AP42 Section:	12.2
Reference:	86
Title:	Report on Source Tests, Visible Emissions, and Plant Observations, Kaiser Steel Corporation, Fontana, California, Coke Oven Battery C, March 26-27, 1979, Engineering-Science, Arcadia, California, May 1979.

AP-42 Section Reference 12.2
Report Sect. Reference 4
86

REPORT ON SOURCE TESTS, VISIBLE EMISSIONS, AND PLANT OBSERVATIONS

Facility Inspection

KAISER STEEL CORPORATION
FONTANA, CALIFORNIA

Coke Oven Battery C

Dates of Inspections

March 26-27, 1979

Inspected By

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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

May 1979

Submitted By

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OBSERVATIONS OF SOURCE TESTS AT KAISER STEEL CORPORATION FONTANA, CALIFORNIA

March 26-27, 1979

INTRODUCTION

Tests to determine particulate emissions from the baghouse serving Coke Oven Battery C were conducted on the above dates by technical personnel of Environmental Quality Control, Kaiser Steel Corporation. Visual emission observations of the discharge stack were also made during the same period by Environmental Quality Control personnel.

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 C 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, F and G) are in the process of having baghouses installed; Battery C is the third to be tested to determine the efficiency of baghouse control of particulates originating from coke oven stacks. (Batteries D and E were tested November 27-28, 1978 and February 12-13, 1979, respectively.)

PROCESS DESCRIPTION

Pertinent data for the coke batteries at Kaiser Steel Corporation have been reported previously (see report for Coke Battery E, March 1979). 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 ovens of Battery C are heated with coke oven gas, using 110,000 to 165,000 cubic feet per hour of gas of about 550 BTU/ft.^{3} heat content (the variations in observed gas usage are a function of the charging activity at the battery during the tests). The brick work surrounding the ovens is used for regenerative heating of the combustion air being introduced, employing a reversal cycle every 30 minutes.

Emissions from the combustion of the coke oven gas used to heat Battery C ovens are drawn through a baghouse by a 400 HP induced draft fan and discharged to atmosphere through a 225-foot stack. The baghouse, manufactured by American Air Filter (AAF), consists of five sections with a total of 840 "silicon-graphite" treated fiberglass bags of about 38,000 ft.^{2} total area (design air/cloth ratio for 56,000 ACFM is about 1-1/2:1). The ducting and baghouse are insulated to maintain operating temperatures near 350°F. The baghouse being constructed for Battery B appears to be similar to that for Battery C (the two are adjacent to each other).

Although 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 angle vertically downward with an approximate 25-foot run prior to the sampling station. Two sampling ports were used at 90-degree diameters, 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 negative static pressure (7" to 9" 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 Kaiser Steel Corporation 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 Rule 52A test results and maximum allowables are shown on Table 1, and are a supplement to the test result summary by Kaiser Steel Corporation at the beginning of the Appendix.

(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 this interpretation 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 Kaiser Steel Corporation calculation, which used only the "front-half" collection of the sampling train. The recalculated mass flow rates are shown as circled values on the Kaiser Steel Corporation Summary and the various calculation sheets.

TABLE 1

KAISER STEEL CORPORATION
COKE PLANT BATTERY C COMPLIANCE TEST

RULE 52A RESULTS[a]

Test No.	Date & Time	Gas Flow Rate (dscfm)	Particulate Matter Concentration Rule 52A - gr/dscf	
			Test[b]	Allowed
C-1	3/26/79 0950-1055		(Sample lost - No data)	
C-2	3/26/79 1330-1529[c]	36844	0.0364	0.0505
C-3	3/27/79 1048-1151	37123	0.0124	0.0503
C-4	3/27/79 1405-1509	37268	0.0222	0.0503

(a) See Appendix for all other results, data and calculations performed by Environmental Quality Control-Kaiser Steel Corporation.

(b) The variability in Rule 52A concentrations, as compared to the Rule 404(a) results, are caused by the differences in the H_2SO_4 content in the "back-half" condensables for the three tests.

(c) Sampling interrupted by power failure (53 minutes).

Other than the Rule 405(a) results, all of the Kaiser Steel Corporation calculations were checked and found to be accurate.

PROCESS EQUIPMENT OBSERVATIONS

The process equipment observations shown on Table 2 were obtained by the writer and by Messrs. Gerald R. Brown and Eldon Winterbourne of Kaiser Steel.

According to the control instrument setting, the baghouse filter bags are cleaned by reverse air pressure when the pressure drop attains 8 inches of water. One cleaning cycle apparently occurred at about 1110 on March 27 during test C-3.

VISIBLE EMISSION OBSERVATIONS

Messrs. Neil Jones and R. L. Skipper of Kaiser Steel Environmental Quality Control observed emissions from Battery C stack during the source tests. Their 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.)

The writer and Mr. Al Gubey, SCAQMD, informally observed the stack at intervals and noted no visible emissions at those times.

TABLE 2

PROCESS EQUIPMENT OBSERVATIONS

Test No.	Date & Time	Pushes	Charges	Gas Reversal Times	Coke Oven Gas Flow Rate (scfm)	Baghouse Avg. Pressure Drop (in. H_2O)	Baghouse Avg. Temp. (°F)	Stack Opacity (meter)
C-1[a]	3/26/79 (0950-1055)	3	3	1004 1034	No Data	5.75	345	No Data
C-2[b]	3/26/79 (1330-1410; 1508-1529)	3[c]	4[d]	1334 1404 1434 1504	160,000 165,000 160,000 165,000	5.75	340	0-3%
C-3	3/27/79 (1048-1151)	3[e]	4	1104 1134	140,000 150,000	5.5	340	1-2%
C-4	3/27/79 (1405-1509)	0	0	1404 1434 1504	115,000 110,000 115,000	6.25	335	1/2-1%

(a) Sample lost - data for comparison only.

(b) Sampling interrupted by power failure.

(c) Two pushes just prior to test and four pushes during period of power failure to test equipment.

(d) Five charges during period of power failure to test equipment.

(e) One push just prior to test.

APPENDIX

Summary - Kaiser Steel Corporation Battery C
Compliance Tests

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

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

Test C-4
- Particulate Field Data
- Laboratory Analysis Data
- Calculations
- Baghouse Data

Visual Emission Observations
- Tests C-2 and C-4: Neil Jones, EQC/KSC
- Test C-3: R. L. Skipper, EQC/KSC

SUMMARY - KSC COKE PLANT BATTERY C COMPLIANCE TEST

Test No.	Date Time	Sample Volume dscf	Sample Percent Isokinetic	Part. Matter Conc. Rule 404(a) gr/dscf Test	Allowed	Solid Part. Rule 405(a) lb/hr. Test	Allowed	Visible Emission Rule 401(a) R-1 or 20% Opacity
C-1	3/26/79 0950-1055	Sample Lost No Data				--	--	--
C-2	3/26/79 1330-1529*	37.8	103.3	0.0092	0.0486@ 36844 dscfm	1.86 (2.91)	15.6	Pass
C-3	3/27/79 1048-1151	38.1	103.4	0.0081	0.0484@ 37123 dscfm	1.78 (2.56)	15.5	Pass
C-4	3/27/79 1405-1509	37.6	101.7	0.0079	0.0484@ 37268 dscfm	1.49 (2.51)	15.5	Pass

*Power Failure to testing station, delayed sampling 53 minutes.
Process Weight of coal charged during 24 hr day:

3/26/79	67,450 lb/hr
3/27/79	66,267 lb/hr

HJM:pw

NOTE: CIRCLED RESULTS ARE CALCULATED BY H.D. (SEE DISCUSSION IN TEXT OF REPORT)

Plant Kaiser Steel Coke Ovens — Start Time 1330, 1508 — Sample Box No. 4
Run No. C-2 — Stop Time ≈1415, 1529 — Meter Box No. 2
Location C. Baghouse Exit — Ambient Temp. °F 68 — Meter ΔH@ 1.89
Date 3/26/79 — Barom. Press. "Hg 28.92 — Heater Box Setting, °F 250
Operator HM, JAM — Nozzle Diam. In. 0.25 — Probe Heater Setting, °F 250
Probe Length 8' — Leak Rate @ "Hg 4.0 Post-Test .007 cfm 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	
E-6	0	262.0	0.72	1.95	305	247	55	226	75	67	3.8	-7.6	
E-5	5	265.9	0.70	1.90	302	260	54	249	83	69	3.7		
E-4	10	269.9	0.55	1.49	303	252	56	246	88	73	3.1		
E-3	15	273.4	0.46	1.25	303	243	57	238	90	74	2.9		
E-2	20	276.6	0.48	1.30	300	239	53	235	89	74	3.0		
E-1	25	279.9	0.41	1.11	306	259	57	251	93	78	2.5	-8.2	
	30	282.8											
N-6	0	283.2	0.68	1.84	308	255	54	240	92	79	3.6	-8.0	
N-5	5	287.1	0.70	1.90	307	249	52	235	95	80	3.9		
"	9.35	290.5	—	Power Failure —									
"		Restart 1508											
N-4	10	291.2	0.55	1.49	305	261	62	253	77	72	3.6		
N-3	15	294.7	0.50	1.36	300	275	60	242	83	72	3.5		
N-2	20	298.0	0.43	1.16	301	262	63	240	87	73	3.0		
N-1	25	301.0	0.20	0.54	296	239	58	234	90	77	1.3	-8.4	
	30	302.9											
			$\sqrt{\Delta P}$						87	74		-8.1	
	60	40.5	0.721	1.44	303				ave 81				

PART. gr/dscf — lb/hr
TOTAL —
NET 0.0092 — 2.91
SOLID 0.0059 — 1.86

GAS VEL., fps 50.93
VOLUME, dscfm 21,844 (6304 actm)
MOISTURE, % 9.3

COMMENTS:

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

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

Analysis Date(s) 3/26/79-3/29/79 Analytical Chemist S. Deutsch

Sample Date 3/26/79 Run No. C-2 Location _____
Lab. No. 40347

MOISTURE DATA:

1. Final Vol. H_2O in Imp.	274 ml.	5. Final Wt. Silica Gel	735.60 gm.
2. Initial Vol. H_2O in Imp.	200 ml.	6. Initial Wt. Silica Gel	726.55 gm.
3. Vol. H_2O Condensed	74 ml.	7. Weight Gain	9.05 gm.
4. Vol. Wash H_2O	371 ml.		

PARTICULATE DATA:

Front Half:		Back Half:	
8. Final Filter Weight	355.3 mg.	13. Total Condensables	74.7 mg.
9. Initial Filter Weight	343.1 mg.	14. $H_2SO_4 \cdot 2H_2O$	66.5 mg.
10. Filter Particulate	12.2 mg.	15. Net Condensables	8.2 mg.
11. Probe Particulate	2.2 mg.		
12. Total Particulate	14.4 mg.		
16. Acetone Wash	85 ml.		

FLUE GAS ANALYSES:
Molecular Weight Determination:

Room Temp. 77°F Barom. Press. 28.93

Component			
17. $\%CO_2$	5.8 @ 3.2% H_2O	= 5.99 dry	Horiba Mexa 204 IR Analyzer
18. $\%O_2$	15.1 "	15.60 "	Teledyne O_2 analyzer
19. %CO	.02 "	.02 "	Horiba Mexa 301 IR Analyzer
20. $\%N_2$	_____	78.39	(by difference)
Other			
21.	_____		
22.	_____		
23.	_____		

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION Kaiser Steel Coke Ovens C Baghouse DATE 3/26/79

RUN NO. C-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} 74 ml.
2. Silica Gel, W_{H_2O} 9.05 gm.

D. Particulate Weight:
1. Front Half, M_f 0.0144 gm.
2. Back Half, M_b 0.0747 gm.
3. Back Half $H_2SO_4 \cdot 2H_2O$ 0.0665 gm.

E. Volume metered

V_m = 40.5 CF x $\overset{1.0}{DGMCF}$ = 40.5 CF

F. Average $\sqrt{\Delta P}$ 0.721 $("H_2O)^{\frac{1}{2}}$

G. Average ΔH 1.44 $"H_2O$ / 13.6 = 0.11 "Hg

H. Average meter temperature, T_m 81 °F + 460 = 541 °R

I. Average stack temperature, T_s 303 °F + 460 = 763 °R

J. Stack absolute pressure, P_s 28.32 "Hg

K. Stack static pressure −8.1 $"H_2O$

L. Barometric pressure, P_b 28.92 "Hg

M. % CO_2 5.99 ; % O_2 15.60 ; % CO 0.02 ; % N_2 78.39

N. Area of stack, A_s 20.63 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

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

$$V_{m(std)} = 17.380 \times (\underline{40.5}\ CF) \times \frac{(\underline{29.03}\ "Hg)}{(\underline{541}\ ^oR)} = \underline{37.77}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

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

$$V_{wc(std)} = 0.04636 \times (\underline{74}\ ml.) = \underline{3.43}\ scf$$

2. H_2O collected in silica gel

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

$$V_{wsg(std)} = 0.04644 \times (\underline{9.05}\ gm.) = \underline{0.42}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{3.43}\ scf) + (\underline{0.42}\ scf)}{(\underline{3.43}\ scf) + (\underline{0.42}\ scf) + (\underline{37.77}\ scf)} = \underline{0.093}$$

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

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

$$M_d = (0.44)\ \underline{5.99}\ \%\ CO_2 + (0.32)\ \underline{15.60}\ \%\ O_2 + (0.28)\ \underline{78.41}\ \%(N_2+CO)$$

$$= \underline{29.58}\ lb/lb\text{-}mole$$

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

$$M_s = (\underline{29.58})\ (1 - \underline{0.093}) + 18\ (\underline{0.093}) = \underline{28.50}\ lb/lb\text{-}m$$

D. Average Stack Gas Velocity

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

$$\bar{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{763}\ ^oR)}{(\underline{28.32}\ "Hg)\ (\underline{28.50}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{0.721}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{50.93}\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{50.93}\ \text{ft/sec})(\underline{20.63}\ \text{ft}^2)(1 - \underline{0.093})\ \frac{(\underline{28.32}\ \text{"Hg})}{(\underline{763}\ ^\circ\text{R})}$$

$$= \underline{2213058}\ \text{dscfh}/60 = \underline{36884}\ \text{dscfm}$$

F. Pollutant Mass Rate (Front Half - Rule 405a) PLUS NET CONDENSABLES IN BACK HALF: .0144 + .0082 = .0226 gm

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

$$PMR = \frac{(\underline{0.0226}\ \text{gm.})}{(\underline{37.77}\ \text{dscf})} \times (\underline{2213058}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{1.86}\ \text{lb/hr} \quad (2.91\ \text{lb/hr})\ \text{WD}$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0144}\ \text{gm}) + (\underline{0.0747}\ \text{gm})}{(\underline{37.77}\ \text{dscf})} \times 15.43 = \underline{0.0364}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0144}\ \text{gm}) + (\underline{0.0747}\ \text{gm}) - (\underline{0.0665}\ \text{gm})}{(\underline{37.77}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0092}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0144}\ \text{gm})}{(\underline{37.77}\ \text{dscf})} \times 15.43 = \underline{0.0059}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(\underline{763}\ ^{\circ}R)(\underline{37.77}\ dscf)}{(\underline{60}\ min)(\underline{50.93}\ ft/sec)(\underline{0.000341}\ ft^2)(\underline{28.32}\ "Hg)(1 - \underline{0.093})}$$

$$= \underline{103.25}$$

(Std Conditions: 60 °F and 29.92 "Hg)

Test C-2

"C" STACK BAGHOUSE

	compartments						Total ΔP	INLET TEMP.	o/o Opacity
	1	2	3	4	5	6			
30	4.35	4.00	4.10	3.85	3.7		5.00	340	0
35	4.90	4.45	4.20	3.90	3.65		6.50	340	0
40	4.35	4.15	4.10	3.80	3.65		5.25	340	0
45	4.50	4.20	4.20	3.85	3.80		5.25	340	0
50	4.75	4.50	4.50	4.20	4.15		5.50	345	0
55	4.80	4.45	4.50	4.20	4.05		5.50	350	0
00	4.70	4.50	4.50	4.15	4.10		5.50	355	0
05	4.90	4.65	4.65	4.30	4.15		5.75	340	0
10	4.90	4.60	4.55	4.30	4.15		5.75	330	0
15	4.95	4.60	4.60	4.35	4.20		5.50	330	0
~~20~~									
~~25~~									
~~30~~									
1509	5.15	4.85	4.85	4.55	4.45		5.75	330	1
14	5.15	4.80	4.80	4.55	4.50		5.75	330	1
~~33~~	"								
19	5.25	4.30	4.85	4.55	4.50		5.75	330	1
24	5.25	4.90	4.90	4.65	4.55		6.00	330	3
29	5.20	4.90	4.90	4.65	4.55		6.00	335	0
31 ~~34~~	5.30	4.95	4.95	4.80	4.75		6.00	335	0

160,000 GPH

PARTICULATE TEST

Plant Kaiser Steel Coke Ovens
Run No. [illegible]
Location [illegible]
Date [illegible]
Operator [illegible]

Start Time 1048
Stop Time 1151
Ambient Temp. °F 56
Barom. Press. "Hg 28.92
Nozzle Diam. In. 0.25
Probe Length 8'

Sample Box No. 2
Meter Box No. 2
Meter $\Delta H_@$ 1.87
Heater Box Setting, °F 250
Probe Heater Setting, °F 250
Leak Rate @ "Hg 4.0 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	
N-6	0	303.5	0.68	1.84	294	232	56	207	63	56	3.6		
N-5	5	307.3	0.65	1.76	296	240	56	225	70	58	3.5		
N-4	10	311.1	0.56	1.52	297	248	60	230	75	60	3.4		
N-3	15	314.5	0.51	1.39	300	256	62	234	79	62	3.2		
N-2	20	317.8	0.50	1.36	297	256	62	225	80	64	3.2		
N-1	25	321.1	0.21	0.57	290	[illegible]	58	227	83	67	1.0	-6.8	
	30	323.1											
S-6	0	323.3	0.70	1.90	291	239	55	212	80	65	3.6		
S-5	5	327.2	0.67	1.82	293	234	54	243	85	69	3.6		
S-4	10	331.1	0.56	1.52	294	246	57	257	87	71	3.4		
S-3	15	334.6	0.52	1.41	293	255	59	234	58	72	3.1		
S-2	20	338.0	0.48	1.30	292	260	59	225	88	73	3.0		
S-1	25	341.1	0.40	1.08	289	262	61	235	89	74	2.7	-7.6	
	30	344.0											
									81	66			
			$\sqrt{\Delta P}$						ave.	74		-7.2	
	60	40.3	0.726	1.46	294								

PART.	gr/dscf	lb/hr
TOTAL		
NET	0.0081	2.58
SOLID	0.0056	1.78

GAS VEL., fps 51.15
VOLUME, dscfm 37123 (63313 acfm)
MOISTURE, % 10.4

COMMENTS: [illegible]

TEST OBSERVERS:
H. [illegible]
A. [illegible]

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

Analysis Date(s) 3/27/79 – 3/29/79 Analytical Chemist S. Deutsch

Sample Date 3/27/79 Run No. C-3 Location _____
1 Lab. No. 40548

MOISTURE DATA:

1. Final Vol. H_2O in Imp.	784 ml.	5. Final Wt. Silica Gel	745.40 gm.
2. Initial Vol. H_2O in Imp.	200 ml.	6. Initial Wt. Silica Gel	733.60 gm.
3. Vol. H_2O Condensed	584 ml.	7. Weight Gain	11.80 gm.
4. Vol. Wash H_2O	240 ml.		

PARTICULATE DATA:

Front Half:		Back Half:	
8. Final Filter Weight	342.9 mg.	13. Total Condensables	16.9 mg.
9. Initial Filter Weight	333.2 mg.	14. $H_2SO_4 \cdot 2H_2O$	10.8 mg.
10. Filter Particulate	9.7 mg.	15. Net Condensables	6.1 mg.
11. Probe Particulate	4.1 mg.		
12. Total Particulate	13.8 mg.		
16. Acetone Wash	95 ml.		

FLUE GAS ANALYSES:
Molecular Weight Determination: Room Temp. 70°F Barom. Press. 28.88

Component			
17. $\%CO_2$	5.0 @ 26% H_2O	= 5.13 dry	Horiba Mexa 23A IR Analyzer
18. $\%O_2$	15.0 "	15.40 "	Teledyne O_2 analyzer
19. %CO	0.02 "	.02 "	Horiba Mexa 201 IR Analyzer
20. $\%N_2$		79.45	(by difference)

Other

21. _____
22. _____
23. _____

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION Kaiser Steel Coke Ovens C Baghouse DATE 3/27/79

RUN NO. C-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} 84 ml.

2. Silica Gel, W_{H_2O} 11.80 gm.

D. Particulate Weight:
1. Front Half, M_f 0.0138 gm.

2. Back Half, M_b 0.0169 gm.

3. Back Half $H_2SO_4 \cdot 2H_2O$ 0.0108 gm.

E. Volume metered

V_m = 40.3 CF x $\overset{1.0}{DGMCF}$ = 40.3 CF

F. Average $\sqrt{\Delta P}$ 0.726 $("H_2O)^{\frac{1}{2}}$

G. Average ΔH 1.46 $"H_2O$ / 13.6 = 0.11 "Hg

H. Average meter temperature, T_m 74 °F + 460 = 534 °R

I. Average stack temperature, T_s 294 °F + 460 = 754 °R

J. Stack absolute pressure, P_s 28.39 "Hg

K. Stack static pressure −7.2 $"H_2O$

L. Barometric pressure, P_b 28.92 "Hg

M. % CO_2 5.13 ; % O_2 15.40 ; % CO 0.02 ; % N_2 79.45

N. Area of stack, A_s 20.63 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

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

$$V_{m(std)} = 17.380 \times (\underline{40.3}\ CF) \times \frac{(\underline{29.03}\ "Hg)}{(\underline{534}\ ^\circ R)} = \underline{38.08}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

$$V_{wc(std)} = K\ (\ V_{H2O}\ )$$

$$V_{wc(std)} = 0.04636 \times (\underline{84}\ ml.\ ) = \underline{3.89}\ scf$$

2. H_2O collected in silica gel

$$V_{wsg(std)} = K \times (\ W_{H2O})$$

$$V_{wsg(std)} = 0.04644 \times (\underline{11.8}\ gm.) = \underline{0.55}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{3.89}\ scf) + (\underline{0.55}\ scf)}{(\underline{3.89}\ scf) + (\underline{0.55}\ scf) + (\underline{38.08}\ scf)} = \underline{0.104}$$

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

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

$$M_d = (0.44)\ \underline{5.13}\ \%\ CO_2 + (0.32)\ \underline{15.40}\ \%\ O_2 + (0.28)\ \underline{79.47}\ \%\ (N_2+CO)$$

$$= \underline{29.44}\ lb/lb\text{-}mole$$

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

$$M_s = (\underline{29.44})\ (1 - \underline{0.104}) + 18\ (\underline{0.104}) = \underline{28.25}\ lb/lb\text{-}mol$$

D. Average Stack Gas Velocity

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

$$\bar{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{754}\ ^\circ R)}{(\underline{28.39}\ "Hg)\ (\underline{28.25}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{0.726}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{51.15}\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{51.15}\ \text{ft/sec})(\underline{20.63}\ \text{ft}^2)(1 - \underline{0.104}) \frac{(\underline{28.39}\ \text{"Hg})}{(\underline{754}\ ^\circ\text{R})}$$

$$= \underline{2227362}\ \text{dscfh}/60 = \underline{37123}\ \text{dscfm}$$

F. Pollutant Mass Rate (Front Half - Rule 405a) PLUS NET CONDENSABLES IN BACK HALF: .0138 + .0061 = .0199 gm.

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

$$PMR = \frac{(\underline{0.0199}\ \text{gm.})}{(\underline{38.08}\ \text{dscf})} \times (\underline{2227362}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{1.78}\ \text{lb/hr}\quad (2.56\ \text{lb/hr.})$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0138}\ \text{gm}) + (\underline{0.0169}\ \text{gm})}{(\underline{38.08}\ \text{dscf})} \times 15.43 = \underline{0.0124}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0138}\ \text{gm}) + (\underline{0.0169}\ \text{gm}) - (\underline{0.0108}\ \text{gm})}{(\underline{38.08}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0081}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0138}\ \text{gm})}{(\underline{38.08}\ \text{dscf})} \times 15.43 = \underline{0.0056}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(\underline{754}\ ^{\circ}R)(\underline{38.08}\ dscf)}{(\underline{60}\ min)(\underline{51.15}\ ft/sec)(\underline{0.000341}\ ft^2)(\underline{28.39}\ "Hg)(1 - \underline{0.104}\ )}$$

$$= \underline{103.43}$$

(Std Conditions: 60 °F and 29.92 "Hg)

Test C-3

"Stack" C Baghouse — Eldon —

Time	compartments 1	2	3	4	5	6	Total ΔP	INLET TEMP.	% Opacity
1045	5.80	5.90	5.90	5.50	5.50	X	6.50	330	~~3.5~~ %
1050	5.85	5.45	5.45	5.15	5.15	X	6.50	337	1.7%
1055	5.95	5.45	5.45	5.15	5.15	X	6.45	340	1.7%
1100	5.95	5.45	5.45	5.15	5.15	X	6.50	348	~~0~~
1105	~~6.15~~	~~8.25~~ BLOWING	~~7.25~~	COMPARTMENTS		X	6.50	350	1.5%
1110		BLOWING		COMPARTMENT	-20	X	8.20	325	1.0
1115	4.30	3.50	3.30	3.50		X	4.50	325	1.0
1120	3.85	3.15	3.15	2.85	3.20	X	4.50	325	1.0
1125	3.95	3.20	3.30	2.95	3.25	X	4.75	330	1.0
1130	4.10	3.45	3.50	3.15	3.45	X	4.75	330	1.0
1135	4.35	3.60	3.70	3.40	3.15	X	5.00	~~335~~	1.0
1140	4.95	4.10	4.05	3.65	3.85	X	5.25	325	1.0
1145	4.55	3.95	4.05	3.70	3.95	X	5.25	330	1.0
1150	4.70	4.15	4.25	3.90	4.10	X	5.25	330	1.0
1155	4.80	4.20	4.35	3.95	4.15	X	5.30	340	1.0
1200	4.85	4.30	4.40	4.05	4.20	X	5.25	340	1.0
	4.85	4.35	4.35	4.15	4.25				

1050 129 Push
1055 119 Oven Charged
1108 149 " Pushed
1158 139 " Pushed
1153 129 " Charged

3 Pushes 2 Charges

150 ... SCFM (...) (1100-1130) ... SCFM (...)

Plant Kaiser Steel Coke Ovens — Start Time 1405 — Sample Box No. 2
Run No. C-4 — Stop Time 1509 — Meter Box No. 2
Location C Battery Exit — Ambient Temp. °F 60 — Meter ΔH@ 1.89
Date 3/27/79 — Barom. Press. "Hg 28.88 — Heater Box Setting, °F 250
Operator GM, JAH — Nozzle Diam. In. 0.25 — Probe Heater Setting, °F 250
Probe Length 8' — Leak Rate @ "Hg 40 Post-Test 0.002 cfm OK.

POINT	TIME MIN.	GAS VOLUME CF	PITOT ΔP "H2O	ORIF. ΔH "H2O	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. "H2O	
E-6	0	344.5	0.82	2.22	295	234	54	214	71	62	3.8	-9.8	
	1.5	346.0	0.78	2.11									
E-5	5	348.7	0.70	1.90	294	230	54	242	75	63	3.5		
E-4	10	352.6	0.58	1.57	292	241	57	261	80	65	3.0		
E-3	15	356.2	0.49	1.33	291	252	59	249	84	67	2.6		
E-2	20	359.4	0.49	1.33	289	257	58	234	86	70	2.6		
E-1	25	362.6	0.40	1.08	284	257	60	233	87	71	2.1	-8.6	
	30	365.5											
N-6	0	365.7	0.7	1.90	287	242	56	219	84	74	3.5	-8.8	
N-5	5	369.6	0.66	1.79	290	245	56	255	90	76	3.4		
N-4	10	373.4	0.55	1.49	290	253	59	259	92	77	3.0		
N-3	15	376.9	0.50	1.36	293	260	63	269	94	79	2.9		
N-2	20	380.2	0.40	1.09	295	264	65	247	94	79	2.5		
N-1	25	383.1	0.20	0.54	293	266	58	235	95	81	1.1	-8.4	
	30	384.9											
			√ΔP						86	72			
	60	40.2	0.725	1.46	291				ave 79			-8.9	

PART. gr/dscf — lb/hr
TOTAL — —
NET 0.0079 — 2.52
SOLID 0.0047 — 1.42

GAS VEL., fps 51.15
VOLUME, dscfm 3726.8 (6331.3 acfm)
MOISTURE, % 9.9

COMMENTS: Rain

TEST OBSERVERS:
H. DeVorkin
A Gubey

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

Analysis Date(s) 3/27/79-3/29/79 Analytical Chemist S. Deutsch

Sample Date _____ Run No. C-4 Location _____
Lab. No. 45349

MOISTURE DATA:

1. Final Vol. H_2O in Imp.	278 ml.	5. Final Wt. Silica Gel	738.35 gm.
2. Initial Vol. H_2O in Imp.	200 ml.	6. Initial Wt. Silica Gel	727.80 gm.
3. Vol. H_2O Condensed	78 ml.	7. Weight Gain	10.55 gm.
4. Vol. Wash H_2O	186 ml.		

PARTICULATE DATA:

Front Half:		Back Half:	
8. Final Filter Weight	347.1 mg.	13. Total Condensables	42.7 mg.
9. Initial Filter Weight	339.8 mg.	14. $H_2SO_4 \cdot 2H_2O$	34.9 mg.
10. Filter Particulate	7.3 mg.	15. Net Condensables	7.8 mg.
11. Probe Particulate	4.1 mg.		
12. Total Particulate	11.4 mg.		
16. Acetone Wash	115 ml.		

FLUE GAS ANALYSES:
Molecular Weight Determination: Room Temp. 70°F Barom. Press. 28.88

Component			
17. $\%CO_2$	4.4 @ 2.62 bkg	= 4.52 dry	Horiba Mexa-204 IR analyzer
18. $\%O_2$	15.1 "	= 15.50 "	Teledyne O_2 analyzer
19. %CO	0.02 "	= .02 "	Horiba Mexa 201 I.R. analyzer
20. $\%N_2$	_____	79.96	(by difference)

Other

21.	_____
22.	_____
23.	_____

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION Kaiser Steel Coke Ovens C Baghouse DATE 3/27/79

RUN NO. C-4

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} 78 ml.
2. Silica Gel, W_{H_2O} 10.55 gm.

D. Particulate Weight:
1. Front Half, M_f 0.0114 gm.
2. Back Half, M_b 0.0427 gm.
3. Back Half $H_2SO_4 \cdot 2H_2O$ 0.0349 gm.

E. Volume metered

V_m = 40.2 CF x $\overset{1.0}{\text{DGMCF}}$ = 40.2 CF

F. Average $\sqrt{\Delta P}$ 0.725 $("H_2O)^{\frac{1}{2}}$

G. Average ΔH 1.46 $"H_2O/13.6$ = 0.11 "Hg

H. Average meter temperature, T_m 79 °F + 460 = 539 °R

I. Average stack temperature, T_s 291 °F + 460 = 751 °R

J. Stack absolute pressure, P_s 28.23 "Hg

K. Stack static pressure −8.9 $"H_2O$

L. Barometric pressure, P_b 28.88 "Hg

M. % CO_2 4.52 ; % O_2 15.50 ; % CO 0.02 ; % N_2 79.96

N. Area of stack, A_s 20.63 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

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

$$V_{m(std)} = 17.380 \times (\underline{40.2}\ CF) \times \frac{(\underline{28.99}\ ^{"}Hg)}{(\underline{539}\ ^{o}R)} = \underline{37.58}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

$$V_{wc(std)} = K\ (\ V_{H2O}\ )$$

$$V_{wc(std)} = 0.04636 \times (\underline{78}\ ml.) = \underline{3.62}\ scf$$

2. H_2O collected in silica gel

$$V_{wsg(std)} = K \times (\ W_{H2O})$$

$$V_{wsg(std)} = 0.04644 \times (\underline{10.55}\ gm.) = \underline{0.49}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{3.62}\ scf) + (\underline{0.49}\ scf)}{(\underline{3.62}\ scf) + (\underline{0.49}\ scf) + (\underline{37.58}\ scf)} = \underline{0.099}$$

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

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

$$M_d = (0.44)\ \underline{4.52}\ \%\ CO_2 + (0.32)\ \underline{15.50}\ \%\ O_2 + (0.28)\ \underline{79.98}\ \%\ (N_2+CO)$$

$$= \underline{29.34}\ lb/lb\text{-}mole$$

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

$$M_s = (\underline{29.34})\ (1 - \underline{0.099}) + 18\ (\underline{0.099}) = \underline{28.22}\ lb/lb\text{-}mol$$

D. Average Stack Gas Velocity

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

$$\bar{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{751}\ ^{o}R)}{(\underline{28.23}\ "Hg)\ (\underline{28.22}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{0.725}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{51.15}\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{51.15}\ \text{ft/sec})(\underline{2063}\ \text{ft}^2)(1 - \underline{0.099})\ \frac{(\underline{28.23}\ \text{"Hg})}{(\underline{751}\ ^{\circ}\text{R})}$$

$$= \underline{2236066}\ \text{dscfh}/60 = \underline{37268}\ \text{dscfm}$$

F. Pollutant Mass Rate (Front Half - Rule 405a) PLUS NET CONDENSABLES IN BACK HALF: .0114 + .0078 = .0192 gm

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

$$PMR = \frac{(\underline{0.0114}\ \text{gm.})}{(\underline{37.58}\ \text{dscf})} \times (\underline{2236066}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

(0.0192)

$$= \underline{1.49}\ \text{lb/hr}\ (2.51\ \text{lb/hr.})$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0114}\ \text{gm}) + (\underline{0.0427}\ \text{gm})}{(\underline{37.58}\ \text{dscf})} \times 15.43 = \underline{0.0222}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0114}\ \text{gm}) + (\underline{0.0427}\ \text{gm}) - (\underline{0.0349}\ \text{gm})}{(\underline{37.58}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0079}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0114}\ \text{gm})}{(\underline{37.58}\ \text{dscf})} \times 15.43 = \underline{0.0047}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(\underline{751}\ ^{\circ}R)(\underline{37.58}\ dscf)}{(\underline{60}\ min)(\underline{51.15}\ ft/sec)(\underline{0.000341}\ ft^2)(\underline{28.23}\ "Hg)(1 - \underline{0.099})}$$

$$= \underline{101.68}$$

(Std Conditions: 60 °F and 29.92 "Hg)

Test C-4

"STACK © BAGHOUSE ELDON 3/27/79

	Compartments						Total ΔP	INLET TEMP.	o/o Opacity
12	1	2	3	4	5	6			
05	5.55	4.95	5.00	4.65	4.70	X	625	330	1.0
10	5.45	4.80	5.00	4.55	4.65	X	625	325	0.5
415	5.45	4.85	4.90	4.60	4.70	X	625	320	0.5
420	5.45	4.85	4.95	4.60	4.65	X	625	325	0.5
425	5.45	4.85	4.95	4.60	4.65	X	625	325	0.5
430	5.45	4.95	5.00	4.65	4.75	X	625	325	0.5
435	5.45	5.45	5.35	5.00	5.00	X	625	330	0.5
440	5.45	4.45	4.95	4.60	4.65	X	625	325	0.5
445	5.45	4.90	4.95	4.65	4.70	X	625	325	0.5
450	5.45	4.90	4.95	4.65	4.70	X	625	325	0.5
455	5.35	4.85	4.90	4.60	4.65	X	625	330	0.5
1500	5.45	4.85	4.95	4.65	4.70	X	625	330	0.5
1505	5.45	4.85	5.55	5.05	5.00	X	600	350	0.5
1510	5.50	4.95	5.05	4.70	4.65	X	625	325	32 (Stack Opacity)

PUSHES = 0

CHARGES = 0

Test C-2

VISIBLE EMISSION OBSERVATION RECORD

Company KSC

Date 3-26-79

Time First Sighted Plume 1:50pm

Time Start 1:31 PM

Time Stop 2:17 PM

Air Temperature 61°F

Relative Humidity 32%

Wind Speed 7MPH

Wind Direction NW

Sky Condition CLOUDY

Background GREY

Plume Characteristics:

Continuous: ( ) yes (X) no

Color GREY

Dispersion Description LOFTING

Stack Height 260 (ft)

Observer location: ±380 (ft) SOUTH of stack

Sun location
( ) Back of Observer
( ) Right Shoulder

(X) Left Shoulder
( ) Other

Emission Point

Min	0	15	30	45
01	0	0	0	0
02	0	0	0	0
03	0	0	0	0
04	0	0	0	0
05	0	0	0	0
06	0	0	0	0
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	10	15	20	10

Min	0	15	30	45
21	10	10	5	5
22	5	5	5	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

Min	0	15	30	45
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: NUMBERS OTHER THAN ZERO REPRESENT PERCENT OPACITY.

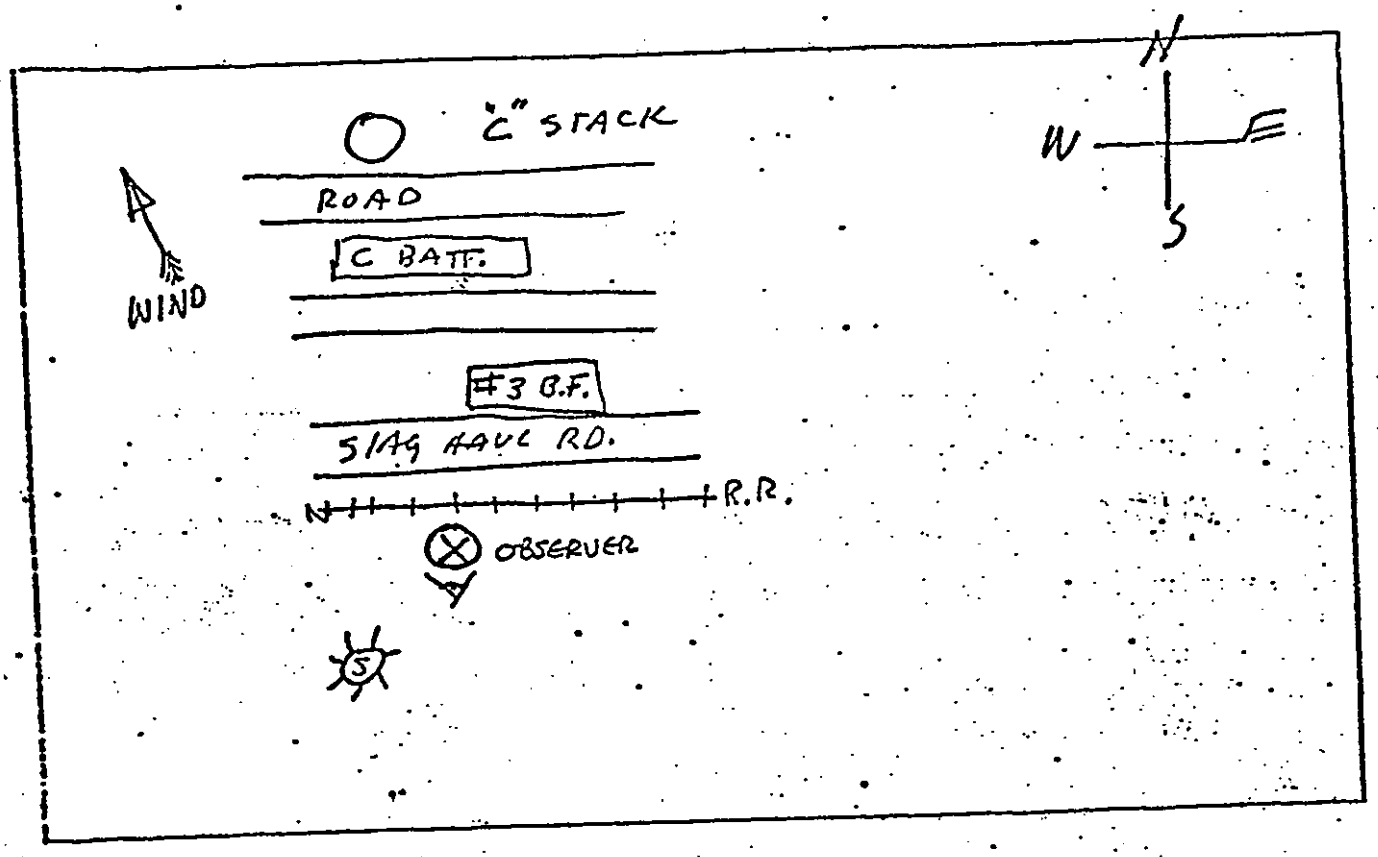
0 = TIME STOP (DELAY) STILL OBSERVING STACK W/NO EMISSIONS

Inspector [signature] - EQC/KSC Date 3-26-79

TSB-A-8 EPA-13-FORM 208

MAP

Test C-2



Symbols

Sun = ☀
Plume direction = ——→

Point where plume observed = ...
Observer = 🚶

Water Vapor Condensate _____

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

Comments _____

Signature _____ Date 3-26-79

Test C-2

VISIBLE EMISSION OBSERVATION RECORD

Company KSC

Date 3-26-79 Time First Sighted Plume 3:24pm

Time Start 3:10 PM Time Stop 3:34 PM.

Air Temperature 62°F Relative Humidity 33%

Wind Speed 7MPH Wind Direction NE

Sky Condition cloudy Background GREY

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

Color GREY Dispersion Description LOFTING

Stack Height 260 (ft) Observer location: 600 (ft) SW of stack

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

Emission Point

Min	0	15	30	45
01	0	0	0	0
02	0	0	0	0
03	0	0	0	0
04	0	0	0	0
05	0	0	0	0
06	0	0	0	0
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	5	10	10	10
14	5	5	5	5
15	5	5	5	5
16	5	5	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0

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

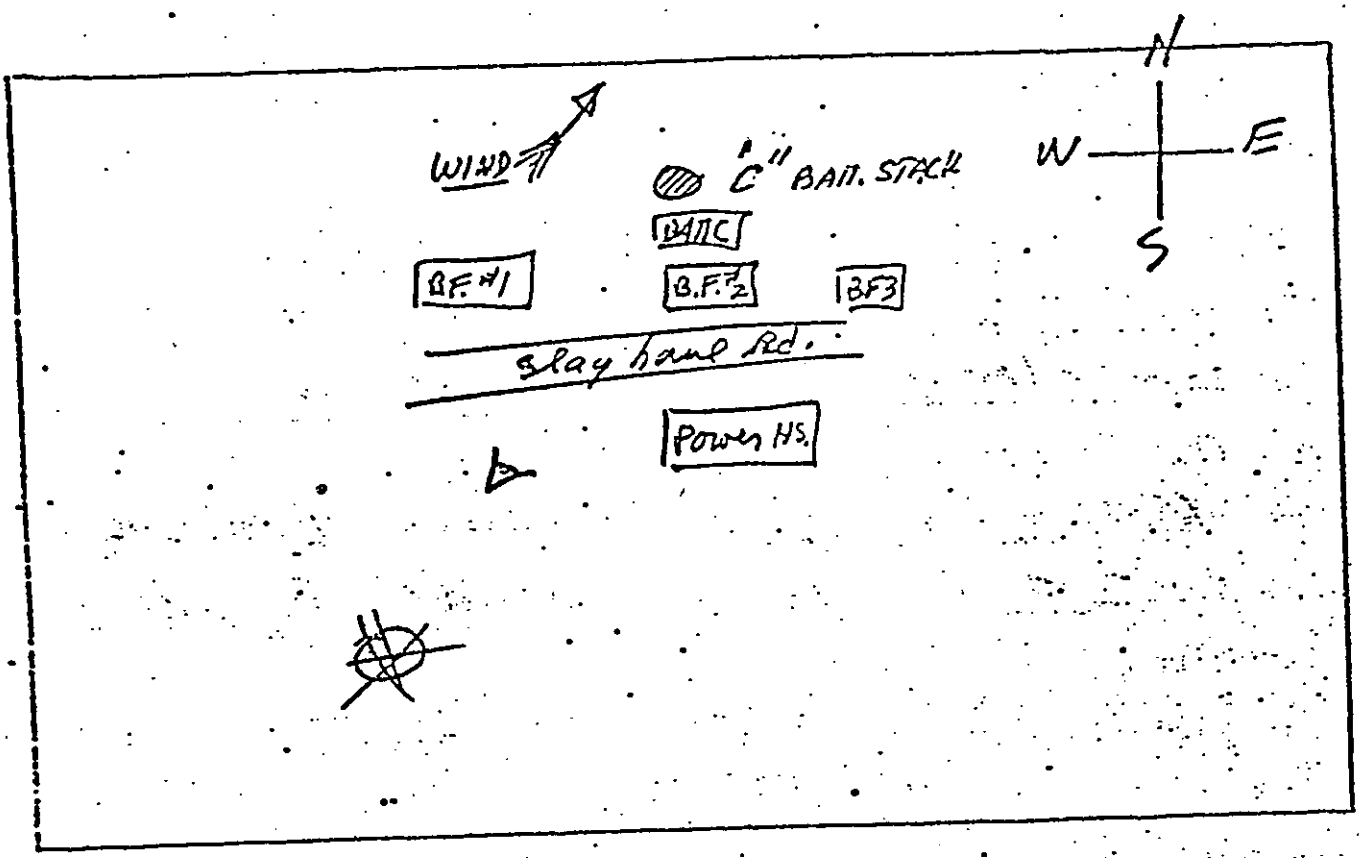
Min	0	15	30	45
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				

NOTES: NUMBERS OTHER THAN ZERO REPRESENT PERCENT OPACITY.

Inspector NAL-BNES EGG/KSC Date 3-26-79

MAP

Test C-2



Symbols

Sun = ☀
Plume direction = ——→
Point where plume observed = ...
Observer = 4

Water Vapor Condensate _____

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

Comments DRIVING — BATT. "C" STACK IS MORE DIRECTLY NORTH OF BLAST FURNACE #3

Signature _____ Date 3-26-79

Test C-3

VISIBLE EMISSION OBSERVATION RECORD

Company KAISER STEEL

Date 3-27-79 Time First Sighted Plume 1106

Time Start 1045 Time Stop 1144

Air Temperature 51° Relative Humidity

Wind Speed 3-4 MPH Wind Direction SE

Sky Condition 100% OVERCAST Background GREY CLOUDS

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

Color LIGHT BLACK Dispersion Description

Stack Height 225 (ft) Observer location: 500 (ft) NE of stack

Sun location
( ) Back of Observer ( ) Left Shoulder
( ) Right Shoulder NO SUN ( ) Other

Emission Point "C" BTRY STACK

Min	0	15	30	45
01	0	0	0	0
02	0	0	0	0
03	0	0	0	0
04	0	0	0	0
05	0	0	0	0
06	5	5	5	5
07	5	5	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	5	5	10	10
18	10	10	0	0
19	0	0	0	0
20	0	0	0	0

Min	0	15	30	45
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

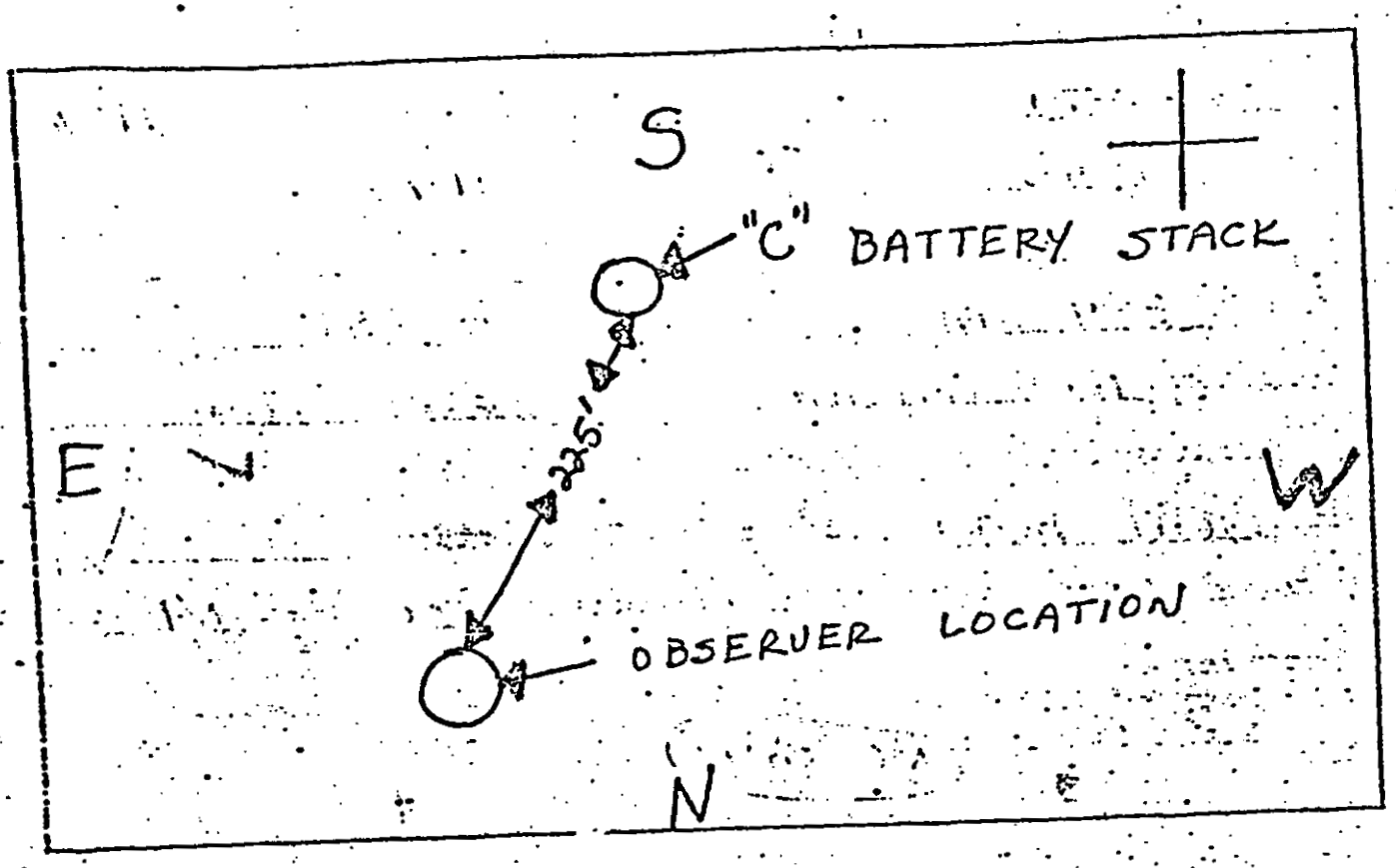
Min	0	15	30	45
41				
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0
48	0	0	0	0
49	0	0	0	0
50	0	0	0	0
51	0	0	0	0
52	0	0	0	0
53	0	0	0	0
54	0	0	0	0
55	0	0	0	0
56	0	0	0	0
57	0	0	0	0
58	0	0	0	0
59	0	0	0	0
60	0	0	0	0

NOTES: 100% OVERCAST, RAIN - HEAVY AT TIMES
VISIBILITY 1 MILE

Inspector R. L. Skippen Date March 27, 1979

MAP

Test C-3



Symbols

Sun = ☼
Plume direction = ⟶
Point where plume observed = ····
Observer = 🚶

Water Vapor Condensate

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

Comments

Signature R. L. Klippel Date 3-27-79

Test C-4

VISIBLE EMISSION OBSERVATION RECORD

Company KSC

Date 3-27-79 Time First Sighted Plume —

Time Start 2:05 PM Time Stop 3:09 PM

Air Temperature 53°F Relative Humidity 100%

Wind Speed 4 MPH Wind Direction NORTH EAST

Sky Condition CLOUDY-OVERCAST Background GREY

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

Color — Dispersion Description —

Stack Height 225 (ft) Observer location: 300 (ft) NORTH of stack

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

Emission Point TOP OF STACK — "C" BATTERY COKE OVENS

Min	0	15	30	45
01	0	0	0	0
02	0	0	0	0
03	0	0	0	0
04	0	0	0	0
05	0	0	0	0
06	0	0	0	0
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

Min	0	15	30	45
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

Min	0	15	30	45
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

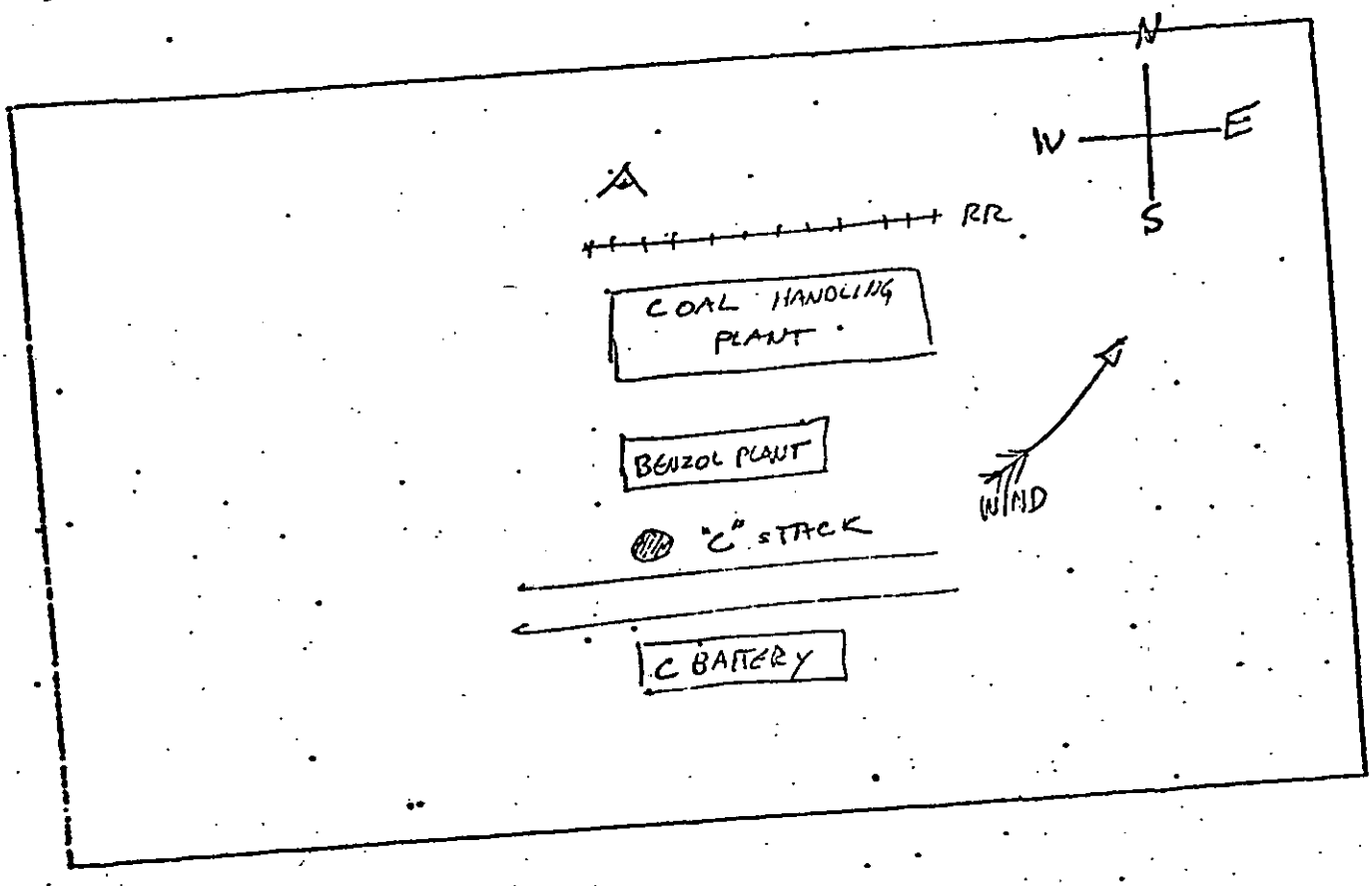
NOTES:

Inspector NEIL JONES Date 3-27-79

TSB-A-8 EPA-IX-FORM 208

Test C-4

MAP



Symbols

Sun = ☼
Plume direction = ——→
Point where plume observed = ·····
Observer = 🚶

Water Vapor Condensate

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

Comments

Signature

Date 3-27-79

Test C-4

VISIBLE EMISSION OBSERVATION RECORD

Company KSC

Date 3-27-79 Time First Sighted Plume —0—

Time Start 2:05 PM Time Stop 3:09 PM

Air Temperature 53°F Relative Humidity 100%

Wind Speed 4 MPH Wind Direction NORTH EAST

Sky Condition CLOUDY Background GREY

Plume Characteristics: Continuous: ( ) yes ( ) no

Color —0— Dispersion Description —0—

Stack Height 225 (ft) Observer location: 300 (ft) NORTH of stack

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

Emission Point TOP OF STACK 6" BATTERY - COKE OVENS.

Min	0	15	30	45
01	0	0	0	0
02	0	0	0	0
03	0	0	0	0
04	0	0	0	0
05	0	0	0	0
06	0	0	0	0
07	0	0	0	0
08	0	0	0	0
09	0	0	0	0
10				
11				
12				
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20				

Min	0	15	30	45
21				
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23				
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34				
35				
36				
37				
38				
39				
40				

Min	0	15	30	45
41				
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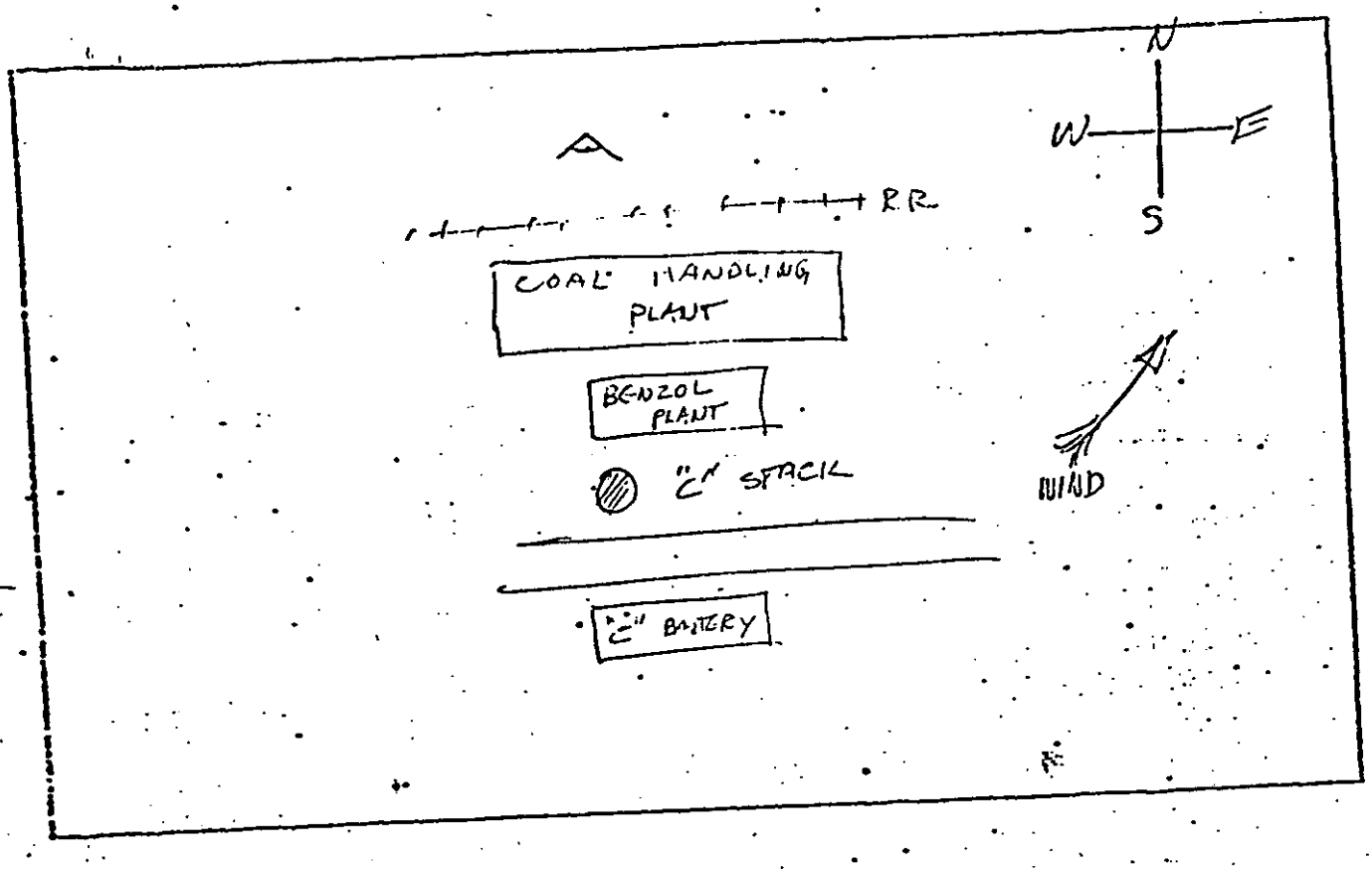
NOTES:

Inspector NEIL JONES ECC/KSC Date 3-27-79

Test C-4

MAP



Symbols

Sun = ☼
Plume direction = ——→
Point where plume observed = ...
Observer = 🚶

Water Vapor Condensate _____

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

Comments _____

Signature _____ Date 3-23-79

SOTDAT/STEEL LIBRARY SYSTEM

Report Title: —

Plant and Location: Kaiser Steel, Fontana, CA

SCC: 30300306

Testing Date(s): 3/26-27/79

By Whom: company

Stack Test Review Attached:

Reviewed by:

Problems Seen by Reviewer:

Confidentiality Status: Clear

If status is confidential, list confidential pages or sections:

Source of Determination of the Confidentiality Status: Memo entitled: "Steel Technical Support Materials", From: Edward Reich, Director DSSE. To: Tom Voltaggio"

Report Encoded by:

Date Encoded:

Form Numbers:

Comments:

Title: see letter pg.

Plant and Location: Kaiser Steel, Fontana, CA

SCC: 30300306

Test Date: 3/26-27/79

By Whom: company

Encoded By:

Date Encoded:

Completed By:

Form No.:

ES

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May 16, 1979

Mr. Gary Lavagnino
Task Manager (S-2-1)
Surveillance & Analysis Division
U.S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94105

Dear Mr. Lavagnino:

Transmitted herewith is a report on observations made during a series of source tests conducted at Kaiser Steel Corporation, Fontana, California on March 26-27, 1979. The tests were to determine emissions from a baghouse controlling stack gases from the heating of coke ovens of Battery C at the above location.

The tests were conducted by the Environmental Quality Control Section of Kaiser Steel Corporation, pursuant to Paragraph X of the Amended Consent Decree entered on September 30, 1977, Case No. CV 76-0675MML (U.S. District Court, Central District of California).

The source test results and visual opacity observations of March 26-27, 1979 indicate compliance of the baghouse emissions with Rules 50A and 52A of the San Bernardino County APCD (as included in the California SIP) and Rules 401, 404, and 405 of the SCAQMD.

Attached is a report on the tests, including an introduction, process description, outline of the sampling and analytical procedures, data and results, and process and visible emission observations.

Please advise if any further information is needed.

Very truly yours,

Howard DeVorkin
Senior Air Pollution Engineer

HDV:eh
Enclosures
cc: J. R. Busik
S. J. Hitte
E. McLean
J. Cline (ES)