Kiln #2
Time	1238-1403	2138-2243	0957-1057	1238-1057
15. Particulate Mass Rate Pounds per Hour, #/hr	8.09	11.55	8.52	9.46
16. Volume at Nozzle Actual Cubic Feet	53.185	55.490	56.165	164.816
Actual Cubic Meters	1.506	1.571	1.591	4.668
17. Concentration Grains per Actual Cubic Ft	0.0187	0.0265	0.0199	0.0217
Grams per Actual Cubic M	0.0427	0.0606	0.0455	0.0497
18. Isokinetic, %	101.08	104.72	103.61	102.38

Sampling & Analytical Procedures



III. SAMPLING AND ANALYTICAL PROCEDURES

General

All sampling and analytical procedures for the determination of the particulate emissions from these sources were conducted in strict adherence with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 1-5 as amended. The sampling equipment used in these tests was manufactured by Research Appliance Corporation and was properly calibrated before these tests (See **Calibrations**). The particulate mass was determined gravimetrically after removal of uncombined water.

METHOD 1

This method was used to determine the number of sampling points and the required sampling matrix. The dimension of the sample location (see **Figure 1**) indicated that 24 points on two diameters would be required to sample the lime kiln. We sampled 24 points (12 per diameter). Verification of absence of cyclonic flow was not determined because cyclonic flow did not seem to exist from the stack.

METHOD 2

Velocity measurements were taken using a properly calibrated S type pitot tube and a 0-10.0 inch inclined vertical manometer, having 0.01 inch H_2O divisions on the 0 to 1 inch inclined scale, and 0.1 inch H_2O divisions on the 1 to 10 inch vertical scale.

METHOD 3

Gas composition for CO_2, O_2, and N_2 by difference was performed twice during each particulate test by using the grab sample technique and analyzed with a Fyrite Gas Analyzer (0-20% scale with 0.5% divisions).

METHOD 4

Moisture content of the stack gases was determined in conjunction with Method 5 for each test by measuring the amount of water collected in the impingers and condenser and the increase in

weight of the silica gel. These weights were combined to give the total amount of water collected.

METHOD 5

Sampling Techniques

Preliminary data was used to determine stack temperature, pressure, range of velocity heads, moisture content and stack gas dry molecular weight prior to sampling. A Radio Shack PC-4 computer and a TI-55 were used to calculate the sampling rate for isokinetic sampling. The particulate determinations were made by utilizing the sample train in **Figure 2.** The meter box was leak checked from the pump to the orifice and initial and final leak checks of the sampling system and pitot lines were performed as outlined in Method 5 and were recorded on the data sheets (See **Field Data**). The nozzle (stainless steel 316 with an angle of taper of 30 degrees and of button hook design) was calibrated before and after each test using a micrometer and was also recorded on the data sheets.

The gases were drawn through a stainless steel nozzle attached to a heated glass lined probe. The probe was maintained at the proper setting to obtain an exit temperature of 248 $\pm$ 25 ^{0} F (See **Calibrations**). The gases then pass through a glass fiber filter (Gelman, Class A) of 0.3 micron retention to remove particulate matter. The filter was maintained at a temperature of 248 $\pm$ 25 ^{0} F. These temperatures were recorded at each point on the data sheets.

The gases then pass through a condenser placed in an ice bath to maintain a maximum exit temperature of 68 ^{0} F. This temperature was also recorded on the data sheets. The gases then pass through a pre-weighed drying column filled with indicating silica gel to remove any remaining moisture. The clean and cool gases then entered the meter box where the gas flow and temperature were measured. (See **Field Data**)

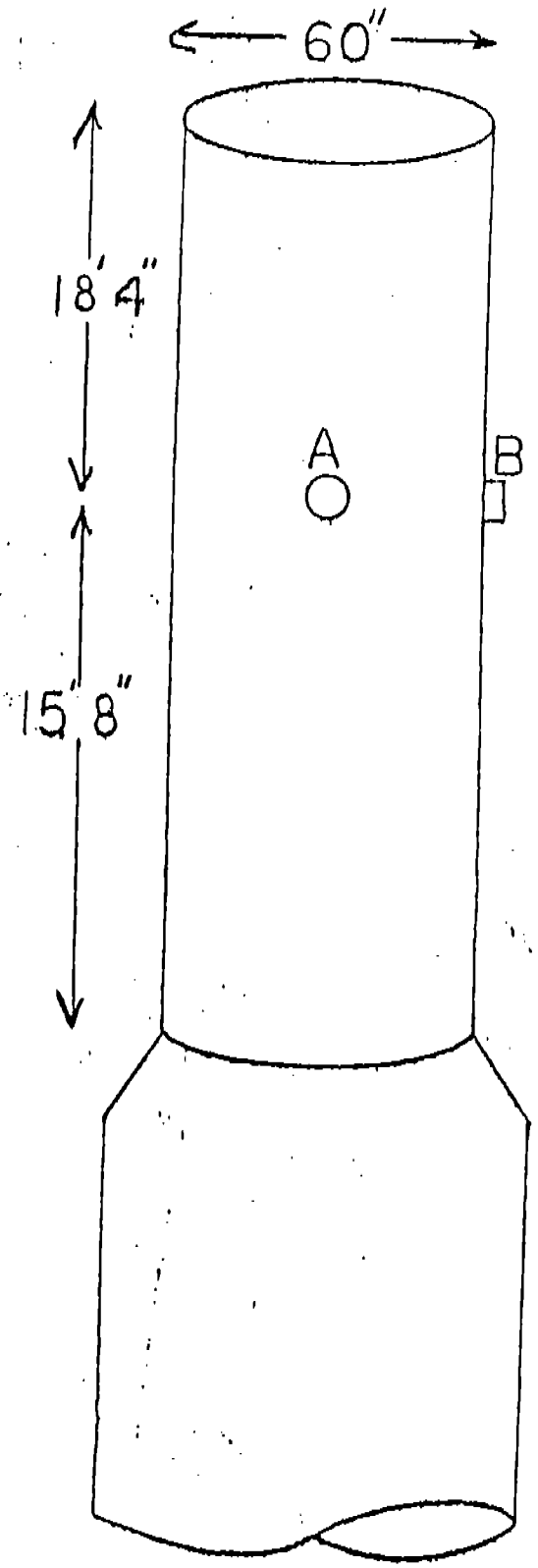
Upon completion of the sampling and the final leak checks, the sampling train and the probe nozzle assembly was transferred to the cleanup area making sure no particulate was lost. The cleanup data was recorded on **Particulate Sample Recovery and Integrity Sheet** located in the Field Data Section.

Particulate catches were placed in sealed petri dishes. Each acetone rinse from the nozzle, probe, and filter holder was combined and placed in a sealed container. For the group of tests an acetone blank of approximately 200 milliliters was placed in a sealed container. These containers were clearly marked and transported to our laboratory for analysis.

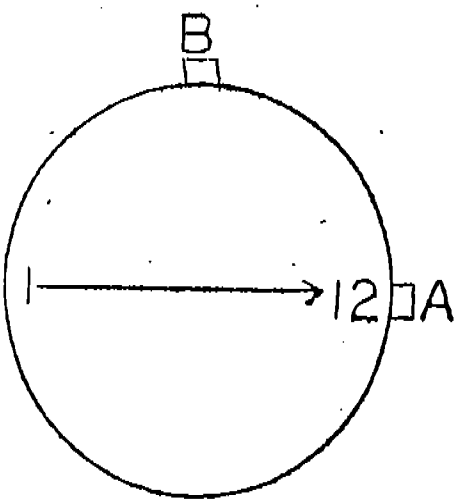
Analysis

The filters (Gelman, Class A, without organic binder, minimum 99.9% retention for particles of 0.3 microns as determined by DOP tests) were prepared for the field test by first heating for 2 hours 220 degrees F then desiccating at 68 $\pm$ 10 ^{0} F at ambient pressure for 24 hours and weighing at intervals of at least six (6) hours to a constant weight to the nearest 0.1 milligrams (less than 0.5 milligrams change from previous reading). Upon return to the laboratory, the filters were subjected to the same procedures as outlined above. The weights were recorded in a bound laboratory book and transferred to the sheets in this report (**Method 5 Train Analytical Particulate Data**). During each weighing the filter was not exposed to laboratory atmosphere for more than two (2) minutes and a relative humidity of less than fifty percent (50%).

The acetone (reagent grade, 0.001% residue, in glass bottles) blank (**Blank Analytical Data**) for the group of tests and the acetone rinses for each test were evaporated to dryness in tared glass beakers. They were then desiccated for twenty-four (24) hours and weighed to a constant weight as described above.

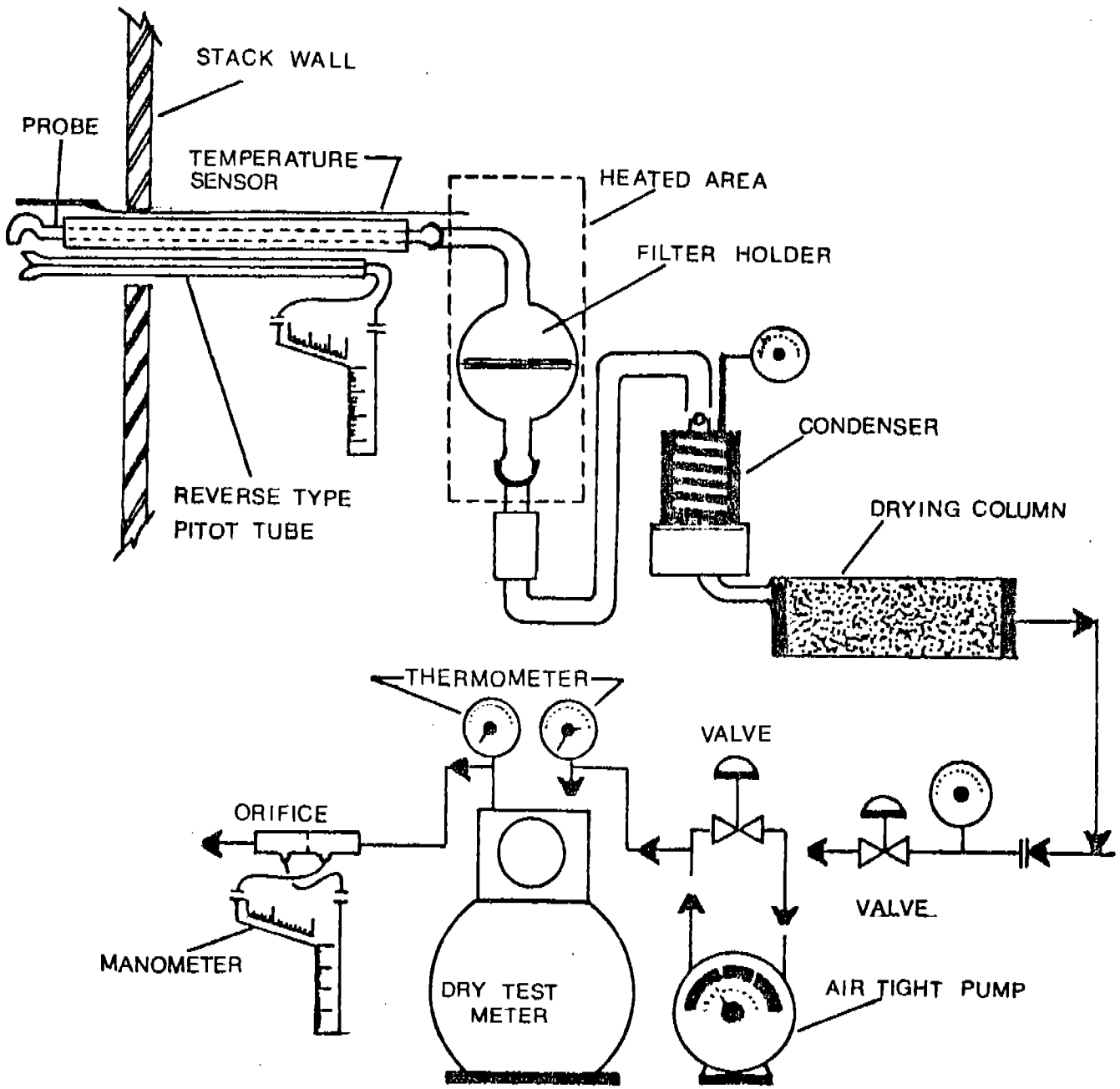


STACK BREECHING & SAMPLING LOCATION



POINT	DISTANCE TO WALL
1	5.3"
2	8.0"
3	11.1"
4	14.6"
5	19.0"
6	25.3"
7	42.7"
8	49.0"
9	53.4"
10	56.9"
11	60.0"
12	62.7"

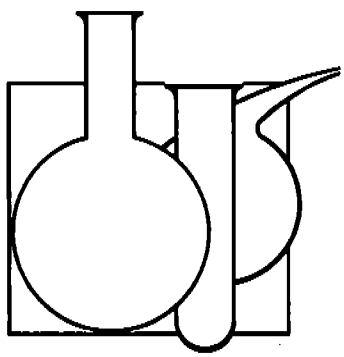
Figure 1



PARTICULATE SAMPLING TRAIN.. METHOD 5

Figure 2

Field Data



NOMENCLATURE

ACF - Actual Cubic Feet

ACFM - Actual Cubic Feet per minute

ACM - Actual Cubic Meters

ACMS - Actual Cubic Meters per second

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)

C_a - Acetone blank residue concentration, mg/g

c_a - Particulate Concentration, ACF

CFM - Cubic feet per minute

C_p - Pitot tube coefficient, (dimensionless)

c_s - Particulate Concentration, grains/DSCF

Cso_2 - Concentration of sulfur dioxide (dry basis) corrected to standard conditions, lb/DSCF

C_{12} - Particulate concentration (c_s adjusted to 12% excess air), grains/DSCF

C_{50} - Particulate concentration (c_s adjusted to 50% excess air), grains/DSCF

DSCF - Dry Standard Cubic Feet

DSCFM - Dry Standard Cubic Feet per minute

DSCM - Dry Standard Cubic Meters

DSCMS - Dry Standard Cubic Meters per second

EA - Excess Air, %

I - Isokinetic Sampling, %

Km - Orifice Correction Factor, (dimensionless)

Kp - Pitot tube constant, 85.49 $\frac{(lb/lb\text{-}mole)(in.Hg)^{1/2}}{(^0R)\ (in.\ H_2O)}$

NOMENCLATURE - continued

La - Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.02 CFM or 4 percent of the average sampling rate, whichever is less.

Li - Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change ($i = 1,2,3,...n$), CFM.

Lp - Leakage rate observed during the post test leak check, $ft^3/min.$ (cfm).

Ma - Mass of residue of acetone after evaporation, mg.

Md - Molecular weight of stack gas; dry basis, lb/lb-mole.

Mn - Total amount of particulate matter collected, mg.

Ms - Molecular weight of stack gas; wet basis, lb/lb-mole.

Mw - Molecular weight of water, 18.0g/g-mole(18.01lb/lb-mole)

ΔP - Velocity head of stack gas, in. H_2O

Pa - Density of acetone, mg/ml

Pbar - Barometric pressure at the sampling site, in. Hg

Pg - Stack static pressure, in. H_2O

Pm - Meter pressure, in. Hg

PMR - Particulate Mass Rate, lbs per hour

Ps - Absolute stack pressure, in. Hg

Pstd - Standard absolute pressure, 29.92 in. Hg

Pw - Density of water, 0.9982 g/ml (0.002201 lb/ml)

Qa - Volumetric flow rate, ACFM

Qs - Volumetric flow rate, DSCFM

R - Ideal gas constant, 0.06236 mm Hg - $m^3/^0K$-g-mole (21.85 in. Hg-$ft^3/^0R$-lb-mole)

SCF - Standard Cubic Foot

ta - Ambient Temperature, ^0F

NOMENCLATURE - continued

tm - Average Temperature of meter, ^0F

t_s - Average Temperature of stack, ^0F

tstd - Standard Temperature, 68^0F

NOTE: Capital "T" denotes degrees Rankin

Va - Volume of acetone blank, ml

Vaw - Volume of acetone used in wash, ml

Vlc - Total volume of liquid collected in condenser 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

Vm(std) - Volume of gas sample measured by the dry gas meter, corrected to standard conditions, DSCF

Vn - Volume collected at stack conditions through nozzle,ACF

Vs - Average stack gas velocity, ft/sec.

Vw(std) - Volume of water in the gas sample, corrected to standard conditions, SCF

Wa - Weight of residue in acetone wash, mg

Y - Dry gas meter calibration factor, (dimensionless)

ΔH - Average pressure differential across the calibrated orifice, in. H_2O

ΔH_a - Value of H measured for a specific orifice when operated under the following conditions: 0.75 cfm of dry air (M.W. = 29) at 68^0F, 29.92 in. Hg.

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

θ - Total Sampling time, min.

NOMENCLATURE - continued

$\theta 1$ - Sampling time interval from the beginning of a run until the first component change, min.

θi - Sampling time interval between two successive component changes, beginning with the interval between the first and second changes, min.

θp - Sampling time interval from the final (n^{th}) component change until the end of the sampling run, min.

$\%CO_2$, $\%O_2$, $\%N_2$, %CO - Number percent (%) by volume (dry basis) of each compound in the stack gas.

EQUATIONS

1.

$$P_s = P_{b_{ar}} + \frac{P_g}{13.6}$$

2.

$$P_m = P_{b_{ar}} + \frac{\overline{\Delta H}}{13.6}$$

3.

$$V_m(std) = V_m Y \left(\frac{Tstd}{Tm}\right) \left(\frac{P_m}{Pstd}\right)$$

4.

$$V_w(std) = 0.04707 V_{l_c}$$

5.

$$B_{w_s} = \frac{V_w(std)}{V_m(std) + V_w(std)}$$

6.

$$M_d = 0.440(\%CO_2) + 0.320(\%0_2) + 0.280(\%N_2 + \%CO)$$

7.

$$M_s = M_d(1 - B_{w_s}) + 18(B_{w_s})$$

8.

$$v_s = K_p C_p (\sqrt{\Delta p})\, avg. \sqrt{\frac{T_s}{M_s P_s}}$$

EQUATIONS - Continued

9.

$$Q_a = (v_s)(A_s)(60)$$

10.

$$Q_s = Q_a(1-B_{w_s})\left(\frac{528}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

11.

$$c_s = [0.0154(Mn/Vmstd)]$$

12.

$$EA = \left[\frac{\%O_2 - 0.5\%CO}{0.264\%N_2 - (\%O_2 - 0.5\%CO)}\right]100$$

13.

$$c_{s_0} = c_s/1 - \left[\frac{(1.5)(\%O_2) - 0.133(\%N_2) - 0.75(\%CO)}{21}\right]$$

14.

$$c_{1_2} = c_s\frac{12}{\%CO_2}$$

15.

$$PMR = (c_s)(Q_s)\left(\frac{60}{7000}\right)$$

EQUATIONS - Continued

16.

$$V_n = \frac{T_s}{P_s}\left[(0.002669)(V_{1_c}) + \frac{V_m}{T_m}(P_m)\right]$$

17.

$$C_a = (0.0154)(M_n)/V_n$$

18.

$$I = \frac{100V_n}{60v_s\theta An}$$

19.

$$V_{m_c} = V_m - (L_p - L_a)\theta$$

20.

$$W_a = CaVawP_a$$

EQUATIONS

Run # 1

1. $P_s = P_{bar} + (P_g/13.6)$ = (29.69) + (-.43)/13.6 = 29.66

2. $P_m = P_{bar} + (\Delta H/13.6)$ = (29.69) + (1.68)/13.6 = 29.81

3. $V_{m(std)} = V_m\ Y\ (T_{std}/T_m)(P_m/P_{std})$
= (35.578)(1.0476)(528/566)(29.81/29.92) = 38.596

4. $V_{w(std)} = 0.04707\ V_{lc}$ = 0.04707(163.) = 7.691

5. $B_{ws} = V_{w(std)}/(V_{m(std)} + V_{w(std)})$ = (7.691)/(7.691 + 38.596) = .1650

6. $M_d = 0.44\ \%CO_2 + 0.32\ \%O_2 + 0.28(\%N_2 + \%CO)$ =
.44(13) + .32(12) + .28(75) = 30.56

7. $M_s = M_d\ (1-B_{ws}) + 18(B_{ws})$ = (30.56)(1-.1650) +18(.1650) = 28.49
.835

8. $v_s = K_pC_p\ (\sqrt{\Delta p})\ \sqrt{(T_s/(M_sP_s))}$
= 85.49(.838)(.712) √(597/(29.66)(28.49)) = 42.87

9. $Q_a = v_s\ A_s\ (60)$ = (42.87)( )(60) = 50,5

(60/12)² π = 19.63

10. $Q_s = Q_a(1-B_{ws})(528/T_s)(P_s/29.92)$
= (50,50)(1-.835)(528/597)(29.66/29.92) = 36,973

11. $c_s = 0.0154(M_n/V_{m(std)})$ = 0.0154(/38.596) = .0255

15. PMR = $c_sQ_s(60/7000)$ = (.0255)(36,973)(60/7000) = 8.08

16. $V_n = T_s/P_s \times ((0.002669)V_{lc} + V_mP_m/T_m)$
= (597/29.66) ((0.002669)(163) + (35.578)(29.81)/(566))
= 53.176

18. $I = V_n(100)/((60)\theta v_sA_n)$ = 100(53.176)/(60(60)(42.17)(.000341))
= 101.52

GUARDIAN SYSTEMS inc

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.

BOX 300
LEEDS, ALABAMA 35094

PLANT Allied Zinc RUN # Run #1 Dup Run1

LOCATION Unit #2 DATE 10/17/90 10/17/90

BARO. PRES. 29.69 TIME 1238-1403 ΔH √ΔP K: 3.482

	TIME MIN	TIME DUR	METER VOL FT 3	STACK TEMP °F	METER TEMP °F IN	METER TEMP °F OUT	METER TEMP °F AVG	IMP TEMP °F	BOX TEMP °F	METER PRESSURE "H2O	VELOCITY PRESSURE "H2O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H2O -.43
			401.118	(1)	(2)	(3)			(5)				PROBE TIP SIZE BEFORE .250 AFTER .250
A 1	2.5	2.5	402.8	137	90	89	90	46	268	1.92	.60	0	.250 .250
2	5.0		404.5	138	94	80	87	46	269	1.97	.62	0	.250 .250
3	7.5		406.3	139	101	87	94	46	260	2.06	.64	0	
4	10.0		408.1	144	108	91	100	46	258	2.00	.62	0	
5	12.5		409.9	142	112	92	102	46	255	1.98	.61	0	
6	15.0		~~411.8~~ 412.2	141	116	93	105	46	253	1.86	.57	0	
7	17.5		413.2	140	117	95	106	46	252	1.44	.44	0	
8	20.0		414.9	138	118	96	107	48	259	1.74	.53	0	
9	22.5		416.6	136	118	97	108	48	258	1.72	.52	0	
10	25.0		418.2	136	118	98	108	48	259	1.62	.49	0	
11	27.5		419.9	136	118	98	108	44	268	1.59	.48	0	
12	30.0		421.3	136	119	99	109	46	269	1.26	.38	0	
B 1	32.5		422.9	137	103	102	103	33	265	1.60	.49	0	
2	35.0		424.8	137	106	102	104	34	267	1.80	.55	0	
3	37.5		426.4	138	112	102	107	34	268	1.81	.55	0	
4	40.0		428.2	136	114	102	108	35	268	1.95	.59	0	
5	42.5		430.3	137	117	102	110	35	268	2.02	.61	0	
6	45.0		432.1	137	119	103	111	35	269	1.96	.59	0	
7	47.5		433.8	137	121	103	112	35	269	1.46	.44	0	
8	50.0		435.2	136	121	103	112	35	268	1.30	.39	0	
9	52.5		436.5	136	120	104	112	35	269	1.40	~~.33~~ .33	0	
10	55.0		437.8	137	120	104	112	36	268	1.26	.38	0	
11	57.5		439.6	136	119	104	112	37	268	1.26	.38	0	
12	60.0		441.096	135	119	104	112	37	268	1.57	.47	0	
			39.978	137			106			1.677	.712		

WATER: X ml. 152 gram ~~44~~ Total 163.4

OPERATOR: Morris / Garvin

Sample Box No. 4
Meter Box No. 100
Meter ΔH@ 1.87
Pitot, CP .838
Temp. Device ~~ATM~~
Probe No. S-1
Probe Liner Glass
Probe Htr. Set 325°
Ambient Temp. 50°
%O_2 12.0 / 12.0
%CO_2 13.0 / 13.0

NOTES

Orifice ✓
Pitot R= S=
Meter ✓

Find leak ck@ 5 ~~MM~~

441.270
441.265
.005 ✓

FIELD DATA SHEET

PLANT Allied Lime RUN # 2
LOCATION Unit #2 DATE 10/18/90
BARO. PRES. 29.70 TIME 1057-1219 ~~#~~ 1244-110 pm

GUARDIAN SYSTEMS INC.
BOX 300
LEEDS, ALABAMA 35094

K = 03.452

	TIME MIN	TIME DUR	METER VOL FT 3	STACK TEMP °F	METER TEMP °F IN	METER TEMP °F OUT	METER TEMP °F AVG	IMP TEMP °F	BOX TEMP °F	METER PRESSURE "H2O	VELOCITY PRESSURE "H2O	VACUUM PRESSURE "Hg
			442.127	(1)	(2)	(3)		(4)	(5)			
B1	2.5	2.5	443.7	137	70	70	70	37	261	1.60	.52	0
2	5.0		445.2	138	71	69	70	37	263	1.72	.56	0
3	7.5		447.0	138	74	70	72	38	260	1.76	.57	0
4	10.0		448.6	138	80	71	76	38	264	1.71	.55	0
5	12.5		450.2	138	84	71	78	38	263	1.75	.56	4.5
6	15.0		452.1	138	88	72	80	38	269	1.85	.59	4.5
7	17.5		453.4	139	93	73	83	38	268	1.07	.34	0.5
8	20.0		454.8	138	95	75	85	38	268	1.23	.39	2.5
9	22.5		456.2	137	97	76	87	37	269	1.37	.43	5.0
10	25.0		457.7	137	100	77	90	37	270	1.28	.40	5.0
11	27.5		459.2	136	103	79	91	37	271	1.22	.38	5.5
12	30.0		460.5	136	105	80	93	37	270	1.09	.34	6.0
A1	32.5		462.1	145	86	87	87	37	235	1.44	.46	10.0
2	35.0	*	462.847 / 463.007	141	89	88	89	37	255	2.09	.66	14.0"
3	37.5		465.8	146	85	86	86	37	247	1.94	.62	0
4	40.0		467.8	147	93	87	90	37	258	2.11	.67	0
5	42.5		470.2	151	102	90	96	38	265	2.09	.66	0
6	45.0		471.8	141	106	89	98	39	268	2.13	.66	0
7	47.5		473.5	143	107	90	99	39	269	2.09	.65	0
8	50.0		475.3	139	108	90	99	39	268	1.72	.53	0
9	52.5		476.8	140	107	91	99	39	269	1.75	.54	0
10	55.0		478.6	140	107	91	99	39	270	1.65	.51	0
11	57.5		480.3	141	107	91	99	39	271	1.55	.48	0
12	60.0		481.619	140	106	92	99	39	268	1.07	.33	0
			39.332	140		88				1.636	.714	

Margin notes: 2' top 33.41.20; * 463.007 ... filter 2 min

leak ck for changing filter @ 15" Hg — 463.003 / 463.004 — .002

STATIC PRESSURE "H2O: -.41

PROBE TIP SIZE

BEFORE	AFTER
.250	.250
.250	.250
.250	.250

WATER #6
ml. 176
gram 12.0
Total 188.0

OPERATOR MORRIS / CURRID

Sample Box No. 4
Meter Box No. 100
Meter ΔH@ 1.87
Pitot, CP .838
Temp. Device A-III
Probe No. 5-1
Probe Liner glass
Probe Htr. Set 35%
Ambient Temp. 62°
% O_2 11.5 / 11.5
% CO_2 14.0 / 14.0

NOTES
Orifice ✓
Pitot R = 5.9 S = 6.2
Meter

Final Leak ck @ 10" Hg
481.667
481.664
.003

G-1

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.
BOX 300
LEEDS, ALABAMA 35094

PLANT Allied Line RUN # 3
LOCATION Unit #2 DATE 10/18/90
BARO. PRES. 29.76 TIME 137 – 250

K = 3.452

	TIME MIN	TIME DUR	METER VOL FT 3	STACK TEMP °F	METER TEMP °F IN	METER TEMP °F OUT	METER TEMP °F AVG	IMP TEMP °F	BOX TEMP °F	METER PRESSURE "H2O	VELOCITY PRESSURE "H2O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H2O −.44
			481.250	(1)	(2)	(3)		(4)	(5)				PROBE TIP SIZE BEFORE .250 AFTER .250
A1	2.5	2.5	483.4	142	89	90	90	34	228	1.36	.43	0	.250 .250
2		5.0	485.3	158	90	90	90	34	235	1.95	.63	0	.250 .250
3		7.5	487.1	149	96	90	93	34	234	2.02	.64	0	.250 .250
4		10.0	489.2	140	99	91	95	34	233	1.96	.61	0	
5		12.5	490.9	142	101	91	96	34	235	2.18	.68	0	
6		15.0	492.9	141	103	91	97	34	238	2.12	.66	0	
7		17.5	494.8	140	105	92	99	34	252	1.91	.59	0	
8		20.0	496.5	141	106	92	99	35	254	1.78	.55	0	
9		22.5	497.9	142	106	92	99	35	264	1.81	.56	0	
10		25.0	500.1	142	105	92	99	35	267	1.61	.50	0	
11		27.5	501.7	142	105	92	99	35	268	1.39	.43	0	
12		30.0	503.0	141	105	92	99	35	271	1.10	.34	0	
B1		32.5	504.8	155	94	91	93	35	268	1.44	.46	0	
2		35.0	506.5	160	96	91	94	35	267	1.71	.55	0	
3		37.5	507.8	139	99	92	96	35	268	1.84	.57	0	
4		40.0	510.1	145	101	92	97	35	265	1.82	.57	0	
5		42.5	512.0	140	103	92	98	35	267	1.58	.49	0	
6		45.0	513.3	140	106	92	99	36	268	1.07	.33	0	
7		47.5	514.6	141	108	93	101	36	267	1.30	.40	0	
8		50.0	516.8	143	107	94	101	36	267	1.36	.42	0	
9		52.5	518.0	145	107	94	101	37	264	1.22	.38	0	
10		55.0	519.3	142	106	95	101	37	257	1.07	.33	0	
11		57.5	520.7	144	105	95	100	37	250	1.25	.39	0	
12	↓	60.0	522.178	142	106	95	101	37	254	1.16	.36	0	
AVG		60	40.428	144			97			1.583	.1699 .67		

#4 WATER
ml. 180
gram 64.2
Total 184.2

OPERATOR
MORRIS / Currin

Sample Box No. 4
Meter Box No. 100
Meter ΔH@ 1.87
Pitot. CP .838
Temp. Device III
Probe No. S-1
Probe Liner S/S 15
Probe Htr. Set 35%
Ambient Temp. 75°
%O_2 10 / 10
%CO_2 14 / 14

NOTES
Orifice ✓
Pitot R = 5.85 = 6.4
Meter ✓

Find leak ck@ 10 "Hg
522.247
522.241
.0062

G U A R D I A N * S Y S T E M S * I N C O R P O R A T E D
P.O. BOX 190
LEEDS. AL 35094
205-699-6647

Blank Analytical Data

Plant: Allied Products

Sample location: Lime Kiln #2

Relative humidity: 35%

Type of blank: Acetone

Liquid level at mark and container sealed: Yes

Density of blank: 0.7899 g/ml

Blank Volume 250 ml

Date & time of wt.:	10/23/90	0900 Gross wt.	98366.0 mg
Date & time of wt.:	10/23/90	1600 Gross wt.	98365.9 mg
		Average Gross wt.	98366.0 mg
		Tare wt.	98365.8 mg
		Weight of blank	0.15 mg
Concentration of Blank		0.0008 mg/g	0.0001% of weight

Note: In no case shall a blank residue greater than (0.01mg/g) of 0.001% of the weight of blank used be subtracted from the sample weight.

Remarks: _____

_____

Signature of analyst: _____

Signature of reviewer: _____

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: Allied Sample date: 10/17/90

Sample location: UNIT #2 Run no.: 1

Sample recovery person: Morris Recovery date: 10/17/90

Filter(s) no.: _____

MOISTURE

Impingers Silica gel X

Final volume (wt) 515 ml(gm) Final wt. 977.4 g _____ g

Initial volume (wt) 0 ml(gm) Initial wt. 966.0 g _____ g

Net volume (wt) 152 ml(gm) Net wt. 11.4 g _____ g

Total moisture 165.4 g

Color of silica gel Blue

Description of impinger water Clear

RECOVERED SAMPLE

Filter container no. R #1 sealed ✓

Description of particulate on filter _____

Acetone rinse container no. R #1 Liquid level marked ✓

Acetone blank container no. BLK Liquid level marked ✓

Samples stored and locked ✓

Remarks: _____

Date of laboratory custody 10/18/90

Laboratory personnel taking custody LOTZ

Remarks: _____

G-5

G U A R D I A N * S Y S T E M S * I N C O R P O R A T E D
P.O. BOX 190
LEEDS. AL 35094
205-699-6647

Method 5 Analytical Particulate Data

Plant: Allied Products Run Number: 1

Sample location: Lime Kiln #2

Relative humidity: 35%

Density of Acetone: 0.7899 g/ml

Liquid level at mark and container sealed: Yes
Filter marked and container sealed: Yes

Acetone rinse container number: 1
Acetone rinse volume 95 ml
Acetone blank residue concentration: 0.0008 mg/g
Acetone blank weight 0.1 mg

ACETONE RINSE WEIGHT

Date & time of wt.:	10/23/90	0900 Gross wt.	105715.6 mg
Date & time of wt.:	10/23/90	1600 Gross wt.	105715.5 mg
		Average Gross wt.	105715.6 mg
		Tare wt.	105702.2 mg
		Less weight of acetone blank	0.1 mg
		Weight of particulate in acetone rinse	13.3 mg

PARTICULATE WEIGHT

Filter(s) container number: 1

Date & time of wt.:	10/23/90	1600 Gross wt.	228.0 mg
Date & time of wt.:	10/25/90	1000 Gross wt.	227.8 mg
		Average Gross wt.	227.9 mg
		Tare wt.	176.7 mg
		Weight of particulate on filter (s)	51.2 mg
		Weight of particulate in acetone rinse	13.3 mg
		TOTAL WEIGHT OF PARTICULATE	64.5 mg

Note: In no case shall a blank residue greater than (0.01mg/g) of 0.001% of the weight of blank used be subtracted from the sample weight.

Remarks: _____

_____

Signature of analyst: _____

Signature of reviewer: _____

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: Allied Sample date: 10/18/90

Sample location: Unit #2 Run no.: 2

Sample recovery person: Mikes Recovery date: 10/18/90

Filter(s) no.: _____

MOISTURE

Impingers Silica gel #6.

Final volume (wt) 176 ml(gm) Final wt. 963.9 g _____ g

Initial volume (wt) 0 ml(gm) Initial wt. 951.9 g _____ g

Net volume (wt) 176 ml(gm) Net wt. 12.0 g _____ g

Total moisture 188.0 g

Color of silica gel Mixed

Description of impinger water Clear

RECOVERED SAMPLE

Filter container no. R #2 sealed ✓

Description of particulate on filter _____

Acetone rinse container no. R #2 Liquid level marked ✓

Acetone blank container no. _____ Liquid level marked _____

Samples stored and locked ✓

Remarks: _____

Date of laboratory custody 10/18/90

Laboratory personnel taking custody Liz

Remarks: _____

G U A R D I A N * S Y S T E M S * I N C O R P O R A T E D
P.O. BOX 190
LEEDS. AL 35094
205-699-6647

Method 5 Analytical Particulate Data

Plant: Allied Products Run Number: 2

Sample location: Lime Kiln #2

Relative humidity: 35%

Density of Acetone: 0.7899 g/ml

Liquid level at mark and container sealed: Yes
Filter marked and container sealed: Yes

Acetone rinse container number: 2
Acetone rinse volume 78 ml
Acetone blank residue concentration: 0.0008 mg/g
Acetone blank weight 0.0 mg

ACETONE RINSE WEIGHT

Date & time of wt.:	10/23/90	0900 Gross wt.	105207.8 mg
Date & time of wt.:	10/23/90	1600 Gross wt.	105207.7 mg
		Average Gross wt.	105207.8 mg
		Tare wt.	105176.6 mg
		Less weight of acetone blank	0.0 mg
		Weight of particulate in acetone rinse	31.1 mg

PARTICULATE WEIGHT

Filter(s) container number: 2

Date & time of wt.:	10/23/90	1600 Gross wt.	411.3 mg
Date & time of wt.:	10/25/90	1000 Gross wt.	411.7 mg
		Average Gross wt.	411.5 mg
		Tare wt.	347.2 mg
		Weight of particulate on filter (s)	64.3 mg
		Weight of particulate in acetone rinse	31.1 mg
		TOTAL WEIGHT OF PARTICULATE	95.4 mg

Note: In no case shall a blank residue greater than (0.01mg/g) of 0.001% of the weight of blank used be subtracted from the sample weight.

Remarks: _____

_____

Signature of analyst: _____

Signature of reviewer: _____

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: Allied Sample date: 10/14/90

Sample location: UNIT #2 Run no.: 3

Sample recovery person: Morris Recovery date: 10/18/90

Filter(s) no.: _____

MOISTURE

Impingers			Silica gel # 1	
Final volume (wt)	180 ml(gm)	Final wt.	93.1 g	____ g
Initial volume (wt)	0 ml(gm)	Initial wt.	89.9 g	____ g
Net volume (wt)	180 ml(gm)	Net wt.	4.2 g	____ g

Total moisture 184.2 g

Color of silica gel Orange

Description of impinger water Clear

RECOVERED SAMPLE

Filter container no. R # 3 sealed ✓

Description of particulate on filter _____

Acetone rinse container no. R # 3 Liquid level marked ✓

Acetone blank container no. _____ Liquid level marked _____

Samples stored and locked ✓

Remarks: _____

Date of laboratory custody 10/15/90

Laboratory personnel taking custody Lutz

Remarks: _____

G U A R D I A N * S Y S T E M S * I N C O R P O R A T E D
P.O. BOX 190
LEEDS. AL 35094
205-699-6647

Method 5 Analytical Particulate Data

Plant: Allied Products Run Number: 3

Sample location: Lime Kiln #2

Relative humidity: 35%

Density of Acetone: 0.7899 g/ml

Liquid level at mark and container sealed: Yes
Filter marked and container sealed: Yes

Acetone rinse container number: 3
Acetone rinse volume 120 ml
Acetone blank residue concentration: 0.0008 mg/g
Acetone blank weight 0.1 mg

ACETONE RINSE WEIGHT

Date & time of wt.:	10/23/90	0900 Gross wt.	104594.6 mg
Date & time of wt.:	10/23/90	1600 Gross wt.	104594.8 mg
		Average Gross wt.	104594.7 mg
		Tare wt.	104562.9 mg
		Less weight of acetone blank	0.1 mg
		Weight of particulate in acetone rinse	31.7 mg

PARTICULATE WEIGHT

Filter(s) container number: 3

Date & time of wt.:	10/23/90	1600 Gross wt.	213.3 mg
Date & time of wt.:	10/25/90	1000 Gross wt.	213.4 mg
		Average Gross wt.	213.4 mg
		Tare wt.	172.5 mg
		Weight of particulate on filter (s)	40.9 mg
		Weight of particulate in acetone rinse	31.7 mg
		TOTAL WEIGHT OF PARTICULATE	72.6 mg

Note: In no case shall a blank residue greater than (0.01mg/g) of 0.001% of the weight of blank used be subtracted from the sample weight.

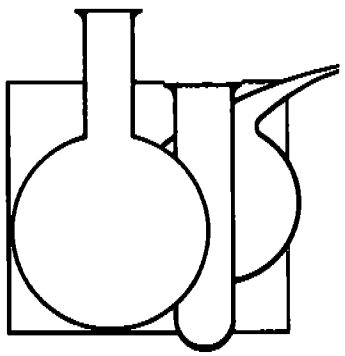
Remarks: _____

_____

Signature of analyst: _____

Signature of reviewer: _____

Plant Operation Data



10-17-90

ALLIED PRODUCTS CO. 10-17-90 DATE

PROCESS DATA

KILN NO 2

TEST No. 8

TIME	STONE FEED RATE	SCRUBBER WATER FLOW	VENTURRI PRESS. DROP	MECH. COLL. PRESS. DROP	COAL FEED RATE	
12:35	22.5	120	17.5	2"	3.9	
12:50	22.5	120	17.5	2"	3.9	
1:05	23.0	120	17.5	2"	4.0	Te
1:20	23.0	120	17.5	2"	4.0	1
1:35	23.0	120	17.5	2"	4.0	
2:09	23.0	120	17.5	2"	4.0	
			+			
10-18-90 10:55	23.0	120	17.5	2"	4.0	
11:10	23.0	120	17.5	2"	4.0	
11:25	23.0	120	17.5	2"	4.0	
11:55	23.0	120	17.5	2"	4.0	
12:10	23.0	120	17.5	2"	4.0	

10-18-7

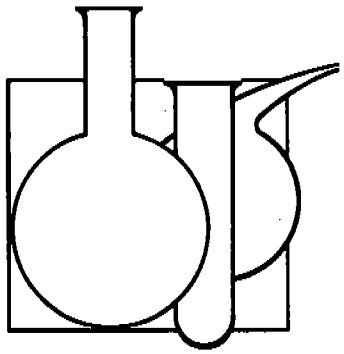
DATE

ALLIED PRODUCTS Co.

TEST No. 3 — PROCESS DATA — KILN NO.

TIME	STONE FEED RATE	SCRUBBER WATER FLOW	VENTURRI PRESS. DROP	MECH. COLL. PRESS. DROP	KILN NO. COAL FEED RATE
12:25	23.0	120	17.5	2"	4.0
12:40	23.0	120	17.5	2"	4.0
12:55	23.0	120	17.5	2"	4.0
1:05	23.0	120	17.5	2"	4.0
	End Test # (2)				
1:35	23.0	120	17.5	2"	4.0
1:50	23.0	120	17.5	2"	4.0
2:05	23.0	120	17.5	2"	4.0
2:20	23.0	120	17.5	2"	4.0
2:35	23.0	120	17.5	2"	4.0
	End Test # 3				

Calibrations



VI. CALIBRATIONS

Meter Box

The meter box is initially calibrated every 6 months at the fixed settings of 0.5, 1.0, 1.5, 2.0, and 2.5 inches of H_2O. Upon return to the laboratory from this test the meter box was recalibrated using the average meter pressure for the test series. The recalibration point shall be the closest point to the initial calibration (for an average meter pressure of 1.63 a 1.50 inches H_2O was used as the recalibration point). These recalibrations produced a single point MCF and a ^H@ which shall be compared to the original calibration to see if they are within the 5% allowed at the highest vacuum seen. These recalibration sheets are located behind the original calibration sheets.

Pitot Tubes

The S type tubes are calibrated against a standard pitot tube (Cp=0.99) in a wind tunnel with a capacity to generate a test section velocity of approximately 3000 feet/minute every 6 months. Additionally the pitot tube is measured as to its specifications and alignment. Upon return, the intercomponent spacings and the face opening alignment of the pitot tube assembly were rechecked and if no changes are noticed; it shall be assumed that the coefficient of the assembly had not changed.

Temperature Measurements

All temperature devices (impinger, meter box, hot box and stack) are calibrated every 6 months against an ASTM mercury-in-glass reference thermometer or a reference thermocouple and potentiometer calibrated by fixed points, e.g., ice bath and boiling water (corrected to barometric pressure). Upon return the stack temperature device was recalibrated within 10% of the average absolute stack temperature. If the device being tested agrees within 1.5% of the reference device, the temperature data taken in the field shall be considered valid.

Barometric Pressure

An aneroid barometer capable of measuring atmospheric pressure to within 0.1 inches Hg was used. If this device is defective the following alternate method shall be used. The barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 0.1 inches Hg per 100 feet elevation increase or vice versa for elevation decrease.

Specific Test Equipment and Measurements

The equipment used during these tests was as follows:

Hot Box	#4
Probe:	5-1
Meter Box:	#100
Stack Temperature:	Omega III
Impinger	#2

The average stack temperature was 140 ^{0}F. The Omega III was recalibrated at 140 ^{0}F and agreed exactly with an ASTM mercury-in-glass reference thermometer. The intercomponent spacing and the face opening alignment of the Pitot Tube assembly was rechecked and no changes were noticed; therefore, it was assumed that the coefficient of the assembly had not changed.

Type A Glass Fiber Filters

FEATURES

▪ High tensile strength. ▪ Excellent handling characteristics. ▪ Good wetting properties. ▪ Minimum of 99.9% retention for particles of .3 μm as determined by DOP tests. ▪ Binder free.

This is the original glass fiber filter pioneered by Gelman Instrument Company over 15 years ago. It continues to be widely used for high volume sampling. Since zinc is one of the raw materials incorporated in the glass fibers, Type A Filters have a variable zinc content. Another component of the filter, sulfuric acid, is used as a dispersion medium, making the sheets unsuitable for measurement of sulfates.

Type A Glass Fiber Filters are less likely to develop static charge or tear than other glass fiber media types. They are used extensively in applications where zinc and iron content is not important, or where sulfate content is not being determined.

Size	37 mm	47 mm	102 mm	8"x10"
Product No.	61715	61694	61696	61701
Filters/Pkg.	500	100	100	100

TYPE A GLASS FIBER FILTER SPECIFICATION REPORT

The following physical/chemical properties represent typical, average values obtained in accordance with accepted test methods. They are subject to normal manufacturing variations and are supplied as a technical service. *The analysis has been made in accordance with EPA procedures (micrograms/8" x 10" sheet).*

ELEMENTS:

Antimony	.30	Manganese	.200
Arsenic	.30	Mercury	.100
Beryllium	.1	Molybdenum	.10
Bismuth	.10	Nickel	.10
Cadmium	.5	Selenium	.5000
Chromium	.10	Tin	.10
Cobalt	.10	Titanium	.170
Copper	.2	Vanadium	.10
Iron	.2300	Zinc	.5000 to 25,000
Lead	.20		

OTHER PHYSICALS:

BSO	.522	Flow Resistance (Max.) @ 320 cm/min.	.80 mm
*pH	.8.5	Flow Rate (air) lpm/cm² @ 70 cm Hg	.50
DOP @320/cm/min (ASTM Method 2986	.99.9%	Max. Use Temp.	.400°C
Tensile Strength (Fed. Spec. UUP31B)	.750 gr	Static Properties	.Low
Weight, 8"x10" sheet	.4.0±.3 gr.	Ability to Fold	.Excellent

WATER EXTRACTABLE IONS:

Sulfate	.100	Chloride	.1500
Nitrate	.50	Fluoride	.15
Ammonia	.20		

*pH—Gelman Procedure:

A 500 ml distilled water
B Add 15 drops saturated KCl solution
C. Shred one 8"x10" sheet and soak in prepared water for one hour
D. Run pH at ambient temperature.

Type A/E Glass Fiber Filters

FEATURES

▪ Low trace metals. ▪ Medium Handling characteristics. ▪ Available in all sizes. ▪ Minimum of 99.9% retention for particles of .3 μm as determined by DOP tests. ▪ Binder free.

Type A/E Glass Fiber Filters are composed of low acid soluble glass fiber. They contain low levels of both zinc and iron. The filters do react with atmospheric sulfur dioxide; and therefore, when high levels of sulfur are expected, corrections for this reaction should be accounted for.

Type A/E Glass Fiber Filters are binder free and ideal for gravimetric analysis of air pollutants. This pure, organic free filter is the basis for procedures widely used in determining municipal and industrial air polluting substances.

Size	25 mm	37 mm	47 mm	102 mm	8"x10"
Product No.	61630	61652	61631	61633	61638
Filters/Pkg.	500	500	100	100	100

TYPE A/E GLASS FIBER FILTER SPECIFICATION REPORT

The following physical/chemical properties represent typical, average values obtained in accordance with accepted test methods. They are subject to normal manufacturing variations and are supplied as a technical service. *The analysis has been made in accordance with EPA procedures (micrograms/8" x 10" sheet).*

ELEMENTS:

Antimony	.20	Manganese	.2
Arsenic	.20	Mercury	.80
Beryllium	.1	Molybdenum	.10
Bismuth	.10	Nickel	.10
Cadmium	.2	Selenium	.200
Chromium	.10	Tin	.10
Cobalt	.10	Titanium	.10
Copper	.2	Vanadium	.10
Iron	.100-1800	Zinc	.90
Lead	.10		

OTHER PHYSICALS:

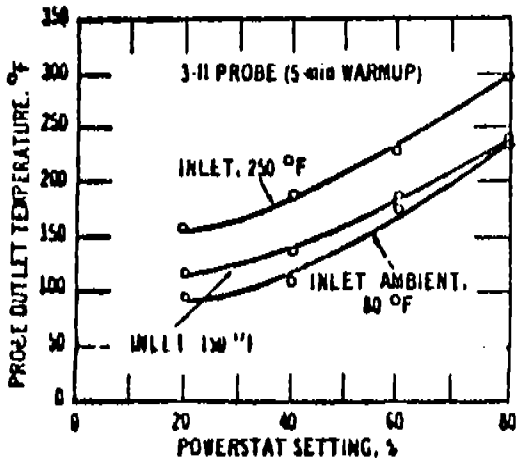
BSO	.522	Flow Resistance (Max.) @ 320 cm/min.	.80 mm
*pH	.9.0	Flow Rate (air) lpm/cm² @ 70 cm Hg	.60
DOP @320/cm/min ASTM Methods 2986)	.99.9%	Max. Use Temp.	.400°C
Tensile Strength (Fed. Spec. UUP31B)	.600 gr.	Static Properties	.Medium
Weight 8"x10"sheet	.4.0±.3 gr.	Ability to Fold	.Good

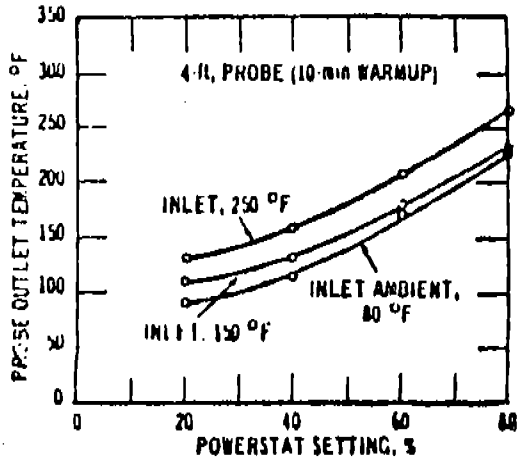
WATER EXTRACTABLE IONS:

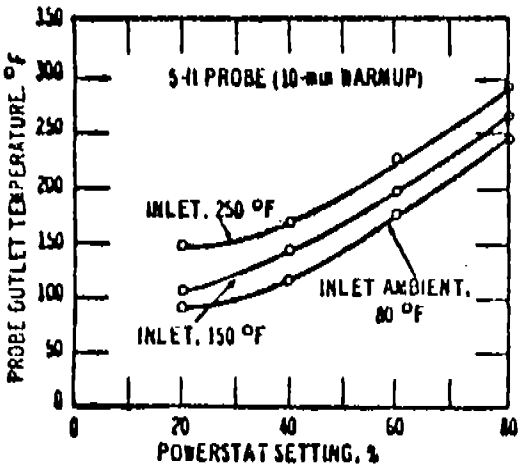
Sulfate	.600	Chloride	.1500
Nitrate	.115	Fluoride	.87
Ammonia	.13		

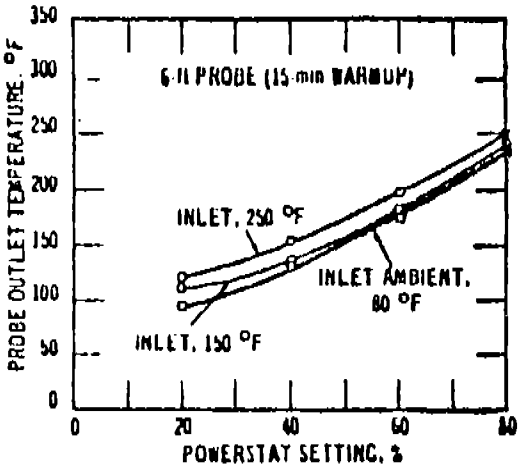
*pH—Gelman Procedure:

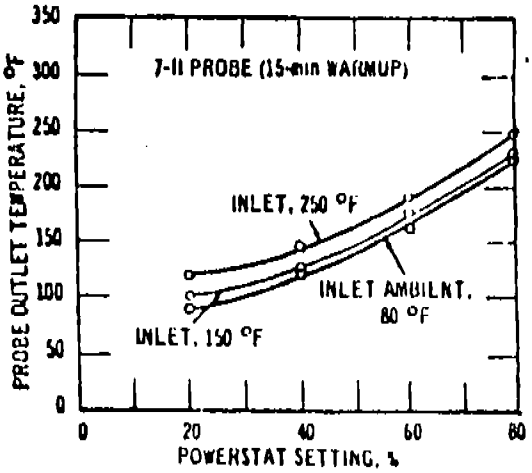
A 500 ml distilled water.
B Add 15 drops saturated KCl solution.
C. Shred one 8"x10" sheet and soak in prepared water for one hour
D Run pH at ambient temperature.











NOTE: Flow rate held constant at 0.75; 50% change in flow rate has little effect on probe temperature.

GUARDIAN SYSTEMS INC
Initial Meter Calibration Box 100
on 5/15/90

Run Number	1	2	3	4	5
Barometric Pres, in Hg	29.54	29.54	29.54	29.54	29.54
Orifice pres drop, in H20	0.5	1.0	1.5	2.0	2.5
Pres Wet Test Meter, in H20	-0.30	-0.50	-0.70	-0.80	-1.00
Gas Volume Wet Init, CF	0.000	6.568	14.808	25.025	36.299
Gas Volume Wet Final, CF	6.568	14.808	25.025	36.299	49.508
Gas Volume Dry Init, CF	543.061	549.544	557.834	568.255	579.962
Gas Volume Dry Final, CF	549.544	557.834	568.255	579.962	593.780
Temp Wet Init, C	22.0	23.0	23.2	23.5	23.5
Temp Wet Final, C	23.0	23.2	23.5	23.5	23.5
Dry Gas Temp Init In, F	88	106	122	132	134
Dry Gas Temp Final In, F	106	122	132	134	134
Dry Gas Temp Init Out, F	88	91	97	104	108
Dry Gas Temp Final Out, F	91	97	104	108	108
Run Time, sec	980	900	915	900	972
Meter Calibration Factor, Y	1.0505	1.0467	1.0476	1.0372	1.0305
Average Y	1.0425				
Qm	0.4141	0.5680	0.6993	0.7907	0.8593
Km	0.7317	0.7072	0.7072	0.6895	0.6695
Average Km	0.7010				
Delta H@	1.72	1.84	1.84	1.94	2.05
Average H@	1.87				

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GUARDIAN SYSTEMS INC
Recalibration of Meter Box 100
on 10/23/90

Run Number	1	2	3	Average
Barometric Pres, in Hg	29.67	29.67	29.67	29.67
Orifice pres drop, in H20	1.5	1.5	1.5	1.50
0				
Pres Wet Test Meter, in H20	-0.70	-0.70	-0.70	-0.70
Gas Volume Wet Init, CF	0.000	9.960	19.943	29.903
Gas Volume Wet Final, CF	9.960	19.943	29.931	59.834
Gas Volume Dry Init, CF	550.766	560.978	571.290	1683.034
Gas Volume Dry Final, CF	560.978	571.290	581.713	1713.981
Temp Wet Init, C	17.5	17.5	17.5	17.5
Temp Wet Final, C	17.5	17.5	17.5	17.5
Dry Gas Temp Init In, F	105	109	110	108
Dry Gas Temp Final In, F	109	110	115	111
Dry Gas Temp Init Out, F	95	96	98	96
Dry Gas Temp Final Out, F	96	98	100	98
Run Time, sec	900	900	900	2700
Meter Calibration Factor, Y	1.0400	1.0359	1.0300	1.0353
Qm	0.7008	0.7043	0.7072	0.7041
Km	0.7134	0.7160	0.7177	0.7157
Delta H@	1.81	1.80	1.79	1.80

Previous Y 1.0476 % Difference 1.18%
Previous H@ 1.84 % Difference 2.28%

Project Allied Stack Unit # 2

SIGNATURE

GUARDIAN SYSTEMS INC
Temperature Calibration for Omega III
on 5/18/90

Actual Temperature, F	Reading Temperature, F	Correction in Reading, F
0	0	0
50	50	0
100	99	1
150	150	0
200	200	0
250	251	-1
300	302	-2
350	350	0
400	401	-1
450	449	1
500	500	0
550	549	1
600	600	0
650	650	0
700	700	0
750	749	1
800	799	1
850	849	1
900	899	1
950	950	0
1000	1000	0

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GUARDIAN SYSTEMS INC
Temperature Calibration for Impingers
on 5/18/90

Device	Actual Temperature, F	Reading Temperature, F	Correction in Reading, F
Impinger 1	40	40	0
	50	50	0
	90	90	0
Impinger 2	40	40	0
	50	50	0
	90	90	0
Impinger 3	40	40	0
	50	50	0
	90	90	0
Impinger 4	40	40	0
	50	50	0
	90	90	0
Impinger 5	40	40	0
	50	50	0
	90	90	0
Impinger 6	40	40	0
	50	50	0
	90	90	0
Impinger 7	40	40	0
	50	50	0
	90	90	0
Impinger 8	40	40	0
	50	50	0
	90	90	0

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GUARDIAN SYSTEMS INC
Temperature Calibration for Hot Boxes
on 5/18/90

Device	Actual Temperature, F	Reading Temperature, F	Correction in Reading, F
Hot Box 1	225	225	0
	250	250	0
	275	275	0
Hot Box 2	225	225	0
	250	250	0
	275	275	0
Hot Box 3	225	225	0
	250	250	0
	275	275	0
Hot Box 4	225	225	0
	250	250	0
	275	275	0
Hot Box 5	225	225	0
	250	250	0
	275	275	0
Hot Box 6	225	225	0
	250	250	0
	275	275	0
Hot Box 7	225	225	0
	250	250	0
	275	275	0
Hot Box 8	225	225	0
	250	250	0
	275	275	0

SIGNATURE Tom E. Jarrell

GUARDIAN SYSTEMS INC
Pitot Calibration Form

Date: 5/15/90 Probe #: 5-1

Calibrated By: Morris/Gravlee Average Velocity, f/m 3,008

Side A

Run #	Pstd	Ptype s	Cp(s)	Deviation
1	0.56	0.78	0.839	0.000
2	0.56	0.78	0.839	0.000
3	0.56	0.78	0.839	0.000

Avg Cp = 0.839 Avg = 0.000

Is average deviation less than or equal to 0.01? YES

Side B

Run #	Pstd	Ptype s	Cp(s)	Deviation
1	0.58	0.81	0.838	0.000
2	0.58	0.81	0.838	0.000
3	0.58	0.81	0.838	0.000

Avg Cp = 0.838 Avg = 0.000

Is average deviation less than or equal to 0.01? YES

Is average PCF equal to or less than 0.01 YES

Average PCF = 0.838

SIGNATURE Tom E Gravlee