Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

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

AP-42 Section 12.2
Reference
Report Sect. 4
Reference 200

Requires interpretation.

ENGINEERING-SCIENCE

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19 February 1980

Mr. Gary Lavagnino
Task Manager (S-2-1)
Surveillance & Analysis Division
U.S. EPA, Region IX
215 Fremont Street
San Francisco, CA 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 January 7-10, 1980. The tests were to determine emissions from each of the baghouses controlling stack gases from the heating of coke ovens of Batteries F and G 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 indicate compliance of emissions from both baghouses 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 / EH

Howard DeVorkin
Senior Air Pollution Engineer

HDV:eh
Enclosures
cc: J. R. Busik
K. Bell
M. Bernd
L. Genoble (ES)

510621

REPORT ON SOURCE TESTS, VISIBLE EMISSIONS, AND PLANT OBSERVATIONS

Facility Inspected:

KAISER STEEL CORPORATION
FONTANA, CALIFORNIA

Coke Oven Batteries F and G

Dates of Inspections:

January 7, 8 and 10, 1980

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 81/TSA 2
Contract No. 68-01-4146

February 1980

Submitted By

ENGINEERING-SCIENCE
125 West Huntington Drive
Arcadia, California 91006

510622

TABLE OF CONTENTS

	Page
INTRODUCTION	1
PROCESS DESCRIPTION	1
SAMPLING AND ANALYTICAL PROCEDURES	2
DATA AND RESULTS	3
PROCESS EQUIPMENT OBSERVATIONS	4
VISIBLE EMISSION OBSERVATIONS	4
APPENDIX	

LIST OF TABLES

Table		
1	Baghouse for Battery G - Process Equipment Observations	5
2	Baghouse for Battery F - Process Equipment Observations	6

510623

EPA Rule 1

OBSERVATIONS OF SOURCE TESTS
AT KAISER STEEL CORPORATION
FONTANA, CALIFORNIA

INTRODUCTION

Tests to determine particulate emissions from the two baghouses serving Coke Oven Batteries F and G were conducted on January 7-10, 1980 by technical personnel of Environmental Quality Control, Kaiser Steel Corporation. Visual emission observations of the common discharge stack were also made during the same period by this writer.

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. CV 76-0657MML).

Twin baghouses were installed for control of particulate emissions in the exit gases from heating of the coke ovens. The baghouses are vented to a common stack. With this installation, Battery A is the last remaining to be controlled for combustion gas emissions.

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 usually done immediately after the expulsion of the coked product.

from Gas Rule

During the tests, the ovens of Battery F were heated with coke oven gas, using 165,000 to 183,000 cubic feet per hour of gas of about 500 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 ovens of Battery G were heated principally with blast furnace gas, using 1.05-1.2 x 10^6 cubic feet per hour of approximately 80 to 85 BTU/ft^3

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heat content. In addition, a total of 70,000 to 80,000 cfh of coke oven gas was also used. 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 gases used to heat Battery F and G ovens are drawn through separate baghouses, each with a 500 HP motor driving an induced-draft fan and are discharged through a common 250-foot stack. The baghouses, manufactured by Buell Envirotech, each consist of five sections with a total of 1,140 "silicon-graphite" treated fiberglass bags of about 55,600 ft^2 total area (design air/cloth ratio for 118,000 ACFM is about 2:1). The ducting and baghouses are insulated to maintain operating temperatures near 450°F. A more detailed description of this equipment is included in the Appendix.

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 (see Observations). 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 each baghouse at a point upstream of the induced draft fan and stack. Each sampling station was similar. The gases angle vertically downward with an approximate 25-foot run prior to the sampling station. Two sampling ports were used on the narrower side of each of the rectangular ducts, sampling at six points along each traverse for a 60 to 72 minute 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 (10 to 13" H_2O).

510625

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.

KSC did the tests

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 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.

Why pay your men fella!

DATA AND RESULTS

I've help here

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 differing requirements of Rule 52A of the former San Berndardino County APCD, and Rules 404(a) and 405(a) of the SCAQMD.

Calculation of particulate matter for Rule 404(a) was done with and without the exclusion of $H_2SO_4 \cdot 2H_2O$. Apparently, up to October 5, 1979, sulfuric acid dihydrate was excluded from Rule 404(a), but since that date has been included. This now effectively makes Rule 404(a) identical to Rule 52A. Calculation of "solid" particulate matter for Rule 405(a) includes "front-" and "back-half" collections of the EPA Method 5 Train, excluding sulfuric acid dihydrate and small amounts of organic material (solvent extractable).

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All Kaiser Steel Corporation calculations were checked and found to be accurate. A transcription error on the compliance result summary sheet was noted by Kaiser after transmittal of the report, and is noted therein by the writer.

PROCESS EQUIPMENT OBSERVATIONS

Amazing!

The process equipment observations shown on Tables 1 and 2 were obtained by the writer and by Jim Matoi of Kaiser Steel Environmental Quality Control.

?

?

According to the control instrument setting, the baghouse filter bags are cleaned by reverse air pressure when the pressure drop attains 8 to 10 inches of water.

VISIBLE EMISSION OBSERVATIONS

Formal visible emission observations were made during tests G-4 and F-2 on January 8 and 10, 1980 (test F-2 was later discarded). These observations are included in the Appendix. As can be seen, no visible emissions were noted at these times as well as during previous observations on December 19 and 20, 1979 (the latter observations have been reported previously). It should be noted, however, that at times where one or the other baghouse has been bypassed (not during these tests), visible emissions up to 40 to 80 percent have been seen.

Why have to have VE data ① ΔP ② Not sample ③ Gullible ④ Poor analysis

what causes the by-pass

F → ⊗ ← G

VE on main stack. Mass on smaller streams. Are NOT comparable !! This issue NOT mentioned

510627

TABLE 1

BAGHOUSE FOR BATTERY G - PROCESS EQUIPMENT OBSERVATIONS

Test No.	Date and Time	During Test		Gas Reversal Times	Average Gas Flow Rate (scfh)	Baghouse	
		Pushes	Charges			Average Pressure Drop (in.H_2O)	Average Inlet Temp. (°F)
G-1	1-7-80 (1105-1211)	0*	0*	1121 1151	BFG 1,130,000 COG 75,000	4.3	489
G-3	1-8-80 (0955-1113)	5	5	1021 1051	BFG 1,150,000 COG 75,000	5.7	478
G-4	1-8-80 (1310-1414)	3	2	1321 1351	BFG 1,200,000 COG 75,000	6.0[a)]	481

*5 pushes and charges made during 30-minute period prior to test.
BFG = Blast Furnace Gas (80-85 BTU/ft^3).
COG = Coke Oven Gas (500 BTU/ft^3).
a) See Appendix for baghouse data for this test.

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TABLE 2

BAGHOUSE FOR BATTERY F - PROCESS EQUIPMENT OBSERVATIONS

Test No.	Date and Time	During Test		Gas Reversal Time	Average Gas Flow Rate (scfh)	Baghouse	
		Pushes	Charges			Average Pressure Drop (in.H_2O)	Average Inlet Temp. (°F)
F-1	1-9-80 (0954-1059)	3*	3*	1016 1046	COG 165,000 BFG None	7.0	465
F-3	1-10-80 (1205-1308)	0	0	1216 1246	COG 183,000 BFG None	6.0	465

*One additional push and charge made 2 minutes prior to test.
COG = Coke Oven Gas (500 BTU/ft^3).
BFG = Blast Furnace Gas (80-85 BTU/ft^3).

Note: Writer not present on 1-9-80.

510629

APPENDIX

Compliance Test Results - Coke Oven Batteries F and G

- Summary - KSC Battery G
- Summary - KSC Battery F
- Test G-1
  - Particulate Field Data
  - Laboratory Analysis Data
  - Calculations
  - Baghouse Data
- Test G-3
  - Particulate Field Data
  - Laboratory Analysis Data
  - Calculations
  - Baghouse Data
- Test G-4
  - Particulate Field Data
  - Laboratory Analysis Data
  - Calculations
  - Baghouse Data
- Test F-1
  - Particulate Field Data
  - Laboratory Analysis Data
  - Calculations
  - Baghouse Data
- Test F-3
  - Particulate Field Data
  - Laboratory Analysis Data
  - Calculations
  - Baghouse Data

Visible Emission Observations (1/8-10/80)

- Buell Baghouse Specifications
  - Design Basis
  - Equipment Description

Compliance Test Results – Coke Oven Batteries F and G

510631

COMPLIANCE TEST RESULTS - COKE OVEN BATTERIES F & G
1/7 to 1/10/80.

BATTERY	Rule 52a		Rule 404a			Rule 405a	
	Allowable gr/dscf	Test gr/dscf	Allowable gr/dscf	Test Tot. gr/dscf	less $H_2SO_4 \cdot 2H_2O$ gr/dscf	Allowable lb/hr	Test lb/hr
"G"	0.0405	0.0091	0.0394	0.0091	0.0086	15.64	3.93
"F"	0.0483	~~0.0391~~ * 0.0319	0.0468	~~0.0391~~ * 0.0319	0.0198	15.33	6.78

Common reverse air jam - too small, problems bigger - smoke are in 13+L
had V.B. hrg on subject.

* TRANSCRIPTION ERROR NOTED BY KSC AFTER REPORT MAILED - CHECKED BY H.D.V.

[he claims this a typo

"F" brought more a problem - Co plan a mk before - he was told

F/G was smoking - by pass on F/G => 'ed

HJM:pw
1/17/80

510632

Summary - KSC Battery G

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SUMMARY - KSC COKE PLANT BATTERY "G" COMPLIANCE TEST

Test No.	Date Time	Sample		Particulate Matter Concentration-gr/dscf				Solid Particulate-lb/hr	
				Rule 52A		Rule 404(a)		Rule 405(a)	
		Volume dscf	Isokinetic %	Allowable	Test	Allowable	Test*	Allowable	Test
G-1	1/7/80 1105-1211	60.6	99.1	0.0409 @ 63260 dscfm gas volume	0.0054	0.0398 @ 63260 dscfm gas volume	0.0052	15.76 @ 70875 lb/hr process wt.	2.50
G-3	1/8/80 0955-1113	45.1	103.0	0.0400 @ 67050 dscfm gas volume	0.0068	0.0389 @ 67050 dscfm gas volume	0.0066	15.57 @ 67500 lb/hr process wt.	3.77
G-4	1/8/80 1310-1414	36.3	102.8	0.0405 @ 64917 dscfm gas volume	0.0150	0.0394 @ 64917 dscfm gas volume	0.0139	15.57 @ 67500 lb/hr process wt.	5.53

*less $H_2SO_4 \cdot 2H_2O$

Current Rule 404(a) amended 10/5/79 does not exclude $H_2SO_4 \cdot 2H_2O$. The grain loading would be the same as under Rule 52A Test column.

Battery G underfiring with enriched blast furnace gas fuel.

Test G-2 discarded due to probe liner coming loose.

HJM:pw
1/17/80

510634

Summary - KSC Battery F

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SUMMARY - KSC COKE PLANT BATTERY "F" COMPLIANCE TEST

Test No.	Date Time	Sample Volume dscf	Sample Isokinetic %	Particulate Matter Concentration-gr/dscf Rule 52A Allowable	Rule 52A Test	Rule 404(a) Allowable	Rule 404(a) Test*	Solid Particulate-lb/hr Rule 405(a) Allowable	Rule 405(a) Test
F-1	1/9/80 0954-1059	37.7	97.1	0.0487 @ 170° 40050 dscfm gas volume	0.0284	0.0472 @ 170° 40050 dscfm gas volume	0.0198	15.51 @ 66375 lb/hr process wt.	6.63
F-3	1/10/80 1205-1308	39.2	96.9	0.0479 @ 41876 dscfm gas volume	0.0353	0.0465 @ 41876 dscfm gas volume	0.0198	15.15 @ 59625 lb/hr process wt.	6.92

*less $H_2SO_4.2H_2O$

Current Rule 404(a) amended 10/5/79 does not exclude $H_2SO_4.2H_2O$. This grain loading would be the same as under Rule 52A test column.

Battery F underfired with Coke Oven gas fuel.

Test F-2 discarded due to leakage in sampling train and non-isokinetic sampling.

HJM:pw
1/17/80

Why NOT 3 tests
w/ edt in impinger

Terrible weather & Deadline!!

5106636

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

Plant Kaiser Steel-Coke "6"
Run No. G-1
Location Baghouse Exit
Date 1-7-80
Operator J.M. Martoff
G.R. Brown

Start Time 1105 1141
Stop Time 1135
Ambient Temp. °F 50
Barom. Press. "Hg 29.04
Nozzle Diam. In. 1/4
Probe Length 8'

Sample Box No. 1/2
Meter Box No.
Meter $\Delta H_@$ 1.89
Heater Box Setting, °F 250
Probe Heater Setting, °F 250
Leak Rate @ 8 "Hg .003 Post-Test 0.015
9"

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	
W1	1105	576.0	1.60	3.41	468	272	46	282	64	56	6.7	-10.4	
W.2	1110	581.0	1.60	3.41	475	282	46	260	69	57	6.7		
W.3	1115	585.7	1.75	3.72	480	275	48	234	74	59	6.7		
W.4	1120	590.1	1.90	4.04	484	264	52	259	77	62	8.0		
W.5	1125	596.4	1.50	3.20	476	260	55	265	79	64	6.6		
W.6	1130	601.4	1.75	3.72	475	258	57	263	81	65	7.4	-10.5	
	1135	607.0											
E1	1141	607.7	1.70	3.62	475	248	54	246	81	68	7.2	-10.5	
E2	1146	612.5	1.70	3.62	478	250	52	265	83	69	7.2		
E3	1151	617.8	1.75	3.72	483	256	54	266	86	71	7.5		
E4	1156	623.1	1.95	4.15	476	261	55	260	86	72	8.5		
E5	1201	628.8	1.90	4.05	476	263	59	264	87	73	8.5		
E6	1206	634.4	1.90	4.05	476	262	61	260	87	74	8.4	-10.5	
	1211	640.1											
			$\sqrt{\Delta P}$										
	60	634	1.32	3.73	477				73			-10.4	

PART. gr/dscf lb/hr
TOTAL
NET
SOLID

GAS VEL., fps
VOLUME, dscfm
MOISTURE, %

COMMENTS:

TEST OBSERVERS:
Howard DeVorkin EPA Contract
Bob Hilovsky - SCAQMD

5106638

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

alysis Date(s) 1/7/80 – 1/15/80 Analytical Chemist Samuel Deutsch

mple Date 1/7/80 Run No. G-1 Location EQC Lab.
Lab.No. 40413

ISTURE DATA:

Final Vol. H_2O in Imp.	253	ml.	5. Final Wt. Silica Gel	757.8	gm.
Initial Vol. H_2O in Imp.	200	ml.	6. Initial Wt. Silica Gel	737.7	gm.
Vol. H_2O Condensed	53	ml.	7. Weight Gain	20.1	gm.
Vol.wash H_2O	102	ml.			

RTICULATE DATA: (Front Half:) (Back Half:)

. Final Filter Weight	344.7	mg.	13. Organic Extract	2.4	mg.
Initial Filter Weight	341.0	mg.	14. Aqueous Insolubles	.	mg.
Filter Particulate	3.8	mg.	15. Aqueous Solubles	8.1	mg.
Probe Particulate	6.9	mg.	16. Total Particulate	10.5	mg.
Total Particulate	10.7	mg.	17. $H_2SO_4.2H_2O$ Assumption	0.7	mg.
			18. Net Particulate	9.8	mg.
Acetone Wash	69	ml.			

LUE GAS ANALYSES

lecular Weight Determination: Room Temp. 70°F Barom. Press. 29.06" Hg

Component		(Bag ANALYSIS)			
. $\%CO_2$	15.1	@ 2.5% H_2O	=	15.5 dry	Horiba IR Analyzer
. $\%O_2$	12.0	"		12.3 "	Teledyne O_2 Analyzer
. %CO	0.5	"		0.5 "	Horiba IR Analyzer ✓
. $\%N_2$				71.7 "	by difference

Other

. _____

510639

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION *Battery G Coke Oven Baghouse Exit* DATE *1/7/80*

RUN NO. *G-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} *53* ml.

2. Silica Gel, W_{H_2O} *20.1* gm.

D. Particulate Weight:

1. Front Half, M_f *0.0107* gm.

2. Back Half, M_b *0.0105* gm.

3. Back Half $H_2SO_4 \cdot 2H_2O$ *0.0007* gm.

4. *Back Half Organic, M_o 0.0024 gm.*

E. Volume metered

V_m = *63.4* CF x DGMCF (*1.0*) = *63.4* CF

F. Average $\sqrt{\Delta P}$ *1.32* $(''H_2O)^{\frac{1}{2}}$

G. Average ΔH *3.73* $''H_2O/13.6$ = *0.27* "Hg

H. Average meter temperature, T_m *73* °F + 460 = *533* °R

I. Average stack temperature, T_s *477* °F + 460 = *937* °R

J. Stack absolute pressure, P_s *28.27* "Hg

K. Stack static pressure *-10.4* $''H_2O$

L. Barometric pressure, P_b *29.04* "Hg

M. % CO_2 *15.5*; % O_2 *12.3*; % CO *0.5*; % N_2 *71.7*

N. Area of stack, A_s *21.17* ft^2

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

P. Pitot tube factor, C_p *0.85*

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II. Calculations:

A. Standard Volume Metered

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

$$V_{m(std)} = 17.380 \times (\underline{63.4}\ CF) \times \frac{(\underline{29.31}\ "Hg)}{(\underline{533}\ ^oR)} = \underline{60.6}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

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

$$V_{wc(std)} = 0.04636 \times (\underline{63}\ ml.) = \underline{2.5}\ scf$$

2. H_2O collected in silica gel

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

$$V_{wsg(std)} = 0.04644 \times (\underline{20.1}\ gm.) = \underline{0.9}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{2.5}\ scf) + (\underline{0.9}\ scf)}{(\underline{2.5}\ scf) + (\underline{0.9}\ scf) + (\underline{60.6}\ scf)} = \underline{0.053}$$

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

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

$$M_d = (0.44)\ \underline{15.5}\ \%\ CO_2 + (0.32)\ \underline{12.3}\ \%\ O_2 + (0.28)\ \underline{72.2}\ \%(N_2+CO)$$

$$= \underline{30.97}\ lb/lb\text{-}mole$$

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

$$M_s = (\underline{30.97})\ (1 - \underline{0.053}) + 18\ (\underline{0.053}) = \underline{30.28}\ lb/lb\text{-}mol$$

D. Average Stack Gas Velocity

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

$$\overline{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{937}\ ^oR)}{(\underline{28.27}\ "Hg)\ (\underline{30.28}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{1.32}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{100.3}\ ft/sec$$

510641

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{100.3}\ \text{ft/sec})(\underline{21.17}\ \text{ft}^2)(1 - \underline{0.053})\ \frac{(\underline{28.27}\ \text{"Hg})}{(\underline{937}\ ^\circ\text{R})}$$

$$= \underline{3795788}\ \text{dscfh}/60 = \underline{63263}\ \text{dscfm}$$

F. Pollutant Mass Rate (Solid Part.- Rule 405a)

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

$M' = M_b - M_o - (H_2SO_4 \cdot 2H_2O)$
$.0105 - .0024 - .0007$

$$PMR = \frac{(\underline{.0107 + .0074}\ \text{gm.})}{(\underline{60.6}\ \text{dscf})} \times (\underline{3795788}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{2.50}\ \text{lb/hr}$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0107}\ \text{gm}) + (\underline{0.0105}\ \text{gm})}{(\underline{60.6}\ \text{dscf})} \times 15.43 = \underline{0.0054}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0107}\ \text{gm}) + (\underline{0.0105}\ \text{gm}) - (\underline{0.0007}\ \text{gm})}{(\underline{60.6}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0052}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0107}\ \text{gm})}{(\underline{60.6}\ \text{dscf})} \times 15.43 = \underline{0.0027}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(\underline{937}\ ^{o}R)(\underline{60.6}\ dscf)}{(\underline{60}\ min)(\underline{100.3}\ ft/sec)(\underline{0.00034}\ ft^2)(\underline{28.27}\ "Hg)(1 - \underline{0.053})}$$

$$= \underline{99.1}$$

(Std Conditions: 60 °F and 29.92 "Hg)

510643

Run G-1

"G" Stack Baghouse – 1/7/80 1:49 pm.

Time	Δ P - compartments - "H2O 1	2	3	4	5	6	Total Δ P	INLET TEMP.	% Opacity	
10	3.1	3.1	3.1	3.1	2.9		4.3	490	3 *	* lens not cleaning
25	3.1	3.1	3.1	3.1	2.9		4.3	473	3	
38	3.1	3.1	3.1	3.1	2.9		4.3	484	3	
50	3.1	3.1	3.1	3.1	2.9		4.2	500	3	
200	3.1	3.1	3.1	3.1	3.0		4.4	500	3	
210	3.2	3.1	3.1	3.2	3.0		4.4	484	3	

510644

Test G-3

Particulate Field Data

Laboratory Analysis Data

Calculations

Baghouse Data

510645

Plant KSC - Coke "G"
Run No. G-3
Location Baghouse Exit
Date 1-8-80
Operator T.A. Hartzoff
G.K. Brown

Start Time 0955 - 1037
Stop Time 1031 - 1113
Ambient Temp. °F 61
Barom. Press. "Hg 29.11
Nozzle Diam. In. 3/16
Probe Length 8'

Sample Box No. 1
Meter Box No. 2
Meter ΔH@ 1.39
Heater Box Setting, °F 250
Probe Heater Setting, °F 250
Leak Rate @ 8 "Hg 0.0 Post-Test 0.0

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	
W-1	0	702.6	1.9	1.43	463	256	53	264	74	66	2.5	-15.2	
W-2	6	706.5	1.8	1.35	467	250	51	263	79	66	2.5		
W-3	12	710.2	2.0	1.50	470	258	50	234	84	69	2.5		
W-4	18	714.1	2.0	1.50	474	245	50	250	88	73	2.6		
W-5	24	718.1	1.5	1.13	477	241	50	275	89	74	2.2		
W-6	30	721.6	1.85	1.39	471	240	52	239	92	76	2.5	-12.4	
	36	725.7											
E-1	0	725.9	1.90	1.43	466	236	53	245	87	78	2.7	-12.1	
E-2	6	729.8	2.0	1.50	469	244	50	262	92	79	2.8		
E-3	12	733.9	2.05	1.54	474	249	50	225	94	79	2.9		
E-4	18	738.1	2.20	1.65	468	252	52	263	96	80	3.0		
E-5	24	742.3	2.15	1.61	469	255	53	246	98	83	3.0		
E-6	30	746.6	2.15	1.61	472	255	52	244	99	84	3.0	-13.6	
	36	751.9											
			$\sqrt{\Delta P}$										
	72	48.1	1.40	1.47	470				82			-13.3	

PART., gr/dscf _____ lb/hr _____
TOTAL _____ _____
NET _____ _____
SOLID _____ _____

GAS VEL., fps _____
VOLUME, dscfm _____
MOISTURE, % _____

COMMENTS: Note: bring/print

TEST OBSERVERS: Howard De Kinder, Representing EPA

510645

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

lysis Date(s) 1/8/80 - 1/15/80 Analytical Chemist Samuel Deutsch

ple Date 1/8/80 Run No. E-3 Location EPC Lab
Lab.No. 40420

STURE DATA:

Final Vol. H_2O in Imp.	250	ml.	5.	Final Wt. Silica Gel	789.0 gm.
Initial Vol. H_2O in Imp.	200	ml.	6.	Initial Wt. Silica Gel	777.8 gm.
Vol. H_2O Condensed	50	ml.	7.	Weight Gain	11.2 gm.
Vol.wash H_2O	195	ml.			

TICULATE DATA: (Front Half:) (Back Half:)

Final Filter Weight	347.9 mg.	13.	Organic Extract	0.1	mg.
Initial Filter Weight	343.8 mg.	14.	Aqueous Insolubles		mg.
Filter Particulate	4.1 mg.	15.	Aqueous Solubles	6.3	mg.
Probe Particulate	9.3 mg.	16.	Total Particulate	6.4	mg.
Total Particulate	13.4 mg.	17.	$H_2SO_4 \cdot 2H_2O$	0.5	mg.
		18.	Net Particulate	5.9	mg.
Acetone Wash	12.9 ml.				

UE GAS ANALYSES

ecular Weight Determination: Room Temp. 73°F Barom.Press. 29.03 "Hg.

Component		(BAG ANALYSIS)		
$\%CO_2$	14.2	@ 2.8% H_2O	≡ 14.6 dry	Horiba I.R. Analyzer
$\%O_2$	12.0	"	≡ 12.3 "	Teledyne Portable Oxygen Analyzer
%CO	0.46	"	≡ 0.47 " ✓	Horiba I.R. Analyzer
$\%N_2$			72.63 "	by difference.

ther

510647

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION *Battery G Coke Oven Baghouse Exit* DATE *1/8/80*

RUN NO. *G-3*

I. Necessary Data:

A. No. of traverse points *12*

B. Total test time, (θ) *72* minutes

C. Water collected:

1. Impinger H_2O; V_{H_2O} *50* ml.

2. Silica Gel, W_{H_2O} *11.2* gm.

D. Particulate Weight:

1. Front Half, M_f *0.0134* gm.

2. Back Half, M_b *0.0064* gm.

3. Back Half $H_2SO_4 \cdot 2H_2O$ *0.0005* gm.

4. *Back Half Organic, M_o* *0.0001* gm.

E. Volume metered

V_m = *48.1* CF x DGMCF (1.0) = *48.1* CF

F. Average $\sqrt{\Delta P}$ *1.40* $(\text{"}H_2O)^{\frac{1}{2}}$

G. Average ΔH *1.47* "H_2O/13.6 = *0.11* "Hg

H. Average meter temperature, T_m *82* °F + 460 = *542* °R

I. Average stack temperature, T_s *470* °F + 460 = *930* °R

J. Stack absolute pressure, P_s *- 28.13* "Hg

K. Stack static pressure *-13.3* "H_2O

L. Barometric pressure, P_b *29.11* "Hg

M. % CO_2 *14.6*; % O_2 *12.3*; % CO *0.47*; % N_2 *72.63*

N. Area of stack, A_s *21.17* ft^2

O. Area of nozzle, A_n *0.000192* ft^2

P. Pitot tube factor, C_p *0.85*

510648

II. Calculations:

A. Standard Volume Metered

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

$$V_{m(std)} = 17.380 \times (\underline{48.1}\ CF) \times \frac{(\underline{29.22}\ "Hg)}{(\underline{542}\ ^oR)} = \underline{45.1}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

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

$$V_{wc(std)} = 0.04636 \times (\underline{50}\ ml.) = \underline{2.3}\ scf$$

2. H_2O collected in silica gel

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

$$V_{wsg(std)} = 0.04644 \times (\underline{11.2}\ gm.) = \underline{0.5}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{2.3}\ scf) + (\underline{0.5}\ scf)}{(\underline{2.3}\ scf) + (\underline{0.5}\ scf) + (\underline{45.1}\ scf)} = \underline{0.058}$$

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

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

$$M_d = (0.44)\ \underline{14.6}\ \%\ CO_2 + (0.32)\ \underline{12.3}\ \%\ O_2 + (0.28)\ \underline{73.1}\ \%(N_2+CO)$$

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

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

$$M_s = (\underline{30.83})\ (1 - \underline{0.058}) + 18\ (\underline{0.058}) = \underline{30.09}\ lb/lb\text{-}mol$$

D. Average Stack Gas Velocity

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

$$\overline{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{930}\ ^oR)}{(\underline{28.13}\ "Hg)\ (\underline{30.09}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{1.40}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{106.6}\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{106.6}\ \text{ft/sec})(\underline{21.17}\ \text{ft}^2)(1 - \underline{0.058})\ \frac{(\underline{28.13}\ \text{"Hg})}{(\underline{930}\ ^\circ\text{R})}$$

$$= \underline{4023090}\ \text{dscfh}/60 = \underline{67050}\ \text{dscfm}$$

F. Pollutant Mass Rate (Solid Part. - Rule 405a)

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

$M' = M_b - M_o - (H_2SO_4 \cdot 2H_2O)$
$.0064 - .0001 - .0005$

$$PMR = \frac{(\underline{.0134 + .0058}\ \text{gm.})}{(\underline{45.1}\ \text{dscf})} \times (\underline{4023090}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{3.77}\ \text{lb/hr}$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0134}\ \text{gm}) + (\underline{0.0064}\ \text{gm})}{(\underline{45.1}\ \text{dscf})} \times 15.43 = \underline{0.0068}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0134}\ \text{gm}) + (\underline{0.0064}\ \text{gm}) - (\underline{0.0005}\ \text{gm})}{(\underline{45.1}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0066}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0134}\ \text{gm})}{(\underline{45.1}\ \text{dscf})} \times 15.43 = \underline{0.0046}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(930\ ^{o}R)(451\ dscf)}{(72\ min)(106.6\ ft/sec)(0.000192\ ft^2)(28.13\ "Hg)(1 - 0.058)}$$

$$= 103.0$$ ✓

(Std Conditions: 60 °F and 29.92 "Hg)

510651

"G" STACK BAGHOUSE — Run G-3 1/8/80 14m

	ΔP-compartments 1	2	3	4	5	6	Total ΔP	INLET TEMP.	% Opacity
12	4.4	4.3	4.3	4.3	4.3		5.6	473	2
15	4.4	4.3	4.3	4.4	4.3		5.6	484	2
34	4.4	4.3	4.3	4.4	4.3		5.6	473	2
047	4.6	4.5	4.5	4.5	4.4		5.7	479	2
05	4.7	4.6	4.7	4.7	4.6		6.0	479	2

510652

Test G-4

Particulate Field Data

Laboratory Analysis Data

Calculations

Baghouse Data

510653

Plant KSC - Coke "G" | Start Time E 1310 W 1344 | Sample Box No. 1
Run No. G-4 | Stop Time 1340 1414 | Meter Box No. 2
Location Baghouse Exit | Ambient Temp. °F 58 | Meter ΔH@ 1.87
Date 1-8-80 | Barom. Press. "Hg 29.03 | Heater Box Setting, °F 250
Operator J.A. Hartroft | Nozzle Diam. In. 3/16 | Probe Heater Setting, °F 250
G.R. Brewer | Probe Length 8' | Leak Rate @6 "Hg 0.000 Post-Test 6.5" Hg = 0.

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	
E1	0	751.3	1.40	1.05	468	266	52	239	77	70	2.4	-11.6	
E2	5	754.0	1.60	1.20	473	268	51	244	85	72	2.5		
E3	10	756.9	1.80	1.35	477	271	49	258	89	73	2.7		
E4	15	760.0	2.50	1.88	468	271	48	260	93	76	4.0		
E5	20	763.7	2.30	1.73	466	265	48	252	94	79	3.7		
E6	25	767.4	2.70	2.03	470	259	49	252	96	81	4.2	-12.8	
	30	771.3											
W-1	0	771.7	1.70	1.28	465	250	50	225	92	81	3.0	-12.8	
W-2	5	774.8	1.80	1.35	470	247	48	249	98	83	3.1		
W-3	10	778.0	2.0	1.50	469	245	48	365	101	85	3.1		
W-4	15	781.3	2.0	1.50	466	245	49	250	102	87	3.1		
W-5	20	784.6	1.6	1.20	469	243	50	245	103	88	2.5		
W-6	25	787.5	1.9	1.43	471	241	50	237	108	88	3.0	-13.3	
	30	790.9											
			$\sqrt{\Delta P}$										
	60	39.2	1.39	1.46	469				87			-12.6	

PART. gr/dscf lb/hr
TOTAL
NET
SOLID

GAS VEL., fps
VOLUME, dscfm
MOISTURE, %

COMMENTS:

TEST OBSERVERS:
Howard DeVorkin, Representing EPA

510654

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

.lysis Date(s) 1/8/80 – 1/15/80 Analytical Chemist Samuel Deutsch

ple Date 1/8/80 Run No. E-11 Location EQC Lab
Lab.No. 40471

'STURE DATA:

Final Vol. H_2O in Imp.	265	ml.	5. Final Wt. Silica Gel	794.4	gm.
Initial Vol. H_2O in Imp.	200	ml.	6. Initial Wt. Silica Gel	782.9	gm.
Vol. H_2O Condensed	65	ml.	7. Weight Gain	11.5	gm.
Vol. wash H_2O	325	ml.			

'TICULATE DATA: (Front Half:) (Back Half:)

Final Filter Weight	342.8	mg.	13. Organic Extract	9.3	mg.
Initial Filter Weight	338.3	mg.	14. Aqueous Insolubles		mg.
Filter Particulate	4.5	mg.	15. Aqueous Solubles	11.2	mg.
Probe Particulate	10.3	mg.	16. Total Particulate	20.5	mg.
Total Particulate	14.8	mg.	17. $H_2SO_4 \cdot 2H_2O$	2.6	mg.
			18. Net Particulate	17.9	mg.
Acetone Wash	126	ml.			

LUE GAS ANALYSES

lecular Weight Determination: Room Temp. 73°F Barom. Press. 29.03

Component	(BAG ANALYSIS)			
. $\%CO_2$	14.0 @ 2.8% H_2O	= 14.4 dry		: Orsat Analyzer
. $\%O_2$	12.0 "	12.3 "		: Teledyne Portable Oxygen Analyzer
. %CO	0.68 "	0.7 "	✓	: Orsat Analyzer
. $\%N_2$		72.6 "		by difference

Other

.

510655

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION: Battery G Coke Oven Baghouse Exit DATE 1/8/80

RUN NO. G-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} 65 ml.
2. Silica Gel, W_{H_2O} 11.5 gm.

D. Particulate Weight:
1. Front Half, M_f 0.0148 gm.
2. Back Half, M_b 0.0205 gm.
3. Back Half $H_2SO_4 \cdot 2H_2O$ 0.0026 gm.
4. Back Half Organic, M_o 0.0093 gm.

E. Volume metered

V_m = 39.2 CF x DGMCF (1.0) = 39.2 CF

F. Average $\sqrt{\Delta P}$ 1.39 $(''H_2O)^{\frac{1}{2}}$

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

H. Average meter temperature, T_m 87 °F + 460 = 547 °R

I. Average stack temperature, T_s 469 °F + 460 = 929 °R

J. Stack absolute pressure, P_s 28.10 "Hg

K. Stack static pressure −12.6 $''H_2O$

L. Barometric pressure, P_b 29.03 "Hg

M. % CO_2 14.4 ; % O_2 12.3 ; % CO 0.70 ; % N_2 72.6

N. Area of stack, A_s 21.17 ft^2

O. Area of nozzle, A_n 0.000192 ft^2

P. Pitot tube factor, C_p 0.85

510656

II. Calculations:

A. Standard Volume Metered

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

$$V_{m(std)} = 17.380 \times (\underline{39.2}\ CF) \times \frac{(\underline{29.14}\ "Hg)}{(\underline{547}\ ^oR)} = \underline{36.3}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

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

$$V_{wc(std)} = 0.04636 \times (\underline{65}\ ml.) = \underline{3.0}\ scf$$

2. H_2O collected in silica gel

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

$$V_{wsg(std)} = 0.04644 \times (\underline{11.5}\ gm.) = \underline{0.5}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{3.0}\ scf) + (\underline{0.5}\ scf)}{(\underline{3.0}\ scf) + (\underline{0.5}\ scf) + (\underline{36.3}\ scf)} = \underline{0.088}$$

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

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

$$M_d = (0.44)\ \underline{14.4}\ \%\ CO_2 + (0.32)\ \underline{12.3}\ \%\ O_2 + (0.28)\ \underline{73.3}\ \%(N_2+CO)$$

$$= \underline{30.80}\ lb/lb\text{-}mole$$

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

$$M_s = (\underline{30.80})\ (1 - \underline{0.088}) + 18\ (\underline{0.088}) = \underline{29.47}\ lb/lb\text{-}mole$$

D. Average Stack Gas Velocity

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

$$\overline{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{929}\ ^oR)}{(\underline{28.10}\ "Hg)\ (\underline{29.47}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{1.39}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{106.6}\ ft/sec$$

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{106.6}\ \text{ft/sec})(\underline{21.17}\ \text{ft}^2)(1 - \underline{0.088})\ \frac{(\underline{28.10}\ \text{"Hg})}{(\underline{929}\ ^\circ\text{R})}$$

$$= \underline{3895000}\ \text{dscfh}/60 = \underline{64917}\ \text{dscfm}$$

F. Pollutant Mass Rate (*Solid Part.* - Rule 405a)

$$PMR = \frac{M_f + M'}{V_{m(std)}} \times \overline{Q}_s \qquad M' = M_b - M_o - (H_2SO_4 \cdot 2H_2O)$$

$$.0205 - .0093 - .0026$$

$$PMR = \frac{(\underline{.0148 + .0086}\ \text{gm.})}{(\underline{36.3}\ \text{dscf})} \times (\underline{3895000}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{5.53}\ \text{lb/hr}$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0148}\ \text{gm}) + (\underline{0.0205}\ \text{gm})}{(\underline{36.3}\ \text{dscf})} \times 15.43 = \underline{0.0150}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0148}\ \text{gm}) + (\underline{0.0205}\ \text{gm}) - (\underline{0.0026}\ \text{gm})}{(\underline{36.3}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0139}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0148}\ \text{gm})}{(\underline{36.3}\ \text{dscf})} \times 15.43 = \underline{0.0063}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(\underline{929}\ ^{\circ}R)(\underline{36.3}\ dscf)}{(\underline{60}\ min)(\underline{106.6}\ ft/sec)(\underline{0.000192}\ ft^2)(\underline{28.10}\ "Hg)(1 - \underline{0.083})}$$

$$= \underline{102.8}$$ ✓

(Std Conditions: 60 °F and 29.92 "Hg)

510659

"G" STACK BAGHOUSE – RUN G-4 1/8/70 HAA.

	ΔP compartments – "H₂O								
12	1	2	3	4	5	6	Total ΔP	INLET TEMP.	% Opacity
314	5.0	4.9	4.8	4.8	4.9		5.9	484	2
324	5.0	4.9	4.9	5.0	5.0		6.0	473	2
350	4.7	4.7	4.7	4.7	4.6		5.9	494	2
	Reverse air cleaning gives negative ΔP of 0.7 – 0.8 "H₂O								
	on section being cleaned. Occurred during 1st 30 min. of sampling								
	Total ΔP across baghouse rises to 9" H₂O								
	ΔP of other compartments rises to 7 – 7.5 "H₂O								
408	4.9	4.8	4.9	4.8	4.7		6.0	484	2

510600

Test F-1

Particulate Field Data

Laboratory Analysis Data

Calculations

Baghouse Data

Plant KSC - Coke F
Run No. F-1
Location Baghouse Exit
Date 1-9-80
Operator J. H. Hartsoff
G. R. Brown

Start Time 0954 - 1029
Stop Time 1024 - 1059
Ambient Temp. °F 58
Barom. Press. "Hg 28.85
Nozzle Diam. In. 1/4
Probe Length 8'

Sample Box No. 1
Meter Box No. 2
Meter ΔH@ 1.88
Heater Box Setting, °F 250
Probe Heater Setting, °F 250
Leak Rate @ 7.5"Hg .001 Post-Test .001

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	
W-1	0	792.1	0.77	1.64	434	272	49	275	65	58	3.2	-11.1	
W-2	5	795.3	0.70	1.49	442	294	48	275	71	58	3.2		
W-3	10	798.7	0.76	1.62	443	276	47	240	74	59	3.2		
W-4	15	802.1	0.76	1.62	444	244	48	250	77	61	3.2		
W-5	20	805.6	0.75	1.60	443	207	48	233	80	65	3.3		
[illegible]	25	809.1	0.73	1.55	442	225	51	235	84	69	3.2	-11.3	
	30	812.6											
F-1	0	812.8	0.74	1.58	437	287	55	235	81	70	3.0	-11.3	
F-2	5	816.1	[illegible]	1.56	436	265	55	237	[illegible]	70	3.0		
F-3	10	819.4	0.70	1.49	435	252	55	237	82	71	3.0		
F-4	15	822.6	0.70	1.49	435	233	54	237	87	72	3.0		
F-5	20	[illegible]	[illegible]	1.46	[illegible]	[illegible]	55	249	86	73	3.0		
F-6	25	828.1	0.69	1.46	444	242	57	249	87	74	3.0	-11.4	
	30	832.2											
			$\sqrt{\Delta P}$										
	60	399	0.853	1.54	438				73			-11.3	

PART. gr/dscf lb/hr
TOTAL
NET
SOLID

GAS VEL., fps
VOLUME, dscfm
MOISTURE, %

COMMENTS:

TEST OBSERVERS: Bob Adovsky JAGRD

510692

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

lysis Date(s) 1/9/80 - 1/15/80 Analytical Chemist Samuel Deutsch

ple Date 1/9/80 Run No. E-1 Location EQC Lab
Lab.No. 40422

STURE DATA:

Final Vol. H_2O in Imp.	295	ml.	5. Final Wt. Silica Gel	789.4	gm.
Initial Vol. H_2O in Imp.	200	ml.	6. Initial Wt. Silica Gel	778.0	gm.
Vol. H_2O Condensed	95	ml.	7. Weight Gain	11.4	gm.
Vol.wash H_2O	307	ml.			

RTICULATE DATA: (Front Half:) (Back Half:)

Final Filter Weight	353.5	mg.	13. Organic Extract	1.2	mg.
Initial Filter Weight	336.5	mg.	14. Aqueous Insolubles		mg.
Filter Particulate	17.2	mg.	15. Aqueous Solubles	29.9	mg.
Probe Particulate	21.2	mg.	16. Total Particulate	31.1	mg.
Total Particulate	38.4	mg.	17. $H_2SO_4 \cdot 2H_2O$	21.2	mg.
			18. Net Particulate	9.9	mg.
Acetone Wash	100	ml.			

LUE GAS ANALYSES

lecular Weight Determination: Room Temp. 70°F Barom.Press. 28.80 "Hg

Component	(BAF ANALYSIS)			
. $\%CO_2$	6.4 @ 2½% H_2O	= 6.6	dry	Horiba Infrared Analyzer
. $\%O_2$	14.5 "	14.9	"	Tekdyne O_2 Analyzer
. %CO	0.03 "	0.03	"	Horiba Infrared Analyzer
. $\%N_2$		78.47	"	by difference

Other

510663

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION *Battery F Coke Oven Baghouse Exit* DATE *1/9/80*

RUN NO. *F-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} *95* ml.

2. Silica Gel, W_{H_2O} *11.4* gm.

D. Particulate Weight:

1. Front Half, M_f *0.0384* gm.

2. Back Half, M_b *0.0311* gm.

3. Back Half $H_2SO_4 \cdot 2H_2O$ *0.0212* gm.

4. *Back Half Organic*, M_o *0.0012* gm.

E. Volume metered

V_m = *39.9* CF x DGMCF (*1.0*) = *39.9* CF

F. Average $\sqrt{\Delta P}$ *0.353* $(\text{"}H_2O)^{\frac{1}{2}}$

G. Average ΔH *1.54* "H_2O/13.6 = *0.11* "Hg

H. Average meter temperature, T_m *73* °F + 460 = *533* °R

I. Average stack temperature, T_s *438* °F + 460 = *898* °R

J. Stack absolute pressure, P_s *28.02* "Hg

K. Stack static pressure *-11.3* "H_2O

L. Barometric pressure, P_b *28.85* "Hg

M. % CO_2 *6.6*; % O_2 *14.9*; % CO *0.03*; % N_2 *78.47*

N. Area of stack, A_s *21.17* ft^2

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

P. Pitot tube factor, C_p *0.85*

510664

II. Calculations:

A. Standard Volume Metered

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

$$V_{m(std)} = 17.380 \times (\underline{39.9}\ CF) \times \frac{(\underline{28.96}\ "Hg)}{(\underline{533}\ ^oR)} = \underline{37.7}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

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

$$V_{wc(std)} = 0.04636 \times (\underline{95}\ ml.) = \underline{4.4}\ scf$$

2. H_2O collected in silica gel

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

$$V_{wsg(std)} = 0.04644 \times (\underline{11.4}\ gm.) = \underline{0.5}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{4.4}\ scf) + (\underline{0.5}\ scf)}{(\underline{4.4}\ scf) + (\underline{0.5}\ scf) + (\underline{37.7}\ scf)} = \underline{0.115}$$

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

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

$$M_d = (0.44)\ \underline{6.6}\ \%\ CO_2 + (0.32)\ \underline{14.9}\ \%\ O_2 + (0.28)\ \underline{78.5}\ \%\ (N_2 + CO)$$

$$= \underline{29.65}\ lb/lb\text{-}mole$$

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

$$M_s = (\underline{29.65})\ (1 - \underline{0.115}) + 18\ (\underline{0.115}) = \underline{28.31}\ lb/lb\text{-}mole$$

D. Average Stack Gas Velocity

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

$$\overline{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{893}\ ^oR)}{(\underline{28.02}\ "Hg)\ (\underline{28.31}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{0.853}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{65.9}\ ft/sec$$

510665

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{65.9}\ \text{ft/sec})(\underline{21.17}\ \text{ft}^2)(1 - \underline{0.115})\ \frac{(\underline{28.02}\ \text{"Hg})}{(\underline{898}\ ^\circ\text{R})}$$

$$= \underline{2410379}\ \text{dscfh}/60 = \underline{40173}\ \text{dscfm}$$

F. Pollutant Mass Rate (Solid Part. - Rule 405a)

$$\text{PMR} = \frac{M_f + M'}{V_{m(std)}} \times \overline{Q}_s \qquad M' = M_b - M_o - (H_2SO_4 \cdot 2H_2O)$$

$$.0311 - .0012 - .0212$$

$$\text{PMR} = \frac{(\underline{.0384 + .0087}\ \text{gm.})}{(\underline{37.7}\ \text{dscf})} \times (\underline{2410379}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{6.63}\ \text{lb/hr}$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0384}\ \text{gm}) + (\underline{0.0311}\ \text{gm})}{(\underline{37.7}\ \text{dscf})} \times 15.43 = \underline{0.0284}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0384}\ \text{gm}) + (\underline{0.0311}\ \text{gm}) - (\underline{0.0212}\ \text{gm})}{(\underline{37.7}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0198}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0384}\ \text{gm})}{(\underline{37.7}\ \text{dscf})} \times 15.43 = \underline{0.0157}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(898\ ^{o}R)(37.7\ dscf)}{(60\ min)(65.9\ ft/sec)(0.000341\ ft^2)(28.02\ "Hg)(1 - 0.115)}$$

$$= 97.1 \checkmark$$

(Std Conditions: 60 °F and 29.92 "Hg)

510667

"F" STACK BAGHOUSE - Run F-1 1/9/80

H.J.M.

HR	1	2	3	4	5	6	Total ΔP	INLET TEMP.	o/p Opacity	
	compartments									
955	6.3	6.3	6.2	6.2	6.2		6.8	470	—	not operating
013	6.3	6.3	6.2	6.3	6.2		6.8	480	—	
030	6.5	6.4	6.4	6.5	6.4		7.0	460	—	
040	6.4	6.3	6.2	6.4	6.4		7.0	475	—	
050	6.5	6.5	6.4	6.5	6.5		7.2	450	—	
100	6.5	6.4	6.5	6.5	6.5		7.2	455	—	

510668

Test F-3

Particulate Field Data

Laboratory Analysis Data

Calculations

Baghouse Data

510669

Plant ASC - Coke "F"
Run No. F-3
Location Bypass Exit
Date 1-10-80
Operator J.A. Martzolf
C.R. Brown

Start Time 1205 1238
Stop Time 1235 1305
Ambient Temp. °F 57
Barom. Press. "Hg 28.99
Nozzle Diam. In. 1/4
Probe Length 5'

Sample Box No. 1
Meter Box No. 2
Meter ΔH@ 1.89
Heater Box Setting, °F 250
Probe Heater Setting, °F 250
Leak Rate @ 5"Hg 0.0 Post-Test 0.01

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-1	0	875.9	0.75	1.60	433	244	58	263	69	66	3.2	-1.8	
E-2	5	879.2	0.71	1.51	440	259	55	272	77	67	3.2		
E-3	10	882.6	0.76	1.62	441	259	53	256	81	65	3.2		
E-4	15	886.1	0.74	1.58	436	238	54	247	84	70	3.2		
E-5	20	889.6	0.70	1.49	435	240	54	236	85	71	3.2		
E-6	25	893.0	0.73	1.55	436	252	54	253	87	72	3.2	-10.0	
	30	896.3											
W-1	0	896.5	0.85	1.80	436	255	56	249	86	74	3.6	-9.8	
W-2	5	899.9	0.63	1.34	435	239	54	262	89	75	3.0		
W-3	10	902.7	0.82	1.75	435	235	55	255	91	77	3.5		
W-4	15	906.8	0.83	1.77	435	239	55	251	92	78	3.7		
W-5	20	910.6	0.82	1.75	435	259	57	241	93	79	3.6		
W-6	25	914.3	0.77	1.64	436	245	59	234	94	79	3.5	-9.9	
	30	917.9											
			$\sqrt{\Delta P}$										
	60	41.8	0.871	1.62	436				79			-9.9	

PART. gr/dscf lb/hr
TOTAL
NET
SOLID

GAS VEL., fps
VOLUME, dscfm
MOISTURE, %

COMMENTS:

TEST OBSERVERS:
Bob Hilovsky SCAQMD
Howard DeVoskin Representing EPA

510670

LABORATORY ANALYSIS DATA
PARTICULATE SOURCE SAMPLE

alysis Date(s) 1/10/80 - 1/15/80 Analytical Chemist Samuel Deutsch

mple Date 1/10/80 Run No. F-3 Location EQC Lab
Lab.No. 40427

ISTURE DATA:

Final Vol. H_2O in Imp.	285	ml.	5. Final Wt. Silica Gel	790.6	gm.
Initial Vol. H_2O in Imp.	200	ml.	6. Initial Wt. Silica Gel	780.0	gm.
Vol. H_2O Condensed	85	ml.	7. Weight Gain	10.6	gm.
Vol. wash H_2O	194	ml.			

RTICULATE DATA: (Front Half:) (Back Half:)

. Final Filter Weight	355.3	mg.	13. Organic Extract	1.2	mg.
Initial Filter Weight	337.1	mg.	14. Aqueous Insolubles		mg.
Filter Particulate	18.2	mg.	15. Aqueous Solubles	45.5	mg.
Probe Particulate	24.8	mg.	16. Total Particulate	46.7	mg.
Total Particulate	43.0	mg.	17. $H_2SO_4 \cdot 2H_2O$	39.5	mg.
			18. Net Particulate	7.2	mg.
Acetone Wash	100	ml.			

LUE GAS ANALYSES

lecular Weight Determination: Room Temp. 70°F Barom. Press. 29.0 "Hg

(GAS ANALYSIS)

Component				
). $\%CO_2$	5.8	@ 2½% H_2O = 5.9	dry	Horiba IR Analyzer
. $\%O_2$	14.7	" 15.1	"	Teledyne O_2 Analyzer
. %CO	0.02	" .02	"	Horiba IR Analyzer
. $\%N_2$		78.98	"	by difference

Other

1.

510671

METHOD 5 PARTICULATE TEST CALCULATION FORM

LOCATION Battery F Coke Oven Baghouse Exit DATE 1/10/80

RUN NO. F-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} 10.6 gm.

D. Particulate Weight:

1. Front Half, M_f 0.0430 gm.

2. Back Half, M_b 0.0467 gm.

3. Back Half $H_2SO_4 \cdot 2H_2O$ 0.0395 gm.

4. Back Half Organic, M_o 0.0012 gm.

E. Volume metered

V_m = 41.8 CF x DGMCF (1.0) = 41.8 CF

F. Average $\sqrt{\Delta P}$ 0.871 $(\text{"}H_2O)^{\frac{1}{2}}$

G. Average ΔH 1.62 "H_2O/13.6 = 0.12 "Hg

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

I. Average stack temperature, T_s 436 °F + 460 = 896 °R

J. Stack absolute pressure, P_s 28.26 "Hg

K. Stack static pressure −9.9 "H_2O

L. Barometric pressure, P_b 28.99 "Hg

M. % CO_2 5.9 ; % O_2 15.1 ; % CO 0.02 ; % N_2 78.98

N. Area of stack, A_s 21.17 ft^2

O. Area of nozzle, A_n 0.000341 ft^2

P. Pitot tube factor, C_p 0.85

510672

II. Calculations:

A. Standard Volume Metered

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

$$V_{m(std)} = 17.380 \times (\underline{41.8}\ CF) \times \frac{(\underline{29.11}\ "Hg)}{(\underline{539}\ ^oR)} = \underline{39.2}\ dscf$$

B. Moisture Content of Stack Gas

1. H_2O collected in impingers

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

$$V_{wc(std)} = 0.04636 \times (\underline{85.}\ ml.) = \underline{3.9}\ scf$$

2. H_2O collected in silica gel

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

$$V_{wsg(std)} = 0.04644 \times (\underline{10.6}\ gm.) = \underline{0.5}\ scf$$

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

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

$$B_{ws} = \frac{(\underline{3.9}\ scf) + (\underline{0.5}\ scf)}{(\underline{3.9}\ scf) + (\underline{0.5}\ scf) + (\underline{39.2}\ scf)} = \underline{0.101}$$

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

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

$$M_d = (0.44)\ \underline{5.9}\ \%\ CO_2 + (0.32)\ \underline{15.1}\ \%\ O_2 + (0.28)\ \underline{79.0}\ \%(N_2+CO)$$

$$= \underline{29.55}\ lb/lb\text{-}mole$$

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

$$M_s = (\underline{29.55})\ (1 - \underline{0.101}) + 18\ (\underline{0.101}) = \underline{28.38}\ lb/lb\text{-}mole$$

D. Average Stack Gas Velocity

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

$$\overline{V}_s = 85.48\ (\underline{0.85}) \left[\frac{(\underline{591}\ ^oR)}{(\underline{28.26}\ "Hg)\ (\underline{28.38}\ lb/mole)}\right]^{\frac{1}{2}} (\underline{0.871}\ "H_2O^{\frac{1}{2}})$$

$$= \underline{66.9}\ ft/sec$$

510673

E. Average Stack Gas Volumetric Flow Rate

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

$$= 62566.8\ (\underline{66.9}\ \text{ft/sec})(\underline{21.17}\ \text{ft}^2)(1 - \underline{0.101})\ \frac{(\underline{28.26}\ \text{"Hg})}{(\underline{896}\ ^{o}\text{R})}$$

$$= \underline{2512550}\ \text{dscfh}/60 = \underline{41876}\ \text{dscfm}$$

F. Pollutant Mass Rate (*Solid Part.* - Rule 405a)

$$PMR = \frac{M_f + M'}{V_{m(std)}} \times \overline{Q}_s \qquad M' = M_b - M_o - (H_2SO_4 \cdot 2H_2O)$$

$$.0467 - .0012 - .0395$$

$$PMR = \frac{(\underline{.043 + .006}\ \text{gm.})}{(\underline{39.2}\ \text{dscf})} \times (\underline{2512550}\ \text{dscfh}) \times \frac{1}{454\ \text{gm/lb}}$$

$$= \underline{6.92}\ \text{lb/hr}$$

G. Particulate Concentration

1. Total Particulate

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

$$C_t = \frac{(\underline{0.0430}\ \text{gm}) + (\underline{0.0467}\ \text{gm})}{(\underline{39.2}\ \text{dscf})} \times 15.43 = \underline{0.0353}\ \text{gr/dscf}$$

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

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

$$C_n = \frac{(\underline{0.0430}\ \text{gm}) + (\underline{0.0467}\ \text{gm}) - (\underline{0.0395}\ \text{gm})}{(\underline{39.2}\ \text{dscf})} \times 15.43$$

$$= \underline{0.0198}\ \text{gr/dscf}$$

3. Front Half Particulate

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

$$C_f = \frac{(\underline{0.0430}\ \text{gm})}{(\underline{39.2}\ \text{dscf})} \times 15.43 = \underline{0.0169}\ \text{gr/dscf}$$

H. % Isokinetic Variation

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

$$\% I = 0.0959 \times \frac{(\underline{896}\ ^{o}R)(\underline{39.2}\ dscf)}{(\underline{60}\ min)(\underline{66.9}\ ft/sec)(\underline{0.000341}\ ft^2)(\underline{28.26}\ "Hg)(1 - \underline{0.101})}$$

$$= \underline{96.9}$$ ✓

(Std Conditions: 60 °F and 29.92 "Hg)

510675

"F" STACK BAGHOUSE – 1/10/20

RUN F-3

#2	compartments 1	2	3	4	5	6	Total ΔP	INLET TEMP.	% OPacity
204	5.3	5.3	5.3	5.4	5.4		6.0	475	—
215	5.3	5.3	5.3	5.3	5.4		5.9	450	—
225	5.5	5.4	5.4	5.4	5.4		6.0	460	—
235	5.5	5.5	5.4	5.5	5.5		6.2	475	—
245	5.5	5.4	5.4	5.5	5.4		6.0	460	—
255	5.5	5.4	5.4	5.5	5.4		6.0	460	—
305	5.5	5.4	5.4	5.4	5.4		6.0	470	—

510676

Visible Emission Observations (1/8-10/80)

510677

VISIBLE EMISSION OBSERVATION RECORD

Company KAISER STEEL CORP — STACK OF F & G B/Hs

Date 1-10-80 Time First Sighted Plume NA

Time Start 1025 Time Stop 1050

Air Temperature 55° F Relative Humidity (est.) 90%

Wind Speed 0-5 Wind Direction W

Sky Condition Overcast Background Sky

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

Color (None) Dispersion Description NA

Stack Height 250 (ft) Observer location: 500 (ft) SE of stack

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

Emission Point STACK OF F & G B/H's for coke batteries

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				
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				

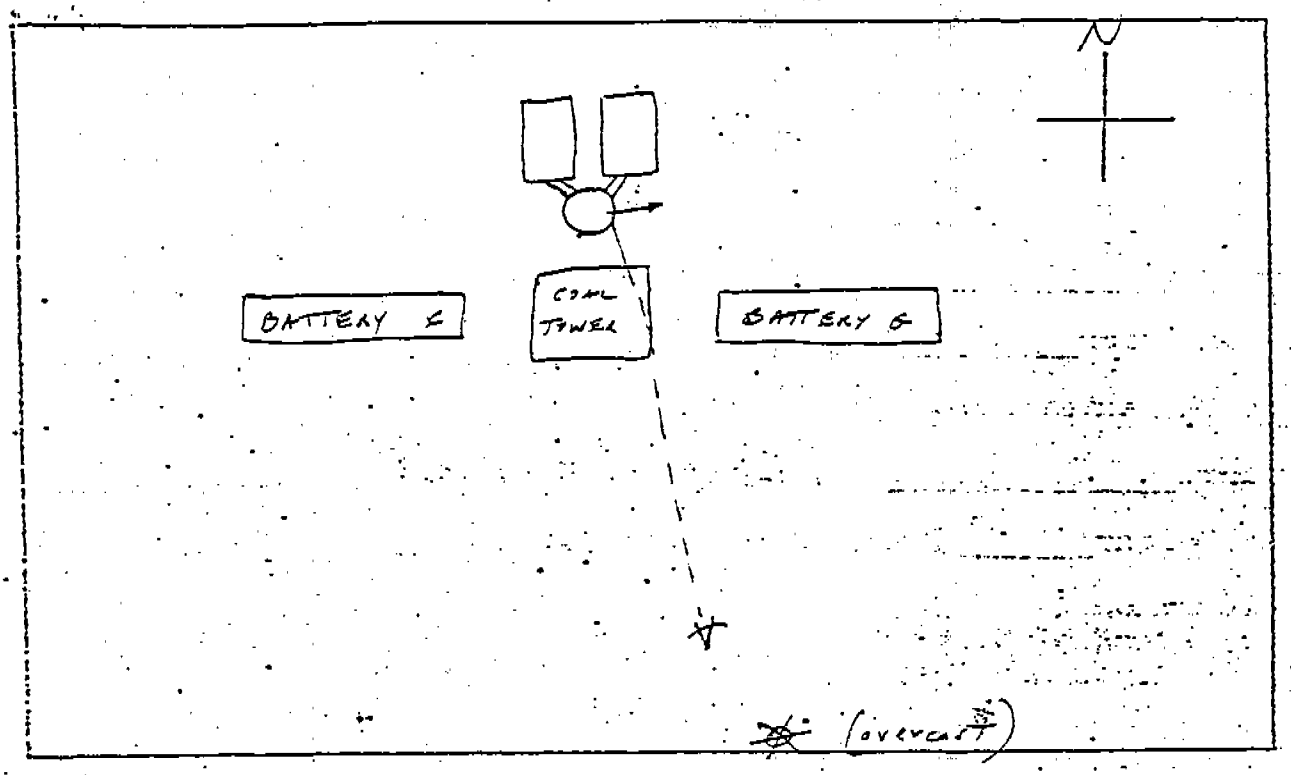
NOTES: No push or charge activity during observations

Inspector [signature] Date 1-10-80

510678

TSB-A-8 EPA-IX-FORM 298

MAP



Symbols

Sun = ☀
Plume direction = ⟶
Point where plume observed = ...
Observer = 🚶

Water Vapor Condensate NONE

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

Comments OBSERVATIONS DURING SECOND SOURCE TEST ON B/H F

Signature [signature] Date 1-10-88

510679

VISIBLE EMISSION OBSERVATION RECORD

Company KAISER STEEL CORP - STACK OF F & G COKE BATTERIES

Date 1-8-80 Time First Sighted Plume NA & B/H's

Time Start 1327 Time Stop 1349

Air Temperature 55° F Relative Humidity 80%

Wind Speed 0-3 Wind Direction NE

Sky Condition Mostly Overcast Background Sky

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

Color (would be black if visible, but none seen) Dispersion Description NA

Stack Height 250 (ft) Observer location: 750 (ft) SW of stack

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

Emission Point STACK OF F & G BAGHOUSES - COKE BATTERIES

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				
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				
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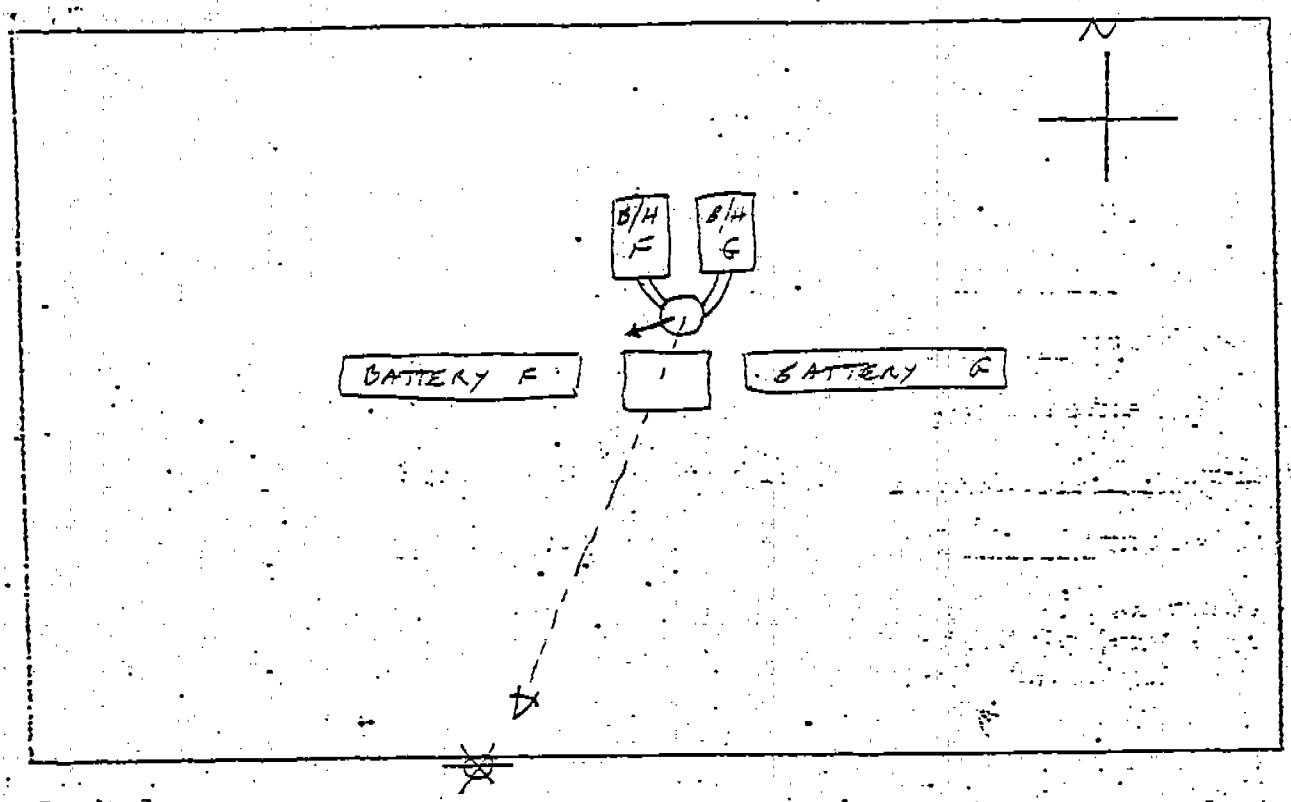
56				
57				
58				
59				
60				

NOTES: No activity on G F being pushed - changed between 1330 and 1350
369 - 379 - 389
PC - PC - R

Inspector [signature] Date 1-8-80 510680

TSB-A-8 EPA-IN-FORM 298

MAP



Symbols

Sun = ⊗
Plume direction = ⟶
Point where plume observed = ...
Observer = 🚶

Water Vapor Condensate NONE

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

Comments

OBSERVATIONS DURING 4th TEST OF B/H G

Signature [signature] Date 1-8-80

510681

Buell Baghouse Specifications
Design Basis
Equipment Descriptions

510682

From KSC - Gary Rowlands

DESIGN BASIS

The Buell fabric filter system will be designed in accordance with design conditions set forth below.

Design Conditions*

Gas Flow:	118,000 ACFM (each battery) 236,000 ACFM (F & G batteries)
Temperature:	450°F. ± 50°
Density:	0.0389-0.0401 pounds per cubic foot
Air to Cloth Ratios:	
All modules on line	2.12:1
One module off line during cleaning (including reverse air flow)	3.03:1
Effective Hopper Dust Densities - Maximum:	
For Volume Design	30 lbs/cf
For Structural Design	75 lbs/cf
Design Criteria for Casing and Dust Hoppers*:	
Pressure Range	Minus 20" S.P.W.G.
Temperature	500°F.
Air Pressure, Minimum/Maximum	
Instruments	80/100 psig
Service	80/100 psig

*The casing and dust hoppers are capable of withstanding a negative pressure of 26" S.P.W.G. at 70°F. A graph is included showing structural pressure capabilities at various operating temperatures.

EQUIPMENT DESCRIPTION

The equipment description applies to one-half of the fabric filter system. Each coke oven battery will be served by one-half the fabric filter system.

Bag Filter Parameters

	Each Coke Oven Battery
Number of Modules	5
Number of Bags per Module	228
Total Number of Bags per Baghouse	1140
Bag Diameter	8 1/4"
Bag Total Length	23'-6"
L/D (Effective Length/Effective Diameter)	22.6-.688 = 32.89
Effective Filtering cloth area per bag*	48.8 sq. ft.
Cloth Area per Module	11,126 sq. ft.
Cloth Area per Baghouse	55,630 sq. ft.
Air to Cloth Ratios:	See Design Basis

Filter Fabric and Bag Construction

Manufacturer	Globe Albany; Menardi-Southern; or equal
Fabric Designation	Glass
Weight	14 oz./sq. yd.
Weave	3 x 1 twill or equivalent
Coating or Lubricant	Siliconized/graphatized/teflon
Permeability (Clean)	65 - 80 CFM/sq. ft.
Bag Lag or Cuff:	
Description	
Top	2" cuff with sewn-in compression band
Bottom	2" cuff with snap band
Total Weight of Bag (without Hardware)	3.3 lbs.
Bag Rings:	
Size	8.625" O.D.
Quantity per Bag	Five (5)
Material	Cadmium plated mild steel
Bottom Attachment:	
Description	Quick release snap band
Material	301 stainless steel

*To obtain the true effective filtering cloth area, Buell has deducted areas of the bag which provide no filtering during the normal operation. These areas include top cuff, bottom cuff, and area enclosing the anti-collapse rings.

510684

Buell expects the life of the fabric filter bags will approach 3 years, based on normal operating conditions and reasonable cleaning and maintenance