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Title:	Report on Source Tests, Visible Emissions, and Plant Observations, Kaiser Steel Corporation, Fontana, California, Coke Oven Battery E, February 12-13, 1979, Engineering-Science, Arcadia, California, April 1979.

SOTDAT/STEEL LIBRARY SYSTEM

Report Title: see title pg.

Plant and Location: Kaiser Steel, Fontana, CA

SCC: 30300306

Testing Date(s): 4/14-17/80

By Whom: TRW

Stack Test Review Attached: No

Reviewed By:

Problems Seen by Reviewer:

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Source of Determination of the Confidentiality Status:
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Comments:

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AP-42 Section 12.2
Reference ___
Report Sect. 4
Reference 85

REPORT ON SOURCE TESTS, VISIBLE EMISSIONS, AND PLANT OBSERVATIONS

Facility Inspected

KAISER STEEL CORPORATION
FONTANA, CALIFORNIA

Coke Oven Battery E

Dates of Inspections

February 12-13, 1979

Inspected By

Howard DeVorkin
Senior Air Pollution Engineer

Prepared For

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION IX
215 FREMONT STREET
SAN FRANCISCO, CALIFORNIA 94105

Task Order 50/TSA 2
Contract No. 68-01-4146

April 1979

Submitted By

ENGINEERING-SCIENCE
150 North Santa Anita Avenue
Arcadia, California 91006

OBSERVATIONS OF SOURCE TESTS
AT KAISER STEEL CORPORATION
FONTANA, CALIFORNIA

February 12-13, 1979

INTRODUCTION

Tests to determine particulate emissions from the baghouse serving Coke Oven Battery E were conducted on the above dates by technical personnel of Environmental Quality Control, Kaiser Steel Corporation. Visual emission observations of the discharge stack were made during the same period by representatives of the South Coast Air Quality Management District (SCAQMD) and Kaiser Steel Corporation (KSC).

The tests and observations were conducted pursuant to Paragraph X of the Amended Consent Decree entered on September 30, 1977 at the U.S. District Court, Central District of California (Case No. CV76-0675MML).

The baghouse was installed at Coke Oven Battery E for control of particulate emissions in the exit gases from heating of the coke ovens. The control equipment was in operation about two weeks prior to these tests. The remaining coke oven batteries (B, C, F, G) are in the process of having baghouses installed; Battery E is the second to be tested to determine the efficiency of baghouse control of particulates originating from coke oven stacks. (Battery D was tested November 27-28, 1978.)

$\frac{14 \text{ tons. ch}}{\text{ch}} \cdot \frac{}{62\text{min}} \cdot \frac{60\text{min}}{1\text{hr}}$

PROCESS DESCRIPTION

Table 1 lists pertinent data for the coke batteries at KSC. Each oven is charged with about 14 tons of coal from an overhead larry car and heated for 16 to 18 hours to complete the coking process. At the end of this period, the incandescent coke is horizontally pushed from the oven into a receiving ("hot") car for quenching and transfer to the blast furnaces. The pushing is accomplished with a ram which travels on the side of the ovens opposite to the hot car. Charging is done immediately after the expulsion of the coked product. The sequence of operations is shown schematically on Figure 1.

The ovens of Battery "E" are heated with blast furnace gas, using about 1,400,000 cubic feet per hour of 85 BTU/ft.^{3} heat content. (This is in contrast to 180,000 scfh of 500 BTU/scf of coke oven gas used for Battery D.) The brick work surrounding the ovens is used for regenerative heating of the combustion air being introduced, employing a reversal cycle every 30 minutes. The general configurations of the two types of coke ovens at KSC are shown in Figures 2 (Batteries A-E) and 3 (Batteries F-G). Figure 4 shows a simplified flow sheet of the coking and by-product recovery processes. (Note: Figures 2-4 are intended for general information regarding these processes, and not necessarily specific for KSC operations.)

Emissions from the combustion of the blast furnace gas used to heat Battery E ovens are drawn through a baghouse by a 500 HP induced draft fan and discharged to atmosphere through a 225-foot stack. The baghouse, manufactured by American Air Filter (AAF), consists of six sections with a total of 1,080 "silicon-graphite" treated fiberglass bags of 49,760 $ft.^2$ total area (design air/cloth ratio for 100,800 ACFM is about 2:1). The baghouse is insulated to maintain operating temperatures near 350°F. The baghouses being constructed for the other batteries appear to be similar to D and E.

Although the blast furnace gas fuel is fairly clean, material distilling from the coke oven charge can leak through cracks in the brick work into the combustion gases, introducing particulates into the coke oven stack gases, with consequent visible emissions (if uncontrolled) that could vary from 10 percent to practically 100 percent at times. This variability is due to differences in the condition of the brick walls of ovens within a battery, and that the cracks, if present, will be sealed by fusion of the material some five to ten minutes after charging, for any individual oven.

SAMPLING AND ANALYTICAL PROCEDURES

The sampling was conducted at the outlet duct of the baghouse at a point upstream of the induced draft fan and stack. The gases travel vertically downward with an approximate 26-foot run prior to the sampling station (an approximate 2-1/2 x 8-foot rectangular cross-section of duct). Two sampling ports were used on the short side, sampling at six points along each traverse for a one-hour total sampling time for each test (see data sheets). Great care was used in the introduction and removal of the sampling probe and nozzle into and from the duct due to the high negative static pressure (10 to 11" H_2O).

The procedure followed EPA Method 5 equipment and procedures, also including the processing of "back-half" (impinger) collection to determine total particulate matter. This was necessary to determine compliance with applicable local regulations. (See Discussion of Data and Results.)

In addition to particulate sampling, samples of gas were aspirated from the duct at five-minute intervals into a 2 cubic foot plastic bag to obtain an integrated average gas sample for each one-hour test. The contents of each bag were analyzed at the laboratory using Horiba MEXA/200 and MEXA/201 infrared analyzers for carbon dioxide and carbon monoxide, respectively, and a Teledyne oxygen analyzer. Nitrogen was determined by difference.

The technique used by KSC personnel during the sampling and sample processing (nozzle-probe, filter, impingers) appeared excellent to this observer. The personnel have many years experience in sampling for particulates; also, the equipment was in excellent condition and showed careful maintenance. The weighing of the filters and determination of the impinger residue weights was not observed due not only to practical limitations, but also deemed unnecessary because of the competence demonstrated by the laboratory personnel.

DATA AND RESULTS

The test data, calculations, and results as submitted by Kaiser Steel Environmental Quality are included in the Appendix. The particulate matter concentration and emission rates were determined by three methods due to the different interpretations of particulate matter by (a) the former San Bernardino County APCD, and (b) the present SCAQMD rules. These are as follows:

(1) Rule 52A: This rule was formerly in effect during the existence of the San Bernardino County APCD. Rule 52A, rather than Rule 404(a) of the SCAQMD (see (2) below), apparently is part of the California SIP as submitted to EPA, hence is still considered effective for compliance determinations. Rule 52A requires all

collected particulate matter, liquid or solid, to be included in concentration calculations; i.e., "front-half" plus total condensables in the "back-half" of the Method 5 sampling train. The KSC summary sheet shows the Rule 52A test results and maximum allowables.

(2) Rule 404(a): This, the present particulate matter concentration rule of the SCAQMD, requires exclusion of all liquid sulfur compounds from the particulate matter weight. In practical terms, this excludes sulfuric acid which is known to exist as the dihydrate ($H_2SO_4 \cdot 2H_2O$) when the impinger residue is evaporated to dryness and desiccated (the determination of H_2SO_4 is made by titration; this yields the most conservative value, as has been determined in analyses over many years by the Los Angeles County APCD laboratories).

(3) Rule 405(a): This, the present particulate matter mass flow rate rule of the SCAQMD, is based upon solid particulate matter, as defined by SCAQMD Rule 102. The latter defines solid particulate matter as "particulate matter which exists as a solid at standard conditions". This definition does not exclude any solid particulate matter which may be collected by the "back-half" of EPA Method 5 train. Thus, solid particulate matter as defined by the SCAQMD includes the total front and back-half collection of the sampling train, less sulfuric acid dihydrate [as for Rule 404(a)], unless the presence of other liquid particulate matter can be shown.

On the above, the SCAQMD and the writer are in agreement, as confirmed with both Messrs. C. O'Malley and W. B. Krenz by telephone on March 22, 1979.

The recalculation of solid particulate matter by SCAQMD interpretation yields (as would be expected) higher emission rates than by the KSC calculation, which used only the "front-half" collection of the sampling train. The recalculated mass flow rates are shown as circled values on the KSC Summary and the various calculation sheets.

Other than the Rule 405(a) results, all of the KSC calculations were checked and found to be accurate, with only one small difference in gr/dscf for Test 2.

PROCESS EQUIPMENT OBSERVATIONS

The following process equipment observations were obtained by the writer and by Gerald R. Brown, Research Engineer, KSC.

Test No.	Date & Time	No. of Pushes	No. of Charges	Gas Reversal Times	Baghouse Pressure Drop (in.H_2O)	Baghouse Temp. (°F)	Stack Opacity (Meter)
1	2-12-79 (0945-1047)	4	3	0952 1022	8.5	350	3%
2	2-12-79 (1315-1418)	5	4	1322 1352	8.3	355	0-1%
3	2-13-79 (0855-0958)	0*	1*	0922 0952	7.6	355	3%

* 3 pushes and 2 charges just prior to test.

According to Kaiser personnel, the baghouse filter bags are cleaned by reverse air pressure when the pressure drop attains 10 inches of water. After about two weeks operation, this had not yet occurred, and very little material (extremely fine and fluffy) had accumulated in the baghouse hoppers.

VISIBLE EMISSION OBSERVATIONS

Mr. R. Bean, Engineering Inspector II, SCAQMD, was present to observe emissions from Battery E stack during the source tests. His observations are included in the Appendix. (Rule 50A of the former San Bernardino APCD and 401 of the SCAQMD limit visible emissions of 20 percent opacity or greater to no more than three minutes during any hour.)

TABLE 1

COKE PLANT

Production Data

ANNUAL CAPACITIES

Coal Charged		2,550,000
	Actual (1977):	1,895,653
Ovens:		
Furnace Coke (3% Moisture)	Net Tons/Yr.	1,620,000
Coke Breeze	Net Tons/Yr.	100,000
Total	Net Tons/Yr.	1,720,000
Coal Chemicals:		
Coal/day	Tons/D	7,100
Coke Oven Gas	MCF/Day	78,000
Diammonium Phosphate	Net Tons/Yr.	30,000
Tar	Gallons/Yr.	27,000,000
Light Oil	Gallons/Yr.	7,200,000
Intermediate Light Oil	Gallons/Yr.	600,000
Phenol	Gallons/Yr.	24,000

OPERATING STATISTICS

Number of Ovens in Plant (7 Batteries, 45 each)	315
Tons of Coal Charged per Oven (Natural)	14.2
Tons of Furnace Coke Produced per Oven	8.9
Current Average Coking Time — Hours	17.5
Current Average Number of Ovens Pushed per Day	400
Current Average Furnace Coke Produced per Day — Net Tons	3,400
Number of Ovens Pushed per Day — Fastest Schedule	500
Average Coking Time — Fastest Schedule — Hours	15.1
Type of Fuel Used for Under-Firing	Enriched — Blast Furnace Gas or Coke Oven Gas
Fuel Consumption — B.T.U. per Pound of Coal	1,350
Average Coal Mix:	
Per Cent High-Volatile	80
Per Cent Medium-Volatile	20
Coal Pulverization — Per Cent to Pass Through 1/8" Mesh Screen	65-70
Coal Storage Capacity — Net Tons	300,000
Number of Days Coal Supply	30

Representative Coke and Coal Analyses:

		Coal: High Volatile Raton	Coal: High Volatile Sunnyside	Coal: Medium Volatile	Furnace Coke
Moisture	Per Cent	6	7	7	2.5
Ash	Per Cent	12	6	7	12
Volatile Matter	Per Cent	38	39	23.5	1.0
Fixed Carbon	Per Cent	50	54	70	87
Sulphur	Per Cent	.65	1.10	.60	.70

Equipment Data

5 Batteries of Koppers-Becker Underjet Ovens (A, B, C, D, E)

Length	40'-5½"
Height	13'
Width — Pusher Side	13"
Width — Coke Side	15½"
Capacity — Cubic Feet	576

A, B (1942); C (1949); D, E (1952)

2 Batteries of Koppers-Becker Gun Flue Ovens (F, G)

Length	40'-5½"
Height	13'
Width — Pusher Side	13"
Width — Coke Side	15½"
Capacity — Cubic Feet	576

F, G (1958)

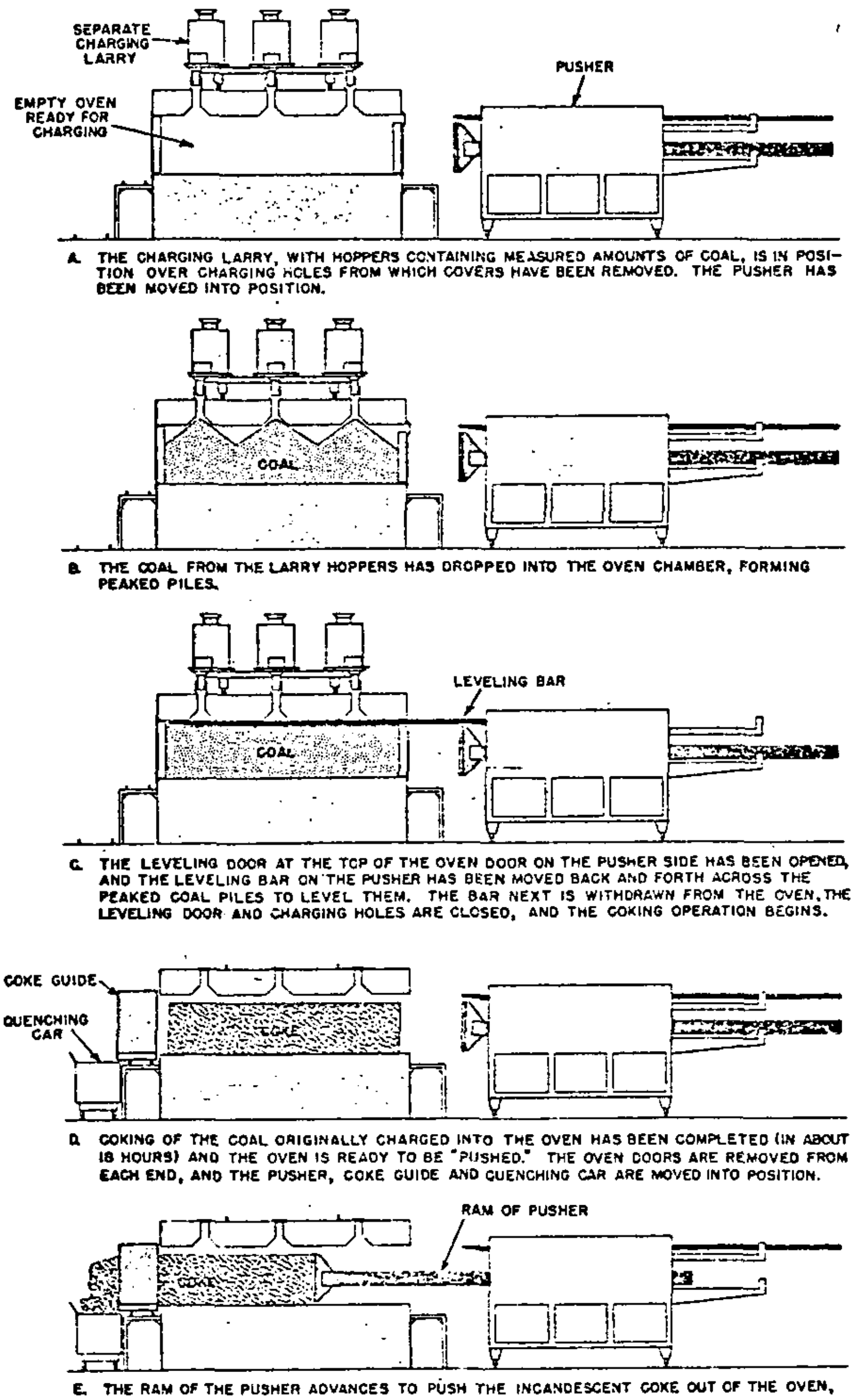
Auxiliary Equipment

Pushers	5
Larry Cars	6
Quenching Cars	5
Quenching Car Locomotives	4

Reference: "Production and Equipment Data, Kaiser Steel Corp." (1969)

FIGURE 1

CHARGING, LEVELING AND PUSHING OPERATIONS
IN ONE COKING CYCLE OF A BY-PRODUCT COKE OVEN



A. THE CHARGING LARRY, WITH HOPPERS CONTAINING MEASURED AMOUNTS OF COAL, IS IN POSITION OVER CHARGING HOLES FROM WHICH COVERS HAVE BEEN REMOVED. THE PUSHER HAS BEEN MOVED INTO POSITION.

B. THE COAL FROM THE LARRY HOPPERS HAS DROPPED INTO THE OVEN CHAMBER, FORMING PEAKED PILES.

C. THE LEVELING DOOR AT THE TOP OF THE OVEN DOOR ON THE PUSHER SIDE HAS BEEN OPENED, AND THE LEVELING BAR ON THE PUSHER HAS BEEN MOVED BACK AND FORTH ACROSS THE PEAKED COAL PILES TO LEVEL THEM. THE BAR NEXT IS WITHDRAWN FROM THE OVEN, THE LEVELING DOOR AND CHARGING HOLES ARE CLOSED, AND THE COKING OPERATION BEGINS.

D. COKING OF THE COAL ORIGINALLY CHARGED INTO THE OVEN HAS BEEN COMPLETED (IN ABOUT 18 HOURS) AND THE OVEN IS READY TO BE "PUSHED." THE OVEN DOORS ARE REMOVED FROM EACH END, AND THE PUSHER, COKE GUIDE AND QUENCHING CAR ARE MOVED INTO POSITION.

E. THE RAM OF THE PUSHER ADVANCES TO PUSH THE INCANDESCENT COKE OUT OF THE OVEN, THROUGH THE COKE GUIDE AND INTO THE QUENCHING CAR.

FIG. 4—5. Schematic representation of the sequence of operations involved in charging, leveling and pushing in one coking cycle of a by-product coke oven.

Reference: "The Making, Shaping, and Treating of Steel", edited by Harold E. McGannon, Published by U.S. Steel. Chapter 4, Ninth Edition (December, 1970).

(BATTERIES A-E)

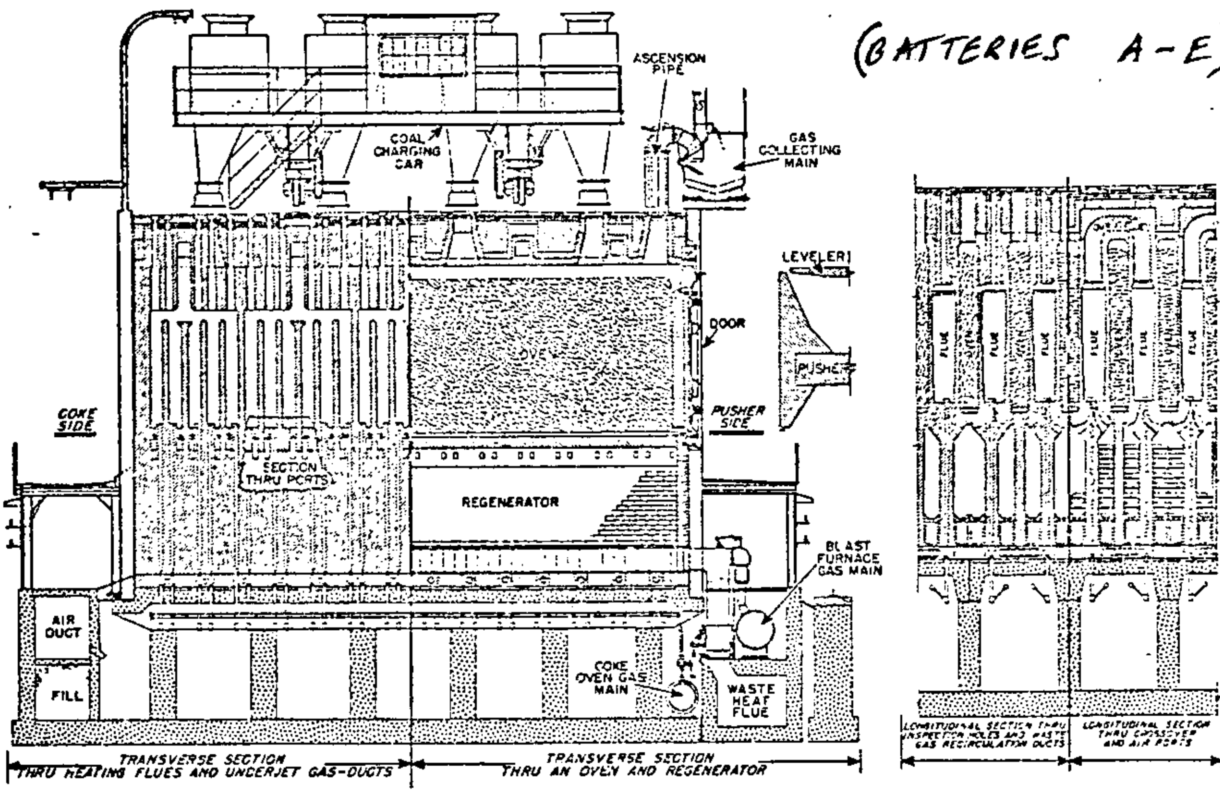
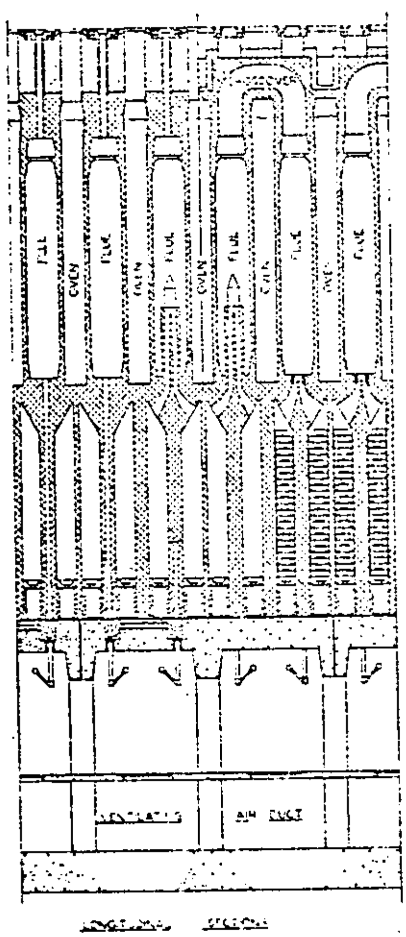


Fig. 4—29. Transverse and longitudinal sections through Koppers-Becker underjet-fired low-differential combination by-product coke oven. (Courtesy, Koppers Company, Inc.)



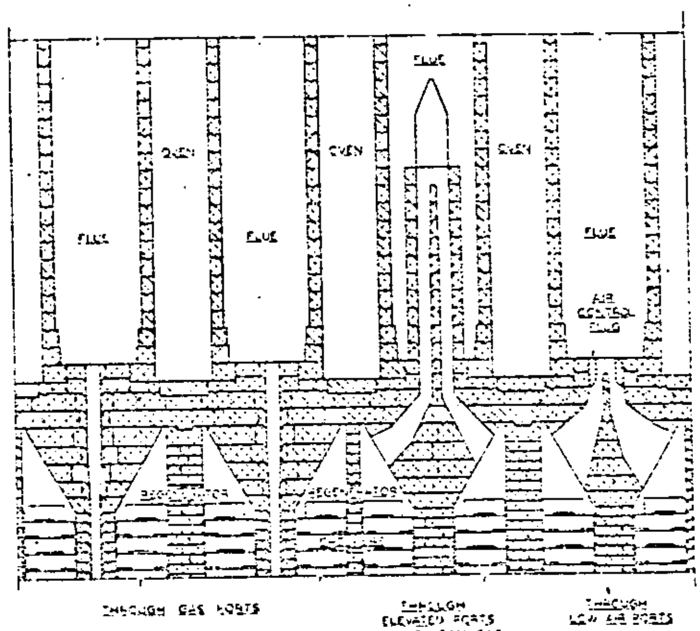


Fig. 4—33. (Left) Longitudinal sections through waste-gas recirculation ducts and gas ports, elevated ports, low air ports and crossover flues, and (Above) Enlarged sections through base of flues of the Koppers-Becker combination underjet coke-oven battery.
(Courtesy, Koppers Company, Inc.)

Reference: Same as for Figure 1.

FIGURE 3

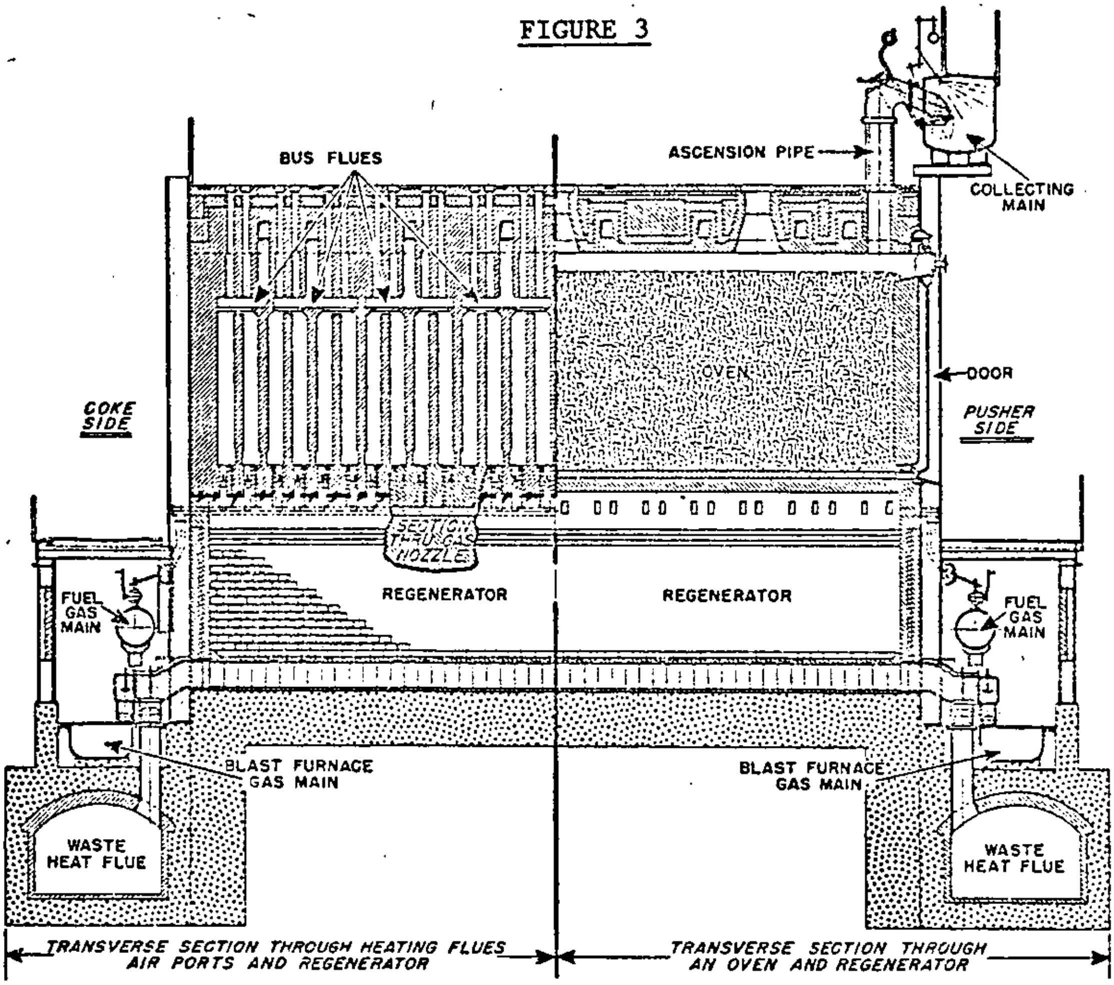


Fig. 4—27a. Transverse sections through a Koppers-Becker combination gun-flue type by-product coke-oven battery. (Courtesy, Koppers Company, Inc.).

(BATTERIES F, G)

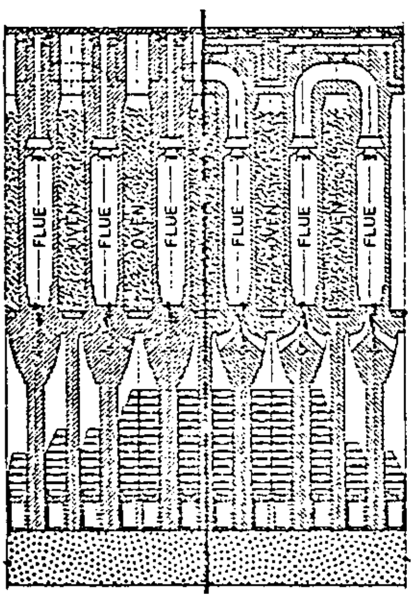


Fig. 4—27b. Longitudinal section (left) through gas nozzles and (right) through air ports of a portion of a Koppers-Becker combination gun-flue type by-product coke-oven battery. (Courtesy, Koppers Company, Inc.)

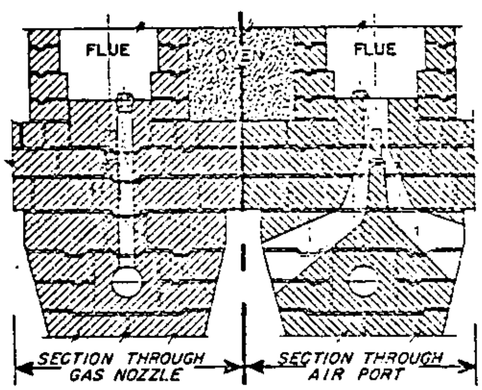


Fig. 4—28. Enlarged sections through gas nozzles and air ports of a Koppers-Becker combination gun-flue type of by-product coke oven, showing detail of part of Figure 4—27b. (Courtesy, Koppers Company, Inc.).

Reference: Same as for Figure 1.

FIGURE 4

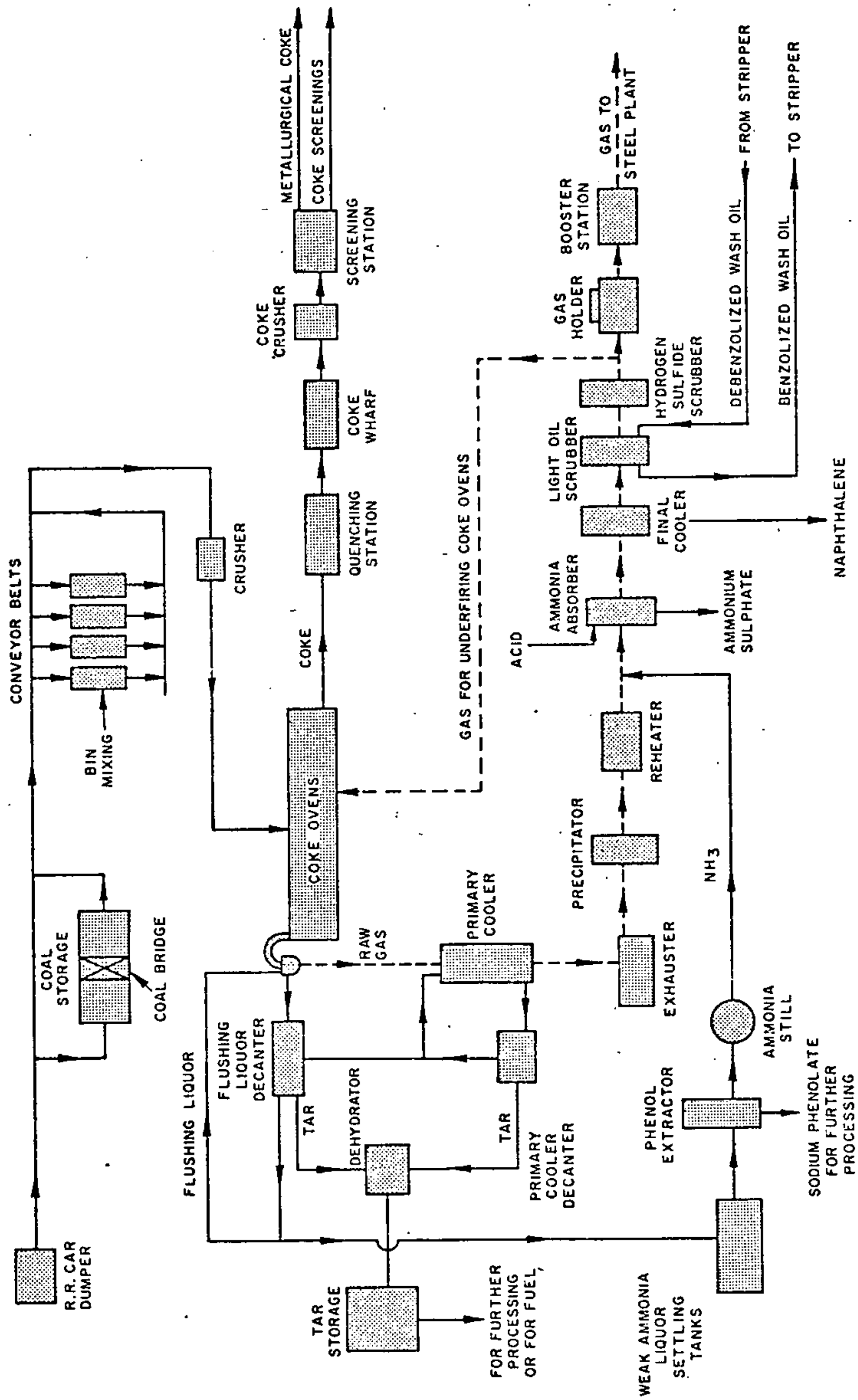


Fig. 4—53. Flow sheet showing the major steps involved in the carbonization of coal by the by-product process and the subsequent recovery of coal chemicals from the gases generated at the ovens.

Reference: Same as for Figure 1.

APPENDIX

Summary - KSC Coke Plant Battery E Compliance Tests

Test 1
- Particulate Field Data
- Laboratory Analysis Data
- Calculations

Test 2
- Particulate Field Data
- Laboratory Analysis Data
- Calculations

Test 3
- Particulate Field Data
- Laboratory Analysis Data
- Calculations

Visual Emission Observations
- Tests 1, 2, 3 - R. Bean SCAQMD

SUMMARY-KSC COKE PLANT BATTERY "E" COMPLIANCE TESTS

Test No.	Date Time	Sample Volume dscf	Sample Percent Isokinetic %	Part. Matter Conc. Rule 52A gr/dscf		Part. Matter Conc. Rule 404(a) gr/dscf $H_2SO_4 \cdot 2H_2O$ Removed		Solid Part. Matter Rule 405(a)-lbs/hr.	
				Test Results gr/dscf	Max. Allowed	Test Results gr/dscf	Max. Allowed	Test Results	Max. Allowed
1	2/12/79 0945-1047	48.98	101.14	0.0111	0.0446 gr/dscf @50,820 dscfm	0.0057 0.0052	0.0432 gr/dscf @50,820 dscfm	0.49 = 0.0011 2.48 = 0.0057	15.6
2	2/12/79 1315-1418	46.6	99.75	0.0108	0.0451 gr/dscf @49,020 dscfm	~~0.0058~~ 0.0057 0.0062	0.0438 gr/dscf @49,020 dscfm	0.26 = 0.000[illegible] 2.38 = 0.0057	15.6
3	2/13/79 0855-0957	45.42	102.75	0.0079	0.0461 gr/dscf @46,390 dscfm	0.0057	0.0444 gr/dscf @46,390 dscfm	0.50 = 0.00125 2.27 = 0.0057	15.8

Standard Conditions - 60°F, 14.7 psia. Process Weight: February 12, 1979 - 67,417 lbs/hour.
February 13, 1979 - 71,000 lbs/hour

Note: Rule 52A included for information only-Rule has been replaced with Rule 404(a).

NOTE: CIRCLED RESULTS - CALCNS. BY H.D. (See Text of Report)

HJM:pw
2/15/79

PARTICULATE FIELD DATA

Plant Kaiser Steel Coke Oven E
Run No. 1 — 3/4/95
Location E Bypass Exit
Date 2/12/79
Operator [illegible]

Start Time 0944
Stop Time 1047
Ambient Temp. °F 65
Barom. Press. "Hg 29.98
Nozzle Diam. In. 1/4
Probe Length 8'

Sample Box No. 2
Meter Box No. 2
Meter ΔH@ 1.89
Heater Box Setting, °F 250
Probe Heater Setting, °F 250
Leak Rate @ "Hg 6.7 Post-Test 0.00 O.K.

POINT	TIME MIN.	GAS VOLUME CF	PITOT ΔP "H_2O	ORIF. ΔH "H_2O	STACK TEMP. °F	BOX TEMP °F	IMP. TEMP. °F	PROBE TEMP. °F	DRY GAS TEMP. °F IN	DRY GAS TEMP. °F OUT	PUMP VAC. "Hg	STACK S.P. "H_2O	
HE-6	0	66.5	.95	2.5	335	214	55	289	70	64	5.5	-10.5	
HE-5	5	70.6	0.94	2.43	340	248	53	285	74	65	5.5		
HE-4	10	74.9	1.10	2.84	341	212	54	252	80	67	6.6		Pushed 206
	11	76.6	0.91	2.48							5.9		
HE-3	15	79.4	0.90	2.32	332	260	55	230	86	70	5.5		
HE-2	20	83.6	1.0	2.59	329	260	55	249	90	78	6.0		Pushed 216
HE-1	25	88.0	1.1	2.84	329	260	56	253	92	75	6.6	-10.7	
	30	92.7											
SE-6	0	92.3	.90	2.30	327	240	57	258	90	77	5.5	-10.6	
SE-5	5	97.6	0.94	2.17	333	251	56	258	95	79	5.1		
SE-4	10	101.7	0.88	2.17	330	264	57	262	98	80	5.1		Pushed 236
SE-3	15	105.8	0.84	2.17	329	260	58	260	100	82	5.1		
	17	107.5	0.90	2.32							5.5		
SE-2	20	110.0	1.1	2.84	331	252	58	260	101	84	6.6		Pushed 236
SE-1	25	114.7	1.1	2.84	333	247	58	262	102	86	6.6		
	30	119.4											
									90 83	76		-10.6	
	60	52.3			332								

PART. gr/dscf | lb/hr
TOTAL 0.0111 |
NET 0.0052 | 2.38
SOLID 0.0044 | 0.49

GAS VEL., fps 68.9
VOLUME, dscfm 52,820
MOISTURE, % 7.8

COMMENTS:

TEST OBSERVERS:
Howard [illegible] (EPA)
Bob Bean (SCAQMD)

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

Analysis Date(s) 2/12-2/15/79 Analytical Chemist ______

Sample Date 2/12/79 Run No. 1 Location KSC Coke Oven E Bat...
Lab. No. 39495

MOISTURE DATA:

1. Final Vol. H_2O in Imp. 275 ml.
2. Initial Vol. H_2O in Imp. 200 ml.
3. Vol. H_2O Condensed 75 ml.
4. Vol. Wash H_2O 280 ml.
5. Final Wt. Silica Gel ______ gm.
6. Initial Wt. Silica Gel ______ gm.
7. Weight Gain 14.0 gm.

PARTICULATE DATA:

Front Half:

8. Final Filter Weight 337.0 mg.
9. Initial Filter Weight 335.8 mg.
10. Filter Particulate 1.2 mg.
11. Probe Particulate 2.4 mg.
12. Total Particulate 3.6 mg.

Back Half:

13. Total Condensables 31.6 mg.
14. $H_2SO_4 \cdot 2H_2O$ 17.1 mg.
15. Net Condensables 14.5 mg.

16. Acetone Wash 90 ml.

FLUE GAS ANALYSES:

Molecular Weight Determination:

2/12/79
Room Temp. 75°F Barom. Press. 29.0 "Hg

Component		
17. $\%CO_2$	14.5 @ 3% H_2O	= 14.95 dry
18. $\%O_2$	10.7 "	= 11.03 "
19. $\%CO$	0.43 "	= .44 "
20. $\%N_2$		73.58 " (by difference)

Other

21. ______
22. ______
23. ______

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION *Kaiser Steel Coke Ovens E Baghouse* DATE *2/12/79*

RUN NO. *1*

I. Necessary Data:

A. No. of traverse points *12*

B. Total test time, (θ) *60* minutes

C. Water collected:

1. Impinger H_2O; V_{H_2O} *75* ml.
2. Silica Gel, W_{H_2O} *14* gm.

D. Particulate Weight:

1. Front Half, M_f *0.0036* gm.
2. Back Half, M_b *0.0316* gm.
3. Back Half $H_2SO_4 \cdot 2H_2O$ *0.0171* gm.

E. Volume metered

V_m = *52.3* CF x DGMCF *1.0* = *52.3* CF

F. Average $\sqrt{\Delta P}$ *0.979* ($"H_2O)^{\frac{1}{2}}$

G. Average ΔH *2.49* $"H_2O/13.6$ = *0.18* "Hg

H. Average meter temperature, T_m *83* °F + 460 = *543* °R

I. Average stack temperature, T_s *332* °F + 460 = *792* °R

J. Stack absolute pressure, P_s *28.30* "Hg

K. Stack static pressure *-10.6* $"H_2O$

L. Barometric pressure, P_b *29.08* "Hg

M. % CO_2 *14.95* ; % O_2 *11.03* ; % CO *0.44* ; % N_2 *73.58*

N. Area of stack, A_s *21.47* ft^2

O. Area of nozzle, A_n *0.000341* ft^2

P. Pitot tube factor, C_p *0.85*

II. Calculations:

A. Standard Volume Metered

$$V_{m(std)} = V_m \times \frac{T_{std}}{P_{std}} \times \frac{(P_b + \frac{H}{13.6})}{T_m}$$

$$V_{m(std)} = 17.380 \times (\underline{\ 52.3\ }\ CF) \times \frac{(\underline{\ 29.26\ }\ "Hg)}{(\underline{\ 543\ }\ ^{o}R)} = \underline{\ 48.98\ }\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

$$V_{wc(std)} = K\ (V_{H_2O})$$

$$V_{wc(std)} = 0.04636 \times (\underline{\ 75\ }\ ml.) = \underline{\ 3.48\ }\ scf$$

2. H_2O collected in silica gel

$$V_{wsg(std)} = K \times (W_{H_2O})$$

$$V_{wsg(std)} = 0.04644 \times (\underline{\ 14\ }\ gm.) = \underline{\ 0.65\ }\ scf$$

3. Moisture Content of Stack Gas, B_{ws}

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

$$B_{ws} = \frac{(\underline{\ 3.48\ }\ scf) + (\underline{\ 0.65\ }\ scf)}{(\underline{\ 3.48\ }\ scf) + (\underline{\ 0.65\ }\ scf) + (\underline{\ 48.98\ }\ scf)} = \underline{\ 0.078\ }$$

C. Molecular Weight of Stack Gas, lb/lb-mole

1. M_d (Dry Molecular Weight) $= \sum M_x B_x$

$$M_d = (0.44)\ \underline{\ 14.95\ }\ \%\ CO_2 + (0.32)\ \underline{\ 11.03\ }\ \%\ O_2 + (0.28)\ \underline{\ 74.02\ }\ \%(N_2+CO)$$

$$= \underline{\ 30.83\ }\ lb/lb\text{-}mole$$

2. M_s (Wet Molecular Weight) $= M_d\ (1 - B_{ws}) + 18\ B_{ws}$

$$M_s = (\underline{\ 30.83\ })(1 - \underline{\ 0.078\ }) + 18\ (\underline{\ 0.078\ }) = \underline{\ 29.83\ }\ lb/lb\text{-}mol$$

D. Average Stack Gas Velocity

$$\overline{V}_s = K_p\ C_p\ \left(\frac{T_s}{P_s\ M_s}\right)^{\frac{1}{2}} \sqrt{\Delta P}$$

$$\overline{V}_s = 85.48\ (\underline{\ 0.85\ }) \left[\frac{(\underline{\ 792\ }\ ^{o}R)}{(\underline{\ 28.3\ }\ "Hg)\ (\underline{\ 29.83\ }\ lb/mole)}\right]^{\frac{1}{2}} (\underline{\ 0.979\ }\ "H_2O^{\frac{1}{2}})$$

$$= \underline{\ 68.9\ }\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

$$\overline{Q}_s = (3600\ \text{sec/hr})\ \overline{V}_s\ A_s\ (1 - B_{ws})\ \frac{T_{std}}{P_{std}}\ \frac{P_s}{T_s}$$

$$= 62566.8\ (\underline{\ 68.9\ }\ \text{ft/sec})(\underline{\ 21.47\ }\ \text{ft}^2)(1 - \underline{\ 0.078\ })\ \frac{(\underline{\ 28.30\ }\ \text{"Hg})}{(\underline{\ 792\ }\ ^\circ\text{R})}$$

$$= \underline{\ 3,049,210\ }\ \text{dscfh}/60 = \underline{\ 50,820\ }\ \text{dscfm}$$

F. Pollutant Mass Rate (Front Half - Rule 405a)

PLUS NON-H_2SO_4 BACK-HALF PARTICS.

$= M_f + M_b - (H_2SO_4 \cdot 2H_2O)$

$= .0036 + .0316 - .0171 = 0.0181$ gm

$$PMR = \frac{M_f}{V_{m(std)}} \times \overline{Q}_s$$

$$PMR = \frac{(\underline{\ 0.0036\ }\ \text{gm.})}{(\underline{\ 48.98\ }\ \text{dscf})} \times (\underline{\ 3,049,210\ }\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

0.0181

$$= \underline{\ 0.49\ }\ \text{lb/hr}$$

2.48 lb/hr.

G. Particulate Concentration

1. Total Particulate (Rule 52A)

$$C_t = \frac{M_f + M_b}{V_{m(std)}} \times 15.43$$

$$C_t = \frac{(\underline{\ 0.0036\ }\ \text{gm}) + (\underline{\ 0.0316\ }\ \text{gm})}{(\underline{\ 48.98\ }\ \text{dscf})} \times 15.43 = \underline{\ 0.0111\ }\ \text{gr/dscf} ✓$$

2. Net Particulate (Total less $H_2SO_4 \cdot 2H_2O$ - Rule 404a)

$$C_n = \frac{M_f + M_b - (H_2SO_4 \cdot 2H_2O)}{V_{m(std)}} \times 15.43$$

$$C_n = \frac{(\underline{\ 0.0036\ }\ \text{gm}) + (\underline{\ 0.0316\ }\ \text{gm}) - (\underline{\ 0.0171\ }\ \text{gm})}{(\underline{\ 48.98\ }\ \text{dscf})} \times 15.43$$

$$= \underline{\ 0.0057\ }\ \text{gr/dscf} ✓$$

3. Front Half Particulate

$$C_f = \frac{M_f}{V_{m(std)}} \times 15.43$$

$$C_f = \frac{(\underline{\ 0.0036\ }\ \text{gm})}{(\underline{\ 48.98\ }\ \text{dscf})} \times 15.43 = \underline{\ 0.0011\ }\ \text{gr/dscf} ✓$$

H. % Isokinetic Variation

$$\% I = \frac{T_s V_{m(std)} P_{std} \times 100}{\theta \bar{V}_s A_n P_s T_{std} (1 - B_{ws}) \times 60}$$

$$\% I = 0.0959 \times \frac{(\underline{\ 792\ }\ ^oR)(\underline{\ 48.98\ }\ dscf)}{(\underline{\ 60\ }\ min)(\underline{\ 68.9\ }\ ft/sec)(\underline{0.000341}\ ft^2)(\underline{\ 28.30\ }\ "Hg)(1 - \underline{0.078}\ )}$$

$$= \underline{\ 101.14\ }$$

(Std Conditions: 60 °F and 29.92 "Hg)

2-12-79

"E" STACK BAGHOUSE ΔP

	compartments								
12	1	2	3	4	5	6	Total ΔP	INLET TEMP.	% Opacity
44	6.3	6.25	6.20	6.05	6.60	6.80	7.60	350	ϕ *
49	6.45	6.35	6.25	6.10	6.70	6.80	7.60	355	ϕ
:54	6.90	6.70	7.0	6.70	7.15	7.2	8.80	365	ϕ
:59	6.50	6.40	6.30	6.20	6.85	6.95	8.60	355	ϕ
:04	6.40	6.30	6.30	6.10	6.70	6.80	8.60	350	ϕ
:09	6.45	6.40	6.30	6.20	6.80	6.95	8.60	355	ϕ
:14	6.45	6.40	6.35	6.20	6.75	6.90	8.40	355	ϕ
0:17	6.55	6.45	6.45	6.30	6.85	7.0	8.50	360	ϕ
:22	6.80	6.85	6.80	6.60	7.30	7.40	8.00	360	ϕ
:27	6.50	6.45	6.45	6.25	6.80	6.95	8.70	355	ϕ
:32	6.45	6.40	6.35	6.20	6.75	6.90	8.70	355	ϕ
:37	6.65	6.45	6.40	6.25	6.75	6.95	8.60	360	ϕ
:42	6.50	6.45	6.35	6.25	6.80	7.00	8.40	365	ϕ
:47	6.50	6.05	6.50	6.30	6.85	7.00	8.80	365	ϕ

* Opacity read out from Contraves Transmissometer (0.45/0.5 m = 3.5%)

4 PUSHES

1,400,000 CFM

45-49 mm

48-50 mm BF Gas.

NO ENRICHMENT

PARTICULATE FIELD DATA

Plant *Kaiser Steel Coke Ovens E*
Run No. *2*
Location *E Baghouse Exit Duct*
Date *2/12/79*
Operator *[illegible]*

Start Time *1315*
Stop Time *1418+*
Ambient Temp. °F *75*
Barom. Press. "Hg *29.02*
Nozzle Diam. In. *1/4*
Probe Length *8'*

Sample Box No. *2*
Meter Box No. *2*
Meter ΔH@ *1.89*
Heater Box Setting, °F *250*
Probe Heater Setting, °F *250*
Leak Rate @ "Hg *5.1* Post-Test *<0.01 O.K.*

POINT	TIME MIN.	GAS VOLUME CF	PITOT ΔP "H_2O	ORIF. ΔH "H_2O	STACK TEMP. °F	BOX TEMP °F	IMP. TEMP. °F	PROBE TEMP. °F	DRY GAS TEMP. °F IN	DRY GAS TEMP. °F OUT	PUMP VAC. "Hg	STACK S.P. "H_2O	
SE-6	0	120.1	0.44	2.17	330	253	65	244	78	73	4.0	-10.5	
SE-5	5	124.2	0.71	1.96	333	265	61	250	86	74	3.8		
SE-4	10	128.0	0.79	2.03	330	264	60	242	90	75	3.9		
SE-3	15	131.9	0.84	2.17	330	265	61	242	94	78	4.1		
SE-2	20	136.0	0.94	2.48	332	266	60	238	98	81	4.5		pushed 201
SE-1	25	140.4	1.10	2.84	334	268	60	243	102	84	4.9		
	30	145.1											
NE-6	0	145.5	0.92	2.37	333	263	59	239	98	87	4.4	-10.1	pushed 211
NE-5	5	149.7	1.0	2.58	342	267	57	257	105	88	4.1		Pushed 221
NE-4	10+	154.3	0.88	2.27	337	271	59	262	106	90	4.4		pushed 231
NE-3	15	158.4	0.80	2.06	329	267	61	252	108	91	4.1		
NE-2	20	162.4	0.88	2.27	326	255	60	254	109	93	4.4	-10.6	pushed 241
NE-1	25	166.8	0.98	2.53	326	243	59	262	111	94	4.1		
	30	171.2											

PART.	gr/dscf	lb/hr
TOTAL	0.0108	[illegible]
NET	0.0058	2.44
SOLID	0.0006	0.26

GAS VEL., fps *66.4*
VOLUME, dscfm *49,030*
MOISTURE, % *22*

COMMENTS:

TEST OBSERVERS:
Howard DeVorkin (EPA)
Bob Sean (SCAQMD)

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

Analysis Date(s) 2/12 - 2/15/79 Analytical Chemist ____________

Sample Date 2/12/79 Run No. 2 Location KSC Coal Drive E Baghouse
Lab. No. 40342

MOISTURE DATA:

1. Final Vol. H_2O in Imp. 272 ml.
2. Initial Vol. H_2O in Imp. 200 ml.
3. Vol. H_2O Condensed 72 ml.
4. Vol. Wash H_2O 248 ml.
5. Final Wt. Silica Gel ____ gm.
6. Initial Wt. Silica Gel ____ gm.
7. Weight Gain 12.25 gm.

PARTICULATE DATA:

Front Half:

8. Final Filter Weight 345.5 mg.
9. Initial Filter Weight 344.9 mg.
10. Filter Particulate 0.6 mg.
11. Probe Particulate 1.3 mg.
12. Total Particulate 1.9 mg.

Back Half:

13. Total Condensables 30.7 mg.
14. $H_2SO_4 \cdot 2H_2O$ 15.5 mg.
15. Net Condensables 15.2 mg.

16. Acetone Wash 248 ml.

FLUE GAS ANALYSES:

Molecular Weight Determination: Room Temp. 2/12/79 75°F Barom. Press. 29.0 "Hg

Component		
17. $\%CO_2$	14.4 @ 37/40 =	14.85 dry
18. $\%O_2$	10.8 "	11.13 "
19. $\%CO$	0.31 "	.32 "
20. $\%N_2$	____	73.70 " (by difference)

Other

21. ____
22. ____
23. ____

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION Kaiser Steel Coke Ovens E Baghouse DATE 2/12/79

RUN NO. 2

I. Necessary Data:

A. No. of traverse points 12

B. Total test time, (θ) 60 minutes

C. Water collected:
1. Impinger H_2O; V_{H_2O} 72 ml.

2. Silica Gel, W_{H_2O} 12.25 gm.

D. Particulate Weight:
1. Front Half, M_f 0.0019 gm.

2. Back Half, M_b 0.0307 gm.

3. Back Half $H_2SO_4 \cdot 2H_2O$ 0.0152 gm.

E. Volume metered

V_m = 50.7 CF x DGMCF (1.0) = 50.7 CF

F. Average $\sqrt{\Delta P}$ 0.944 $("H_2O)^{\frac{1}{2}}$

G. Average ΔH 2.31 $"H_2O/13.6$ = 0.17 "Hg

H. Average meter temperature, T_m 92 °F + 460 = 552 °R

I. Average stack temperature, T_s 331 °F + 460 = 791 °R

J. Stack absolute pressure, P_s 28.26 "Hg

K. Stack static pressure −10.4 $"H_2O$

L. Barometric pressure, P_b 29.02 "Hg

M. % CO_2 14.85 ; % O_2 11.13 ; % CO 0.32 ; % N_2 73.70

N. Area of stack, A_s 21.47 ft^2

O. Area of nozzle, A_n 0.000341 ft^2

P. Pitot tube factor, C_p 0.85

II. Calculations:

A. Standard Volume Metered

$$V_{m(std)} = V_m \times \frac{T_{std}}{P_{std}} \times \frac{(P_b + \cancel{\frac{H}{13.6}})}{T_m}$$

$$V_{m(std)} = 17.380 \times (\underline{\ 50.7\ }\ CF) \times \frac{(\underline{\ 29.19\ }\ "Hg)}{(\underline{\ 552\ }\ ^oR)} = \underline{\ 46.60\ }\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

$$V_{wc(std)} = K (V_{H_2O})$$

$$V_{wc(std)} = 0.04636 \times (\underline{\ 72\ }\ ml.) = \underline{\ 3.34\ }\ scf$$

2. H_2O collected in silica gel

$$V_{wsg(std)} = K \times (W_{H_2O})$$

$$V_{wsg(std)} = 0.04644 \times (\underline{\ 12.25\ }\ gm.) = \underline{\ 0.57\ }\ scf$$

3. Moisture Content of Stack Gas, B_{ws}

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

$$B_{ws} = \frac{(\underline{\ 3.34\ }\ scf) + (\underline{\ 0.57\ }\ scf)}{(\underline{\ 3.34\ }\ scf) + (\underline{\ 0.57\ }\ scf) + (\underline{\ 46.60\ }\ scf)} = \underline{\ 0.077\ }$$

C. Molecular Weight of Stack Gas, lb/lb-mole

1. M_d (Dry Molecular Weight) $= \sum M_x B_x$

$$M_d = (0.44)\ \underline{\ 14.85\ }\ \%\ CO_2 + (0.32)\ \underline{\ 11.13\ }\ \%\ O_2 + (0.28)\ \underline{\ 74.02\ }\ \%(N_2+CO)$$

$$= \underline{\ 30.82\ }\ lb/lb\text{-}mole$$

2. M_s (Wet Molecular Weight) $= M_d\ (1 - B_{ws}) + 18\ B_{ws}$

$$M_s = (\underline{\ 30.82\ })(1 - \underline{\ 0.077\ }) + 18\ (\underline{\ 0.077\ }) = \underline{\ 29.83\ }\ lb/lb\text{-}mol$$

D. Average Stack Gas Velocity

$$\overline{V}_s = K_p\ C_p\ \left(\frac{T_s}{P_s\ M_s}\right)^{\frac{1}{2}} \sqrt{\Delta P}$$

$$\overline{V}_s = 85.48\ (\underline{\ 0.85\ }) \left[\frac{(\underline{\ 791\ }\ ^oR)}{(\underline{\ 28.26\ }\ "Hg)\ (\underline{\ 29.83\ }\ lb/mole)}\right]^{\frac{1}{2}} (\underline{\ 0.944\ }\ "H_2O^{\frac{1}{2}})$$

$$= \underline{\ 66.4\ }\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

$$\overline{Q}_s = (3600\ \text{sec/hr})\ \overline{V}_s\ A_s\ (1 - B_{ws})\ \frac{T_{std}}{P_{std}}\ \frac{P_s}{T_s}$$

$$= 62566.8\ (\underline{\ 66.4\ }\ \text{ft/sec})(\underline{\ 21.47\ }\ \text{ft}^2)(1 - \underline{0.077}\ )\ \frac{(\underline{\ 28.26\ }\ \text{"Hg})}{(\underline{\ 791\ }\ {}^{\circ}\text{R})}$$

$$= \underline{\ 2,941,314\ }\ \text{dscfh}/60 = \underline{\ 49,022\ }\ \text{dscfm}$$

F. Pollutant Mass Rate (Front Half - Rule 405a) (PLUS NON-H_2SO_4 BACK-HALF PARTICS.
= $M_f + M_b - (H_2SO_4 \cdot 2H_2O)$
= .0019 + .0307 − .0155 = 0.0171 gm.

$$\text{PMR} = \frac{M_f}{V_{m(std)}} \times \overline{Q}_s$$

$$\text{PMR} = \frac{(\underline{\ 0.0171\ \ 0.0019\ }\ \text{gm.})}{(\underline{\ 46.60\ }\ \text{dscf})} \times (\underline{\ 2,941,314\ }\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{\ 0.264\ }\ \text{lb/hr}\quad \boxed{2.38\ \text{lb/hr.}}$$ AD

G. Particulate Concentration

1. Total Particulate (Rule 52A)

$$C_t = \frac{M_f + M_b}{V_{m(std)}} \times 15.43$$

$$C_t = \frac{(\underline{\ 0.0019\ }\ \text{gm}) + (\underline{\ 0.0307\ }\ \text{gm})}{(\underline{\ 46.60\ }\ \text{dscf})} \times 15.43 = \underline{\ 0.0108\ }\ \text{gr/dscf}$$

2. Net Particulate (Total less $H_2SO_4 \cdot 2H_2O$ - Rule 404a)

$$C_n = \frac{M_f + M_b - (H_2SO_4 \cdot 2H_2O)}{V_{m(std)}} \times 15.43$$

$$C_n = \frac{(\underline{0.0019}\ \text{gm}) + (\underline{0.0307}\ \text{gm}) - (\underline{\ 0.0155\ }\ \text{gm})}{(\underline{\ 46.60\ }\ \text{dscf})} \times 15.43$$

$$= \underline{\ 0.0057\ }\ \text{gr/dscf}$$

3. Front Half Particulate

$$C_f = \frac{M_f}{V_{m(std)}} \times 15.43$$

$$C_f = \frac{(\underline{\ 0.0019\ }\ \text{gm})}{(\underline{\ 46.60\ }\ \text{dscf})} \times 15.43 = \underline{\ 0.0006\ }\ \text{gr/dscf}$$

H. % Isokinetic Variation

$$\% I = \frac{T_s V_{m(std)} P_{std} \times 100}{\theta \bar{V}_s A_n P_s T_{std} (1 - B_{ws}) \times 60}$$

$$\% I = 0.0959 \times \frac{(\underline{791}\ {}^{o}R)(\underline{46.6}\ \text{dscf})}{(\underline{60}\ \text{min})(\underline{66.4}\ \text{ft/sec})(\underline{0.000341}\ \text{ft}^2)(\underline{28.26}\ \text{"Hg})(1 - \underline{0.077})}$$

$$= \underline{99.75}$$

(Std Conditions: 60 ^{o}F and 29.92 "Hg)

"E" STACK BAGHOUSE 2-12-79

[Ti]me	compartments 1	2	3	4	5	6	Total Δ P	INLET TEMP. °F	% Opacity	
3:15	6.25	6.10	6.00	5.80	6.40	6.50	8.30	355	ϕ	
:20	6.20	6.10	6.00	5.85	6.45	6.55	8.30	355	ϕ	
:25	6.25	6.20	6.15	5.90	6.40	6.50	8.30	355	ϕ	
:30	6.20	6.15	6.05	5.85	6.35	6.45	8.10	355	ϕ	
:35	6.20	6.15	6.15	5.85	6.40	6.55	8.20	360	ϕ	1
:40	6.10	6.05	6.05	5.85	6.35	6.50	8.00	360	ϕ	
:45	6.10	6.20	6.10	5.90	6.40	6.45	8.00	360	ϕ	
13:48	6.15	6.05	6.00	5.80	6.35	6.50	8.00	360	ϕ	1
:53	6.20	6.20	6.20	6.20	6.80	7.00	7.10	360	ϕ	
:58	6.35	6.20	6.10	5.95	6.50	6.65	8.40	350	ϕ	1
4:03	6.35	6.35	6.30	6.10	6.65	6.80	8.30	345	ϕ	1
:08	6.40	6.30	6.25	6.00	6.55	6.80	8.30	350	ϕ	1
:13	6.50	6.45	6.35	6.20	6.75	6.85	8.50	350	ϕ	
:18	6.50	6.50	6.45	6.30	6.85	7.00	8.50	350	ϕ	

1,350,000 CFM AN BFG

46 - 50 mm Push Side

43 - 54 mm Coke Side

5 Coke Pushes During Test

PARTICULATE FIELD DATA

Plant Kaiser Steel Coke Ovens E
Run No. 3
Location E Baghouse Exit
Date 2/13/79
Operator [illegible]

Start Time 0855
Stop Time 0957+
Ambient Temp. °F 60
Barom. Press. "Hg 29.01
Nozzle Diam. In. 1/4
Probe Length 8'

Sample Box No. 2
Meter Box No. 2
Meter $\Delta H_@$ 1.89
Heater Box Setting, °F 250
Probe Heater Setting, °F 250
Leak Rate @ "Hg 7.1 Post-Test 0.01 cfm OK.

POINT	TIME MIN.	GAS VOLUME CF	PITOT ΔP "H_2O	ORIF. ΔH "H_2O	STACK TEMP. °F	BOX TEMP °F	IMP. TEMP. °F	PROBE TEMP. °F	DRY GAS TEMP. °F IN	DRY GAS TEMP. °F OUT	PUMP VAC. "Hg	STACK S.P. "H_2O	
NE-6	0	171.7	0.96	2.48	331	225	53	263	61	53	7.0	-10.3	
NE-5	5	175.9	0.94	2.43	334	250	53	270	70	55	6.6		
NE-4	10	180.1	0.84	2.17	332	261	54	251	77	59	6.1		
NE-3	15	184.2	0.76	1.96	329	260	55	245	82	62	5.5		
NE-2	20	188.0	0.80	2.06	329	260	55	264	86	66	5.9		
NE-1	25	192.0	0.86	2.22	329	261	53	270	89	69	6.4		
	30	196.1											
SE-6	0	196.4	0.76	1.96	324	253	51	247	85	72	5.4	-9.8	
SE-5	5	200.3	0.68	1.76	328	257	53	239	91	74	4.6		
SE-4	10	203.9	0.68	1.76	330	260	54	247	93	75	4.7		
SE-3	15	207.6	0.76	1.91	332	263	55	221	96	78	5.2		
SE-2	20	211.6	0.81	2.22	335	265	56	242	98	80	6.0		
SE-1	25	215.8	0.94	2.43	337	268	56	257	98	82	6.4	-10.5	
	30	220.2											

PART.	gr/dscf	lb/hr
TOTAL	0.0057	
NET	0.0043	2.27
SOLID	0.0013	0.50

GAS VEL., fps 63.8
VOLUME, dscfm 41,390
MOISTURE, % 9.1

COMMENTS:

TEST OBSERVERS:
Howard Devorkin (EPA)
Al Gubey (SCAQMD)

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

Analysis Date(s) 2/13 - 2/15/79 Analytical Chemist ____________

Sample Date 2/13/79 Run No. 3 Location KSC Coll Outlet E Baghouse
Lab. No. 4C344

MOISTURE DATA:

1. Final Vol. H_2O in Imp.	285 ml.	5. Final Wt. Silica Gel	____ gm.
2. Initial Vol. H_2O in Imp.	200 ml.	6. Initial Wt. Silica Gel	____ gm.
3. Vol. H_2O Condensed	85 ml.	7. Weight Gain	13.05 gm.
4. Vol. Wash H_2O	280 ml.		

PARTICULATE DATA:

Front Half:		Back Half:	
8. Final Filter Weight	347.7 mg.	13. Total Condensables	19.5 mg.
9. Initial Filter Weight	346.4 mg.	14. $H_2SO_4 \cdot 2H_2O$	6.4 mg.
10. Filter Particulate	1.3 mg.	15. Net Condensables	13.1 mg.
11. Probe Particulate	2.4 mg.		
12. Total Particulate	3.7 mg.		

16. Acetone Wash 125 ml.

FLUE GAS ANALYSES:

Molecular Weight Determination: Room Temp. 75°F Barom. Press. 29.01 "Hg

Component			
17. % CO_2	14.8 @ 3% H_2O =	15.26	dry
18. % O_2	9.3 "	9.59	"
19. % CO	0.34 "	.35	"
20. % N_2	____	74.80	" (by difference)

Other

21. ____

22. ____

23. ____

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION Kaiser Steel Coke Ovens E Baghouse DATE 2/13/79

RUN NO. 3

I. Necessary Data:

A. No. of traverse points 12

B. Total test time, (θ) 60 minutes

C. Water collected:

1. Impinger H_2O; V_{H_2O} 85 ml.

2. Silica Gel, W_{H_2O} 13.05 gm.

D. Particulate Weight:

1. Front Half, M_f 0.0037 gm.

2. Back Half, M_b 0.0195 gm.

3. Back Half $H_2SO_4 \cdot 2H_2O$ 0.0064 gm.

E. Volume metered

V_m = 48.2 CF x DGMCF (1.0) = 48.2 CF

F. Average $\sqrt{\Delta P}$ 0.904 $("H_2O)^{\frac{1}{2}}$

G. Average ΔH 2.11 $"H_2O/13.6$ = 0.16 "Hg

H. Average meter temperature, T_m 78 °F + 460 = 538 °R

I. Average stack temperature, T_s 331 °F + 460 = 791 °R

J. Stack absolute pressure, P_s 28.26 "Hg

K. Stack static pressure -10.2 $"H_2O$

L. Barometric pressure, P_b 29.01 "Hg

M. % CO_2 15.26 ; % O_2 9.59 ; % CO 0.35 ; % N_2 74.8

N. Area of stack, A_s 21.47 ft^2

O. Area of nozzle, A_n 0.000341 ft^2

P. Pitot tube factor, C_p 0.85

II. Calculations:

A. Standard Volume Metered

$$V_{m(std)} = V_m \times \frac{T_{std}}{P_{std}} \times \frac{(P_b + \frac{H}{13.6})}{T_m}$$

$$V_{m(std)} = 17.380 \times (\underline{48.2}\ CF) \times \frac{(\underline{29.17}\ ''Hg)}{(\underline{538}\ ^oR)} = \underline{45.42}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

$$V_{wc(std)} = K\ (V_{H_2O})$$

$$V_{wc(std)} = 0.04636 \times (\underline{85}\ ml.) = \underline{3.94}\ scf$$

2. H_2O collected in silica gel

$$V_{wsg(std)} = K \times (W_{H_2O})$$

$$V_{wsg(std)} = 0.04644 \times (\underline{13.05}\ gm.) = \underline{0.61}\ scf$$

3. Moisture Content of Stack Gas, B_{ws}

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

$$B_{ws} = \frac{(\underline{3.94}\ scf) + (\underline{0.61}\ scf)}{(\underline{3.94}\ scf) + (\underline{0.61}\ scf) + (\underline{45.42}\ scf)} = \underline{0.091}$$

C. Molecular Weight of Stack Gas, lb/lb-mole

1. M_d (Dry Molecular Weight) $= \sum M_x B_x$

$$M_d = (0.44)\ \underline{15.26}\ \%\ CO_2 + (0.32)\ \underline{9.59}\ \%\ O_2 + (0.28)\ \underline{75.15}\ \%(N_2+CO)$$

$$= \underline{30.83}\ lb/lb\text{-}mole$$

2. M_s (Wet Molecular Weight) $= M_d\ (1 - B_{ws}) + 18\ B_{ws}$

$$M_s = (\underline{30.83})(1 - \underline{0.091}) + 18\ (\underline{0.091}) = \underline{29.66}\ lb/lb\text{-}mol$$

D. Average Stack Gas Velocity

$$\bar{V}_s = K_p\ C_p\ \left(\frac{T_s}{P_s\ M_s}\right)^{\frac{1}{2}} \sqrt{\Delta P}$$

$$\bar{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{791}\ ^oR)}{(\underline{28.26}\ ''Hg)\ (\underline{29.66}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{0.904}\ ''H_2O^{\frac{1}{2}})$$

$$= \underline{63.8}\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

$$\overline{Q}_s = (3600 \text{ sec/hr})\ \overline{V}_s\ A_s\ (1 - B_{ws})\ \frac{T_{std}}{P_{std}}\ \frac{P_s}{T_s}$$

$$= 62566.8\ (\underline{\ 63.8\ }\ \text{ft/sec})(\underline{\ 21.47\ }\ \text{ft}^2)(1 - \underline{\ 0.091\ })\ \frac{(\underline{\ 28.26\ }\ \text{"Hg})}{(\underline{\ 791\ }\ {}^oR)}$$

$$= \underline{\ 2,783,276\ }\ \text{dscfh}/60 = \underline{\ 46,388\ }\ \text{dscfm}$$

F. Pollutant Mass Rate (Front Half - Rule 405a)

PLUS NON-H_2SO_4 BACK-HALF PARTICS.
$= M_f + M_b - (H_2SO_4 \cdot 2H_2O)$
$= .0037 + .0195 - .0064 = 0.0168$ gm

$$PMR = \frac{M_f}{V_{m(std)}} \times \overline{Q}_s$$

$$PMR = \frac{(\underline{\ 0.0037\ }\ \text{gm.})}{(\underline{\ 45.42\ }\ \text{dscf})} \times (\underline{\ 2,783,276\ }\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

(0.0168)

$$= \underline{\ 0.50\ }\ \text{lb/hr}$$

2.27 lb/hr std

G. Particulate Concentration

1. Total Particulate

$$C_t = \frac{M_f + M_b}{V_{m(std)}} \times 15.43$$

$$C_t = \frac{(\underline{\ 0.0037\ }\ \text{gm}) + (\underline{\ 0.0195\ }\ \text{gm})}{(\underline{\ 45.42\ }\ \text{dscf})} \times 15.43 = \underline{\ 0.0079\ }\ \text{gr/dscf}$$

2. Net Particulate (Total less $H_2SO_4 \cdot 2H_2O$ - Rule 404a)

$$C_n = \frac{M_f + M_b - (H_2SO_4 \cdot 2H_2O)}{V_{m(std)}} \times 15.43$$

$$C_n = \frac{(\underline{\ 0.0037\ }\ \text{gm}) + (\underline{\ 0.0195\ }\ \text{gm}) - (\underline{\ 0.0064\ }\ \text{gm})}{(\underline{\ 45.42\ }\ \text{dscf})} \times 15.43$$

$$= \underline{\ 0.0057\ }\ \text{gr/dscf}$$

3. Front Half Particulate

$$C_f = \frac{M_f}{V_{m(std)}} \times 15.43$$

$$C_f = \frac{(\underline{\ 0.0037\ }\ \text{gm})}{(\underline{\ 45.42\ }\ \text{dscf})} \times 15.43 = \underline{\ 0.0013\ }\ \text{gr/dscf}$$

H. % Isokinetic Variation

$$\% I = \frac{T_s V_{m(std)} P_{std} \times 100}{\theta \bar{V}_s A_n P_s T_{std} (1 - B_{ws}) \times 60}$$

$$\% I = 0.0959 \times \frac{(\underline{791}\ ^{o}R)(\underline{45.42}\ dscf)}{(\underline{60}\ min)(\underline{63.8}\ ft/sec)(\underline{0.000341}\ ft^2)(\underline{28.26}\ "Hg)(1 - \underline{0.091})}$$

$$= \underline{102.75}$$

(Std Conditions: 60 °F and 29.92 "Hg)

"E" STACK BAGHOUSE 2-13-79

Time	compartments 1	2	3	4	5	6	Total ΔP	INLET TEMP. °F	% Opacity
08:54	6.30	6.15	6.15	5.75	6.45	6.50	8.70	370	ϕ
:59	6.15	5.95	6.00	5.75	6.45	6.55	8.10	355	ϕ
09:04	6.00	5.70	5.75	5.50	6.15	6.30	7.90	350	ϕ
:09	5.80	5.60	5.65	5.40	6.10	6.20	7.75	345	ϕ
:14	5.75	5.60	5.60	5.45	6.10	6.20	7.75	345	ϕ
:19	5.80	5.65	5.70	5.45	6.65	6.25	7.45	350	ϕ
:24	5.95	5.65	5.70	5.35	6.05	6.15	7.70	350	ϕ
09:26	5.85	5.75	5.70	5.45	5.95	6.10	7.70	350	ϕ
:31	5.80	5.70	5.70	5.45	6.10	6.20	7.45	350	ϕ
:36	5.90	5.75	5.75	5.40	6.00	6.10	7.70	355	ϕ
:41	5.85	5.70	5.75	5.45	6.60	6.20	7.50	355	ϕ
:46	5.85	5.70	5.75	5.50	6.15	6.25	7.70	355	ϕ
:51	5.90	5.75	5.75	5.45	6.10	6.25	7.65	355	ϕ
:56	5.95	5.80	5.85	5.60	6.25	6.20	7.80	340	ϕ

1,400,000 CFM BF 6 Only

40-45 mm Push Side
45-50 mm Coke Side

VISIBLE EMISSION OBSERVATION RECORD

Company: KAISER STEEL - FONTANA

Date: 2-12-79 Time First Sighted Plume: 1026 am

Time Start: 0945 Time Stop: 1045

Air Temperature: 73°F Relative Humidity: 41%

Wind Speed: 3-5 mpH Wind Direction: East

Sky Condition: HIGH CLOUDS Background: SKY

Plume Characteristics: Continuous: ( ) yes (✓) no

Color: white Dispersion Description: ______

Stack Height: 225 (ft) Observer location: 600 (ft) SE of stack

Sun location
(✓) Back of Observer ( ) Left Shoulder
( ) Right Shoulder ( ) Other

Emission Point: STACK OF BATTERY E

Min	0	15	30	45	Min	0	15	30	45	Min	0	15	30	45
01	0	0	0	0	21	0	0	0	0	41	5%	5%	5%	5%
02	0	0	0	0	22	0	0	0	0	42	5%	5%	5%	5%
03	0	0	0	0	23	0	0	0	0	43	5%	5%	5%	5%
04	0	0	0	0	24	0	0	0	0	44	5%	5%	0	0
05	0	0	0	0	25	0	0	0	0	45	0	0	0	0
06	0	0	0	0	26	0	0	0	0	46	0	0	0	0
07	0	0	0	0	27	0	0	0	0	47	0	0	0	0
08	0	0	0	0	28	0	0	0	0	48	0	0	0	0
09	0	0	0	0	29	0	0	0	0	49	0	0	0	0
10	0	0	0	0	30	0	0	0	0	50	0	0	0	0
11	0	0	0	0	31	0	0	0	0	51	0	0	0	0
12	0	0	0	0	32	0	0	0	0	52	0	0	0	0
13	0	0	0	0	33	0	0	0	0	53	0	0	0	0
14	0	0	0	0	34	0	0	0	0	54	0	0	0	0
15	0	0	0	0	35	0	0	0	0	55	0	0	0	0
16	0	0	0	0	36	0	0	0	0	56	0	0	0	0
17	0	0	0	0	37	0	0	0	0	57	0	0	0	0
18	0	0	0	0	38	0	0	0	0	58	0	0	0	0
19	0	0	0	0	39	0	0	0	0	59	0	0	0	0
20	0	0	0	0	40	0	0	0	0	60	0	0	0	0

NOTES: HEAT WAVES observed FROM STACK

Inspector: Robert B. Bean Date: 2/12/79

TSB-A-8 EPA-IX-FORM 29S AP ENG INSPECTOR II SCAQMD.

VISIBLE EMISSION OBSERVATION RECORD

Company KAISER STEEL CORP

Date 12 Feb 79 (Cont'd) Time First Sighted Plume ______

Time Start 1045 Time Stop 1110

Air Temperature 74° Relative Humidity 41%

Wind Speed 3-5 Wind Direction EAST

Sky Condition HIGH CLOUDS Background SKY

Plume Characteristics: Continuous: ( ) yes ( ) no

Color ______ Dispersion Description ______

Stack Height 225 (ft) Observer location: 600 (ft) SE of stack

Sun location
(✓) Back of Observer
( ) Right Shoulder
( ) Left Shoulder
( ) Other

Emission Point E BATTERY STACK COKE OVENS

Min 61 →

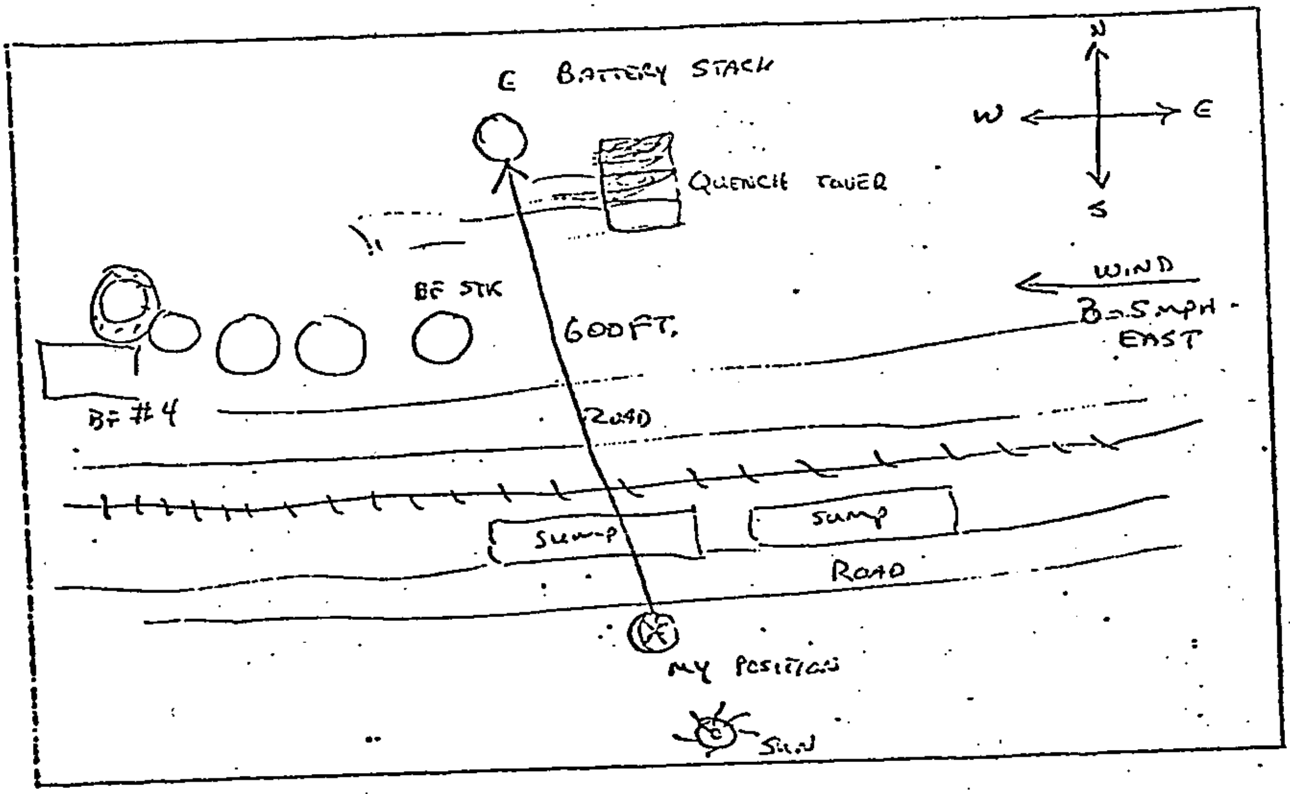
Min	0	15	30	45	Min	0	15	30	45	Min	0	15	30	45
01	⊖	⊖	⊖	⊖	21	⊖	⊖	⊖	⊖	41				
02	⊖	⊖	⊖	⊖	22	⊖	⊖	⊖	⊖	42				
03	⊖	⊖	⊖	⊖	23	⊖	⊖	⊖	⊖	43				
04	⊖	⊖	⊖	⊖	24	⊖	⊖	⊖	⊖	44				
05	⊖	⊖	⊖	⊖	25	⊖	⊖	⊖	⊖	45				
06	⊖	⊖	⊖	⊖	26					46				
07	⊖	⊖	⊖	⊖	27					47				
08	⊖	⊖	⊖	⊖	28					48				
09	⊖	⊖	⊖	⊖	29					49				
10	⊖	⊖	⊖	⊖	30					50				
11	⊖	⊖	⊖	⊖	31					51				
12	⊖	⊖	⊖	⊖	32					52				
13	⊖	⊖	⊖	⊖	33					53				
14	⊖	⊖	⊖	⊖	34					54				
15	⊖	⊖	⊖	⊖	35					55				
16	⊖	⊖	⊖	⊖	36					56				
17	⊖	⊖	⊖	⊖	37					57				
18	⊖	⊖	⊖	⊖	38					58				
19	⊖	⊖	⊖	⊖	39					59				
20	⊖	⊖	⊖	⊖	40					60				

NOTES: ______

Inspector Robert B. Bean Date 12 Feb 79

TSB-A-8 EPA-IX-FORM 298 AP ENG. INSP II SCAQMD

MAP



Symbols

Sun =

Plume direction =

Point where plume observed = ...

Observer =

Water Vapor Condensate

Photographs: S&A File (·) Enclosed ( ) None ( )

Comments

Signature Robert B Brown Date 12 Feb 79

VISIBLE EMISSION OBSERVATION RECORD

mpany KAISER STEEL CORP

te 12 Feb 79 Time First Sighted Plume

me Start 1315 Time Stop 1437

ir Temperature 76°F Relative Humidity 34 %

ind Speed 3-5 mpH Wind Direction SW

ky Condition HIGH CLOUDS Background SKY

lume Characteristics: Continuous: ( ) yes ( ) no

Color Dispersion Description

Stack Height (ft) Observer location: 600 (ft) SE of stack

Sun location
( ) Back of Observer
( ) Right Shoulder
(✓) Left Shoulder
( ) Other

Emission Point

Min	0	15	30	45
01	⊖	⊖	⊖	⊖
02	⊖	⊖	⊖	⊖
03	⊖	⊖	⊖	⊖
04	⊖	⊖	⊖	⊖
05	⊖	⊖	⊖	⊖
06	⊖	⊖	⊖	⊖
07	⊖	⊖	⊖	⊖
08	⊖	⊖	⊖	⊖
09	⊖	⊖	⊖	⊖
10	⊖	⊖	⊖	⊖
11	⊖	⊖	⊖	⊖
12	⊖	⊖	⊖	⊖
13	⊖	⊖	⊖	⊖
14	⊖	⊖	⊖	⊖
15	⊖	⊖	⊖	⊖
16	⊖	⊖	⊖	⊖
17	⊖	⊖	⊖	⊖
18	⊖	⊖	⊖	⊖
19	⊖	⊖	⊖	⊖
20	⊖	⊖	⊖	⊖

Min	0	15	30	45
21	⊖	⊖	⊖	⊖
22	⊖	⊖	⊖	⊖
23	⊖	⊖	⊖	⊖
24	⊖	⊖	⊖	⊖
25	⊖	⊖	⊖	⊖
26	⊖	⊖	⊖	⊖
27	⊖	⊖	⊖	⊖
28	⊖	⊖	⊖	⊖
29	⊖	⊖	⊖	⊖
30	⊖	⊖	⊖	⊖
31	⊖	⊖	⊖	⊖
32	⊖	⊖	⊖	⊖
33	⊖	⊖	⊖	⊖
34	⊖	⊖	⊖	⊖
35	⊖	⊖	⊖	⊖
36	⊖	⊖	⊖	⊖
37	⊖	⊖	⊖	⊖
38	⊖	⊖	⊖	⊖
39	⊖	⊖	⊖	⊖
40	⊖	⊖	⊖	⊖

Min	0	15	30	45
41	⊖	⊖	⊖	⊖
42	⊖	⊖	⊖	⊖
43	⊖	⊖	⊖	⊖
44	⊖	⊖	⊖	⊖
45	⊖	⊖	⊖	⊖
46	⊖	⊖	⊖	⊖
47	⊖	⊖	⊖	⊖
48	⊖	⊖	⊖	⊖
49	⊖	⊖	⊖	⊖
50	⊖	⊖	⊖	⊖
51	⊖	⊖	⊖	⊖
52	⊖	⊖	⊖	⊖
53	⊖	⊖	⊖	⊖
54	⊖	⊖	⊖	⊖
55	⊖	⊖	⊖	⊖
56	⊖	⊖	⊖	⊖
57	⊖	⊖	⊖	⊖
58	⊖	⊖	⊖	⊖
59	⊖	⊖	⊖	⊖
60	⊖	⊖	⊖	⊖

NOTES:

Inspector Robert B. Bera [signature] Date 12 Feb 79
AP ENV INSPTR
SCAQMD

TSB-A-8 EPA-IX-FORM 798

VISIBLE EMISSION OBSERVATION RECORD

Company KAISER STEEL CORP.

Date 12 Feb 79 (Cont'd) Time First Sighted Plume

Time Start 1315 Time Stop 1437

Air Temperature 76°F Relative Humidity 34%

Wind Speed 3-5 MPH Wind Direction South

Sky Condition High clouds Background Sky

Plume Characteristics: Continuous: ( ) yes ( ) no

Color Dispersion Description

Stack Height 225 (ft) Observer location: 600 (ft) SE of stack

Sun location
( ) Back of Observer
( ) Right Shoulder
(✓) Left Shoulder
( ) Other

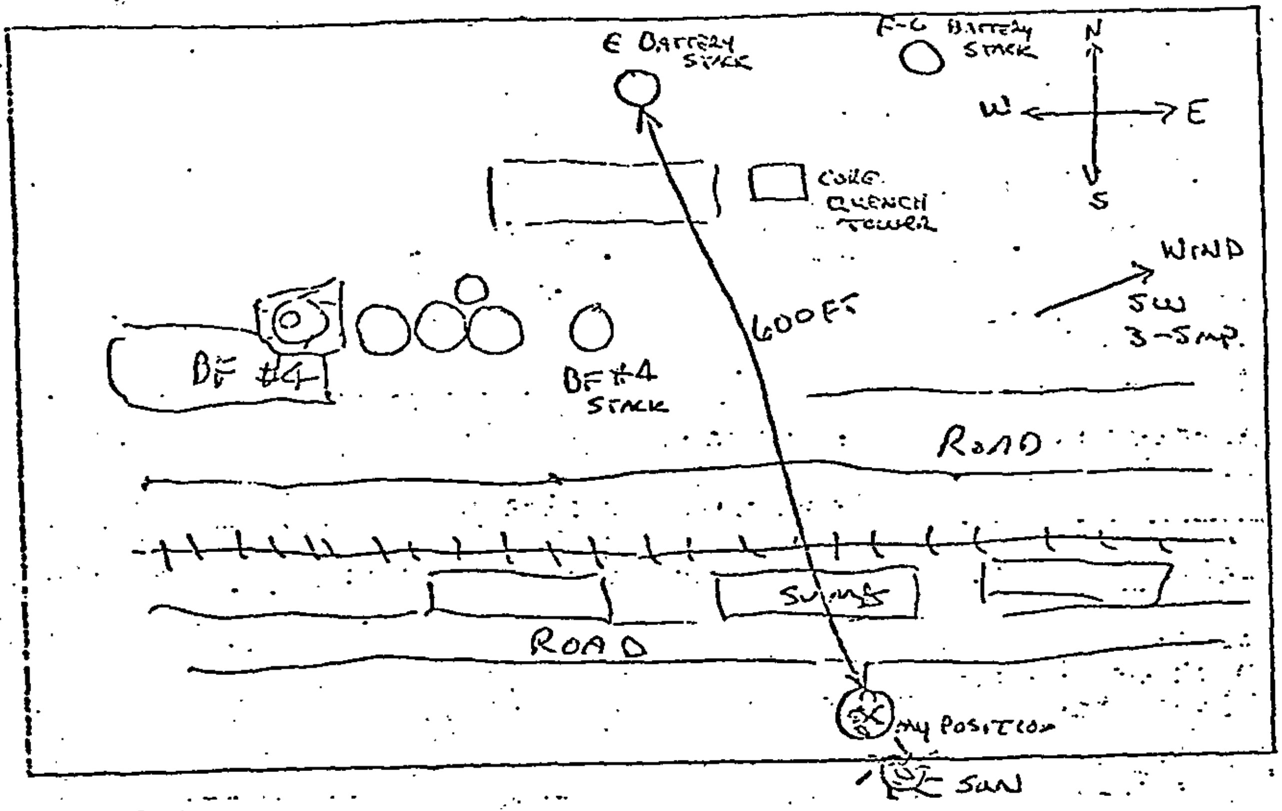
Emission Point

Min	0	15	30	45	Min	0	15	30	45	Min	0	15	30	45
01	0	0	0	0	21	0	0	0	0	41				
02	0	0	0	0	22	0	0	0	0	42				
03	0	0	0	0	23					43				
04	0	0	0	0	24					44				
05	0	0	0	0	25					45				
06	0	0	0	0	26					46				
07	0	0	0	0	27					47				
08	0	0	0	0	28					48				
09	0	0	0	0	29					49				
10	0	0	0	0	30					50				
11	0	0	0	0	31					51				
12	0	0	0	0	32					52				
13	0	0	0	0	33					53				
14	0	0	0	0	34					54				
15	0	0	0	0	35					55				
16	0	0	0	0	36					56				
17	0	0	0	0	37					57				
18	0	0	0	0	38					58				
19	0	0	0	0	39					59				
20	0	0	0	0	40					60				

NOTES:

Inspector Robert B Bean Date 12 Feb 79
AP Eng Inspector
SCAQMD

TSB-A-S EPA-IX-FORM 29S



Symbols

Sun =

Plume direction =

Point where plume observed = ...

Observer =

Water Vapor Condensate ____________________

Photographs: S&A File ( ) Enclosed ( ) None ( )

Comments ____________________

Signature ____________________ Date ____________________

VISIBLE EMISSION OBSERVATION RECORD

mpany KAISER STEEL CORP

te 13 FEB 79 Time First Sighted Plume

me Start 0905 Time Stop 1005 – (10 35 am)

r Temperature 68°F Relative Humidity 40%

ind Speed 0-2 mph Wind Direction SW

ky Condition CLEAR Background SKY

lume Characteristics: Continuous: ( ) yes (✓) no

Color Dispersion Description

Stack Height (ft) Observer location: 600 (ft) SE of stack

Sun location
( ) Back of Observer
(✓) Right Shoulder
( ) Left Shoulder
( ) Other

Emission Point E BATTERY STACK

Min	0	15	30	45
01	0	0	0	0
02	A	0	0	0
03	0	0	0	0
04	0	0	0	0
05	5%	5%	5%	5%
06	5%	5%	5%	5%
07	0	0	0	0
08	0	0	0	0
09	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
33	0	0	0	0
34	0	0	0	0
35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0
60	0	0	0	0

NOTES:

Inspector Robert B. Bean AP ENG INSTR II SCAQMD Date 13 Feb 79

TSB-A-8 EPA-IN-FORM 208

VISIBLE EMISSION OBSERVATION RECORD

ompany KAISER STEEL

ate 13 Feb 79 (cont'd) Time First Sighted Plume

ime Start 0905 Time Stop 1030

ir Temperature 68°F Relative Humidity 40%

ind Speed 0-2 mph Wind Direction SW.

Sky Condition Clear Background Sky

Plume Characteristics: Continuous: ( ) yes (✓) no

Color Dispersion Description

Stack Height 225 (ft) Observer location: 600 (ft) SE of stack

Sun location
( ) Back of Observer ( ) Left Shoulder
(✓) Right Shoulder ( ) Other

Emission Point E BATTERY STACK

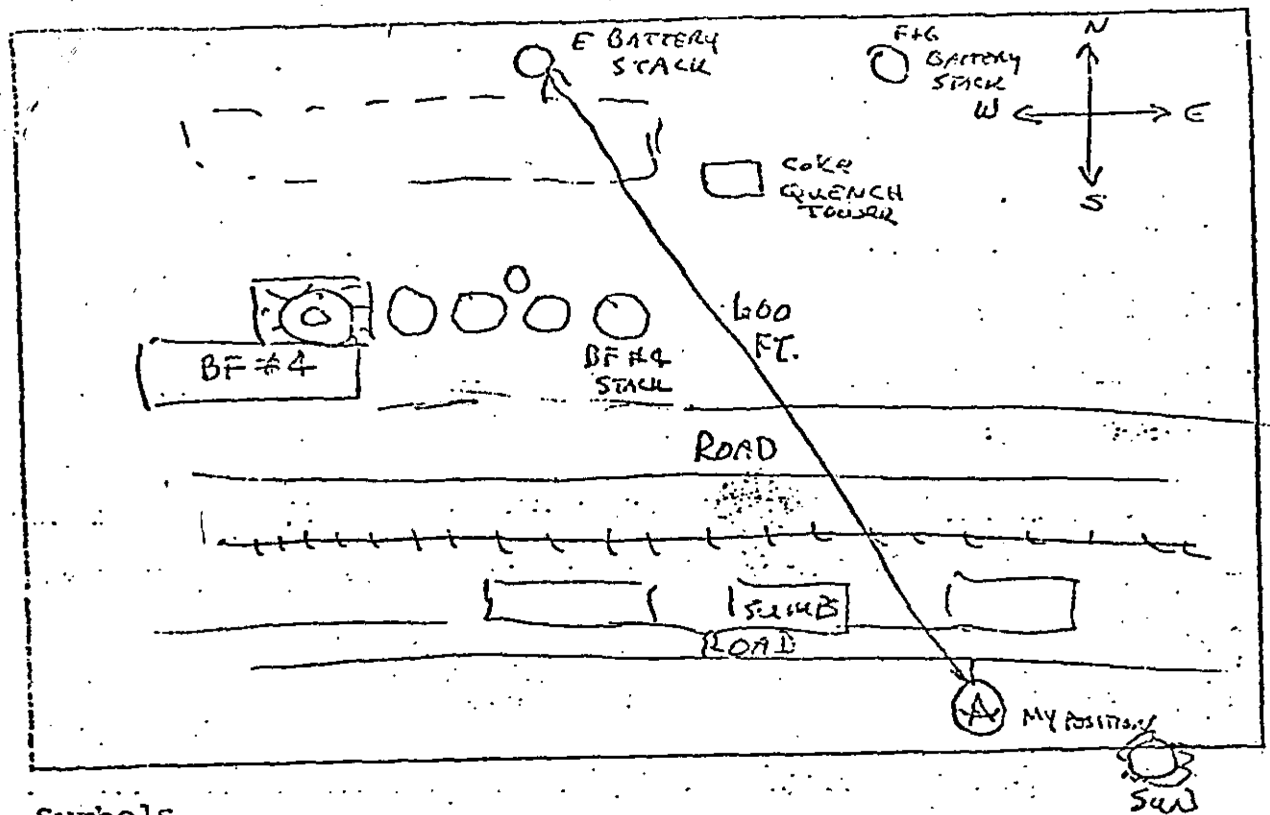
Min	0	15	30	45	Min	0	15	30	45	Min	0	15	30	45
01	⊖	⊖	⊖	⊖	21	⊖	⊖	⊖	⊖	41				
02	⊖	⊖	⊖	⊖	22	⊖	⊖	⊖	⊖	42				
03	⊖	⊖	⊖	⊖	23	⊖	⊖	⊖	⊖	43				
04	⊖	⊖	⊖	⊖	24	⊖	⊖	⊖	⊖	44				
05	⊖	⊖	⊖	⊖	25	⊖	⊖	⊖	⊖	45				
06	⊖	⊖	⊖	⊖	26					46				
07	⊖	⊖	⊖	⊖	27					47				
08	⊖	⊖	⊖	⊖	28					48				
09	⊖	⊖	⊖	⊖	29					49				
10	⊖	⊖	⊖	⊖	30					50				
11	⊖	⊖	⊖	⊖	31					51				
12	⊖	⊖	⊖	⊖	32					52				
13	⊖	⊖	⊖	⊖	33					53				
14	⊖	⊖	⊖	⊖	34					54				
15	⊖	⊖	⊖	⊖	35					55				
16	⊖	⊖	⊖	⊖	36					56				
17	⊖	⊖	⊖	⊖	37					57				
18	⊖	⊖	⊖	⊖	38					58				
19	⊖	⊖	⊖	⊖	39					59				
20	⊖	⊖	⊖	⊖	40					60				

NOTES:

Inspector Robert R Boad Date 13 Feb 79

APCNS INS II
SCAQMD

TSB-A-8 EPA-IX-FORM 298



Symbols

Sun = ☼
Plume direction = ⟶

Point where plume observed = ...
Observer = ✝

Water Vapor Condensate ____________________

Photographs: S&A File ( ) Enclosed ( ) None ( )

Comments ____________________

Signature Robert B Bern Date 13 Feb 79