ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
EPA-330/2-76-028

Visible Emission Observation

Kaiser Steel Corporation

Fontana, California

September 1975

NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
DENVER, COLORADO
AND
REGION IX
SAN FRANCISCO, CALIFORNIA
MAY 1976

ENVIRONMENTAL PROTECTION AGENCY
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VISIBLE EMISSION OBSERVATIONS
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and
REGION IX - San Francisco, California

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I. INTRODUCTION

Kaiser Steel Corporation operates a steel mill at Fontana, California, about 80 km (50 mi) east of Los Angeles. The facility is a fully integrated steel mill with basic coke, iron and steel production processes and a full range of finishing operations. It is the only integrated mill in California. The basic coke, iron and steel processes result in the emission to the atmosphere of excessive levels of particulate air pollutants, despite the installation of various air pollution control devices.

On 11 July 1974, the Corporation entered into a Consent Order with EPA-Region IX to control these emissions. The Order specified various steps to be taken by the Corporation, including process modifications and installation of air pollution control devices. A compliance schedule for both interim and final compliance dates was also established. The Order was amended 11 November 1974, changing several interim dates but not affecting the final compliance dates.

Subsequent to the amendment, the Corporation on 24 July 1975 submitted a $150 million Steelmaking Modernization Project Proposal to EPA. The proposal included significant changes from the schedule in the Consent Order. Among these were extended compliance dates, with the final EPA compliance date of 31 December 1977 advanced to 30 June 1981. To date no EPA action has occurred on this proposal.

At the request of the Enforcement Director, EPA-Region IX, San Francisco, California, the National Enforcement Investigations Center (NEIC) conducted a study of the Kaiser facility in September 1975. The objectives of the study were to determine the status of compliance with the Consent Order and to observe sources of visible emissions to determine compliance with applicable County regulations. The field portion of the study was conducted 16-24 September 1975.

This report presents the results of the study. Applicable visible emission regulations are presented in Section III. A discussion of the results of the visible emission observations is contained in Section IV. The status of compliance with the Consent Order is evaluated in Section V.

II. SUMMARY AND CONCLUSIONS

A survey of Kaiser Steel Corporation's integrated steel mill at Fontana, California was conducted 16-24 September 1975. The survey was to determine the status of compliance with applicable visible emission regulations and with an abatement schedule of the Kaiser-EPA Consent Order.

VISIBLE EMISSION OBSERVATIONS

Observations were made of all major sources of visible emissions in the blast furnaces, sinter plant, coke oven batteries, open hearth furnaces, basic oxygen steel process (BOSP) furnaces, rolling mill soaking pits, hot strip mill and scrap cutting areas. Visible emissions exceeding applicable regulations were observed at 29 stacks and numerous coke oven doors, standpipes and quench towers. These sources and the number of observations at each source are summarized in Table II-1.

Not all occasions were recorded during the study when emissions exceeded allowable limits. Excessive visible emissions were almost continuous from stack No. 6 serving coke oven Battery A, and from coke oven door leaks. Excessive emissions also occurred from scrap cutting operations while in progress.

Charging procedures at the coke oven batteries had recently been changed from sequential to staged charging. Therefore, operations were not normal and observations of emissions from the charging cycle were deferred until a later date.

Table II-1

SUMMARY OF OBSERVATIONS OF VISIBLE EMISSIONS EXCEEDING APPLICABLE REGULATIONS

Process Area	Source	Observations Exceeding Limits
Blast Furnaces	stack no. 1	3
	2	1
	4	3
	Cast House Roof	1
Sinter Plant	5	1
Coke Oven Batteries	6	10
	7	8
	stack no. 8	3
	9	8
	10	6
	11	6
	Door Leaks	29
	Standpipes	2
	Quench Towers	3
Open Hearth Furnaces	12	8
	13	5
	stack no. 16	1
	20	8
	Roof Monitors	5
Basic Oxygen Steel Process (BOSP)	stack no. 21	7
	23	2
	ESP† Bypass	3
	Roof Monitors	7
Rolling Mills	31	1
	37	2
	stack no 38	1
	40	1
	41	1
	43	2
Hot Strip Mill	57	1
Scrap Cutting	Main Area	6
	Near BOSP	2
	Total	145

† *electrostatic precipitator*

COMPLIANCE WITH CONSENT ORDER

Compliance with the 11 July 1974 Consent Order to date has been minimal. This is best illustrated summarizing Corporation progress under each Appendix to the Order.

Appendix A

Part A. An EPA contractor is studying control technology that may bring "A" Battery stack into compliance. An experimental unit is presently processing half the stack emission as part of the study.

Part B. The Corporation has requested an extension of up to 30 months for compliance with emissions from Battery stacks B through G.

Appendix B

Part A. The Corporation certified that pushing and charging at all batteries were in compliance with Rule 50A.

Part B. The Corporation certified that coke oven doors and standpipes in Batteries C through G were in compliance with Rule 50A.

Part C. The Corporation has installed new doors on Batteries A and B but is not required to certify compliance until 31 December 1975.

Part D. No action required.

Part E. The final control plan to bring combined visible emissions from each coke oven into compliance was not submitted on 30 July 1975 as required.

Appendix C

Part A. The Corporation did not certify to compliance with Rule 50A. However, they did indicate meeting the necessary increment of progress for charging and tapping operations at furnaces No. 1 and 3 of the basic oxygen steel process (BOSP).

Part B. A 7-1/2 month extension was requested due to delivery problems with the baghouse.

Appendix D

On 17 January 1975 the Corporation was advised that they are in violation of the Order. The Corporation has not met a later date for installing additional control equipment at the open hearth furnaces but has proposed an alternative Steelmaking Modernization Program. This would extend the final compliance date on these units for 17 months.

Appendix E

The Corporation has indicated they will not erect a scrap cutting building with control equipment as required by the Order. They were advised of being in violation of the Consent Order on 15 May 1975. The Steel Modernization Program included installation of a ball drop facility and machine torch cutting devices on the outside as the alternative to an enclosure. These are in place but not in accordance with the Order.

Appendix F

The Steelmaking Modernization Plan suggests a 3-1/2 year extension for compliance with the desulphurization of coke oven gas.

Progress thus far has led to the following conclusions:

The Corporation has acted unilaterally in modifying elements of the Consent Order without consulting EPA. These modifications may or may not bring the particular operation into final compliance.

The Corporation has certified to compliance with various elements of the Consent Order that appear to be out of compliance.

Visible emission observations indicate that other facilities at the plant not covered by the Consent Order are exceeding Rule 50A.

Operations and Maintenance procedures which will play a major role in meeting clean air objectives do not seem to receive the priority necessary.

III. APPLICABLE REGULATIONS

Emissions of air pollutants from the Kaiser steel mill are subject to regulations promulgated for the San Bernardino County Air Pollution Control Zone, Southern California Air Pollution Control District. Specific regulations concerned with visible emissions and with upset or breakdown conditions are presented below.

In addition, emissions from the steel mill are the subject of a Consent Order entered into by EPA and the Kaiser Steel Corporation on 11 July 1974. The Order specifies various abatement measures to be implemented by the Corporation on a specific time schedule. The requirements of the Order and the Corporation's progress to date in complying with the Order are discussed in detail in Section V of this report.

VISIBLE EMISSIONS

Visible emissions are subject to the limitations specified in the following San Bernardino County regulation:

Rule 50A. Visible Emissions

A person shall not discharge into the atmosphere from any single source of emission whatsoever, any air contaminant for a period or periods aggregating more than three (3) minutes in any one (1) hour which is:

a. As dark or darker in shade as that designated as No. 1 on the Ringelmann Chart, as published by the United States Bureau of Mines, or

b. Of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in Section (a) of this Rule.

This Rule is effective on 1 June 1972 for all sources which are not either in operation or under construction prior to that date, and Rule 50 shall not be applicable to such sources on or after that date. This Rule is to become effective for all other sources on 1 January 1975, and Rule 50 shall not be applicable on or after that date.

Variances from compliance with Rule 50A have been granted to Kaiser Steel Corporation for several of their Fontana operations by the San Bernardino County Hearing Board. These variances have not been approved by EPA. Operations excepted and compliance dates are as follows:

Scrap Cutting	31 May 1976
Open Hearth Stacks	31 July 1977
Coke Oven Battery A Stack	31 Dec. 1976
Coke Oven Batteries B to G Stacks	31 Dec. 1977

EMERGENCY VARIANCES

The regulations grant emergency variances for excessive emissions during upset or breakdown of control equipment under certain conditions.

Rule 55. Upset Conditions or Breakdowns

Emissions exceeding any of the limits established in this regulation as a direct result of upset conditions in or breakdown of any air pollution control equipment or related processing equipment shall not be deemed to be in violation of the rules establishing such limits, provided the following requirements (a) and (b) of this section are met.

a. Any upset condition or breakdown of equipment which causes a violation of the Rules and Regulations of the District or the Health and Safety Code of the State of California shall be reported to the office of the District within thirty (30) minutes.

b. As soon as possible after notification, the District shall be informed of the estimated time for repairs; and if more than four (4) hours are required to repair the condition, the Control Officer shall request the source either to shut down the operation until repairs can be made or file immediately for an emergency or interim variance in accordance with Rule 85(d). In the event that the breakdown or upset condition occurs during other than normal working hours of the Air Pollution Control District, the intent to file for an emergency or interim variance shall be transmitted by telephone for recording within four (4) hours after the violation is reported and that every reasonable effort is taken to minimize the emissions.

Investigations will be made by a member of the District staff to verify the upset conditions.

This Rule is effective 10 September 1974.

Rule 55 has not been approved as part of the California State Implementation Plan.

IV. VISIBLE EMISSION OBSERVATIONS

STUDY METHODS

The primary purpose of the field study was to observe the major sources of visible emissions to determine the present status of compliance with applicable regulations. Detailed process information had previously been obtained by both San Bernardino County and EPA-Region IX personnel. Therefore, no detailed process evaluation was made. A limited walk-through reconnaissance of the plant was conducted by San Bernardino County personnel to familiarize study staff with the location and identification of emission sources to be observed.

Actual observations of visible emissions were conducted 16-24 September 1975. Ten certified smoke readers from NEIC, EPA-Region IX, the California Air Resources Board, and the San Bernardino County Air Pollution Control Zone took visible emission observations (VEO's) during the study. Sources observed are listed in Table IV-1. The smoke readers used standard observation methods (EPA Method 9) for orientation of the observer with respect to sun position, wind direction and viewing background. Environmental data, plume characteristics, source data, visible emission readings and other pertinent information for each set of readings were recorded on EPA-IX-Form 298 [Appendix], a modification of the California Air Resources Board visible emission observation record form. Environmental data collected by the observers included wind speed and direction, air temperature and relative humidity. Only summaries of the VEO records are included in this report. Individual VEO records are on-file at NEIC.

Table IV-1

SUMMARY OF SOURCES OF VISIBLE EMISSIONS EVALUATED

PROCESS AREA	SOURCES
Blast Furnaces	Stove Stacks (3), Cast House Roof Monitors (3)
Sinter Plant	Main Stack
Coke Oven Batteries	Main Stacks (6), Oven Doors, Standpipes, Quench Towers
Open Hearth Furnaces	Main Stacks (8), Roof Monitors
Basic Oxygen Steel Process	Furnace Stacks (3), ESP† Bypass, Roof Monitors
Rolling Mills	Soaking Pit Stacks (19)
Hot Strip Mill	Reheat Furnace Stacks (3)
Scrap Cutting	Open Areas (2)

† *electrostatic precipitator*

During the study, no attempt was made to record every visible emission that appeared to exceed applicable regulations. Instead, a number of VEO's were systematically taken at major emission sources within each process area listed in Table IV-1. When practical, incidental emissions occurring in the area being observed were recorded. Smoke readers periodically switched sources so that several readers observed each major source of emissions at different times during the survey.

Color photographs were taken to document visible emissions and to record a general overview of the plant. Several types of cameras were used and the photographs were taken from ground and roof level at the plant and from a low-flying light aircraft. The photographs are not presented in this report but are on-file at NEIC.

ENVIRONMENTAL DATA

In addition to the environmental data recorded by the study crew, data was obtained from a meteorological station at the plant operated by Kaiser's Environmental Quality Control Department. The system includes wind speed and direction sensors mounted on a tower atop the galvanizing facility and temperature, pressure, and relative humidity sensors on the roof of the Environmental Quality Control office. Data are automatically scanned, printed, and punched every two minutes. Hourly readings were tabulated from this file for the period during which VEO's were being taken [Table IV-2]. Wind speed data are suspect because of problems with the sensor at the lower wind speed threshold, which will be corrected by Kaiser in the near future. Relative humidity also appeared to be inaccurate when compared on several occasions to EPA wet and dry bulb hygrometer readings.

Table IV-2

METEOROLOGICAL DATA FROM KAISER STEEL
FONTANA, CALIFORNIA

Date	Time	Wind Speed (km/hr)	Wind Speed (mph)	Wind Direction (°)	Temperature (°C)	Temperature (°F)	Relative Humidity (%)
9/16	1200	15.6	9.7	256	33	91	55
	1300	9.0	5.6	279	34	94	57
	1400	19.2	11.9	256	36	97	57
	1500	25.2	15.7	279	36	97	56
	1600	19.3	12.0	276	36	96	56
	1700	26.2	16.3	274	36	96	57
	1800	19.6	12.2	260	34	94	57
	1900	23.2	14.4	257	31	88	57
9/17	0800	0.6	0.4	149	26	78	62
	0900	0.6	0.4	171	28	83	59
	1000	0.8	0.5	208	29	85	58
	1100	0.6	0.4	255	31	87	58
	1200	0.6	0.4	283	32	90	58
	1300	16.4	10.2	288	33	92	58
	1400	19.5	12.2	264	34	94	58
	1500	24.3	15.1	250	35	94	58
	1600	21.6	13.4	299	34	93	59
	1700	30.4	18.9	280	33	92	53
9/18	0800	7.0	4.3	174	24	75	62
	0900	0.6	0.4	180	27	81	59
	1000	0.4	0.3	213	27	81	58
	1100	0.4	0.3	266	29	84	57
	1200	0.4	0.3	238	31	87	55
	1300	0.4	0.3	262	31	88	51
	1400	0.4	0.3	265	32	90	46
	1500	21.8	13.5	278	32	90	45
	1600	9.8	6.2	264	32	89	47
	1700	33.2	14.4	280	32	89	46
	1800	19.0	11.8	269	29	85	46
	1900	0.6	0.4	259	27	81	45
9/19	0800	0.6	0.4	146	22	72	54
	0900	0.6	0.4	166	24	76	54
	1000	0.6	0.4	168	28	82	49
	1100	0.6	0.4	254	29	85	49
	1200	0.4	0.3	200	30	86	50
	1300	0.4	0.3	251	32	90	51
	1400	0.4	0.3	279	32	90	51
	1500	0.4	0.3	260	32	90	49
	1600	1.3	0.8	267	32	90	50
	1700	0.6	0.4	283	32	89	53
	1800	0.6	0.4	273	29	84	53
	1900	0.6	0.4	268	27	81	56
9/20	0800	0.6	0.4	128	22	71	65
	0900	0.6	0.4	192	24	76	62
	1000	0.6	0.4	281	27	80	60
	1100	0.6	0.4	267	28	83	56
	1200	0.6	0.4	219	30	86	53
	1300	0.6	0.4	283	31	88	54
	1400	0.6	0.4	258	32	90	52
	1500	0.6	0.4	293	33	91	51
	1600	0.6	0.4	254	33	91	51
	1700	0.6	0.4	252	32	89	51
	1800	0.6	0.4	284	30	86	54
	1900	0.6	0.4	277	28	82	53
9/22	0800	0.6	0.4	076	27	79	51
	0900	0.6	0.4	077	35	95	41
	1000	0.6	0.4	101	37	99	33
	1100	0.4	0.3	397	37	98	32
	1200	0.4	0.3	405	37	99	32
	1300	0.4	0.3	422	38	100	32
	1400	1.1	0.7	402	39	103	33
	1500	0.4	0.3	403	39	102	32
	1600	0.4	0.3	413	39	103	28
	1700	0.4	0.3	400	39	102	27
	1800	0.6	0.4	413	36	97	27
	1900	0.6	0.4	420	34	94	25
9/23	0800	0.6	0.4	52	24	76	31
	0900	0.6	0.4	147	29	85	30
	1000	0.6	0.4	191	33	91	30
	1100	0.6	0.4	204	34	94	29
	1200	0.6	0.4	242	36	96	29
	1300	0.6	0.4	243	37	98	09
	1400	0.4	0.3	400	38	101	10
	1500	0.4	0.3	401	38	101	10
	1600	0.4	0.3	391	39	102	11
	1700	0.4	0.3	411	38	101	11
	1800	0.4	0.3	261	35	95	10
	1900	0.6	0.4	279	33	91	10
9/24	0800	0.6	0.4	103	27	81	38
	0900	0.6	0.4	165	29	85	39
	1000	0.6	0.4	191	33	91	39
	1100	0.6	0.4	167	35	95	37
	1200	0.6	0.4	111	37	98	37
	1300	0.6	0.4	110	37	99	37
	1400	0.6	0.4	39	38	100	37
	1500	0.4	0.3	167	38	100	36
	1600	0.4	0.3	147	38	99	36

The data are useful, however, in showing the general environmental conditions prevailing during the study.

FACILITY DESCRIPTION

The large Kaiser facility is the only fully-integrated steel mill in California. Basic operations include coke making with by-product recovery, basic production of iron in blast furnaces, conversion of iron to steel in both open hearth and basic oxygen process furnaces, a sintering plant, and a full range of finishing operations including production of structural shapes, pipe, sheet metal, galvanized products and tin plate. Production of coke, iron and steel in 1972 was 1.36, 2.07, and 2.72 million metric tons (1.50, 2.28, 2.99 tons) respectively.

Basic process units are compactly arranged in a rectangular area about 2.6 km^2(1.0 mi^2) [Fig. IV-1]. The basic coke, iron and steel making processes are located in the north half of this area. Most of the emission points of interest are also in the north half. Finishing operations occupy most of the south half of the plant site.

An inventory of stacks including sources of emissions and stack characteristics is presented in Table IV-3. The relative locations of the stacks are shown schematically in Figure IV-2.

In the following sections, the results of the visible emission observations are discussed by process area. A limited basic process discussion common to the industry is presented to orient the reader and to define what emission points were observed. Minor variations may be expected throughout the industry. Detailed process information

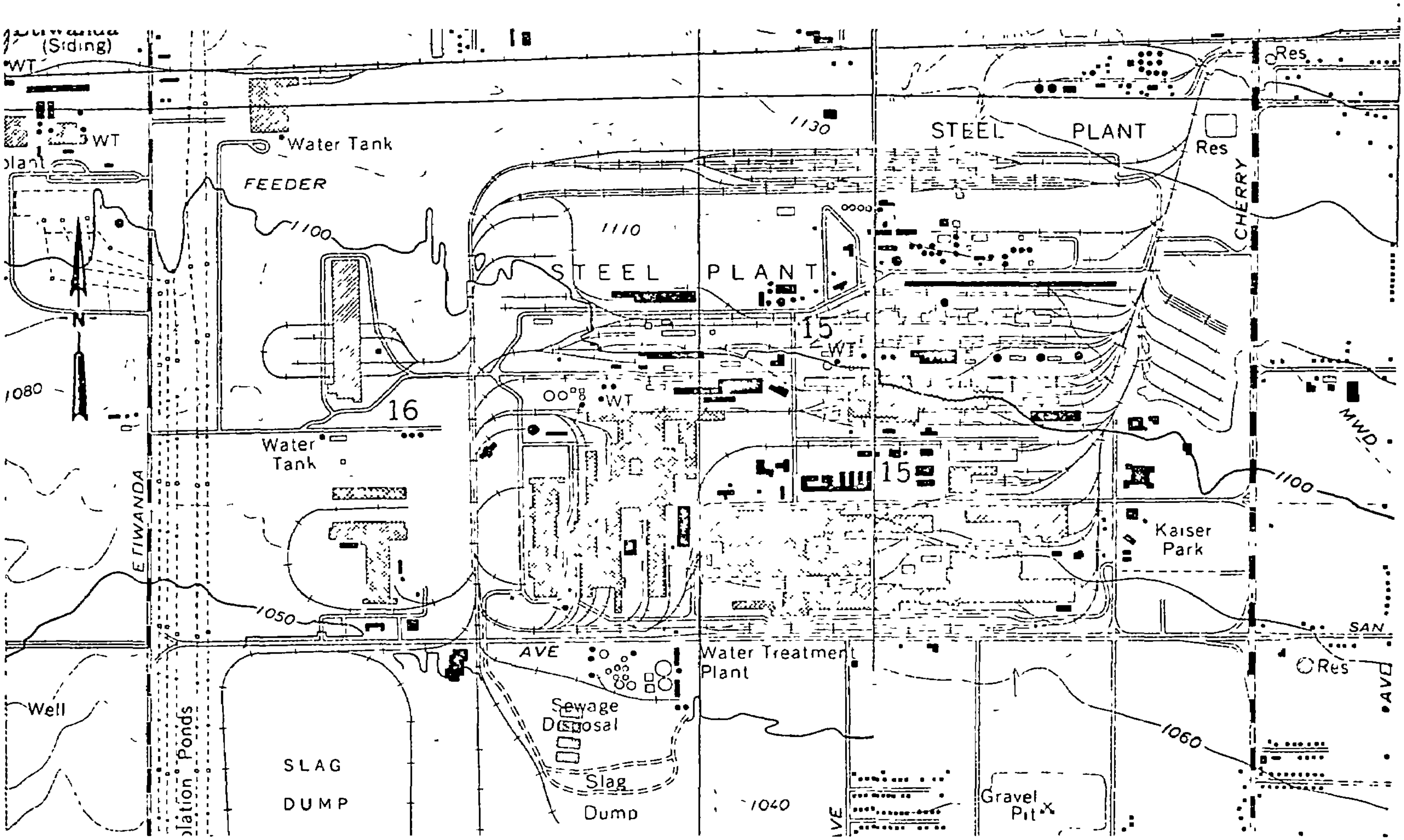

Figure IV-1. Kaiser Steel Plant Vicinity Map

Table IV-3
STACK CHARACTERISTICS[†]

Stack[††]	Type Furnace	Height	Type Stack
1.	Blast Furnace #1	200'	Concrete
2.	Blast Furnace #2	200'	Concrete
3.	Blast Furnace #3	200'	Concrete
4.	Blast Furnace #4	200'	Concrete
5.	Sinter Plant	300'	Concrete
6.	Coke Oven, Battery A	225'	Concrete
7.	Coke Oven, Battery B	225'	Concrete
8.	Coke Oven, Battery C	225'	Concrete
9.	Coke Oven, Battery D	225'	Concrete
10.	Coke Oven, Battery E	225'	Concrete
11.	Coke Oven, Batteries F&G	250'	Concrete
12.	Open Hearth #1	175'	Concrete
13.	Open Hearth #2	175'	Concrete
14.[†††]	Open Hearth #3	175'	Concrete
15.	Open Hearth #4	175'	Concrete
16.	Open Hearth #5	175'	Concrete
17.	Open Hearth #6	175'	Concrete
18.	Open Hearth #7	175'	Concrete
19.	Open Hearth #8	175'	Concrete
20.	Open Hearth #9	175'	Concrete
21.	Oxygen Furnace	150'	Steel
22.	Oxygen Furnace	150'	Steel
23.	Oxygen Furnace	150'	Steel
24.	Soaking Pits 21 & 22	110'	Concrete
25.	Soaking Pits 19 & 20	110'	Concrete
26.	Soaking Pits 17 & 18	110'	Concrete
27.	Soaking Pits 15 & 16	110'	Concrete
28.	Soaking Pits 13 & 14	110'	Concrete
29.	West preheating pits	75'	Steel
30.	Soaking Pits 11 & 12	110'	Concrete
31.	Soaking Pits 9 & 10	110'	Concrete
32.	Soaking Pits 7 & 8	110'	Concrete
33.	Soaking Pits 5 & 6	110'	Concrete
34.	Soaking Pits 3 & 4	110'	Concrete
35.	East preheating pits	75'	Steel
36.	Soaking Pits 23 & 24	110'	Concrete
37.	Soaking Pits 25 & 26	110'	Concrete
38.	Soaking Pits 27 & 28	110'	Concrete
39.	Soaking Pits 29 & 30	110'	Concrete
40.	Soaking Pits 31 & 32	110'	Concrete
41.	Soaking Pits 33 & 34	110'	Concrete
42.	Soaking Pits 35 & 36	110'	Concrete
43.	Soaking Pits 37 & 38	110'	Concrete
44.	Soaking Pits 39 & 40	110'	Concrete
45.	Merchant Mill (Skelp line)	135'	Concrete
46.	Plate Mill (Slab Fce. #2)	159'	Steel (Abandoned)
47.	Plate Mill (Slab Fce. #1)	175'	Steel
48.	Plate Mill (Slab Fce. #3)	175'	Steel
49.	C.W.Pipe Mill (Skelp Fce.)	125'	Steel
50.	C.W.Pipe Mill (Galv.Dept.)	52'	Steel
5[illegible]	C.W.Pipe Mill (Galv.Dept.)	60'	Steel
52.	Merchant Mill (Roughing)	125'	Steel (Removed)
53.	Structural Mill (29")	159'	Steel
54.	Tin Plate Mill (Scruff)	75'	Steel
55.	Tin Plate Mill (Pickle)	70'	Steel
56.	86" Hot Strip Mill (Fce.#3)	150'	Steel
57.	86" Hot Strip Mill (Fce.#2)	150'	Steel
58.	86" Hot Strip Mill (Fce.#1)	150'	Steel
59.	Power House		
60.	Power House		
61.	Power House		
62.	Power House		
63.	Power House		
64.	Power House		
65.	Power House		
66.	Flare		
67.	Flare		
68.	Sheet Galv. Pickle Line		
69.	Hot Scarfer		
70.	62" Pickle Line		
71.	Alk. Cln. Line Sheet Galv.		
72.	Walking Beam Furnace		
73.	Type R Rotoclone Exhaust Stack (Foundry)		
74.	Type N Rotoclone Exhaust Stack (Foundry)		
75.	Type N Rotoclone Exhaust Stack (Foundry)		

† *Table prepared by the San Bernardino County Air Pollution Control Zone staff and current through 15 October 1975*

†† *See Figure IV-2 for stack locations.*

††† *Abandoned*

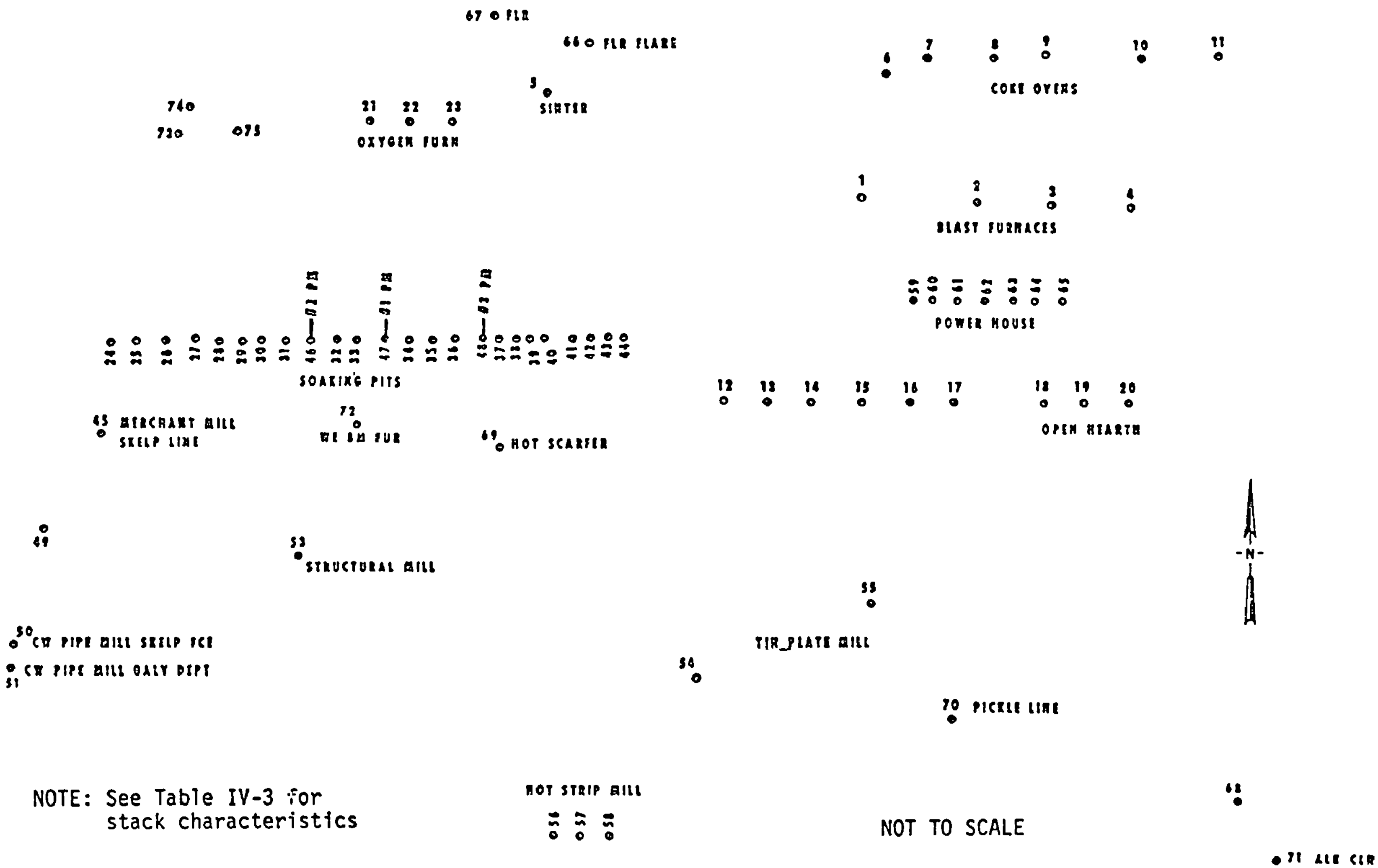

Figure IV-2. Schematic of Stack Orientation is on-file at the San Bernardino County Air Pollution Control Zone and EPA-Region IX offices. Observations of visible emissions exceeding applicable regulations are summarized and evaluated.

BLAST FURNACES

Basic Process

Blast furnaces are used to reduce iron ore to metallic iron. The basic process flow is shown schematically in Figure IV-3. Raw materials including coke, iron ore, limestone and sinter are intermittently charged to the top of the blast furnace through a hopper equipped with air locks. Hot air blown into the bottom of the furnace causes the coke to burn, producing high temperatures and large volumes of carbon monoxide (CO). The combination of heat and the reducing atmosphere in the mid-level of the furnace converts the iron ore to metallic iron that collects in a molten state at the bottom of the furnace. Impurities in the ore combine with the limestone to form slag that collects as a liquid on top of the molten iron. This reduction process proceeds continuously. Periodically the furnace is tapped during casting operations and the molten iron is drawn off to hot metal cars for transfer to the steelmaking operations. Slag is also drawn off periodically. In many blast furnace operations, the slag flows to ladles for transfer to disposal points at other plant locations. At Fontana, the slag is discharged directly to pits adjacent to the blast furnaces. After cooling, the solidified slag is removed mechanically for byproduct processing.

The gas that flows upward in the furnace has a useful fuel value because of its high CO content. Before use, the gas is cleaned in a dust catcher and a wet scrubber to remove flue dust. The flue dust

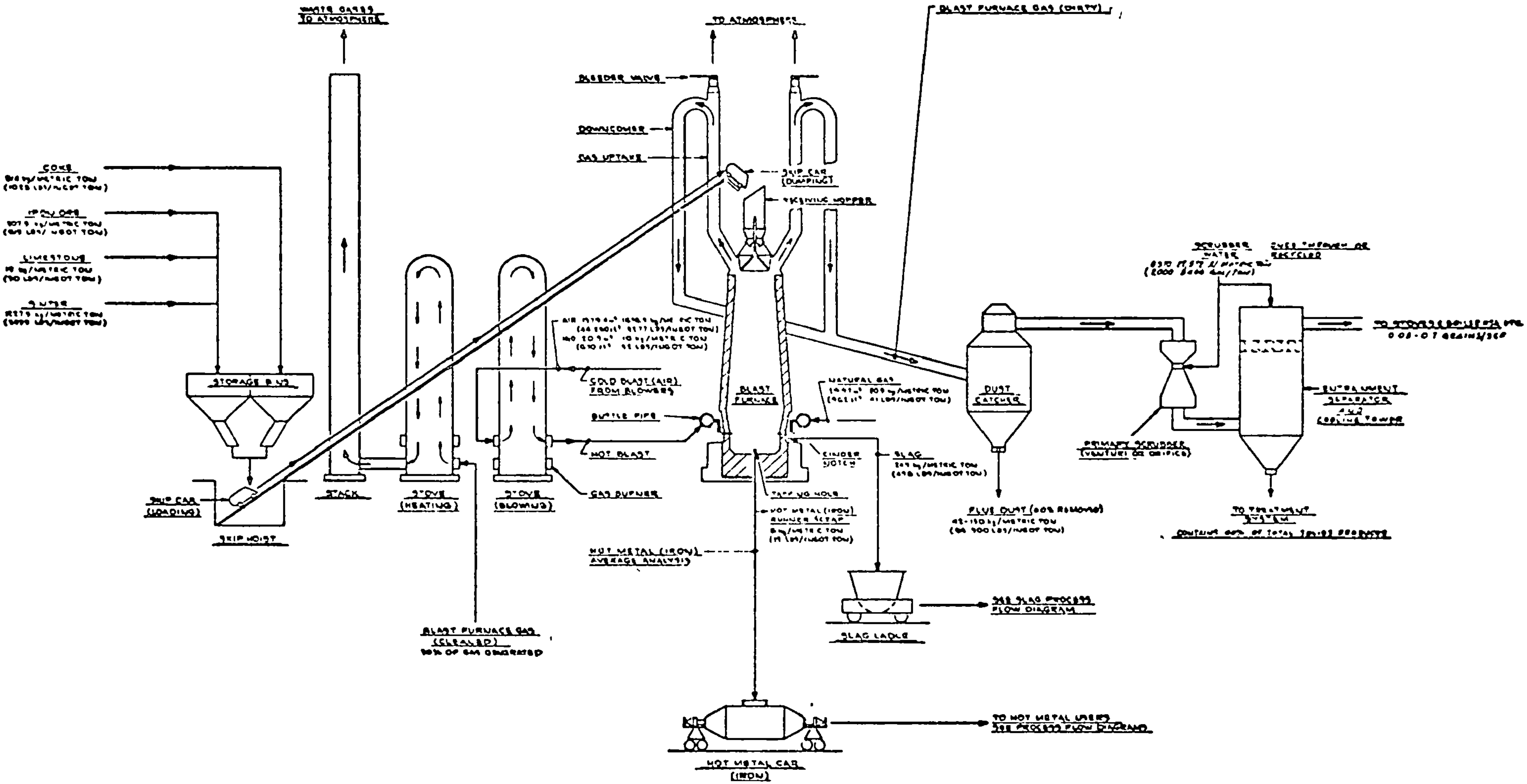

Figure IV-3. Typical Blast Furnace Process Flow Diagram (primarily iron fines) is sent to the sinter plant for processing and recycle to the blast furnace. About one-third of the blast furnace gas is used to heat stoves as discussed below. The remainder is primarily used to fire powerhouse boilers that drive turbines that compress the air for the hot blast.

Each blast furnace is equipped with three stoves used to heat air for the hot blast. Blast furnace gas is burned in the stoves to heat a checkerwork of refractory material filling the stove. Combustion gases are vented to the atmosphere through a single stack serving all three stoves. Normally, while two stoves are being heated, cold air is blown through the third (preheated) stove and heated by the refractory material before entering the blast furnace.

Blast furnace gas is usually cleaned before burning in the stove. However, periodically the blast furnace is "back drafted." During this operation, gas is drawn off the bottom of the furnace and, without being cleaned, it is burned in a stove.

Emission Sources

Visible emissions may occur from the stove stack, from the hopper at the top of the furnace during charging operations, from bleeder valves on the blast furnace gas lines, and from the cast house roof monitors during hot metal transfer and slag drawoff operations.

Air Pollution Controls

There are no air pollution control devices on the stove stack, the furnace hopper or the bleeder valves. The blast furnace cast house encloses the base area of the furnace where hot metal transfer and slag drawoff operations take place. Emissions from these sources are thus semi-confined in the building but vent directly to the atmosphere through roof monitors.

Observations

The Fontana mill has four blast furnaces numbered 1 through 4 from west to east [Fig. IV-2]. The stove stacks have the same numbers. Furnaces No. 2 and No. 4 were in continuous operation during the survey. Furnace No. 3 was out of operation for relining. Furnace No. 1 was being reheated and was placed in operation on 22 September. Furnace No. 2 was casting on a 3-1/2 hour schedule beginning at 3:00 a.m. daily; iron from the unit normally supplies the basic oxygen steel process furnaces. The No. 4 furnace was casting on a 4-hour schedule starting at 12:30 a.m. daily. This unit supplied iron to the open hearth furnaces and the foundry.

Observations of the stove stacks for the three operating furnaces documented seven occurrences of visible emissions in excess of allowable limits. These are summarized in Table IV-4. The table lists the total time during each observation period that emissions were equal to or greater than 20% opacity. Rule 50-A limits emissions to 20% opacity; however, since an average deviation not to exceed 7.5% opacity is allowed during certification readings, Region IX Enforcement Division considers 30% opacity to be in violation of Rule 50-A for purposes of enforcement actions. Thus the table also includes the time readings exceeded 30% opacity. Actual observation periods varied in length and ranged from a minimum of the time shown in the table to a maximum of 60 minutes. In cases where the emissions were essentially in excess of limits continuously, observation periods of 10 to 15 minutes were used. The emissions thus continued beyong the recorded time. For intermittent emissions or occasional emissions in excess of limits, longer observation periods were necessary.

Table IV-4 also lists the maximum opacity observed and the average opacity of readings exceeding the 20% and 30% values. These give an indication of how excessive the observed emissions were.

For stack No. 1 serving stoves on blast furnace No. 1, one observation of excessive emissions was made while the furnace was being heated and two more observations after the furnace began operating.

The Corporation indicated that visible emissions from the stacks result from "back drafting" during casting. This practice draws dirty furnace gases back through the stoves where the gases are burned and exhausted through the stove stack.

Table IV-4
SUMMARY OF VISIBLE EMISSION
OBSERVATIONS AT THE BLAST FURNACE PROCESS AREA

Emission Source	Date (1975)	Time (min) Observed	Time (min) >20%	Time (min) >30%	Avg. Opacity† >20%	Avg. Opacity† >30%	Max. Opacity (%)
Stack 1	9/17	10.75	10.75	10.75	79	79	100
	9/23	13	12.50	8.50	29	32	35
	9/23	9.75	9.75	9.75	63	63	70
Stack 2	9/20	12	12	12	72	72	90
Stack 4	9/17	11.5	11.5	11.5	74	74	90
	9/19	20	20	20	84	84	100
	9/20	12	12	10	36	38	40
#4 Blast Furnace Cast House	9/19	9	9	9	68	68	95

† *Average opacity of emissions observed in excess of stated value.*

Visible emissions occasionally were observed originating from roof monitors on blast furnace cast houses during casting and slag drawoff activities. One such excessive emission recorded during slag drawoff is shown in Table IV-4.

SINTERING PLANT

Basic Process

The primary function of a sintering plant is to agglomerate and recycle fines back to the blast furnace. Fines, consisting of iron-bearing wastes such as mill scale from finishing operations and dust from the basic oxygen open hearth and blast furnaces, are blended with coke fines that serve as fuel in the sintering process. The material is spread on a moving down-draft grate and ignited. Combustion of the coke produces heat that fuses the material together. The fused sinter is crushed, screened and air-cooled.

The material handling, crushing and cooling operations are very dusty. In addition, dust and volatized oil are present in the process gases. The sinter machine, crusher, cooler and part of the material-handling equipment are contained in the sinter plant building.

Emission Sources

Visible emissions may occur as fugitive dust emissions from material handling operations outside the sinter plant building or as process gas emissions from the sinter plant stack (stack No. 5). At 91 m (300 ft), this stack is the tallest in the steel mill.

Air Pollution Controls

Process gases from the sinter emissions and dust emissions from other points within the sinter plant building are exhausted to a large baghouse before discharge to the plant stack.

Observations

Visible emissions from the sinter plant stack were infrequent. When visible, the plume was white and detached. The visible emissions probably originated from volatization of oil from mill scale fed to the process.

A single 9.25-minute observation of stack No. 5 on 16 September documented excessive emissions. Emissions of greater than 20% opacity were recorded for the total of 9.25 minutes of which 7.50 minutes were in excess of 30% opacity. The excessive emissions averaged 32% opacity for the 9.25-minute period and 34% opacity during the 7.5-minute period. The maximum capacity observed during the interval was 40%.

COKE OVEN BATTERIES

Basic Process

The primary function of the coke ovens is to convert bituminous coal to coke. This is accomplished by heating the coal in special ovens to drive off the volatiles, leaving the residue coke. The volatiles are collected and processed to yield a number of byproduct chemicals and coke oven gas. The gas is used to fuel burners in the ovens and other furnaces in the steel mill complex.

Figure IV-4 is a schematic diagram of a typical process flow for coke ovens. The ovens are rectangular and constructed of silica brick. Each oven is usually about 45 cm wide, 4.5 high and

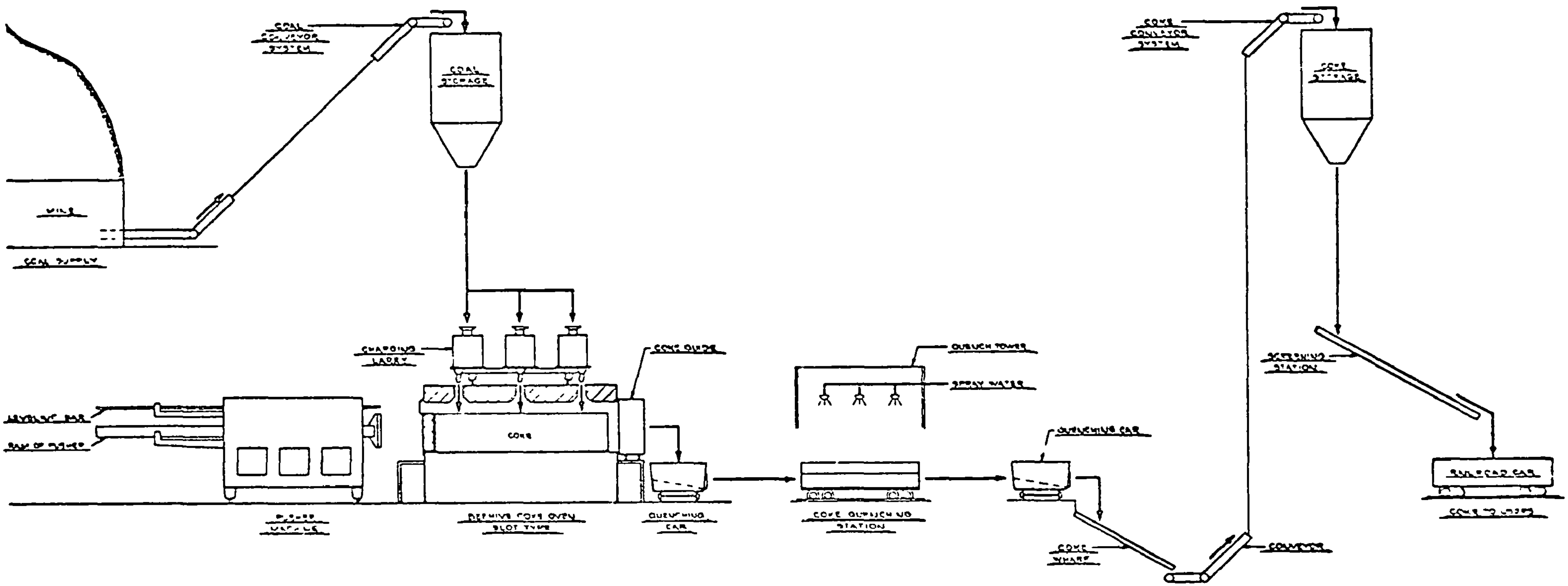

Figure IV-4. Typical Coke Oven Process Flow Diagram

12 m long (18 in x 15 ft x 39 ft). The ovens are arranged side-by-side in groups called batteries. The Fontana installation has seven batteries designated A through G from west to east. Each battery has 45 ovens. The ovens are numbered sequentially from west to east as 1 through 349 except that numbers ending in 0 are not used.

Coal is charged through holes (ports) in the roof of each oven from hopper bottom (larry) cars that run on tracks on top of the battery. A leveler bar on the push machine that runs on tracks parallel to the battery is inserted into the oven through the small chuck door to level the top of the coal. Heat is applied by burning coke oven gas in flues in the walls between ovens. Combustion products are collected from all flues in a battery and discharged through one stack.

During the coking period, volatile materials are distilled from the coal and are collected through standpipes passing out through the roof of the oven at either end. These materials are processed in the byproducts plant and coke oven gas is recovered.

When the coking period is completed, the doors at both ends of the oven are opened and the red-hot coke is pushed from the oven into the quench car by the ram on the push machine. The quench car moves the coke to the quench tower where it is sprayed with water to cool it. The cooled coke is delivered to handling equipment for subsequent movement to point of use, normally the blast furnaces.

Once the coke has been removed from an oven, the doors are closed and the charging cycle is repeated.

Emission Sources

Combustion gases from the flues are exhausted to the atmosphere through the main battery stack. If there are leaks in the oven walls, volatile material from the ovens may also vent through this stack. Visible emissions occur when the coke is pushed into the quench car, and from the quench car, as it is moved to the quench tower. The quench produces visible emissions from the tower, along with large volumes of steam. Volatile materials in the ovens may escape to the atmosphere through leaks around the charging ports and oven doors and from leaks at blowoff valves on the gas standpipes or around the base of the standpipes. Emissions also occur from the charging ports during charging operations.

Air Pollution Controls

There are no control devices on any of the sources of emissions with the exception of a TRW charged droplet scrubber installed on Battery A for a pilot study of control of flue gas emissions.

Observations

Batteries A through E are served by stacks #6 through 10. Batteries F and G are served by stack No. 11. During this survey, the coking period for Batteries A through E was 40 hours while for Batteries F and G, the period was 15.7 to 17.1 hours. Batteries A and E are operated at lower temperatures than are F and G. Each oven was charged with 12,200 kg (26,800 lb) of coal.

Visible emissions from the battery stack normally occur only when leaks into the flues from the ovens are present. Since the batteries are never shut down, maintenance to seal the leaks must be done while the ovens are hot. A silicone sealer is used for this purpose.

Observations of excessive visible emissions from coke battery stacks are summarized in Table IV-5. The worst emissions occurred

Table IV-5
SUMMARY OF VISIBLE EMISSION OBSERVATIONS AT COKE BATTERY STACKS

Battery	Date (1975)	Time (min) Observed	>20%	>30%	Avg. Opacity† >20%	>30%	Max. Opacity (%)
A (Stack #6)	9/17	18.25	18.25	18.25	98	98	100
		28	25.75	25.50	79	80	100
	9/18	24.75	24.75	24.75	94	94	100
		12.25	12.25	12.25	50	50	60
		25	25	25	91	91	100
		9	9	9	55	55	65
	9/20	10	10	10	88	88	100
		13	13	13	57	57	65
	9/22	23.50	23.5	23.5	98	98	100
		20	20	20	80	80	100
B (Stack #7)	9/17	8	7.75	7	67	72	80
		17.25	17.25	17.25	82	82	100
	9/18	22.50	22.50	22.50	74	74	100
		13	13	12.50	43	44	65
		20	20	20	93	93	100
	9/20	10	10	10	84	84	100
	9/22	19	19	19	86	86	100
		9	9	9	74	74	95
C (Stack #8)	9/17	9.75	9.75	8.75	53	56	100
	9/18	16.25	16.25	16.25	75	75	100
	9/19	10	10	9.25	48	50	65
D (Stack #9)	9/17	6	5.5	3.75	44	55	85
		13.75	13.75	12.75	52	55	100
	9/18	15	15	15	56	56	85
		7.25	7	5	60	75	95
	9/19	15	13	8.5	34	44	60
		19	18.75	15.75	48	63	80
		12	12	12	80	80	100
	9/22	10	10	8.75	43	46	70
E (Stack #10)	9/18	26	25.75	24.50	61	63	95
		16.75	15	13	42	46	80
	9/19	23	22.5	17.25	35	39	70
		13	13	10.5	55	63	100
		12.25	11.75	11	51	53	80
	9/20	22.25	22.25	18.75	49	54	95
F, G (Stack #11)	17	10.25	9.5	5.5	49	68	100
		19	18.75	16	45	49	80
		6	4.75	3.5	37	42	50
	9/18	4.25	4.25	4	48	50	65
	9/19	8	8	8	85	85	100
	9/20	10.5	9	4.25	28	33	40

† *Average opacity observed in excess of stated value.*

from stack #6 serving Battery A, the oldest battery in the installation.

Excessive visible emissions also occurred from other coke battery operations. The most significant emissions were from oven door leaks. Observations of excessive door emissions are summarized in Table IV-6. Door leaks occurred both immediately after charging and later during the coking period. Doors on the A through E Batteries (oven numbers less than 250) appeared to take longer to seal. The company indicated that this was due to the lower operating temperatures in these batteries.

Observations were made of all ovens on three days to determine the frequency of occurrence of door leaks without regard to the opacity of emissions. The results of these observations are shown graphically in Figure IV-5. On 20 September, only the coke side of the battery was observed during the first five time periods. Beginning at 1555 hours, both sides of the battery were observed, as was the case for all three periods on 23 September. On 24 September, only the push side was observed. These observations indicated that door leaks occurred much more frequently on the push side, probably due to additional wear produced by the pushing ram and leveling bar striking the rim of the oven and chuck doors. Changes in pressure within the coke oven gas collecting system was the probable cause of changes in the number of door leaks. This is shown in Figure IV-5 for 1130 hours on 23 September and 1135 hours on 24 September when a large increase in door leaks occurred.

Closer examination of individual doors after charging indicated that in some cases the initial leakage emissions were from 20 to 40% opacity and sealed within 15 minutes. Others took longer to seal or were of a higher opacity. These high opacity emissions are summarized in Table IV-6 for the observations of leaks immediately after charging. Emissions from doors that took longer to seal are summarized under the observations taken during coking.

Table IV-6
SUMMARY OF VISIBLE EMISSION OBSERVATIONS AT MISCELLANEOUS COKE BATTERY SOURCES

Date (1975)	Oven No.	Oven Side	Time (Min.) Observed	>20%	>30%	Avg. Opacity† >20%	>30%	Max. Opacity (%)
			Door Leaks Immediately After Charging					
9/23	204	Coke	8.25	8.25	8.25	48	48	80
	244	Coke	7	7	7	64	64	80
9/24	75	Coke	22	22	20.75	66	70	100
	85	Coke	20.25	19.25	14.75	38	43	60
	267	Coke	11.75	11.75	11	52	53	100
	277	Coke	8.25	8.25	6	36	41	60
	283	Push	9.25	9.25	9.25	65	65	70
	25	Coke	6.25	6.25	6.25	41	41	50
	35	Coke	9	9	9	45	45	55
	45	Coke	9.75	9.75	9.75	48	48	60
	285	Coke	14	13	11.25	39	42	60
	333	Push	9	9	9	61	61	70
			Door Leaks After Coking					
9/17	24	Push	9	9	9	82	82	100
9/20	157	Push	15	14.5	14.25	44	44	60
	14	Coke	9	9	9	56	56	85
9/22	186	Push	11.75	11.75	11.75	74	74	80
	124	Push	6.75	6.75	6.75	64	64	80
9/23	74	Coke	8.75	8.75	8.75	74	74	80
9/24	53	Push	10	10	10	80	80	90
	143	Coke	7.75	7.75	7.75	74	74	80
	15	Push	10	10	10	83	83	90
	13	Coke	10.25	10.25	10.25	61	61	80
	101	Coke	13	13	13	48	48	65
	65	Push	10	10	10	70	70	80
	213	Coke	10	10	9.5	43	44	65
	47	Coke	10	10	9	48	50	70
	315	Coke	13	13	12.75	53	54	100
	127	Coke	11.25	9.75	7.5	33	36	45
	157	Coke	9	9	8	58	62	100
			Standpipe Leaks					
9/20	129	Coke	10	10	10	85	85	100
	187	Push	15.75	14.75	14.25	49	50	65
			Quench Tower Emissions					
9/18	East	-	23.25	20.25	16.50	41	46	100
9/19	East	-	17	17	16.75	54	54	80
9/20	East	-	14.50	13.50	12.25	47	49	100

† *Average opacity observed in excess of stated value.*

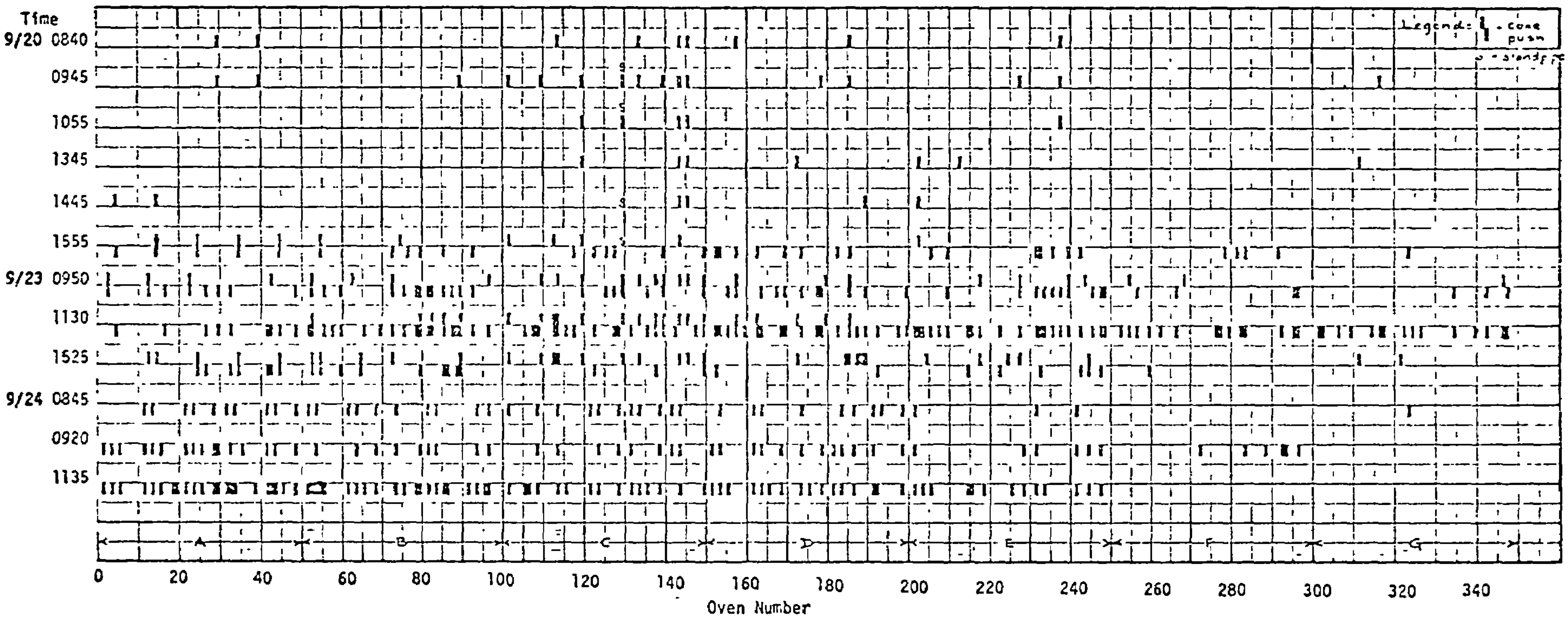

Figure IV-5. Observed Coke Oven Leaks

Excessive emissions from standpipe leaks on top of the coke batteries were observed on several occasions [Table IV-6]. The optimum location for observing these leaks, however, is from on top the batteries as discussed below.

Excessive emissions were also observed from the quench towers [Table IV-6]. When the quench car arrived at the quench tower, emissions could be observed before quenching began. During quenching, large steam clouds were produced but dissipated about 30 m (100 ft) downwind leaving a visible white plume. About 3 minutes were required from the time the car arrived at the tower until the quench was completed, during which time reading was possible.* On several occasions, a delay occurred between arrival of the quench car at the tower and the start of the water spray. This resulted in excessive smoke emissions. For Batteries F and G, processing coke on a 15 to 17 hour cycle, about six quenches per hour would be expected. However, during one 60-minute period, eight quenches were observed.

Each process associated with the pushing and charging cycle was timed to examine the range of these variables. The push cycle was separated into the period between the coke door opening and time the coke began to move; the time during which the coke was being pushed into the coke car; and the time of travel of the coke car to the quench tower.

Charge time was measured from the time the larry car moved into place until it moved from over the oven. This may not correspond in all cases to the actual charging time. However, to determine actual charge time would have required personnel to be on top of the battery.

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* *Deterioration of baffles in the tower and the poor quality of quench water probably contributed to these emissions.*

The company instituted stage charging quite recently, 5 September, on Batteries A through E and 25 August for Batteries F and G. Only one larry car had been completely modified for this new procedure and it was out of operation. The company indicated that this change was being resisted (as most changes will be) by operating personnel. Thus, while sequential charging required about 2-1/4 minutes, stage charging was presently requiring between 3 and 6 minutes but should reduce to about 2-3/4 minutes when accepted. The break-in period, plus the hazards and heat associated with monitoring the process from top-side during high ambient temperature conditions, suggested that timing and evaluation of visible emissions from the push-charge cycle would be more productive and meaningful at a later date. The heat and hazardous conditions also suggested that standpipe and charge port leaks would best be evaluated at that time as well.

The largest time variable in the push cycle (27 observations) was the time between door opening and the push. This ranged from 30 seconds to 14-1/2 minutes, with a median of 2-3/4 minutes. The push time into the coke car was relatively uniform, between 25 and 50 seconds, with a median of 30 seconds. The time to reach one of the three quench towers largely depended on the towers in use relative to the location of the particular oven. This ranged between 15 seconds and 2-1/3 minutes with a median of 55 seconds. Total time for the push varied from 2 to 17-1/4 minutes with a median of 4-1/4 minutes.

Charging time as measured required from 2-1/4 to 12-3/4 minutes (23 observations) with a median time of 4-1/4 minutes. Four of these observations (17%) were below 3 minutes, indicating either that stage charging was beginning to be accepted or that sequential charging was still occurring.

OPEN HEARTH FURNACES

Basic Process

For many years, the open hearth furnace process was the major means of converting iron to steel. In most steel mills, the open hearths are being replaced by basic oxygen steel process (BOSP) furnaces. At Fontana, both processes are in use but additional conversions from open hearth to BOSP furnaces have been proposed as discussed in Section V.

The open hearth furnace is basically a shallow rectangular refractory basin or hearth enclosed by refractory lined walls and roof. A typical process flow diagram is shown in Figure IV-6. Scrap iron and steel, iron ore, and limestone are charged into the furnace, and fuel from a burner at one end of the hearth is ignited to produce heat over the scrap to melt it. Combustion gases are drawn off at the other end of the hearth through a chamber filled with a checkerwork of refractory materials that absorb heat and cool the gas. An identical chamber at the burner end of the furnace preheats combustion air. Periodically the air flow direction is reversed.

When meltdown of the scrap has been completed, molten iron from the blast furances is charged. The iron is poured from the hot metal transfer car into a hot metal ladle which, in turn, charges it into the furnace.

As heating continues, carbon monoxide and carbon dioxide are released from the iron ore and limestone to produce the ore and lime boils. Further heating refines the steel by removing impurities. The refining period can be speeded up by lancing the surface of the hot metal with pure oxygen.

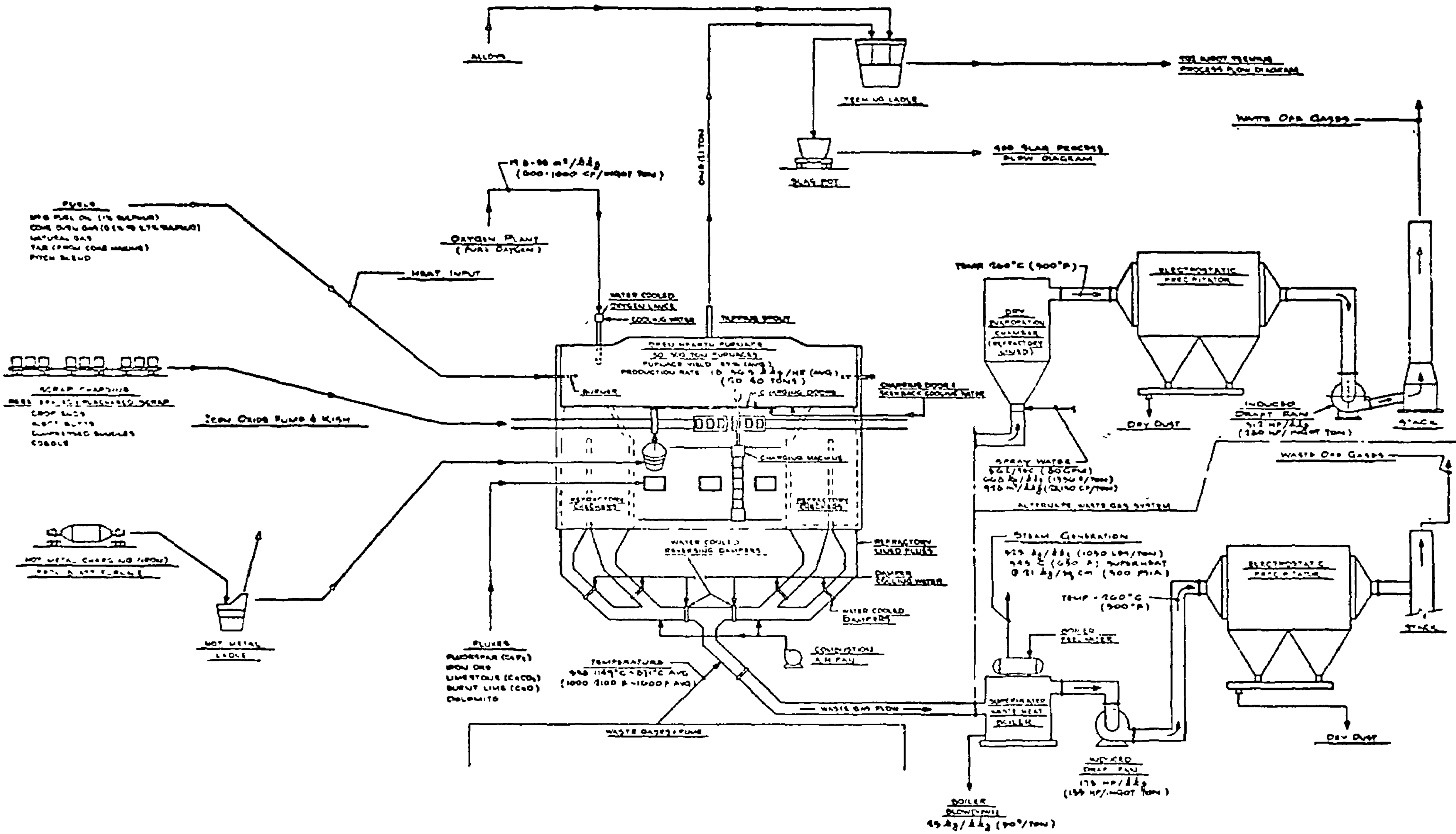

Figure IV-6. Typical Open Hearth Furnace Process Flow Diagram

When the proper steel composition and temperature are reached, the furnace is tapped and the molten contents drawn off to a teeming ladle. Slag is floated off the metal surface in the teeming ladle to slag ladles for disposal. The molten steel is ladled into ingot molds and is air cooled.

Emission Sources

The primary emission source is the stack that conveys combustion gases and fumes from the hearth to the atmosphere. In addition, various operations produce emissions inside the furnace building that are vented to the atmosphere through roof monitors. These include the charging of scrap and hot metal, the transfer of hot metal to the charging ladle, and the tapping of steel into the teeming ladle.

Air Pollution Controls

Emissions from the hearth are controlled by electrostatic precipitators (ESP) before release to the furnace stack. There are no controls on roof emissions.

Observations

There are currently eight operable open hearth furnaces at Fontana. These are numbered 1 through 9 with unit No. 3 disassembled. The corresponding stack numbers and locations are shown in Table IV-3 and Figure IV-2. Stack No. 14 that formerly served furnace No. 3 is still in place. During the survey only furnaces No. 1, 2, 5 and 9 were operating.

Excessive visible emissions were observed to originate from both furnace stacks and roof monitors. These are summarized in Table IV-7.

Excessive stack emissions generally occur as a result of mechanical or electrical problems with the ESP or when rapid fluctuations in process emissions cause the ESP to be operated outside design specifications.

Process data (heat reports) made available by the company indicated that the overall time from charge to tap was between 5 and 7 hours. Charging of raw materials required between 30 and 90 minutes, followed by the addition of hot metal between 30 minutes to 2-1/2 hours later. Comparison of stack emission observations with these heat records showed that the excessive visible emissions occurred during the working period following hot metal addition, except for one instance when emissions were observed during the melting period.

The emissions during the working period probably occurred during oxygen lancing. For those cases checked, no excessive visible emissions from the stacks occurred during scrap charging or hot metal addition.

BASIC OXYGEN STEEL PROCESS FURNACES

Basic Process

The basic oxygen steel process, through the use of large volumes of oxygen, condenses the process for converting iron to steel from 5 to 7 hours in the open hearth furnaces into a period of less

Table IV-7
SUMMARY OF VISIBLE EMISSION OBSERVATIONS AT OPEN HEARTH FURNACE AREA

Emission Source	Date (1975)	Time (min)			Avg. Opacity†		Max.
		Observed	>20%	>30%	>20%	>30%	Opacity (%)
				Stack Emissions			
Hearth #1 (Stack #12)	9/18	9	9	6.50	33	36	45
		8.25	8	6.75	36	39	50
		23	22.75	21.50	40	41	60
		26.75	25.50	19.25	32	36	45
		21.75	21.75	18.75	42	45	70
	9/20	19.75	15.25	6.50	28	35	45
	9/22	18	15.25	7.75	28	34	50
	9/23	10	10	9.75	41	43	60
Hearth #2 (Stack #13)	9/18	7.5	7.5	7.5	58	58	90
	9/19	16.75	14.5	12.25	42	45	80
		18.75	18	13	31	34	50
	9/20	12.25	12	11.50	53	55	70
	9/22	10	10	10	54	54	75
Hearth #5 (Stack #16)	9/24	10	10	10	43	43	55
Hearth #9 (Stack #20)	9/17	28.75	18.5	11.5	29	33	45
		13.75	10.75	9	34	37	60
		7.5	6	5.5	45	47	60
	9/18	22	19.5	16.75	42	45	70
		7.25	5.75	5	42	45	60
	9/19	17	11.25	5	28	36	50
	9/20	14	14	12.25	57	61	95
	9/22	11	11	11	53	53	60
				Roof Monitors			
Hearth #2	9/17	21.25	8	4	28	35	40
" #4		6.25	5.25	4.25	32	35	80
" #4	9/18	17.50	13.25	9.75	34	38	50
" #6		25.75	24.50	18.50	44	53	90
" #6	9/19	9	6	4.75	43	48	80

† *Average opacity observed in excess of stated value.*

than 1 hour. The process is carried out in a refractory-lined, pear-shaped, open-mouthed furnace mounted on trunnions so that it may be tipped for charging and pouring of melted metal. A typical process flow design is shown in Figure IV-7. Iron from the blast furnace is poured from the hot metal transfer car into the hot metal ladle for subsequent charging into the furnace. Scrap metal up to 30% of the melt weight is also charged into the furnace. Limestone and other fluxes are added. Oxygen is then blown into the furnace at supersonic velocities through a water-cooled lance. This produces an exothermic reaction that releases enough heat to melt the scrap metal without adding fuel. After about 20 minutes of oxygen lancing, the steel has been refined and reaches the desired temperature. Off gases from the furnace are collected in a hood that fits over the mouth of the furnace.

The furnace is tilted and the molten steel is tapped into the teeming table for subsequent ingot casting. Slag remaining in the furnace is then poured into slag ladles and the process cycle can be repeated.

Emission Sources

The major off-gas emissions from the furnace are collected in the hood, cleaned in an ESP and then discharged to the atmosphere through a stack. Emissions can also occur from pressure relief or bypass hatches on the ducts from the furnaces to the ESPs. There are three BOSP furnaces at Fontana, Nos. 1, 2, 3, served by stacks Nos. 21, 22, 23, respectively. Emissions from each ESP can be vented through any of the three stacks.

Various operations in the BOSP building including hot metal reladling, charging, tapping, and oxygen lancing of ladles to remove residual metal from the refractory lining produce emission that reach

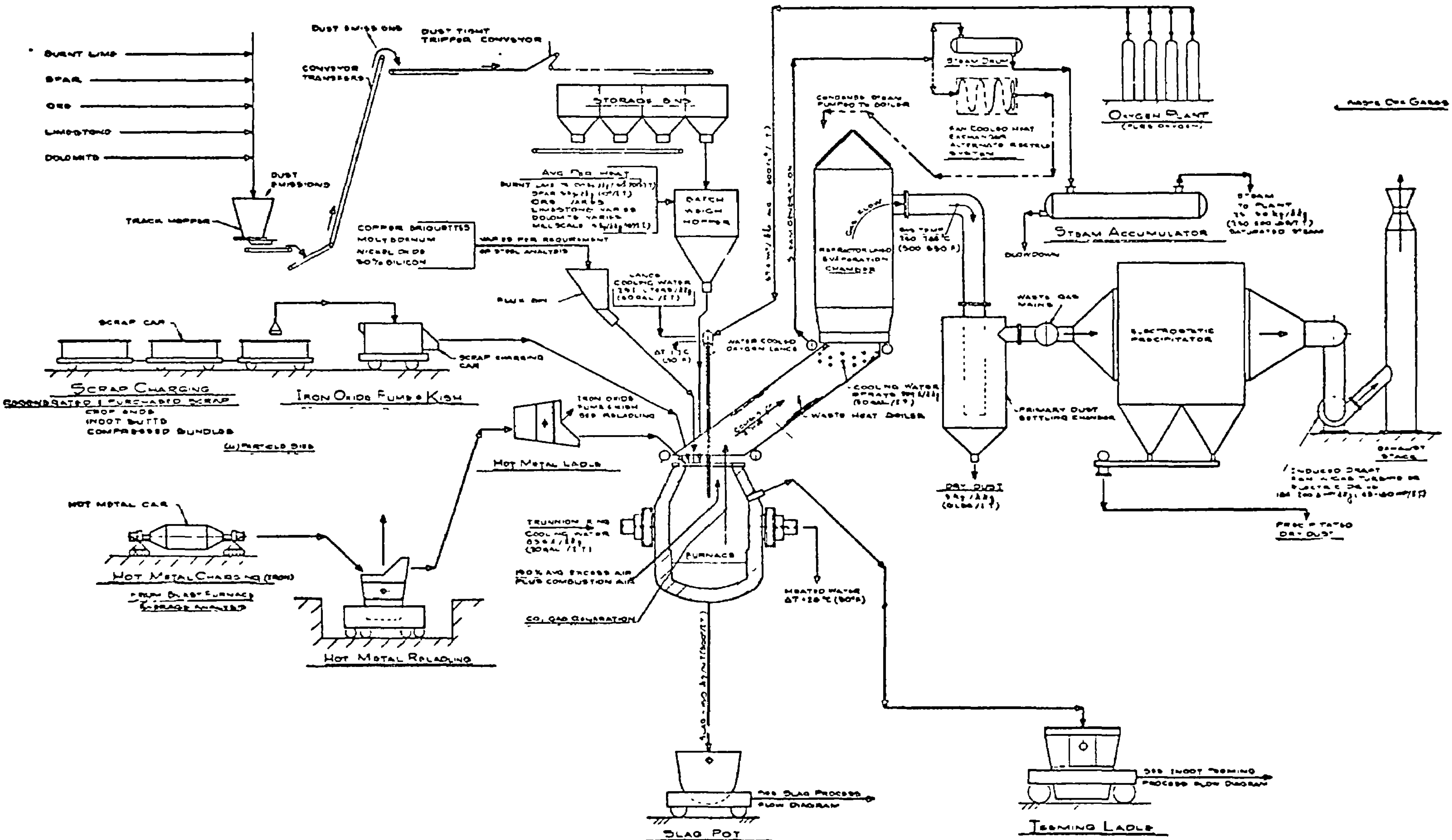

Figure IV-7. Typical Basic Oxygen Steel Process (BOSP) Furnace Process Flow Diagram the atmosphere through roof monitors and other building openings. Some of these emissions are captured by a series of ducts that convey them to the ESP serving furnace No. 3.

Air Pollution Controls

The major off-gas emissions are controlled by large electrostatic precipitators. Partial control of emissions within the building is also achieved by an ESP. A baghouse is scheduled to be installed to control building emissions as discussed in Section V.

Observations

During the survey, furnace No. 2 was not in use. Excessive visible emissions were observed originating from stacks No. 21 and 23 and from roof openings. These observations are summarized in Table IV-8. The emissions were generally rust-red although yellow emissions characteristic of scrap cutting were observed from roof openings on five occasions. The 23 September observation of stack No. 23 was taken when furnace No. 3 was not in operation. This emission thus originated from either furnace No. 1 or from other operations within the building.

Company representatives indicated that visible emissions from the stack could result from several causes. If the ESP was operating cooler or hotter than its design range, or if any of the steam or water sprays in the hood duct were inoperative, continuous emissions could be expected.

Each of the main stacks is equipped with a Bailey Smoke Density Meter and an integrator to measure the total time the emissions exceed 20% opacity.

Table IV-8

SUMMARY OF VISIBLE EMISSION OBSERVATIONS AT THE BASIC OXYGEN STEEL PROCESS FURNACES

Emission Source	Date (1975)	Time (min) Observed	Time (min) >20%	Time (min) >30%	Avg. Opacity† >20%	Avg. Opacity† >30%	Max. Opacity (%)
Stack Emissions							
Stack #21	9/19	13.75	12	11.25	40	41	60
	††	5.25	4.5	3.75	45	50	60
	9/22	14	14	12.75	58	61	100
		22	19.5	17.25	41	42	60
	9/23	9	5.75	3.25	30	35	45
	††	12	10	8.75	47	50	100
	††	12	12	7.25	33	40	60
Stack #23	9/19††	14.75	13.5	11.75	83	93	100
	9/23	19	15.25	4.75	27	40	100
ESP††† Bypass Hatches							
	9/19	18.25	12.5	10	51	57	100
		8.25	8.25	8	59	60	100
	9/23	12	10.25	8.5	54	61	95
Yellow Smoke Emissions							
Roof Openings	9/17	8.75	8.5	8	47	49	60
		13.5	13.5	13	42	43	55
		11.75	10.5	9.5	42	45	65
	9/18	14.75	14.5	12.75	49	53	85
		7.5	7.5	7.5	54	55	85
White and Rust Emissions							
Roof Openings	9/17	16	12	7.75	44	65	80
		5.25	5.25	4.75	38	39	45

† *Average opacity observed in excess of stated value.*
†† *Upset Condition reported to the San Bernardino County Air Pollution Control Zone.*
††† *Electrostatic precipitator.*

Examination of the smoke density recordings [Figs. IV-8, IV-9] indicates that emissions from stack No. 23 varied only slightly and were within acceptable opacity limits on both days illustrated, 20-21 September. The charts also show that the meters are kept in good repair since they continue to return to a 2% minimum, indicative of routine maintenance and the use of a live zero. On the other hand, similar charts for stack No. 21 [Figs. IV-10, IV-11] show that emissions from this stack were in excess of the Rule 50A limitation for about six periods each day. This is probably indicative of poor operation or maintenance of the ESP, but it is also directly related to the cyclical operation of the BOSP furnace.

Reddish-brown emissions were observed when leaks occurred at the seals on the pressure relief or bypass hatches mounted on the roof in the exhaust stream from the furnace to the ESP. This occurred when the hatches were not closed and sealed properly. These emissions were related to the cyclical operations of the furnaces. Visible emissions in the building were also observed during charging and tapping operations.

The most significant visible emissions within the BOSP furnace building that eventually reached the atmosphere through roof openings resulted from hot metal reladling and lancing of ladles. Emissions were produced when molten iron was poured from the hot metal transfer car into the hot metal ladle at the reladling station. Emissions also resulted when ladles were lanced as part of regular maintenance to remove metal deposits remaining on the refractory lining. Both activities produced emissions that appeared to far exceed those produced by charging and tapping operations.

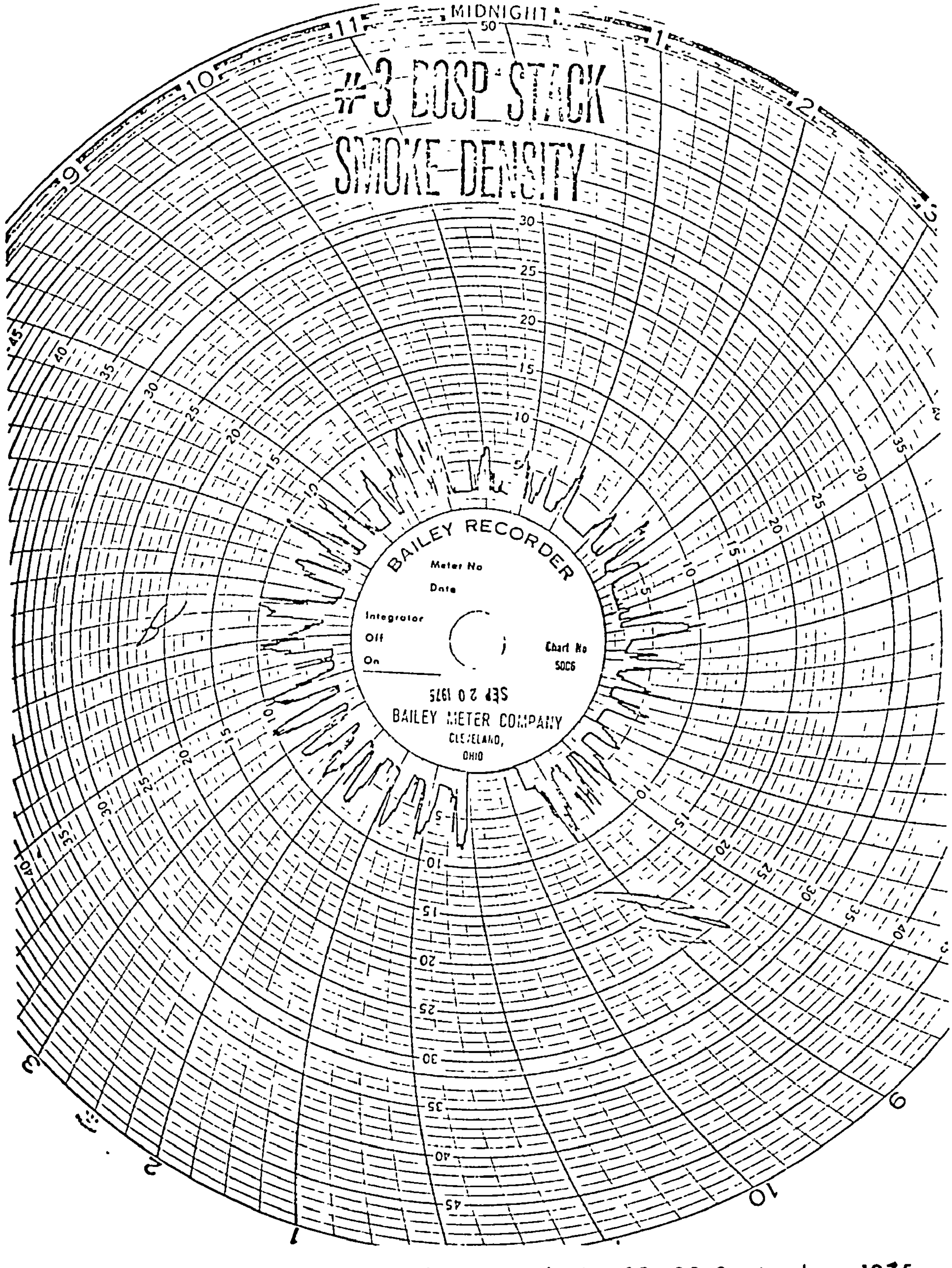

Figure IV-8. Smoke Density Readings-Stack No. 23, 20 September 1975

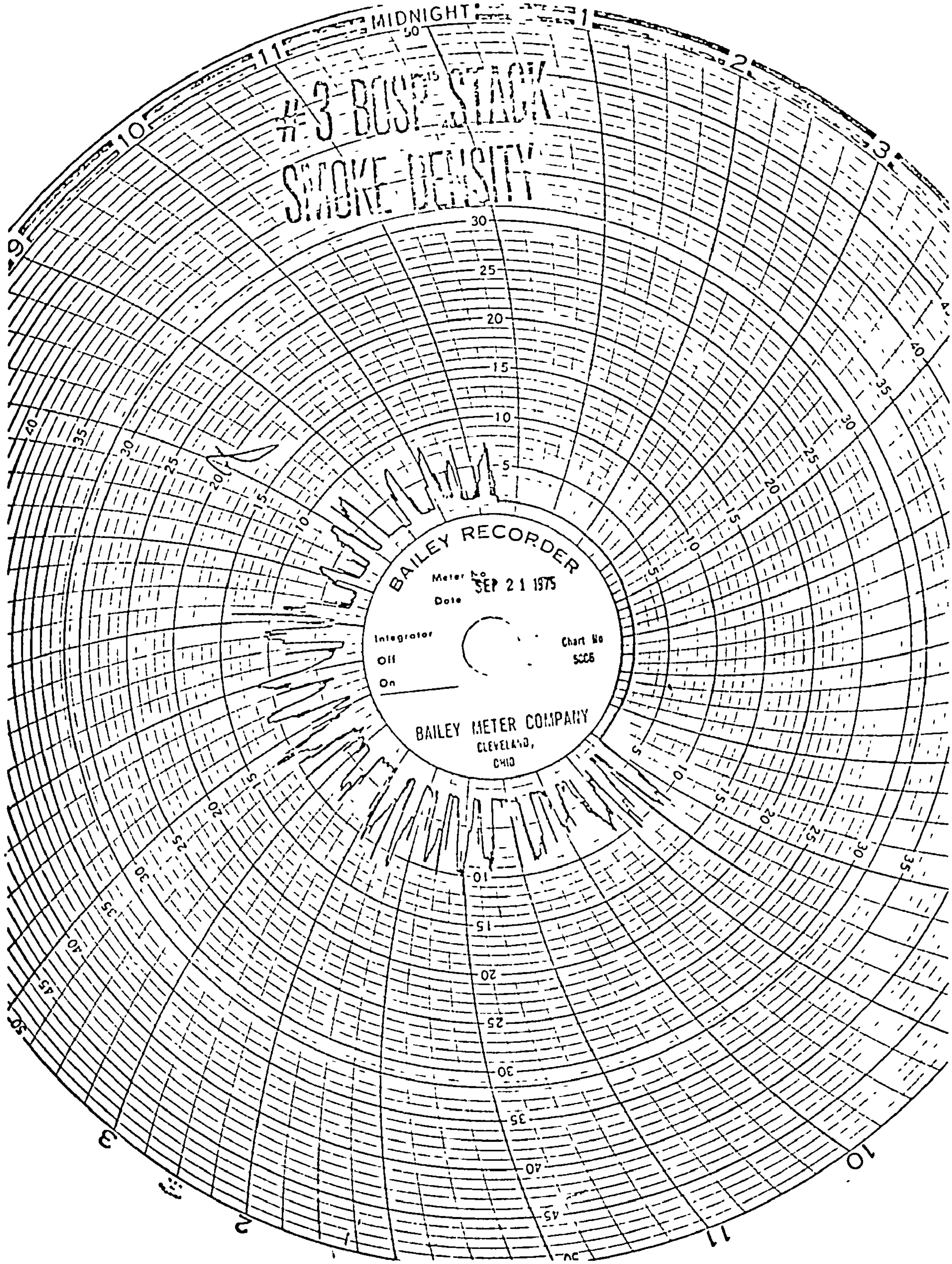

Figure IV-9. Smoke Density Readings-Stack No. 23, 21 September 1975

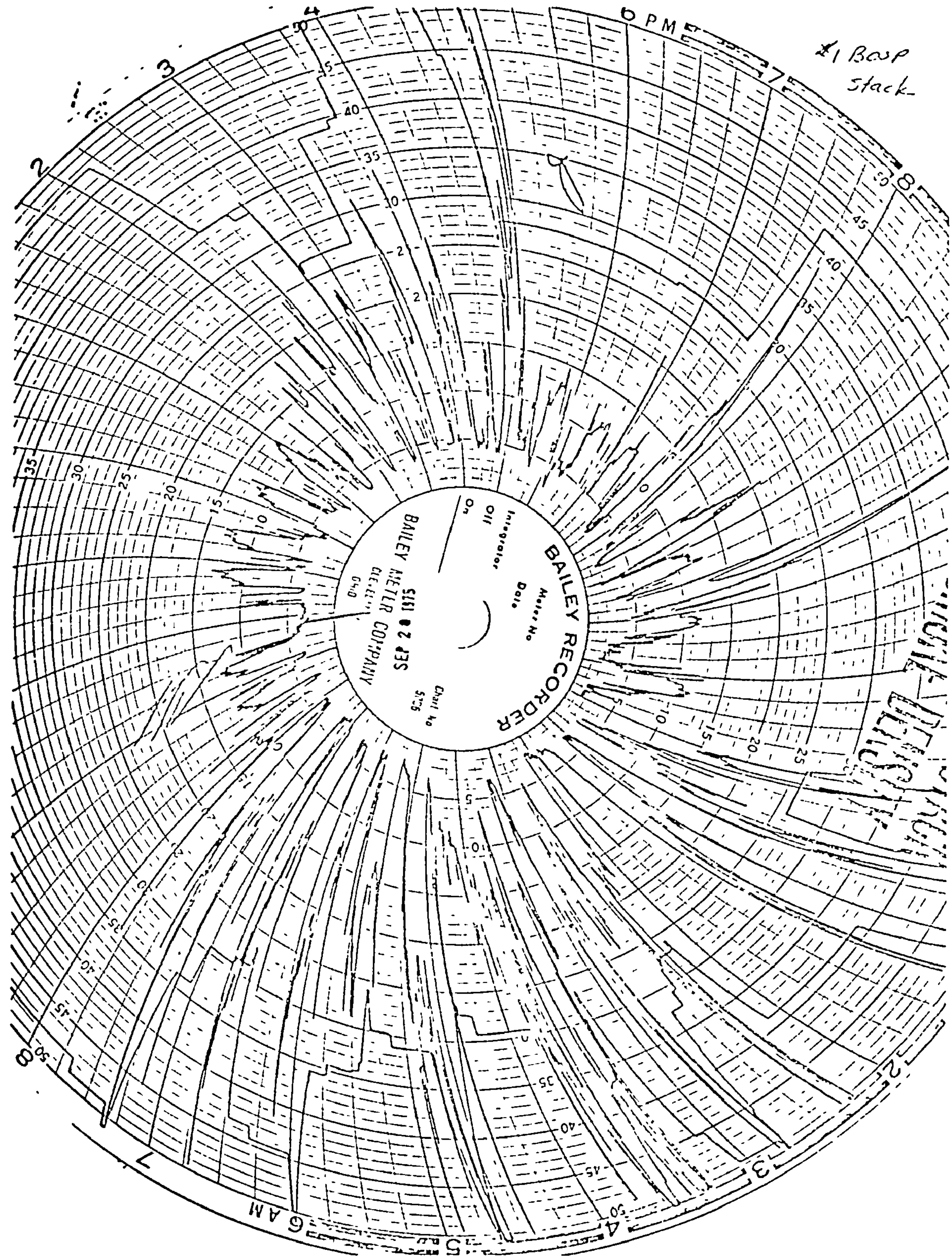

Figure IV-10. Smoke Density Readings-Stack No. 21, 20 September 1975

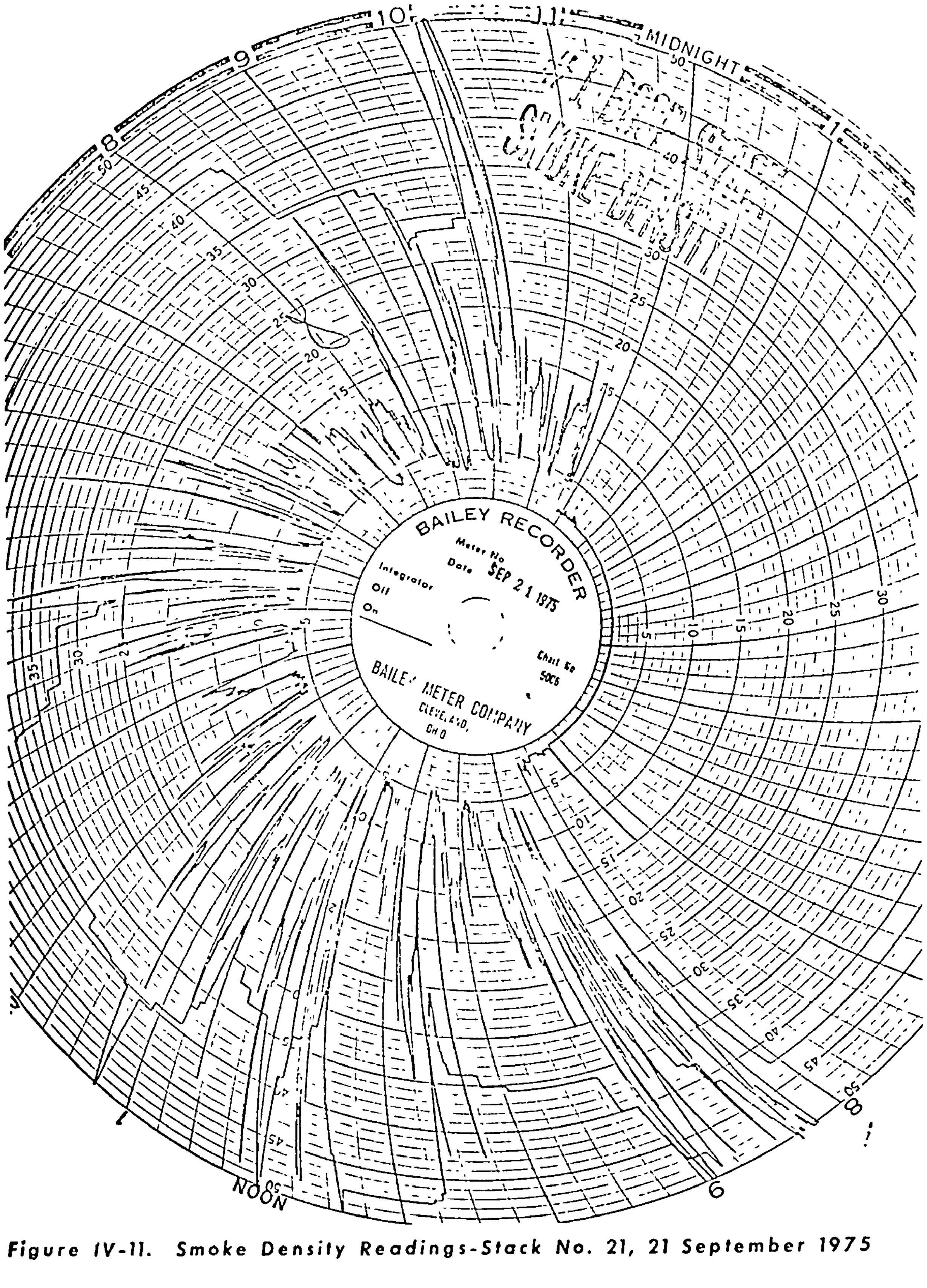

Figure IV-11. Smoke Density Readings-Stack No. 21, 21 September 1975

ROLLING MILL SOAKING PITS

Basic Process

Steel ingots from the BOSP or open hearth furnaces must be passed through hot forming processes before they can be converted to finished steel products. The ingots are heated in special furnaces called soaking pits before they are fed to the primary rolling mills for forming into intermediate forms such as slabs, blooms and billets. Coke oven gas or natural gas is usually burned in the pits with combustion gases and exhausted to the atmosphere through furnace stacks.

Emission Sources

There are 38 soaking pits serving the rolling mills at Fontana. Each pair of soaking pits is served by a single 34 m (110 ft) tall stack. Stack locations and designations are shown in Figure IV-2 and listed in Table IV-3.

Air Pollution Controls

There are no air pollution controls on soaking pit emissions.

Observations

Excessive visible emissions were observed from six of the soaking pit stacks [Table IV-9]. The emissions were gray to black and resulted from improper fuel combustion. Because of the location of the stacks with respect to the rolling mill buildings, many were virtually impossible to observe from ground level while meeting EPA Method 9 requirements.

Table IV-9

SUMMARY OF VISIBLE EMISSION OBSERVATIONS AT ROLLING MILL SOAKING PITS

Emission Source	Date (1975)	Time (min)			Avg. Opacity†		Max. Opacity (%)
		Observed	>20%	>30%	>20%	>30%	
Stack No.							
33	9/17	6	6	5.5	38	39	50
37		31	30.25	30	56	57	60
40		12.75	11	3.25	25	32	35
37	9/18	10	10	10	58	58	85
31	9/19	19.25	16.5	8.5	27	32	40
41	9/20	18.5	16.5	6.75	26	31	35
43		11	9	3.75	26	31	35
43	9/22	9	9	9	45	45	55

† *Average opacity observed in excess of stated value.*

HOT STRIP MILL

Basic Process

Hot strip mills reduce slabs formed from ingots in primary rolling mills to flat strip steel generally less than 30 cm (12 in) thick. The slabs are heated in reheating furnaces and then conveyed to a rolling train for forming and finishing to size. The furnaces heat the slabs to a temperature of about 1,100° to 1,300°C (2,010° to 2,370°F). Coke oven gas or natural gas is generally used to fire the furnaces.

Emission Sources

The 218 cm (86 in) hot strip mill has three reheat furnaces (Nos. 1, 2, 3). Each furnace is served by a 46 m (150 ft) tall stack. Furnace No. 1 is served by stack No. 58, furnace No. 2 by stack No. 57

and furnace No. 3 by stack No. 56. With the exception of minor emissions released to the hot strip mill building when slabs are removed from the furnace, all combustion products are exhausted to the atmosphere through the stacks.

Air Pollution Controls

Emissions from the stacks are monitored by Bailey Smoke Meters set to sound an alarm whenever the opacity exceeds 10%. This reportedly permits sufficient time for operating personnel to adjust the combustion characteristics of the furnace before emissions exceed the 20% opacity limit. The stack emissions are not visible from within the mill; thus the need for the automatic alarm. There are no other air pollution controls on the furnaces.

Observations

On 23 September, excessive visible emissions were observed from stack No. 57 serving Furnace No. 2 when the alarm failed to operate. Emissions exceeded the 30% limit for 10 minutes during the period of observation. The maximum opacity observed was 60%, with a 49% average.

SCRAP CUTTING

Basic Process

Basic iron and steel production processes and the finishing mills generate scrap iron and steel that can be recycled through the steel making process without waste. This scrap ranges in size from large ladle "skulls" to small sheet scraps. Scrap steel is also imported to the plant from other locations. The large pieces must be cut or broken into smaller sizes before they can be charged into the basic oxygen and open hearth furnaces. This can be accomplished by cracking the pieces by impacting with a large steel ball, by shearing plates or more commonly by cutting with gas torches. When torches are used for cutting ingots and other thick scrap, visible emissions in the form of yellow-brown or green smoke are released to the atmosphere.

Emission Sources

The major scrap cutting operation is conducted in the open on the east side of plant property. On several occasions, scrap cutting was observed at other locations on plant property. For these open air operations, the smoke is released directly to the atmosphere. Scrap cutting inside buildings produces emissions that are released to the atmosphere through roof monitors.

Air Pollution Controls

There are no air pollution controls for the scrap cutting operations.

Observations

Excessive visible emissions from scrap cutting operations were observed on several occasions at both the main scrap area and south of the BOSP area. These are summarized in Table IV-10.

Table IV-10

SUMMARY OF VISIBLE EMISSION OBSERVATIONS AT SCRAP CUTTING AREAS

Emission Source	Date (1975)	Time (min) Observed	>20%	>30%	Avg. Opacity† >20%	>30%	Max. Opacity (%)
South of BOSP	9/17	9.25	7.5	5.75	34	37	50
		9	7.5	6.75	57	61	80
Main Area	9/18	18.25	10	6.5	37	45	75
		19.50	10.5	9.25	46	49	80
		11.75	10	9.5	52	54	80
		13.25	7.5	6.75	44	46	80
	9/19	28	20	18	56	60	90
		9.5	9.5	9.5	79	79	95

† *Average opacity observed in excess of stated value.*

V. ANALYSIS OF THE STATUS OF COMPLIANCE WITH THE CONSENT ORDER

On 11 July 1974, the EPA and the Kaiser Steel Corporation entered into a Consent Order (Docket No. 9-74-9) under which the Company agreed to an implementation plan and schedule for reducing air pollution from that facility. This Order was revised on 11 November 1974 to adjust intermediate increments to Appendix E of the Order without affecting final compliance dates. The Order included these six Appendices dealing with various processes at the plant:

A Coke Oven Battery Stacks
B Coke Oven Batteries
C Basic Oxygen Steel Processing Shop
D Open Hearth Furnace Stacks
E Scrap Metal Cutting Operation
F Desulfurization of Coke Oven Gas

Subsequent to this revision, the Company proposed a $150 million Steelmaking Modernization Project contingent upon securing financial commitments and obtaining the necessary concurrence and permits from regulatory agencies. This plan would extend the compliance dates of portions of the air quality control program past those contained in the Consent Order.

On 17 September 1975 progress toward compliance with the Consent Order was discussed with a representative of the Company. Present were:

Mr. John H. Smith, Director, Environmental Quality Control, Kaiser Steel Corporation
Ms. Lois E. Green, Enforcement Division, EPA-Region IX
Dr. Jules B. Cohen, EPA-NEIC
Mr. Karl Krause, California Air Resources Board

Information obtained during that discussion is contained below. Every milestone in each Appendix to the Order to date has been listed, followed by Company progress in meeting that milestone.

EVALUATION OF APPENDIX A REQUIREMENTS

The Kaiser Steel Corporation, Steel Manufacturing Division, shall complete the following acts with respect to its coke oven battery stacks, listed below, on or before the dates specified:

A. "A" Battery Stack.

(1) 1 November 1974 - submit progress report on status of research and development program.

By letter dated 30 October 1974 the Company transmitted "TRW Systems Group Progress Report No. 15" prepared for EPA. TRW is conducting a research and development program on a Charged Droplet Scrubber for Fine Particle Control. The pilot plant portion of the program included a proposal to process one-half the normal output of "A" Battery stack at the Kaiser coke ovens.

(2) 1 May 1975 - submit final control plan.

The Corporation submitted a control plan on 10 June 1975 confirming the system in (1) above. But the plan only addressed installation of the prototype unit designed to process up to half the normal capacity of the stack. A submittal on 23 April 1975, including drawings of the unit, did not meet the requirements of the Order. The Company was so advised on 23 May 1975.

(3) 1 July 1975 - let contracts for the purchase of control equipment or process modification.

On 25 June 1975 the Company advised they had let a contract for purchase of the Charged Droplet Scrubber and for installation of the unit. However, the only contract that had been let at that time was a contract from TRW to Kaiser Steel for installation of the prototype Charged Droplet Scrubber.

The Consent Order has no requirements to date; however, the Kaiser Steel Modernization Program proposes to extend the EPA compliance date of 31 December 1977 until 31 December 1978 on two stacks, and 30 June 1980 on the remaining three stacks. This assumes the success of the

TRW project discussed above. Should this not be successful, a Wet Precipitrol by Fluid Ionics would be considered; however, this could extend dates even further.

EVALUATION OF APPENDIX B REQUIREMENTS

The Kaiser Steel Corporation, Steel Manufacturing Division, shall complete the following acts with respect to its coke oven operations on or before the dates specified:

A. Pushing and charging operations at each coke oven in coke Batteries "A", "B", "C", "D", "E", "F" and "G". For the purposes of this paragraph, visible emissions from the pushing and charging operations at each coke oven shall be combined for determining interim compliance as required by sub-paragraph (5).

(1) 31 July 1974 - submit approvable operating and maintenance program. Either certify compliance as required by sub-paragraph (5) or submit final control plan.

By letter dated 30 July 1974 the Company submitted an operating and maintenance program and certified compliance with San Bernardino County Air Pollution Control District (SBAPCD) Regulation IV, Rules 50 and 50A. The above action precluded the necessity for further activity under this paragraph.

B. Coke oven doors and standpipes at each coke oven in coke oven Batteries "C", "D", "E", "F" and "G". For purposes of this paragraph, visible emissions from the doors and standpipes at each coke oven shall be combined for determining interim compliance as required by sub-paragraph (5).

(1) 31 July 1974 - submit approvable operating and maintenance program. Either certify compliance as required by sub-paragraph (5) or submit final control plan.

By letter dated 30 July 1974 the Company submitted an operating and maintenance program and certified compliance with San Bernardino

County Air Pollution Control District Regulation IV, Rules 50 and 50A. The above action precluded the necessity for further activity under this paragraph.

C. Coke oven doors and standpipes at each coke oven in coke oven Batteries "A" and "B". For the purpose of this paragraph, visible emissions from the doors and standpipes at each coke oven shall be combined for determining interim compliance as required by sub-paragraph (6).

(1) 31 July 1974 - submit approvable final control plan to include installation of new doors as well as operating and maintenance program.

A final control plan to replace all doors on "A" and "B" Batteries was submitted on 30 July 1974. The operation and maintenance program was included in the A(1) submittal above.

(2) 30 August 1974 - let contracts for the purchase of control equipment or process modification.

On 4 September 1974 the Company advised that contracts were awarded for new coke oven doors.

(3) 30 September 1974 - commence on-site construction or installation of control equipment or process modification.

The Company did not certify to completion of this increment of progress.

(4) 31 December 1974 and 30 June 1975 - submit progress report.

Progress reports were submitted on the dates required. The report of 30 June 1975 indicated no foreseeable problem in meeting the compliance schedule.

D. Such approvable operating and maintenance programs as are required by paragraphs A, B and C above, shall be incorporated into and made a part of this Order.

No action required.

E. Program designed to bring combined visible emissions from pushing and charging operations, doors and standpipes at each coke oven in coke oven Batteries "A", "B", "C", "D", "E", "F" and "G" into compliance with San Bernardino County Air Pollution Control District Regulation IV, Rules 50 and 50A.

(1) 31 August 1974 - submit plan for engineering studies.

A plan for conducting engineering studies, prepared by Battelle, Columbus Laboratories, was submitted on schedule.

(2) 31 December 1974 - submit progress report on status of engineering studies.

The Corporation advised that Battelle had completed the first portion of their report to EPA on 30 December 1974. On 26 March 1975, Kaiser submitted the Battelle report to EPA. The report, dated 31 December 1974 was a state-of-the-art review on control of emissions from coke ovens.

(3) 31 July 1975 - submit results of engineering studies and either certify compliance as defined above with San Bernardino County Air Pollution Control District Regulation IV, Rules 50 and 50A, or submit an approvable final control plan reflecting the state-of-the-art in technology to achieve compliance. Such approvable control plan shall be incorporated into and made a part of this Order.

On 30 July 1975 the Corporation submitted the final portion of the Battelle study resulting from field trips to a number of steel companies throughout the country. The San Bernardino Air Pollution Control Officer has indicated by letter (6 August 1975) to the corporation that the report contained certain errors and drew some incorrect conclusions.

The transmittal of 30 July 1975 did not certify compliance nor did it contain an approvable final control plan as required.

EVALUATION OF APPENDIX C REQUIREMENTS

The KAISER Steel Corporation, Steel Manufacturing Division, shall complete the following acts with respect to its basic oxygen steel processing shop building on or before the dates specified:

A. Charging and tapping operations at furnaces No. 1 and 3. 15 October 1974 - achieve compliance with San Bernardino County Air Pollution Control District Regulation IV, Rules 50 and 50A.

On 18 October 1974 Kaiser Steel advised that the required increment of progress regarding the charging and tapping operation had been completed. They did not certify to compliance with SBAPCD Regulation IV, Rules 50 and 50A as required.

B. Hot metal transfer operation*.

(1) 31 December 1974 - submit final control plan.

The Company submitted an engineering drawing depicting the baghouse and ductwork location with some details, in fulfillment of this requirement.

(2) 15 February 1975 - let contracts for purchase of control equipment or process modification.

On 18 February 1975 Kaiser advised that contracts had been let as required. Kaiser stated that delivery was not possible until January 1976 and requested an extension of the final compliance date from 15 December 1975 until 31 July 1976.

(3) 1 May 1975 - commence on-site construction or installation of control equipment or process modification.

Kaiser Steel advised the Agency on 8 May 1975 that on-site preparation and installation of utilities had begun in order to comply with this increment. The final compliance date has not yet been extended by the Agency.

EVALUATION OF APPENDIX D REQUIREMENTS

The Kaiser Steel Corporation, Steel Manufacturing Division, shall complete the following acts with respect to its open hearth furnace stacks Nos. 1, 2, 4, 5, 6, 7, 8, and 9, on or before the dates specified:

---

* *For purposes of Appendix C, the hot metal transfer operation at the basic oxygen steel processing shop shall include the hot metal transfer station which results in emissions from the sides and roof monitors of the basic oxygen steel processing shop building. The hot metal transfer station includes pouring of molten pig iron from torpedo cars into ladles which carry the molten iron to the basic oxygen furnaces.*

(1) *31 July 1974 - submit final control plan for upgrading of existing electrostatic precipitators as well as an operating and maintenance program therefor and for the construction of additional control equipment (electrostatic precipitators).*

On 24 July 1974 the Corporation submitted a final control plan which included modifications to the precipitators, included an operation and maintenance (O&M) program, and called for installation of a balloon flue between the furnaces and precipitators to average the flow.

(2) *30 November 1974 - let contracts for the purchase of control equipment or process modification. Continue to upgrade existing electrostatic precipitators and implement operating and maintenance program as required by Decision No. 86-D of the Hearing Board, Air Pollution Control District, County of San Bernardino, California, which is incorporated into and made a part of this Appendix.*

On 14 November 1974 Kaiser Steel requested a revision in the compliance date to 21 December 1974. This was followed on 4 December by a letter advising that the increment of progress had not been met. After a meeting on 7 January 1975 at the EPA offices, the Agency could find no justification for a delay. Kaiser Steel was advised on 17 January 1975 that they were in violation of the Order and must let contracts forthwith.

(3) *15 May 1975 - complete construction or installation of all process modifications as required by the Decision referenced in subparagraph (2) above.*

The Corporation certified completion of all construction and process modifications required by Decision No. 86-D of the Hearing Board, SBAPCD, on 21 May 1975.

(4) *1 September 1975 - commence on-site construction or installation of additional control equipment.*

The date was not met. Instead, the Company has proposed their Steelmaking Modernization Program which includes two new basic oxygen steel furnaces. These furnaces would replace five open hearth furnaces, leaving two in operation and one for standby. The open hearth furnaces would be operated at reduced rates so as not to exceed existing precipitator capacity.

The Kaiser Steel plan calls for a final compliance date of 31 December 1978, 17 months later than required by the Consent Order.

EVALUATION OF APPENDIX E REQUIREMENTS

> The Kaiser Steel Corporation, Steel Manufacturing Division, shall complete the following acts with respect to its scrap metal cutting operation on or before the dates specified:
>
> *(1) 31 July 1974 - submit final control plan to include a building enclosure and baghouse.*

The Company submitted design drawings of a scrap cutting building with baghouse control on 24 July 1974.

> *(2) 30 September 1974 - let contract for purchase of building and control equipment (baghouse). Commence off-site fabrication of building and control equipment (baghouse).*

On 4 October 1974 the Company advised that they had "initiated contract awards" for the scrap cutting operation. As stated, this did not indicate that the contract had been let as required by the Consent Order. This was clarified on 28 October 1974 when the Company indicated awarding contracts for fabrication of the building and for design and fabrication of a baghouse.

> *(3) 1 April 1975 - commence on-site construction or installation of building and control equipment (baghouse).*

No certification was received; this date was missed. The Company indicated by letter of 24 March, 1975 that they would not erect a building and baghouse for this facility. The Company was advised by the agency on 15 May 1975 that they were in violation of this provision of the Consent Order.

A new proposal is included in the Steelmaking Modernization Program. By 5 October, machine torch cutting devices were anticipated to be in place, along with a ball drop facility. Compliance by this facility will take advantage of the increased size of the charging boxes on the oxygen furnaces that have been proposed. However, the anticipated completion date for those is 31 December 1978, 31 months after the compliance date in this Order.

The Company anticipates that using the machine torches will reduce emissions enough to negate the requirement for a building and the necessary air pollution control equipment. However, while the torches and ball drop facility will process an estimated 13,970 m. tons (15,400 tons)/month, an additional 9,070 m. tons (10,000 tons)/month remains to be processed by as yet undetermined means.

EVALUATION OF APPENDIX F REQUIREMENTS

> The Kaiser Steel Corporation, Steel Manufacturing Division, shall complete the following acts with respect to the sulfur content of its coke oven gas on or before the dates specified:
>
> *(1) 31 October 1974, 30 April 1975, and 30 September 1975 - submit progress reports on status of the research and development program.*

Progress reports regarding similar installations at other steel plants were submitted on 30 October 1974 and 30 April 1975.

The Company is considering two alternative processes for desulfurization, the Firma Karl Still and the Sulfiban Process, but a decision has not been made to date.

While the Consent Order requires a final compliance date of 31 December 1977, the Steelmaking Modernization Program is suggesting 30 June 1981 for achieving compliance with SBAPCD Regulation IV, Rule 62.

DISCUSSION

Review of the Consent Order documentation, coupled with in-plant observations and VEO's, indicates that the Kaiser Steel Corporation has made progress in air pollution control at the plant but still has much to accomplish.

Analysis of the documentation required by the Consent Order indicated that in some cases the Corporation submitted plans which they did not follow. Thus, they submitted plans for (1) modifying the ESP's on the open hearth furnaces, which they now propose to eliminate through the Steelmaking Modernization Program, and (2) for a scrap metal cutting building which they now plan to negate by use of machine cutting torches which may or may not be effective.

A major problem appears to be that those certifying compliance at Corporate headquarters are not those complying at Fontana. Thus, compliance will be elusive and certification meaningless unless: (1) plant employees in the shops comprising the steel making operation are aware of the necessity for following O&M procedures, submitted as a requirement of the Consent Order to control air pollution, and (2) plant employees are advised of Corporate determination to comply with Federal, State and local requirements. For example, O&M programs have been submitted for coke oven Batteries "C" through "G" (Appendix B, Part B) and "A" and "B" (Appendix B, Part C); yet the field study documented numerous door leaks, including 29 VEO's that recorded excessive emissions from doors and two VEO's that showed excessive emissions from standpipes. If observations had been made from top-side, additional excessive emissions from standpipes would have been documented.

Without rigid requirements for the O&M necessary to bring individual portions of the coke oven door emission problem under control, it will certainly be impossible to bring combined emissions from pushing and charging operations, door and standpipes into compliance. Thus, even if pushing and charging operations can be modified to curtail emissions to within the 3-minute limitation, leaking standpipes, doors or charge ports (operating and maintenance problems) will negate this effort.

The survey also indicated air pollution contributions from facilities that were not covered by the Consent Order. Most of these could be improved by additional instrumentation or by better O&M procedures, but some need air pollution control equipment or a combination of these methods. Excessive visible emissions were recorded from blast furnace cast house roofs and stove draft stacks (8), from the ESP stacks of the basic oxygen steel furnaces (9), and from the soaking pits (8). Only those indicated earlier were reported as emergencies, so others msut be considered as routine.

In the case of the basic oxygen steel furnace, it would appear that with three ESP's available and only two furnaces operating, generally not concurrently, that sufficient ESP capacity is available to control these emissions.

Since soaking pit stacks are probably not visible from within the facility, smoke detectors with alarms could indicate when fuel mixtures must be adjusted. This approach has been used successfully at other locations at the plant.

In the absence of Federal scrutiny in these areas, Complaint Citations issued by the SBAPCD against those sources not covered by APCD variances may provide some impetus for control. However, with nominal assessments this may not be the case.

APPENDIX

VISIBLE EMISSION OBSERVATION RECORD

VISIBLE EMISSION OBSERVATION RECORD

Company ______________________________

Date ____________________ Time First Sighted Plume ____________

Time Start ____________ Time Stop ____________

Air Temperature ____________ Relative Humidity ____________

Wind Speed ____________ Wind Direction ____________

Sky Condition ____________ Background ____________

Plume Characteristics: Continuous: ( ) yes ( ) no

Color ____________ Dispersion Description ____________

Stack Height ______ (ft) Observer location: ____ (ft) ______ of stack

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

Emission Point ______________________________

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

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

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

NOTES: ______________________________

____

____

Inspector ____________________ Date ____________

MAP

Symbols

Sun = [symbol]
Plume direction = [symbol]
Point where plume observed = ...
Observer = [symbol]

Water Vapor Condensate ____

____

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

Comments ____

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____

____

____

____

____

Signature ______________________________ Date ____________________