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/

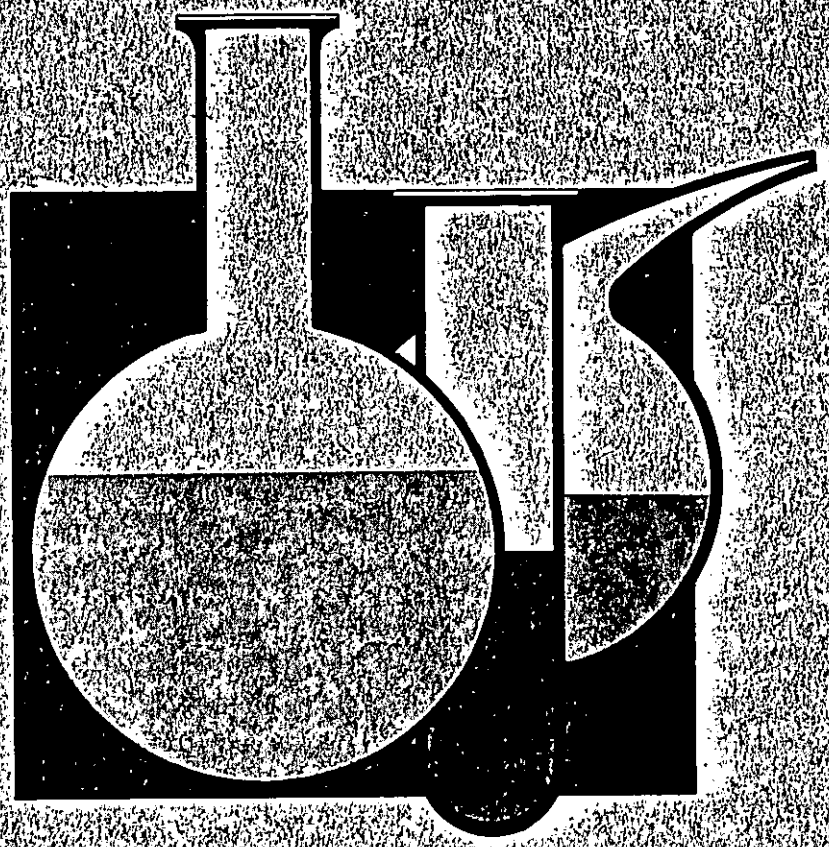
The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP42 Section:	11.3
Reference:	19
Title:	Particulate Emission Tests For General Shale Products Corporation, Kingsport, TN, Tunnel Kiln TK-29 And Coal Crusher, Guardian Systems, Inc., Leeds, AL, July 21, 1982.

AP-42 Section 11.3
Reference 19

GUARDIAN SYSTEMS INC.

2809 Central Avenue
Birmingham, Alabama 35209
205/879-1850



Test Report

PARTICULATE EMISSION TESTS

FOR

GENERAL SHALE PRODUCTS CORPORATION

KINGSPORT, TENNESSEE

TUNNEL KILN TK-29

AND

COAL CRUSHER

CONDUCTED ON

JULY 21, 1982

APPROVED BY: _____

Tom Lotz
Director Field Services

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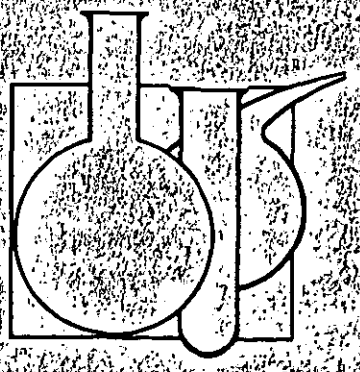
Introduction



INTRODUCTION AND PROCESS DESCRIPTION

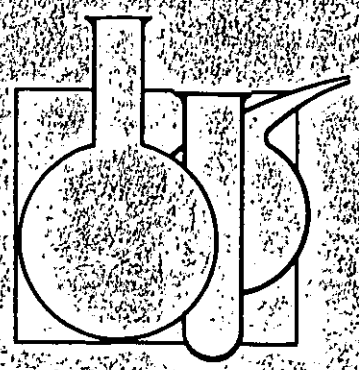
On July 21, 1982, a series of three (3) particulate emission tests were conducted on the Tunnel Kiln TK-29 discharges located in Kingsport, Tennessee. Individual bricks are formed and stacked into kiln cars measuring approximately 9' x 9'. Cars are inserted on a regular basis into a long, continuous-fired tunnel kiln. As one car is discharged another is inserted. This provides a constant moving mass inside the kiln. Cars are pushed through the kiln at a slow, methodical pace requiring almost three (3) days for the complete travel. By means of a coal firing process, heat is increased in each chamber until the total firing is complete. As the car continues through the kiln from the main firing zone the temperatures are reduced to provide necessary cooling. The control device used was a CE Preheater Baghouse #9MW50.

Immediately after the previous test series, another series of two (2) tests were conducted on the coal crushing stack. These tests were conducted under slightly abnormal conditions (ie longer grinding time and greater frequency) as can be seen from the circle graphs found on pages The control device for this operation is a Carter-Day Baghouse #48RF8.

The following companies were represented:

Mr. Walt Banyas	General Shale Product Corporation
Mr. Gary McGinnis	General Shale Product Corporation
Mr. B. Archer	General Shale Product Corporation
Mr. Bob Peoples	General Shale Product Corporation
Mr. Tupili Reddy	Tennessee Air Pollution Control Division
Mr. Thomas Issacs	Tennessee Air Pollution Control Division
Mr. Ronnie Crigger	Tennessee Air Pollution Control Division
Mr. Tom Lotz	Guardian Systems, Inc.
Mr. Bill McKinney	Guardian Systems, Inc.

Test Results



SUMMARY OF TEST RESULTS

The following is a table of the Particulate Emissions during the two test series process weights were provided by General Shale Production Corporation. (See pages 51 & 52)

Test #	1	2	3	Average
Process Weight ton/hr.	11.8	11.8	11.8	11.8
Paritculate Emission Rate, lbs/hr from TK-29	0.47	0.35	0.37	0.40
Particulate Emission Rate, lbs/hr. from Coal Crusher	0.12	0.20	--	0.16

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205-879-1850

SUMMARIZED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34843

RUN NUMBER	1	2	3
DATE OF TEST	07/21/82	07/21/82	07/21/82
TIME OF TEST	0901-1007	1106-1215	1310-1416
LOCATION OF TEST	TK-29	TK-29	TK-29
STACK GAS TEMPERATURE DEGREES F	310	308	313
MOISTURE CONTENT, % V/V	6.47	5.66	4.78
OXYGEN CONTENT, % V/V	16.00	17.00	17.00
CARBON DIOXIDE CONTENT, % V/V	4.50	4.00	3.50
STACK GAS VELOCITY FEET PER SECOND	66.34	66.26	65.70
VOLUMETRIC FLOW ACTUAL CUBIC FEET PER MINUTE	28,137	28,106	27,869
VOLUMETRIC FLOW DRY STANDARD CUBIC FEET PER MINUTE	18,216	18,402	18,299
CONCENTRATION GRAINS PER DRY STANDARD CUBIC FOOT	0.003	0.002	0.002
CONCENTRATION GRAINS PER ACTUAL CUBIC FOOT	0.002	0.001	0.002
PARTICULATE MASS RATE (#/HR.)	0.47	0.35	0.37
% ISOKINETIC	102.23	104.75	104.05

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SUMMARIZED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34844

RUN NUMBER	1	2
DATE OF TEST	07/21/82	07/21/82
TIME OF TEST	1637-1737	1813-1913
LOCATION OF TESY	COAL C	COAL C
STACK GAS TEMPERATURE DEGREES F	133	132
MOISTURE CONTEN", % V/V	5.29	5.52
OXYGEN CONTENT, % V/V	20.50	21.00
CARBON DIOXIDE CONTENT, % V/V	0.00	0.00
STACK GAS VELOCITY FEET PER SECOND	23.05	23.39
VOLUMETRIC FLOW ACTUAL CUBIC FEET PER MINUTE	2807 ~~4,315~~	2848 ~~4,379~~
VOLUMETRIC FLOW DRY STANDARD CUBIC FEET PER MINUTE	2368 ~~3,672~~	2422 ~~3,724~~
CONCENTRATION GRAINS PER DRY STANCARD CUBIC FOOT	~~0.004~~	~~0.006~~
CONCENTRATION GRAINS PER ACTUAL CUBIC FOOT	~~0.003~~	~~0.005~~
PARTICULATE MASS RATE (#/HR.)	~~0.12~~	~~0.20~~
% ISOKINETIC	107.54	109.08

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COMPUTER INPUT PARAMETERS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34843

RUN NUMBER	1	2	3
DATE	07/21/82	07/21/82	07/21/82
LOCATION	TK-29	TK-29	TK-29
TIME	0901-1007	1106-1215	1310-1416
BAROMETRIC PRESSURE (IN. HG)	30.20	30.20	30.20
STATIC PRESSURE (IN. H2O)	0.070	0.070	0.070
RUN TIME (MINUTES)	64	64	64
METER VOLUME (CORRECTED)	56.392	58.665	58.871
STACK TEMPERATURE (•F)	310	308	313
METER TEMPERATURE (•F)	101	104	113
METER PRESSURE (IN.H2O)	2.13	2.23	2.22
SQR VELOCITY PRESSURE	0.979	0.980	0.969
MASS OF PARTICULATE (MG.)	10.5	8.1	8.5
ML. OF WATER COLLECTED	79.2	71.1	58.7
% OXYGEN	16.0	17.0	17.0
% CARBON DIOXIDE	4.5	4.0	3.5
% CARBON MONOXIDE	0.0	0.0	0.0
STACK AREA (SQ. FT.)	7.07	7.07	7.07
PITOT CORRECTION FACTOR	0.84	0.84	0.84
NOZZLE DIAMETER (IN.)	0.242	0.242	0.242

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COMPUTER INPUT PARAMETERS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34844

	1	2
RUN NUMBER	1	2
DATE	07/21/82	07/21/82
LOCATION	COAL C	COAL C
TIME	1637-1737	1813-1913
BAROMETRIC PRESSURE (IN. HG)	30.20	30.20
STATIC PRESSURE (IN. H2O)	- 0.130	- 0.130
RUN TIME (MINUTES)	60	60
METER VOLUME (CORRECTED)	41.353	43.217
STACK TEMPERATURE (•F)	133	132
METER TEMPERATURE (•F)	110	119
METER PRESSURE (IN.H2O)	1.22	1.13
SQR VELOCITY PRESSURE	0.385	0.391
MASS OF PARTICULATE (MG.)	9.5	16.4
ML. OF WATER COLLECTED	46.0	49.5
% OXYGEN	20.5	21.0
% CARBON DIOXIDE	0.0	0.0
% CARBON MONOXIDE	0.0	0.0
STACK AREA (SQ. FT.)	3.12	3.12
PITOT CORRECTION FACTOR	0.84	0.84
NOZZLE DIAMETER (IN.)	0.306	0.306

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COMPUTED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34843

RUN NUMBER	1	2	3
DATE OF TEST	07/21/82	07/21/82	07/21/82
LOCATION OF TEST	TK-29	TK-29	TK-29
1. STACK PRESSURE			
INCHES HG	30.21	30.21	30.21
MILLIMETERS HG	767.21	767.21	767.21
2. METER PRESSURE			
INCHES HG	30.36	30.36	30.36
MILLIMETERS HG	771.05	771.25	771.23
3. METER VOLUME			
DRY STANDARD CUBIC FEET	53.849	55.735	55.051
DRY STANDARD CUBIC METERS	1.525	1.578	1.559
4. WATER VOLUME			
STANDARD CUBIC FEET	3.728	3.347	2.763
STANDARD CUBIC METERS	0.106	0.095	0.078
5. MOISTURE CONTENT (%)	6.47	5.66	4.78
6. MOLECULAR WEIGHT DRY	29.36	29.32	29.24
7. MOLECULAR WEIGHT WET	28.62	28.68	28.70
8. STACK VELOCITY			
FEET PER SECOND	66.34	66.26	65.70
METERS PER SECOND	20.22	20.20	20.02
9. VOLUMETRIC FLOW			
ACTUAL CUBIC FEET PER MINUTE	28,137	28,106	27,869
ACTUAL CUBIC METERS PER SECOND	13.28	13.26	13.15
10. VOLUMETRIC FLOW			
DRY STANDARD CUBIC FEET PER MINUTE	18,216	18,402	18,299
DRY STANDARD CUBIC METER PER SECOND	8.60	8.68	8.64

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COMPUTED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34843

RUN NUMBER	1	2	3
DATE OF TEST	07/21/82	07/21/82	07/21/82
LOCATION OF TEST	TK-29	TK-29	TK-29
11. CONCENTRATION			
GRAINS PER DRY STANDARD CUBIC FOOT	0.0030	0.0022	0.0024
GRAMS PER DRY STANDARD CUBIC METER	0.0069	0.0051	0.0054
15. PARTICULATE MASS RATE (#/HR.)	0.47	0.35	0.37
16. VOLUME AT NOZZLE			
ACTUAL CUBIC FEET	83.179	85.131	83.846
ACTUAL CUBIC METERS	2.355	2.411	2.374
17. CONCENTRATION			
GRAINS PER ACTUAL CUBIC FOOT	0.0019	0.0015	0.0016
GRAMS PER ACTUAL CUBIC METER	0.0044	0.0034	0.0036
18. % ISOKINETIC	102.23	104.75	104.05

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COMPUTED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34844

RUN NUMBER	1	2
DATE OF TEST	07/21/82	07/21/82
LOCATION OF TEST	COAL C	COAL C
1. STACK PRESSURE		
INCHES HG	30.19	30.19
MILLIMETERS HG	766.84	766.84
2. METER PRESSURE		
INCHES HG	30.29	30.28
MILLIMETERS HG	769.36	769.19
3. METER VOLUME		
DRY STANDARD CUBIC FEET	38.779	39.889
DRY STANDARD CUBIC METERS	1.098	1.130
4. WATER VOLUME		
STANDARD CUBIC FEET	2.165	2.330
STANDARD CUBIC METERS	0.061	0.066
5. MOISTURE CONTENT (%)	5.29	5.52
6. MOLECULAR WEIGHT DRY	28.82	28.84
7. MOLECULAR WEIGHT WET	28.25	28.24
8. STACK VELOCITY		
FEET PER SECOND	23.05	23.39
METERS PER SECOND	7.03	7.13
9. VOLUMETRIC FLOW		
ACTUAL CUBIC FEET PER MINUTE	2807 ~~4,315~~	2848 ~~4,379~~
ACTUAL CUBIC METERS PER SECOND	2.04	2.07
10. VOLUMETRIC FLOW		
DRY STANDARD CUBIC FEET PER MINUTE	~~3,672~~	~~3,724~~
DRY STANDARD CUBIC METER PER SECOND	1.73	1.76

$V = 1096\sqrt{\frac{P}{C}}$

$\left(\frac{8000}{1096}\right)^2 (.067) = P = 3.6''$

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BIRMINGHAM, AL 35209
205-879-1850

COMPUTED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
JOB NUMBER 34844

RUN NUMBER	1	2
DATE OF TEST	07/21/82	07/21/82
LOCATION OF TEST	COAL C	COAL C
11. CONCENTRATION		
GRAINS PER DRY STANCARD CUBIC FOOT	0.0038	0.0063
GRAMS PER DRY STANDARD CUBIC METER	0.0086	0.0145
15. PARTICULATE MASS RATE (#/HR.)	0.12 / 0.07	0.20 / 0.13
16. VOLUME AT NOZZLE		
ACTUAL CUBIC FEET	45.576	46.915
ACTUAL CUBIC METERS	1.291	1.328
17. CONCENTRATION		
GRAINS PER ACTUAL CUBIC FOOT	0.0032	0.0054
GRAMS PER ACTUAL CUBIC METER	0.0073	0.0123
18. % ISOKINETIC	107.54	109.08

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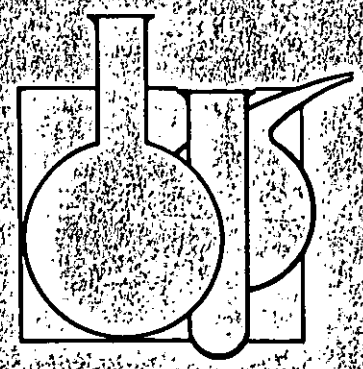
Sampling & Analytical Procedures



III. SAMPLING AND ANALYTICAL PROCEDURES

General

All sampling and analytical procedures for determination of the particulate emissions from this source were conducted in strict adherence with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 1-5 as amended, and the Tennessee Air Polution Control Regulations.

Preliminary measurements were made of the stack to determine the number of sampling points according to Method 1. The tunnel kiln required thirty two points, sixteen points on two diameters. The coal crusher was sampled at 30 points in a 5x6 matrix. (See figures 1 and 2) Each point was sampled two minutes. Stack temperature, pressure, range of velocity heads, moisture content, and stack gas dry molecular weight were determined to select the proper nozzle size for isokinetic sampling. A TI55-II was used to set the flow rate through the meter box. The meter box was leak checked from the pump to the orifice as outlined in Method 5. The equipment used in this test was manufactured by Research Appliance Corporation and was properly calibrated before these tests. (See Calibration)

Sampling Techniques

The particulate determinations were made by utilizing the sample train in Figure 3. 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. The nozzle 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 heater was maintained at the proper setting to obtain an exit temperature of 248 $\pm$ 25 ^{o}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 ^{o}F. The sample box 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 ^{o}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 enter the meter box where the gas flow and temperature were measured. Gas analysis for CO_2 and O_2 was determined for each test by using Fyrite gas analyzers. Particulate catches were placed in sealed petri dishes. Each acetone wash from the nozzle and probe was combined and placed in a

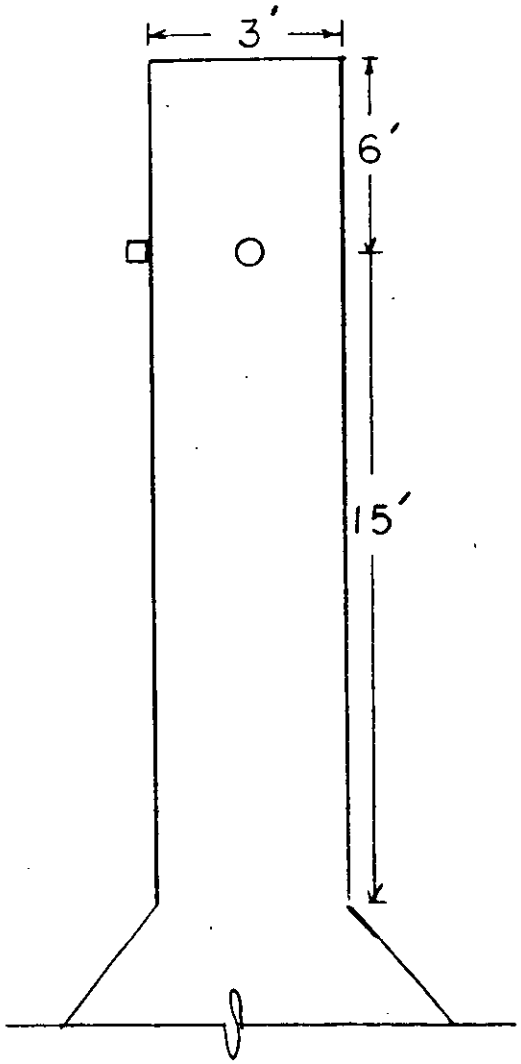
sealed container. For these tests an acetone blank of approximately 300 milliliters was placed in a sealed container. These containers were kept in a locked box and were transported to the laboratory for analysis.

Analysis

The filters (Gelman, Class A, without organic binder, minimum 99.9% retention for particles 0.3 microns as determined by DOP tests) were prepared for the field test by desiccating at 68 $\pm$ 10 ^{o}F and ambient pressure for 24 hours and weighing at intervals of at least six (6) hours to a constant weight (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 laboratory report sheets in this report. During each weighing the filter was exposed to the laboratory atmosphere for no more than two (2) minutes and a relative humidity of less than fifty percent (50%).

The acetone washes and blank for the group of tests were evaporated to dryness in tared glass beakers. They were then desiccated for twenty four (24) hours and weighed to a constant weight.

The moisture content for each test was determined by measuring the amount of increased water collected in the impingers and the increase in weight of the silica gel. These weights were combined to give the total amount of water collected. Mr. Tom Lotz was responsible for the collection, transportation, and analysis of the samples recovered during the series of tests.



Not to Scale

SAMPLE POINT LOCATION
AND
STACK BREECHING DIATRAM
TUNNEL KILN NO. 29
GENERAL SHALE PRODUCT CORPORATION
KINGSPORT, TENNESSEE

Point No.	Distance from Inside Wall Inches
1	35.0
2	34.2
3	32.9
4	31.5
5	29.9
6	28.1
7	25.8
8	22.5
9	13.5
10	10.2
11	7.9
12	6.1
13	4.5
14	3.1
15	1.8
16	1.0

Figure 1

SAMPLE POINT LOCATION
AND
STACK BREECHING DIAGRAM
COAL CRUSHER
GENERAL SHALE PRODUCT CORPORATION
KINGSPORT, TENNESSEE

Point Number	Distance from Inside Wall Inches
1	14.1
2	10.9
3	7.8
4	4.7
5	1.6

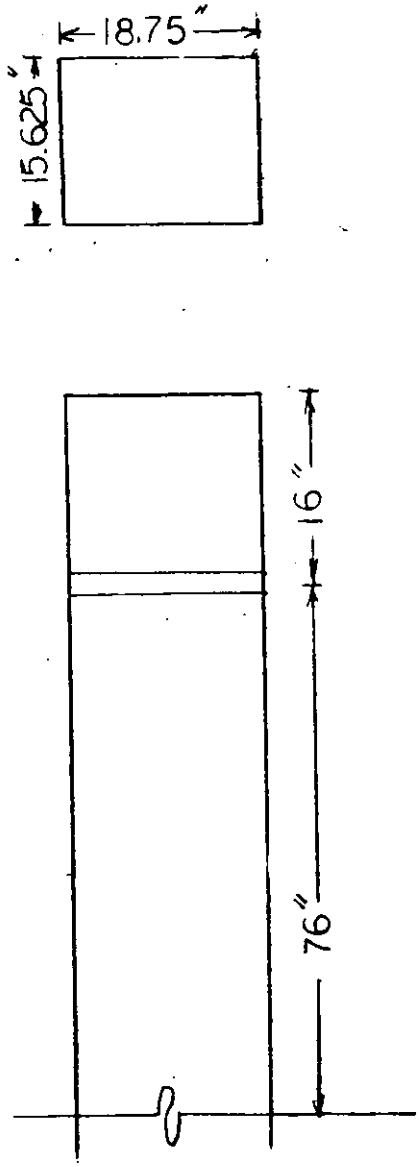
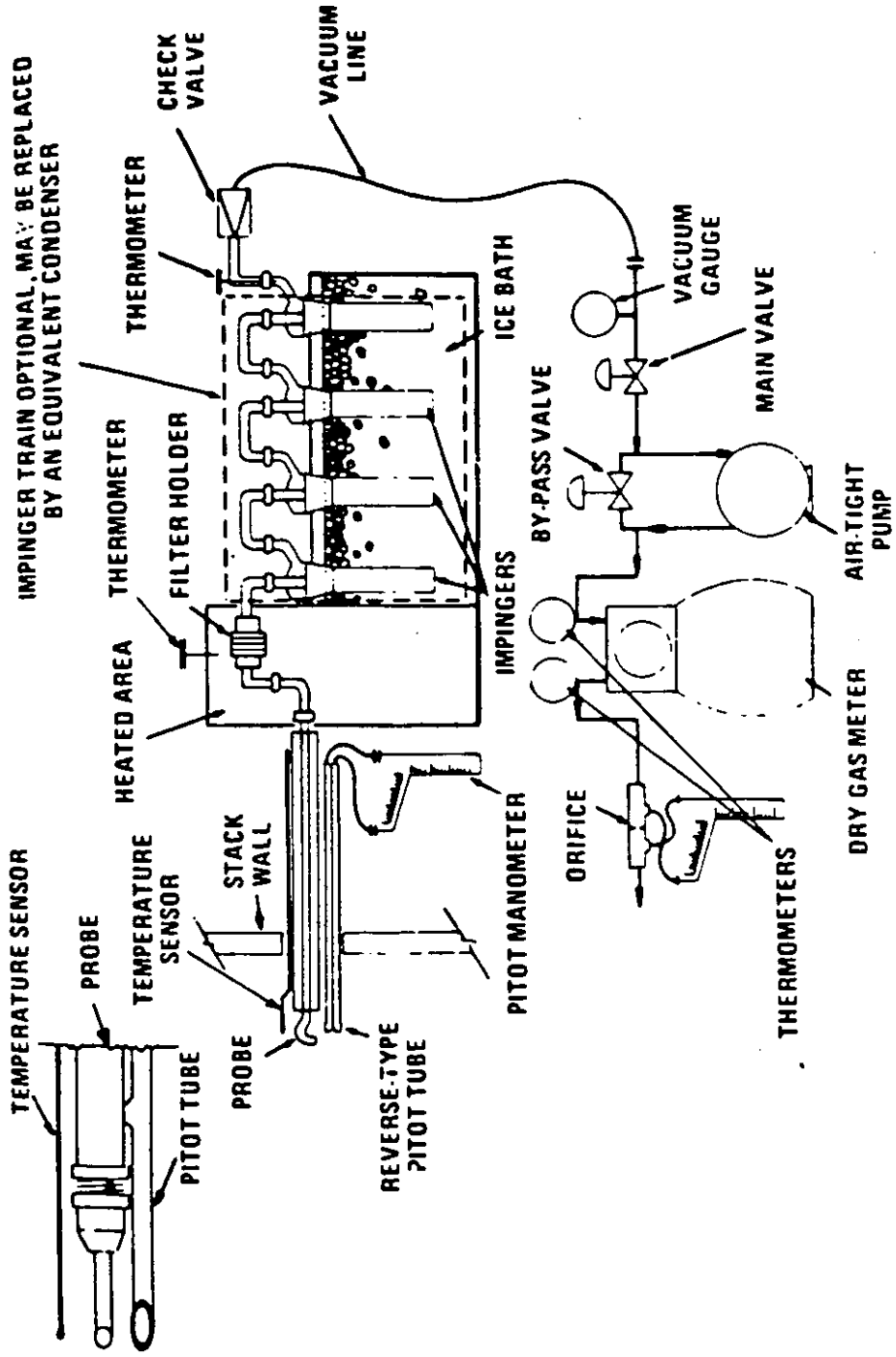


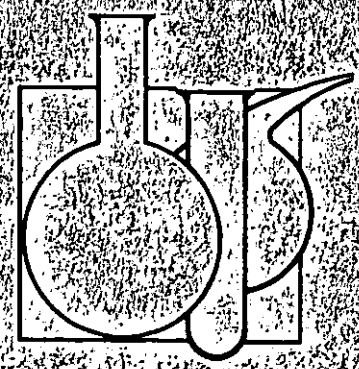
Figure 2



PARTICULATE SAMPLING TRAIN
METHOD 5

Figure 3

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)

Ca - Acetone blank residue concentration, mg/g

c_a - Particulate Concentration, ACF

CFM - Cubic feet per minute

Cp - 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 $\left[\frac{(lb/lb\text{-}mole)(in.\ Hg)}{(^{o}R)\ (in.\ H_2O)}\right]^{1/2}$

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, 18.0 g/g-mole (18.01 lb/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 - $m^3/^oK$-g-mole (21.85 in. Hg-$ft^3/^oR$-lb-mole)

SCF - Standard Cubic Foot

ta - Ambient Temperature, ^oF

tm - Average Temperature of meter, ^oF

t_s - Average Temperature of stack, ^oF

tstd - Standard Temperature, 68°F

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 ΔH measured for a specific orifice when operated under the following conditions: 0.75 cfm of dry air (M.W. = 29) at 68°F, 29.92 in. Hg.

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

Θ - Total sampling time, min.

Θ_1 - Sampling time interval from the beginning of a run until the first component change, min.

Θ_i - 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. $P_s = P_{bar} + \frac{P_g}{13.6}$

2. $P_m = P_{bar} + \frac{\overline{\Delta H}}{13.6}$

3. $V_{m(std)} = V_m Y \left(\frac{Tstd}{Tm}\right) \left[\frac{Pbar + \frac{\overline{\Delta H}}{13.6}}{Pstd}\right]$

4. $V_w(std) = 0.04707\ V_{lc}$

5. $B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$

6. $M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$

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

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

9. $Q_a = (v_s)\ (A_s)\ (60)$

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

11. $c_s = \left[0.0154\ (Mn/Vmstd)\right]$

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

13. $c_{50} = \frac{c_s}{1 - \left[\frac{(1.5)(\%O_2) - 0.133(\%N_2) - 0.75\ (\%CO)}{21}\right]}$

14. $c_{12} = c_s \frac{12}{\%\ CO_2}$

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

16. $$V_n = \frac{T_s}{P_s}\left[(0.002669)(V_{1c}) + \frac{V_m}{T_m}\left(P_{bar} + \frac{\overline{\Delta H}}{13.6}\right)\right]$$

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

18. $$I = \frac{100\ V_n}{60\ \Theta\ v_s\ An}$$

19. $$V_{mc} = V_m - (L_p - L_a)\ \Theta$$

20. $$W_a = Ca\ Vaw\ p_a$$

TENNESSEE AIR POLLUTION CONTROL DIVISION
SOURCE SAMPLING SECTION
Source Sampling Observation Report Sheet (Particulates)

Company General Shale Ref. No. 82-00036
Source I.D. 82-36-25 Tr. 29
Test Conducted by Guardian S[illegible]
Person in Charge of Test Tom [illegible]
Observer Thomas Isaacs
Run Number Observed 1, 2, 3

Date 7-21-82 Time Test Observed 9:01 - 4:16

THIS REPORT SHEET IS AN EVALUATION OF SAMPLING PROCEDURES CONDUCTED AT THE ABOVE MENTIONED SITE. THIS EVALUATION COVERS ONLY GENERAL ITEMS OBVIOUS TO THE OBSERVER. THIS DOES NOT IN ANY WAY IMPLY THAT ALL TEST PROCEDURES ARE ACCURATE OR THAT THE TEST REPORT WILL BE ACCEPTED BY THE TAPCD. EVEN THOUGH THE FIELD PROCEDURE MAY BE ACCEPTABLE, INFORMATION PRESENTED IN THE TEST REPORT MAY RENDER THE ENTIRE TEST UNACCEPTABLE. THIS REPORT APPLIES ONLY TO THE TESTS ACTUALLY OBSERVED BY THE TAPCD OBSERVER.

PRELIMINARY DETERMINATIONS

- Sampling Location ✓
- Number of sample points ✓
- Velocity traverse ✓
- Method of moisture determination ✓

SAMPLING

- Leak check: pretest (specify <.02) ✓
  post test (specify <.02) ✓
- Probe tip orientation ✓
- Filter heated to minimum temp. ✓
- Time sampled each point ✓
- Accurately monitored train temps. ✓
- Initial readings recorded ✓
- Readings recorded if train shut down ✓
- Final readings recorded ✓
- Gas analysis (specify Fyrite ✓) ✓

PROCESS INFORMATION

Engineer Present (Name Tupili Reddy)

Pretest Agreement _____

SAMPLING TRAIN

- Basic Construction ✓
- Probe Design ✓
- Nozzle Condition ✓
- Pitot Condition ✓
- Filter ✓
- Correct amt. H_2O and Silica Gel in impingers N/A

TRAIN BREAK-DOWN

- Probe moved so as to not lose material ✓
- Probe washed and brushed ✓
- Acceptable container to store washings ✓
- Reagent grade acetone used ✓
- Blank of solutions taken ✓
- Train re-set acceptably ✓

CALIBRATION DATA

Proper calibration data available at site ✓

Observer Thomas Isaacs Team Leader [signature]

Original to observer; copy to team leader (to be submitted with test report)

PH-0463

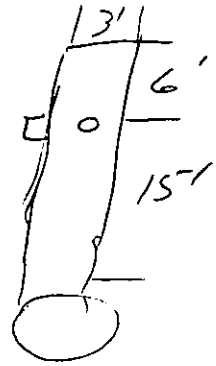
APC 8/79

GUARDIAN SYSTEMS INC.

2810 18th Street South
Birmingham, Alabama 35209
205/879-1850

TRAVERSE POINT LOCATION FOR CIRCULAR OR RECTANGULAR DUCTS

PLANT General Shale
DATE 7/20/22
SAMPLING LOCATION TK-29
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) 40"
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) 4"
STACK I.D. (DISTANCE A - DISTANCE B) 36"
NEAREST UPSTREAM DISTURBANCE 6'
NEAREST DOWNSTREAM DISTURBANCE 15'
OPERATOR LCTL / McKinney

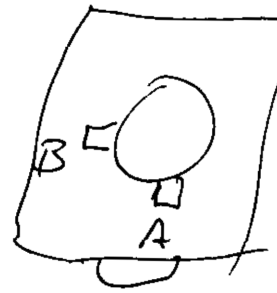


SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	PERCENT OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 0.1 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1			1.0		
2			1.8		
3			3.1		
4			4.5		
5			6.1		
6			7.9		
7			10.2		
8			13.5		
9			22.5		
10			25.8		
11			28.1		
12			29.9		
13			31.5		
14			32.9		
15			34.2		
16			35.0		

VELOCITY TRAVERSE

PLANT General Shale
DATE 7/20/82
LOCATION TE-29 STACK
STACK I.D. 36 "
BAROMETRIC PRESSURE, in. Hg 29.55
STACK GAUGE PRESSURE, in. H_2O 0.07
OPERATORS Lotz / McKin



TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
A 1	0.63	263
2	0.81	
3	0.84	
4	0.83	
5	0.83	
6	0.78	
7	0.78	294
8	1.3	
9	1.2	
10	1.2	
11	1.1	
12	1.05	
13	1.05	
14	1.05	304
15	1.05	
16	.88	
AVERAGE	.976	

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
AVERAGE		

FIELD DATA SHEET

PLANT General Shale RUN # 1

LOCATION Stack TK-29 DATE 7/21/82

BARO. PRES. 30.20 TIME 901 - 1007

GUARDIAN SYSTEMS INC.
2610 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
Port A			617.427	1	2	3		4	5			
1	2	2	619.1	298	73	73	73	31	225	1.8	.87	3
2		4	620.6	312	80	77	78	34	248	1.9	.92	3.5
3		6	622.4	318	84	78	80	36	254	2.0	.94	4
4		8	624.2	315	87	79	83	39	257	2.0	.95	4
5		10	625.9	315	92	79	86	43	259	2.1	.98	4
6		12	627.7	315	96	81	88	41	263	2.1	.98	4
7		14	629.1	314	99	81	90	44	266	1.6	.76	3.5
8		16	630.8	314	101	82	92	45	266	1.6	.75	3.5
9		18	632.7	315	103	83	93	44	266	2.6	1.2	5
10		20	634.7	313	105	84	94	46	267	2.6	1.2	5
11		22	636.6	311	109	85	97	51	267	2.4	1.1	5
12		24	638.6	313	112	86	99	41	267	2.4	1.1	5
13		26	640.2	311	113	87	100	41	266	1.7	.77	4
14		28	642.0	305	114	88	101	42	266	2.1	.96	4.5
15		30	643.7	307	115	89	102	41	262	1.9	.88	4
16		32	645.230	307	115	90	102	40	260	1.4	.62	3.5
Port B												
1	2	34	647.2	307	112	92	102	38	251	2.6	1.2	5
2		36	649.2	311	112	93	102	42	254	2.8	1.25	5
3		38	651.4	312	117	94	106	40	263	2.8	1.25	5
4		40	653.3	315	120	96	108	41	265	2.9	~~.75~~ 1.3	5.5
5		42	655.5	313	121	97	109	52	264	2.8	1.25	5.5
6		44	657.6	310	122	97	110	53	262	2.8	1.25	5.5
7		46	659.6	312	124	99	112	54	251	2.7	1.2	5.5
8		48	661.8	311	124	99	112	53	248	2.6	1.15	5.0
9		50	663.3	310	125	100	112	37	229	1.6	.73	4
10		52	665.0	313	125	100	112	39	230	1.7	.75	4

STATIC PRESSURE "H2o +.07

PROBE TIP SIZE

BEFORE	AFTER
.242	.242
.242	.242
.242	.242

WATER

ml. 70

gram 9.2

Total 79.2

OPERATOR [signature]

Sample Box No. 2

Meter Box No. 700

Meter ΔH@ 1.67

Pitot, CP 84

Temp. Device 199 Ω

Probe No. 5'-N

Probe Liner ~~80~~ GLASS

Probe Htr. Set 80

Ambient Temp. 73

% O_2 16.0

% CO_2 4.5

NOTES

Orifice @9.5

Pitot ~~@9.5~~

Meter ~~617.307~~ ~~617.285~~ BAD BOX

~~.017~~ @25" Hg

617.427

617.412

.015 @23" Hg

R-9.5

S-9.5

G-1

FIELD DATA SHEET

PLANT GS TK-29 RUN # 1

LOCATION STACK DATE 7/21/82

BARO. PRES. 30.80 TIME 901-1007

GUARDIAN SYSTEMS INC.
2610 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
11	2	54	666.5	311	124	101	112	38	251	1.6	.73	4
12		56	668.3	307	123	101	112	39	270	2.1	.92	4.5
13		58	670.1	309	124	103	114	40	270	2.0	.88	4
14		60	671.8	305	125	103	114	42	252	1.8	.82	4
15		62	673.6	305	127	104	116	42	251	1.6	.72	3.5
16		64	674.970	305	124	103	114	44	254	1.4	.62	3
				9934			3225			68.	31.314	
22		64	57.543	310			101			2.125	.979	5.5

675.003
675.993
.010 @ 7" Hg 1 min –

RAN – 10.0" H_2O
STATIC – 9.8" H_2O

STATIC PRESSURE "H2o +0.07

PROBE TIP SIZE

BEFORE	AFTER
.242	.242
.242	.242
.242	.242

WATER

ml. 70
gram 9.2
Total 79.2

OPERATOR
[signature]

Sample Box No. 2
Meter Box No. 700
Meter ΔH@ 1.69
Pitot, CP .84
Temp. Device 199 Ω
Probe No. 52 N
Probe Liner GLASS
Probe Htr. Set 80
Ambient Temp. 80
% O_2 16.0
% CO_2 4.5

NOTES

Orifice
Pitot
Meter

G-1

FIELD DATA SHEET

PLANT Gerrard Shale RUN # 2

LOCATION Stack TK-29 DATE 7-21-82

BARO. PRES. 30.20 TIME 1106-1215

GUARDIAN SYSTEMS INC.
2610 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
Port B			675.180	1	2	3		4	5			
1	2	2	676.9	309	85	85	85	30	254	2.7	1.2	5
2		4	679.3	309	86	87	86	30	265	2.7	1.2	5
3		6	680.9	307	92	87	90	38	256	2.8	1.25	5
4		8	658	308	96	87	92	35	262	2.8	1.25	5
5		10	685.4	307	100	87	94	42	258	2.8	1.25	5
6		12	687.5	308	102	87	94	41	249	2.7	1.2	5
7		14	689.5	308	105	88	96	41	250	2.7	1.2	5
8		16	691.2	310	107	89	98	44	255	1.7	.75	4
9		18	692.7	310	108	89	98	44	251	1.6	.71	4
10		20	694.5	310	109	90	100	41	243	2.3 ~~1.6~~	1.00 ~~.72~~	5
11		22	696.4	309	110	91	100	43	252	2.2	.97	5
12		24	698.3	308	112	92	102	41	246	2.1	.92	4.5
13		26	700.0	306	114	94	104	41	245	2.0	.86	4.5
14		28	701.8	304	117	96	106	41	252	1.9	.80	4
15		30	703.4	305	118	97	108	37	244	1.7	.73	4
16		32	704.950	305	119	99	109	44	252	1.5	.64	3.5
Port A												
1	2	34	706.7	305	111	98	104	41	252	2.1	.90	4.5
2		36	709.0	305	109	99	104	39	252	2.2	.93	5
3		38	710.4	310	112	99	106	43	252	2.0	.86	4.5
4		40	712.2	311	115	99	107	42	262	2.0	.86	4.5
5		42	714.0	310	116	100	108	43	256	1.9	.83	4.5
6		44	715.7	313	118	102	110	43	257	1.8	.78	4.5
7		46	717.6	313	118	102	110	42	256	2.3	1.0	5
8		48	719.6	312	119	102	110	42	257	2.4	1.05	5.5
9		50	721.5	311	119	101	110	42	258	2.5	1.1	5.5
10		52	723.7	311	120	102	111	42	259	2.7	1.15	5.5

STATIC PRESSURE "H2o +0.07

PROBE TIP SIZE

BEFORE	AFTER
.242	.242
.242	.241
.242	.242

WATER

ml. 50

gram 21.1

Total 71.1

OPERATOR

Lots / M=Kinney

Sample Box No. 2

Meter Box No. 700

Meter ΔH@ 1.69

Pitot, CP .84

Temp. Device 89Ω

Probe No. 5'-N

Probe Liner GLASS

Probe Htr. Set 80

Ambient Temp. 88

% O_2 17

% CO_2 4

NOTES

Orifice NA -

Pitot

Meter @ 23" Hg

675.180
675.167
.013

R - 10"
S - 8.34

G-1

FIELD DATA SHEET

PLANT Gen'l Shl RUN # 2

LOCATION Stk TK-29 DATE 7/21/82

BARO. PRES. 30.20 TIME 1106 - 1215

GUARDIAN SYSTEMS INC.
2610 19th Street South
Birmingham, Alabama 35209
205/879-1850

	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
11	2	54	725.6	309	120	102	111	41	258	2.6	1.1	5.5
12		56	727.8	309	121	102	112	40	258	2.6	1.1	5.5
13		58	729.7	305	122	102	112	40	259	2.3	1.0	5
14		60	731.6	305	122	103	112	40	257	2.2	.92	5
15		62	733.4	305	122	104	113	39	257	1.9	.82	4.5
16		64	735.042	305	123	105	114	39	254	1.6	.67	3.5
				9862			3316			71.3	31.353	
32		64	59.862	308			104			2.23	.980	5.5

STATIC PRESSURE "H2o +0.07

PROBE TIP SIZE

BEFORE	AFTER
.242	.242
.242	.242
.242	.242

WATER

ml. 50.0

gram 21.1

Total 71.1

OPERATOR

LB/McKinney

735.069
735.065
.004 @ 7" Hg 1 min

Run - 9.0
Static - 8.5

Sample Box No. 2
Meter Box No. 700
Meter ΔH@ 1.69
Pitot, CP .84
Temp. Device 189 Ω
Probe No. 5'-N
Probe Liner GLASS
Probe Htr. Set 80
Ambient Temp. 68
% O_2 17
% CO_2 4

NOTES

Orifice
Pitot
Meter

G-1

FIELD DATA SHEET

PLANT [illegible] RUN # 3

LOCATION Stack TL-25 DATE 7/11/92

BARO. PRES. 30.20 TIME 1310 -

GUARDIAN SYSTEMS INC.
2810 19th Street South
Birmingham, Alabama 35209
205/879-1850

	TIME MIN	TIME DUR	METER VOL FT 3	STACK TEMP °F	METER TEMP. °F IN	OUT	AVG	IMP TEMP °F	BOX TEMP °F	METER PRESSURE "H2O	VELOCITY PRESSURE "H2O	VACUUM PRESSURE "Hg
Port A			735.320	1	2	3		4	5			
1	2	2	736.8	310	107	102	102	31	235	1.8	.79	3.5
2		4	738.7	310	101	100	101	32	233	2.1	.91	4
3		6	740.6	311	107	102	104	35	225	2.3	.98	4.5
4		8	742.4	315	103	101	107	36	237	2.1	.90	4.5
5		10	744.0	314	116	104	108	35	234	2.0	.84	4.0
6		12	745.9	317	118	101	109	35	234	1.9	.82	4
7		14	747.9	318	119	101	110	35	239	2.5	1.05	5
8		16	749.9	315	121	101	111	37	249	2.6	1.1	5
9		18	752.0	316	123	102	112	38	255	2.6	1.1	5
10		20	754.0	318	125	102	114	38	255	2.7	1.15	5
11		22	756.2	317	126	103	115	37	256	2.6	1.1	5
12		24	758.1	314	127	103	115	37	255	2.5	1.05	5
13		26	760.1	312	130	104	117	37	255	2.5	1.05	5
14		28	762.3	307	132	105	118	36	254	2.5	1.05	5
15		30	764.0	307	132	106	119	36	251	2.1	.90	4
16		32	765.862	308	131	107	119	35	246	1.7	.73	3.5
Port B												
1	2	34	767.2	310	120	105	112	31	238	1.6	.67	3
2		36	769.3	310	120	106	113	32	228	2.8	1.2	5
3		38	771.5	313	122	106	114	35	229	2.8	1.2	5
4		40	773.7	315	125	107	116	36	231	2.8	1.2	5
5		42	775.3	319	126	106	116	36	237	1.7	.74	3.5
6		44	776.9	317	126	106	114	33	238	1.7	.73	3.5
7		46	779.1	316	126	107	116	32	236	2.8	1.2	5
8		48	781.1	315	126	107	116	34	243	2.6	1.1	5
9		50	783.1	315	126	108	117	34	247	2.5	1.05	5
10	↓	52	784.9	315	127	108	118	34	247	2.3	.99	4.5

STATIC PRESSURE "H2O +.07

PROBE TIP SIZE

BEFORE	AFTER
.242	.242
.242	.242
.242	.242

WATER

ml. 50

gram 8.7

Total 58.7

OPERATOR [illegible]

Sample Box No. 2

Meter Box No. 2-10

Meter ΔH@ 1.65

Pitot, CP .84

Temp. Device 195Ω

Probe No. 5-N

Probe Liner Glass

Probe Htr. Set 80

Ambient Temp. 88

% O_2 17

% CO_2 3.5

NOTES

Orifice

Pitot

Meter

735323
-735.25
.0623

P. 5.5
Stk 5.5

FIELD DATA SHEET

PLANT Gurf Shale RUN # 3

LOCATION STACK TK-29 DATE 7/21/82

BARO. PRES. 30.20 TIME 1310 - 1416

GUARDIAN SYSTEMS INC.
2810 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
11	2	54	787.0	312	128	108	118	33	249	2.2	.96	4
12		56	788.8	311	126	108	117	33	246	2.1	.89	4
13		58	790.6	311	126	108	117	32	246	1.9	.83	4
14		60	792.1	311	123	107	115	32	245	1.7	.74	3.5
15		62	793.8	311	122	106	114	32	251	1.5	.66	3
16		64	~~795.8~~	310	121	105	113	32	246	1.5	.66	3
				10023			3029			71.0	31.016	
32		64	60.072	313			113			2.22	.969	5

STATIC PRESSURE "H2o 40.07

PROBE TIP SIZE

BEFORE	AFTER
.242	.242
.242	.242
.242	.242

WATER

ml. 50

gram 8.7

Total 58.7

OPERATOR

Log / McKinney

Sample Box No. 2

Meter Box No. 700

Meter ΔH@ 1.69

Pitot, CP .84

Temp. Device 1992

Probe No. 5'-N

Probe Liner Glass

Probe Htr. Set 80

Ambient Temp. 88

% O_2 12.0

% CO_2 3.5

NOTES

Orifice

Pitot

Meter

795.406

795.395

.011 @ 7" Hg/min

Ran 10"

Static 9.3"

G-1

BLANK ANALYTICAL DATA

Plant General Shale Kingsport

Sample location TK-29 + Coal Crusher

Relative humidity 20%

Type of blank Acetone

Liquid level at mark and container sealed ✓

Density of blank (ρa) .785 g/ml

Blank volume (Va) 406 ml

Date and time of wt. 7/26/82 9:22 Am Gross wt. 82440.7 mg

Date and time of wt. 7/27/82 9:40 Am Gross wt. 82440.7 mg

Average gross wt. 82440.7 mg

Tare wt. 82439.5 mg

Weight of blank (ma) 1.2 mg

$$Ca = \frac{ma}{Va\ \rho a} = \frac{(1.2)}{(406)(.785)} = .0038 \text{ mg/g}$$

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

Remarks:

Signature of analyst [illegible]

Signature of reviewer

G-5

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: General Shale TK-25 Sample date: 7/21/82
Sample location: Stack Run no.: 1
Sample recovery person: LOTZ/M SKINNY Recovery date: 7/21/82
Filter(s) no.: T-14

MOISTURE

Impingers			Silica gel		
Final volume (wt)	70	ml(gm)	Final wt.	999.0 g	g
Initial volume (wt)	0	ml(gm)	Initial wt.	989.8 g	g
Net volume (wt)	70	ml(gm)	Net wt.	9.2 g	g

Total moisture 79.2 g
Color of silica gel MUD
Description of impinger water CLEAR

RECOVERED SAMPLE

Filter container no. Run #1 sealed ✓
Description of particulate on filter SLIGHTLY GREY → VERY LIGHT ALMOST WHITE
Acetone rinse container no. Run #1 Liquid level marked ✓
Acetone blank container no. BLANK Liquid level marked ✓
Samples stored and locked ✓
Remarks:

Date of laboratory custody NA
Laboratory personnel taking custody LOTZ
Remarks:

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant General Shale Kingsport Run No. 1

Sample location TK-29

Relative humidity 20%

Density of acetone (ρa) .785 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	—	—

Acetone rinse container no. Run #1

Acetone rinse volume (Vaw) 278 ml

Acetone blank residue concentration (Ca) 0.0038 mg/g

Wa = Ca Vaw ρa = (.0038)(278)(.785) = 0.8 mg

Date and time of wt 7/26/82 9:22A Gross wt 52812.9 mg

Date and time of wt 7/27/82 9:40A Gross wt 52812.9 mg

Average gross wt 52812.9 mg

Tare wt 52836 mg

Less acetone blank wt (Wa) -0.8 mg

Weight of particulate in acetone rinse 8.5 mg

Filter(s) container no. Run #1

Date and time of wt 7/26/82 9:22A Gross wt 241.1 mg

Date and time of wt 7/27/82 9:40A Gross wt 241.1 mg

Average gross wt 241.1 mg

Tare wt 239.1 mg

Weight of particulate on filter(s) 2.0 mg

Weight of particulate in acetone rinse 8.5 mg

Total weight of particulate 10.5 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks:

Signature of analyst [signature]

Signature of reviewer

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: General Shale Sample date: 7/21/82
Sample location: Stack TK-29 Run no.: 2
Sample recovery person: LOTZ/MSkinney Recovery date: 7/21/82
Filter(s) no.: T-13

MOISTURE

Impingers			Silica gel		
Final volume (wt)	50	ml(gm)	Final wt.	981.6 g	g
Initial volume (wt)	0	ml(gm)	Initial wt.	960.5 g	g
Net volume (wt)	50	ml(gm)	Net wt.	21.1 g	g

Total moisture 71.1 g
Color of silica gel Mixed
Description of impinger water CLEAR

RECOVERED SAMPLE

Filter container no. Run #2 sealed ✓
Description of particulate on filter Grayish white

Acetone rinse container no. Run #2 Liquid level marked ✓
Acetone blank container no. Liquid level marked
Samples stored and locked ✓
Remarks:

Date of laboratory custody NA
Laboratory personnel taking custody LOTZ
Remarks:

G-5

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant General Shale Kingsport Run No. 2

Sample location TK-29

Relative humidity 20%

Density of acetone (ρa) .785 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	✓	✓

Acetone rinse container no. Run #2

Acetone rinse volume (Vaw) 232 ml

Acetone blank residue concentration (Ca) 0.0038 mg/g

Wa = Ca Vaw ρa = (0.0038)(232)(.785) = 0.7 mg

Date and time of wt 7/26/82 9:22AM Gross wt 80197.5 mg

Date and time of wt 7/27/82 9:40AM Gross wt 80197.4 mg

Average gross wt 80197.4 mg

Tare wt 80191.7 mg

Less acetone blank wt (Wa) -0.7 mg

Weight of particulate in acetone rinse 5.0 mg

Filter(s) container no. Run #2

Date and time of wt 7/26/82 9:22AM Gross wt 241.5 mg

Date and time of wt 7/27/82 9:40AM Gross wt 242.5 mg

Average gross wt 242.5 mg

Tare wt 235.4 mg

Weight of particulate on filter(s) 3.1 mg

Weight of particulate in acetone rinse 5.0 mg

Total weight of particulate 8.1 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks:

Signature of analyst [illegible]

Signature of reviewer

GUARDIAN SYSTEMS inc

G5

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: General Shale Sample date: 7/21/82
Sample location: TK-25 Stack Run no.: 3
Sample recovery person: [illegible] Recovery date: 7/21/82
Filter(s) no.: T-12

MOISTURE

Impingers			Silica gel		
Final volume (wt)	50	ml(gm)	Final wt.	1007.7	g
Initial volume (wt)	0	ml(gm)	Initial wt.	999.0	g
Net volume (wt)	50	ml(gm)	Net wt.	8.7	g

Total moisture 58.7 g
Color of silica gel Mixed
Description of impinger water Clear

RECOVERED SAMPLE

Filter container no. R #3 sealed ✓
Description of particulate on filter Grey white

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 NA
Laboratory personnel taking custody [illegible]
Remarks:

G-5

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant General Shale Kingsport Run No. 3

Sample location TK-29

Relative humidity 20 %

Density of acetone (ρa) .785 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	✓	✓

Acetone rinse container no. Run #3

Acetone rinse volume (Vaw) 302 ml

Acetone blank residue concentration (Ca) 0.0038 mg/g

Wa = Ca Vaw ρa = (0.0038)(302)(.785) = 0.9 mg

Date and time of wt 7/26/82 9:22Am Gross wt 81153.4 mg

Date and time of wt 7/27/82 9:40Am Gross wt 81155.5 mg

Average gross wt 81155.4 mg

Tare wt 81148.5 mg

Less acetone blank wt (Wa) -0.9 mg

Weight of particulate in acetone rinse 6.2 mg

Filter(s) container no. Run #3

Date and time of wt 7/26/82 9:22A Gross wt 244.5 mg

Date and time of wt 7/27/82 9:40Am Gross wt 244.5 mg

Average gross wt 244.5 mg

Tare wt 242.2 mg

Weight of particulate on filter(s) 2.3 mg

Weight of particulate in acetone rinse 6.2 mg

Total weight of particulate 8.5 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks:

Signature of analyst [signature]

Signature of reviewer

G-5

TENNESSEE AIR POLLUTION CONTROL DIVISION
SOURCE SAMPLING SECTION
Source Sampling Observation Report Sheet (Particulates)

Company General Shale Ref. No. 82-00036
Source I.D. Coal Grinder Baghouse
Test Conducted by Guardian Systems
Person in Charge of Test Tom Lotz
Observer Thomas Isaacs
Run Number Observed 1, 2

Date 7-21-82 Time Test Observed 4:37 - 7:30

THIS REPORT SHEET IS AN EVALUATION OF SAMPLING PROCEDURES CONDUCTED AT THE ABOVE MENTIONED SITE. THIS EVALUATION COVERS ONLY GENERAL ITEMS OBVIOUS TO THE OBSERVER. THIS DOES NOT IN ANY WAY IMPLY THAT ALL TEST PROCEDURES ARE ACCURATE OR THAT THE TEST REPORT WILL BE ACCEPTED BY THE TAPCD. EVEN THOUGH THE FIELD PROCEDURE MAY BE ACCEPTABLE, INFORMATION PRESENTED IN THE TEST REPORT MAY RENDER THE ENTIRE TEST UNACCEPTABLE. THIS REPORT APPLIES ONLY TO THE TESTS ACTUALLY OBSERVED BY THE TAPCD OBSERVER.

PRELIMINARY DETERMINATIONS

- Sampling Location ✓
- Number of sample points ✓
- Velocity traverse ✓
- Method of moisture determination ✓

SAMPLING

- Leak check: pretest (specify <.02) ✓
  post test (specify <.02) ✓
- Probe tip orientation ✓
- Filter heated to minimum temp. ✓
- Time sampled each point ✓
- Accurately monitored train temps. ✓
- Initial readings recorded ✓
- Readings recorded if train shut down ✓
- Final readings recorded ✓
- Gas analysis (specify Fyrite) ✓

PROCESS INFORMATION

Engineer Present (Name Tupili Reddy)

Pretest Agreement _____

SAMPLING TRAIN

- Basic Construction ✓
- Probe Design ✓
- Nozzle Condition ✓
- Pitot Condition ✓
- Filter ✓
- Correct amt. H_2O and Silica Gel in impingers N/A

TRAIN BREAK-DOWN

- Probe moved so as to not lose material ✓
- Probe washed and brushed ✓
- Acceptable container to store washings ✓
- Reagent grade acetone used ✓
- Blank of solutions taken ✓
- Train re-set acceptably ✓

CALIBRATION DATA

Proper calibration data available at site ✓

Observer Thomas Isaacs Team Leader [signature]

Original to observer; copy to team leader (to be submitted with test report)

PH-0463

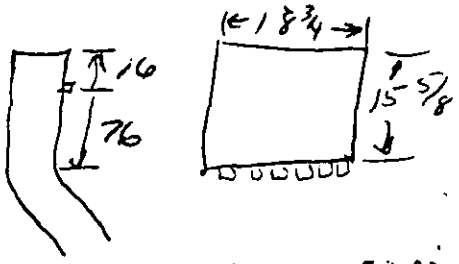
APC 8/79

GUARDIAN SYSTEMS INC.

2610 18th Street South
Birmingham, Alabama 35209
205/879-1850

TRAVERSE POINT LOCATION FOR CIRCULAR OR RECTANGULAR DUCTS

PLANT Coal Shale Kingsport
DATE 7/21/82
SAMPLING LOCATION Coal Crusher
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A)
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B)
STACK I.D. (DISTANCE A - DISTANCE B) 15 5/8 x 18 3/4
NEAREST UPSTREAM DISTURBANCE
NEAREST DOWNSTREAM DISTURBANCE
OPERATOR LOTZ/McKinney



5X6 = 30 points

SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	PERCENT OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 0.1 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1		15.625	1.6		
2			4.7		
3			7.8		
4			10.9		
5			14.1		

VELOCITY TRAVERSE

PLANT General Shale
DATE 7/21/82
LOCATION Goal Crusher Baghouse Stack
STACK I.D. ~~[illegible]~~ 15 5/8 X
BAROMETRIC PRESSURE, in. Hg 30.20
STACK GAUGE PRESSURE, in. H_2O
OPERATORS LOTZ / McKinney

.306
.313
9.028
9.394
100
119
.17 - 1.54
.11 - .99
.08 - .72

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
A 1	.08	113
2	.11	113
3	.11	118
4	.11	120
5	.11	120
B 1	.10	113
2	.11	119
3	.12	123
4	.14	125
5	.15	126
C 1	.11	119
2	.11	118
3	.12	120
4	.13	126
5	.15	126
D 1	.11	118
2	.12	120
3	.13	125
4	.14	126
5	.16	129
AVERAGE		

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
E 1	.10	120
2	.12	122
3	.13	126
4	.15	129
5	.17	130
F 1	.11	123
2	.13	123
3	.14	129
4	.16	130
5	.17	130
	.355	119
	.13 1.54	
	.99	
.17 - 3.18	.72	
.11 = 2.06		
.05 = 1.50		
AVERAGE		

GUARDIAN SYSTEMS inc

FIELD DATA SHEET

PLANT Cement Shale RUN # 1

LOCATION Coke Crush DATE 7/21/82

BARO. PRES. 30.20 TIME 1637-1737

GUARDIAN SYSTEMS INC.
2810 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
A			795.575	1	2	3	4	4	5			
1	2	2	797.0	125	94	93	94	35	227	1.30	.16	3
2		4	798.4	131	93	93	93	33	245	1.3	.16	3
3		6	799.7	134	97	93	95	33	262	1.2	.15	3
4		8	801.0	134	100	94	97	37	270	1.05	.13	3
5		10	802.2	—	103	94	98	37	264	.89	.11	2
B												
1	2	12	803.7	132	105	95	100	34	271	1.4	.17	3
2		14	805.1	134	105	95	100	34	270	1.3	.16	3
3		16	806.5	135	111	96	104	35	267	1.1	.14	3
4		18	807.7	134	113	97	105	35	242	.98	.12	2.5
5		20	808.8	—	114	97	106	35	232	.82	.10	2
Port C												
1	2	22	810.3	132	115	98	106	34	238	1.4	.17	3
2		24	811.7	134	117	99	108	35	255	1.0	.16	3
3		26	813.1	135	120	99	110	35	262	1.2	.15	3
4		28	814.4	134	122	100	111	35	264	1.1	.14	3
5		30	815.7	—	122	101	112	35	260	.91	.11	2.5
Port D												
1	2	32	817.2	134	122	103	112	35	255	1.5	.18	3
2		34	818.6	134	124	103	114	35	256	1.4	.17	3
3		36	820.1	134	125	104	114	35	258	1.2	.15	3
4		38	821.4	134	126	105	116	36	262	1.2	.14	3
5		40	822.7	—	127	106	116	36	256	1.00	.12	2.5
Port E												
1	2	42	824.2	134	127	108	118	36	267	1.5	.18	3
2		44	825.7	134	128	108	118	36	258	1.4	.17	3
3		46	827.3	134	129	108	118	36	257	1.3	.16	3

STATIC PRESSURE "H2o: -0.13

PROBE TIP SIZE

BEFORE	AFTER
.306	.306
.306	.306
.306	.300

WATER

ml. 40

gram 6.0

Total 46.0

OPERATOR

Sample Box No. 2

Meter Box No. 700

Meter ΔH@ 1.69

Pitot, CP .84

Temp. Device 199Ω

Probe No. PG-4-3

Probe Liner GLASS

Probe Htr. Set 65

Ambient Temp. 88

% O_2 20.5

% CO_2 0.0

NOTES

Orifice

Pitot

Meter

795.575
795.565
.010 @ 22°

R - 10⁴
S - 10⁴

G-1

FIELD DATA SHEET

PLANT General Shale RUN # 1

LOCATION Coal Crusher DATE 7/21/82

BARO. PRES. 30.20 TIME 1637-1737

GUARDIAN SYSTEMS INC.
2810 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
2		48	828.7	134	129	109	119	36	256	1.25	.15	3
1		50	830.0	—	129	109	119	36	261	1.10	.13	3
Port F												
5		52	831.5	134	129	109	119	36	263	1.5	.18	3
4		54	833.1	132	130	110	120	37	258	1.4	.17	3
3		56	834.6	133	131	111	121	37	257	1.4	.17	3
2		58	836.1	133	132	112	122	37	255	1.26	.15	3
1		60	837.542	—	132	113	122	38	259	1.01	.12	2.5
				3198			3367			36.67	4.546	
30		40	41.771	133			110			1.22	.385	3

STATIC PRESSURE "H2o: −0.13

PROBE TIP SIZE

BEFORE	AFTER
.306	.306
.306	.306
.306	.300

WATER

ml. 42

gram 6.0

Total 46.0

OPERATOR Lott / McKinney

Sample Box No. 2

Meter Box No. 200

Meter ΔH@ 1.69

Pitot, CP .84

Temp. Device 1992

Probe No. 16-4-3

Probe Liner GLASS

Probe Htr. Set 65

Ambient Temp. 88

% O_2 20.5

% CO_2 0

NOTES

Orifice

Pitot

Meter

837.374
837.367
.007 @ 7" Hg 1 min

Run −8.5" H_2O
Stab 8.5" H_2O

G-1

FIELD DATA SHEET

PLANT Gaul Shale RUN # 2

LOCATION Coal Cruster DATE 7/21/82

BARO. PRES. 70.20 TIME 1813-1913

GUARDIAN SYSTEMS INC.
2610 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
Port F			837.670									
5	2	2	839.2	132	106	105	106	37	227	1.5	.18	3
4		4	840.7	130	107	107	107	40	227	1.5	.18	3
3		6	842.2	134	111	108	110	42	229	1.4	.17	3
2		8	843.6	134	114	107	110	39	234	1.2	.15	2.5
1		10	844.9	132	117	107	112	37	242	.99	.12	2.5
Port E												
5	2	12	846.5	134	119	107	113	36	240	1.5	.18	3
4		14	848.1	134	121	107	114	36	244	1.4	.17	3
3		16	849.5	133	123	107	115	36	237	1.3	.16	3
2		18	851.0	130	124	108	116	35	241	1.25	.15	3
1		20	852.3	132	124	108	116	35	238	1.08	.13	2.5
Port D												
5	2	22	853.9	134	124	108	116	35	240	1.5	.18	3
4		24	855.4	132	125	109	117	35	237	1.4	.17	3
3		26	856.9	132	126	110	118	35	239	1.3	.16	3
2		28	858.3	132	126	110	118	35	236	1.25	.15	3
1		30	859.7	132	127	111	119	36	237	1.1	.13	2.5
Port C												
5	2	32	861.3	132	129	111	120	36	240	1.5	.18	3
4		34	862.8	132	130	112	121	36	239	1.3	.16	3
3		36	864.3	133	131	113	122	36	242	1.3	.16	3
2		38	865.6	132	131	113	122	35	240	1.25	.15	3
1		40	866.9	131	131	114	122	36	242	1.00	.12	2.5
Port B												
5	2	42	868.5	132	132	114	123	36	259	1.4	.17	3
4		44	870.0	132	132	115	124	36	254	1.4	.17	3
3		46	871.5	132	133	115	124	36	251	1.3	.15	3

STATIC PRESSURE "H2o: -0.13

PROBE TIP SIZE

BEFORE	AFTER
.306	.306
.306	.306
.306	.306

WATER

ml. 40

gram 9.5

Total 49.5

OPERATOR: Lot / McKinney

Sample Box No. 2

Meter Box No. 700

Meter ΔH@ 1.69

Pitot, CP .84

Temp. Device 199Ω

Probe No. PG-4-3

Probe Liner Glass

Probe Htr. Set 60

Ambient Temp. 88

% O_2 21.0

% CO_2 0.0

NOTES

Chg thru cyclone

Orifice

Pitot

Meter

837.670
837.665
.005@23" Hg

R-7.5
S-7.6

G-1

FIELD DATA SHEET

PLANT Grand Shelf RUN # 2

LOCATION Coal Crusher DATE 7/21/82

BARO. PRES. 30.20 TIME 1813-1913

GUARDIAN SYSTEMS INC.
2610 18th Street South
Birmingham, Alabama 35209
205/879-1850

	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
.2		48	872.9	132	134	116	125	36	253	1.2	.14	3
.1		50	874.2	131	135	116	126	36	260	1.0	.12	2.5
PMA												
5		52	875.6	132	134	117	126	36	261	1.3	.15	3
4		54	877.1	132	135	117	126	35	252	1.3	.15	3
3		56	878.7	132	136	118	127	36	250	1.3	.15	3
2		58	880.0	131	136	119	128	36	257	1.1	.13	2.5
1		60	881.324	130	136	118	128	35	259	1.0	.12	2.5
							3571			73.837	4723	
30		60	43.654	132			119			1.13	.391	3

881.354
881.353
.001 @ 8" Hg

R - 9.5
S - 0.0

STATIC PRESSURE "H2o -0.13

PROBE TIP SIZE

BEFORE	AFTER
.306	.306
.306	.306
.306	.306

WATER

ml. 40

gram 9.5

Total 49.5

OPERATOR [signature] / M E King

Sample Box No. 2
Meter Box No. 700
Meter ΔH@ 1.69
Pitot, CP .84
Temp. Device 199Ω
Probe No. PG-4-3
Probe Liner Clark
Probe Htr. Set 60
Ambient Temp. 88
% O_2 21.0
% CO_2 0.0

NOTES

Orifice
Pitot
Meter

G-1

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: General Shale Sample date: 7/21/86

Sample location: Coal Crusher Stk Run no.: 1

Sample recovery person: [illegible] Recovery date: 7/21/86

Filter(s) no.: T-11

MOISTURE

Impingers			Silica gel		
Final volume (wt)	40	ml(gm)	Final wt.	986.3 g	g
Initial volume (wt)	0	ml(gm)	Initial wt.	980.3 g	g
Net volume (wt)	40	ml(gm)	Net wt.	6.0	g

Total moisture 46 g

Color of silica gel Mixed

Description of impinger water Clear

RECOVERED SAMPLE

Filter container no. Pr #1 sealed ✓

Description of particulate on filter Light grey [illegible]

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

Acetone blank container no. Same as TK-29 Liquid level marked ✓

Samples stored and locked ✓

Remarks:

Date of laboratory custody NA

Laboratory personnel taking custody [illegible]

Remarks:

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant General Shale Kingsport Run No. 1

Sample location Coal Crusher

Relative humidity 20%

Density of acetone (ρa) .785 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	✓	✓

Acetone rinse container no. Run #1

Acetone rinse volume (Vaw) 176 ml

Acetone blank residue concentration (Ca) 0.0038 mg/g

Wa = Ca Vaw ρa = (0.0038)(176)(.785) = 0.5 mg

Date and time of wt 7/26/82 9:22AM Gross wt 28769.0 mg

Date and time of wt 7/27/82 9:40AM Gross wt 28769.1 mg

Average gross wt 28769.0 mg

Tare wt 28762.0 mg

Less acetone blank wt (Wa) - 0.5 mg

Weight of particulate in acetone rinse 6.5 mg

Filter(s) container no. Run #1

Date and time of wt 7/26/82 9:22AM Gross wt 240.7 mg

Date and time of wt 7/27/82 9:45AM Gross wt 240.6 mg

Average gross wt 240.6 mg

Tare wt 237.6 mg

Weight of particulate on filter(s) 3.0 mg

Weight of particulate in acetone rinse 6.5 mg

Total weight of particulate 9.5 mg

Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks:

Signature of analyst [signature]

Signature of reviewer

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: General Shale Sample date: 7/21/82

Sample location: COAL CRUSHER STK Run no.: 2

Sample recovery person: LOTZ/McKINNY Recovery date: 7/21/82

Filter(s) no.: T-

MOISTURE

Impingers			Silica gel		
Final volume (wt)	40	ml(gm)	Final wt.	1017.2 g	g
Initial volume (wt)	0	ml(gm)	Initial wt.	1007.7 g	g
Net volume (wt)	40	ml(gm)	Net wt.	9.5 g	g

Total moisture 49.5 g

Color of silica gel mixed

Description of impinger water Clear

RECOVERED SAMPLE

Filter container no. Run #1 sealed ✓

Description of particulate on filter Light grey & lobish

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

Acetone blank container no. Liquid level marked

Samples stored and locked ✓

Remarks:

Date of laboratory custody NA

Laboratory personnel taking custody LOTZ

Remarks:

G-5

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant General Shale Kingsport Run No. 2

Sample location Cone Crusher

Relative humidity 20%

Density of acetone (ρa) .785 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	✓	✓

Acetone rinse container no. Run # 2

Acetone rinse volume (Vaw) 280 ml

Acetone blank residue concentration (Ca) 0.0038 mg/g

Wa = Ca Vaw ρa = (.0038)(280)(.785) = _____ mg

Date and time of wt 7/26/82 9:22 Am Gross wt 78838.0 mg

Date and time of wt 7/27/82 9:40 Am Gross wt 78838.1 mg

Average gross wt 78838.0 mg

Tare wt 78828.8 mg

Less acetone blank wt (Wa) -0.8 mg

Weight of particulate in acetone rinse 8.4 mg

Filter(s) container no. Run # 2

Date and time of wt 7/26/82 9:22 Am Gross wt 246.2 mg

Date and time of wt 7/27/82 9:40 Am Gross wt 246.3 mg

Average gross wt 246.2 mg

Tare wt 238.2 mg

Weight of particulate on filter(s) 8.0 mg

Weight of particulate in acetone rinse 8.4 mg

Total weight of particulate 16.4 mg

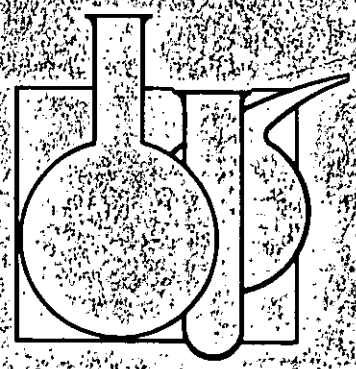
Note: In no case shall a blank residue greater than (.01 mg/g) or .001% of the weight of acetone used be subtracted from the sample weight.

Remarks: _____

Signature of analyst Tom Lot

Signature of reviewer _____

Plant Operation Data



PROCESS INFORMATION

PLANT: KINGSPORT, TN - PLANT 29

DATE: July 21, 1982

Brick Rate:

Car Schedule	=	120	Minutes	= .5	Cars/Hour
Car Count	=	10,240	S/S Brick/Car		
Hourly Rate	=	5,120	S/S Brick/Hour		
Brick Weight	=	4,375	Lbs.		
Brick Rate	=	22,400	Lbs./Hour		

Coal Rate:

Firing Rate	=	14.33	Tons Coal/Day
		1,194	Lbs. Coal/Hour
		233	Lbs. Coal/M Brick

Total Process Weight:

	22,400	Lbs. Brick/Hour
+	1,194	Lbs. Coal/Hour
	23,594	Total Lbs./Hour
	11.8	Tons/Hour

Coal Analysis:

14,154	Btu/Lb.	37.93% Volatiles
.78%	Sulfur	
4.91%	Ash	

Allowable Emissions:

Kingsport SIP Plan - 1.4 lbs./hr.

COAL TEST RESULTS

TO: B. Archer

CC:

GSPC PLANT # Kingsport #29

Date Sample Received 7-16-82

Sample Identification Pellico Seam 4" x 1" for Stack Test 7-21-82

Coal Grinding Information

Imp Mill Model

Hammer Placement Row F-1 2 3 4

Coal Screening - Mesh

Wire Size

Wire Diameter

Coal Size Analysis

Mesh Size	Per Cent Retained	Cumulative % Retained
14M		
28M		
48M		
100M		
200M		
-200M		
Fineness Modulus		

Test Data

BTU/lb. (net @ 5% Moisture)

BTU/lb. (oven dry) 14,154

% Volatiles 37.93%

% Ash 4.91%

% Sulfur 0.78%

% Moisture (As Received)

COMMENTS

COMMENTS (Continued)

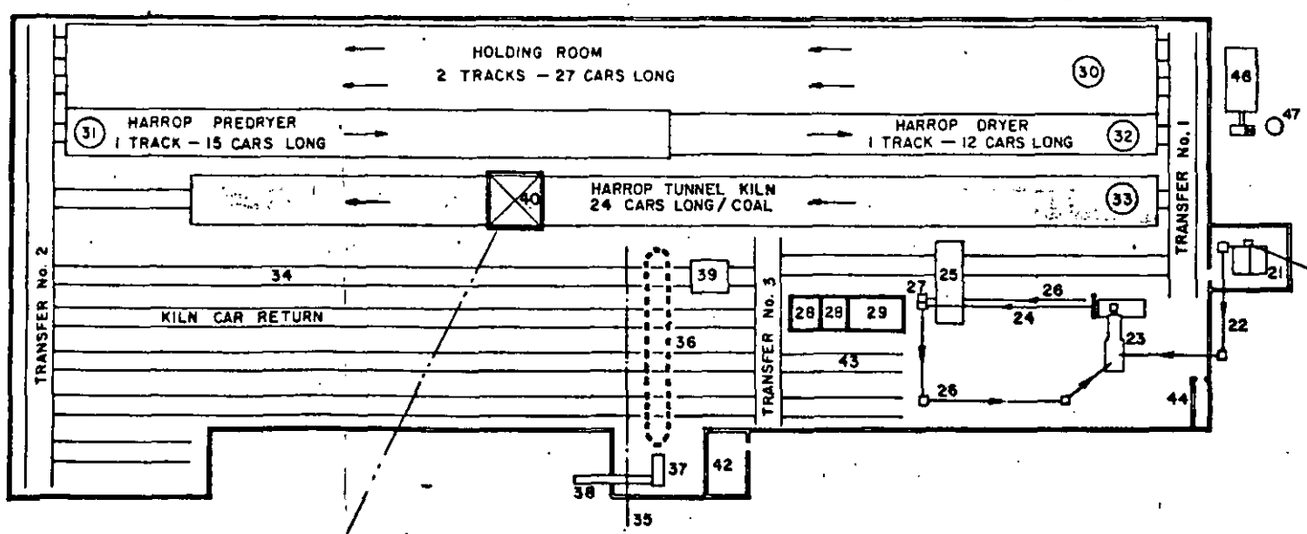
GENERAL SHALE PRODUCTS CORPORATION

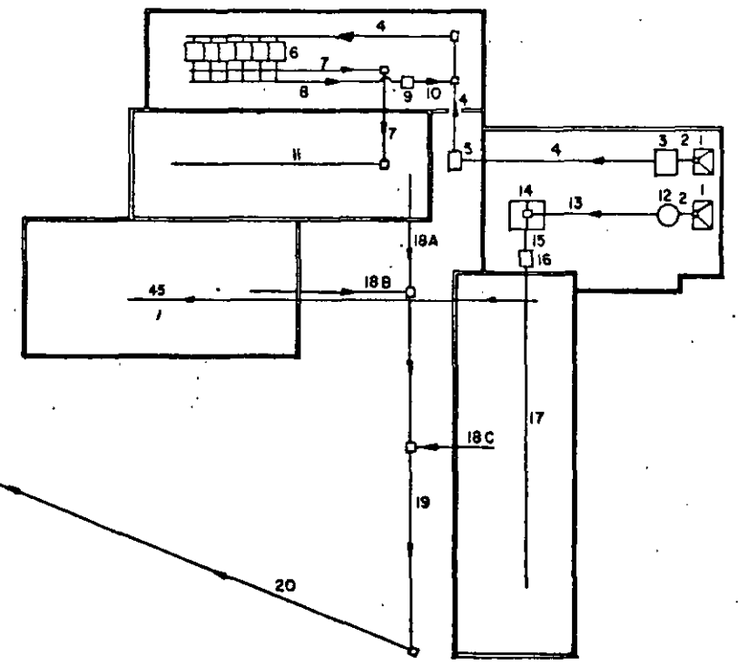
PROCESS EQUIPMENT

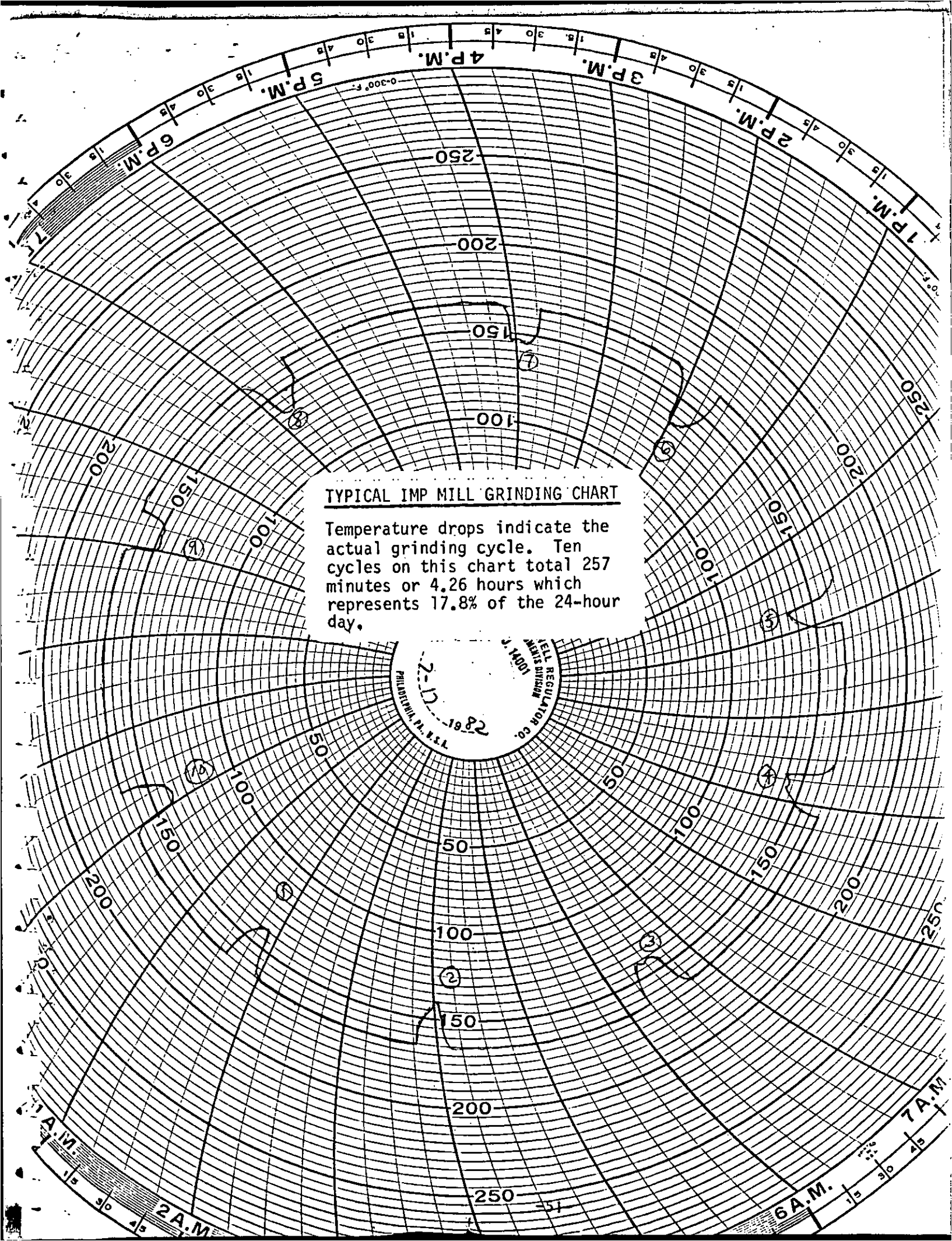
FOR PLANT No. 29 - KINGSPORT, TENNESSEE

PLANT CAPACITY - 52,000,000 BRICK/YEAR

1. Receiving Hoppers
2. Feeders
3. Single Roll Crusher
4. Conveyor to Blue Shale Screens
5. Pennsylvania Impactor
6. Six 4' X 5' Tyler Screens
7. Fines Conveyor to Blue Shale Storage
8. Tailings Conveyor
9. Stedman Mill
10. Screw Conveyor
11. Reciprocating Belt Conveyor
12. 384 Pan Grinder
13. Conveyor to Red Clay Screens
14. Two 4' X 10' Tyler Screens
15. Feed Conveyor to Elevator
16. Elevator
17. Conveyor Over Storage Pile
18. Conveyors Feeding Collection Conveyor
    (A) - Blue Shale, (B) - Cordova Clay, (C) - Red Shale
19. Collection Conveyor
20. Conveyor to Plant No. 29 (200'-0")
    24" Belt, 200 F.P.M., 210 T.P.H, 3.5 T.P.M.
21. Material Receiving Hoppers
22. Conveyor to Pug Sealer
23. Pug Sealer and Extruder (J.C. Steele) No. 90
24. Off-Bearing Belt
25. Automatic Setting Machine - 640 Std. Brick/Lift
26. Die Scrap Return Conveyor
27. Slug Chopper
28. Rest Rooms
29. Control Room
30. Holding Room - 2 Tracks, 27 Cars Long (409'-6")
31. Harrop Predryer - 1 Track, 15 Cars Long (227'-6")
32. Harrop Dryer - 1 Track, 12 Cars Long (182'-0")
33. Harrop Tunnel Kiln - 1 Track, 24 Cars Long/Coal (362'-6")
34. Burned Ware Storage Tracks
35. Batt Conveyor
36. Monorail
37. Package Strapper
38. Dead Roll Conveyor
39. Kiln Car - 10240 Std. Brick/Car, Set 4/10
40. Coal Processing Equipment
41. Raw Coal Supply Conveyor (440'-0")
    24" Belt, 200 F.P.M., 105.8 T.P.H., 1.76 T.P.M.
42. Air Compressor Room
43. Kiln Car Repair Pit
44. Electrical Room
45. Cordova Fines Belt to Ground Storage
46. C-E Air Preheater Baghouse #9MW50
    for Kiln Exhaust
47. Carter-Day Baghouse #48RF8
    for Coal Processing System

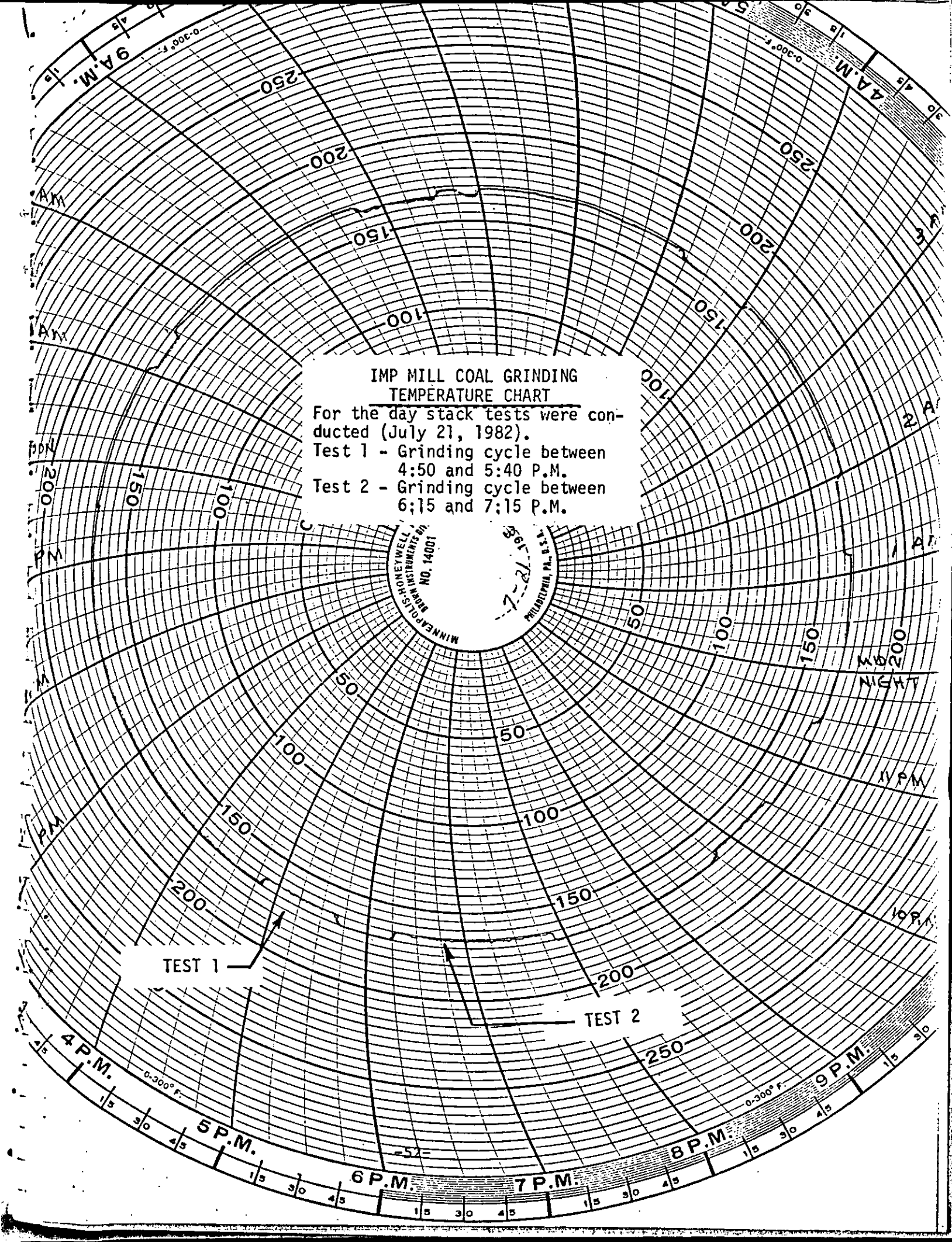




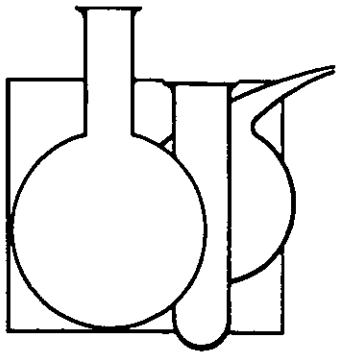


TYPICAL IMP MILL GRINDING CHART

Temperature drops indicate the actual grinding cycle. Ten cycles on this chart total 257 minutes or 4.26 hours which represents 17.8% of the 24-hour day.


IMP MILL COAL GRINDING
TEMPERATURE CHART
For the day stack tests were conducted (July 21, 1982).
Test 1 - Grinding cycle between 4:50 and 5:40 P.M.
Test 2 - Grinding cycle between 6:15 and 7:15 P.M.
TEST 1
TEST 2
MINNEAPOLIS-HONEYWELL
BROWN INSTRUMENTS DIV.
NO. 14001
PHILADELPHIA, PA., U.S.A.
7-21-1982
9 A.M.
4 A.M.
4 P.M.
5 P.M.
6 P.M.
7 P.M.
8 P.M.
9 P.M.
MID NIGHT
11 PM
10 PM
0-300° F.
250
200
150
100
50

Calibrations



VI. CALIBRATIONS

General

The meter box was recalibrated upon return to the laboratory from this test. Using the average meter pressure, the box was calibrated at the closest point (for an average meter pressure of 1.18 a 1.00 "H_2O was used; and for 2.19 a 2.00 "H_2O was used as the calibration point). These calibrations produced a single point of MCF and Δ H@ which was compared to the original calibration. All were within the 5% allowed at the highest vacuum seen. This new MCF was applied against all meter volumes in these tests. These calibration sheets are located behind the original calibration sheets.

The equipment used was as follows:

Location	TK-29	Coal Crusher
Probe	5'-N	PG-4-3
Box	700	700
Stack Temperature	OMEGA 199	OMEGA 199
Sample Box	2	2
Average Temperature	310	132
Average Δ H	2.19	1.18

The OMEGA 199 was recalibrated at 310 °F and 132 °F and agreed within 1.5% of the initial calibration value.

Type A/E
Glass Fiber Filters

FEATURES

- Low trace metals • Medium tensile 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" x 10"
Product No.	61630	61652	61631	61633	61638
Filters Pkg.	500	500	100	100	100

TYPE A/E GLASS FIBER FILTER SPECIFICATION REPORT

[illegible]

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

WATER EXTRACTABLE IONS:

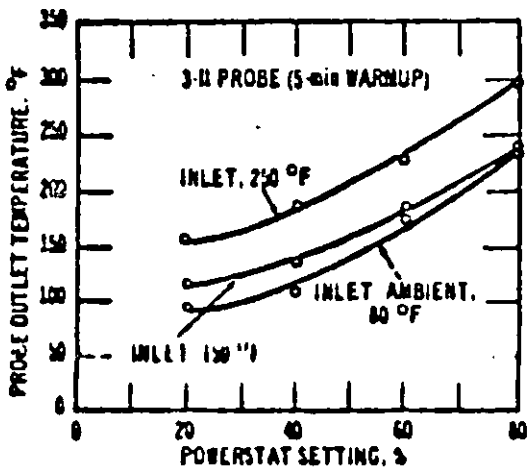
Sulfate	600	Chloride	1500
Nitrate	115	Fluoride	67
Ammonia	13		

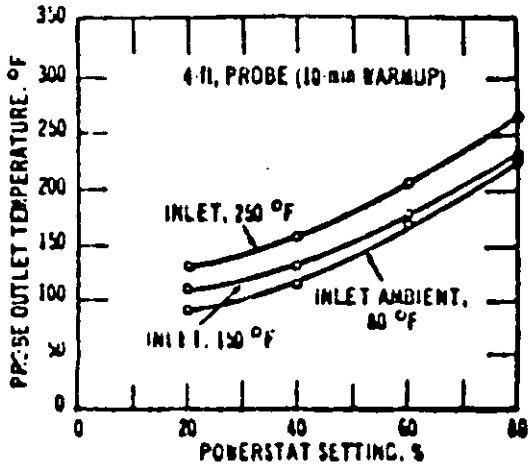
[illegible]

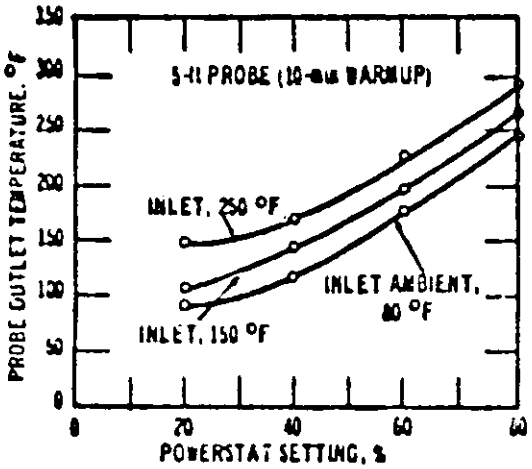
A [illegible]

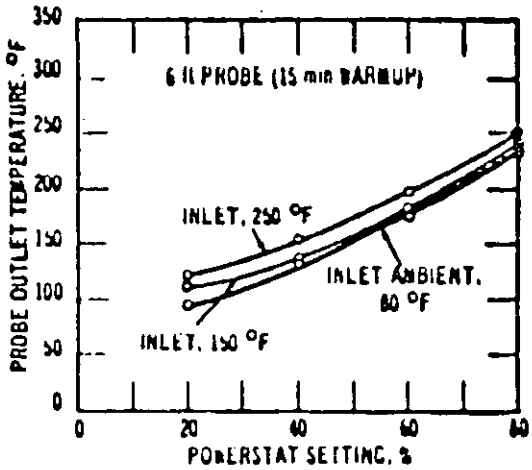
B [illegible]

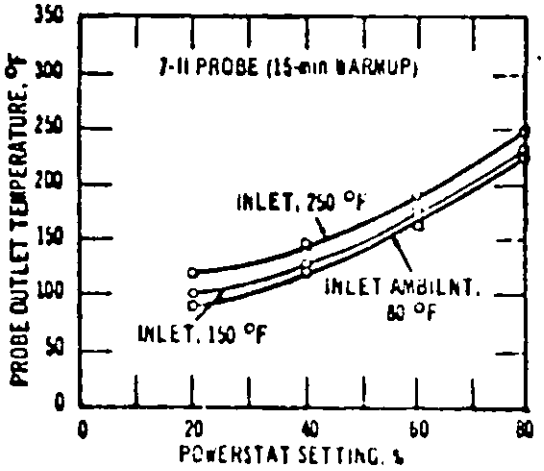
[illegible]











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

METER CALIBRATION FORM

Date 7/31/82 Box No. 700

P_{bar} = 30.10 in. Hg Calibrated by CDT2

Orifice Manometer Setting ΔH (in. H_2O)	Δ wtm (in. H_2O)	Gas Volume Wet Test Meter		Gas Volume Dry Gas Meter		Temperature Wet Test Meter		Avg. Temp. Dry Gas Meter	
		Initial	Final	Initial	Final	Initial	Final	Inlet	Outlet
.5 @ 28" Hg	-1.05	41.175	47.581	757.547	763.880	24.5°C	24.7	97/107	84/89
1.0	-1.40	47.581	57.087	763.880	773.394	24.7	25°C	107/116	89/93
1.5	-1.65	57.087	69.768	773.394	786.292	25°C	25°C	114/120	93/97
2.0	-1.85	69.768	82.252	786.292	799.144	25°C	25.2	110/124	97/101
2.5	-2.15	82.252	97.103	799.144	814.378	25.2	25.4	114/120	101/104

Pump must be operated for at least 15 minutes at each ΔH setting (.5, 1, 1.5, 2 and 3)

T_{dgm} = average temperature of dry gas meter (inlet and outlet) + 460°F

T_{wtm} = average temperature of wet test meter + 460°F

$$P_{wtm} = P_{bar} - \frac{\Delta wtm}{13.6}$$

$$P_{dgm} = P_{bar} + \frac{\Delta H}{13.6}$$

1.0098
1.0044
0.9962
0.9986
0.9869
.9972 = 1.00

Δwtm = pressure on wet test meter in inches of H_2O

Y = meter calibration factor

28.316 =conversion factor when using a wet test meter calibrated in liters

Calculations

$$Y = \frac{(\text{wet final} - \text{wet initial})(T_{dgm})(P_{wtm})}{(\text{dry final} - \text{dry initial})(28.316)(T_{wtm})(P_{dgm})} \text{ or } (1)$$

$$\bar{Y} = \frac{\Sigma Y}{5}$$

Meter Tolerance = 1.00 ± 0.01

If the meter calibration factor is not within the allowable tolerance, the calibration factory Y may be used to mathematically correct the gas meter dial readings to the proper values instead of physically adjusting the dry gas meter dials to correspond to the wet test meter readings.

FINAL
METER CALIBRATION FORM

Date 7/23/82 Box No. 700 (TC-29)

P_{bar} = 29.98 in. Hg Calibrated by LOTZ

Orifice Manometer Setting ΔH (in. H_2O)	Δ wtm (in. H_2O)	Gas Volume Wet Test Meter		Gas Volume Dry Gas Meter		Temperature Wet Test Meter		Avg. Temp. Dry Gas Meter	
		Initial	Final	Initial	Final	Initial	Final	Inlet	Outlet
2.0 @ 6" Hg	-12.0	20.780	34.989	930.182	944.329	25.0	25.0	111 / 113	93 / 95
2.0 @ 6" Hg	-12.0	34.989	49.292	944.529	958.653	25.0	25.4	113 / 114	95 / 96
2.0 @ 6" Hg	-12.0	49.292	62.675	958.653	972.058	25.4	25.5	114 / 115	96 / 98

Pump must be operated for at least 15 minutes at each ΔH setting

T_{dgm} = average temperature of dry gas meter (inlet and outlet) + 460°F

T_{wtm} = average temperature of wet test meter + 460°F

$P_{wtm} = P_{bar} - \frac{\Delta wtm}{13.6}$ (includes vapor pressure of water at saturation at the temperature of the wet test meter)

$P_{dgm} = P_{bar} + \frac{\Delta H}{13.6}$

Δwtm = pressure on wet test meter in inches of H_2O

Y = meter calibration factor

28.316 = conversion factor when using a wet test meter calibrated in liters

Calculations

$$Y = \frac{(\text{wet final} - \text{wet initial})(T_{dgm})(P_{wtm})}{(\text{dry final} - \text{dry initial})(28.316)(T_{wtm})(P_{dgm})} \text{ or } (1)$$

$$\bar{Y} = \frac{\Sigma Y}{5}$$

.9843
.9802
.9779
.9808 = .98

ORIGINAL VALUE = .9886 ok

FINAL
METER CALIBRATION FORM

Date 7/23/82 Box No. 700 (Coal Crusher)

P_{bar} = 29.98 in. Hg Calibrated by Lotz

Orifice Manometer Setting ΔH (in. H_2O)	Δ wtm (in. H_2O)	Gas Volume Wet Test Meter		Gas Volume Dry Gas Meter		Temperature Wet Test Meter		Avg. Temp. Dry Gas Meter	
		Initial	Final	Initial	Final	Initial	Final	Inlet	Outlet
1.0 @ 3" Hg	-8.4	90.010	99.486	898.230	907.608	24.6	24.6	101 / 108	85 / 88
1.0 @ 3" Hg	-8.3	99.486	108.948	907.608	917.044	24.6	24.6	108 / 111	88 / 91
1.0 @ 3" Hg	-8.3	108.948	118.411	917.044	926.508	24.6	24.6	111 / 112	91 / 92

Pump must be operated for at least 15 minutes at each ΔH setting

T_{dgm} = average temperature of dry gas meter (inlet and outlet) + 460°F

T_{wtm} = average temperature of wet test meter + 460°F

$P_{wtm} = P_{bar} - \frac{\Delta wtm}{13.6}$ (includes vapor pressure of water at saturation at the temperature of the wet test meter)

$P_{dgm} = P_{bar} + \frac{\Delta H}{13.6}$

Δwtm = pressure on wet test meter in inches of H_2O

Y = meter calibration factor

28.316 = conversion factor when using a wet test meter calibrated in liters

Calculations

$$Y = \frac{(\text{wet final} - \text{wet initial})(T_{dgm})(P_{wtm})}{(\text{dry final} - \text{dry initial})(28.316)(T_{wtm})(P_{dgm})} \text{ or } (1)$$

$$\bar{Y} = \frac{\Sigma Y}{5}$$

.9908
.9906
.9920
.9911 = .99

ORIGINAL VALUE
1.0044 ok

ORIFICE CALIBRATION FORM

Date 3/31/82 Meter Box No. 700

P_{bar} 30.10 Calibrated By LOTZ

ΔH	V_1	V_2	θ	t_1	t_2	$V_2 - V_1$	Q_m	K_m
in. H_2O	CF	CF	Sec.	°F	°F	CF		
.5			900	102	86	6.330	.4204	.7518
1.0			960	109	91	9.514	.5876	.7405
1.5			1030	117	95	12.898	.7340	.7529
2.0			900	120	99	12.852	.8310	.7361
2.5			960	127	102	15.454	.9329	.7323
							Average K_m	.7437

V_1 = Dry gas meter reading at the start of each test

V_2 = Dry gas meter reading at the end of each test

t_1 = Dry gas meter inlet temperature

t_2 = Dry gas meter outlet temperature

1.67
3

Calculations

1. Q_m = (for each ΔH) $\quad \dfrac{V_2 - V_1}{\theta} \left[\dfrac{t_2 + 460}{\dfrac{t_1 + t_2}{2} + 460} \right] (60)(Y)$

2. K_m = (for each ΔH) $\quad Q_m \sqrt{\dfrac{P_m}{T_m} \dfrac{M_m}{\Delta H}}$

$M_m = 29$
$T_m = t_2 + 460$
$P_m = P_{bar} + \dfrac{\Delta H}{13.6}$

Y = meter calibration factor

3. Calculate the average K_m as follows:

$$\bar{K}_m = \frac{\Sigma K_m}{5}$$

4. Calculate ΔH_a as follows:

$$\Delta H_a = \frac{Q@^2 \; P@ \; M@}{T@} \left[\frac{1}{\bar{K}_m^2} \right] = \frac{0.921}{\bar{K}_m^2}$$

Q@ = 0.75 cfm
T@ = 528°R
P@ = 29.92 in Hg

5. [illegible]

FINAL

ORIFICE CALIBRATION FORM

Date 7/23/82 Meter Box No. 700 (TK-29)

P_{bar} 29.98 Calibrated By LOTZ

ΔH	V_1	V_2	θ	t_1	t_2	$V_2 - V_1$	Q_m	K_m
in. H_2O	CF	CF	Sec.	°F	°F	CF		
2.0	930.162	944.309	960	112	94	14.147	.8564	.7605
2.0	944.309	958.653	960	113.5	95.5	14.324	.8635	.7657
2.0	958.653	972.098	900	114.5	97	13.445	.8630	.7643
							Average K_m	.7635

V_1 = Dry gas meter reading at the start of each test

V_2 = Dry gas meter reading at the end of each test

t_1 = Dry gas meter inlet temperature

t_2 = Dry gas meter outlet temperature

1.58
3

Calculations

1. Q_m = (for each ΔH) $\quad \dfrac{V_2 - V_1}{\Theta} \left[\dfrac{t_2 + 460}{\dfrac{t_1 + t_2}{2} + 460} \right] (60)(Y)$

2. K_m = (for each ΔH) $\quad Q_m \sqrt{\dfrac{P_m \, M_m}{T_m \, \Delta H}}$

$M_m = 29$
$T_m = t_2 + 460$
$P_m = P_{bar} + \dfrac{\Delta H}{13.6}$

Y = meter calibration factor

3. Calculate the average K_m as follows:

$$\bar{K}_m = \frac{\Sigma K_m}{5}$$

4. Calculate ΔH_a as follows:

$$\Delta H_a = \frac{Q@^2 \; P@ \; M@}{T@} \left[\frac{1}{\bar{K}_m^2} \right] = \frac{0.921}{\bar{K}_m^2}$$

Q@ = 0.75 cfm
T@ = 528°R
P@ = 29.92 in.Hg
M@ = 29

GUARDIAN SYSTEMS inc

FINAL

ORIFICE CALIBRATION FORM

Date 7/23/82 Meter Box No. 700 (Coal Crusher

P_{bar} 29.98 Calibrated By LDTL

ΔH	V_1	V_2	θ	t_1	t_2	$V_2 - V_1$	Q_m	K_m
in. H_2O	CF	CF	Sec.	°F	°F	CF		
1.0	898.230	907.608	900	104.5	86.5	9.378	.6094	.7696
1.0	907.608	917.044	900	109.5	89.5	9.436	.6120	.7708
1.0	917.044	926.508	900	111.5	91.5	9.464	.6147	.7728
							Average K_m	.7711

V_1 = Dry gas meter reading at the start of each test

V_2 = Dry gas meter reading at the end of each test

t_1 = Dry gas meter inlet temperature

t_2 = Dry gas meter outlet temperature

1.55

Calculations

1. Q_m = (for each ΔH) $\quad \dfrac{V_2 - V_1}{\Theta} \left[\dfrac{t_2 + 460}{\dfrac{t_1 + t_2}{2} + 460} \right] (60)(Y)$

2. K_m = (for each ΔH) $\quad Q_m \sqrt{\dfrac{P_m M_m}{T_m \Delta H}}$

$M_m = 29$
$T_m = t_2 + 460$
$P_m = P_{bar} + \dfrac{\Delta H}{13.6}$

Y = meter calibration factor

3. Calculate the average K_m as follows:

$$\bar{K}_m = \frac{\Sigma K_m}{5}$$

4. Calculate ΔH_a as follows:

$$\Delta H_a = \frac{Q@^2 \; P@ \; M@}{T@} \left[\frac{1}{\bar{K}_m^2} \right] = \frac{0.921}{\bar{K}_m^2}$$

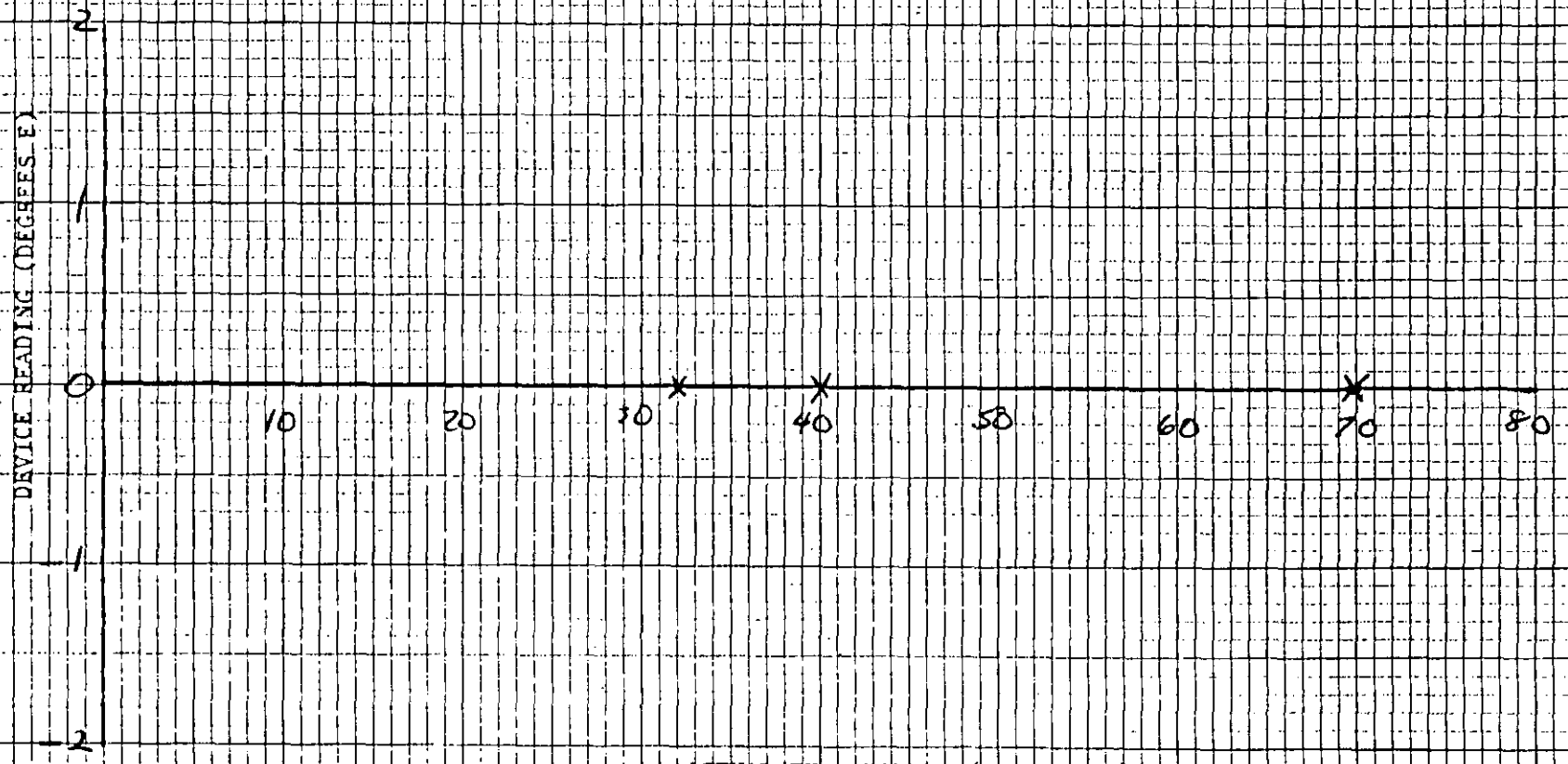
Q@ = 0.75 cfm
T@ = 528°R
P@ = 29.92 in.Hg
M@ = 29

TEMPERATURE CALIBRATION
FOR Omega 199

DATE INITIAL 7/16/82 DATE FINAL

X—X ISL

Type CA



GUARDIAN SYSTEMS inc

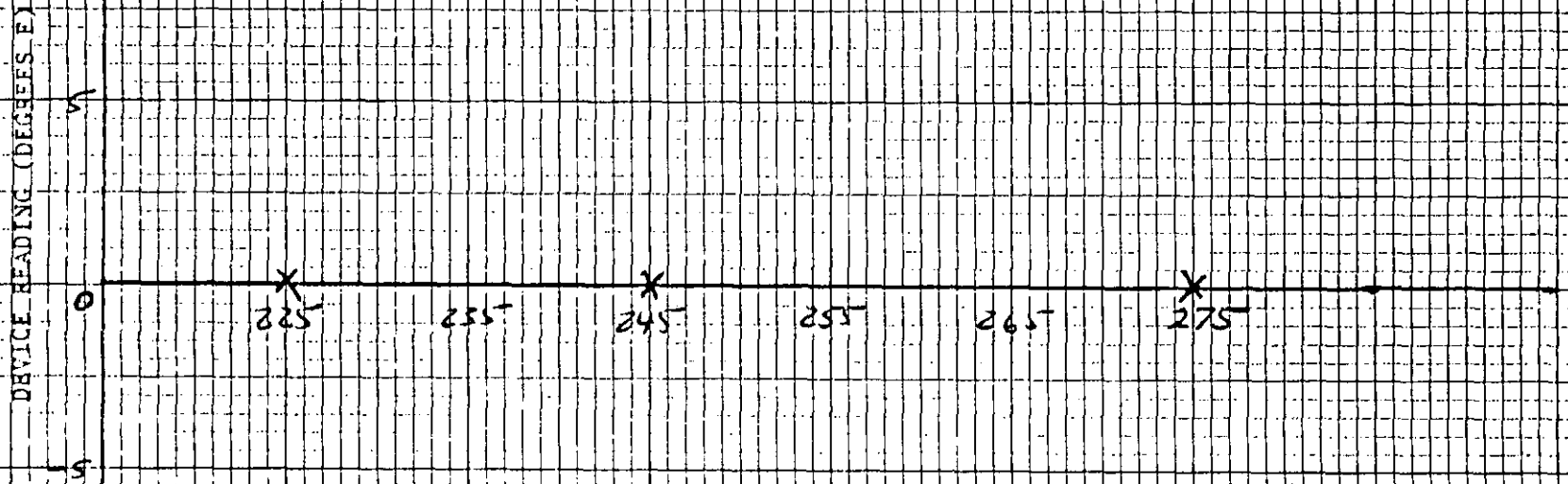
TEMPERATURE CALIBRATION

FOR HOT BOX 1

DATE INITIAL 7/16/82 DATE FINAL

X—X SEC

TYPECA



ACTUAL TEMPERATURE (DEGREES F)

GUARDIAN SYSTEMS INC

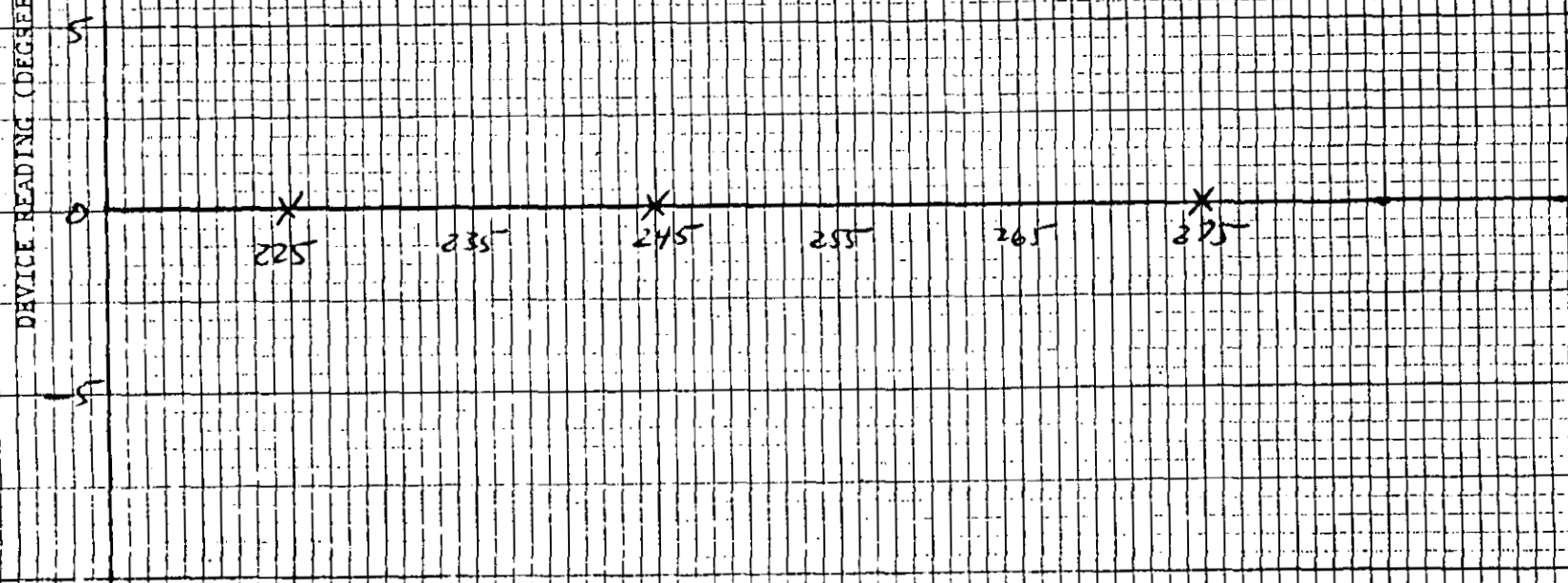
TEMPERATURE CALIBRATION

FOR Hot Box 2

DATE INITIAL 7/16/82 DATE FINAL

X—X JSP

Type CA



GUARDIAN SYSTEMS inc

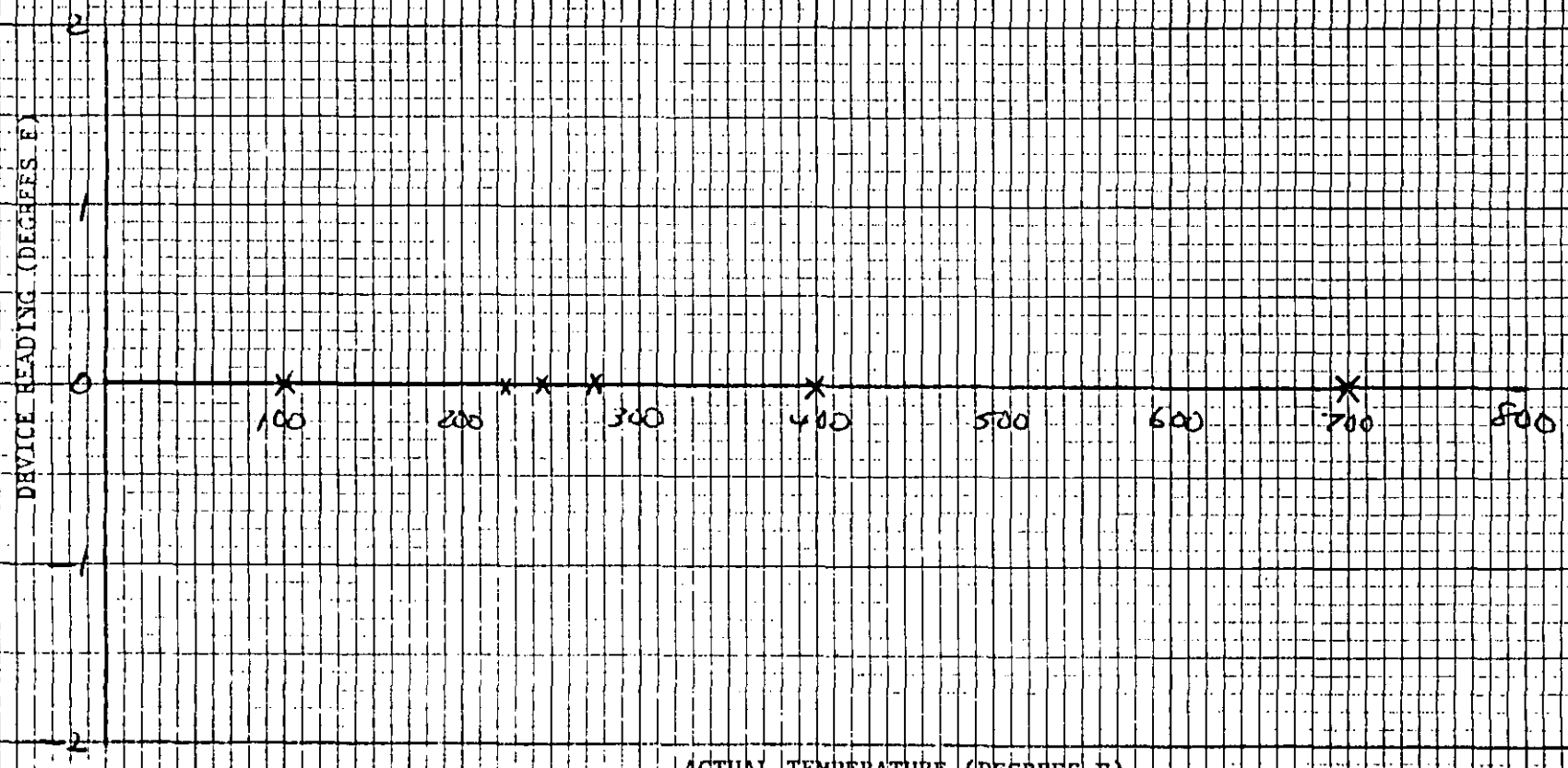
TEMPERATURE CALIBRATION

FOR Omega 199 Hsh

DATE INITIAL 7/16/82 DATE FINAL

x-x LEL

Type CA



GUARDIAN SYSTEMS inc

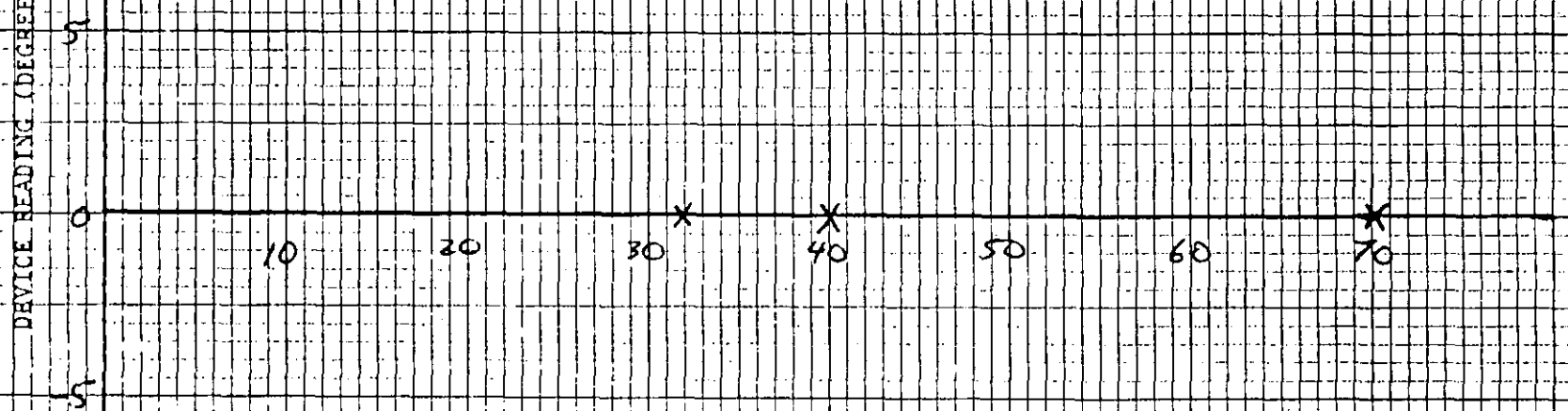
TEMPERATURE CALIBRATION

FOR Impinger #1

DATE INITIAL 7/16/82 DATE FINAL

X—X 5%

Type CA



GUARDIAN SYSTEMS inc

PITOT INSPECTION FORM

Pitot No. PG-4-3

Pitot tube assembly level? ☑ yes ☐ no

Pitot tube openings damaged? ☐ yes ☑ no

If yes, explain _____

α_1 = 2.0 ° (<10°) α_2 = 2.5 ° (<10°)

β_1 = 2.0 ° (<5°) β_2 = 1.0 ° (<5°)

γ = 2.5 °, θ = 1 °, A = 2.7 cm

z = A sin γ = 0.118 cm (<0.32 cm)

w = A sin θ = 0.047 cm (<0.08 cm)

P_A = 1.35 cm P_b = 1.35 cm

($P = P_A = P_b$)

D_t = .9525 cm $\frac{P}{D_t}$ = 1.417 ($\geq$1.05 and $\leq$1.50)

Calibration required? ☐ yes ☑ no

C_p = 0.84

Comments: Pitot tubes are in good condition

Date: 5-12-82 Conducted by David Shugart

PITOT CALIBRATION FORM

Date 7/16/82 Probe # 5'-N

Calibrated By LO72

Nozzle Size

SIDE A

Run #	ΔP_{std} (in. H_2O) Standard	$\Delta P(s)$ (in. H_2O) Type "s"	$C_p(s)$	Deviation $C_p(s) - \overline{C}_p(A)$
1	0.59	0.82	0.840	
2	0.59	0.82	0.840	
3	0.59	0.82	0.840	
		$\overline{C}_p(A)$	0.840	

SIDE B

Run #	ΔP_{std} (in. H_2O) Standard	$\Delta P(s)$ (in. H_2O) Type "s"	$C_p(s)$	Deviation $C_p(s) - \overline{C}_p(B)$
1	0.59	0.82	0.840	
2	0.59	0.82	0.840	
3	0.59	0.82	0.840	
		$\overline{C}_p(B)$	0.84	

CALCULATIONS

$$C_p(s) = C_{p(std)} \text{ (or 0.99)} \sqrt{\frac{\Delta P_{std}}{\Delta P(s)}}$$

$$\text{Average Deviation} = \frac{\Sigma \left| C_p(s) - \overline{C}_p(A \text{ or } B) \right|}{3} \longleftarrow \text{Must be} \leq 0.01$$

$$\left| \overline{C}_p(A) - \overline{C}_p(B) \right| \longleftarrow \text{Must be} \leq 0.01$$