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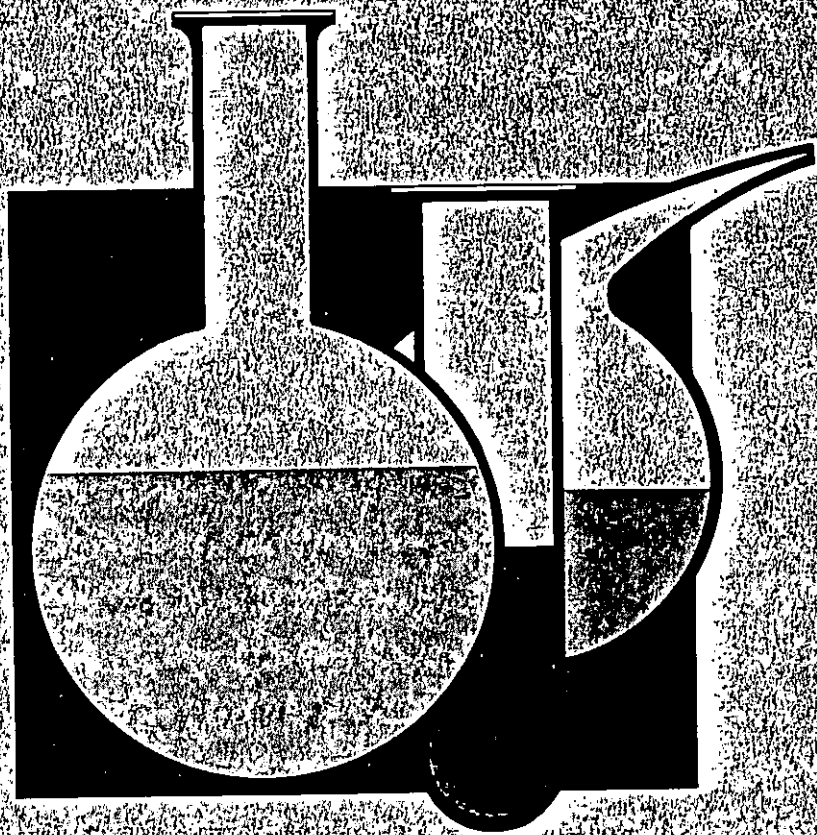
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AP42 Section:	11.3
Reference:	18
Title:	Mass Emission Tests Conducted On Plant #15 In Kingsport, TN, For General Shale Products Corporation, Guardian Systems, Inc., Leeds, AL, October 11, 1983.

AP-42 Section 11.3
Reference 18


GUARDIAN SYSTEMS INC.

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



Test Report

MASS EMISSION TESTS
CONDUCTED ON
PLANT #15
IN
KINGSPORT, TENNESSEE
FOR
GENERAL SHALE PRODUCTS CORPORATION
ON
OCTOBER 11, 1983

Approved by: 

Tom Lotz
Director
Field Services Division

Introduction

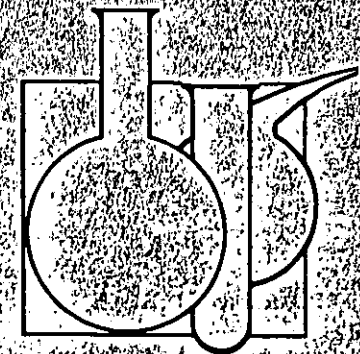


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I. INTRODUCTION AND PROCESS DESCRIPTION

On October 11, 1983, Guardian Systems, Inc. performed a series of particulate emissions tests on General Shale Products Brick Plant Kiln No. 15 located in Kingsport, Tennessee. These tests were conducted in accordance to the rules and regulations expressed in the Code of Federal Regulations, Title 40, Section 60, Reference Methods 1-5 as amended.

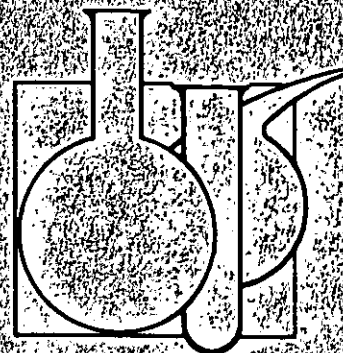
Individual bricks are formed and stacked onto kiln cars measuring approximately 7'-5" x 9'-6". Cars are inserted on a regular basis into a long, continuous-fired tunnel kiln. As one car is discharged another is inserted. This provides a constant moving mass inside the kiln. Cars are pushed through the 424-6" long kiln at a slow, methodical pace requiring almost 59.6 hours 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.

On October 11, 1983 at approximately 8:00 AM, an informal pre-test meeting was held at the sampling location. The purpose of the meeting was to discuss the test procedures to be used for sampling Kiln 15 that day. Mr. Thomas Isaacs and Mr. Ron Drigger represented the Division of Air Pollution Control First Tennessee Regional Health Office; Mr. Greg Forte represented the Division of Air Pollution Control Nashville Office; Mr. Dave McNees, Corporate Representative, and Mr. Buddy Archer, Plant Superintendent represented General Shale Products Corporation and Mr. Tom Lotz and Mr. Ashley Riley represented Guardian Systems, Inc.

The following personnel were present during the actual field sampling and performed the duties indicated:

Mr. Dave McNees	Provided production data
Mr. Buddy Archer	Stable operation of plant
Mr. Thomas Isaacs	Observed field sampling
Mr. Ron Digger	Opacity measurements
Mr. Greg Forte	Observed plant operations
Mr. Tom Lotz	Field sampling
Mr. Ashley Riley	Field sampling and coal sampling

Test Results



II. SUMMARY OF TEST RESULTS

Table I is a summary of the test results for plant #15. The allowable emission rate for this source is 9.3 pounds per hour. The average emission rate (Tests 1,3, & 4) of 4.83 pounds per hour is 52% of the allowable amount.

GUARDIAN ** SYSTEMS ** INCORPORATED
 2610 19TH. STREET, SOUTH
 BIRMINGHAM, AL 35209
 205-879-1850

SUMMARIZED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
 JOB NUMBER 41332

RUN NUMBER	1	2	3	4
DATE OF TEST	10/11/83	10/11/83	10/11/83	10/11/83
TIME OF TEST	0830-0937	1115-1221	1328-1433	1520-1625
LOCATION OF TEST	TK #15	TK #15	TK #15	TK #15
STACK GAS TEMPERATURE DEGREES F	381	381	382	379
MOISTURE CONTENT, % V/V	5.82	6.95	6.83	6.91
OXYGEN CONTENT, % V/V	17.00	17.30	16.50	17.00
CARBON DIOXIDE CONTENT, % V/V	5.00	4.50	5.30	4.00
STACK GAS VELOCITY FEET PER SECOND	40.01	39.65	39.67	39.45
VOLUMETRIC FLOW ACTUAL CUBIC FEET PER MINUTE	13,419	13,299	13,307	13,231
VOLUMETRIC FLOW DRY STANDARD CUBIC FEET PER MINUTE	8,016	7,847	7,852	7,829
CONCENTRATION GRAINS PER DRY STANDARD CUBIC FOOT	0.069	0.070	0.080	0.065
CONCENTRATION GRAINS PER ACTUAL CUBIC FOOT	0.041	0.042	0.047	0.038
PARTICULATE MASS RATE (#/HR.)	4.73	4.73	5.39	4.36
% ISOKINETIC	100.09	100.91	100.93	100.60

GUARDIAN ** SYSTEMS ** INCORPORATED
 2610 19TH. STREET, SOUTH
 BIRMINGHAM, AL 35209
 205-879-1850

COMPUTER INPUT PARAMETERS FOR GENERAL SHALE PRODUCTS CO
 JOB NUMBER 41332

	1	2	3	4
RUN NUMBER	10/11/83	10/11/83	10/11/83	10/11/83
DATE	TK #15	TK #15	TK #15	TK #15
LOCATION	0830-0937	1115-1221	1328-1433	1520-1625
TIME	30.24	30.24	30.24	30.24
BAROMETRIC PRESSURE (IN. HG)	- 0.200	- 0.270	- 0.270	- 0.250
STATIC PRESSURE (IN. H2O)	64	64	64	64
RUN TIME (MINUTES)	49.572	49.388	49.250	49.390
METER VOLUME (CORRECTED)	381	381	382	379
STACK TEMPERATURE (°F)	78	83	81	86
METER TEMPERATURE (°F)	1.83	1.80	1.80	1.80
METER PRESSURE (IN.H2O)	0.567	0.560	0.561	0.557
SQR VELOCITY PRESSURE	220.8	222.7	253.8	204.7
MASS OF PARTICULATE (MG.)	64.8	77.4	76.0	76.5
ML. OF WATER COLLECTED	17.0	17.3	16.5	17.0
% OXYGEN	5.0	4.5	5.3	4.0
% CARBON DIOXIDE	0.0	0.0	0.0	0.0
% CARBON MONOXIDE	5.59	5.59	5.59	5.59
STACK AREA (SQ. FT.)	0.84	0.84	0.84	0.84
PITOT CORRECTION FACTOR	0.314	0.314	0.314	0.314
NOZZLE DIAMETER (IN.)				

GUARDIAN ** SYSTEMS ** INCORPORATED
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 BIRMINGHAM, AL 35209
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COMPUTED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
 JOB NUMBER 41332

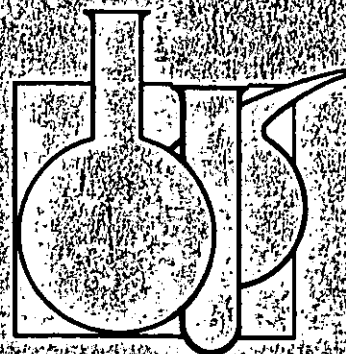
	1	2	3	4
RUN NUMBER				
DATE OF TEST	10/11/83	10/11/83	10/11/83	10/11/83
LOCATION OF TEST	TK #15	TK #15	TK #15	TK #15
1. STACK PRESSURE INCHES HG	30.23	30.22	30.22	30.22
MILLIMETERS HG	767.72	767.59	767.59	767.63
2. METER PRESSURE INCHES HG	30.37	30.37	30.37	30.37
MILLIMETERS HG	771.51	771.46	771.46	771.46
3. METER VOLUME DRY STANDARD CUBIC FEET	49,390	48,750	48,793	48,484
DRY STANDARD CUBIC METERS	1,399	1,380	1,382	1,373
4. WATER VOLUME STANDARD CUBIC FEET	3,050	3,643	3,577	3,601
STANDARD CUBIC METERS	0.086	0.103	0.101	0.102
5. MOISTURE CONTENT (%)	5.82	6.95	6.83	6.91
6. MOLECULAR WEIGHT DRY	29.48	29.41	29.51	29.32
7. MOLECULAR WEIGHT WET	28.81	28.62	28.72	28.54
8. STACK VELOCITY FEET PER SECOND	40.01	39.65	39.67	39.45
METERS PER SECOND	12.19	12.09	12.09	12.02
9. VOLUMETRIC FLOW ACTUAL CUBIC FEET PER MINUTE	13,419	13,299	13,307	13,231
ACTUAL CUBIC METERS PER SECOND	6.33	6.28	6.28	6.24
10. VOLUMETRIC FLOW DRY STANDARD CUBIC FEET PER MINUTE	8,016	7,847	7,852	7,829
DRY STANDARD CUBIC METER PER SECOND	3.78	3.70	3.71	3.69

GUARDIAN ** SYSTEMS ** INCORPORATED
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 BIRMINGHAM, AL 35209
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COMPUTED AIR TEST RESULTS FOR GENERAL SHALE PRODUCTS CO
 JOB NUMBER 41332

1	2	3	4
RUN NUMBER			
DATE OF TEST	10/11/83	10/11/83	10/11/83
LOCATION OF TEST	TK #15	TK #15	TK #15
11. CONCENTRATION			
GRAINS PER DRY STANCARD CUBIC FOOT	0.0688	0.0801	0.0650
GRAMS PER DRY STANDARD CUBIC METER	0.1575	0.1833	0.1488
15. PARTICULATE MASS RATE (M/HR.)	4.73	5.39	4.36
16. VOLUME AT NOZZLE			
ACTUAL CUBIC FEET	82.688	82.691	81.943
ACTUAL CUBIC METERS	2.341	2.342	2.320
17. CONCENTRATION			
GRAINS PER ACTUAL CUBIC FOOT	0.0411	0.0473	0.0385
GRAMS PER ACTUAL CUBIC METER	0.0941	0.1081	0.0880
18. % ISOKINETIC	100.09	100.93	100.60

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.

The dimensions of the stack (see figure 1) indicated that 24 points would be required to sample this source. We sampled 32 points (16 per diameter) for two minutes at each point. Stack temperature, pressure, range of velocity heads, moisture content and stack gas dry molecular weight were determined for isokinetic sampling. A TI-55 was used to calculate the sampling rate. 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 Calibrations). Two (2) separate gas analysis for CO_2 and O_2 were determined during each test by a Fyrite Gas Analyser. After the second test, a leak check of the sampling system could be made due to a broken sample liner. It is felt by our sampling personnel the liner was broken at the end of the test, but as requested by Mr. Thomas Issacs the test was scrubbed and another run in its place. The information on test #2 is provided for informational purposed only.

Sampling Techniques

The particulate determinations were made by utilizing the sample train in Figure 2 . 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 ± 25 °F. (See Calibrations) The gases then passed through a glass fiber filter (Gelman) of 0.3 micron retention to remove particulate matter. The filter was maintained at a temperature of 248 ± 25 °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 °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. At the end of each test, the particulate catch was placed in sealed petri dish. Each acetone wash 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 kept in a locked box and then transported to the Birmingham laboratory for analysis.

Analysis

The Filter (Gelman, Class A, without organic binder, minimum 99.9% retention for particules of 0.3 microns as determined by DOP tests) were prepared for the field test by first heating for 2 hours 105 °C then desiccating at 68 ± 10 °F at 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 sheets in this report. 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 washes and the blank for the group of tests were evaporated to dryness in tared glass beakers. They were then desiccated for twenty-four (24) hour and weighed to a constant weight, utilizing the weight procedure previously mention for the filters.

The moisture content for each test was determined by measuring the amount of water collected in the condenser and the increase in weight of the silica gel. These weights were combined to give the total amount of water collected.

STACK BREECHING DIAGRAM AND SAMPLE POINT LOCATION

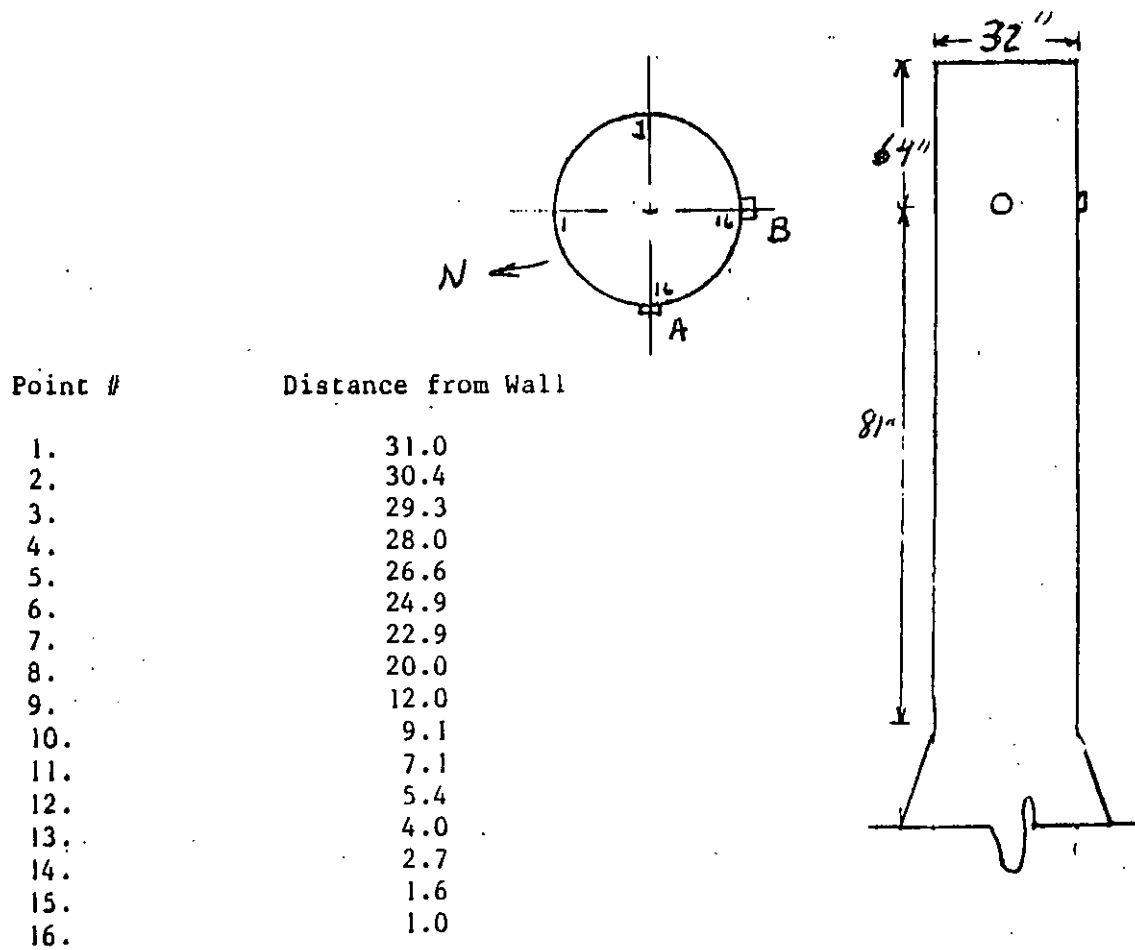


FIGURE 1

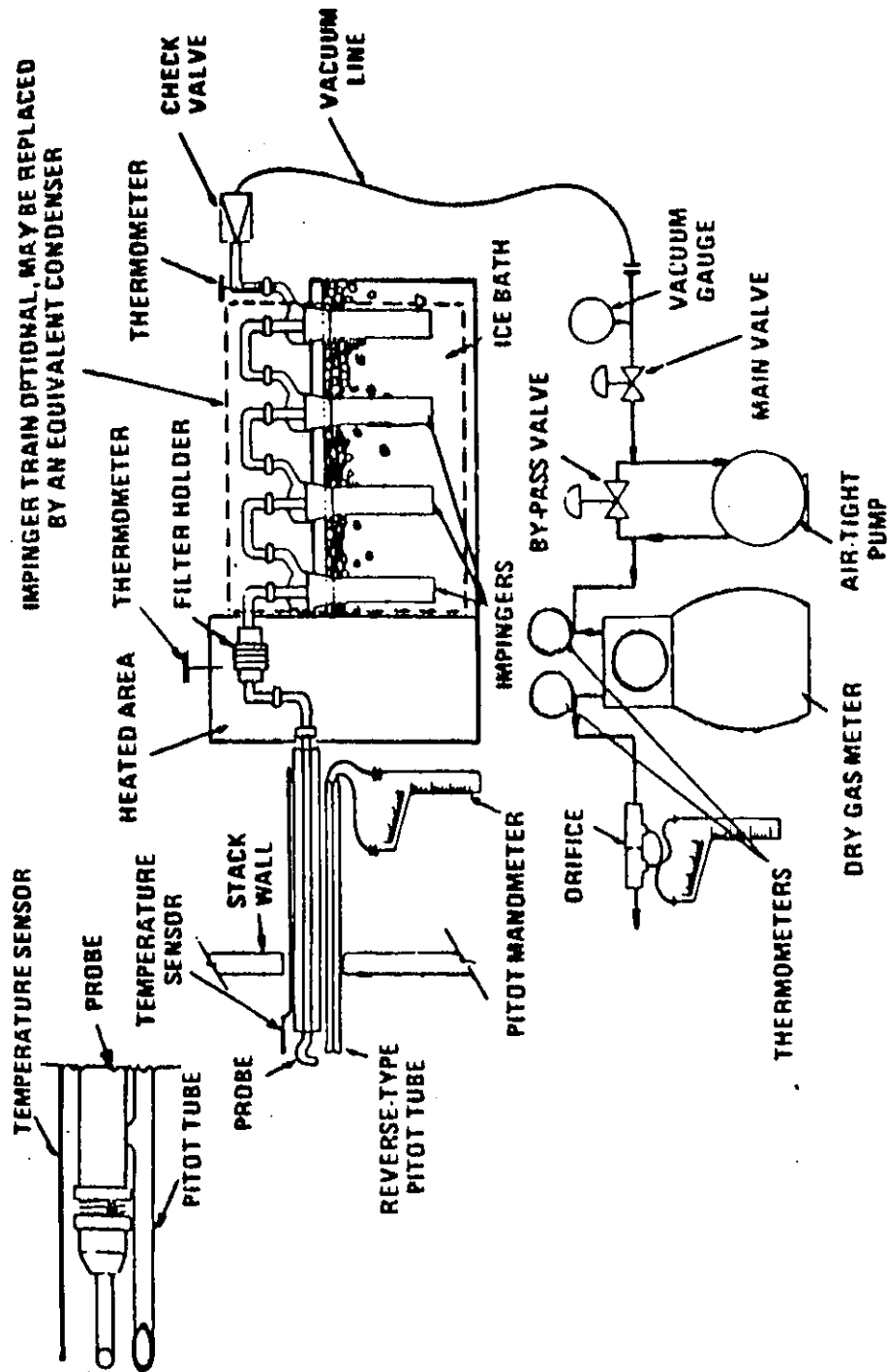
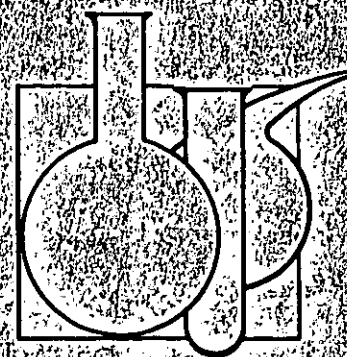


Figure 2

Field Data



NOMENCLATURE

- ACF - Actual Cubic Feet
- ACFM - Actual Cubic Feet per minute
- ACM - Actual Cubic Meters
- ACMS - Actual Cubic Meters per second
- A_n - Cross sectional area of nozzle, (ft²)
- A_s - Area of Stack, (ft²)
- B_{ws} - 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
- C_{so_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, %
- K_m - Orifice Correction Factor, (dimensionless)
- K_p - Pitot tube constant, $85.49 \left[\frac{(\text{lb/lb-mole})(\text{in. Hg})}{(^{\circ}\text{R})(\text{in. H}_2\text{O})} \right]^{1/2}$

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 "ith" component change (i = 1,2,3,...n), CFM.
- Lp - Leakage rate observed during the post test leak check, ft³/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. H₂O
- Pa - Density of acetone, mg/ml
- Pbar - Barometric pressure at the sampling site, in. Hg
- Pg - Stack static pressure, in. H₂O
- 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 - m³/°K-g-mole (21.85 in. Hg-ft³/°R-lb-mole)
- SCF - Standard Cubic Foot
- ta - Ambient Temperature, °F
- tm - Average Temperature of meter, °F
- ts - Average Temperature of stack, °F

NOMENCLATURE - continued

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. H₂O

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. H₂O

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.

θ_p - Sampling time interval from the final (nth) component change until the end of the sampling run, min.

%CO₂, %O₂, %N₂, %CO - Number percent (%) by volume (dry basis) of each compound in the stack gas.

EQUATIONS

$$1. \quad P_s = P_{\text{bar}} + \frac{P_g}{13.6}$$

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

$$3. \quad V_{m(\text{std})} = V_m Y \left(\frac{T_{\text{std}}}{T_m} \right)$$

$$\left[\frac{P_{\text{bar}} + \frac{\Delta H}{13.6}}{P_{\text{std}}} \right]$$

$$4. \quad V_w(\text{std}) = 0.04707 V_{1c}$$

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

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

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

$$8. \quad v_s = K_p C_p (\sqrt{\Delta p}) \text{ avg.}$$

$$\sqrt{\frac{T_s}{M_s P_s}}$$

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

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

$$11. \quad c_s = [0.0154 (Mn/Vm_{\text{std}})]$$

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

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

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

EQUATIONS - continued

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

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

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

$$18. \quad I = \frac{100 V_n}{60 \theta v_s A_n}$$

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

$$20. \quad W_a = C_a V_{aw} p_a$$

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.

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

PLANT Coal Slake RUN # vel
LOCATION K.LN DATE 10-10-83
BARO. PRES. _____ TIME 1520-

TIME	METER		STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H2o	VELOCITY PRESSURE "H2o	VACUUM PRESSURE "Hg	STATIC PRESSURE "H2o	
	MIN	DUR		VOL FT ³	IN	OUT						AVG	- .16
1			411							.27		PROBE TIP SIZE BEFORE <u>.185</u> AFTER _____	
2			412							.28		.314	.314
3			413							.30			
4			414							.28			
5			415							.28			
6			415							.28			
7			415							.29		ml. _____	
8			416							.25		gram _____	
9			417							.32		Total _____	
10			416							.33		OPERATOR <u>JH/Riley</u>	
11			416							.34			
12			414						6.549241	.32	.546	Sample Box No. <u>2</u>	
13			385							.45		Meter Box No. <u>400</u>	
14			389							.44		Meter ΔH@ <u>1.71</u>	
15			392							.40		Pitot, CP <u>.84</u>	
16			394							.36		Temp. Device <u>NTT</u>	
17			397							.33		Probe No. <u>5-LN</u>	
18			399							.29		Probe Liner <u>GUSS</u>	
19			405							.27		Probe Htr. Set <u>60</u>	
20			405							.27		Ambient Temp. <u>80</u>	
21			406							.26		% O ₂ <u>16.0</u>	
22			405							.25		% CO ₂ <u>3.5</u>	
23			402							.22		NOTES	
24			398							.22		Orifice _____	
			406							.551		Pitot _____	
												Meter _____	



FIELD DATA SHEET

41332

PLANT General Stone RUN # 1
 LOCATION TK-15 DATE 10-11-83
 BARO. PRES. 50.24 TIME 830-937

GUARDIAN SYSTEMS INC.
 2810 18th Street South
 Birmingham, Alabama 35208
 205/878-1850



	TIME		METER VOL FT ³	STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H ₂ O	VELOCITY PRESSURE "H ₂ O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H ₂ O	
	MIN	DUR			IN	OUT	AVG						BEFORE	AFTER
			880.785	(1)	(2)	(3)		(4)	(5)				- .20	
<u>Port A</u>													PROBE TIP SIZE	
													BEFORE	AFTER
1	2	2	882.0	375	64	64	64	33	227	1.49	.27	5	.314	.314
2		4	883.4	384	65	65	65	34	235	1.59	.29	5.5	.314	.314
3		6	884.8	385	68	65	66	35	239	1.54	.28	5.5	.314	.314
4		8	886.3	386	71	65	68	38	239	1.60	.29	5.7		
5		10	887.7	386	73	66	70	41	242	1.60	.29	5.7		
6		12	889.2	386	75	66	70	43	244	1.66	-.30	6.1	ml. <u>50</u>	
7		14	890.6	386	78	67	72	45	246	1.61	.29	6.0	gram <u>14.8</u>	
8		16	892.0	386	80	67	74	46	234	1.61	.29	6.0	Total <u>64.8</u>	
9		18	893.5	386	81	68	74	47	237	1.67	.30	6.3	OPERATOR <u>Lot/Riley</u>	
10		20	895.0	386	83	69	76	48	242	1.79	.32	6.7		
11		22	896.5	387	84	69	76	48	232	1.96	.35	7.0	Sample Box No. <u>2</u>	
12		24	898.4	385	85	71	78	45	234	1.96	.35	7.0	Meter Box No. <u>400</u>	
13		26	899.9	384	86	71	78	46	233	1.96	.35	7.5	Meter ΔH@ <u>1.71</u>	
14		28	901.6	378	86	72	79	47	234	1.83	.34	7.9	Pitot, CP <u>.84</u>	
15		30	903.1	368	87	73	80	47	237	1.88	.33	7.9	Temp. Device <u>RT</u>	
16		32	904.635	365	87	73	80	47	237	1.67	.29	7.5	Probe No. <u>5-N</u>	
<u>Port B</u>													Probe Liner <u>G-LASS</u>	
1	2	34	906.3	380	83	74	88	36	225	2.26	.40	8.1	Probe Htr. Set <u>40</u>	
2		36	908.1	381	83	74	78	44	229	2.49	.44	9.0	Ambient Temp. <u>63</u>	
3		38	909.9	385	86	75	80	38	224	2.65	.47	9.5	% O ₂ <u>17 / 17</u>	
4		40	911.8	386	87	75	81	40	227	2.65	.47	9.6	% CO ₂ <u>5 / 5</u>	
5		42	913.6	386	89	75	82	46	229	2.65	.47	9.8	NOTES:	
6		44	915.3	386	90	76	83	46	232	2.43	.43	9.5	Orifice <u>0.524</u>	
7		46	917.1	385	91	76	84	46	235	2.32	.41	9.3	Pitot <u>0.34 x 7.6</u>	
8		48	918.8	385	91	77	84	47	237	2.15	-.38	8.9	Meter <u>0.274</u>	
9		50	920.2	384	91	77	84	46	238	1.70	.30	8.0	<u>SPD. 880</u>	
10		52	921.7	383	92	78	85	44	239	1.60	.28	7.5	<u>880.776</u>	

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.

2610 18th Street South
Birmingham, Alabama 35208
205/878-1850

PLANT Grand Shale RUN # 1
LOCATION TK-15 DATE 10-11-80
BARO. PRES. 30.24 TIME 830-937

	TIME		METER VOL FT ³	STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H ₂ O	VELOCITY PRESSURE "H ₂ O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H ₂ O	
	MIN	DUR			IN	OUT	AVG						-	20
11 ⁷	2	54	923.1	383	91	78	84	45	240	1.59	.28	7.5	PROBE TIP SIZE BEFORE AFTER	
12 ⁹		56	924.5	379	90	78	84	45	239	1.48	.26	7.2	.314	.314
13 ¹¹		58	925.9	372	90	78	84	46	237	1.50	.26	7.6	.314	.314
14 ¹³		60	927.3	372	90	78	84	46	235	1.27	.22	7.2	.314	.314
15 ¹⁵		62	928.6	370	90	79	84	45	235	1.27	.22	7.2		
16 ²		64	929.866	370	89	79	84	41	235	1.16	.20	7.1	WATER	
			49.081										ml.	50
32		64	49.572 ^{1.01} ✓	381 ✓			78 ✓			1.83 ✓	.567 ✓	9.8 ✓	gram	14.8
													Total	64.8
													OPERATOR <i>Lis/Riley</i>	
													Sample Box No.	2
													Meter Box No.	400
													Meter ΔH@	1.71
													Pitot, CP	.84
													Temp. Device	2.4
													Probe No.	5-N
													Probe Liner	GLASS
													Probe Htr. Set	60
													Ambient Temp.	63-67
													% O ₂	17/17
													% CO ₂	5/5
													NOTES	
													Orifice	
													Pitot	
													Meter	

929.893
929.890
.003 @ 10" Hg 1 min
Low 8.0
Static 5.7

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.

2810 18th Street South
Birmingham, Alabama 35208
205/879-1800

PLANT General Store RUN # 2
LOCATION TK15 DATE 10-11-83
BARO. PRES. 30.24 TIME 1115-1221

	TIME		METER VOL FT ³	STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H ₂ O	VELOCITY PRESSURE "H ₂ O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H ₂ O	
	MIN	DUR			IN	OUT	AVG						BEFORE	AFTER
Port B													-1.27	
			930.00	(1)	(2)	(2)		(4)	(5)				PROBE TIP SIZE	
1	2	2	931.7	375	75	74	74	33	225	2.31	.41	6.8	.314	.314
2		4	933.5	381	75	73	74	40	234	2.29	.41	7.0	.314	.314
3		6	935.2	382	78	73	76	43	240	2.63	.47	7.5	.314	.314
4		8	937.1	383	81	74	78	47	242	2.65	.47	7.8		
5		10	938.9	383	83	74	77	49	247	2.65	.47	8.0	WATER	
6		12	940.6	384	84	74	79	49	252	2.50	.45	7.7	ml.	55
7		14	942.3	385	85	75	80	47	255	2.37	.42	7.6	gram	22.4
8		16	944.0	386	86	75	80	47	260	2.03	.36	7.2	Total	77.4
9		18	945.5	385	87	75	81	47	264	1.75	.31	6.9	OPERATOR	
10		20	946.9	385	88	76	82	45	264	1.53	.27	6.7	F. Rieg	
11		22	948.7	383	88	77	82	45	268	1.53	.27	6.7	Sample Box No. 2	
12		24	950.0	383	88	77	82	45	265	1.53	.27	7.0	Meter Box No. 400	
13		26	951.4	381	89	77	83	45	230	1.36	.24	6.8	Meter ΔH@ 1.74	
14		28	952.7	380	89	78	84	47	241	1.25	.22	6.5	Pitot, CP 84	
15		30	953.9	374	89	78	84	48	232	1.19	.21	6.5	Temp. Device AH	
16		32	955.04	372	89	78	84	51	235	.97	.17	6.0	Probe No. 5-11	
Port A													Probe Liner 5-115	
1	7	34	956.5	383	86	78	82	50	247	1.53	.27	7.0	Probe Htr. Set 60	
2		36	957.8	380	87	79	83	50	254	1.53	.27	7.0	Ambient Temp. 69-72	
3		38	959.3	383	89	80	84	52	260	1.70	.30	7.5	% O ₂ 17/17.5	
4		40	960.7	382	89	80	84	53	256	1.65	.29	7.2	% CO ₂ 5/4	
5		42	962.2	383	90	80	85	53	244	1.65	.29	7.5	NOTES	
6		44	963.7	383	90	80	85	55	234	1.71	.30	7.7	Orifice _____	
7		46	965.1	380	91	80	86	56	229	1.60	.28	7.6	Pitot _____	
8		48	966.6	383	92	81	86	36	227	1.54	.27	7.6	Meter _____	
9		50	968.1	383	92	81	86	37	227	1.71	.30	8.2	930.050	
10		52	969.7	383	92	81	86	37	229	1.83	.32	8.5	950.045	

930.050
950.045
955.0214
e-8.0
s-6.3

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.

2610 18th Street South
Birmingham, Alabama 35208
205/879-1850

PLANT Gulf Shale RUN # 2
LOCATION TK15 DATE 10-11-82
BARO. PRES. 30.24 TIME 1115-1221

	TIME		METER VOL FT ³	STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H ₂ O	VELOCITY PRESSURE "H ₂ O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H ₂ O	
	MIN	DUR			IN	OUT	AVG						- .27	
11	7	54 ⁷	971.2	383	92	81	86	39	233	1.89	.33	8.6	PROBE TIP SIZE	
12		56 ⁷	972.8	383	93	82	88	40	239	1.95	.34	8.9	BEFORE	AFTER
13		58 ¹¹	974.4	381	93	82	88	40	247	1.89	.33	8.7	.314	.314
14		60 ⁰	976.0	374	93	82	88	38	257	1.95	.34	9.0	.314	.314
15		61 ¹⁵	977.5	375	93	82	88	37	251	1.55	.27	8.2		
16		64 ²	978.949	372	92	83	88	39	253	1.45	.22	8.0	WATER	
			48.899										ml.	55
32		64	49.388	381			83			1.80	.560	9.0	gram	22.4
													Total	77.4
												OPERATOR		
												LBS/RS		
												Sample Box No. <u>2</u>		
												Meter Box No. <u>7940</u>		
												Meter ΔH@ <u>1.74</u>		
												Pitot, CP <u>54</u>		
												Temp. Device <u>24</u>		
												Probe No. <u>51N</u>		
												Probe Liner <u>6.188</u>		
												Probe Htr. Set <u>60</u>		
												Ambient Temp. <u>69-72</u>		
												% O ₂ <u>17/12.5</u>		
												% CO ₂ <u>5/4</u>		
												NOTES		
												Orifice _____		
												Pitot _____		
												Meter _____		

NO vent check

@ 9" H₂ fuel in

*Raw 6.9 ✓
SMTC 6.9 ✓*

FIELD DATA SHEET

PLANT Quilshub RUN # 3
 LOCATION TK15 DATE 10-11-87
 BARO. PRES. 30.24 TIME 1328-1433

GUARDIAN SYSTEMS INC.
 2610 18th Street South
 Birmingham, Alabama 35209
 205/878-1850

	TIME		METER VOL FT 3	STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H2O	VELOCITY PRESSURE "H2O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H2O	
	MIN	DUR			IN	OUT	AVG						- .27	
Port A													PROBE TIP SIZE	
			979.95	(1)	(2)	(3)	(4)	(5)					BEFORE	AFTER
1	2	2	981.3	383	71	71	71	34	226	1.44	.26	5.5	.314	.314
2		4	982.6	387	72	71	71	36	230	1.50	.27	5.9	.314	.314
3		6	983.9	383	74	72	73	37	236	1.55	.28	6.0	.314	.314
4		8	985.4	384	76	72	74	38	231	1.61	.29	6.1		
5		10	986.9	384	78	72	75	39	232	1.57	.28	6.5	WATER	
6		12	988.3	384	80	72	76	39	242	1.62	.29	6.5	ml.	65
7		14	989.7	385	82	73	78	40	244	1.57	.28	6.5	gram	11.0
8		16	991.2	384	83	73	78	41	244	1.52	.27	6.5	Total	76.0
9		18	992.6	385	84	74	79	40	236	1.52	.27	6.5	OPERATOR	
10		20	994.0	384	84	74	79	40	230	1.85	.33	7.0	Foy / Riley	
11		22	995.7	383	85	75	80	37	232	1.92	.34	7.3	Sample Box No. 1	
12		24	997.3	383	86	75	80	37	228	1.92	.34	7.3	Meter Box No. 400	
13		26	999.3	382	87	75	81	38	227	2.00	.36	7.6	Meter ΔH@ 1.74	
14		28	1000.6	380	88	76	82	38	240	1.92	.34	7.6	Pitot, CP .84	
15		30	1002.1	373	89	76	82	39	248	1.76	.31	7.0	Temp. Device 2H	
16		32	3.934	372	89	77	83	39	241	1.67	.29	6.9	Probe No. 5LN	
Port B													Probe Liner 600S	
1	2	34	5.2	383	86	77	82	37	229	2.32	.41	8.2	Probe Htr. Set 60	
2		36	7.0	383	86	77	82	38	236	2.49	.44	8.9	Ambient Temp. 72	
3		38	8.8	382	87	77	82	39	233	2.55	.45	9.0	% O ₂ 16.5 / 16.5	
4		40	10.6	383	88	77	82	40	228	2.55	.45	9.0	% CO ₂ 5.5 / 5.0	
5		42	12.5	384	89	78	84	41	229	2.56	.45	9.1	NOTES	
6		44	14.3	385	90	78	84	41	237	2.50	.44	9.0	Orifice _____	
7		46	16.0	385	91	78	84	41	243	2.22	.39	8.7	Pitot _____	
8		48	17.6	386	91	78	84	41	250	1.99	.35	8.2	Meter _____	
9		50	19.1	385	92	79	86	41	247	1.77	.31	8.0	6.2	
10		52	20.6	385	92	79	86	41	246	1.54	.27	7.5	6.1	

979.985
 978.590
 .005 @ 27.44

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.

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

PLANT

Good Stick

RUN #

4

LOCATION

TK15

DATE

10-11-83

BARO. PRES.

30.24

TIME

1520-1625

	TIME		METER VOL FT ³	STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H ₂ O	VELOCITY PRESSURE "H ₂ O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H ₂ O	
	MIN	DUR			IN	OUT	AVG						- .25	
<i>Port B</i>			28.967	(1)	(2)	(3)	(4)	(5)					PROBE TIP SIZE	
													BEFORE	AFTER
1	2	2	30.6	383	77	77	77	36	229	2.36	.42	6.8	.314	.314
2		4	32.4	383	76	75	76	37	229	2.17	.44	7.2	.314	.314
3		6	34.3	382	80	76	78	41	230	2.59	.46	7.5	.314	.314
4		8	35.9	381	83	76	80	43	236	2.71	.48	7.9		
5		10	37.8	382	86	76	81	45	241	2.72	.48	8.2		
6		12	39.6	383	88	76	82	45	244	2.55	.45	8.0		
7		14	41.0	382	90	76	83	45	253	2.38	.42	7.9		
8		16'	43.1	381	91	77	84	42	252	2.16	.38	7.4		
9		18'	44.5	381	92	77	84	40	257	1.71	.30	6.6		
10		20'	46.0	381	92	78	85	40	257	1.48	.26	6.3		
11		22'	47.4	379	93	79	86	42	260	1.48	.26	6.3		
12		24'	49.1	377	93	79	86	42	262	1.37	.24	6.4		
13		26"	50.3	371	94	79	86	42	264	1.28	.22	6.1		
14		28"	51.5	371	94	79	86	40	257	1.28	.22	6.1		
15		30"	52.8	370	94	80	87	42	261	1.22	.21	6.0		
16		32"	53.987	370	94	80	87	42	262	1.05	.18	5.6		
<i>Port A</i>														
1		34"	55.4	377	91	81	86	38	270	1.51	.26	6.6		
2		36"	56.8	378	92	81	86	44	269	1.61	.28	7.0		
3		38"	58.3	380	94	82	88	45	272	1.61	.28	7.0		
4		40"	59.9	381	94	82	88	45	250	1.60	.28	7.0		
5		42"	61.2	381	95	82	88	45	267	1.61	.28	7.1		
6		44"	62.6	381	95	82	88	45	272	1.61	.28	7.1	5.8.2	
7		46"	64.2	382	96	83	90	42	272	1.61	.28	7.1	R.10.0	
8		48"	65.5	382	96	82	89	44	265	1.67	.28	7.1		
9		50"	67.1	381	97	83	90	44	252	1.73	.30	7.8		
10		52"	68.6	382	97	83	90	45	229	1.79	.31	7.8		

PROBE TIP SIZE
BEFORE AFTER

WATER
ml. 60
gram 16.5
Total 76.5

OPERATOR
[Signature]

Sample Box No. 1
Meter Box No. 400
Meter ΔH@ 1.74
Pitot, CP .84
Temp. Device RTT
Probe No. 51-N
Probe Liner GLASS
Probe Htr. Set 60
Ambient Temp. 68
% O₂ 17.0 / 17.0
% CO₂ 4.0 / 4.0

NOTES
Orifice _____
Pitot _____
Meter _____
28.967
28.860
- .007 @ 274g

FIELD DATA SHEET

GUARDIAN SYSTEMS INC.

2810 18th Street South
Birmingham, Alabama 35209
205/878-1850

PLANT Quilshub RUN # 4
LOCATION TKS DATE 10-11-83
BARO. PRES. 30.24 TIME 1520-1625

	TIME		METER VOL FT ³	STACK TEMP OF	METER TEMP. OF			IMP TEMP OF	BOX TEMP OF	METER PRESSURE "H ₂ O	VELOCITY PRESSURE "H ₂ O	VACUUM PRESSURE "Hg	STATIC PRESSURE "H ₂ O	
	MIN	DUR			IN	OUT	AVG						- 0.25	
11	2	54 ⁷	70.5	382	99	83	91	45	231	1.85	.32	7.9	PROBE TIP SIZE	
													BEFORE	AFTER
12		56 ⁹	71.8	377	99	83	91	46	241	1.85	.32	7.9	.314	.314
13		58 ¹¹	73.3	375	99	84	92	46	248	1.86	.32	7.9	.314	.314
14		60 ¹³	74.9	374	99	84	92	46	246	1.86	.32	7.9	.314	.314
15		62 ¹⁵	76.4	375	99	84	92	46	259	1.57	.27	7.0		
16	✓	64 ¹⁷	77.868	370	99	85	92	46	229	1.58	.27	7.2	WATER	
			48.901										ml.	60
32	✓	64 [✓]	49.390	379			86			1.80	.557	8.2	gram	16.5
													Total	76.5
													OPERATOR	
													A/S / Rib	
													Sample Box No. 1	
													Meter Box No. 400	
													Meter ΔH@ 1.7f	
													Pitot, CP .04	
													Temp. Device 20.11	
													Probe No. 5-N	
													Probe Liner 9mm	
													Probe Htr. Set 50	
													Ambient Temp. 48	
													% O ₂ 12.1 / 12.2	
													% CO ₂ 4.0 / 4.0	
													NOTES.	
													Orifice _____	
													Pitot _____	
													Meter _____	

77.892
77.888

.004 @ 9.0' Hg 1 min

P_a - 7.5
Static - 6.5

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: General shale Sample date: 10-11-83
Sample location: TK 15 Run no.: 1
Sample recovery person: W. Z. Riey Recovery date: 10-11-83
Filter(s) no.: L-24

MOISTURE

Impingers	Silica gel
Final volume (wt) <u>50</u> ml (gm)	Final wt. <u>1021.5</u> g _____ g
Initial volume (wt) <u>0</u> ml (gm)	Initial wt. <u>1006.7</u> g _____ g
Net volume (wt) <u>50</u> ml (gm)	Net wt. <u>14.8</u> g _____ g
Total moisture <u>64.8</u> g	
Color of silica gel <u>mixed</u>	
Description of impinger water <u>CLEAN</u>	

RECOVERED SAMPLE

Filter container no. R-#1 sealed
Description of particulate on filter Brownish

Acetone rinse container no. <u>R-#1</u>	Liquid level marked <u>✓</u>	<u>.7847</u>
Acetone blank container no. <u>Blank</u>	Liquid level marked <u>✓</u>	

Samples stored and locked

Remarks: _____

Date of laboratory custody _____

Laboratory personnel taking custody _____

Remarks: _____

BLANK ANALYTICAL DATA

Plant General Shale
Sample location TK15
Relative humidity 20%
Type of blank Acetone
Liquid level at mark and container sealed ✓
Density of blank (ρ_a) .7847 g/ml
Blank volume (V_a) 406 ml
Date and time of wt. 10/15/83 800 Gross wt. 11196.9 mg
Date and time of wt. 10/15/83 1600 Gross wt. 11191.9 mg
Average gross wt. 11194.9 mg
Tare wt. 11191.7 mg
Weight of blank (m_a) 0.2 mg

$$Ca = \frac{m_a}{V_a \rho_a} = \frac{(0.2)}{(406)(.7847)} = .0006 \text{ mg/g}$$

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 _____

Signature of reviewer _____

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant Genl Shale Run No. 1
 Sample location TR15
 Relative humidity 20%
 Density of acetone (pa) .7847 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
filter(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Acetone rinse container no. R #1
 Acetone rinse volume (Vaw) 332 ml
 Acetone blank residue concentration (Ca) 0.0006 mg/g
 $W_a = Ca V_{aw} p_a = (0.0006)(332)(.7847) = \underline{0.2}$ mg
 Date and time of wt 10/15/83 800 Gross wt 1136.474 mg
 Date and time of wt 10/15/83 1600 Gross wt 1136.475 mg
 Average gross wt 1136.475 mg
 Tare wt 1135.51.2 mg
 Less acetone blank wt (W_a) -0.2 mg
 Weight of particulate in acetone rinse 96.1 mg

Filter(s) container no. R #1
 Date and time of wt 10/15/83 800 Gross wt 363.4 mg
 Date and time of wt 10/15/83 1600 Gross wt 363.4 mg
 Average gross wt 363.4 mg
 Tare wt 238.7 mg
 Weight of particulate on filter(s) 124.7 mg
 Weight of particulate in acetone rinse 96.1 mg
 Total weight of particulate 220.8 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 [Signature]

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: Gold Star Sample date: _____
Sample location: TK75 Run no.: 2
Sample recovery person: L074/RLG Recovery date: 10-11-83
Filter(s) no.: 6-22

MOISTURE

Impingers	Silica gel
Final volume (wt) <u>55</u> ml(gm)	Final wt. <u>1019.0</u> g _____g
Initial volume (wt) <u>0</u> ml(gm)	Initial wt. <u>996.6</u> g _____g
Net volume (wt) <u>55</u> ml(gm)	Net wt. <u>22.4</u> g _____g
Total moisture <u>77.4</u> g	
Color of silica gel <u>white</u>	
Description of impinger water <u>clear</u>	

RECOVERED SAMPLE

Filter container no. R#2 sealed
Description of particulate on filter brownish

Acetone rinse container no. <u>R#2</u>	Liquid level marked _____
Acetone blank container no. _____	Liquid level marked _____

Samples stored and locked _____

Remarks: _____

Date of laboratory custody _____

Laboratory personnel taking custody _____

Remarks: _____

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant Genel Shale Run No. 2
 Sample location TK15
 Relative humidity 20%
 Density of acetone (pa) .7847 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse filter(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Acetone rinse container no. R # 2
 Acetone rinse volume (Vaw) 270 ml
 Acetone blank residue concentration (Ca) 0.0006 mg/g
 $W_a = Ca \cdot V_{aw} \cdot \rho_a = (0.0006)(270)(.7847) = \underline{0.1}$ mg
 Date and time of wt 10/15/83 500 Gross wt 115.5356 mg
 Date and time of wt 10/15/83 1600 Gross wt 115.5854 mg
 Average gross wt 115.5555 mg
 Tare wt 115.4675 mg
 Less acetone blank wt (W_a) -0.1 mg
 Weight of particulate in acetone rinse 117.9 mg

Filter(s) container no. R # 2
 Date and time of wt 10/15/83 500 Gross wt 342.8 mg
 Date and time of wt 10/15/83 1600 Gross wt 342.8 mg
 Average gross wt 342.8 mg
 Tare wt 238.0 mg
 Weight of particulate on filter(s) 104.8 mg
 Weight of particulate in acetone rinse 117.9 mg
 Total weight of particulate 222.7 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 [Signature]

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: Coolidge Sample date: 10-11-83
Sample location: KILN #1 Run no.: 3
Sample recovery person: Lotz/Riley Recovery date: 10-11-83
Filter(s) no.: (L-2)

MOISTURE

Impingers	Silica gel
Final volume (wt) <u>65</u> ml (gm)	Final wt. <u>957.0</u> g
Initial volume (wt) <u>0</u> ml (gm)	Initial wt. <u>946.0</u> g
Net volume (wt) <u>65</u> ml (gm)	Net wt. <u>11.0</u> g
Total moisture <u>76</u> g	
Color of silica gel <u>clear pink</u>	
Description of impinger water <u>clear</u>	

RECOVERED SAMPLE

Filter container no. R#2 sealed
Description of particulate on filter brownish

Acetone rinse container no. <u>#3</u>	Liquid level marked <input checked="" type="checkbox"/>
Acetone blank container no. _____	Liquid level marked _____

Samples stored and locked _____

Remarks: _____

Date of laboratory custody _____

Laboratory personnel taking custody _____

Remarks: _____

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant General Shale Run No. 3
 Sample location TK15
 Relative humidity 20%
 Density of acetone (ρ_a) .7847 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
filter(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Acetone rinse container no. R #3
 Acetone rinse volume (V_{aw}) 309 ml
 Acetone blank residue concentration (C_a) .0006 mg/g
 $W_a = C_a V_{aw} \rho_a = (.0006)(309)(.7847) =$ 0.1 mg

Date and time of wt 10/15/83 8:00 Gross wt 114305.2 mg
 Date and time of wt 10/15/83 16:00 Gross wt 114305.1 mg
 Average gross wt 114305.2 mg
 Tare wt 114179.4 mg
 Less acetone blank wt (W_a) -0.1 mg

Weight of particulate in acetone rinse 125.8 mg

Filter(s) container no. R #3
 Date and time of wt 10/15/83 8:00 Gross wt 366.3 mg
 Date and time of wt 10/15/83 16:00 Gross wt 366.3 mg
 Average gross wt 366.5 mg
 Tare wt 238.3 mg

Weight of particulate on filter(s) 128.0 mg
 Weight of particulate in acetone rinse 125.8 mg
 Total weight of particulate 253.8 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 [Signature]

METHOD 5

PARTICULATE SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: Grand Shale Sample date: 10-11-83
Sample location: TK15 Run no.: 4
Sample recovery person: LTZ/RL Recovery date: 10-11-83
Filter(s) no.: L-20

MOISTURE

Impingers	Silica gel
Final volume (wt) <u>60</u> ml (gm)	Final wt. <u>973.5</u> g _____ g
Initial volume (wt) <u>0</u> ml (gm)	Initial wt. <u>957.0</u> g _____ g
Net volume (wt) <u>60</u> ml (gm)	Net wt. <u>16.5</u> g _____ g
Total moisture <u>76.5</u> g	
Color of silica gel <u>Gr. mixed</u>	
Description of impinger water <u>clean</u>	

RECOVERED SAMPLE

Filter container no. R #4 sealed ✓
Description of particulate on filter powdery

Acetone rinse container no. <u>R #4</u>	Liquid level marked <u>✓</u>
Acetone blank container no. _____	Liquid level marked _____

Samples stored and locked _____

Remarks: _____

Date of laboratory custody _____

Laboratory personnel taking custody _____

Remarks: _____

METHOD 5 TRAIN ANALYTICAL PARTICULATE DATA

Plant General Shale Run No. 4
 Sample location TK15
 Relative humidity 20%
 Density of acetone (pa) 0.7847 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse filter(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Acetone rinse container no. R#4

Acetone rinse volume (Vaw) 361 ml

Acetone blank residue concentration (Ca) 0.0006 mg/g

$W_a = C_a V_{aw} p_a = (0.0006)(361)(0.7847) = 0.2$ mg

Date and time of wt 10/15/83 800 Gross wt 113634.0 mg

Date and time of wt 10/15/83 1600 Gross wt 112614.0 mg

Average gross wt 113634.0 mg

Tare wt 113531.5 mg

Less acetone blank wt (W_a) -0.2 mg

Weight of particulate in acetone rinse 100.3 mg

Filter(s) container no. R#4

Date and time of wt 10/15/83 500 Gross wt 344.0 mg

Date and time of wt 10/15/83 1600 Gross wt 344.0 mg

Average gross wt 344.0 mg

Tare wt 239.6 mg

Weight of particulate on filter(s) 104.4 mg

Weight of particulate in acetone rinse 100.3 mg

Total weight of particulate 204.7 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 [Signature]

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

Company General Shale Ref. No. 82-36
 Source I.D. Tunnel Kilo #15
 Test Conducted by Guardian Systems
 Person in Charge of Test Tom Lot
 Observer Thomas Isaacs
 Run Number Observed 1, 2, 3
 Date October 11, 1983 Time Test Observed 8:30 - 3:15

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 OK
 Number of sample points OK
 Velocity traverse OK
 Method of moisture determination OK

SAMPLING

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

PROCESS INFORMATION

Engineer Present (Name Greg Forte)
 Pretest Agreement _____
 Observer _____

SAMPLING TRAIN

Basic Construction OK *Hot box used*
 Probe Design OK
 Nozzle Condition OK
 Pitot Condition OK
 Filter OK
 Correct amt. H₂O and Silica Gel in impingers OK *Condenser & silica gel trap used; no impingers*

TRAIN BREAK-DOWN

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

CALIBRATION DATA

Proper calibration data available at site OK

Team Leader [Signature]

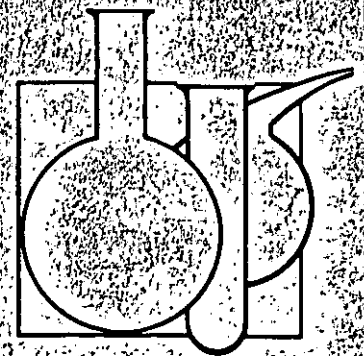
Original to observer; copy to team leader (to be submitted with test report)

* Run #2 post test leak check unacceptable - test thrown out
 Run #1 to start around 8:45

PH-0463

APC 8/79

Plant Operation Data



Pretest Agreement for Process Information

Source to be Tested TK-15 Tunnel Kiln

Company Name General Shale Co.

1.) Method of Process Wt. Determination:

Reference No. 82-36-06 (TK-15)

Weight of bricks introduced into kiln
24-hour coal and gas usage over test period

Coal: BTU, sulfur, ash analyses

2.) Items to be monitored during test to document process operation.

temperatures of kiln

3.) Items to be monitored during test to document operation of control equipment.

Submitted By

[Signature]

Phone

General Shale Products
615/282-4661

Acceptable to State

[Signature]
Name

Date October 11, 1983

Unacceptable to State

Date _____

Reason Unacceptable: _____

PROCESS INFORMATION

PLANT: Kingsport -- TK-15 DATE: October 11, 1983

Brick Rate:

Car Schedule	=	<u> 80 </u>	Minutes	=	<u> .75 </u>	Cars/Hour
Car Count	=	<u> 3,968 </u>	Q/S Brick/Car			
Hourly Rate	=	<u> 2,976 </u>	Q/S Brick/Hour			
Brick Weight	=	<u> 4.3 </u>	Lbs.			
Brick Rate	=	<u> 12,797 </u>	Lbs./Hour			

Fuel Rate:

Total	=	<u> 30.8 </u>	Therms/M Brick			
Coal	=	<u> 6.69 </u>	Tons/Day			
		<u> 557.5 </u>	Lbs./Hour	=	<u> 79 </u>	% of Btu's
Natural Gas	=	<u> 48.9 </u>	MCF/Day			
		<u> 2037.5 </u>	Cu. Ft./Hour	=	<u> 21 </u>	% of Btu's

Total Process Weight:

		<u> 12,797 </u>	Lbs. Brick/Hour			
	+	<u> 557 </u>	Lbs. Coal/Hour			
		<u> 13,354 </u>	Total Lbs./Hour			
		<u> 6.68 </u>	Tons/Hour			

Coal Analysis:

<u> 14,551 </u>	Btu/Lb.	
<u> 0.79% </u>	Sulfur	
<u> 3.22% </u>	Ash	

Allowable Emissions:

9.3 lbs./hr.

LANT: 15

DAILY REPORT
KINGSPORT, TENNESSEE

Day Tuesday Date 10-11-83

REGULAR PRODUCTION

No. in Today	UNITS	Prod. To Date	Unloaded & Graded to Date				Shipments To Date	YARD INVENTORY			
			A-Quarry	A-2,3,4	Off Grade	Base		A-2,3,4	Off Grade	First Quality	Quality
	5/8 R Pines 15-11-20							19000			
	5/8 Sand R. Pines										
	5/8 Post-Cut Pines										
	5/8 R. PATINA CENT.	109490		58,800	300	1100		58800	300		
	0.3 1.1 Ancaster							15520			
	0.3 1.1 Yuma, Paines									11210	
	0.3 1.1 Ancaster										44400
	0.3 1.1 Test Brick										
	5/8 CENT.			25200		300		15432			
	5/8 A-3 Night Pines							70400	600		
	5/8 1.3 Carpas									700	185100
	5/8 Special Continental						18000				918500
	5/8 Continental										51300

SPECIAL PRODUCTION

	5/8 Brick										16600
15	Total to Date	113159	266300	6327	.13	218	152900	98139	18257	1257171	
	Today	108680	0	92400	.35	163	18000				
											Intra Co. Shipped

GRINDING	
Grinder Operated	
Grinding Room Worked	
Yds Per/Hour	
Loads Hauled	
Fineness Modulus	
Remarks:	

MACHINING	
Mill - Type Brick	5/8 R. PATINA
Brick Mach. Ran. Hr.	9 Brck/Hr. 1699
Vacuum (Absolute)	25
Green Strength	
Green Brick Wt.	4.05
Column Temp	100
Void Area	29.7%
LUE 6"	50.90
deva 6"	50.90
Predryer	
Green Cars	47
Dew Point	
Pre. Sup. Temp.	
Remarks:	

BURNING		STD	ACTUAL
Kiln Schedule		80	80
Cars Burned		18	18
Car Count		3968	3968
Brick Burned		78566	78566
Type of Brick		216 cent	216 cent
Rate of Suction		7.2	9.10
Key Check Reading A&B		75	53-85
Remarks:			
LOADING			
Brick Graded/Man Hour		2000	1955
General Information			
No. Employees			7-9 HOURS
N.U.B. Produced		9 Brck 78	
Remarks:			

FUEL REPORT			
15	Nat. Gas	48895	Cu. Ft. 50815
K	Fuel Oil		Gal. 18
I	Coal	13380	Lb. 1910
L	Total Therms.	2418.5	Therm. 79.0%
N	RTI/11 be Ware	48.5	Therm. Per. 30.8

GREEN CARS AT FIRST OF EACH SHIFT

	1	2	3
TRACK 1	7		
2	7		
3	7		
4	7		
5	7		
6			
7	12		

471
 96011/M
 12225/M

DATE 10/12/83
 PRODUCTION Chg patina
 SCHEDULE 80 minutes
 TOTAL KILN HOURS _____
 BURNED BRICK WEIGHT _____
 KEY CHECK AVERAGE _____

	(COAL)	(GAS)
FUEL METER (END)	9837	53700
(BEGIN)	9168	41000
(TOTAL)		

	BTU	THERMS	COST	THERM % OF TOTAL	COST PER M	THERMS PER M
COAL <u>13380</u> lb. @ <u>14274</u> = <u>191946120</u> / 100,000 = <u>1919.46</u> /therm = \$ <u>343.90</u>		<u>119</u>		<u>79.0</u>	<u>4.36</u>	<u>24.3</u>
OIL _____ gal. @ 140,000 = _____ / 100,000 = _____ /therm = \$ _____						
GAS <u>47875</u> c.f. @ 1,040 = <u>50450000</u> / 100,000 = <u>504.5</u> /therm = \$ <u>143.06</u>		<u>36</u>		<u>21.0</u>	<u>2.35</u>	<u>1.5</u>

COSTS:

COAL <u>50.85</u> per ton	<u>118</u> per therm	Total Therms <u>2418.5</u>
OIL _____ per gal.	_____ per therm	Total Brick Burned <u>74566</u>
GAS <u>3.61</u> per MCF	<u>.36</u> per therm	Total Therms/M Brick Burned <u>30.4</u>
<u>4.59</u> Average Cost Per Therm		\$ <u>526.86</u> Total Cost
<u>993.00</u> BTU/lb. of Brick		\$ <u>6.71</u> Cost Per M

	1	2	3
PREDRYER TEMP.	95	95	90
WET BULB			
DRY BULB			
% R. H.			
DEW POINT			
BRICK BODY			

	1	2	3
PRIMARY AIR PRESSURE			
PRIMARY GAS PRESSURE			
PREHEAT GAS PRESSURE			
FIRE ZONE GAS PRESSURE			

COLD AIR SUPPLY <u>9.5</u> (amps)	DRYER TEMP. NO. 1 <u>130</u>	WET BULB _____
KILN EXHAUST <u>27.5</u> (amps)	DRYER TEMP. NO. 2 <u>290</u>	DRY BULB _____
TURBO BLOWER <u>40.0</u> (amps)	DRYER TEMP. NO. 3 <u>250</u>	% R. H. _____
BALANCE GAUGE _____	DRYER TEMP. NO. 4 <u>300</u>	DEW POINT _____
DRYER EXHAUST <u>26.5</u> (amps)	PRESSURE GAUGE <u>122</u>	BRICK BODY _____
DRYER EXHAUST TEMP. <u>100</u>	DRYER TEMP. <u>425</u>	UNDER CAR TEMP. _____

COAL TEST RESULTS

TO: DAVE McNEES

CC: B. F. Archer

GSPC PLANT # 15-KINGSPOET

Date Sample Received 10-11-83

Sample Identification SAMPLED DURING STACK TEST of 10-11-83

Coal Grinding Information

Imp Mill Model _____

Hammer Placement
Row F-T 2 3 4

Coal Screening - Mesh _____

Opening 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) 14,551

% Volatiles 34.18%

% Ash 3.22%

% Sulfur 0.79%

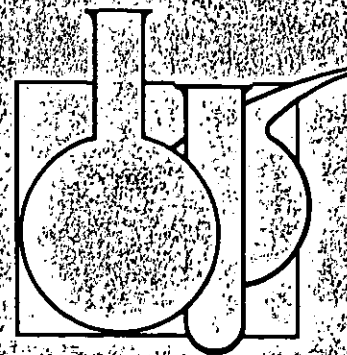
% Moisture (As Received) _____

COMMENTS _____

COMMENTS (Continued) _____

FL

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 1.81 a 2.00 "H₂O was used as the calibration point). These calibrations produced a single point MCF and a $\Delta H@$ which was compared to the original calibration. All were within the 5% allowed at the highest vacuum seen. These calibration sheets are located behind the original calibration sheets.

The equipment used during these tests was as follows:

Probe: 5-N

Meter Box: #400

Stack Temperature: OMEGA II

Sample Box: #1 & #2

Condenser: #1

The average temperature of the stack was 381 °F. The OMEGA II was recalibrated at 380 °F and agreed exactly with an ASTM mercury-in-glass reference thermometer. The intercomponent spacings 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.

Gauge	Average Test Condition Temperature	Gauge Reading	Reference Reading	Difference
Impinger 1 (Pre) 10/7/83		70	Room Temp 70	—
Meter In 400 (Pre) 10/7/83		70	Room Temp 70	—
Meter Out 400 (Pre) 10/7/83		70	Room Temp 70	—
Filter Heated Area # 2 (Pre) 10/7/83		250	248 ± 25°F 250	—
Stack (Post)	381	380	Stack Temp ° F 380	—

Post Test

Run 1

Run 03

Run 04

Train Leak Rate

.003 CFM

.003 CFM

.004 CFM

Pitot Leak Check

✓

✓

✓

Pre Test (Answer Yes or No)

Orsat Leak Check

NA

—

—

Metering System Leak Check

—

Barometer Calibrated

—

Sample Bag Leak Check (if used)

—

Signature Jon Lotz

Title Director

Date 10/17/83

METER CALIBRATION FORM

Date 9/12/80

Box No. 400

P_{bar} = 30.0 in. Hg

Calibrated by For Lot

Orifice Manometer Setting ΔH (in. H ₂ O)	Δ wtm (in. H ₂ O)	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
2.5 @ 21" H ₂ O	-1.3	0.002	14.371	404.517	418.723	26.4	26.2	105 123	90 98
2.0 @ 22" H ₂ O	-1.05	14.371	26.598	418.723	431.022	26.2	26.0	120 124	98 103
1.5 @ 23" H ₂ O	-0.80	26.598	37.175	431.022	441.607	26.0	26.0	120 123	102 105
1.0 @ 24" H ₂ O	-0.60	37.175	46.224	441.607	450.680	26.0	26.0	121 125	105 107
0.5 @ 25" H ₂ O	-0.38	46.224	52.403	450.680	457.094	26.0	26.0	123 122	107 107

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} + $\frac{\Delta H}{13.6}$

Δwtm = pressure on wet test meter in inches of H₂O

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.

1.0075
1.0167
1.0208
1.0242
0.9963
1.0131 = 1.01

POST TEST METER CALIBRATION

PROJECT General Store STACK 15
 Date 10/17/83 Box No. 400
 P_{bar} = 30.24 in. Hg Calibrated by [Signature]
 Signature

Orifice Manometer Setting ΔH (in. H ₂ O)	Δ wtm (in. H ₂ O)	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 @ 17 "Hg	-1.05	0.005	16.803	210.547	227.500	20.0	20.0	88 91	105 113
2.0 @ 17 "Hg	-1.05	16.803	33.099	227.500	244.038	20.0	20.0	91 93	109 114
2.0 @ 17 "Hg	-1.05	33.099	48.048	244.038	259.267	20.0	20.0	93 93	111 111

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 H₂O

Y = meter calibration factor

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

Calculations

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

or (1)

$$\bar{Y} = \frac{\Sigma Y}{3} = \underline{1.0160}$$

Pre test Y 1.0167

% Difference -0.07

1.0179
1.0168
1.0134

ORIFICE CALIBRATION FORM

Date 9/12/83
 P_{bar} 30.00

Meter Box No. 400
 Calibrated By Tom L. A.

Δ H	V ₁	V ₂	θ	t ₁	t ₂	V ₂ - V ₁	Q _m	K _m
in. H ₂ O	CF	CF	Sec.	°F	°F	CF		
2.5	404.517	418.753	930	114	94	14.236	.5115	.7247
2.0	418.753	431.072	900	122	100.5	12.229	.5133	.7182
1.5	431.072	441.607	900	121.5	103.5	10.535	.7090	.7206
1.0	441.607	452.132	930	123.0	106.0	9.073	.5906	.7332
0.5	452.132	457.051	950	102.5	107.0	6.414	.4203	.7367
Average K _m								.7267

1.75
1.79
1.77
1.71
1.70

- V₁ = Dry gas meter reading at the start of each test
- V₂ = Dry gas meter reading at the end of each test
- t₁ = Dry gas meter inlet temperature
- t₂ = Dry gas meter outlet temperature.

1.74

Calculations

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

2. $K_m = \frac{Q_m}{\sqrt{\frac{P_m M_m}{T_m \Delta H}}}$

M_m = 29
 T_m = t₂ + 460
 P_m = P_{bar} + $\frac{\Delta H}{13.6}$

Y = meter calibration factor

3. Calculate the average K_m as follows:

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

4. Calculate Δ H_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@ = 528OR
 P@ = 29.92 in.Hg
 M@ = 29

5. Orifice Tolerance = 1.84 ± .25

POST TEST ORIFICE CALIBRATION

Date Gen Shale 10/17/83

Meter Box No. 400

P_{bar} 30.24

Calibrated By [Signature]
Signature

Δ H	V ₁	V ₂	θ	t ₁	t ₂	V ₂ - V ₁	Q _m	K _m
in. H ₂ O	CF	CF	Sec.	°F	°F	CF		
2.0	210.547	227.502	1290	89.5	109	16.953	.8166	.7186
2.0	227.502	244.078	1260	92	111.5	16.538	.8146	.7153
2.0	244.038	259.267	1140	93	111	15.229	.8252	.7249
Average K _m								.7196

1.78
1.80
1.75

V₁ = Dry gas meter reading at the start of each test

V₂ = Dry gas meter reading at the end of each test

t₁ = Dry gas meter inlet temperature

t₂ = Dry gas meter outlet temperature

Average H@ 1.78
Pre test H@ 1.79
% Difference -0.56

Calculations

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

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

M_m = 29
T_m = t₂ + 460
P_m = P_{bar} + $\frac{\Delta H}{13.6}$

Y = meter calibration factor

3. Calculate the average K_m as follows:

$$K_m = \frac{\sum K_m}{3}$$

4. Calculate Δ H_a as follows:

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

Qθ = 0.75 cfm
Tθ = 528°R
Pθ = 29.92 in.Hg
Mθ = 29

DEVICE READING (DEGREES F)

5 0 5

10 20 30 40 50 60 70

ACTUAL TEMPERATURE (DEGREES F)

TEMPERATURE CALIBRATION FOR TEMPERATURE
DATE 9/18/53 INITIALS STC

DEVICE READING (DEGREES F)

5
0
5

270
270
270
270
270
270
270
270

ACTUAL TEMPERATURE (DEGREES F)

TEMPERATURE CALIBRATION FOR
DATE 9/24/83
INITIALS JLS
270 270

Temperature
Humidity
Barometric Pressure
Wind Speed
Wind Direction
Solar Radiation
Global Radiation
Net Longwave Radiation
Net Shortwave Radiation
Net Radiation
Air Temperature
Surface Air Temperature
Soil Temperature
Soil Moisture
Soil Water Potential
Soil Heat Flux
Soil Temperature
Soil Moisture
Soil Water Potential
Soil Heat Flux
Soil Temperature
Soil Moisture
Soil Water Potential
Soil Heat Flux

DEVICE READING (DEGREES F)

5 0 5

100

200

300

400

500

600

700

800

900

ACTUAL TEMPERATURE (CORRECTED)

TEMPERATURE CALIBRATION FOR COLEMAN 11 1959
DATE 9/15/60 INITIALS ES

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100

DEVICE READING (DEGREES F)

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0
5

30

40

50

60

70

80

90

100

ACTUAL TEMPERATURE (DEGREES F)

TEMPERATURE CALIBRATION FOR 011118 1979
DATE 01/11/83 INITIALS SSS

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" x 10"
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
Lead	.20		to 25,000

OTHER PHYSICALS:

BSO	.522	Flow Resistance (Max.)	@ 320 cm/min. .80 mm
*pH	.8.5	Flow Rate (air)	lpm/cm ² @ 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" x 10" 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:

- 500 ml distilled water.
- Add 15 drops saturated KCl solution
- Shred one 8" x 10" sheet and soak in prepared water for one hour.
- 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" x 10"
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:

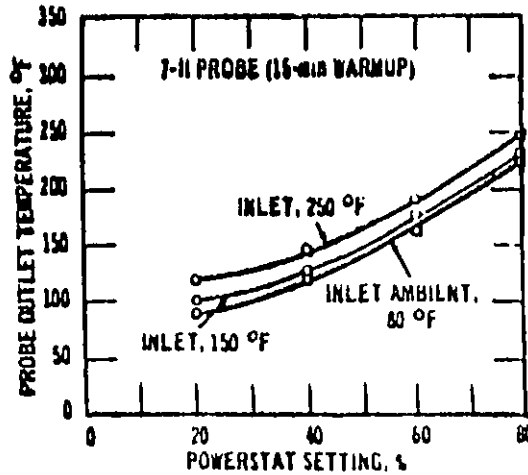
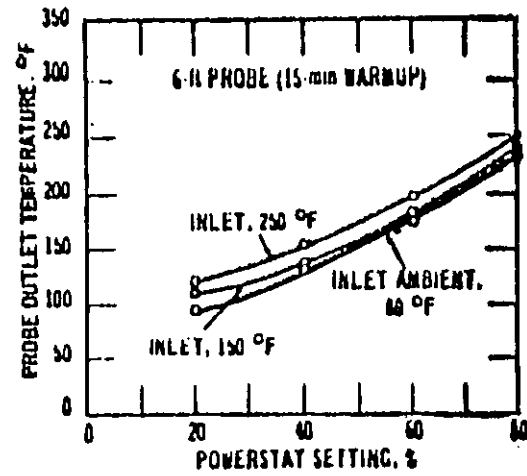
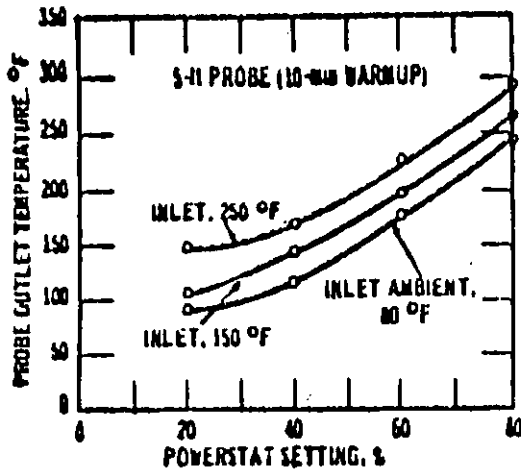
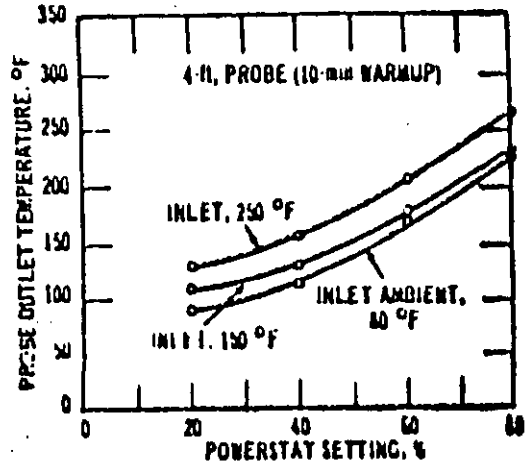
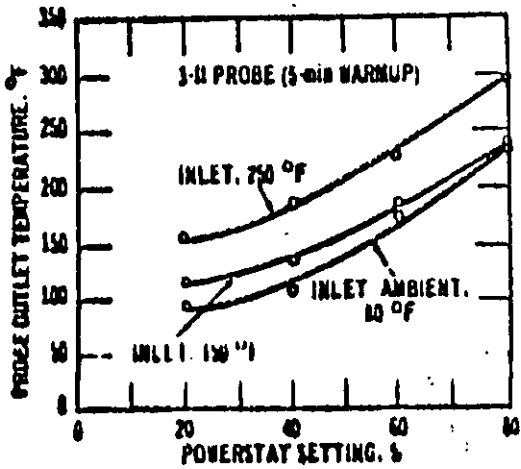
BSO	.522	Flow Resistance (Max.)	@ 320 cm/min. .80 mm
*pH	.9.0	Flow Rate (air)	lpm/cm ² @ 70 cm Hg .60
DOP @320/cm/min	(ASTM Method 2986) .99.9%	Max. Use Temp.	.400°C
Tensile Strength	(Fed. Spec. UUP31B) .600 gr.	Static Properties	.Medium
Weight	8" x 10" sheet .4.0 ± .3 gr.	Ability to	Fold .Good

WATER EXTRACTABLE IONS:

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

*pH—Gelman Procedure:

- 500 ml distilled water.
- Add 15 drops saturated KCl solution.
- Shred one 8" x 10" sheet and soak in prepared water for one hour.
- Run pH at ambient temperature.



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

PITOT CALIBRATION FORM

Date 9/12/83 Probe # S'-N

Calibrated By Tom Lutz

Nozzle Size None Used

SIDE A

Run #	ΔP_{std} (in. H ₂ O) Standard	$\Delta P(s)$ (in. H ₂ O) Type "s"	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(A)$
1	0.60	0.84	0.845	+0.003
2	0.60	0.85	0.840	-0.002
3	0.60	0.85	0.840	-0.002
		$\bar{C}_p(A)$	0.842	

SIDE B

Run #	ΔP_{std} (in. H ₂ O) Standard	$\Delta P(s)$ (in. H ₂ O) Type "s"	$C_p(s)$	Deviation $C_p(s) - \bar{C}_p(B)$
1	0.59	0.835	0.841	+0.001
2	0.59	0.835	0.841	+0.001
3	0.59	0.84	0.838	-0.002
		$\bar{C}_p(B)$	0.840	

CALCULATIONS

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

(or 0.99)

$$\text{Average Deviation} = \frac{\sum |C_p(s) - \bar{C}_p(A \text{ or } B)|}{3} \leftarrow \text{Must be } \leq 0.01$$

$$|\bar{C}_p(A) - \bar{C}_p(B)| \leftarrow \text{Must be } \leq 0.01$$