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.

2-170-149

AP-42 Section 12.2
Reference
Report Sect. 4
Reference 136

Confidential
D. Gonzo

ONTARIO MINISTRY OF THE ENVIRONMENT IN CONJUNCTION WITH DOMINION FOUNDRIES AND STEEL, LIMITED

HAMILTON, ONTARIO

PAH SOURCE EMISSION STUDY
COKE OVEN PUSHING FUME COLLECTION SYSTEM

P-4322 BAYFRONT SOUTH COKE PLANT
COKE SIDE ENCLOSURE

DATE..... ....ISSUED BY.....

FOR ☐ COMMENT ☐ FILE

By:

ENVIROCON LIMITED
Suite 421
45 Sheppard Avenue East
Willowdale, Ontario
M2N 2Z8

Telephone: (416) 226-6012
Telex: 06-966-895

TE-2612

March 1977

SOTDAT/STEEL LIBRARY SYSTEM

Report Title: –

Plant and Location: Dominion Foundries and Steel, Hamilton Ontario

SCC: 30300303, 30300308

Testing Date(s): Envirocon 12/13-15/76

By Whom:

Stack Test Review Attached:

Reviewed by:

Problems Seen by Reviewer:

Confidentiality Status: Clear

If status is confidential, list confidential pages or sections:

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

Report Encoded by:

ıte Encoded:

m Numbers:

ents:

(2)

Title: PAH Source Emission Study

Plant and Location: Dominion Foundries and Steel Hamilton, Ontario

list twice

SCC: 30300303
30300308

Test Date: 12/13-15/76

By Whom: Envirocon

shed. See also

Encoded By:

Date Encoded:

Completed By:

Form No.:

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE OF CONTENTS

		PAGE
1.0	SUMMARY	1
2.0	INTRODUCTION	5
3.0	PROCESS DESCRIPTION	6
	3.1 Points of Emission	7
	3.2 Exhaust System	7
	3.3 Emission Control System	8
4.0	SAMPLE COLLECTION	11
	4.1 Methodology	11
	4.2 Exhaust Stack	14
	4.3 Inlet Ducts	14
	4.4 Sampling Technique	16
	4.5 Sample Recovery	19
	4.6 Process Samples	21
	4.7 Analytical Techniques	21
5.0	RESULTS	24
	5.1 General	24
	5.2 Exhaust Stack	24
	5.3 Inlet Ducting	25
	5.3.1 No. 1 and 2 Duct	25
	5.3.2 No. 3 Duct	26
	5.4 General	27
	5.5 Process Samples	28
	5.6 System Balance	28

APPENDICES

1 - Computer Output
2 - Detailed Analytical Procedures and Results
3 - Pitot Calibration Data
4 - Coke Oven Operating Data

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

LIST OF TABLES

			PAGE
TABLE 1	-	SUMMARY OF RESULTS	4
TABLE 2	-	STACK EMISSION DATA - FRONT PORTION	30
TABLE 2B	-	STACK EMISSION DATA - BACK PORTION	31
TABLE 3	-	PAH - PARTICULATE	32
TABLE 4	-	PAH - VAPOUR PHASE	33
TABLE 5	-	PROCESS SAMPLE PAH COMPOSITION SUMMARY	34
TABLE 6	-	MATERIAL FLOW BALANCES	36
TABLE 7A	-	SAMPLING TIME FOR EXHAUST STACK	37
TABLE 7B	-	SAMPLING TIME FOR PRECIPITATOR INLET	38
TABLE 8	-	COAL BLEND - DEC. 1 TO DEC. 15	39

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

LIST OF DRAWINGS

			PAGE
DRAWING A-001	-	SOUTH COKE PLANT COKE OVEN FUME COLLECTION SYSTEM	9
DRAWING A-002	-	EMISSION CONTROL SYSTEM FLOW SCHEMATIC	10
DRAWING A-003	-	CLEANING SYSTEM FLOW SCHEMATIC	12
DRAWING A-004	-	SAMPLE TRAVERSE POINTS	13
DRAWING A-005	-	INLET DUCTING TO PRECIPITATORS	15

LIST OF FIGURES

			PAGE
FIGURE 1	-	SAMPLE TRAIN SCHEMATIC	17
FIGURE 2	-	ADSORBENT SAMPLING SYSTEM	18
FIGURE 3	-	SAMPLE IDENTIFICATION	22
FIGURE 4	-	PAH ANALYSIS FLOW CHART	23

1.0 SUMMARY

Envirocon Limited, in conjunction with the Ontario Ministry of the Environment and Dominion Foundries and Steel, Limited (Dofasco), conducted a sampling program at the south side coke shed pushing fume collecting system, at Dofasco's Hamilton operation to determine the following:

* Particulate loading entering the wet electrostatic precipitator (WEP).
* Particulate loading exhausted from the WEP.
* Concentration of solvent extractables entering and leaving the WEP.
* Concentration of certain polycyclic aromatic hydrocarbons (PAH) entering and leaving the WEP.

Process samples of coal, coke, dust fallout under the hoods and samples of water entering and leaving the precipitator were taken during the survey for subsequent analysis.

Although there are many possible PAH compunds present, only the following seven were selected for analysis:

Benz(a)anthracene (B(a)A)	Perylene
Chrysene	Benz(a) Pyrene (B(a)P)
Benz(k)fluranthene (B(k)F)	Dibenz(ah) anthracene (DB(ah)A)
Benz(e)pyrene (B(c)P)	

Of these, only B(a)A, B(k)F and B(a)P were found to be present in the samples as major polycyclic aromatic hydrocarbons. PAH's reported represent these three only.

The test procedures employed were based on methods developed by Battelle Labs (Columbus, Onio) and accepted by the U.S. E.P.A. The field data collection was conducted in accordance with the specifications of and under the close scrutiny of the Ontario Ministry of the Environment.

On the basis of the tests, it was found that the system exhaust stack gas volumetric flow rates averaged 425,300 DCMH (250,200 DSCFM), 464,100 DCMH (273,000 DSCFM) and 531,200 DCMH (312,500 DSCFM) across three respective runs.

The exhaust particulate loadings for two complete tests were 0.002 (0.001 GRS/DSCF) and 0.007 (0.003 GRS/DSCF) grams per dry standard cubic meter (GM/DCM) or 1.3 (2.8 LBS/HR) and 3.8 (8.5 LBS/HR) kilograms per hour (KG/HR). The loading in the inlet ducts averaged 0.085 GM/DCM (0.036 GRS/DSCF) under pushing conditions and 0.007 GM/DCM (0.003 GRS/DSCF) under door leakage conditions. The inlet loading into the precipitation system averaged 20.8 KG/HR (45.8 LBS/HR) and 27.3 KG/HR (60.2 LBS/HR) for two series of tests. Based on the inlet and exhaust particulate loadings, the precipitator efficiency was found to be 89.3 percent.

The total solvent extractables entering the precipitator averaged 6.51 KG/HR (14.35 LBS/HR) of which 3.28 KG/HR (7.22 LBS/HR) was contained in the particulate. Of the 5.5 KG/HR (12.18 LBS/HR) of solvent extractables leaving the exhaust, 2.30 KG/HR (5.1 LB/HR) was contained in the particulates.

The total PAH entering the precipitator averaged 31×10^{-3} KG/HR (68.51×10^{-3} LBS/HR) of which 29.33×10^{-3} KG/HR (64.67×10^{-3} LBS/HR) was contained in the particulates. A total of 2.01×10^{-3} KG/HR (4.43×10^{-3} LBS/HR) was emitted from the exhaust stack, of which 1.75×10^{-3} KG/HR (3.86×10^{-3} LBS/HR) was contained in the particulates, representing a removal efficiency of 86.5 percent for the total PAH's analyzed.

Table 1 presents a summary of the average flow rates, particulate, solvent extractable and PAH concentrations and emission rates. The table separates the solvent extractables and PAH according to where they were collected in the sampling train. The front portion represents material collected before the filter and on the filter. The back portion represents material collected on the glassware after the filter, including material collected by the Tenax adsorbent.

TABLE 1

SUMMARY OF RESULTS

Source	Flowrate DCMH (DSCFM)	FRONT PORTION[1] Particulate GM/DCM (GRS/DSCF)	Particulate KG/HR (LBS/HR)	Solvent Ext. GM/DCM (GRS/DSCF) x 10^{-3}	Solvent Ext. KG/HR (LBS/HR)	PAH[6] GM/DCM (GRS/DSCF) x 10^{-6}	PAH KG/HR (LBS/HR) x 10^{-3}	BACK PORTION[2] Solvent Ext. GM/DCM (GRS/DSCF) x 10^{-3}	Solvent Ext. KG/HR (LBS/HR)	PAH GM/DCM (GRS/DSCF) x 10^{-6}	PAH KG/HR (LBS/HR) x 10^{-3}
Exhaust Stack[3]	473,600 (278,600)	0.005 (0.002)	2.56 (5.65)	4.46 (1.95)	2.30 (5.08)	3.62 (1.58)	1.75 (3.86)	6.6 (2.9)	3.2 (7.1)	0.55 (0.24)	0.26 (0.57)
Inlet Breeching (Push Cycle)[4]	268,900 (158,200)	0.085 (0.037)	22.54 (49.70)	7.32 (3.20)	1.97 (4.34)	60.86 (26.60)	16.62 (36.64)	6.6 (2.9)	1.75 (3.86)	0.85 (0.37)	0.22 (0.49)
Inlet Breeching (Exhaust Cycle)[5]	226,800 (133,400)	0.007 (0.003)	1.51 (3.32)	5.03 (2.20)	1.31 (2.88)	41.14 (17.98)	12.71 (28.03)	5.95 (2.6)	1.48 (3.27)	5.58 (2.44)	1.52 (3.35)

1. Based on material collected before and on filter.
2. Based on material collected after filter.
3. Average of 3 tests for flows, and back portion, 2 runs for front portion.
4. Average of 2 tests, on each of two hoods.
5. Average of 2 tests, on each of two hoods.
6. PAH = Sum of B(a)P, B(a)A, B(k)S

2.0 INTRODUCTION

The results obtained during an air emission survey at the Hamilton operations of Dominion Foundries and Steel Limited are presented in the following report.

The air monitoring program involved testing at the south coke oven pushing fume collection system in accordance with Dominion Foundries and Steel Limited Requisition No. P-4322-L-20.

The scope of the work include: the following:

1. Conduct specified source emission tests to determine particulate and vapour phase PAH (Polycyclic Aromatic Hydrocarbons) at the inlet and outlet of the precipitators.

   The testing consisted of:
   (a) Three particulate and vapour phase PAH tests at the exhaust stack.
   (b) One test for particulate and vapour phase PAH at each of the two inlet ducts under pushing conditions.
   (c) One test for particulate and vapour phase PAH at each of the two inlet ducts under primary door leakage conditions.

2. Conduct the testing using sampling equipment, sampling techniques, and sample recovery procedures in accordance with the standard procedures and recommendations of the Air Resources Branch of the Ministry of the Environment.

3. Collect specified process samples of coal, shed dust deposits, inlet precipitator water and precipitator bottoms during each testing sequence.

4. Document process operating conditions.

3.0 PROCESS DESCRIPTION

The manufacture of metallurgical coke provides a suitable reducing agent for the blast furnace operation in the steel making industry. Coking involves the heating of bituminous coal in a oxygen deficient atmosphere until the volatiles in the coal have been driven off.

The current technology in coking is the use of the by-product process. This process involves the use of slot-type ovens which are grouped together in a series to form a battery. The Number 1, 2 and 3 batteries at Dofasco contain 25, 35 and 45 ovens respectively. Coal is fed or "charged" to the oven through ports located on the top of the oven. The 4 meter ovens currently in use at Dofasco hold approximately 16.4 tons of coal each. The ovens are gun flue combination ovens manufactured by Koppers Beckers. Number one battery was constructed in 1956, number two in 1951 and number three in 1958.

Heat is supplied indirectly from a gas-fired regenerative combustion system located below the oven with flues between the ovens. The coking period is approximately 17 hours with coke temperatures reaching 2000° F. At the end of a cycle, when 'coking' is complete, the doors on both sides of the oven are removed and the coke pushed out of the oven into an open

railway car using a ram. The coke is then transported to a quench tower where water is sprayed for cooling and the coke is finally transferred for use in the blast furnace.

3.1 Points of Emission

Possible points of emission from a by-product coke oven system include:

(a) Charging ports and levelling bar ports during charging.

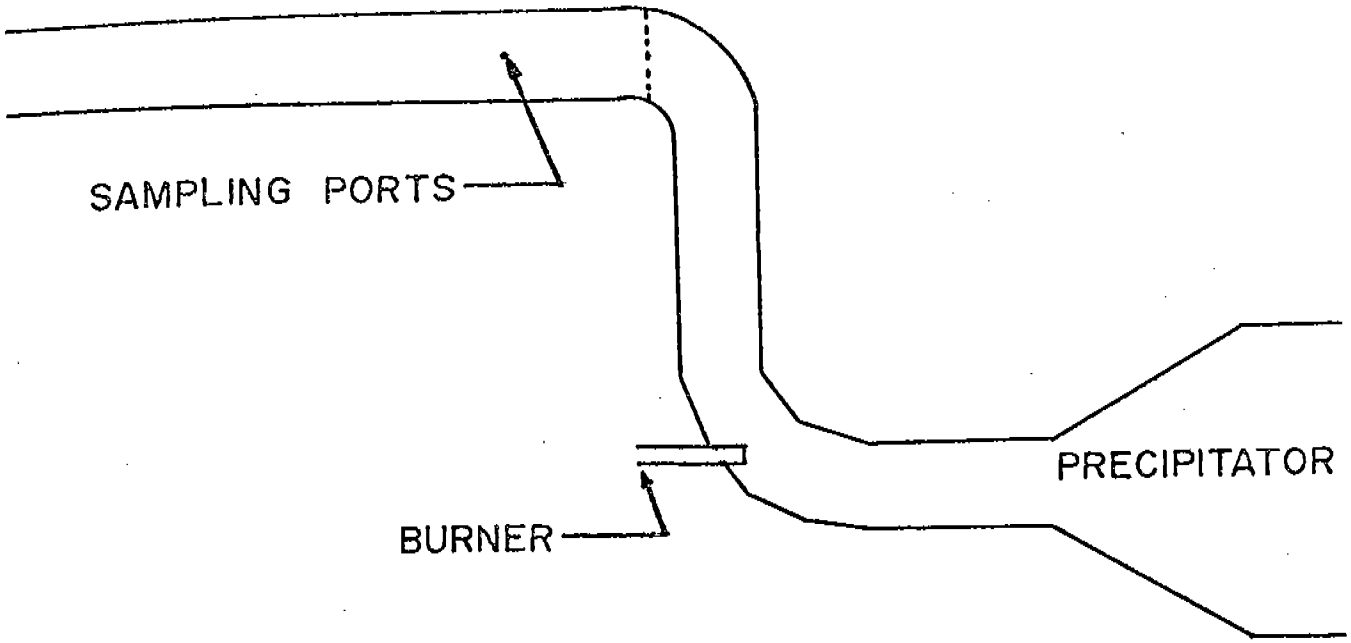
(b) Leaks in the oven at charging ports and oven doors.

(c) Oven door openings during pushing.

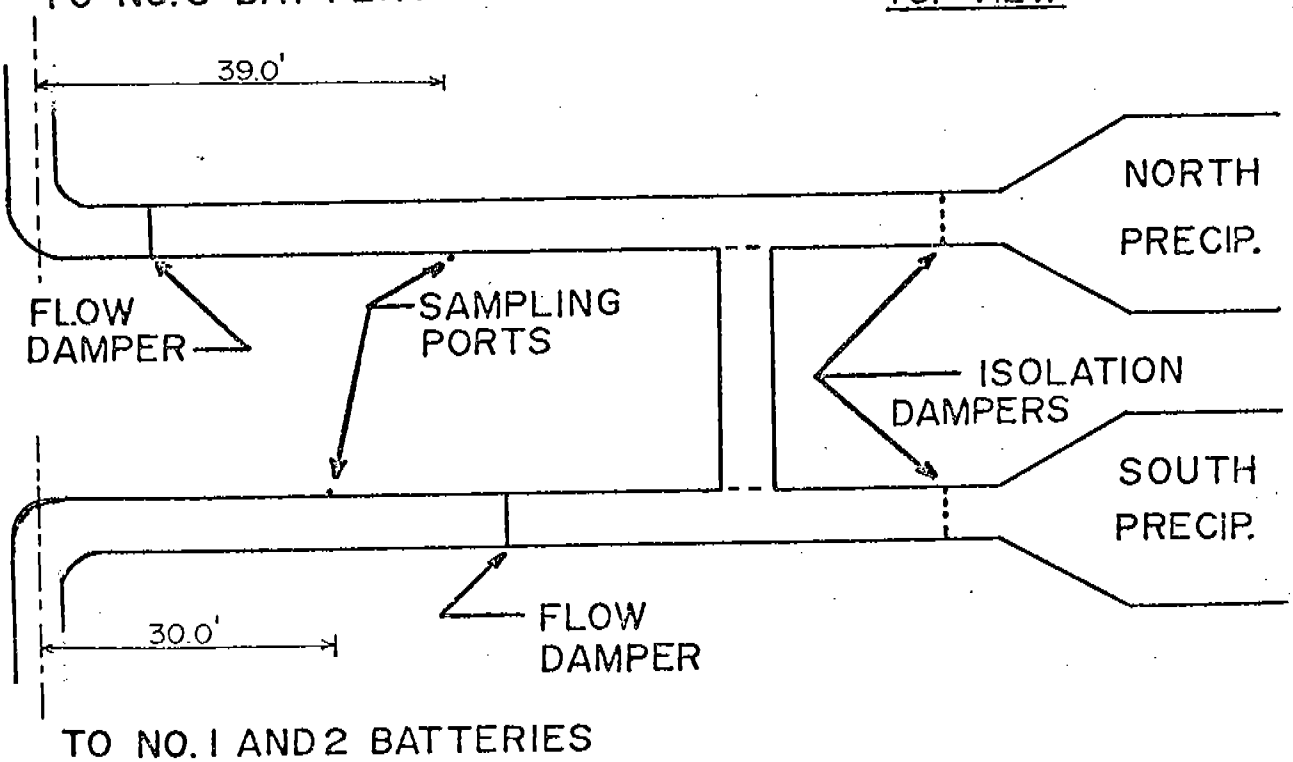
3.2 Exhaust System

In order to collect and control the emissions leaking from the coke side oven doors and the emissions generated during pushing operations, Dofasco has installed hoods or "coke oven sheds" on their number one, two and three batteries.

One shed exhausts batteries number 1 and 2 and one shed exhausts battery number 3. Only one battery is pushed at any one time, therefore, to improve the exhaust during pushing, a larger portion of the air flow is normally taken from the battery being pushed. During the non-pushing sequence, the hood with reduced draw ventilates door leakages.



SIDE VIEW



TOP VIEW

envirocon Ltd.

VANCOUVER TORONTO CALGARY

INLET DUCTING
TO PRECIPITATORS

SCALE	N.T.S.	DAY	MO.	YR.
DR'N				
CH'K'D.				
APP'D.				

DWG. A-005

REV

Usually 6 pushes in a row are conducted under the shed venting batteries 1 and 2, and 5 pushes in a row are conducted at battery No. 3. As pushes are approximately 8 minutes apart, the shed exhaust flow rates are alternated approximately every 48 and 40 minutes respectively.

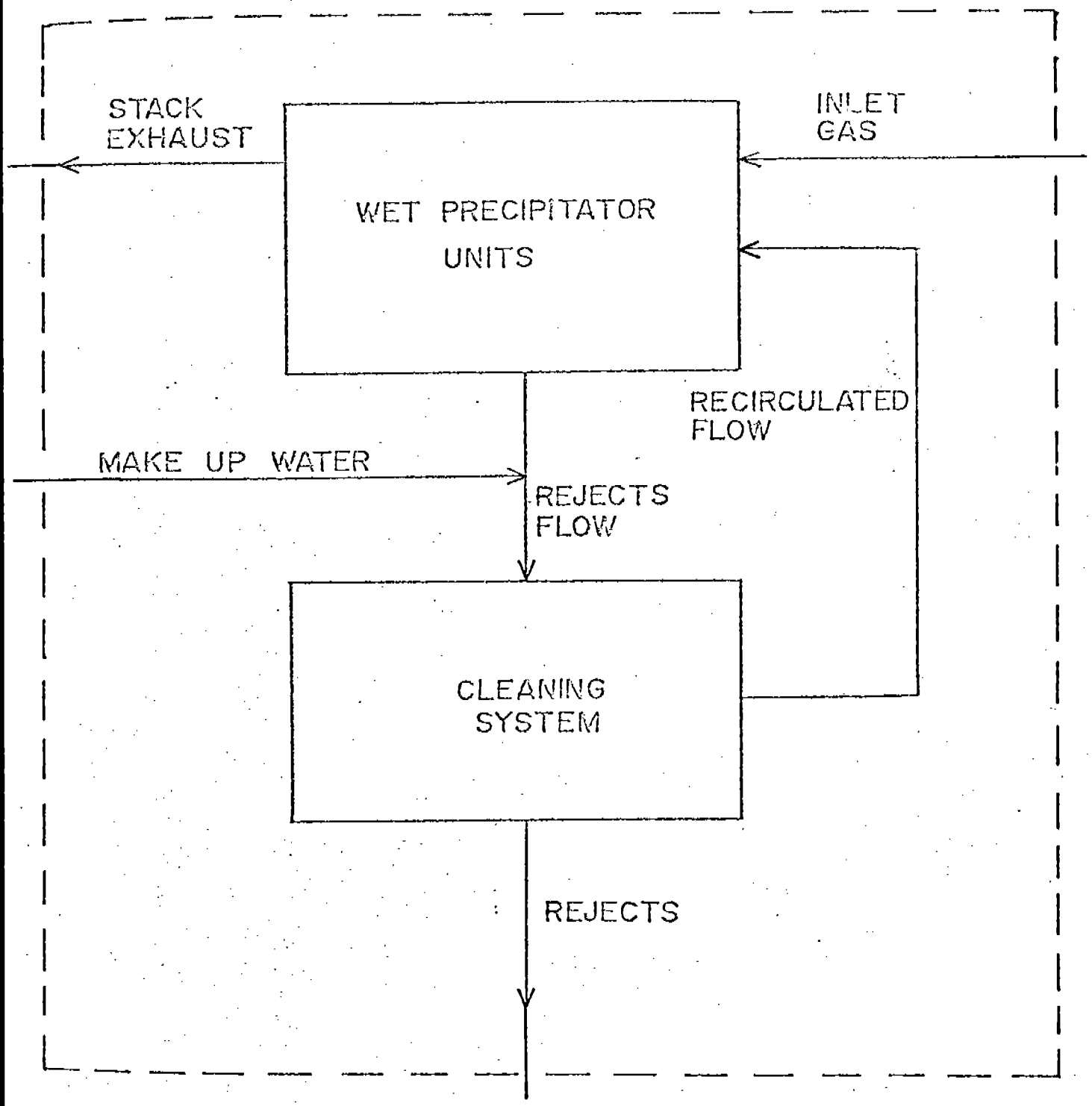
Fumes generated by the door leakage and the coke pushing operation are drawn off by two ducts; one duct for No. 1 and 2 batteries and one duct for No. 3 battery. Before entering two wet plate electrostatic precipitation units, the ducts are interconnected and the gas flows are damper-balanced. The gases are drawn through the precipitation units by two fans which exhaust into a common stack (see Drawing No. A-001).

3.3 Emission Control System

A flow diagram of the emission control system is illustrated in Drawing A-022. Emissions are collected in two parallel wet plate electrostatic precipitators of Ducon Mikropul design. Each has an air induced draft fan with a design capacity of 150,000 cubic feet per minute at 125° F.

The following is a summation of precipitator characteristics:

Precipitators	=	Three stage
Spacing between plates	=	Design 6" Actual 5-3/4"
Length of electrodes	=	18 feet
Area of electrodes	=	29,700 sq. ft. per precip.
Total linear feet of effective electrode	=	29,700 ft.
No. of collection plates	=	33
Design capacity per field	=	82 KVA (running at 70% of design)
Power flow	=	55 K Volts (average)



envirocon ltd.

VANCOUVER TORONTO CALGARY

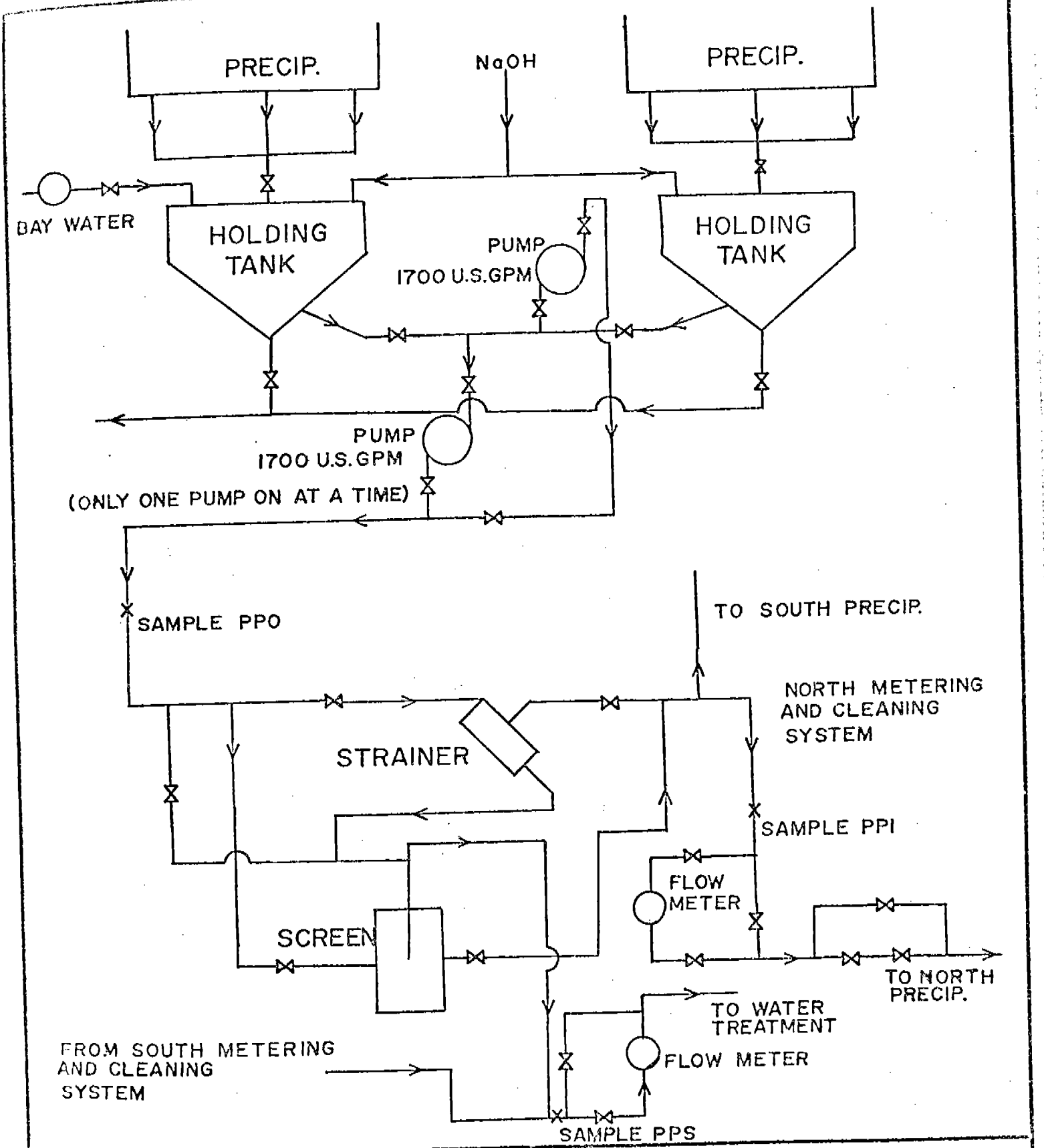
EMISSION CONTROL SYSTEM

FLOW SCHEMATIC

		DAY	MO.	YR.
SCALE				
DR'N				
CH'K'D.				

DWG. A-002

REV



envirocon Ltd.

VANCOUVER TORONTO CALGARY

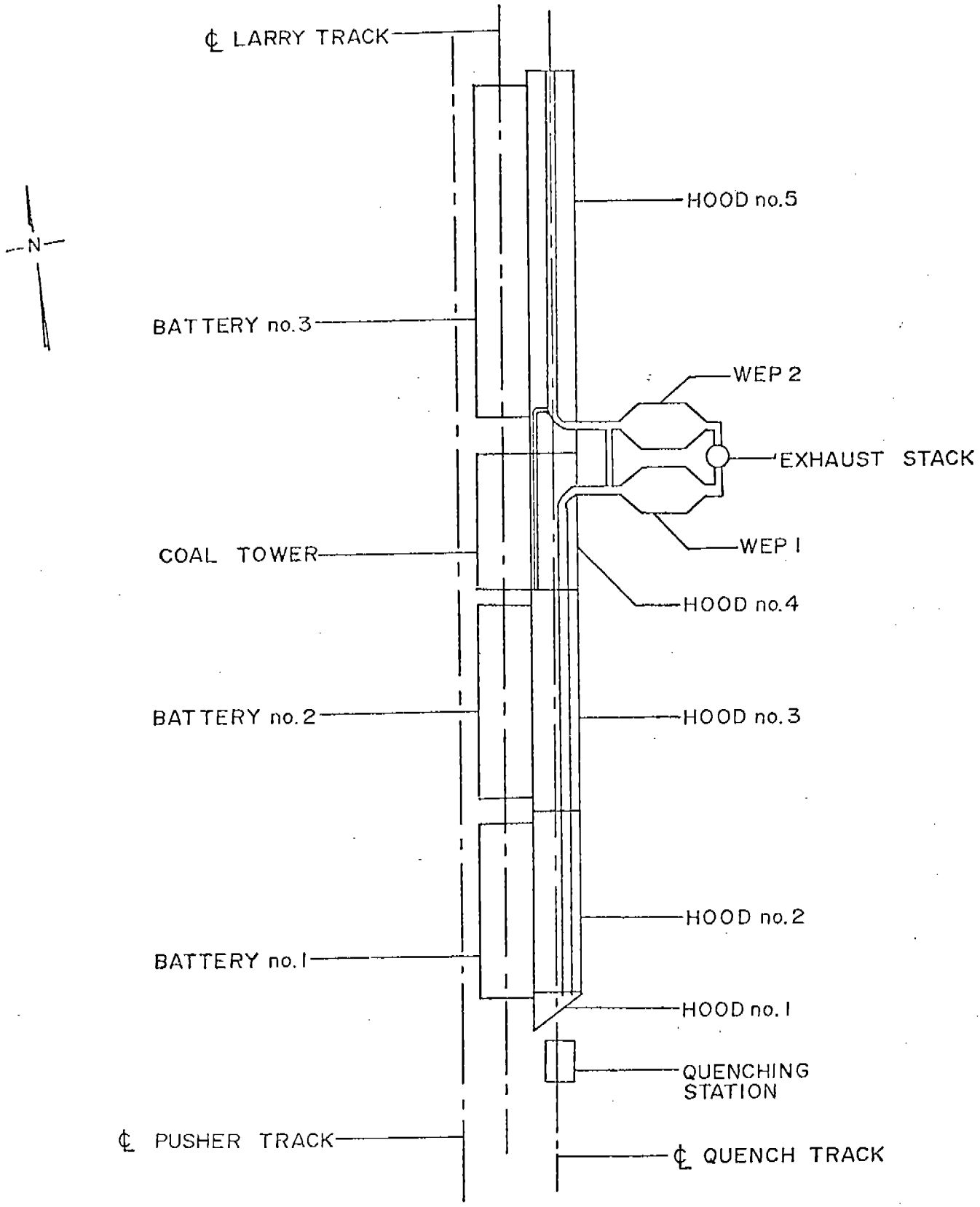
CLEANING SYSTEM

FLOW SCHEMATIC

		DAY	MO.	YR.
SCALE				
DR'N				
CH'K'D.				
APP'D.				

DWG. A-003

REV



envirocon ltd.

VANCOUVER TORONTO CALGARY

SOUTH COKE PLANT
COKE OVEN FUME
COLLECTION SYSTEM

SCALE	N.T.S.	DAY	MO.	YR.
DR'N				
CH'K'D.				
APP'D.				

TOP VIEW

DWG. A-001

REV

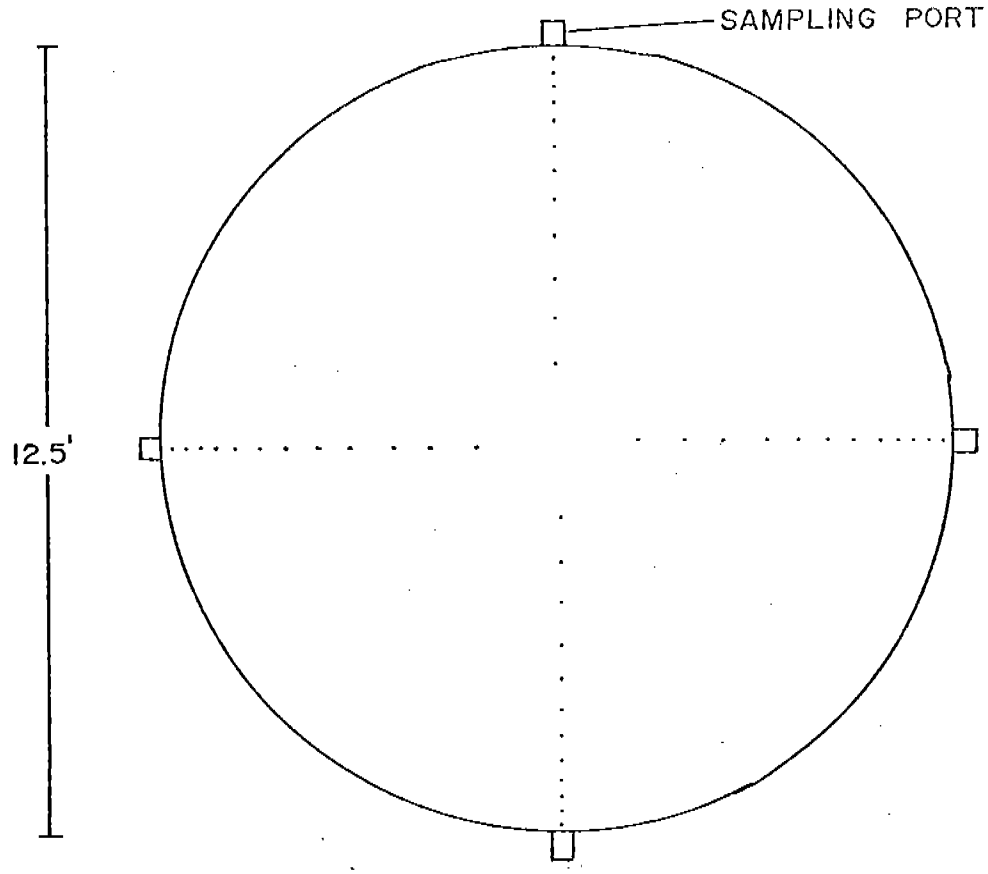
Each precipitator unit is equipped with 15 water spray headers. Incoming gases are saturated via a staggered arrangement of spray nozzles.

Water for saturation purposes is pumped from within a recirculation/cleaning system. The water is pumped via one of two 1,700 USGPM rated pumps from holding tanks, through a cleaning system, from where it is recirculated back to the precipitators. Make up water from the bay is continually supplied to the holding tanks. Water losses within the system include approximately 18% used in slurry bleed off and a maximum of 5% in evaporation. A pH control system constantly monitors and compensates for any build up of acidity within the system. Drawing No. A-003 illustrates a schematic of the water supply cleaning system.

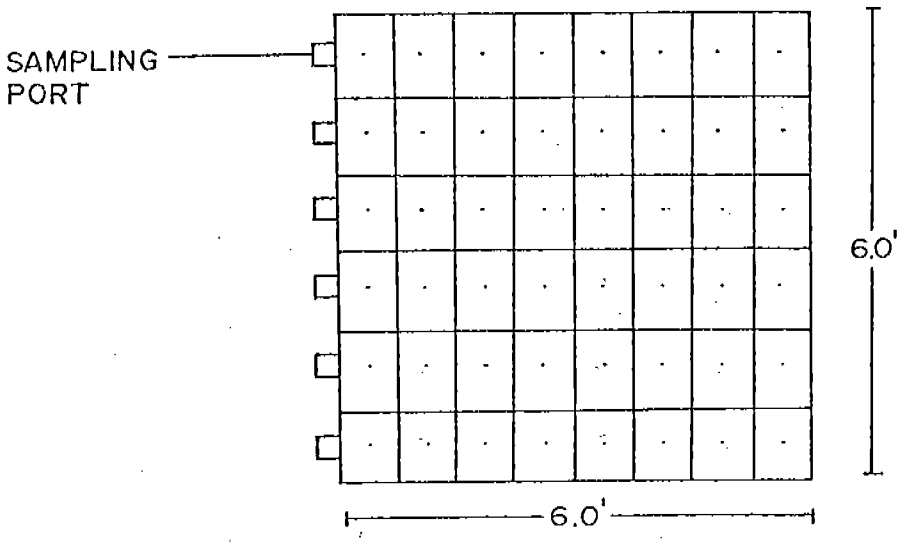
4.0 SAMPLE COLLECTION

4.1 Methodology

The scope of work required that three isokinetic samples be collected from the stack exhaust. As well, one sample from each of the two inlet ducts under 'push' conditions and one sample from each of the two ducts under primary door leakage conditions was required. Sampling locations at each stack and location of traverse sample points was in accordance with Ministry recommendations. A cross section view of sampling traverse points for the stacks is illustrated in Drawing No. A-004. Sampling duration at each point was established to give a predetermined minimum elapsed sample volume as specified by the Ministry.



EXHAUST STACK



PRECIPITATOR INLET

envirocon Ltd.

VANCOUVER TORONTO CALGARY

SAMPLE TRAVERSE POINTS

SCALE	N.T.S.	DAY	MO.	YR.
DR'N				
CH'K'D.				
APP'D.				

CROSS-SECTIONAL VIEW

DWG. A-004

REV

4.2 Exhaust Stack

The exhaust stack samples were collected at the 90 foot platform level through 4 sample ports located at the centre of quadrants on the same plane. Sample port location was 2 diameters from the exit and 7.6 diameters from the inlet of the fan.

In compliance with Ministry guidelines, the stack was divided into 12 equal area sections to yield a total of 48 traverse points. For the PAH determinations, each point was sampled for 6 minutes to yield a total sampling time of 288 minutes or 4.8 hours.

The tests were taken across periods of representative operation when one of two hoods was venting a push sequence and the alternate hood was venting primary door leakage.

4.3 Inlet Ducts

The inlet duct samples were collected at the upper walkway level through 6 sample ports located in the same vertical plane on a vertical face of the square 6' x 6' ducts. Sample port locations are indicated on Drawing No. A-005. A total of 8 points per traverse were utilized to yield 48 sampling points. At 5 minutes per point, the cumulative sample time was 4 hours per sample. Two sampling units (1 & 2) were used to sample each duct. Under a push condition, Unit 1 was used for sampling with Unit 2 on standby. When the duct was venting door leakage only, Unit 2 was used for sampling with Unit 1 on standby, etc. The total time period spanned for collection of two inlet samples in this manner approximated 12 hours. Sampling during each of the push and leakage

condition was on a continuous basis. Results from push cycles are, therefore, averages over the entire push cycle, including timeswhen ovens were being pushed and the approximate 8 minutes between pushes.

4.4 Sampling Techniques

Standard type source sampling trains of Envirocon manufacture were used for the sampling. A schematic of the sampling train is shown in Figure 1. The sampling trains were identical to those outlined in the Source Testing Code with the following exception; for the particulate and vapour phase sampling, the glassware was modified to accept a Tenax adsorbing tube in the thermostatically controlled oven as depicted in Figure 1. A schematic of the Tenax adsorbent system is illustrated in Figure 2. The distance between the filter holder and the Tenax tube was minimized to reduce glassware rinse requirements.

Teflon lined probes were used at all sources. Teflon being chosen because it is durable, non-reactive and its smooth surface is conducive for cleaning purposes.

Preliminary measurements were made at each stack prior to testing to determine average stack gas velocity, gas temperature, moisture content and gas composition, as specified in the Code. Isokinetic conditions were established for each test.

To maximize Tenax adsorbent efficiency, temperatures of the Tenax adsorbent was set in the range of 130° F to 150° F., just high enough to preclude possibility of water condensation.

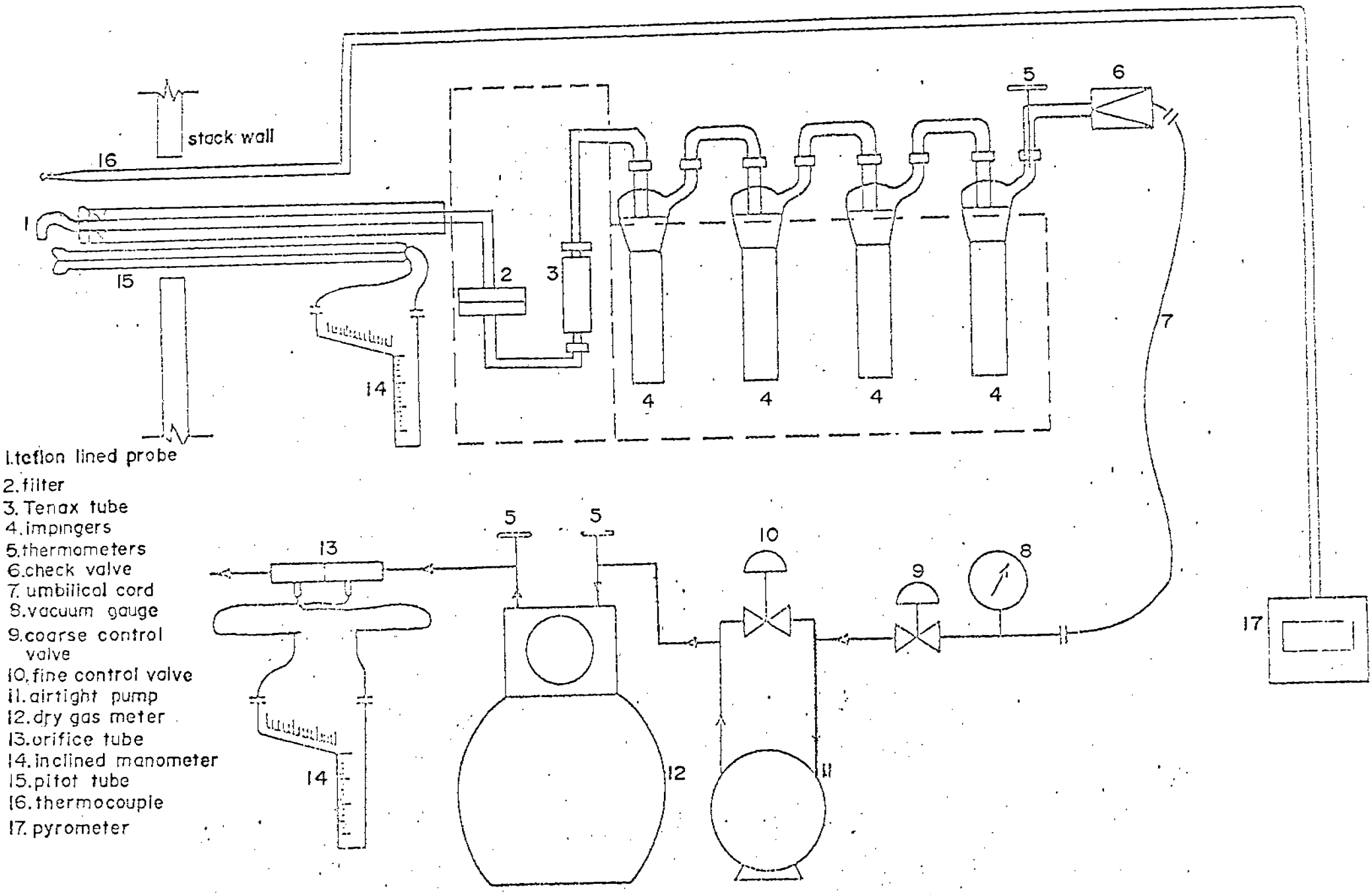
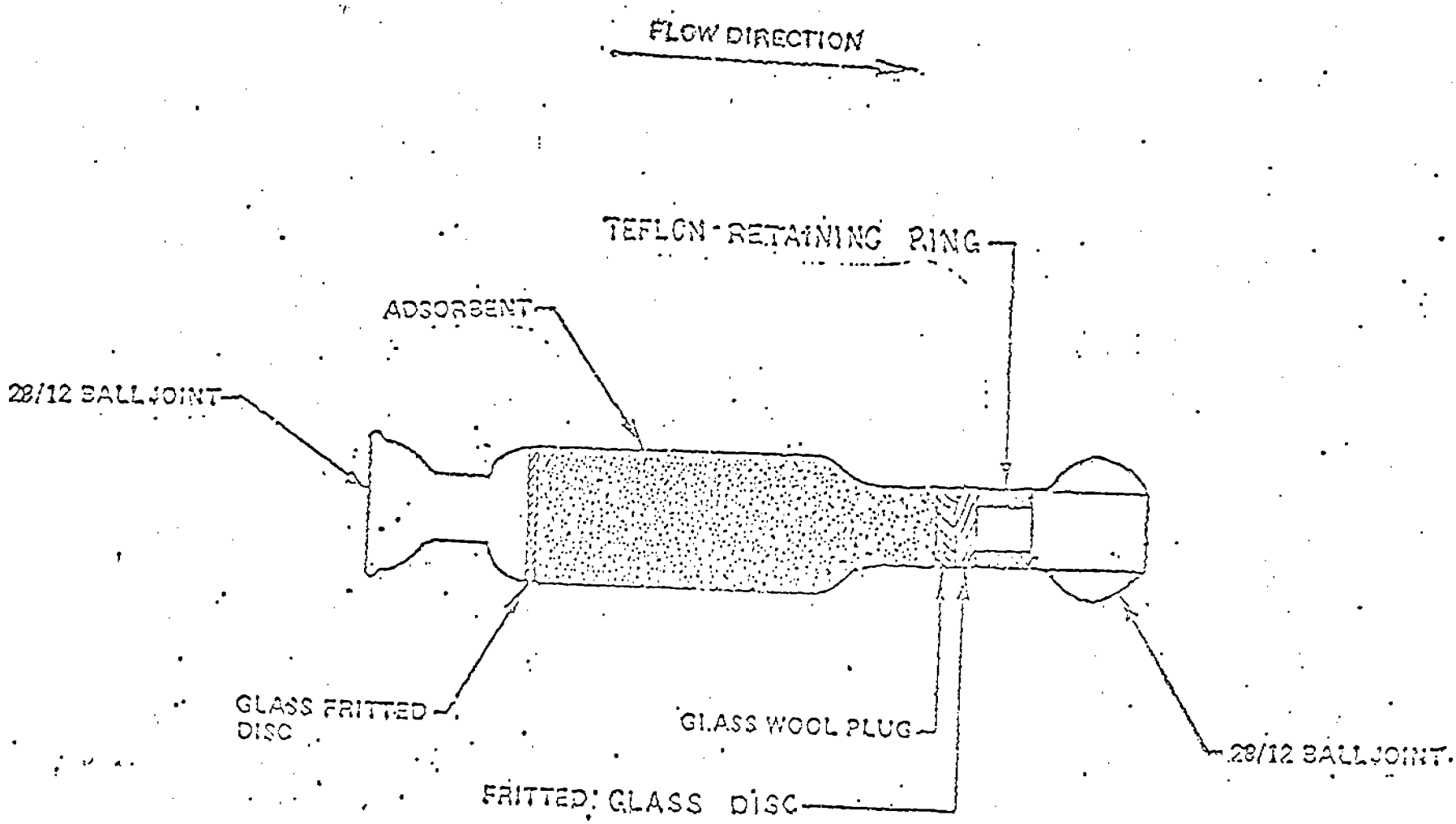
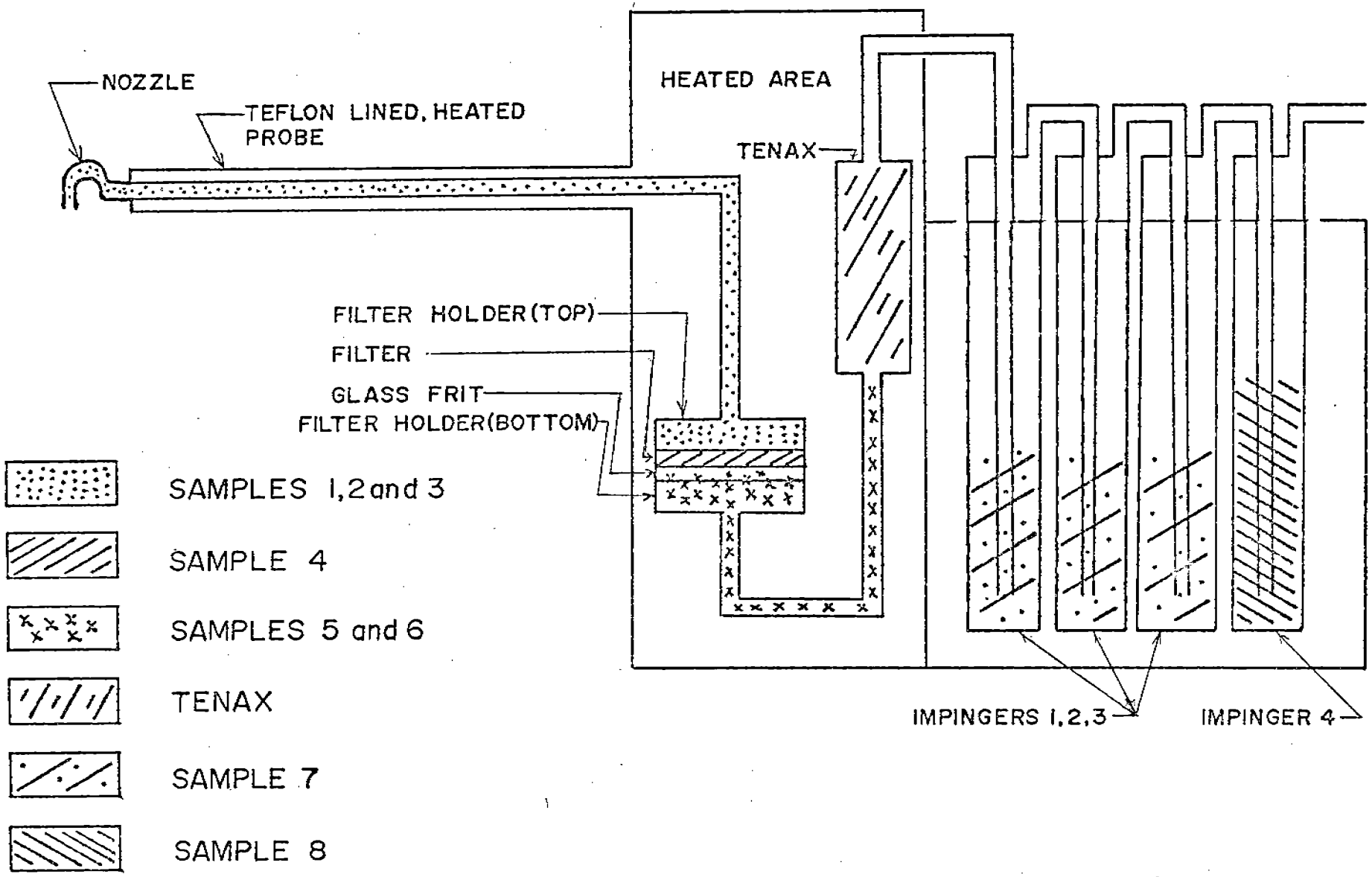

stack wall
16
1
15
2
3
4
4
4
4
5
6
7
14
1.teflon lined probe
2.filter
3.Tenax tube
4.impingers
5.thermometers
6.check valve
7.umbilical cord
8.vacuum gauge
9.coarse control valve
10.fine control valve
11.airtight pump
12.dry gas meter
13.orifice tube
14.inclined manometer
15.pitot tube
16.thermocouple
17.pyrometer
13
5
5
10
9
8
17
14
12
11

FIGURE 1



SIMPLIFIED ADSORBENT SAMPLING SYSTEM

FIGURE 2



SAMPLE IDENTIFICATION FIGURE 3

The Tenax tube consisted of an all glass tube, 3.4 centimeters I.D. and 6 centimeters in length with compatable male and female glass ball fittings. Approximately 10 grams of 30 - 60 mesh Tenax GC was contained in the tube. A teflon retaining ring and a glass wool plug were located at the outlet of the tube.

Gas temperature was measured at each traverse point with a thermocouple and monitored on the control console. Precalibrated 'S' type pitot tubes were used for velocity determinations. Test sampling was started at the wall furthest from the port.

The sampling probe tips, used on each probe, were selected to give an isokinetic sampling rate at a flow rate compatible to the pressure drop across the Tenax tube. The flow rate approximated .6 - .9 CFM. Fibreglass filter paper with a DOP efficiency of 99.97% was used to collect the particulate matter.

The first two impingers of the sampling train were filled with 100 ml of distilled water; the third impinger was empty and the fourth contained 6 - 16 mesh silica gel for final moisture removal. At the end of each test, the ends of the sample probe were sealed and the unit was transferred to a laboratory for clean-up.

4.5 Sample Recovery

Recovery procedures for each test run were in accordance with the Ontario Source Code, except for the following:

1. The nozzle, probe and front half of the filter holder were rinsed with spectro-grade benzene into a teflon capped glass container (Container #1).

2. The above components were rinsed with spectro-grade acetone into a second glass container equipped with a teflon cap (Container #2).
3. A ball of preweighed, benzene extracted, kimwipe tissue paper, wetted with spectro-grade benzene, was pushed through the probe. This procedure was repeated with further portions of kimwipe until there was no visible sign of discoloration or particulate adherence. The kimwipes were stored in a teflon capped container (Container #3).
4. The filter was placed in an enclosed petri dish (Container #4)
5. The adsorbent tube was capped with glass plugs.
6. The fritted disc, back half of the filter holder, and the connection leading to the adsorbent tube were rinsed with spectro-grade benzene into a glass container equipped with a teflon cap (Container #5).
7. A second rinse of the above components was conducted using spectro-grade acetone and kept in a teflon capped glass container (Container #6).
8. The total volume of water in the impinger solutions was measured, transferred and stored in a teflon capped glass container (Container #7).
9. The silica gel was placed in a capped polyethylene container (Container #8).
10. Glass funnels were used to avoid spillage and sample loss.
11. Filters, kimwipes, and fritted filter holder discs were stripped with benzene prior to being used.
12. All containers and adsorbent tubes were wrapped in aluminum foil to minimize exposure to sunlight.

The benzene rinse was used to extract the particulate matter, and the acetone was used to remove any traces of moisture.

A diagramatic illustration of the designated collection areas of the sampling unit is found in Figure 3.

Upon completion of sampling, all samples were transferred to laboratory facilities for analysis.

4.6 Process Samples

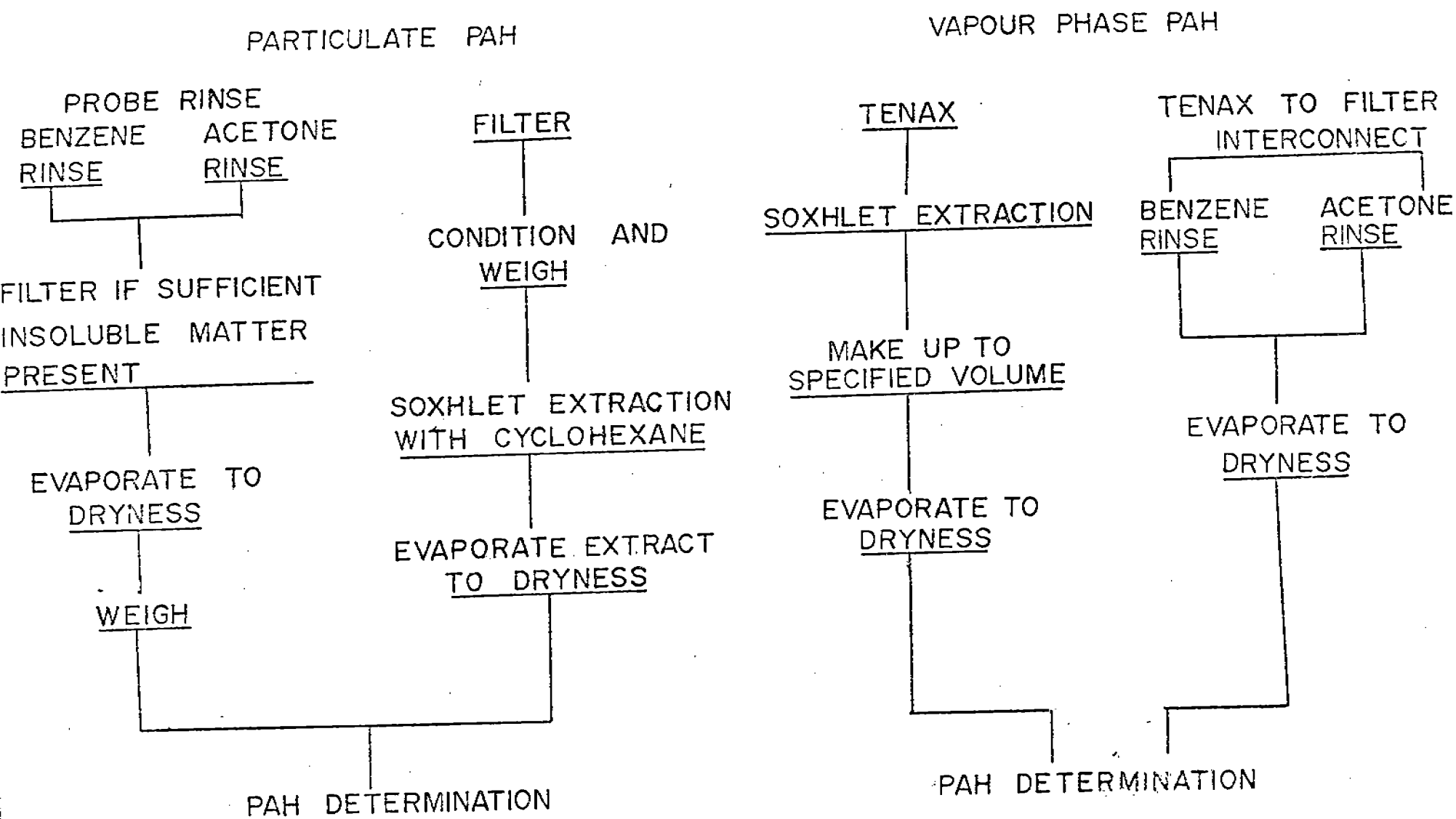
During the course of the air emission testing, samples were taken of coal, shed dust deposits, precipitator inlet water, precipitator outlet water and slurry purge samples. Due to analytical time requirements, only a selected number of process samples collected were analyzed. Liquid samples were analyzed for suspended solids, dissolved solids, and PAH composition. Solid samples were analyzed for PAH composition only.

4.7 Analytical Techniques

PAH analysis of the samples was conducted at the laboratory facilities of the Ontario Ministry of the Environment and the laboratory facilities of the Ontario Research Foundation. The analysis was conducted by liquid chromatographic techniques using optical fluorescence and ultraviolet variable wavelength detectors. Figure 4 illustrates the sequential methodology utilized in the sample analysis.

The Tenax was extracted using cyclohexane as solvent. Cyclohexane was also used for the soxhlet extraction of the particulates in accordance with standard laboratory procedures.

The dry weight of the probe rinses in all the runs (in runs 3 and 6 after filtering) are considered to be solvent extractables, although a small fraction of the weights may in fact contain



PAH ANALYSIS FLOW CHART FIGURE 4

Very useful BB

insoluble particulate. It is expected that the insoluble fraction would be less than 10%.

The insoluble particulate obtained after filtering the probe rinses of runs 3 and 6 are considered to contain no solvent extractables. The length of time these particulates were exposed to the solvent in the sample jars was considered to result in extraction of the extractables from the particulates.

A more detailed description of analytical procedures, along with the raw analytical data, is appended.

5.0 RESULTS

5.1 General

A summary of the results obtained from the survey is presented in Table 1. Average values and flue gas characteristic are presented in Table 2 and Table 2B. The PAH values obtained are presented in Tables 3 and 4. PAH analysis of the process samples are found in Table 5. Table 6 contains material flow blance information on the control system. Tables 7A and 7B are a summation of the field sampling times. Copies of computer runs, including velocity profiles, calculated per cent isokinetics for each meter reading, and field sheets, along with a description of analytical procedures, raw analytical data and pitot calibration information are appended.

5.2 Exhaust Stack

Three exhaust stack tests were conducted on the 9, 13 and 15 of December. The respective run numbers are 4, 7 and 8. Results of run number 1 are not included due to the equipment problems encountered during testing. Because of damage

incurred to the filter, subsequent to test No. 4, no particulate data on that run is given. Runs 7 and 8 resulted in particulate concentrations of 0.002 GM/DCM (0.001 GRS/DSCF), and 0.007 GM/DCM (0.003 GRS/DSCF) respectively. Exhaust volumes for runs 4, 7 and 8 were 425,300 DCMH (250,200 DSCFM), 464,100 DCMH (273,000 DSCFM) and 531,200 DCMH (312,500 DSCFM) respectively.

The sample volumes collected for the respective runs were 188.99, 208.34 and 240.81 cubic feet. The weight of particulate collected for runs 7 and 8 was 16.7 mg. and 52.1 mg. respectively. The weights of the vapour phase fractions collected for runs 4, 7 and 8 were 31.4, 48.0 and 37.4 mgs.

The concentration and emission rates for solvent extractables and PAH's are given in Tables 2 and 2B.
The front portion includes material collected before and on the filter, the back portion includes material collected between the filter and the Tenax tube and material collected in the Tenax tube.

5.3 Inlet Ducting

5.3.1 No. 1 and 2 Duct

The test on No. 1 and 2 duct were conducted on December 12.

Under push conditions, the particulate loading was 0.073 GM/DCM (0.032 GRS/DSCF) at a stack flow of 255,300 DCMH (150,200 DSCFM). To yield an inlet loading of 18.5 KG/HR (40.8 LBS/HR). The vapour phase concentration was 0.007 GM/DCM (0.003 GRS/DSCF) to give an inlet loading of 1.87 KG/HR (4.13 LBS/HR). The sample volume collected was 120.86 cubic feet. The weights

of particulate and vapour phase fraction collected were 260.2 mg. and 26.1 mg. respectively. The respective percent PAH of each fraction was 0.045% of particulate and 0.019% of vapor phase. The total solvent extractable emission rate was 3.87 KG/HR (8.54 LBS/HR) of which 2.00 KG/HR (4.41 LBS/HR) was contained in the particulates.

Under door leakage conditions the duct volumetric flow rate was 155,400 DCMH (91,400 DSCFM). Particulate concentration was 0.004 GM/DCM (0.002 GRS/DSCF) to contribute an inlet loading of 0.7 KG/HR (1.6 LBS/HR). Vapor phase concentration was 0.005 GM/DCM (0.002 GRS/DCMH) to contribute an emission rate of 0.77 KG/HR (1.70 LBS/HR). The weight of particulate and vapor phase fraction collected was 26.6 mg. and 27.5 mg. The percent PAH content of each fraction was 0.029% of particulate and 0.057% of vapor phase. The total solvent extractable emission rate was 1.34 KG/HR (2.96 LBS/HR), of which 0.57 KG/HR (1.26 LBS/HR) was contained in the particulates.

5.3.2 No. 3 Duct

The tests on No. 3 duct were conducted on December 9. Because of incorrect switchover damper settings, an anomaly of exhaust rates was encountered. The flow volumes for door leakage were higher than optimum and flow volumes for pushing conditions were lower than optimum.

Under push conditions, the stack flow rate was 282,900 DCMH (166,400 DSCFM). Particulate concentration was 0.094 GM/DCM (0.041 GRS/DSCF) to contribute an inlet loading of 26.6 KG/HR (58.6 LBS/HR). Vapour phase concentration was 0.006 GM/DCM (0.002 GRS/DSCF) for an emission rate of 1.62 KG/HR (3.58 LBS/HR). Sample weight collected was 574.2 mg. particulate and 20.5 mg. vapour phase. The sample volume collected was 203.93 cubic

feet. PAH content was 0.094% of particulates and 0.0058% of vapour phase. The total solvent extractable emission rate was 3.56 KG/HR (7.86 LBS/HR) of which 1.94 KG/HR (4.28 LBS/HR) was contained in the particulate.

Under door leakage conditions, the duct flow rate was 311,100 DCMH (183,000 DSCFM). A sample gas volume of 220.39 cubic feet was drawn. 48.7 mg. of particulate and 46.9 mg. of vapour phase fraction were collected which represents a loading of 0.007 GM/DCM and 0.007 GM/DCM (0.003 GRS/DSCF) respectively. Respective emission rates are 2.28 and 2.19 KG/HR (5.03 and 4.83 LBS/HR). PAH content was 1.11% of particulates and 0.119% of vapour phase fraction. The total solvent extractable emission rate was 4.22 KG/HR (9.32 LBS/HR), of which 2.04 KG/HR (4.49 LBS/HR) was contained in the particulate.

5.4 General

Across the entire sampling program, the Dofasco operation maintained an average coking time of 16.2 hours. Green pushes were observed on No. 1 and 2 batteries on the morning of December 9 when repairs were being conducted on No. 3 battery. Tests that day, however, were not conducted until the afternoon. Coking times and flue temperatures during the tests can be found in Appendix 4.

From observations on site and from discussions with coke oven personnel, there appeared to be no trouble in maintaining good door sills and seals on the pusher side. On the coke side, however, there appeared to be more tars, residues and build-ups running down, resulting in an increased number of door leaks. This is especially applicable with regard to battery No. 3 .

Based on the testing of the gases entering

and leaving the precipitator, the removal efficiency of the particulates is 89.3%, and the efficiency of removing the PAH's analyzed is 86.5%. Efficiency of removing the total and front half solvent extractable portions is 16.0% and 26.6% respectively. The fraction of PAH collected in the front portion of the sampling train represented between 80 and 99 percent of the total in all runs, except run 2, where the percentage was 32 percent.

5.5 Process Samples

An average analysis of the coal used at Dofasco is presented in Table 8.

The overall average percent PAH for the fallout collected was 1.67×10^{-5}%.

The average PAH content of the process liquid samples was as follows: precipitator inlet 0.33 PPM, precipitator outlet 0.49 PPM, precipitator slurry 0.21 PPM. In calculations involving the liquid samples, the water was assumed to weigh 1 gram per millilitre.

5.6 System Balance

Based on the stack emission data and the limited number of process samples, several approximate balances have been calculated in Table 6. Values were obtained for rate of rejects based on: (1) gas balance (2) S.S. determination of slurry grab samples (3) difference of inlet and outlet water at the precipitator (4) long-term S.S. determination of slurry samples by Dofasco personnel. With the exception of (3) (where results of outlet precipitator water analysis were extremely variable) the rejects rate values are relatively consistent and range from 18.3 to 22.2 KG/HR (40.3 to 49.0 LB/HR).

A balance on the PAH's analysed shows an average rate of 29.3×10^{-3} KG/HR (64.7×10^{-3} LBS/HR) entering the precipitator and an average of 1.8×10^{-3} KG/HR (3.9×10^{-3} LBS/HR) leaving the exhaust stack, for a reject rate of 27.5×10^{-3} KG/HR (60.8×10^{-3} LBS/HR). The reject rate of PAH's based on the slurry analysis was found to be 12×10^{-3} KG/HR (26.4×10^{-3} LBS/HR).

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE 2

STACK EMISSION DATA - FRONT PORTION[1]

Run No.	Date	Source	Stack Temp. °C (°F)	Flow Rate ACMH (ACFM)	Flow Rate DCMH (DSCFM)	Particulate GM/DCM (GRS/DSCF)	Particulate KG/HR (LBS/HR)	Solvent Ext. GM/DCM (GRS/DSCF) x 10^{-3}	Solvent Ext. KG/HR (LBS/HR)	PAH GM/DCM (GRS/DSCF) x 10^{-6}	PAH KG/HR (LBS/HR) x 10^{-3}
4	9/12/76	Exhaust Stack	7.7 (45.8)	406,500 (239,100)	425,300 (250,200)	- -	- -	- -	- -	- -	- -
7	13/12/76	Exhaust Stack	4.8 (40.7)	438,900 (258,200)	464,100 (273,000)	0.002 (0.001)	1.3 (2.8)	2.0 (0.9)	0.97 (2.13)	5.08 (2.22)	2.36 (5.20)
8	15/12/76	Exhaust Stack	9.9 (49.8)	509,200 (299,500)	531,200 (312,500)	0.007 (0.003)	3.8 (8.5)	6.9 (3.0)	3.65 (8.04)	2.15 (0.94)	1.15 (2.53)
3	1/12/76	1 & 2 Push	24.8 (76.6)	259,900 (152,900)	255,300 (150,200)	0.073 (0.032)	18.5 (40.8)	7.8 (3.4)	2.00 (4.41)	33.08 (14.46)	8.37 (18.45)
6	9/12/76	3 Push	13.1 (55.6)	277,900 (163,500)	282,900 (166,400)	0.094 (0.041)	26.6 (58.6)	6.9 (3.0)	1.94 (4.28)	88.66 (38.75)	24.86 (54.82)
2	1/12/76	1 & 2 Leak	18.9 (66.1)	155,900 (91,700)	155,400 (91,400)	0.004 (0.002)	0.7 (1.6)	3.7 (1.6)	0.57 (1.26)	1.37 (0.60)	0.21 (0.46)
5	9/12/76	3 Leak	5.4 (41.7)	297,500 (175,000)	311,100 (183,000)	0.007 (0.003)	2.3 (5.0)	6.4 (2.8)	2.04 (4.49)	80.93 (35.37)	25.22 (55.60)

1. Based on material collected before and on filter.

PROJECT REPORT: TE-1612
STACK EMISSION MONITORING
COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED
HAMILTON ONTARIO
DATE: MARCH 1977

TABLE 2B

STACK EMISSION DATA - BACK PORTION[1]

Run No.	Date	Source	Stack Temp. °C (°F)	Flow Rate ACMH (ACFM)	Flow Rate DCMH (DSCFM)	Solvent Ext. GM/DCM (GRS/DSCF) x 10^{-3}	Solvent Ext. KG/HR (LBS/HR)	PAH GM/DCM (GRS/DSCF) x 10^{-6}	PAH KG/HR (LBS/HR) x 10^{-3}	Tot. Org. Emissions Sol.Ext. KG/HR (LBS/HR)	Tot. Org. Emissions PAH KG/HR (LBS/HR) x 10^{-3}
4	9/12/76	Exhaust Stack	7.7 (45.8)	406,500 (239,100)	425,300 (250,200)	5.92 (2.59)	2.06 (4.55)	0.27 (0.12)	0.10 (0.22)	- -	- -
7	13/12/76	Exhaust Stack	4.8 (40.7)	438,900 (258,200)	464,100 (273,000)	7.89 (3.45)	3.66 (8.07)	0.96 (0.42)	0.45 (0.99)	4.62 (10.20)	2.81 (6.19)
8	15/12/76	Exhaust Stack	9.9 (49.8)	509,200 (299,500)	531,200 (312,500)	5.24 (2.29)	2.78 (6.13)	0.41 (0.18)	0.23 (0.50)	6.43 (14.17)	1.37 (3.03)
3	1/12/76	1 & 2 Push	24.8 (76.6)	259,900 (152,900)	255,300 (150,200)	7.34 (3.21)	1.87 (4.13)	1.37 (0.60)	0.35 (0.77)	3.87 (8.54)	8.72 (19.22)
6	9/12/76	3 Push	13.1 (55.6)	277,900 (163.500)	282,900 (166,400)	5.74 (2.51)	1.62 (3.58)	0.32 (0.14)	0.09 (0.21)	3.56 (7.86)	24.96 (55.03)
2	1/12/76	1 & 2 Leak	18.9 (66.1)	155,900 (91,700)	155,400 (91,400)	4.96 (2.17)	0.77 (1.70)	2.84 (1.24)	0.44 (0.97)	1.34 (2.96)	0.65 (1.43)
5	9/12/76	3 Leak	5.4 (41.7)	297,500 (175,000)	311,100 (183,000)	7.05 (3.08)	2.19 (4.83)	8.35 (3.65)	2.60 (5.73)	4.22 (9.32)	27.82 (61.33)

1. Based on material collected after filter.

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE 3

PAH - PARTICULATE

Run No.	Source	Total Wt. (mg) Filter + Probe Rinse	WT. OF PAH (μ) B(a)A	B(k)F	B(a)P	Total	% PAH OF PART B(a)A	B(k)F	B(a)P	Total
4	Exhaust St.	--								
7	Exhaust St.	16.7	10.18	8.94	11.78	30.9	.0610	.0535	.0705	.185
8	Exhaust St.	52.1	5.34	4.86	5.27	15.47	.0102	.0093	.0101	.0296
3	1 & 2 Push	260.2	33.09	28.55	55.86	117.5	.0127	.0110	.0215	.0452
6	3 Push	574.2	171.08	118.44	248.28	537.8	.0298	.0206	.0432	.0936
2	1 & 2 Leak	26.6	1.52	1.68	4.47	7.67	.0057	.0063	.0168	.0288
5	3 Leak	48.7	141.15	126.54	270.77	538.46	.2898	.2598	.5560	1.1056

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE 4

PAH - VAPOUR PHASE

Run No.	Source	Wt.of Rinse Between Filter and Tenax (A) (Mg)	Wt.of Tenax (B) (Mg)	Total Wt. (A) + (B)	WT. OF PAH (µg)				% PAH			
					B(a)A	B(k)F	B(a)P	Total	B(a)A	B(k)F	B(a)P	Total
4	Exhaust St.	22.3	9.1	31.4	.55	.16	.09	0.80	.0018	.0005	.0025	.0048
7	Exhaust St.	30.2	17.8	48.0	1.89	1.94	2.12	5.95	.0039	.0040	.0044	.0123
8	Exhaust St.	14.7	22.7	37.4	1.07	1.03	0.91	3.01	.0029	.0028	.0024	.0081
3	1 & 2 Push	6.5	19.6	26.1	3.33	.84	.71	4.88	.0128	.0032	.0027	.0187
6	3 Push	20.5	14.3	34.8	.70	.52	.81	2.03	.0020	.0015	.0023	.0058
2	1 & 2 Leak	21.7	5.8	27.5	5.62	3.77	6.34	15.73	.0204	.0137	.0230	.0571
5	3 Leak	29.4	17.5	46.9	36.05	10.14	9.45	55.64	.0769	.0216	.0201	.1186

envirocon

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE 5

PROCESS SAMPLE PAH COMPOSITION SUMMARY

Sample	Date	Sample Type	Total[1] Wt. GM.	WEIGHT OF PAH µG B(a)A	B(k)F	B(a)P	Total	% PAH X 10^{-3} B(a)A	B(k)F	B(a)P	Total
60	Dec.1	Coal	10.63	1.25	1.10	3.13	5.48	.012	.010	.029	.052
70	Dec.9	Coal	10.33	34.36	40.44	108.60	183.40	.33	.39	1.05	1.78
83	Dec.15	Coal	11.17	1.22	1.09	3.10	5.41	.011	.009	.028	.048
52	Dec.1	Coke	11.38	N.D.	N.D.	N.D.	N.D.	0	0	0	0
71	Dec.9	Coke	10.44	0.0018	0.0004	0.0004	0.0026	.00001	.000003	.00003	.00002
50	Nov.30	Fg.1,2	6.21	0.12	0.13	0.19	0.44	.0019	.0021	.0031	.0071
57	Dec.1	Fg.1,2	2.87	0.34	0.32	0.53	1.19	.012	.011	.018	.041
72	Dec.9	Fg.1,2	10.41	0.77	0.63	0.95	2.35	.0074	.006	.009	.023
51	Nov.30	Fg.3	2.18	0.05	0.02	0.03	0.10	.0023	.0009	.001	.0046
58	Dec.1	Fg.3	1.56	0.08	0.03	0.04	0.15	.0051	.0019	.0025	.0096
73	Dec.9	Fg.3	7.93	0.57	0.33	0.50	1.40	.0072	.0042	.0063	.017
81	Dec.15	Fg.3	10.70	0.69	0.44	0.68	1.8[illegible]	.0064	.0041	.0063	.017
56	Dec.1	PP 1	375.1	2.67	21.52	42.22	66.41	.00071	.0057	.011	.018
62	Dec.1	PP 1	350.1	3.12	14.59	26.99	43.22	.0009	.0042	.0078	.012
65	Dec.9	PP 1	275.9	11.04	14.19	25.51	50.74	.004	.0051	.0092	.018

N.D.- Not Detected

1. Includes water

envirocon

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE 5 CONT'D

PROCESS SAMPLE PAH COMPOSITION SUMMARY

Sample	Date	Sample Type	Total[1] Wt. GMS	WEIGHT OF PAH µG B(a)A	B(k)F	B(a)P	Total	% PAH X 10^{-3} B(a)A	B(k)F	B(a)P	Total
67	Dec.9	PP 1	350.1	31.20	26.0	46.09	103.29	.0089	.0074	.013	.024
82	Dec.15	PP 1	365.2	13.52	48.07	87.80	149.39	.0037	.013	.024	.041
90	Dec.7	PP 1	350.1	36.07	30.58	55.56	122.21	.010	.0087	.016	.035
54	Dec.1	PP 0	275.2	12.75	30.51	57.41	100.67	.0046	.011	.021	.037
63	Dec.1	PP 0	350.1	8.25	19.16	35.81	63.22	.0024	.0054	.010	.018
66	Dec.9	PP 0	270.1	3.18	11.58	22.38	37.14	.0012	.0043	.0083	.014
68	Dec.9	PP 0	350.1	33.12	42.74	82.39	158.25	.0095	.012	.024	.045
80	Dec.15	PP 0	420.6	59.85	82.27	161.82	303.94	.014	.019	.038	.072
88	Dec.7	PP 0	365.5	114.18	91.30	192.69	398.17	.031	.025	.053	.11
64	Dec.9	PP S	250.7	11.58	12.65	22.58	46.81	.0046	.0050	.0090	.018
69	Dec.9	PP S	286.0	17.82	16.71	30.50	65.03	.0062	.0058	.011	.023

1. Includes water

envirocon

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE 6

MATERIAL FLOW BALANCES

No.	Inlet PPI KG/Hr. (4410 L/Min)	Outlet PPO KG/Hr. (5390 L/Min)	Slurry PPS KG/Hr. (980 L/Min)	Bay Water KG/Hr.	Inlet 1 & 2 Push 3 Leakage KG/Hr.	Loading 1 & 2 Leakage 3 Push KG/Hr.	Exhaust Loading KG/Hr.
1	88	197	17	Negligible	21	27	1.3
2	82	112	20				3.8
3	91	119					
4	86	112					
5	177	447					
6	98	468					
Average Aalues	103	243	18			24	2.6

1. Gas Balance: KG/Hr. Inlet - KG/Hr. Exhause = 21.4 KG/Hr.
2. Liquid Rejects = 18 KG/Hr.
3. Dofasco Long-Term Slurry Sampling = 22.2 KG/Hr.
4. Internal recycle (extremely variable especially PPI values) = 27 KG/Hr. to 369 KG/Hr.

envirocon

PROJECT REPORT: TE-2612

STACK EMISSION MONITORING

COKE OVEN FUME COLLECTION SYSTEM

DOMINION FOUNDRIES AND STEEL LIMITED

HAMILTON ONTARIO

DATE: MARCH 1977

TABLE 7B

SAMPLING TIME FOR PRECIPITATOR INLET

Run No.	Traverse No.	Date	Time
3 (1 & 2 Push)	1	Dec. 1	15:30 - 16:10
	2	Dec. 1	17:30 - 17:35; 18:35 - 18:50 and 19:00 - 19:20
	3	Dec. 1	20:40 - 21:20
	4	Dec. 1	22:30 - 00:12
	5	Dec. 2	00:16 - 00:56
	6	Dec. 2	01:50 - 02:45
6 (3 Push)	1	Dec. 9	12:30 - 13:10
	2	Dec. 9	14:00 - 14:20; 16:00 - 16:20
	3	Dec. 9	17:30 - 18:10
	4	Dec. 9	20:00 - 20:48
	5	Dec. 9	22:00 - 22:05; 22:30 - 23:05
	6	Dec. 10	01:15 - 01:55
2 (1 & 2 Leak)	1	Dec. 1	15:09 - 15:29; 16:40 - 17:10
	2	Dec. 1	17:40 - 18:00; 19:15 - 19:35
	3	Dec. 1	19:45 - 20:25
	4	Dec. 1	21:32 - 22:14
	5	Dec. 1	23:16 - 23:58
	6	Dec. 2	01:09 - 01:30; 02:45 - 03:05
5 (3 Leak)	1	Dec. 9	13:30 - 13:40; 16:30 - 17:00
	2	Dec. 9	12:30 - 18:10
	3	Dec. 9	19:30 - 20:10
	4	Dec. 9	20:15 - 20:47; 22:00 - 22:08
	5	Dec. 9	22:15 - 22:55
	6	Dec. 10	00:20 - 01:00

TABLE 7A

SAMPLING TIMES FOR EXHAUST STACK

Run No.	Traverse No.	Date	Time
4	1	Dec. 9	12:00 - 13:12
	2	Dec. 9	15:40 - 16:52
	3	Dec. 9	17:30 - 18:42
	4	Dec. 9	19:30 - 20:42
7	1	Dec. 13	11:30 - 12:42
	2	Dec. 13	13:10 - 14:22
	3	Dec. 13	14:30 - 15:42
	4	Dec. 13	18:00 - 19:72
8	1	Dec. 14	10:25 - 11:37
	2	Dec. 15	9:45 - 10:57
	3	Dec. 15	11:15 - 12:27
	4	Dec. 15	12:40 - 13:52

TABLE 8

COAL BLEND - DEC. 1 TO DEC. 15

	18% Pocahantas
	14% Lusčar
	39.5% Moss
	28.5% Wharton
Pulverization	+ 1/4 Inch 15%
	- 1/8 Inch 66%
Stability	33
Hardness of Coke	67

APPENDIX 1

COMPUTER OUTPUT

PARTICULATE EMISSION REPORT BY ENVIROCON LTD.

DATE OF SURVEY: DEC 1 1976

CLIENT: DOFASCO
BURLINGTON AVE
HAMILTON ONT

PLANT TYPE: STEEL MFG
1&2 BREECHING

REF: TE2612

RUN NUMBER: 2

STACK EMISSIONS

STACK HEIGHT, FEET		80.0
STACK WIDTH AND BREADTH, FEET	6.00	6.00
AVERAGE TEMPERATURE OF FLUE GAS, DEG.F.		66.1
BAROMETRIC PRESSURE, IN.HG.ABS.		29.90
AVERAGE FLUE STATIC PRESSURE, IN.H20		-4.000
AVERAGE VELOCITY PRESSURE, IN.H20		.644
PITOT COEFFICIENT		.787
% CO2(ORSAT)		.00
% O2(ORSAT)		20.80
% CO(ORSAT)		.00

FIELD DATA(CONT.)

PARTICULATE EMISSIONS

NUMBER OF SAMPLING POINTS	48.
TOTAL SAMPLING TIME, MINS.	240.00
NOZZLE DIAMETER, INS.	.2500
TOTAL VOLUME MEASURED AT METER CONDITIONS, CF	190.75
AVERAGE SAMPLING RATE, CF/MIN.	.7948
AVERAGE METER TEMPERATURE, DEG.F.	50.34
NET VOLUME IN IMPINGER 1, MLS.	-2.0
NET VOLUME IN IMPINGER 2, MLS	8.0
NET VOLUME IN IMPINGER 3, MLS.	7.0
MOISTURE IN SILICA GEL, GMS.	25.0000
VOLUME OF CONDENSATE COLLECTED, MLS.	38.00
FILTER PARTICULATE, GMS.	.0139
WASHINGS PARTICULATE, GMS.	.0127
WEIGHT OF PARTICULATE COLLECTED,GMS.	.0266

PLANT OPERATION

PRODUCTION RATE, LBS./HOUR	N/A
LIQUID FUEL CONSUMPTION, IMP.GAL./HOUR	N/A
GASEOUS FUEL CONSUMPTION, CU.FT./HOUR	N/A

SUMMARY OF RESULTS

STACK EMISSIONS

AVERAGE FLUE GAS COMPOSITION

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	.0	.0
CO	.0	.0
O2	20.6	20.8
N2	78.5	79.2
H2O	.9	
MOL.WT.	28.75	28.84

AVG. VELOCITY OF GAS AT STACK CONDITIONS, FPM.	2547.3
VOLUME OF GAS AT STACK CONDITIONS, CFM.	91702.8
VOLUME OF GAS AT 70 DEG.F. AND 29.92 IN.HG., CFM	91417.4
VOLUME OF GAS AT STD. COND.(DRY)	90598.3
PERCENT EXCESS AIR	N/A

PARTICULATE EMISSIONS

CONCENTRATION:

GRAINS/SCF(DRY)	.0021
GRAINS/SCF(DRY) ADJUSTED TO 12% CO2	.0000
GRAINS/ACF	.0020
LBS/HOUR	1.60
LBS/TON OF PRODUCT	N/A
LBS/1000 IMP.GAL.LIQUID FUEL	N/A
LBS/10^6 FT. GASEOUS FUEL	N/A
LBS/1000 LBS.EFFLUENT	.00393
LBS/1000 LBS.EFFLUENT @ 50% EXCESS AIR	.0026
LBS/1000 LBS.EFFLUENT(DRY)	.0039

FIELD SHEETS

RUN NUMBER: 2 TRAVERSE: P2 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	62	1.400	62.3	4.060	141.83	43	42	161	152	3.0	96.3
1	2.5	62	1.100	55.2	4.000	144.70	48	43	162	150	3.0	95.6
2	5.0	62	.620	41.5	1.800	147.24	53	45	167	150	3.0	96.5
2	7.5	73	.660	43.2	1.900	149.19	53	45	167	153	3.0	96.0
3	10.0	67	.580	40.3	1.710	151.17	53	45	162	150	3.5	96.7
3	12.5	65	.580	40.2	1.740	153.05	55	46	162	150	3.0	96.2
4	15.0	69	.680	43.7	2.200	154.93	55	46	162	150	3.0	95.5
4	17.5	69	.680	43.7	2.200	156.94	55	46	162	150	3.0	95.5
5	20.0	80	.680	44.2	2.100	158.95	46	43	156	150	3.0	99.0
5	22.5	73	.700	44.5	2.100	160.99	46	43	158	150	2.0	96.5
6	25.0	69	.740	45.6	2.220	163.02	52	41	159	150	2.0	95.9
6	27.5	72	.740	45.7	2.220	165.11	54	45	159	150	2.0	95.6
7	30.0	69	.760	46.2	2.280	167.20	54	45	159	150	2.0	95.5
7	32.5	67	.720	44.9	2.200	169.32	54	45	151	150	2.0	95.1
8	35.0	62	.740	45.3	2.200	171.38	54	45	151	150	2.0	94.7
8	37.5	69	.740	45.6	2.200	173.47	54	45	151	150	2.0	95.4

FIELD SHEETS

RUN NUMBER: 2 TRAVERSE: P1 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	71	.600	41.1	1.700	109.49	39	38	161	150	12.0	99.5
1	2.5	62	.640	42.1	1.900	111.41	44	39	165	150	2.0	97.5
2	5.0	60	.660	42.7	1.900	113.38	44	39	166	150	2.0	96.3
2	7.5	68	.660	43.0	1.900	115.36	45	39	166	150	2.0	96.9
3	10.0	63	.640	42.2	1.900	117.34	50	41	166	150	2.0	96.8
3	12.5	63	.660	42.8	1.900	119.31	50	41	165	150	2.0	95.8
4	15.0	69	.720	45.0	2.100	121.29	52	41	165	150	2.0	95.8
4	17.5	69	.740	45.6	2.100	123.35	52	41	163	150	2.0	95.9
5	20.0	71	.680	43.8	2.000	125.44	51	42	165	150	2.0	96.4
5	22.5	83	.740	46.2	2.100	127.45	51	42	165	150	2.0	97.2
6	35.0	72	.700	44.5	2.000	129.54	52	44	165	150	2.0	95.7
6	27.5	72	.780	47.0	2.300	131.57	57	44	163	150	2.0	95.6
7	30.0	68	.680	43.7	2.000	133.72	55	46	163	150	2.0	95.3
7	32.5	75	.740	45.9	2.200	135.73	54	46	163	150	2.0	95.8
8	35.0	67	.660	43.0	1.900	137.82	54	46	166	150	2.0	95.3
8	37.5	67	.700	44.3	2.000	139.80	54	46	165	150	2.0	94.9

FIELD SHEETS

RUN NUMBER: 2 TRAVERSE: P3 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	61	.560	39.4	1.680	175.56	55	46	158	150	2.0	94.4
1	2.5	62	.560	39.4	1.680	177.38	55	46	158	150	2.0	94.5
2	5.0	62	.560	39.4	1.680	179.20	55	46	158	150	2.0	94.5
2	7.5	63	.560	39.4	1.680	181.02	55	46	158	150	2.0	94.6
3	10.0	57	.480	36.3	1.440	182.84	55	46	158	150	2.0	94.3
3	12.5	51	.480	36.1	1.440	184.53	55	46	158	150	2.0	93.7
4	15.0	58	.500	37.1	1.500	186.22	55	46	158	150	2.0	94.1
4	17.5	60	.500	37.2	1.500	187.94	55	46	158	150	2.0	94.3
5	20.0	61	.600	40.8	1.800	189.66	57	47	157	150	2.0	96.0
5	22.5	62	.560	39.4	1.680	191.58	57	47	157	150	2.0	94.2
6	25.0	63	.680	43.5	2.040	193.40	57	48	157	150	2.0	94.5
6	27.5	62	.720	44.7	2.160	195.41	57	48	157	150	2.0	94.1
7	30.0	75	.740	45.9	2.220	197.47	58	50	157	150	2.0	95.1
7	32.5	61	.720	44.6	2.160	199.56	58	50	157	150	2.0	99.6
8	35.0	61	.720	44.6	2.160	201.75	58	50	157	150	2.0	90.5
8	37.5	61	.740	45.3	2.220	203.74	58	50	157	150	2.0	93.8

FIELD SHEETS

RUN NUMBER: 2 TRAVERSE: PS DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX TEMP	PROBE TEMP	VAC	% ISO
1	.0	68	.580	40.3	1.740	205.83	49	48	141	150	2.0	96.9
1	2.5	65	.580	40.2	1.740	207.71	51	48	144	150	2.0	100.5
2	5.0	65	.600	40.9	1.800	209.67	53	48	145	150	2.0	100.7
2	7.5	66	.600	41.0	1.800	211.67	55	49	147	150	2.0	100.5
3	10.0	75	.620	42.0	1.860	213.67	57	49	146	150	2.0	101.0
3	12.5	70	.660	43.1	1.980	215.70	57	49	146	150	2.0	98.9
4	15.0	68	.660	43.0	1.980	217.76	61	50	146	150	2.0	98.2
4	17.5	64	.680	43.5	2.040	219.82	61	50	146	150	2.0	97.8
5	20.0	75	.740	45.9	2.300	221.91	61	50	146	150	2.0	98.9
5	22.5	64	.680	43.5	2.040	224.09	63	51	145	150	2.0	97.5
6	25.0	65	.720	44.8	2.250	226.18	64	51	145	150	2.0	97.5
6	27.5	67	.800	47.3	2.500	228.33	65	52	145	150	2.0	97.8
7	30.0	66	.740	45.5	2.300	230.60	65	52	145	150	2.0	97.5
7	32.5	66	.740	45.5	2.300	232.78	65	53	145	150	2.0	97.4
8	35.0	65	.620	41.6	1.860	234.96	65	53	145	150	2.0	98.9
8	37.5	58	.600	40.6	1.800	236.99	65	53	145	150	2.0	98.3

FIELD SHEETS

RUN NUMBER: 2 TRAVERSE: P6 DATE: DEC 1 1976

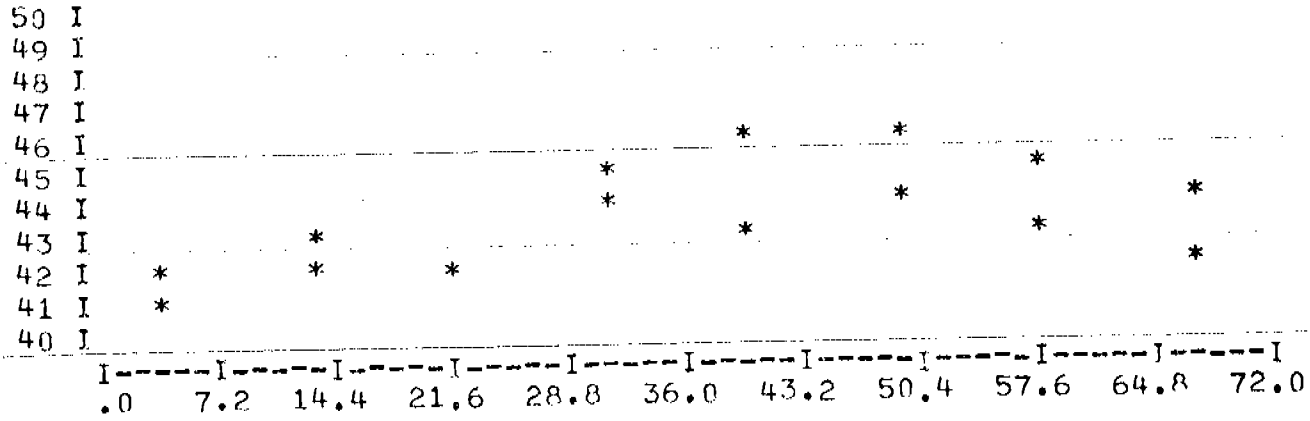
POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	69	.480	36.7	1.300	238.99	46	47	140	150	4.0	94.4
1	2.5	65	.480	36.6	1.300	240.65	51	47	140	150	4.0	98.6
2	5.0	76	.620	42.0	1.860	242.40	51	47	140	150	4.0	101.9
2	7.5	63	.560	39.4	1.600	244.43	54	48	149	150	4.0	100.2
3	10.0	65	.540	38.8	1.500	246.36	54	48	149	150	4.0	100.6
3	12.5	70	.600	41.1	1.500	248.26	54	48	149	150	4.0	101.0
4	15.0	65	.640	42.3	1.500	250.26	57	48	149	150	4.0	98.9
4	17.5	63	.580	40.1	1.500	252.30	57	48	149	150	4.0	99.7
5	20.0	64	.600	40.9	1.860	254.26	56	48	148	150	4.0	99.8
5	22.5	62	.620	41.5	1.860	256.25	61	52	151	150	7.0	98.1
6	25.0	64	.590	40.5	1.770	258.26	61	52	152	150	7.0	97.2
6	27.5	60	.600	40.7	1.800	260.20	61	52	152	150	7.0	94.1
7	30.0	59	.620	41.4	1.860	262.10	62	52	147	150	7.0	89.9
7	32.5	69	.630	42.1	1.890	263.95	62	52	149	150	7.0	93.5
8	35.0	58	.620	41.3	1.860	265.87	62	52	149	150	7.0	98.6
8	37.5	58	.620	41.3	1.860	267.90	62	52	149	150	7.0	98.6

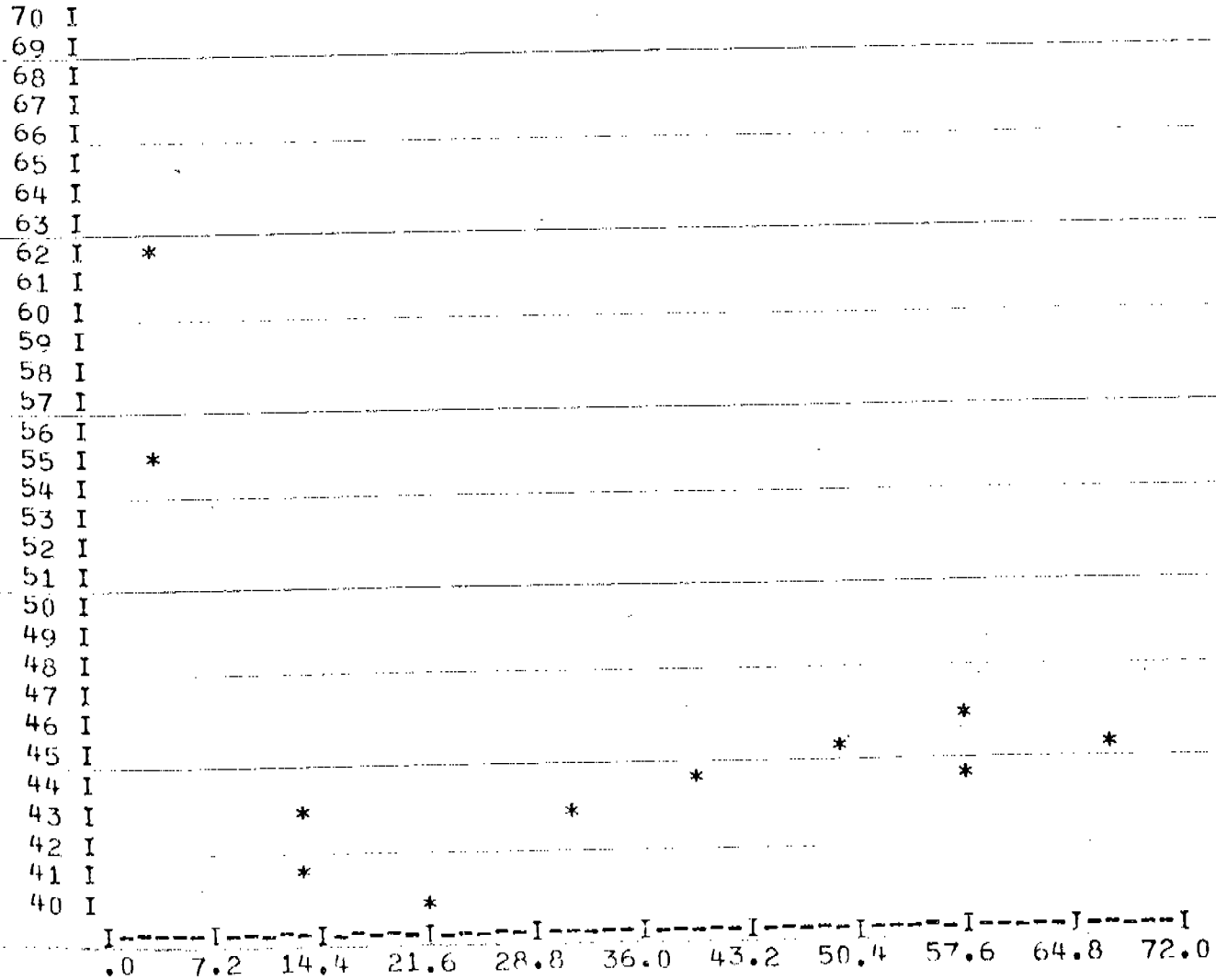
FIELD SHEETS

RUN NUMBER: 2 TRAVERSE: P4 DATE: DEC 1 1976

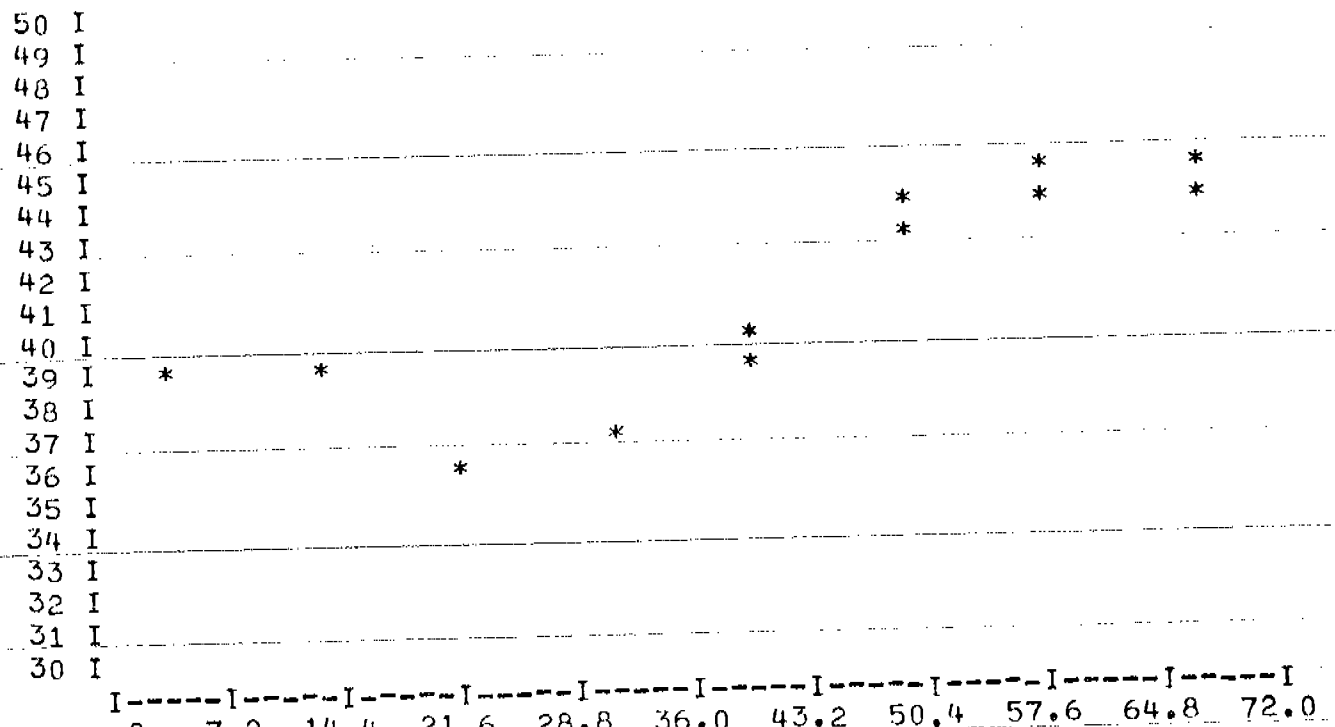
POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	TEMP BOX	TEMP PROBE	VAC	% ISO
1	.0	68	.640	42.4	1.920	269.93	45	44	160	150	9.0	100.9
1	2.5	60	.620	41.4	1.860	271.97	46	44	160	150	9.0	101.1
2	5.0	74	.560	39.9	1.680	274.00	48	44	160	150	9.0	102.3
2	7.5	60	.570	39.7	1.710	275.93	48	43	165	150	8.0	100.7
3	10.0	62	.550	39.1	1.650	277.87	51	45	166	150	8.0	100.6
3	12.5	78	.490	37.4	1.470	279.78	52	45	166	150	8.0	101.8
4	15.0	65	.510	37.7	1.530	281.58	53	44	160	150	8.0	101.3
4	17.5	66	.500	37.4	1.500	283.43	54	45	162	150	8.0	101.7
5	20.0	68	.500	37.5	1.500	285.27	56	47	162	150	8.0	101.5
5	22.5	66	.600	41.0	1.800	287.11	56	46	160	150	9.0	100.7
6	25.0	69	.600	41.1	1.800	289.11	51	47	159	150	9.0	101.3
6	27.5	69	.600	41.1	1.800	291.11	47	42	162	150	9.0	102.2
7	30.0	79	.720	45.4	2.160	293.11	50	42	160	150	9.0	117.5
7	32.5	72	.700	44.5	2.000	295.61	53	42	159	150	9.0	100.1
8	35.0	60	.660	42.7	1.900	297.73	57	42	159	150	9.0	98.6
8	37.5	60	.660	42.7	1.900	299.79	52	42	159	150	9.0	99.1
	0					301.85						

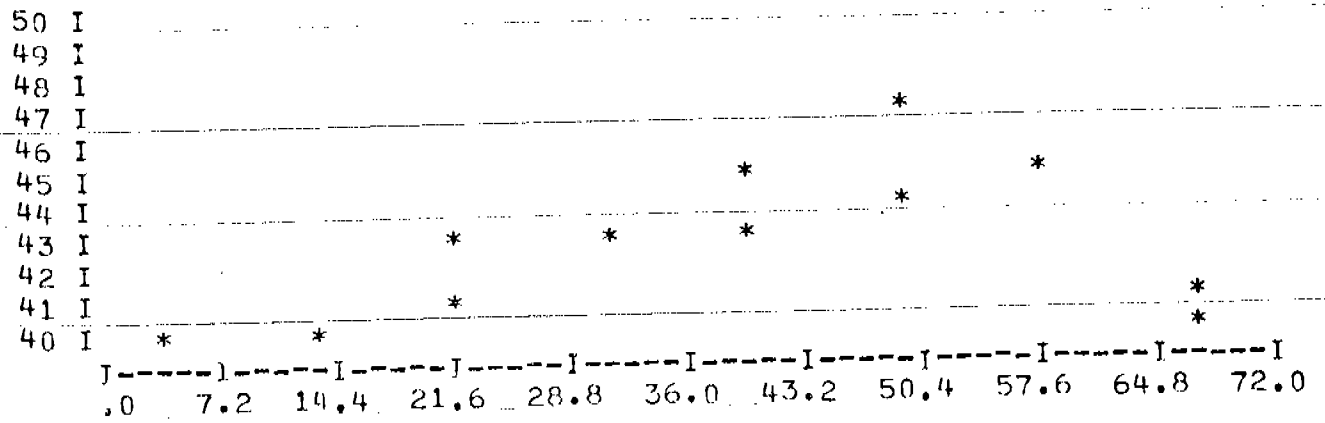
STEEL MFG, 1&2 BREECHING, RUN NUMBER: 2 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



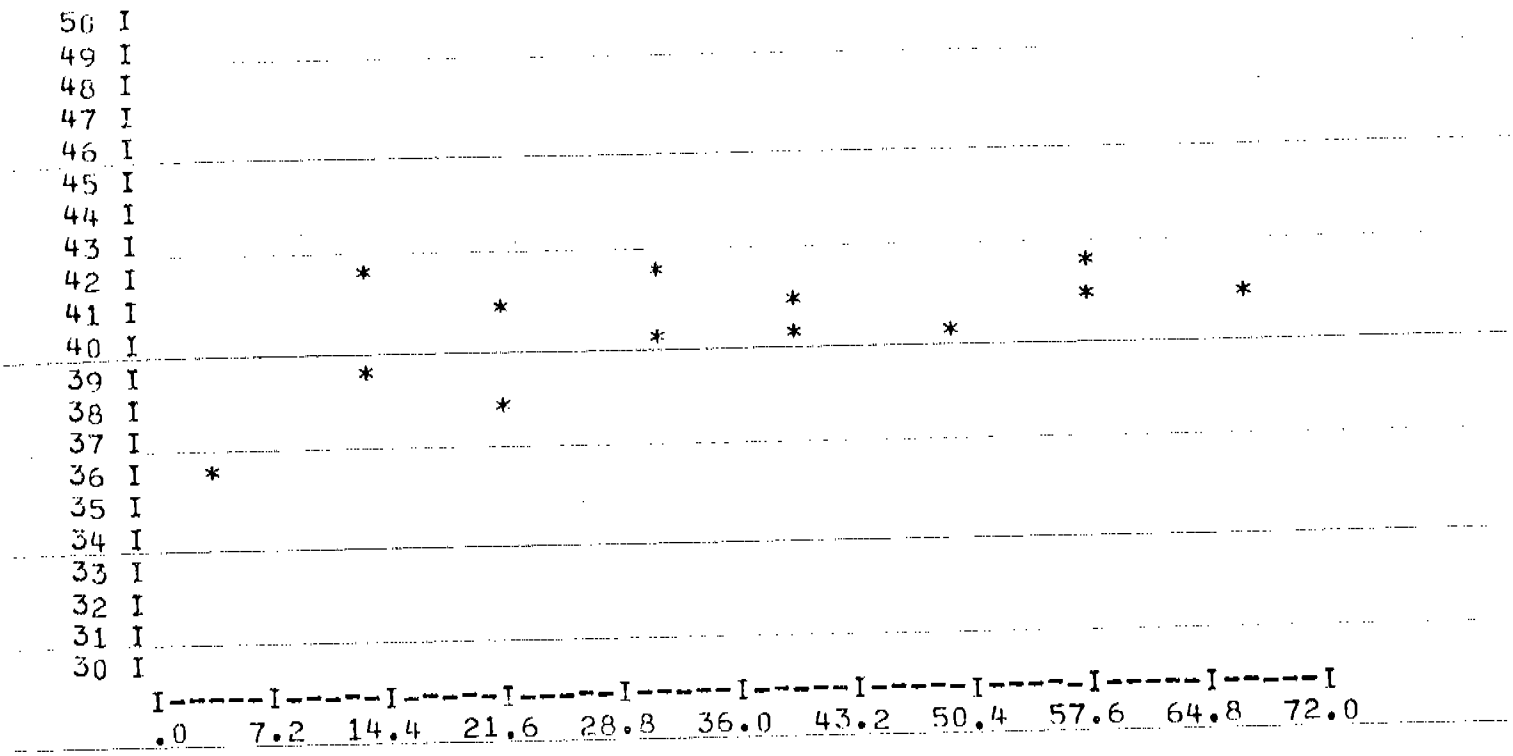


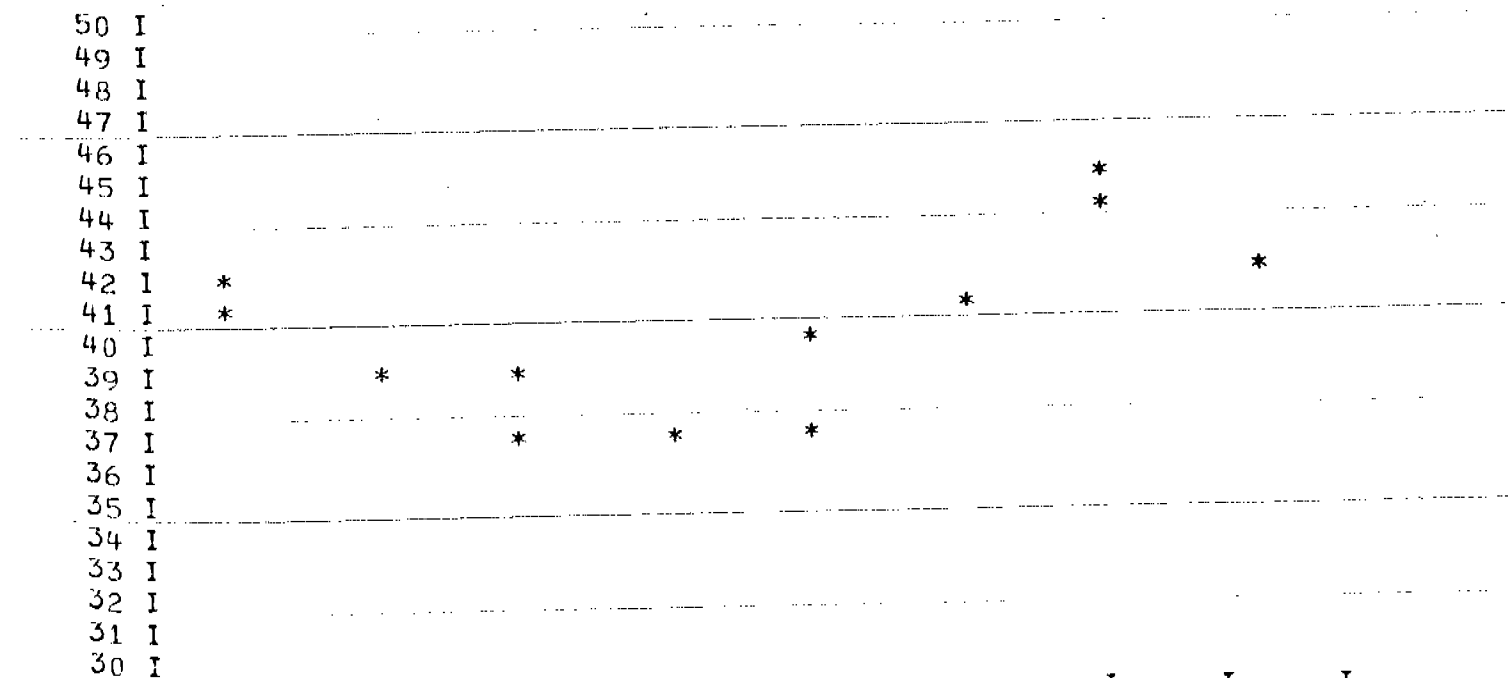
STEEL MFG, 1&2 BREECHING, RUN NUMBER: 2 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)





STEEL MFG, 1&2 BREECHING, RUN NUMBER: 2 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)





PARTICULATE EMISSION REPORT BY ENVIROCON LTD.

DATE OF SURVEY: DEC 1 1976

CLIENT: DOFASCO
BURLINGTON AVE
HAMILTON ONT

REF: TE2612

PLANT TYPE: STEEL MANUFACTURE
INLET BREECHING1,2

RUN NUMBER: 3

STACK EMISSIONS

STACK HEIGHT,FEET		80.0
STACK WIDTH AND BREADTH,FEET	6.00	6.00
AVERAGE TEMPERATURE OF FLUE GAS, DEG.F.		76.6
BAROMETRIC PRESSURE, IN.HG.ABS.		30.05
AVERAGE FLUE STATIC PRESSURE, IN.H20		-4.000
AVERAGE VELOCITY PRESSURE, IN.H20		1.679
PITOT COEFFICIENT		.807
% CO2(ORSAT)		.00
% O2(ORSAT)		20.80
% CO(ORSAT)		.00

FIELD DATA(CONT.)

PARTICULATE EMISSIONS	
NUMBER OF SAMPLING POINTS	48.
TOTAL SAMPLING TIME, MINS.	240.00
NOZZLE DIAMETER, INS.	.1563
TOTAL VOLUME MEASURED AT METER CONDITIONS, CF	120.86
AVERAGE SAMPLING RATE, CF/MIN.	.5036
AVERAGE METER TEMPERATURE, DEG.F.	54.35
NET VOLUME IN IMPINGER 1, MLS.	-6.0
NET VOLUME IN IMPINGER 2, MLS.	10.0
NET VOLUME IN IMPINGER 3, MLS.	5.0
MOISTURE IN SILICA GEL, GMS.	15.0000
VOLUME OF CONDENSATE COLLECTED, MLS.	24.00
FILTER PARTICULATE, GMS.	.1467
WASHINGS PARTICULATE, GMS.	.1135
WEIGHT OF PARTICULATE COLLECTED, GMS.	.2602
PLANT OPERATION	
PRODUCTION RATE, LBS./HOUR	N/A
LIQUID FUEL CONSUMPTION, IMP.GAL./HOUR	N/A
GASEOUS FUEL CONSUMPTION, CU.FT./HOUR	N/A

SUMMARY OF RESULTS

STACK EMISSIONS

AVERAGE FLUE GAS COMPOSITION

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	.0	.0
CO	.0	.0
O2	20.6	20.8
N2	78.5	79.2
H2O	.9	
MOL.WT.	28.75	28.84

AVG. VELOCITY OF GAS AT STACK CONDITIONS, FPM.	4247.4
VOLUME OF GAS AT STACK CONDITIONS, CFM.	152907.5
VOLUME OF GAS AT 70 DEG.F. AND 29.92 IN.HG., CFM	150211.8
VOLUME OF GAS AT STD. COND.(DRY)	148863.9
PERCENT EXCESS AIR	N/A

PARTICULATE EMISSIONS

CONCENTRATION:

GRAINS/SCF(DRY)	.0320
GRAINS/SCF(DRY) ADJUSTED TO 12% CO2	.0000
GRAINS/ACF	.0311
LBS/HOUR	40.81
LBS/TON OF PRODUCT	N/A
LBS/1000 IMP.GAL.LIQUID FUEL	N/A
LBS/10A6 FT. GASEOUS FUEL	N/A
LBS/1000 LBS.EFFLUENT	.06092
LBS/1000 LBS.EFFLUENT @ 50% EXCESS AIR	.0406
LBS/1000 LBS.EFFLUENT(DRY)	.0613

FIELD SHEETS

RUN NUMBER: 3 TRAVERSE: P5 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	57	1.200	58.7	.800	517.87	41	39	165	150	6.0	96.3
1	2.5	67	1.200	59.3	.800	518.94	48	41	151	150	6.0	96.3
2	5.0	67	.920	51.9	.600	520.01	40	41	152	150	6.0	96.3
2	3.5	62	.920	51.7	.600	520.94	48	41	152	150	6.0	95.1
3	10.0	60	.700	45.0	.470	521.87	48	41	147	150	6.0	95.9
3	12.5	60	.700	45.0	.470	522.69	48	41	151	151	6.0	94.8
4	15.0	70	1.600	68.7	1.100	523.50	48	41	151	151	6.0	96.2
4	17.5	56	1.600	67.7	1.100	524.73	48	41	151	151	6.0	94.9
5	20.0	85	1.800	73.8	1.200	525.96	50	39	151	151	6.0	98.0
5	22.5	63	1.800	72.3	1.200	527.27	51	39	151	151	6.0	95.9
6	25.0	90	1.800	74.2	1.200	528.58	42	39	131	150	4.0	99.2
6	27.5	74	1.800	73.1	1.200	529.89	50	39	131	150	3.5	97.0
7	30.0	100	1.700	72.7	1.140	531.20	55	41	135	150	4.0	98.4
7	32.5	70	1.700	70.8	1.140	532.47	55	41	135	150	4.0	95.7
8	35.0	71	2.000	76.8	1.340	533.74	55	42	135	150	4.0	95.3
8	37.5	85	2.000	77.8	1.340	535.11	55	42	135	150	4.0	96.5

FIELD SHEETS

RUN NUMBER: 3 TRAVERSE: P6 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	61	1.200	59.0	.800	536.48	51	44	163	150	2.0	95.2
1	2.5	71	1.200	59.5	.800	537.55	51	44	163	150	2.0	96.1
2	5.0	80	1.500	67.1	1.000	538.62	51	44	163	150	2.0	96.5
2	7.5	88	1.500	67.6	1.000	539.81	57	51	163	150	2.0	95.9
3	10.0	73	1.600	68.9	1.100	541.00	60	51	163	150	2.0	94.4
3	12.5	90	1.800	74.2	1.300	542.23	62	51	163	150	2.0	96.2
4	15.0	80	1.600	69.3	1.110	543.54	63	51	163	150	2.0	94.8
4	7.5	78	1.700	71.3	1.170	544.77	63	51	163	150	2.0	94.8
5	20.0	79	2.100	79.3	1.450	546.04	63	54	169	150	2.0	94.6
5	22.5	90	2.100	80.1	1.450	547.45	63	51	169	150	2.0	95.8
6	25.0	77	2.000	77.3	1.390	548.86	63	55	169	150	2.0	93.9
6	17.5	90	2.000	78.2	1.390	550.23	63	55	169	150	2.0	95.0
7	30.0	77	1.800	73.3	1.200	551.60	63	55	169	150	2.0	94.6
7	32.5	90	1.800	74.2	1.200	552.91	63	55	169	150	2.0	95.7
8	36.0	79	1.400	64.8	.980	554.22	63	55	168	150	2.0	94.3
8	37.5	90	1.400	65.4	.980	555.37	63	55	162	150	2.0	98.5

FIELD SHEETS

RUN NUMBER: 3 TRAVERSE: P3 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	80	1.400	64.8	1.000	556.56	50	48	148	150	3.0	96.2
1	2.5	86	1.500	67.5	1.050	557.71	51	46	145	150	3.0	96.8
2	5.0	75	1.400	64.5	1.000	558.90	56	46	144	150	3.0	95.4
2	7.5	87	1.400	65.2	1.000	560.05	56	46	138	150	3.0	93.1
3	10.0	72	1.500	66.6	1.050	561.16	56	46	146	150	3.0	95.1
3	12.5	95	1.400	65.7	1.000	562.35	56	46	160	150	3.0	97.1
4	15.0	84	1.700	71.7	1.200	563.50	60	50	161	150	3.0	95.7
4	17.5	75	1.700	71.1	1.200	564.77	62	52	161	150	3.0	94.5
5	20.0	45	2.200	78.6	1.540	566.04	66	53	150	150	3.0	91.8
5	22.5	75	2.200	80.9	1.540	567.49	66	53	150	150	4.0	94.5
6	25.0	73	2.200	80.7	1.540	568.94	66	56	147	150	4.0	94.0
6	27.5	74	2.200	80.8	1.540	570.39	68	58	147	150	4.0	93.8
7	30.0	85	2.100	79.8	1.470	571.84	70	55	150	150	4.0	94.4
7	32.5	80	2.300	83.1	1.610	573.25	70	55	150	150	4.0	94.2
8	35.0	73	2.100	78.9	1.470	574.73	72	54	156	150	4.0	93.2
8	37.5	81	2.100	79.5	1.470	576.14	72	55	156	150	4.0	93.8

FIELD SHEETS

RUN NUMBER: 3 TRAVERSE: P2 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	64	1.500	66.1	1.050	577.55	50	48	134	150	2.0	94.7
1	2.5	66	1.500	66.2	1.050	578.74	52	47	134	150	2.5	94.8
2	5.0	85	1.600	69.6	1.120	579.93	56	48	138	150	2.5	96.2
2	7.5	75	1.600	69.0	1.120	581.16	56	48	138	150	3.0	95.3
3	10.0	85	2.000	77.8	1.400	582.39	56	48	142	150	4.0	95.9
3	12.5	70	1.600	68.7	1.120	583.76	56	48	142	150	4.0	94.8
4	15.0	95	1.600	70.3	1.120	584.99	59	49	146	150	4.0	96.7
4	17.5	70	1.800	72.8	1.300	586.22	60	49	146	150	4.0	94.8
5	20.0	80	2.000	77.5	1.300	587.53	60	49	146	150	4.0	94.9
5	22.5	80	2.000	77.5	1.350	588.90	65	50	147	150	4.0	94.4
6	25.0	80	2.100	79.4	1.350	590.27	65	50	147	150	4.0	94.8
6	27.5	80	1.900	75.5	1.310	591.68	66	50	147	150	4.0	90.4
7	30.0	75	2.100	79.0	1.350	592.96	49	47	150	150	4.0	96.1
7	32.5	75	2.100	79.0	1.350	594.37	56	49	149	150	4.0	95.3
8	35.0	90	2.200	82.0	1.400	595.78	60	47	149	150	4.0	96.9
8	37.5	75	2.200	80.9	1.400	597.23	62	47	149	150	4.0	95.4

FIELD SHEETS

RUN NUMBER: 3 TRAVERSE: P1 DATE: DEC 1 1976

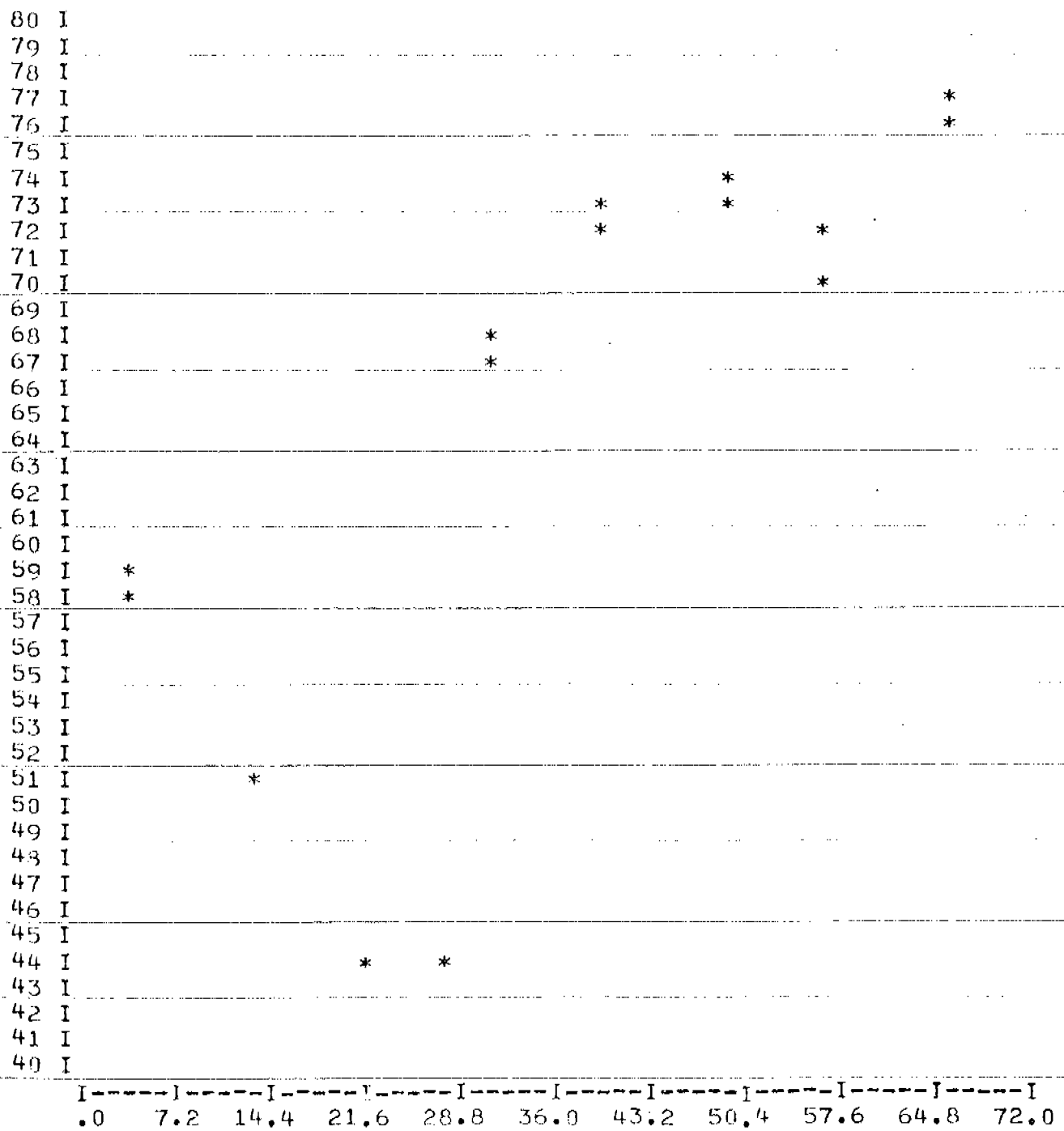
POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	72	1.600	68.8	1.040	598.68	50	48	149	150	4.0	95.5
1	2.5	68	1.500	66.4	.960	599.91	60	48	149	150	4.0	94.2
2	5.0	95	1.800	74.5	1.210	601.10	65	48	149	150	4.0	96.6
2	7.5	84	1.700	71.7	1.160	602.41	65	48	149	150	4.0	95.4
3	10.0	68	1.700	70.6	1.160	603.68	65	47	149	150	4.0	94.1
3	12.5	92	1.600	70.1	1.100	604.95	68	50	145	150	4.5	95.5
4	15.0	80	1.700	71.4	1.160	606.18	69	50	145	150	4.5	94.5
4	17.5	73	1.800	73.0	1.240	607.45	64	50	145	150	4.5	94.6
5	20.0	72	1.800	73.0	1.240	608.76	69	50	145	150	4.5	94.0
5	22.5	70	2.000	76.8	1.340	610.07	72	54	141	150	4.5	92.5
6	24.5	74	1.900	75.1	1.300	611.44	72	54	141	150	4.5	93.2
6	27.5	75	2.000	77.1	1.340	612.78	72	54	143	150	4.5	93.0
7	30.0	75	1.900	75.2	1.300	614.15	72	54	143	150	4.5	93.3
7	32.5	95	2.000	78.6	1.300	615.49	72	54	143	150	4.5	92.6
8	35.0	76	1.900	75.2	1.280	616.83	75	56	143	150	4.5	92.9
8	37.5	72	2.100	78.8	1.400	618.17	74	56	143	150	4.5	92.8

FIELD SHEETS

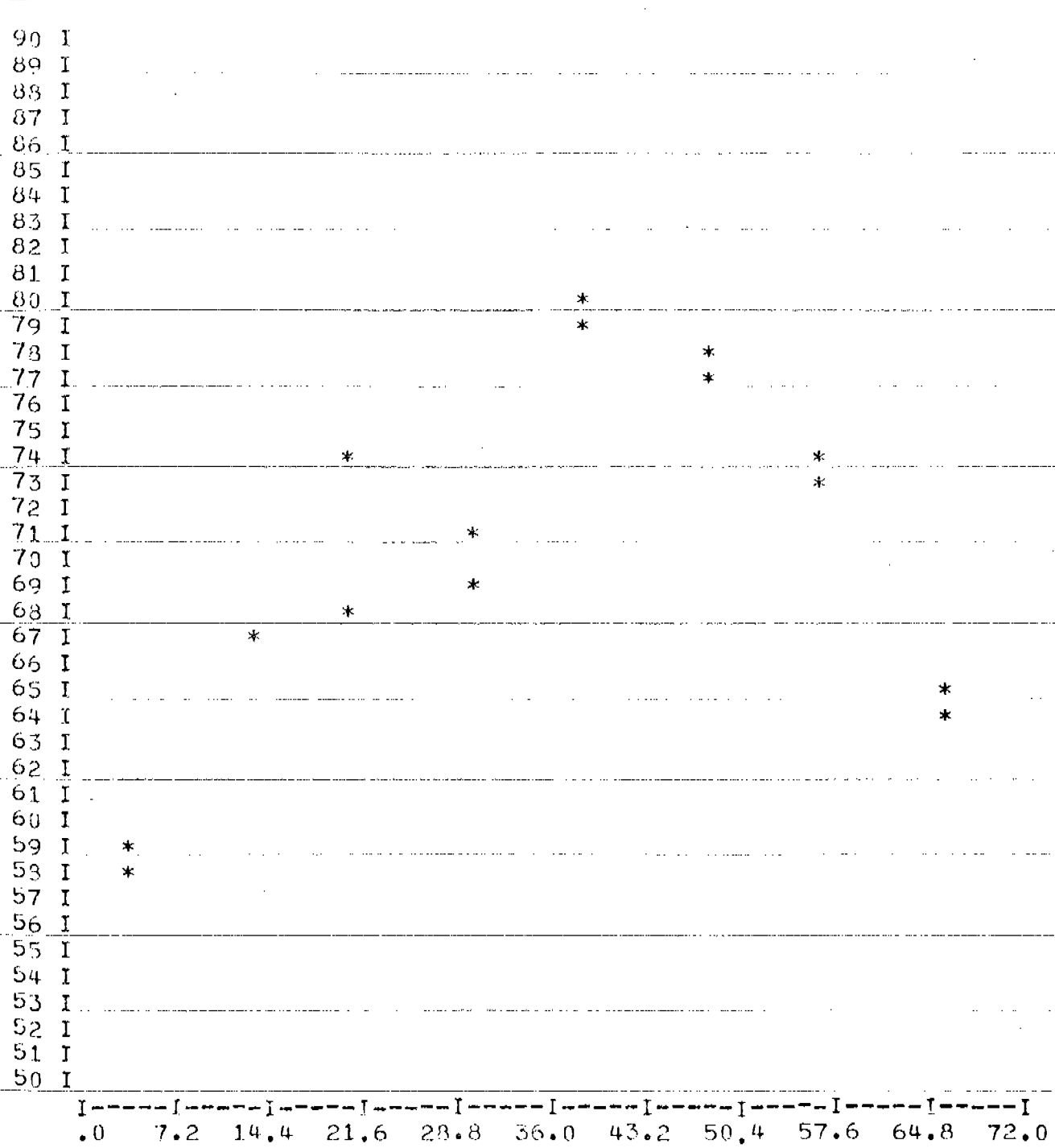
RUN NUMBER: 3 TRAVERSE: P4 DATE: DEC 1 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	68	1.200	59.3	.804	619.58	51	49	162	150	4.0	95.4
1	2.5	67	1.400	64.0	.970	620.65	55	49	163	150	6.0	94.5
2	5.0	80	1.500	67.1	1.000	621.80	59	50	163	150	6.0	95.1
2	7.5	69	1.500	66.4	1.000	622.99	60	50	140	150	7.0	94.1
3	10.0	67	1.400	64.0	.970	624.18	60	50	130	150	6.0	93.9
3	12.5	85	1.300	62.8	.880	625.33	60	50	130	150	7.0	95.7
4	15.0	75	1.500	66.8	1.000	626.44	65	50	130	150	7.0	94.2
4	17.5	75	1.400	64.5	.970	627.63	66	50	140	150	7.0	95.7
5	20.0	80	1.400	64.8	.970	628.80	66	50	143	150	6.0	92.9
5	22.5	72	1.500	66.6	.980	629.93	66	50	148	150	6.0	93.8
6	25.0	73	1.500	66.7	.980	631.12	66	50	148	150	6.0	93.9
6	27.5	85	1.500	67.4	.980	632.31	66	50	148	150	6.0	94.9
7	30.0	80	1.800	73.5	1.200	633.50	66	50	148	150	6.5	95.0
7	32.5	75	1.800	73.2	1.200	634.81	63	52	140	150	6.5	94.7
8	35.0	72	1.900	75.0	1.300	636.12	63	52	148	150	6.5	94.0
8	37.5	70	2.000	76.8	1.400	637.46	63	52	148	150	6.5	93.5
	40					638.83						

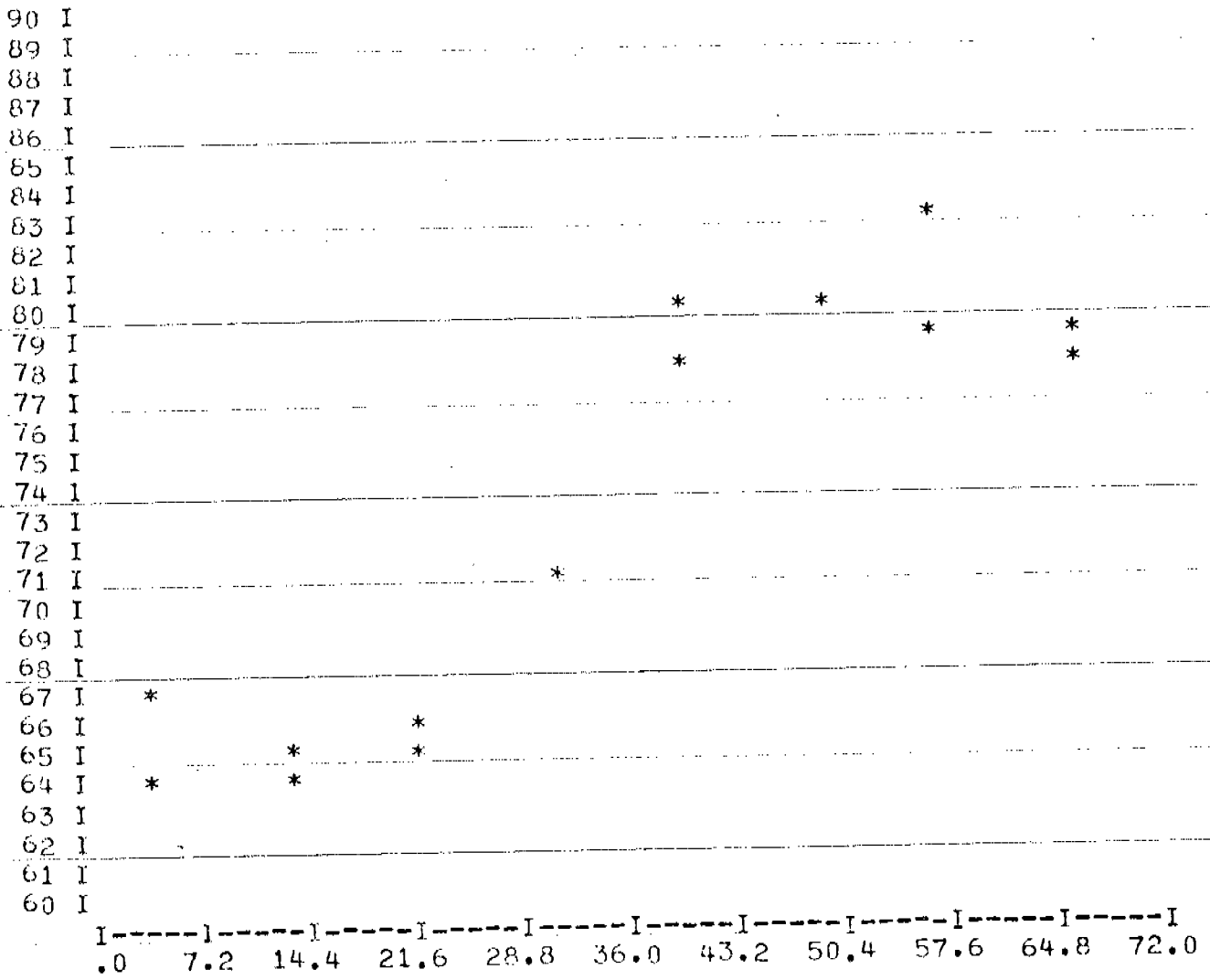
STEEL MANUFACTURE, INLET BREECHING1,2, RUN NUMBER: 3 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



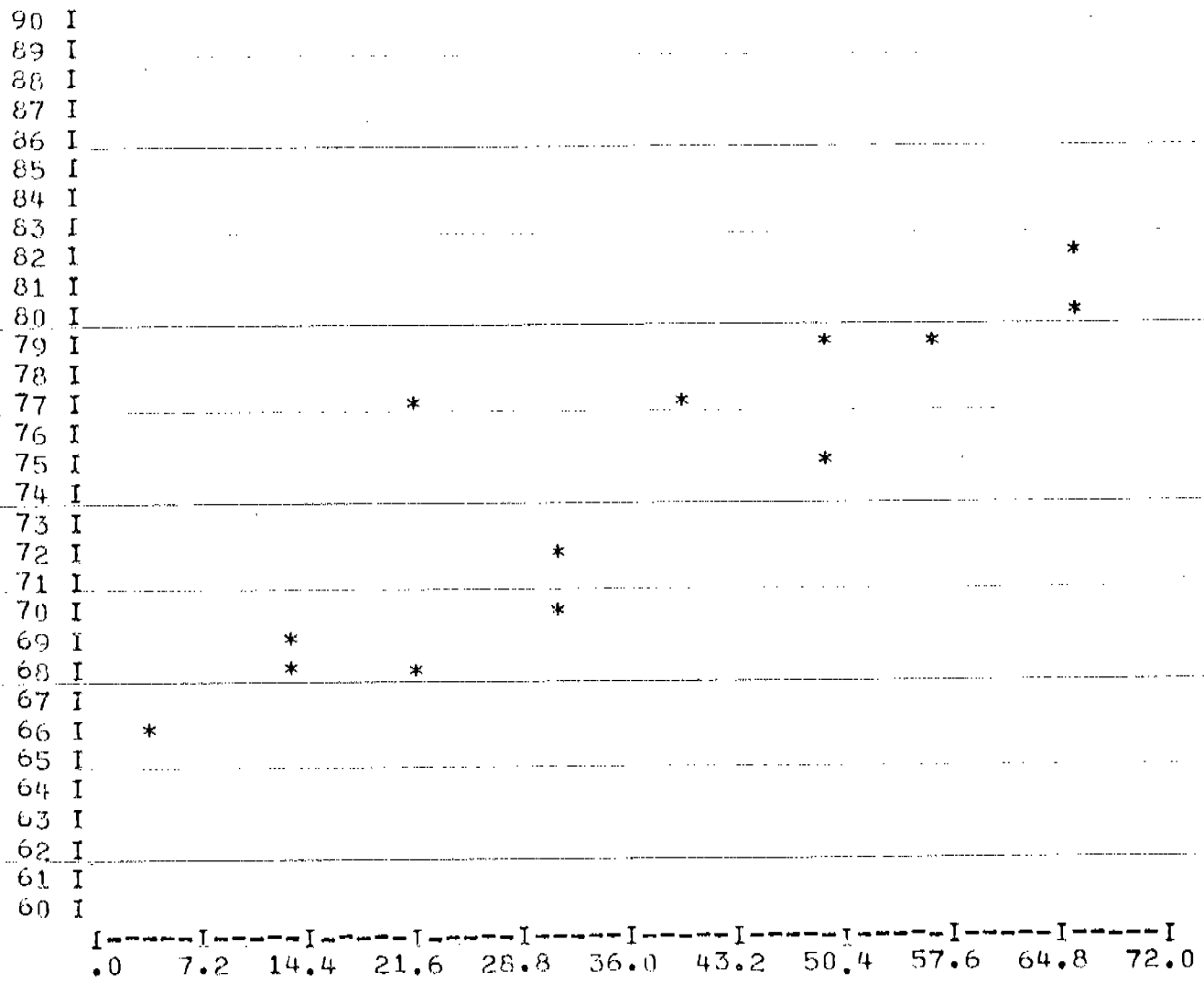
STEEL MANUFACTURE, INLET BREECHING1,2, RUN NUMBER: 3 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



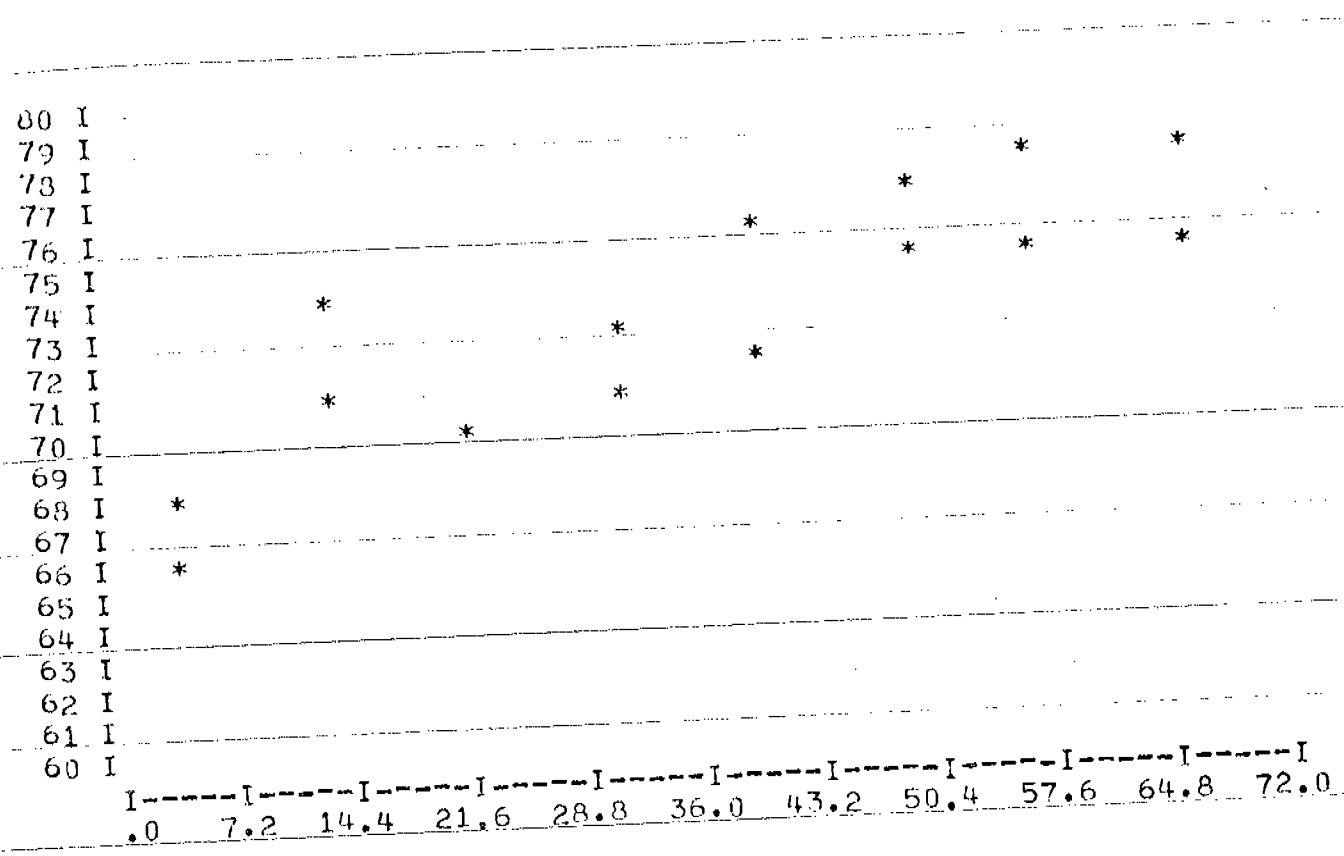
STEEL MANUFACTURE, INLET BREECHING1,2, RUN NUMBER: 3 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



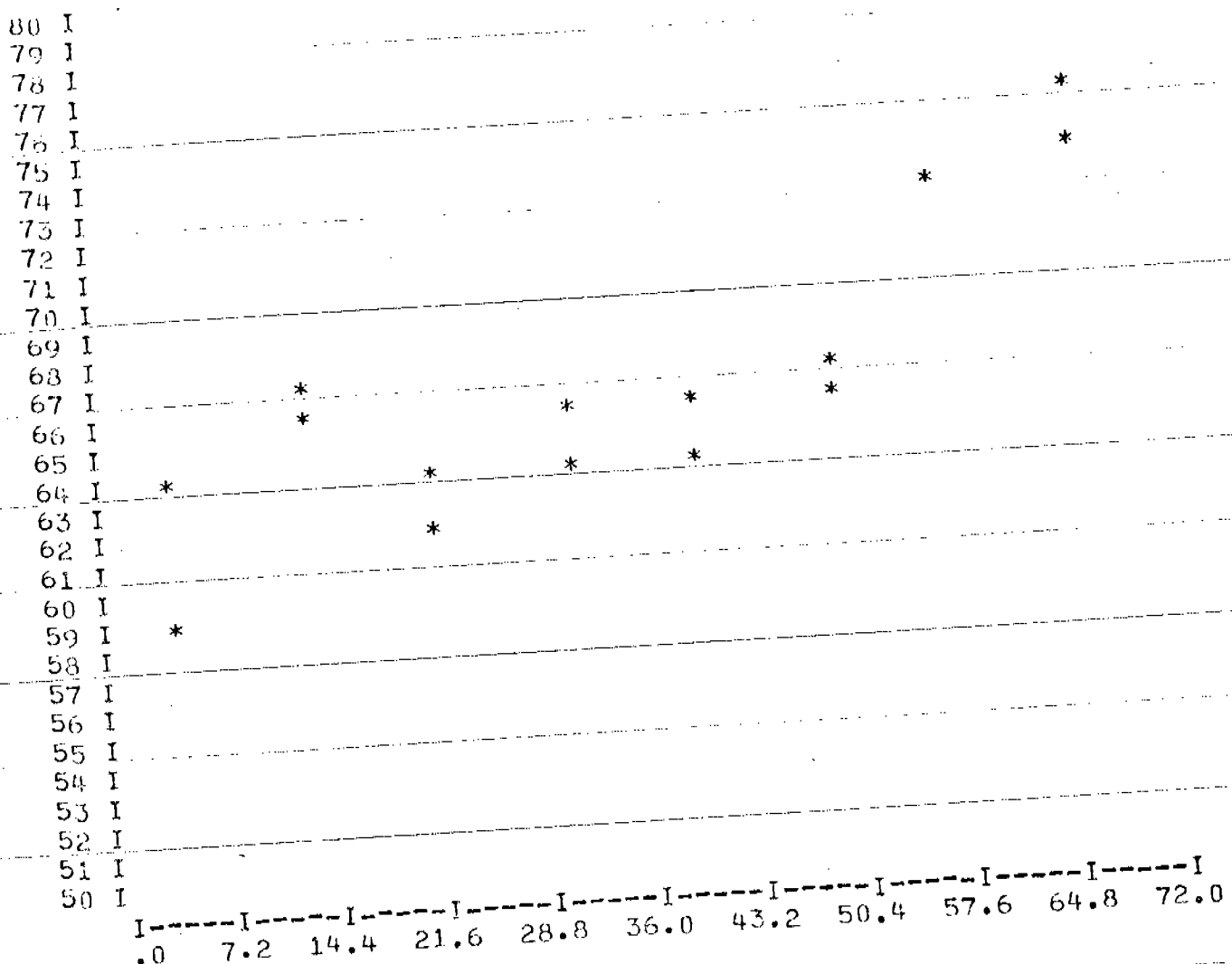
STEEL MANUFACTURE, INLET BREECHING1,2, RUN NUMBER: 3 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



STEEL MANUFACTURE, INLET BREECHING1,2, RUN NUMBER: 3 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



STEEL MANUFACTURE, INLET BREECHING1,2, RUN NUMBER: 3 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



PARTICULATE EMISSION REPORT BY ENVIROCON LTD.

DATE OF SURVEY: DEC 9 1976

CLIENT: DOFASCO
BURLINGTON AVE
HAMILTON ONT

PLANT TYPE: STEEL MANUFACTURING
PRECIPATATOR EXHAUST STACK

REF: TE 2612

RUN NUMBER: 4

STACK EMISSIONS

STACK HEIGHT, FEET	150.0
STACK DIAMETER, FEET	12.50
AVERAGE TEMPERATURE OF FLUE GAS, DEG.F.	45.8
BAROMETRIC PRESSURE, IN.HG.ABS.	29.90
AVERAGE FLUE STATIC PRESSURE, IN.H2O	-.350
AVERAGE VELOCITY PRESSURE, IN.H2O	.375
PITOT COEFFICIENT	.808
% CO2(ORSAT)	.00
% O2(ORSAT)	20.80
% CO(ORSAT)	.00

FIELD DATA(CONT.)

PARTICULATE EMISSIONS

NUMBER OF SAMPLING POINTS	48.
TOTAL SAMPLING TIME, MINS.	288.00
NOZZLE DIAMETER, INS.	.2500
TOTAL VOLUME MEASURED AT METER CONDITIONS, CF	188.99
AVERAGE SAMPLING RATE, CF/MIN.	.6562
AVERAGE METER TEMPERATURE, DEG.F.	93.31
NET VOLUME IN IMPINGER 1, MLS.	17.5
NET VOLUME IN IMPINGER 2, MLS	10.0
NET VOLUME IN IMPINGER 3, MLS.	.0
MOISTURE IN SILICA GEL, GMS.	11.9000
VOLUME OF CONDENSATE COLLECTED, MLS.	39.40
FILTER PARTICULATE, GMS.	.0120
WASHINGS PARTICULATE, GMS.	.0074
WEIGHT OF PARTICULATE COLLECTED,GMS.	.0194

PLANT OPERATION

PRODUCTION RATE, LBS./HOUR	N/A
LIQUID FUEL CONSUMPTION, IMP.GAL./HOUR	N/A
GASEOUS FUEL CONSUMPTION, CU.FT./HOUR	N/A

SUMMARY OF RESULTS

STACK EMISSIONS

AVERAGE FLUE GAS COMPOSITION

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	.0	.0
CO	.0	.0
O2	20.6	20.8
N2	78.4	79.2
H2O	1.0	
MOL.WT.	28.73	28.84

AVG. VELOCITY OF GAS AT STACK CONDITIONS, FPM.	1948.7
VOLUME OF GAS AT STACK CONDITIONS, CFM.	239139.3
VOLUME OF GAS AT 70 DEG.F. AND 29.92 IN.HG., CFM	250207.1
VOLUME OF GAS AT STD. COND.(DRY)	247665.1
PERCENT EXCESS AIR	N/A

PARTICULATE EMISSIONS

CONCENTRATION:

GRAINS/SCF(DRY)	.0016
GRAINS/SCF(DRY) ADJUSTED TO 12% CO2	.0000
GRAINS/ACF	.0017
LBS/HOUR	3.50
LBS/TON OF PRODUCT	N/A
LBS/1000 IMP.GAL.LIQUID FUEL	N/A
LBS/10A6 FT. GASEOUS FUEL	N/A
LBS/1000 LBS.EFFLUENT	.00313
LBS/1000 LBS.EFFLUENT @ 50% EXCESS AIR	.0021
LBS/1000 LBS.EFFLUENT(DRY)	.0032

FIELD SHEETS

RUN NUMBER: 4 TRAVERSE: W-E DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	40	.220	24.7	.850	309.69	75	65	130	130	6.0	93.0
1	3.0	40	.220	24.7	.850	311.17	75	65	130	130	6.0	102.8
2	6.0	40	.340	30.7	1.300	312.80	75	65	130	130	6.0	100.5
2	9.0	40	.300	28.9	1.250	314.78	90	80	130	130	5.0	87.8
3	12.0	40	.350	31.2	1.300	316.45	90	80	130	130	7.0	113.4
3	15.0	40	.350	31.2	1.300	318.78	90	80	130	130	7.0	98.3
4	18.0	40	.420	34.1	2.200	320.80	95	85	130	130	8.0	91.8
4	21.0	40	.420	34.1	2.200	322.88	90	80	130	130	7.0	92.6
5	24.0	40	.450	35.3	2.500	324.96	90	80	130	130	7.0	94.3
5	27.0	45	.450	35.5	2.500	327.15	95	85	130	130	7.0	92.2
6	30.0	45	.420	34.3	2.200	329.30	90	80	130	130	5.0	93.5
6	33.0	45	.420	34.3	2.200	331.39	95	80	130	130	5.0	82.4
7	36.0	45	.430	34.7	2.300	333.24	95	80	130	130	7.0	96.0
7	39.0	45	.430	34.7	2.300	335.42	95	80	130	130	7.0	96.0
8	42.0	45	.440	35.1	2.400	337.60	95	85	130	130	7.5	92.3
8	45.0	45	.440	35.1	2.400	339.73	95	85	130	130	7.5	92.3
9	48.0	45	.420	34.3	2.200	341.86	95	85	130	130	6.0	92.2
9	51.0	50	.420	34.5	2.200	343.94	95	85	130	130	7.0	92.7
10	54.0	50	.450	35.7	2.500	346.02	95	85	130	130	7.0	92.6
10	57.0	50	.450	35.7	2.500	348.17	95	85	130	130	6.0	92.6
11	60.0	50	.450	35.7	2.500	350.32	95	90	130	130	6.5	92.2
11	63.0	50	.450	35.7	2.500	352.47	95	90	130	130	6.0	92.2
12	66.0	50	.450	35.7	2.500	354.62	100	90	130	130	6.0	91.8
12	69.0	50	.450	35.7	2.500	356.77	100	90	130	130	6.0	91.8

FIELD SHEETS

RUN NUMBER: 4 TRAVERSE: S-N DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	TEMP BOX	TEMP PROBE	VAC	% ISO
1	.0	45	.350	31.3	1.300	358.92	90	80	150	130	7.0	93.4
1	3.0	45	.350	31.3	1.300	360.83	90	80	150	130	7.0	91.4
2	6.0	45	.350	31.3	1.300	362.70	95	80	150	130	8.0	88.6
2	9.0	45	.320	30.0	1.200	364.52	95	80	150	130	7.0	92.6
3	12.0	45	.320	30.0	1.200	366.34	100	85	150	130	7.0	96.8
3	15.0	45	.360	31.8	1.500	368.26	100	90	150	130	7.0	91.0
4	18.0	47	.360	31.8	1.500	370.18	100	90	150	130	7.0	91.1
4	21.0	47	.360	31.8	1.500	372.10	100	90	150	130	7.0	91.1
5	24.0	47	.370	32.3	1.700	374.02	100	90	150	130	6.0	91.3
5	27.0	47	.370	32.3	1.700	375.97	100	90	150	130	6.0	91.3
6	30.0	45	.380	32.6	1.800	377.92	100	90	150	130	6.5	90.9
6	33.0	45	.380	32.6	1.800	379.89	100	90	150	130	6.5	90.9
7	36.0	48	.420	34.4	1.900	381.86	100	90	150	130	7.0	91.6
7	39.0	48	.420	34.4	1.900	383.94	100	90	150	130	7.5	91.6
8	42.0	48	.440	35.2	2.000	386.02	100	90	150	130	8.0	91.2
8	45.0	48	.440	35.2	2.000	388.14	100	90	150	130	8.0	91.2
9	48.0	50	.450	35.7	2.200	390.26	100	90	150	130	8.0	91.7
9	51.0	50	.450	35.7	2.200	392.41	100	90	150	130	8.0	91.7
10	54.0	50	.420	34.5	1.900	394.56	100	90	150	130	8.0	91.8
10	57.0	50	.420	34.5	1.900	396.64	100	90	150	130	8.0	91.8
11	60.0	50	.460	36.1	2.300	398.72	100	95	150	130	8.0	91.2
11	63.0	50	.460	36.1	2.300	400.89	105	95	150	130	8.0	90.8
12	66.0	50	.430	34.9	2.100	403.06	105	95	150	130	8.0	90.8
12	69.0	50	.430	34.9	2.100	405.16	105	95	150	130	8.0	90.8

FIELD SHEETS

RUN NUMBER: 4 TRAVERSE: E-W DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	40	.250	26.3	.600	407.26	100	95	150	130	8.0	89.9
1	3.0	40	.250	26.3	.600	408.86	100	95	150	130	8.0	89.9
2	6.0	40	.250	26.3	.600	410.46	100	95	150	130	8.0	89.9
2	9.0	40	.250	26.3	.600	412.06	100	95	150	130	8.0	89.9
3	12.0	40	.320	29.8	1.000	413.66	100	95	150	130	9.0	90.0
3	15.0	40	.320	29.8	1.000	415.47	100	95	150	130	9.0	90.0
4	18.0	43	.350	31.3	1.300	417.28	100	95	150	130	9.5	90.2
4	21.0	43	.350	31.3	1.300	419.17	100	95	150	130	9.0	90.2
5	24.0	43	.400	33.4	2.000	421.06	100	95	150	130	8.5	90.8
5	27.0	43	.400	33.4	2.000	423.09	100	95	150	130	8.5	90.8
6	30.0	43	.360	31.7	1.800	425.12	100	95	150	130	8.0	90.9
6	33.0	43	.360	31.7	1.800	427.05	100	95	150	130	8.0	90.9
7	36.0	45	.400	33.5	2.000	428.98	100	95	150	130	7.5	86.5
7	39.0	45	.400	33.5	2.000	430.91	100	95	150	130	7.5	86.5
8	42.0	45	.440	35.1	2.300	432.84	100	95	150	130	8.0	90.6
8	45.0	45	.440	35.1	2.300	434.96	100	95	150	130	8.0	90.6
9	48.0	45	.400	33.5	2.000	437.08	100	95	150	130	6.5	90.9
9	51.0	50	.400	33.7	2.000	439.11	100	95	150	130	6.5	91.4
10	54.0	50	.400	33.7	2.000	441.14	100	95	150	130	7.0	91.4
10	57.0	50	.400	33.7	2.000	443.17	100	95	150	130	7.0	91.4
11	60.0	50	.400	33.7	2.000	445.20	100	95	150	130	7.0	91.4
11	63.0	50	.400	33.7	2.000	447.23	100	95	150	130	7.0	91.4
12	66.0	50	.400	33.7	2.000	449.26	100	95	150	130	7.0	91.4
12	69.0	50	.400	33.7	2.000	451.29	100	95	150	130	7.0	91.4

FIELD SHEETS

RUN NUMBER: 4 TRAVERSE: N-S DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	40	.200	23.6	.700	453.32	100	90	150	130	5.0	90.3
1	3.0	40	.200	23.6	.700	454.75	100	90	150	130	5.0	90.3
2	6.0	40	.280	27.9	.900	456.18	100	90	150	130	6.0	90.7
2	9.0	40	.280	27.9	.900	457.88	100	90	150	130	6.0	90.7
3	12.0	40	.280	27.9	.900	459.58	100	90	150	130	6.0	90.7
3	15.0	40	.280	27.9	.900	461.28	100	90	150	130	6.0	90.7
4	18.0	42	.350	31.2	1.200	462.98	100	90	150	130	6.5	90.5
4	21.0	42	.350	31.2	1.200	464.87	100	90	150	130	6.5	90.5
5	24.0	45	.350	31.3	1.200	466.76	100	90	150	130	6.5	90.7
5	27.0	45	.350	31.3	1.200	468.65	100	90	150	130	6.5	90.7
6	30.0	45	.350	31.3	1.200	470.54	100	90	150	130	6.5	90.7
6	33.0	45	.350	31.3	1.200	472.43	100	90	150	130	6.5	90.7
7	36.0	48	.400	33.6	1.700	474.32	100	90	150	130	7.0	91.5
7	39.0	48	.400	33.6	1.700	476.35	100	90	150	130	7.0	91.5
8	42.0	48	.400	33.6	1.700	478.38	100	90	150	130	6.5	91.5
8	45.0	48	.400	33.6	1.700	480.41	100	90	150	130	6.5	91.5
9	48.0	52	.400	33.7	1.700	482.44	100	90	150	130	6.5	91.9
9	51.0	52	.400	33.7	1.700	484.47	100	90	150	130	6.5	91.9
10	54.0	52	.400	33.7	1.700	486.50	100	90	150	130	6.5	91.9
10	57.0	52	.400	33.7	1.700	488.53	100	90	150	130	6.0	91.9
11	60.0	52	.400	33.7	1.700	490.56	100	90	150	130	6.0	91.9
11	63.0	52	.400	33.7	1.700	492.59	100	90	150	130	6.0	91.9
12	66.0	52	.400	33.7	1.700	494.62	100	90	150	130	6.0	91.9
12	69.0	52	.400	33.7	1.700	496.65	100	90	150	130	6.0	91.9
	72					498.68						

STEEL MANUFACTURING, PRECIPATATOR EXHAUST STACK, RUN NUMBER:
X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)

```
40 I
39 I
38 I
37 I
36 I
35 I            *
34 I
33 I      *  *   *  *  *   *
32 I
31 I    *  *
30 I
29 I   *
28 I
27 I
26 I**
25 I
24 I
23 I
22 I
21 I
20 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

```
40 I
39 I
38 I
37 I
36 I
35 I
34 I
33 I          * * *  *  *   *
32 I
31 I    * **
30 I
29 I
28 I
27 I * *
26 I
25 I
24 I
23 I*
22 I
21 I
20 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
```

.0 15.0 30.0 45.0 60.0 75.0 90.0 105.0 120.0 135.0 150.0

.0 15.0 30.0 45.0 60.0 75.0 90.0 105.0 120.0 135.0 150.0

PARTICULATE EMISSION REPORT BY ENVIROCON LTD.

DATE OF SURVEY: DEC 9 1976

CLIENT: DOFASCO
BURLINGTON AVE
HAMILTON ONT

PLANT TYPE: STEEL MFG
BREECHING 3

REF: TE2612

RUN NUMBER: 5

STACK EMISSIONS

STACK HEIGHT, FEET		80.0
STACK WIDTH AND BREADTH, FEET	6.00	6.00
AVERAGE TEMPERATURE OF FLUE GAS, DEG.F.		41.7
BAROMETRIC PRESSURE, IN.HG.ABS.		29.90
AVERAGE FLUE STATIC PRESSURE, IN.H20		-3.800
AVERAGE VELOCITY PRESSURE, IN.H20		2.462
PITOT COEFFICIENT		.787
% CO2(ORSAT)		.00
% O2(ORSAT)		20.80
% CO(ORSAT)		.00

FIELD DATA(CONT.)

PARTICULATE EMISSIONS

NUMBER OF SAMPLING POINTS	48.
TOTAL SAMPLING TIME, MINS.	240.00
NOZZLE DIAMETER, INS.	.1875
TOTAL VOLUME MEASURED AT METER CONDITIONS, CF	220.39
AVERAGE SAMPLING RATE, CF/MIN.	.9183
AVERAGE METER TEMPERATURE, DEG.F.	45.41
NET VOLUME IN IMPINGER 1, MLS.	5.0
NET VOLUME IN IMPINGER 2, MLS	-3.0
NET VOLUME IN IMPINGER 3, MLS.	10.0
MOISTURE IN SILICA GEL, GMS.	28.0000
VOLUME OF CONDENSATE COLLECTED, MLS.	40.00
FILTER PARTICULATE, GMS.	.0141
WASHINGS PARTICULATE, GMS.	.0346
WEIGHT OF PARTICULATE COLLECTED,GMS.	.0487

PLANT OPERATION

PRODUCTION RATE, LBS./HOUR	N/A
LIQUID FUEL CONSUMPTION, IMP.GAL./HOUR	N/A
GASEOUS FUEL CONSUMPTION, CU.FT./HOUR	N/A

SUMMARY OF RESULTS

STACK EMISSIONS

AVERAGE FLUE GAS COMPOSITION

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	.0	.0
CO	.0	.0
O2	20.6	20.8
N2	78.6	79.2
H2O	.8	
MOL.WT.	28.76	28.84

AVG. VELOCITY OF GAS AT STACK CONDITIONS, FPM.	4860.3
VOLUME OF GAS AT STACK CONDITIONS, CFM.	174970.9
VOLUME OF GAS AT 70 DEG.F. AND 29.92 IN.HG., CFM	183003.2
VOLUME OF GAS AT STD. COND.(DRY)	181524.4
PERCENT EXCESS AIR	N/A

PARTICULATE EMISSIONS

CONCENTRATION:

GRAINS/SCF(DRY)	.0032
GRAINS/SCF(DRY) ADJUSTED TO 12% CO2	.0000
GRAINS/ACF	.0034
LBS/HOUR	5.03
LBS/TON OF PRODUCT	N/A
LBS/1000 IMP.GAL.LIQUID FUEL	N/A
LBS/10^6 FT. GASEOUS FUEL	N/A
LBS/1000 LBS.EFFLUENT	.00616
LBS/1000 LBS.EFFLUENT @ 50% EXCESS AIR	.0041
LBS/1000 LBS.EFFLUENT(DRY)	.0062

FIELD SHEETS

RUN NUMBER: 5 TRAVERSE: P1 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	40	2.500	81.5	2.500	356.10	36	28	140	140	15.0	103.0
1	2.5	40	2.500	81.5	2.500	358.42	36	32	137	140	15.0	102.6
2	5.0	40	2.700	84.7	2.700	360.74	36	32	137	140	15.0	102.2
2	7.5	40	2.700	84.7	2.700	363.14	36	32	137	140	15.0	102.2
3	10.0	45	2.800	86.6	2.800	365.54	37	32	137	140	15.0	102.9
3	12.5	45	2.900	88.2	2.900	367.99	37	32	137	140	15.0	102.8
4	15.0	45	2.800	86.6	2.800	370.48	38	32	135	140	15.0	102.8
4	17.5	47	2.900	88.4	2.900	372.93	39	33	135	140	15.0	102.7
5	20.0	46	3.000	89.8	3.000	375.42	40	33	132	140	15.0	102.8
5	22.5	45	3.000	89.7	3.000	377.96	40	33	132	140	15.0	102.7
6	25.0	45	3.000	89.7	3.000	380.50	40	33	132	140	15.0	102.7
6	27.5	46	3.000	89.8	3.000	383.04	40	34	131	140	15.0	102.7
7	30.0	45	3.000	89.7	3.000	385.58	40	34	131	140	15.0	102.6
7	32.5	41	3.000	89.3	3.000	388.12	45	38	131	140	15.0	101.3
8	35.0	41	2.900	87.8	2.900	390.66	48	39	130	140	15.0	100.5
8	37.5	41	2.900	87.8	2.900	393.15	49	39	130	140	15.0	100.4

FIELD SHEETS

RUN NUMBER: 5 TRAVERSE: P5 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	44	2.500	81.8	2.500	395.64	53	38	130	140	15.0	100.7
1	2.5	44	2.400	80.1	2.400	397.96	53	38	130	140	15.0	100.1
2	5.0	42	2.400	80.0	2.400	400.22	53	39	130	140	15.0	99.8
2	7.5	43	2.400	80.1	2.400	402.48	53	39	130	140	15.0	99.9
3	10.0	42	2.400	80.0	2.400	404.74	53	39	132	140	15.0	99.8
3	12.5	42	2.400	80.0	2.400	407.00	53	39	132	140	15.0	99.8
4	15.0	42	2.600	83.2	2.600	409.26	53	39	132	140	15.0	100.2
4	17.5	42	2.600	83.2	2.600	411.62	53	39	132	140	15.0	100.2
5	20.0	42	2.500	81.6	2.500	413.98	53	40	132	140	15.0	100.3
5	22.5	41	2.600	83.2	2.600	416.30	53	40	132	140	15.0	100.0
6	25.0	39	2.500	81.4	2.500	418.66	53	40	135	140	15.0	100.0
6	27.5	40	2.600	83.1	2.600	420.98	53	40	135	140	15.0	99.9
7	30.0	40	2.500	81.5	2.500	423.34	53	40	135	140	15.0	100.1
7	32.5	39	2.500	81.4	2.500	425.66	52	42	136	140	15.0	99.9
8	35.0	37	2.700	84.4	2.700	427.98	52	42	136	140	15.0	99.3
8	37.5	38	2.700	84.5	2.700	430.38	52	42	137	140	15.0	99.4

FIELD SHEETS

RUN NUMBER: 5 TRAVERSE: P6 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	37	2.300	77.9	2.300	432.78	50	39	135	140	14.0	99.9
1	2.5	36	2.300	77.8	2.300	435.00	50	39	135	140	14.0	99.8
2	5.0	38	2.100	74.5	2.100	437.22	50	39	135	140	14.0	99.9
2	7.5	37	2.100	74.4	2.100	439.34	52	40	128	140	14.0	99.5
3	10.0	39	2.200	76.3	2.200	441.46	52	40	128	140	14.0	100.2
3	12.5	38	2.100	74.5	2.100	443.64	53	41	128	140	14.0	99.4
4	15.0	39	2.200	76.3	2.200	445.76	53	41	128	140	14.0	100.0
4	17.5	40	2.000	72.9	2.000	447.94	53	41	128	140	14.0	99.1
5	20.0	37	2.200	76.2	2.200	450.00	53	41	131	140	14.0	99.8
5	22.5	38	2.200	76.3	2.200	452.18	53	41	131	140	14.0	99.9
6	25.0	38	2.200	76.3	2.200	454.36	54	43	135	140	14.0	99.6
6	27.5	38	2.200	76.3	2.200	456.54	54	43	135	140	14.0	99.6
7	30.0	37	2.100	74.4	2.100	458.72	55	43	135	140	14.0	98.9
7	32.5	38	2.100	74.5	2.100	460.84	55	43	135	140	14.0	99.0
8	35.0	38	1.800	69.0	1.800	462.96	55	43	135	140	14.0	99.3
8	37.5	36	1.800	68.8	1.800	464.93	55	43	135	140	14.0	99.1

FIELD SHEETS

RUN NUMBER: 5 TRAVERSE: P2 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	35	2.900	87.3	2.900	466.90	50	42	135	140	15.0	99.4
1	2.5	33	2.900	87.1	2.900	469.39	50	42	135	140	15.0	99.2
2	5.0	34	2.800	85.7	2.800	471.88	51	43	135	140	15.0	99.3
2	7.5	35	2.700	84.2	2.700	474.33	51	43	135	140	15.0	99.1
3	10.0	37	2.900	87.5	2.900	476.73	51	43	135	140	15.0	99.4
3	12.5	38	2.700	84.5	2.700	479.22	52	44	134	140	15.0	99.2
4	15.0	38	2.900	87.6	2.900	481.62	52	44	134	140	15.0	99.3
4	17.5	40	2.900	87.7	2.900	484.11	52	44	134	140	15.0	99.5
5	20.0	40	2.900	87.7	2.900	486.60	52	44	134	140	15.0	99.5
5	22.5	41	2.900	87.8	2.900	489.09	52	44	134	140	15.0	99.6
6	25.0	42	2.900	87.9	2.900	491.58	52	44	134	140	15.0	99.7
6	27.5	42	2.700	84.8	2.700	494.07	52	44	134	140	15.0	99.6
7	30.0	39	2.700	84.6	2.700	496.47	52	44	134	140	15.0	99.3
7	32.5	42	2.800	86.4	2.800	498.87	48	41	126	140	15.0	100.6
8	35.0	42	2.900	87.9	2.900	501.32	44	41	136	140	15.0	100.8
8	37.5	44	2.900	88.1	2.900	503.81	48	42	127	140	15.0	100.5

FIELD SHEETS

RUN NUMBER: 5 TRAVERSE: P3 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	44	2.800	86.6	2.800	506.30	52	42	127	140	15.0	100.3
1	2.5	45	2.800	86.6	2.800	508.75	52	42	127	140	15.0	100.4
2	5.0	46	2.600	83.6	2.600	511.20	54	43	128	140	15.0	100.1
2	7.5	46	2.400	80.3	2.400	513.56	54	43	132	140	15.0	99.7
3	10.0	45	2.400	80.2	2.400	515.82	55	43	132	140	15.0	99.5
3	12.5	45	2.600	83.5	2.600	518.08	55	43	132	140	15.0	99.9
4	15.0	44	2.800	86.6	2.800	520.44	54	44	135	140	15.0	99.9
4	17.5	44	2.900	88.1	2.900	522.89	54	44	135	140	15.0	99.7
5	20.0	46	2.900	88.3	2.900	525.38	54	44	135	140	15.0	99.9
5	22.5	47	2.900	88.4	2.900	527.87	54	44	135	140	15.0	100.0
6	25.0	46	2.800	86.7	2.800	530.36	53	44	135	140	15.0	100.2
6	27.5	45	2.600	83.5	2.600	532.81	53	44	135	140	15.0	100.0
7	30.0	45	2.400	80.2	2.400	535.17	53	44	135	140	15.0	99.6
7	32.5	45	2.400	80.2	2.400	537.43	53	44	135	140	15.0	99.6
8	35.0	46	2.400	80.3	2.400	539.69	53	44	135	140	15.0	99.7
8	37.5	47	2.400	80.4	2.400	541.95	53	44	135	140	15.0	99.8

FIELD SHEETS

RUN NUMBER: 5 TRAVERSE: P4 DATE: DEC 9 1976

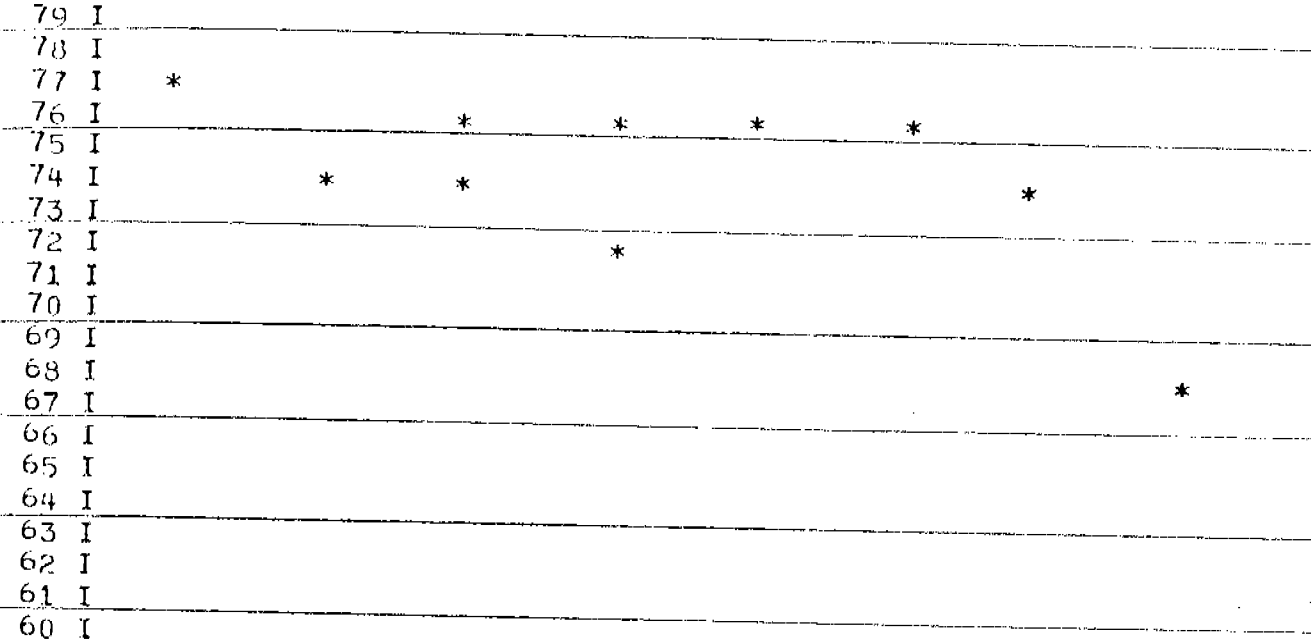
POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	TEMP BOX	TEMP PROBE	VAC	% ISO
1	.0	44	1.600	65.4	1.600	544.21	50	42	125	140	13.0	100.0
1	2.5	44	1.600	65.4	1.600	546.06	50	42	125	140	13.0	100.0
2	5.0	42	1.400	61.1	1.400	547.91	50	42	125	140	13.0	99.8
2	7.5	43	1.800	69.3	1.800	549.64	50	42	125	140	13.0	100.4
3	10.0	43	2.300	78.4	2.300	551.61	50	42	126	140	14.0	100.2
3	12.5	43	2.300	78.4	2.300	553.83	50	42	128	140	14.0	100.2
4	15.0	44	2.300	78.5	2.300	556.05	50	42	128	140	14.0	100.3
4	17.5	44	2.300	78.5	2.300	558.27	52	43	132	140	14.0	100.0
5	20.0	44	2.400	80.1	2.400	560.49	53	43	132	140	14.0	99.6
5	22.5	44	2.400	80.1	2.400	562.75	53	43	132	140	14.0	99.6
6	25.0	44	2.400	80.1	2.400	565.01	53	43	134	140	14.0	99.6
6	27.5	44	2.000	73.2	2.000	567.27	53	43	134	140	14.0	99.3
7	30.0	44	1.500	63.4	1.500	569.33	53	43	134	140	14.0	99.6
7	32.5	44	1.500	63.4	1.500	571.12	53	43	135	140	14.0	99.6
8	35.0	44	1.500	63.4	1.500	572.91	53	43	133	140	14.0	99.6
8	37.5	44	1.500	63.4	1.500	574.70	53	43	133	140	14.0	99.6
	40					576.49						

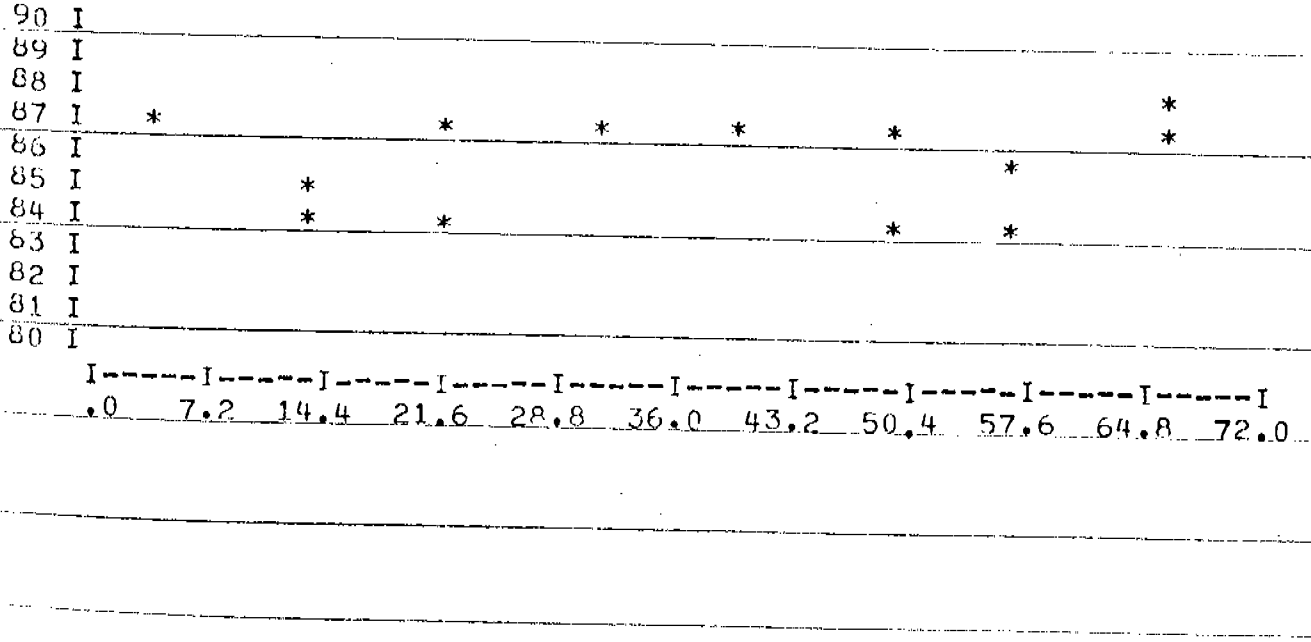
STEEL MFG. BREECHING 3, RUN NUMBER: 5 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)

```
90 I
89 I                                    *       *       *
88 I                    *       *
87 I                                                            *
86 I                    *       *
85 I
84 I            *
83 I
82 I
81 I    *
80 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0    7.2   14.4  21.6  28.8  36.0  43.2  50.4  57.6  64.8  72.0
```

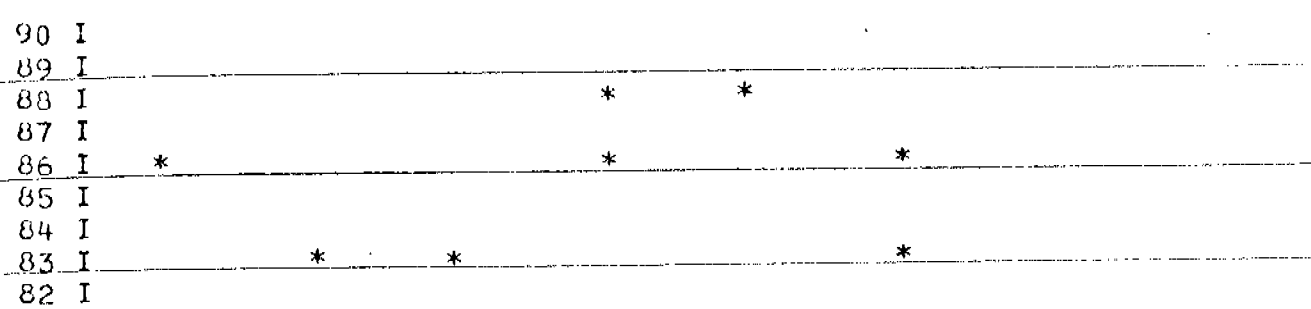
```
90 I
89 I
88 I
87 I
86 I
85 I
84 I                                                            *
83 I                            *       *       *
82 I
81 I    *                               *       *       *
80 I    *       *
79 I            *       *
78 I
77 I
76 I
75 I
74 I
73 I
72 I
71 I
70 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0    7.2   14.4  21.6  28.8  36.0  43.2  50.4  57.6  64.8  72.0
```

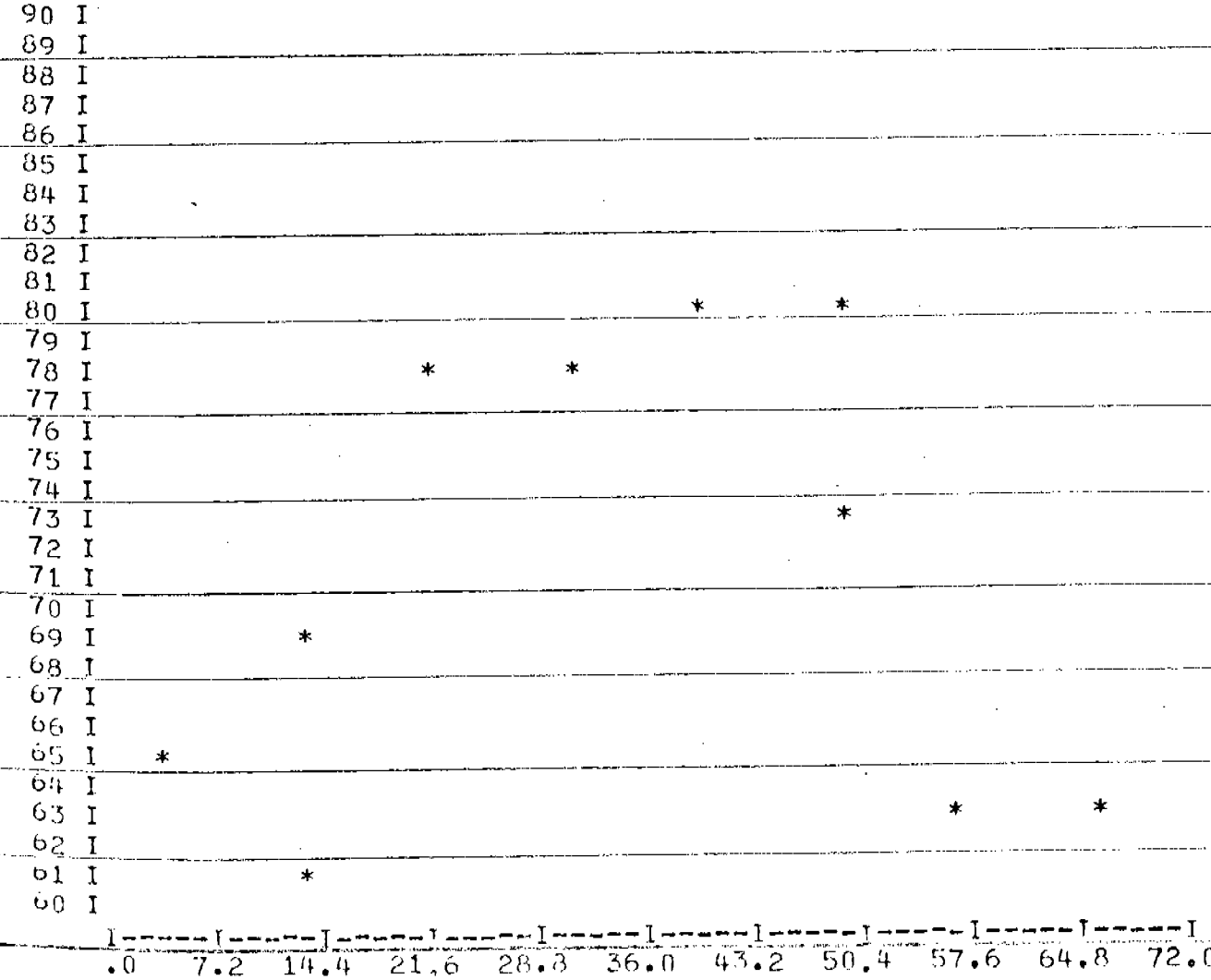
STEEL MFG, BREECHING 3, RUN NUMBER: 5 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)





STEEL MFG, BREECHING 3, RUN NUMBER: 5 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)





PARTICULATE EMISSION REPORT BY ENVIROCON LTD.

DATE OF SURVEY: DEC 9 1976

CLIENT: DOFASCO
BURLINGTON AVE
HAMILTON ONT

PLANT TYPE: STEEL MFG
BREECHING 3

REF: TE2612

RUN NUMBER: 6

STACK EMISSIONS

STACK HEIGHT,FEET		80.0
STACK WIDTH AND BREADTH,FEET	6.00	6.00
AVERAGE TEMPERATURE OF FLUE GAS, DEG.F.		55.6
BAROMETRIC PRESSURE, IN.HG.ABS.		29.90
AVERAGE FLUE STATIC PRESSURE, IN.H20		-3.800
AVERAGE VELOCITY PRESSURE, IN.H20		1.994
PITOT COEFFICIENT		.806
% CO2(ORSAT)		.00
% O2(ORSAT)		20.80
% CO(ORSAT)		.00

FIELD DATA(CONT.)

PARTICULATE EMISSIONS

NUMBER OF SAMPLING POINTS	48.
TOTAL SAMPLING TIME, MINS.	240.00
NOZZLE DIAMETER, INS.	.1875
TOTAL VOLUME MEASURED AT METER CONDITIONS, CF	203.93
AVERAGE SAMPLING RATE, CF/MIN.	.8497
AVERAGE METER TEMPERATURE, DEG.F.	48.22
NET VOLUME IN IMPINGER 1, MLS.	5.0
NET VOLUME IN IMPINGER 2, MLS	10.0
NET VOLUME IN IMPINGER 3, MLS.	7.0
MOISTURE IN SILICA GEL, GMS.	20.0000
VOLUME OF CONDENSATE COLLECTED, MLS.	42.00
FILTER PARTICULATE, GMS.	.3521
WASHINGS PARTICULATE, GMS.	.2221
WEIGHT OF PARTICULATE COLLECTED,GMS.	.5742

PLANT OPERATION

PRODUCTION RATE, LBS./HOUR	N/A
LIQUID FUEL CONSUMPTION, IMP.GAL./HOUR	N/A
GASEOUS FUEL CONSUMPTION, CU.FT./HOUR	N/A

SUMMARY OF RESULTS

STACK EMISSIONS

AVERAGE FLUE GAS COMPOSITION

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	.0	.0
CO	.0	.0
O2	20.6	20.8
N2	78.5	79.2
H2O	.9	
MOL.WT.	28.74	28.84

AVG. VELOCITY OF GAS AT STACK CONDITIONS, FPM.	4542.1
VOLUME OF GAS AT STACK CONDITIONS, CFM.	163515.3
VOLUME OF GAS AT 70 DEG.F. AND 29.92 IN.HG., CFM	166405.5
VOLUME OF GAS AT STD. COND.(DRY)	164871.3
PERCENT EXCESS AIR	N/A

PARTICULATE EMISSIONS

CONCENTRATION:

GRAINS/SCF(DRY)	.0414
GRAINS/SCF(DRY) ADJUSTED TO 12% CO2	.0000
GRAINS/ACF	.0418
LBS/HOUR	58.57
LBS/TON OF PRODUCT	N/A
LBS/1000 IMP.GAL.LIQUID FUEL	N/A
LBS/10A6 FT. GASEOUS FUEL	N/A
LBS/1000 LBS.EFFLUENT	.07893
LBS/1000 LBS.EFFLUENT @ 50% EXCESS AIR	.0526
LBS/1000 LBS.EFFLUENT(DRY)	.0794

FIELD SHEETS

RUN NUMBER: 6 TRAVERSE: PS DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	50	3.200	95.4	3.200	646.26	30	30	140	140	15.0	102.9
1	2.5	78	3.200	97.9	3.200	648.90	31	29	137	140	15.0	105.7
2	5.0	78	3.200	97.9	3.200	651.54	31	28	137	140	15.0	105.8
2	7.5	50	3.000	92.3	3.000	654.18	33	25	134	140	15.0	103.2
3	10.0	45	3.000	91.9	3.000	656.74	35	25	134	140	15.0	102.5
3	12.5	45	3.000	91.9	3.000	659.30	35	25	134	140	15.0	102.5
4	15.0	45	3.000	91.9	3.000	661.86	37	26	135	140	15.0	102.2
4	17.5	45	2.800	88.8	2.800	664.42	37	26	135	140	14.0	102.0
5	20.0	42	2.700	86.9	2.700	666.89	40	27	135	140	14.0	101.4
5	22.5	43	2.800	88.6	2.800	669.32	41	28	136	140	15.0	101.2
6	25.0	48	2.700	87.4	2.700	671.79	42	29	136	140	14.0	101.6
6	27.5	43	2.700	87.0	2.700	674.22	42	29	136	140	14.0	101.1
7	30.0	43	2.700	87.0	2.700	676.65	42	29	133	140	14.0	101.1
7	32.5	43	2.700	87.0	2.700	679.08	42	29	132	140	14.0	101.1
8	35.0	65	2.700	88.9	2.700	681.51	42	29	132	140	14.0	103.3
8	37.5	55	2.600	86.4	2.600	683.94	42	29	132	140	14.0	102.1

FIELD SHEETS

RUN NUMBER: 6 TRAVERSE: P6 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	55	2.000	75.8	2.100	686.32	50	34	128	140	9.0	100.3
1	2.5	48	2.100	77.1	2.200	688.40	48	34	127	140	9.0	100.3
2	5.0	65	2.500	85.5	2.600	690.54	48	34	128	140	9.0	102.2
2	7.5	48	2.500	84.1	2.600	692.88	48	34	128	140	9.0	100.6
3	10.0	45	2.000	75.0	2.600	695.22	48	34	128	140	9.0	99.7
3	12.5	45	2.000	75.0	2.100	697.30	48	34	128	140	9.0	99.5
4	15.0	45	1.900	73.1	2.100	699.38	50	36	128	140	9.0	99.3
4	17.5	45	1.900	73.1	2.100	701.41	50	36	128	140	9.0	99.3
5	20.0	55	2.500	84.7	2.500	703.44	38	33	138	140	12.0	102.4
5	22.5	45	2.600	85.5	2.600	705.78	38	34	138	140	12.0	101.0
6	25.0	45	2.900	90.3	2.900	708.16	39	34	138	140	12.0	101.2
6	27.5	44	2.900	90.2	2.900	710.68	40	34	134	140	12.0	101.0
7	30.0	68	3.200	97.0	3.200	713.20	41	34	132	140	12.0	103.1
7	32.5	68	3.200	97.0	3.200	715.84	42	35	132	140	12.0	102.9
8	35.0	45	2.800	88.8	2.800	718.48	42	35	132	140	12.0	100.6
8	37.5	48	2.800	89.0	2.800	720.95	42	35	132	140	12.0	102.9

FIELD SHEETS

RUN NUMBER: 6 TRAVERSE: P1 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	TEMP BOX	TEMP PROBE	VAC	% ISO
1	.0	70	1.500	66.6	1.500	723.47	59	39	126	140	8.0	100.7
1	2.5	68	1.500	66.4	1.500	725.28	59	39	126	140	8.0	100.5
2	5.0	47	1.600	67.2	1.600	727.09	60	41	126	140	8.0	98.3
2	7.5	46	1.600	67.2	1.600	728.96	60	42	131	140	8.0	99.1
3	10.0	46	1.700	69.2	1.700	730.85	61	41	133	140	8.0	98.2
3	12.5	46	1.700	69.2	1.700	732.78	61	41	133	140	8.0	98.2
4	15.0	72	1.500	66.7	1.500	734.71	61	41	133	140	8.0	100.5
4	17.5	52	1.500	65.4	1.500	736.52	62	42	135	140	8.0	98.4
5	20.0	48	1.400	62.9	1.400	738.33	62	42	135	140	8.0	98.1
5	22.5	77	1.400	64.7	1.400	740.08	62	42	130	140	8.0	100.8
6	25.0	48	1.300	60.7	1.300	741.83	62	42	130	140	8.0	97.7
6	27.5	48	1.300	60.7	1.300	743.51	62	42	130	140	7.5	97.7
7	30.0	75	1.500	66.9	1.500	745.19	62	42	130	140	7.5	100.6
7	32.5	75	1.400	64.6	1.400	747.00	62	42	128	140	7.5	100.6
8	35.0	45	1.500	65.0	1.500	748.75	62	42	128	140	7.5	102.6
8	37.5	44	1.400	62.7	1.400	750.65	62	42	128	140	7.5	102.7

FIELD SHEETS

RUN NUMBER: 6 TRAVERSE: P2 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	68	1.600	68.6	1.600	752.49	65	45	126	140	8.0	99.4
1	2.5	50	1.700	69.5	1.700	754.36	65	47	126	140	8.0	102.2
2	5.0	53	1.800	71.7	1.800	756.38	65	47	126	140	8.0	103.1
2	7.5	50	1.800	71.5	1.800	758.47	65	47	126	140	8.0	102.8
3	10.0	47	1.800	71.3	1.800	760.56	65	47	126	140	8.0	102.5
3	12.5	48	1.400	62.9	1.400	762.65	55	47	126	140	8.0	103.3
4	15.0	45	1.400	62.8	1.400	764.49	57	48	130	140	7.5	102.7
4	17.5	78	1.400	64.8	1.400	766.33	57	48	130	140	7.5	100.8
5	20.0	50	1.400	63.1	1.400	768.08	57	48	130	140	7.5	103.2
5	22.5	50	1.300	60.8	1.300	769.92	60	50	129	140	7.5	101.9
6	25.0	78	1.400	64.8	1.400	771.68	60	50	129	140	7.5	100.3
6	27.5	54	1.400	63.3	1.400	773.43	60	50	129	140	7.5	103.1
7	30.0	50	1.500	65.3	1.500	775.27	60	50	129	140	7.5	102.5
7	32.5	49	1.500	65.2	1.500	777.17	63	51	128	140	7.5	102.0
8	35.0	78	1.600	69.3	1.600	779.07	64	51	128	140	7.5	99.8
8	37.5	55	1.600	67.8	1.600	780.94	64	51	128	140	7.5	99.8

FIELD SHEETS

RUN NUMBER: 6 TRAVERSE: P3 DATE: DEC 9 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	50	1.300	60.8	1.300	782.85	63	50	126	140	7.5	101.6
1	2.5	50	1.300	60.8	1.300	784.61	63	50	126	140	7.5	101.6
2	5.0	70	1.700	70.8	1.700	786.37	63	50	132	140	7.5	99.4
2	7.5	50	1.800	71.5	1.800	788.30	58	52	132	140	7.5	103.0
3	10.0	49	1.800	71.4	1.800	790.39	58	52	133	140	7.5	102.9
3	12.5	48	1.800	71.4	1.800	792.48	60	51	133	140	7.5	102.7
4	15.0	48	1.500	65.2	1.500	794.57	60	51	133	140	7.5	102.2
4	17.5	75	1.500	66.9	1.500	796.47	60	51	133	140	7.5	99.9
5	20.0	55	1.600	67.8	1.600	798.28	62	52	129	140	7.5	99.9
5	22.5	50	1.500	65.3	1.500	800.19	62	52	129	140	7.5	102.1
6	25.0	78	1.600	69.3	1.600	802.09	64	52	129	140	7.5	99.8
6	27.5	78	1.600	69.3	1.600	803.96	64	52	129	140	7.5	99.8
7	30.0	52	1.700	69.6	1.700	805.83	64	53	126	140	7.5	101.9
7	32.5	51	1.700	69.6	1.700	807.85	64	53	126	140	7.5	101.8
8	35.0	50	1.700	69.5	1.700	809.87	64	53	126	140	7.5	101.7
8	37.5	78	1.700	71.4	1.700	811.89	64	53	126	140	7.5	99.8

FIELD SHEETS

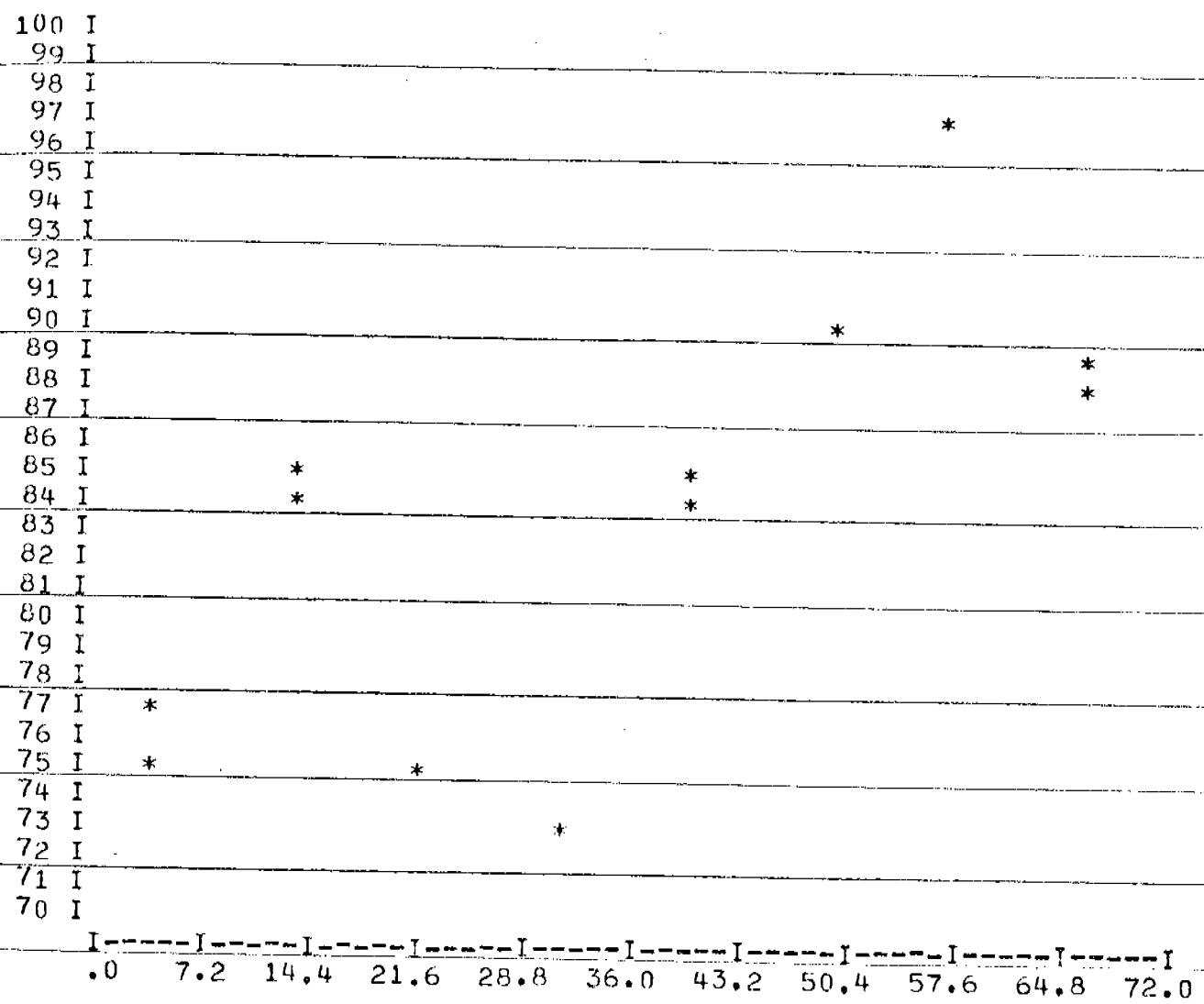
RUN NUMBER: 6 TRAVERSE: P4 DATE: DEC 9 1976

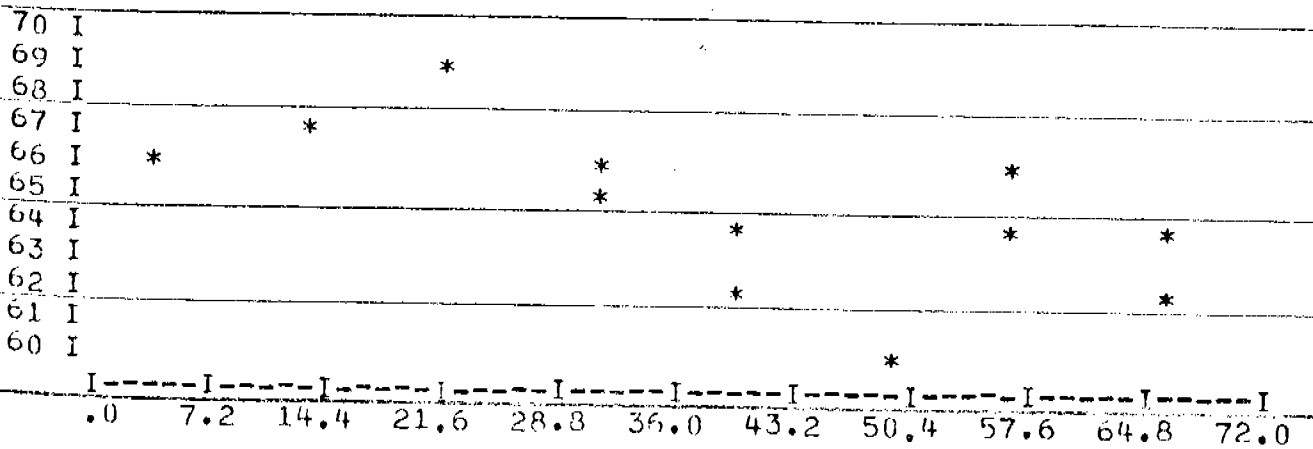
POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	51	2.500	84.4	2.500	813.82	56	48	133	140	8.0	103.3
1	2.5	50	2.500	84.3	2.500	816.27	56	48	133	140	8.0	103.2
2	5.0	85	2.700	90.5	2.700	818.72	57	49	133	140	8.5	106.7
2	7.5	57	2.500	84.9	2.500	821.27	58	49	134	140	8.5	103.6
3	10.0	52	2.400	82.7	2.400	823.72	58	49	133	140	9.0	103.1
3	12.5	75	2.300	82.8	2.300	826.12	59	49	133	140	9.0	100.8
4	15.0	55	2.100	77.6	2.100	828.37	59	50	130	140	8.5	103.3
4	17.5	56	1.900	73.9	1.900	830.62	59	50	130	140	8.5	102.9
5	20.0	55	2.000	75.8	2.000	832.75	59	50	130	140	9.0	102.6
5	22.5	74	2.000	77.1	2.000	834.93	59	50	130	140	9.0	99.6
6	25.0	71	2.100	78.8	2.100	837.01	59	50	130	140	9.5	99.8
6	27.5	55	2.000	75.8	2.000	839.15	59	51	130	140	9.5	102.5
7	30.0	56	2.100	77.7	2.100	841.33	59	51	130	140	9.5	103.3
7	32.5	56	2.100	77.7	2.100	843.58	59	51	130	140	9.5	103.3
8	35.0	57	2.000	75.9	2.000	845.83	59	51	130	140	9.5	102.7
8	37.5	57	2.000	75.9	2.000	848.01	59	51	130	140	9.5	102.7
	8					850.19						

STEEL MFG, BREECHING 3, RUN NUMBER: 6 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)

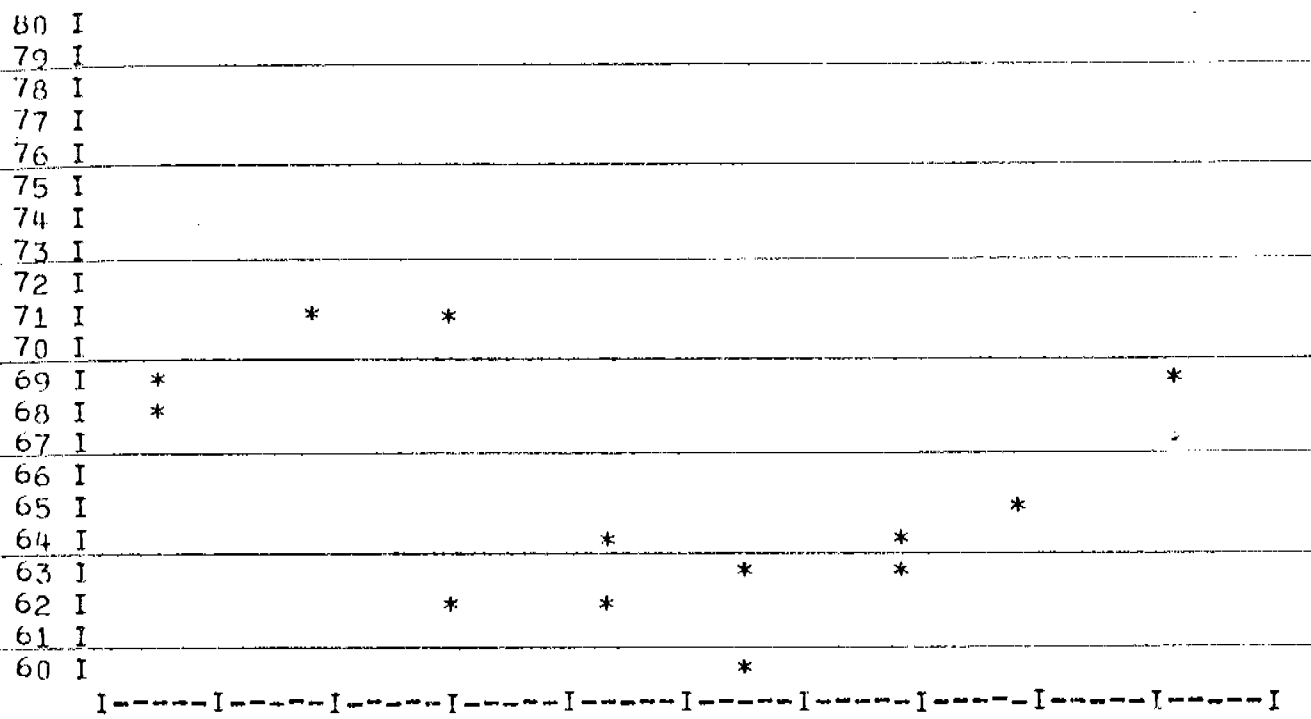
```
100 I
 99 I
 98 I
 97 I    *         *
 96 I
 95 I    *
 94 I
 93 I
 92 I              *
 91 I                        *         *
 90 I
 89 I
 88 I                                  *         *                        *
 87 I                                                  *
 86 I                                            *         *       *        *
 85 I
 84 I
 83 I
 82 I
 81 I
 80 I
     I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
     .0    7.2   14.4  21.6  28.8  36.0  43.2  50.4  57.6  64.8  72.0
```

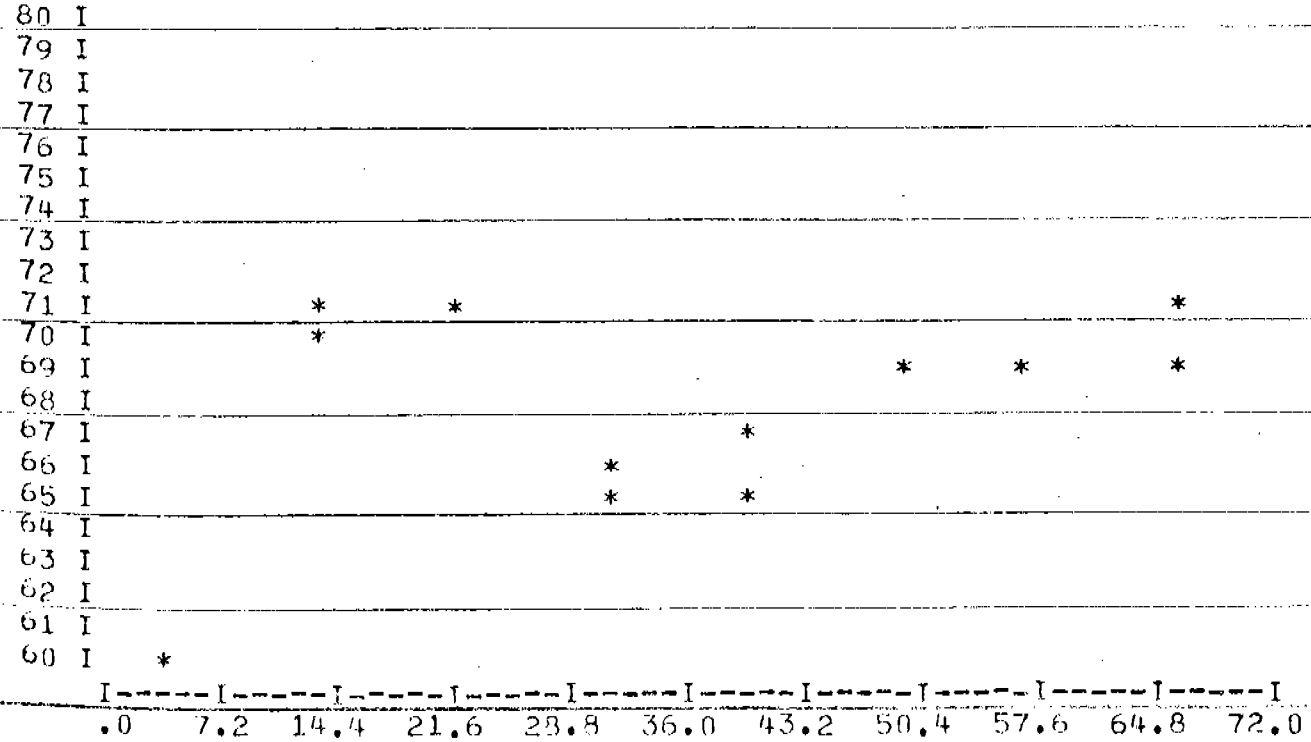
STEEL MFG, BREECHING 3, RUN NUMBER: 6 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



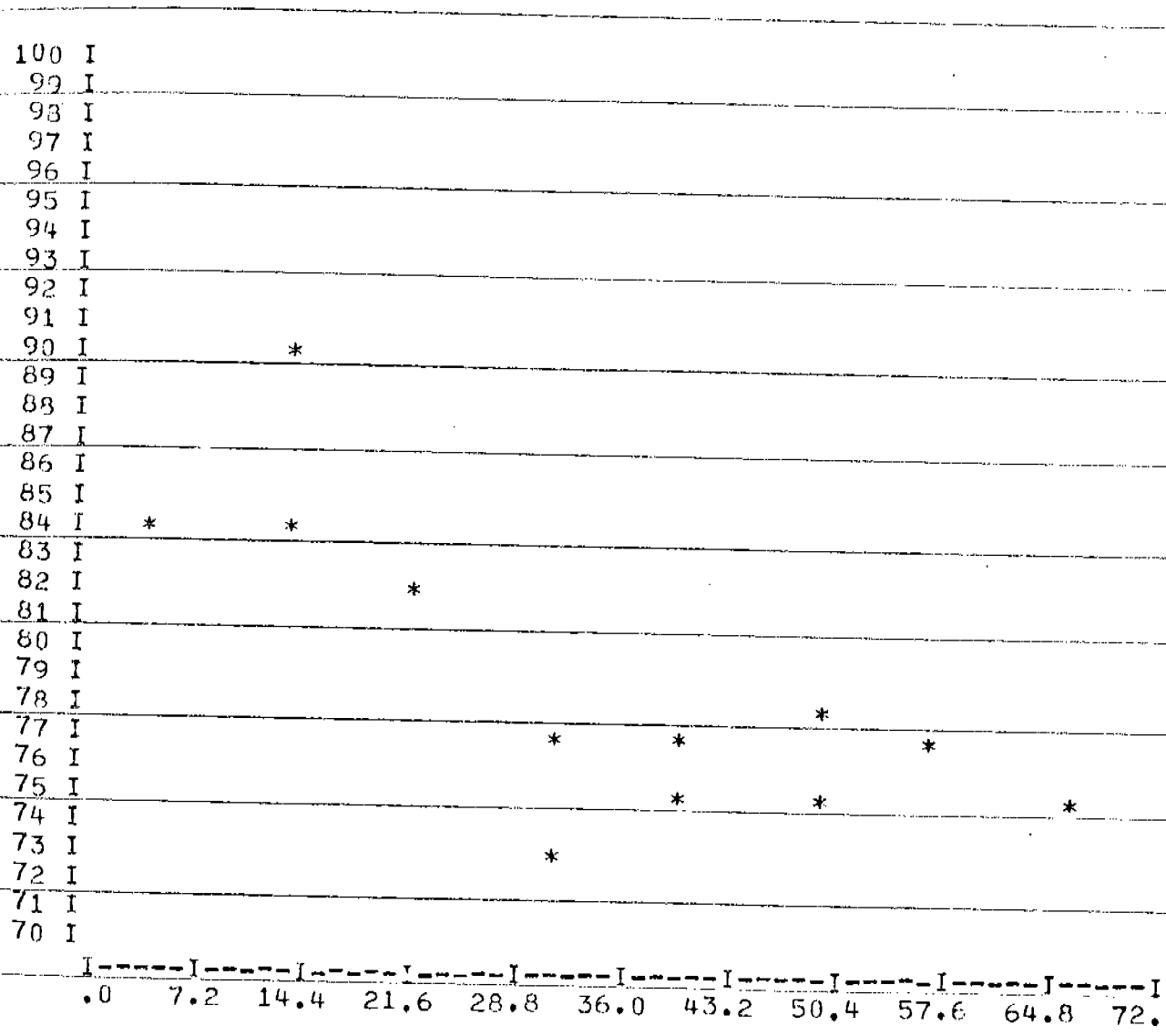


STEEL MFG, BREECHING 3, RUN NUMBER: 6 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)





STEEL MFG, BREECHING 3, RUN NUMBER: 6 X AXIS = DISTANCE (IN)
Y AXIS = VELOCITY (FPS)



PARTICULATE EMISSION REPORT BY ENVIROCON LTD.

DATE OF SURVEY: DEC 13 1976

CLIENT: DOFASCO
BURLINGTON AVE
HAMILTON ONT

PLANT TYPE: STEEL MANUFACTURING REF: TE2612
PRECIPITATOR EXHAUST STACK

RUN NUMBER: 7

STACK EMISSIONS

STACK HEIGHT, FEET	150.0
STACK DIAMETER, FEET	12.50
AVERAGE TEMPERATURE OF FLUE GAS, DEG.F.	40.7
BAROMETRIC PRESSURE, IN.HG.ABS.	29.90
AVERAGE FLUE STATIC PRESSURE, IN.H20	-.350
AVERAGE VELOCITY PRESSURE, IN.H20	.442
PITOT COEFFICIENT	.808
% CO2(ORSAT)	.00
% O2(ORSAT)	20.80
% CO(ORSAT)	.00

FIELD DATA(CONT.)

PARTICULATE EMISSIONS

NUMBER OF SAMPLING POINTS	48.
TOTAL SAMPLING TIME, MINS.	288.00
NOZZLE DIAMETER, INS.	.2500
TOTAL VOLUME MEASURED AT METER CONDITIONS, CF	209.22
AVERAGE SAMPLING RATE, CF/MIN.	.7265
AVERAGE METER TEMPERATURE, DEG.F.	64.76
NET VOLUME IN IMPINGER 1, MLS.	14.2
NET VOLUME IN IMPINGER 2, MLS	10.0
NET VOLUME IN IMPINGER 3, MLS.	.0
MOISTURE IN SILICA GEL, GMS.	16.0000
VOLUME OF CONDENSATE COLLECTED, MLS.	40.20
FILTER PARTICULATE, GMS.	.0093
WASHINGS PARTICULATE, GMS.	.0074
WEIGHT OF PARTICULATE COLLECTED,GMS.	.0167

PLANT OPERATION

PRODUCTION RATE, LBS./HOUR	N/A
LIQUID FUEL CONSUMPTION, IMP.GAL./HOUR	N/A
GASEOUS FUEL CONSUMPTION, CU.FT./HOUR	N/A

SUMMARY OF RESULTS

STACK EMISSIONS

AVERAGE FLUE GAS COMPOSITION

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	.0	.0
CO	.0	.0
O2	20.6	20.8
N2	78.5	79.2
H2O	.9	
MOL.WT.	28.75	28.84

AVG. VELOCITY OF GAS AT STACK CONDITIONS, FPM.	2104.2
VOLUME OF GAS AT STACK CONDITIONS, CFM.	258226.8
VOLUME OF GAS AT 70 DEG.F. AND 29.92 IN.HG., CFM	272932.4
VOLUME OF GAS AT STD. COND.(DRY)	270508.4
PERCENT EXCESS AIR	N/A

PARTICULATE EMISSIONS

CONCENTRATION:

GRAINS/SCF(DRY)	.0012
GRAINS/SCF(DRY) ADJUSTED TO 12% CO2	.0000
GRAINS/ACF	.0013
LBS/HOUR	2.81
LBS/TON OF PRODUCT	N/A
LBS/1000 IMP.GAL.LIQUID FUEL	N/A
LBS/10^6 FT. GASEOUS FUEL	N/A
LBS/1000 LBS.EFFLUENT	.00231
LBS/1000 LBS.EFFLUENT @ 50% EXCESS AIR	.0015
LBS/1000 LBS.EFFLUENT(DRY)	.0023

FIELD SHEETS

RUN NUMBER: 7 TRAVERSE: N-S DATE: DEC 13 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	45	.350	31.3	1.300	499.70	40	40	130	130	7.5	99.0
1	3.0	45	.350	31.3	1.300	501.56	50	40	130	130	10.0	98.1
2	6.0	45	.350	31.3	1.300	503.42	55	50	130	130	13.0	96.6
2	9.0	45	.350	31.3	1.300	505.28	55	50	130	130	13.0	106.0
3	12.0	45	.450	35.5	2.500	507.32	60	55	130	130	13.0	94.6
3	15.0	45	.400	33.5	2.000	509.40	60	55	130	130	9.0	98.8
4	18.0	45	.400	33.5	2.000	511.45	70	55	130	130	9.0	97.9
4	21.0	45	.400	33.5	2.000	513.50	70	55	130	130	11.0	97.4
5	24.0	45	.400	33.5	2.000	515.54	70	60	130	130	11.0	97.4
5	27.0	45	.400	33.5	2.000	517.59	70	65	130	130	11.0	99.8
6	30.0	45	.420	34.3	2.200	519.70	80	70	130	130	10.5	95.6
6	33.0	45	.420	34.3	2.200	521.80	80	75	130	130	10.0	102.4
7	36.0	45	.440	35.1	2.400	524.06	85	75	140	130	10.0	99.6
7	39.0	40	.430	34.5	2.300	526.32	85	75	140	130	10.5	105.6
8	42.0	40	.420	34.1	2.200	528.70	85	75	140	130	10.5	92.0
8	45.0	40	.420	34.1	2.200	530.75	85	75	150	130	8.0	94.3
9	48.0	40	.400	33.3	2.000	532.85	85	75	140	130	8.0	94.2
9	51.0	40	.400	33.3	2.000	534.90	90	75	150	130	8.0	102.5
10	54.0	40	.420	34.1	2.200	537.14	90	75	140	130	8.0	96.5
10	57.0	40	.420	34.1	2.200	539.30	90	75	130	130	8.5	100.5
11	60.0	40	.420	34.1	2.200	541.55	90	75	140	130	8.5	96.1
11	63.0	40	.420	34.1	2.200	543.70	90	75	140	130	9.0	102.8
12	66.0	40	.430	34.5	2.300	546.00	90	75	140	130	10.0	95.0
12	69.0	40	.430	34.5	2.300	548.15	90	75	145	130	10.5	86.1

FIELD SHEETS

RUN NUMBER: 7 TRAVERSE: W-E DATE: DEC 13 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	40	.350	31.2	1.300	550.10	80	75	140	130	7.0	96.1
1	3.0	40	.350	31.2	1.300	552.05	80	75	145	130	8.5	97.1
2	6.0	40	.350	31.2	1.300	554.02	80	75	145	130	8.0	97.6
2	9.0	40	.350	31.2	1.300	556.00	80	75	145	130	8.0	106.0
3	12.0	40	.400	33.3	1.700	558.15	80	75	150	130	10.0	96.9
3	15.0	40	.400	33.3	1.700	560.25	85	75	145	130	10.0	96.5
4	18.0	40	.380	32.5	1.500	562.35	85	75	135	130	10.0	96.6
4	21.0	40	.380	32.5	1.500	564.40	85	75	135	130	10.0	101.3
5	24.0	40	.400	33.3	1.700	566.55	90	75	130	130	10.0	96.0
5	27.0	40	.400	33.3	1.700	568.65	90	80	135	130	10.0	97.9
6	30.0	40	.400	33.3	1.700	570.80	90	80	130	130	10.5	97.9
6	33.0	40	.400	33.3	1.700	572.95	90	80	135	130	10.5	97.9
7	36.0	40	.400	33.3	1.700	575.10	90	80	135	130	10.5	97.9
7	39.0	40	.400	33.3	1.700	577.25	90	80	140	130	11.0	95.6
8	42.0	40	.380	32.5	1.500	579.35	90	80	145	130	10.0	95.7
8	45.0	40	.380	32.5	1.500	581.40	95	85	140	130	10.0	97.1
9	48.0	40	.400	33.3	1.700	583.50	95	85	145	130	10.0	97.0
9	51.0	40	.400	33.3	1.700	585.65	100	85	145	130	10.0	96.5
10	54.0	40	.400	33.3	1.700	587.80	100	85	145	130	10.0	94.3
10	57.0	40	.400	33.3	1.700	589.90	100	85	145	130	10.0	94.3
11	60.0	40	.400	33.3	1.700	592.00	100	85	140	130	10.0	96.5
11	63.0	40	.400	33.3	1.700	594.15	100	85	140	130	10.0	96.5
12	66.0	40	.400	33.3	1.700	596.30	100	90	135	130	10.5	96.1
12	69.0	40	.400	33.3	1.700	598.45	100	90	135	130	10.5	96.1
						600.60						

LEACK CHECK VOLUME = -25.05

FIELD SHEETS

RUN NUMBER: 7 TRAVERSE: S-N DATE: DEC 13 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	40	.320	29.8	1.600	575.55	36	36	150	130	8.0	96.1
1	3.0	40	.450	35.3	2.500	577.27	46	35	158	130	8.0	98.8
2	6.0	40	.450	35.3	2.500	579.38	50	37	148	130	11.5	96.3
2	9.0	40	.450	35.3	2.500	581.45	53	38	145	130	11.5	97.3
3	12.0	40	.450	35.3	2.500	583.55	53	41	140	130	11.0	94.7
3	15.0	40	.450	35.3	2.500	585.60	56	44	130	130	11.0	98.8
4	18.0	40	.450	35.3	2.500	587.75	57	44	130	130	11.0	98.7
4	21.0	40	.450	35.3	2.500	589.90	55	44	130	130	10.5	101.2
5	24.0	40	.450	35.3	2.500	592.10	53	42	135	130	10.5	101.6
5	27.0	40	.450	35.3	2.500	594.30	54	42	137	130	10.5	101.5
6	30.0	40	.450	35.3	2.500	596.50	55	45	143	130	10.0	100.2
6	33.0	40	.450	35.3	2.500	598.68	56	45	145	130	10.0	95.0
7	36.0	40	.450	35.3	2.500	600.75	56	45	148	130	10.0	97.8
7	39.0	40	.450	35.3	2.500	602.88	56	45	147	130	9.5	95.0
8	42.0	40	.500	37.3	2.700	604.95	58	46	149	130	11.5	97.7
8	45.0	40	.500	37.3	2.700	607.20	59	46	148	130	11.5	97.6
9	48.0	40	.500	37.3	2.700	609.45	55	42	144	130	11.0	98.4
9	51.0	40	.500	37.3	2.700	611.70	54	42	143	130	11.5	98.5
10	54.0	40	.500	37.3	2.700	613.95	54	43	143	130	11.5	98.4
10	57.0	40	.500	37.3	2.700	616.20	53	42	142	130	11.5	98.6
11	60.0	40	.500	37.3	2.700	618.45	54	43	142	130	11.5	98.4
11	63.0	40	.500	37.3	2.700	620.70	54	44	143	130	11.5	100.5
12	66.0	40	.500	37.3	2.700	623.00	58	46	140	130	11.5	95.6
12	69.0	40	.500	37.3	2.700	625.20	55	46	135	130	11.5	99.3

FIELD SHEETS

RUN NUMBER: 7 TRAVERSE: E-W DATE: DEC 13 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER IN	TEMP OUT	TEMP BOX	TEMP PROBE	VAC	% ISO
1	.0	40	.450	35.3	2.300	627.48	60	53	132	130	11.0	96.1
1	3.0	40	.450	35.3	2.200	629.60	54	48	132	130	11.0	98.5
2	6.0	40	.500	37.3	2.500	631.75	55	48	135	130	11.5	97.8
2	9.0	40	.500	37.3	2.500	634.00	54	49	137	130	11.5	95.6
3	12.0	40	.450	35.3	2.200	636.20	56	48	135	130	11.0	102.9
3	15.0	40	.450	35.3	2.200	638.45	58	51	138	130	11.0	100.1
4	18.0	40	.530	38.4	2.600	640.65	57	50	139	130	12.0	100.9
4	21.0	40	.530	38.4	2.600	643.05	56	48	137	130	12.0	99.1
5	24.0	40	.500	37.3	2.500	645.40	58	50	140	130	12.0	101.6
5	27.0	40	.500	37.3	2.500	647.75	57	49	139	130	12.0	97.5
6	30.0	40	.550	39.1	2.700	650.00	57	50	142	130	12.0	104.5
6	33.0	40	.550	39.1	2.700	652.53	58	51	142	130	12.0	101.8
7	36.0	40	.550	39.1	2.700	655.00	58	51	142	130	12.0	100.6
7	39.0	40	.550	39.1	2.700	657.44	58	51	140	130	12.0	99.3
8	42.0	40	.500	37.3	2.500	659.85	58	50	143	130	11.5	97.3
8	45.0	40	.500	37.3	2.500	662.10	55	49	143	130	11.5	102.0
9	48.0	40	.530	38.4	2.600	664.45	57	50	144	130	11.5	98.8
9	51.0	40	.530	38.4	2.600	666.80	60	57	145	130	11.5	100.0
10	54.0	40	.550	39.1	2.700	669.20	64	60	150	130	12.0	99.5
10	57.0	40	.550	39.1	2.700	671.65	62	60	150	130	12.0	97.7
11	60.0	40	.550	39.1	2.700	674.05	60	54	150	130	12.0	100.5
11	63.0	40	.550	39.1	2.700	676.50	61	58	148	130	12.0	100.0
12	66.0	40	.550	39.1	2.700	678.95	60	57	143	130	12.0	100.2
12	69.0	40	.550	39.1	2.700	681.40	57	49	144	130	12.0	102.1
	72					683.87						

STEEL MANUFACTURING, PRECIPITATOR EXHAUST STACK, RUN NUMBER:
X AXIS = DISTANCE (IN)

Y AXIS = VELOCITY (FPS)

```
40 I
39 I
38 I
37 I
36 I
35 I    *      *
34 I        * * *    *  *   *
33 I    ** *       *
32 I
31 I**
30 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

```
40 I
39 I
38 I
37 I
36 I
35 I
34 I
33 I    *  ** *   *  *  *   *
32 I     *      *
31 I**
30 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

STEEL MANUFACTURING, PRECIPITATOR EXHAUST STACK, RUN NUMBER:
X AXIS = DISTANCE (IN)

Y AXIS = VELOCITY (FPS)

```
40 I
39 I
38 I
37 I            * *  *  *   *
36 I
35 I** ** ** *
34 I
33 I
32 I
31 I
30 I
29 I*
28 I
27 I
26 I
25 I
24 I
23 I
22 I
21 I
20 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

```
40 I
39 I        * *       *  *   *
38 I    *         *
37 I *    *    *
36 I
35 I*  *
34 I
33 I
32 I
31 I
30 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

PARTICULATE EMISSION REPORT BY ENVIROCON LTD.

DATE OF SURVEY: DEC 15 1976

CLIENT: DOFASCO
BURLINGTON AVE
HAMILTON ONT

PLANT TYPE: STEEL MANUFACTURING
PRECIP EXHAUST STACK

REF: TE2612

RUN NUMBER: 8

STACK EMISSIONS

STACK HEIGHT, FEET	150.0
STACK DIAMETER, FEET	12.50
AVERAGE TEMPERATURE OF FLUE GAS, DEG.F.	49.8
BAROMETRIC PRESSURE, IN.HG.ABS.	30.02
AVERAGE FLUE STATIC PRESSURE, IN.H20	-.250
AVERAGE VELOCITY PRESSURE, IN.H20	.588
PITOT COEFFICIENT	.808
% CO2(ORSAT)	.00
% O2(ORSAT)	20.80
% CO(ORSAT)	.00

FIELD DATA(CONT.)

PARTICULATE EMISSIONS

NUMBER OF SAMPLING POINTS	48.
TOTAL SAMPLING TIME, MINS.	288.00
NOZZLE DIAMETER, INS.	.2500
TOTAL VOLUME MEASURED AT METER CONDITIONS, CF	240.81
AVERAGE SAMPLING RATE, CF/MIN.	.8361
AVERAGE METER TEMPERATURE, DEG.F.	57.41
NET VOLUME IN IMPINGER 1, MLS.	20.0
NET VOLUME IN IMPINGER 2, MLS	20.0
NET VOLUME IN IMPINGER 3, MLS.	.0
MOISTURE IN SILICA GEL, GMS.	24.0000
VOLUME OF CONDENSATE COLLECTED, MLS.	64.00
FILTER PARTICULATE, GMS.	.0146
WASHINGS PARTICULATE, GMS.	.0375
WEIGHT OF PARTICULATE COLLECTED, GMS.	.0521

PLANT OPERATION

PRODUCTION RATE, LBS./HOUR	N/A
LIQUID FUEL CONSUMPTION, IMP.GAL./HOUR	N/A
GASEOUS FUEL CONSUMPTION, CU.FT./HOUR	N/A

SUMMARY OF RESULTS

STACK EMISSIONS

AVERAGE FLUE GAS COMPOSITION

CONSTITUENT	WET BASIS MOLE PERCENT	DRY BASIS MOLE PERCENT
CO2	.0	.0
CO	.0	.0
O2	20.6	20.8
N2	78.2	79.2
H2O	1.2	
MOL.WT.	28.71	28.84

AVG. VELOCITY OF GAS AT STACK CONDITIONS, FPM.	2443.7
VOLUME OF GAS AT STACK CONDITIONS, CFM.	299884.6
VOLUME OF GAS AT 70 DEG.F. AND 29.92 IN.HG., CFM	312622.6
VOLUME OF GAS AT STD. COND.(DRY)	308865.5
PERCENT EXCESS AIR	N/A

PARTICULATE EMISSIONS

CONCENTRATION:

GRAINS/SCF(DRY)	.0032
GRAINS/SCF(DRY) ADJUSTED TO 12% CO2	.0000
GRAINS/ACF	.0033
LBS/HOUR	8.54
LBS/TON OF PRODUCT	N/A
LBS/1000 IMP.GAL.LIQUID FUEL	N/A
LBS/10Δ6 FT. GASEOUS FUEL	N/A
LBS/1000 LBS.EFFLUENT	.00613
LBS/1000 LBS.EFFLUENT @ 50% EXCESS AIR	.0041
LBS/1000 LBS.EFFLUENT(DRY)	.0062

FIELD SHEETS

RUN NUMBER: 8 TRAVERSE: E-W DATE: DEC 15 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	PROBE	VAC	% ISO
1	.0	40	.650	42.4	2.500	685.86	70	60	130	130	5.0	98.3
1	3.0	40	.650	42.4	2.500	688.50	73	60	128	130	6.0	98.6
2	6.0	40	.650	42.4	2.500	691.15	74	62	128	130	6.0	96.4
2	9.0	40	.650	42.4	2.500	693.75	75	63	128	130	6.0	96.2
3	12.0	40	.750	45.6	3.000	696.35	70	56	130	130	7.0	89.0
3	15.0	45	.750	45.8	3.000	698.90	65	52	129	130	7.0	100.8
4	18.0	50	.800	47.5	3.500	701.75	65	54	130	130	7.5	101.5
4	21.0	50	.800	47.5	3.500	704.70	67	55	135	130	7.5	102.9
5	23.0	50	.800	47.5	3.500	707.70	65	55	135	130	7.5	101.4
5	27.0	45	.800	47.3	3.500	710.65	69	59	134	130	7.5	98.4
6	30.0	45	.850	48.7	3.500	713.55	69	59	138	130	7.5	113.6
6	33.0	45	.800	47.3	3.500	717.00	68	57	143	130	7.5	98.7
7	36.0	45	.750	45.8	3.000	719.90	66	56	142	130	7.5	98.6
7	39.0	45	.750	45.8	3.000	722.70	64	55	138	130	7.5	98.9
8	42.0	45	.800	47.3	3.500	725.50	66	55	135	130	7.5	100.8
8	45.0	45	.800	47.3	3.500	728.45	66	55	137	130	7.5	100.8
9	48.0	45	.800	47.3	3.500	731.40	64	55	134	130	7.5	99.3
9	51.0	45	.800	47.3	3.500	734.30	64	55	136	130	7.5	99.3
10	54.0	45	.750	45.8	3.000	737.20	66	56	140	130	7.5	98.6
10	57.0	45	.750	45.8	3.000	740.00	66	54	146	130	7.5	104.1
11	60.0	45	.750	45.8	3.000	742.95	63	53	136	130	7.5	100.9
11	63.0	45	.750	45.8	3.000	745.80	64	54	140	130	7.5	99.0
12	66.0	45	.750	45.8	3.000	748.60	63	54	138	130	7.5	100.8
12	69.0	45	.750	45.8	3.000	751.45	64	54	136	130	7.5	100.7
						754.30						

LEACK CHECK VOLUME = .125

FIELD SHEETS

RUN NUMBER: 8 TRAVERSE: N-S DATE: DEC 15 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	TEMP BOX	TEMP PROBE	VAC	% ISO
1	.0	45	.550	39.2	2.500	754.43	65	50	143	130	7.0	94.1
1	3.0	45	.500	37.4	2.200	756.70	65	50	146	130	8.0	99.7
2	6.0	45	.500	37.4	2.200	759.00	67	51	146	130	8.0	99.4
2	9.0	45	.500	37.4	2.200	761.30	67	52	148	130	8.0	100.6
3	12.0	50	.500	37.6	2.200	763.63	65	51	148	130	8.5	100.9
3	15.0	50	.500	37.6	2.200	765.95	69	57	145	130	9.0	103.4
4	18.0	50	.500	37.6	2.200	768.35	65	55	145	130	9.0	101.8
4	21.0	50	.500	37.6	2.200	770.70	63	51	140	130	9.0	102.4
5	24.0	50	.520	38.3	2.300	773.05	67	55	135	130	8.5	99.7
5	27.0	50	.500	37.6	2.200	775.40	63	50	135	130	8.5	102.5
6	30.0	50	.500	37.6	2.200	777.75	63	51	135	130	8.0	102.4
6	33.0	50	.500	37.6	2.200	780.10	62	50	135	130	7.5	102.6
7	36.0	50	.600	41.1	2.400	782.45	62	49	135	130	8.5	97.8
7	39.0	50	.600	41.1	2.400	784.90	62	51	135	130	8.5	97.6
8	42.0	50	.500	37.6	2.200	787.35	64	52	135	130	8.0	102.2
8	45.0	55	.500	37.7	2.200	789.70	60	49	135	130	8.0	103.4
9	48.0	55	.550	39.6	2.400	792.05	61	49	135	130	7.0	100.7
9	51.0	55	.550	39.6	2.400	794.45	61	49	135	130	7.0	100.7
10	54.0	55	.550	39.6	2.400	796.85	61	49	135	130	7.0	98.6
10	57.0	55	.500	37.7	2.000	799.20	61	49	135	130	7.5	103.3
11	60.0	55	.500	37.7	2.400	801.55	63	52	135	130	8.5	102.9
11	63.0	55	.500	37.7	2.000	803.90	62	50	135	130	8.0	100.9
12	66.0	55	.500	37.7	2.000	806.20	62	50	135	130	8.0	100.9
12	69.0	55	.500	37.7	2.000	808.50	65	52	135	130	8.0	97.8

FIELD SHEETS

RUN NUMBER: 8 TRAVERSE: W-E DATE: DEC 15 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	55	.500	37.7	2.000	810.74	55	48	140	130	7.5	100.0
1	3.0	55	.500	37.7	2.000	813.00	54	48	140	130	8.5	104.1
2	6.0	55	.450	35.8	1.800	815.35	58	49	140	130	8.0	102.2
2	9.0	55	.450	35.8	1.800	817.55	58	50	140	130	7.5	102.1
3	12.0	55	.500	37.7	2.000	819.75	57	49	140	130	7.5	103.7
3	15.0	55	.500	37.7	2.000	822.10	61	52	140	130	7.5	103.0
4	18.0	55	.500	37.7	2.000	824.45	62	52	140	130	7.5	102.9
4	21.0	55	.500	37.7	2.000	826.80	67	56	140	130	7.5	93.3
5	24.0	55	.550	39.6	2.400	828.95	64	55	140	130	7.5	99.8
5	27.0	55	.550	39.6	2.400	831.35	64	53	140	130	7.5	102.1
6	30.0	55	.500	37.7	2.000	833.80	60	51	140	130	7.5	103.2
6	33.0	50	.500	37.6	2.000	836.15	65	54	140	130	7.0	97.5
7	36.0	50	.550	39.4	2.400	838.40	63	52	140	130	7.0	101.8
7	39.0	50	.550	39.4	2.400	840.85	62	51	140	130	7.5	97.8
8	42.0	50	.550	39.4	2.400	843.20	60	50	140	130	7.0	98.1
8	45.0	50	.550	39.4	2.400	845.55	60	50	140	130	7.5	98.1
9	48.0	50	.500	37.6	2.000	847.90	59	50	140	130	7.5	100.7
9	51.0	50	.550	39.4	2.400	850.20	61	51	140	130	7.5	102.1
10	54.0	50	.550	39.4	2.400	852.65	59	49	140	130	7.5	102.5
10	57.0	50	.550	39.4	2.400	855.10	60	50	140	130	7.5	102.3
11	60.0	50	.550	39.4	2.400	857.55	60	51	140	130	7.5	102.2
11	63.0	50	.550	39.4	2.400	860.00	61	50	140	130	7.5	102.2
12	66.0	55	.550	39.6	2.400	862.45	62	52	140	130	7.5	102.4
12	69.0	55	.550	39.6	2.400	864.90	62	52	140	130	7.5	106.1

FIELD SHEETS

RUN NUMBER: 8 TRAVERSE: S-N DATE: DEC 15 1976

POINT NO	TIME	STACK TEMP	VELOCITY HEAD	VELOCITY FPS	ORFICE PRESS	METER VOL	METER TEMP IN	METER TEMP OUT	BOX	TEMP PROBE	VAC	% ISO
1	.0	55	.500	37.7	2.000	867.44	67	52	140	130	7.5	98.5
1	3.0	55	.500	37.7	2.000	869.70	67	52	140	130	7.5	102.4
2	6.0	55	.550	39.6	2.200	872.05	67	53	140	130	8.0	101.7
2	9.0	55	.550	39.6	2.200	874.50	66	52	140	130	8.0	99.8
3	12.0	50	.550	39.4	2.200	876.90	55	48	140	130	8.5	98.7
3	15.0	50	.500	37.6	2.000	879.25	57	47	140	130	8.0	99.0
4	18.0	50	.550	39.4	2.200	881.50	57	48	140	130	8.5	102.7
4	21.0	50	.550	39.4	2.200	883.95	58	48	140	130	8.5	102.6
5	24.0	50	.500	37.6	2.000	886.40	59	49	140	130	8.5	98.6
5	27.0	50	.550	39.4	2.200	888.65	59	49	140	130	9.0	102.4
6	30.0	50	.550	39.4	2.200	891.10	58	48	140	130	9.0	102.6
6	33.0	50	.600	41.1	2.400	893.55	60	49	140	130	9.5	101.2
7	36.0	50	.600	41.1	2.400	896.08	60	50	140	130	9.5	102.7
7	39.0	50	.600	41.1	2.400	898.65	60	49	140	130	9.5	102.0
8	42.0	50	.600	41.1	2.400	901.20	60	49	140	130	9.5	103.2
8	45.0	50	.600	41.1	2.400	903.78	61	50	140	130	9.5	102.6
9	48.0	50	.600	41.1	2.400	906.35	60	49	140	130	9.5	102.0
9	51.0	50	.600	41.1	2.400	908.90	60	49	140	130	9.5	102.0
10	54.0	50	.600	41.1	2.400	911.45	60	49	140	130	9.5	98.0
10	57.0	50	.600	41.1	2.400	913.90	60	48	140	130	9.0	102.1
11	60.0	50	.600	41.1	2.400	916.45	60	49	140	130	9.0	104.0
11	63.0	50	.600	41.1	2.400	919.05	60	49	140	130	9.0	102.0
12	66.0	50	.630	42.2	2.500	921.60	61	50	140	130	9.5	101.3
12	69.0	50	.630	42.2	2.500	924.20	62	51	140	130	9.5	101.1
	72					926.80						

STEEL MANUFACTURING, PRECIP EXHAUST STACK, RUN NUMBER: 8 X AXIS = DISTANCE (
Y AXIS = VELOCITY (FPS)

```
50 I
49 I
48 I        *
47 I     * **   * *
46 I
45 I   *     *      *  *   *
44 I
43 I
42 I**
41 I
40 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

```
50 I
49 I
48 I
47 I
46 I
45 I
44 I
43 I
42 I
41 I          *
40 I
39 I*              *  *
38 I       *
37 I** ** **   *    *  *   *
36 I
35 I
34 I
33 I
32 I
31 I
30 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

STEEL MANUFACTURING, PRECIP EXHAUST STACK, RUN NUMBER: 8 X AXIS = DISTANCE (
Y AXIS = VELOCITY (FPS)

```
40 I
39 I       *  * * *  *  *   *
38 I
37 I*  **  *     *
36 I
35 I *
34 I
33 I
32 I
31 I
30 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

```
50 I
49 I
48 I
47 I
46 I
45 I
44 I
43 I
42 I                        *
41 I        * * * *  *  *
40 I
39 I * ** **
38 I
37 I*  *  *
36 I
35 I
34 I
33 I
32 I
31 I
30 I
    I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I
    .0  15.0  30.0  45.0  60.0  75.0  90.0 105.0 120.0 135.0 150.0
```

APPENDIX 2

DETAILED ANALYTICAL PRECEDURES
AND RESULTS

ONTARIO RESEARCH FOUNDATION
SHERIDAN PARK RESEARCH COMMUNITY
MISSISSAUGA, ONTARIO, CANADA L5K 1B3 • (416) 822 4111 • TELEX 06-982311

Technology Development & Appraisal Section
Air Resources Branch
880 Bay Street
Toronto, Ontario

March 4, 1977

Attn: Mr. D. Mozzon

REPORT NUMBER ACS1-7784

IDENTIFICATION P.O. #A 47149

SPECIFICATIONS OF ORDER Analysis Stack and Process Samples for Polycyclic Aromatic Hydrocarbons (PAH's).

The samples for polycyclic aromatic hydrocarbon (PAH) analysis were collected by Envirocon Limited during the month of December 1976 at Dofasco. The samples were delivered to ORF in two batches, one on December 10th (14 stack samples) and the other on December 24th (42 stack samples + 30 process samples).

For each particulate sampling run, seven (7) separate samples were collected. The seven samples consisted of the following:

1. Probe rinse (acetone).
2. Probe rinse (benzene).
3. Kimwipe that has been pushed through probe.
4. Filter.
5. Rinse from connector tube between filter and Tenax trap (acetone).
6. Rinse as in #5 (benzene).
7. Tenax trap.

Filters and Kimwipes used in the sampling had been pre-extracted with benzene, tared and numbered by ORF personnel.

At a meeting held at Resources Road Laboratories on Wednesday,

THIS REPORT RELATES ONLY TO THE PARTICULAR INSTRUMENT, MATERIAL, OR OTHER SUBJECT REFERRED TO IN IT. NO REPRESENTATION IS MADE THAT SIMILAR ARTICLES WILL BE OF LIKE QUALITY. WITHOUT THE PRIOR WRITTEN CONSENT OF THE ONTARIO RESEARCH FOUNDATION, NO PUBLICATION IN WHOLE OR IN PART OF THE TEXT OR SUBSTANCE OF THIS REPORT SHALL BE MADE, NOR SHALL THE NAME OF THE ONTARIO RESEARCH FOUNDATION BE USED IN ANY WAY IN CONNECTION WITH THE SALE, OFFERING OR ADVERTISING OF ANY ARTICLE OR PRODUCT. ANY TESTING, INSPECTION OR INVESTIGATION OF THE INSTRUMENTS, MATERIALS OR OTHER SUBJECTS PERFORMED BY ONTARIO RESEARCH FOUNDATION WILL BE CONDUCTED IN ACCORDANCE WITH THE BEST TECHNICAL STANDARDS BY THE ONTARIO RESEARCH FOUNDATION BUT NEITHER IT NOR ITS EMPLOYEES SHALL BE RESPONSIBLE FOR ANY LOSS OR DAMAGE RESULTING DIRECTLY OR INDIRECTLY FROM ANY DEFAULT, ERROR OR OMISSION.

December 15th 1976 two decisions were made regarding the collected samples. They were:

(i) Acetone and benzene rinses for the appropriate portions of the sampling train were to be combined prior to analysis.

(ii) Filtering of probe rinse samples would only be performed if sufficient insoluble matter was present in the samples.

This reduced the number of samples per run to five (5). The number was further reduced when the used Kimwipes after conditioning were found to weigh less than the original unused Kimwipe. This was probably a result of tearing and consequent loss of material during the forcing of the Kimwipe through the probe cylinder body. No further attempt was made to process the Kimwipe samples.

The Tenax tubes were extracted by Ministry of Environment (MOE) personnel at Resources Road Laboratories. The tubes were delivered to MOE and the extracts picked up by ORF personnel.

EXPERIMENTAL

A. PARTICULATE TRAIN SAMPLES

The appropriate acetone and benzene rinses were combined, concentrated to dryness and the residues weighed. The filter was conditioned and then weighed to obtain the weight of particulate material collected by the filter. The filter was then extracted with cyclohexane (150 ml) using a Soxhlet apparatus. The extract was concentrated to dryness to obtain the weight of organic extractable residue present on the particulate material collected by the filter. This organic extractable residue was combined with the probe rinse sample for PAH analysis. The respective weights obtained for the various samples are recorded in Table I.

Table I

Results from Particulate Train Samples

Run No.	Weight of Particulate on Filter(mg)	Dry wt. of Cyclohexane Extract from Particulate (A) (mg)	Dry wt. of Combined Acetone Benzene Probe Rinse (B) (mg)	Dry wt. of (A + B) ** (mg)	Dry wt. of TENAX Ext. *** (mg)	Dry wt. of Combined Acetone Benzene Rinse between filter/TENAX**** (mg)
1	22.0	8.0	24.3	32.3	26.2	26.1
2	13.9	8.3	12.7	21.0	5.8	21.7
3	146.7*	8.6	19.5	28.1	19.6	6.5
4	? †	? †	7.4	7.4	9.1	22.3
5	14.1	8.9	34.6	43.5	17.5	29.4
6	352.1*	26.8	15.1	41.9	14.3	20.5
7	9.3	5.3	7.4	12.7	17.8	30.2
8	14.6	11.6	37.5	49.1	22.7	14.7

* Additional insoluble particulate residue was obtained after filtering probe rinses Run No. 3 → 94 mg, Run No. 6 → 207 mg, which are to be added to respective weights above, to obtain total insoluble particulate.

** To be used for dry weight of SA samples in Table III

*** " " " SB " "

**** " " " SC " "

† No value obtained.

B. PROCESS SAMPLES

Four types of process samples were collected. They are listed below together with the legend used for identification purposes.

1. Coal
2. Coke
3. Fallout (Guide cars #1, 2 and 3)
   (a) FG1
   (b) FG2
   (c) FG3
4. Liquid
   (a) precipitator inlet - PP1
   (b) Precipitator outlet - PPO
   (c) Precipitator slurry - PPS

Representative weighed amounts of the solid samples (#1, 2 and 3) were Soxhlet extracted with cyclohexane.

The liquid samples were filtered to give filtrate and residue fractions. A weight was obtained for the residue prior to Soxhlet extraction with cyclohexane. The filtrate volume was measured prior to liquid/liquid extraction with cyclohexane. The Soxhlet extract and liquid/liquid extract for a given sample were combined prior to PAH analyses.

Process samples that were analysed for PAH content are listed in Table II.

Table II

PROCESS SAMPLES ANALYSED

SAMPLE #	DATE	TIME	SAMPLE TYPE	WEIGHT (g)	VOLUME LIQUID (ml)	RESIDUE WITH LIQUID (mg)
50	Nov.30		FG1,2	6.21		
51	Nov.30		FG 3	2.18		
52	Dec.1		Coke	11.38		
54	Dec.1		PPO		275	169
56	Dec.1		PP1		375	122
57	Dec.1		FG1,2	2.87		
58	Dec.1		FG3	1.56		
60	Dec.1	6.30pm	Coal	10.63		
62	Dec.1	6.30pm	PP1		350	112
63	Dec.1		PPO		350	123
64	Dec.9		PPS		250	74
65	Dec.9	1.45pm	PP1		275	95
66	Dec.9	1.45pm	PPO		270	100
67	Dec.9	4.30pm	PP1		350	117
68	Dec.9	4.30pm	PPO		350	122
69	Dec.9	4.30pm	PPS		285	97
70	Dec.9	11.00am	Coal	10.33		
71	Dec.9	11.00am	Coke	10.44		
72	Dec.9		FG1,2	10.41		
73	Dec.9		FG3	7.93		
80	Dec.15		PPO		420	584
81	Dec.15		FG3	10.7		
82	Dec.15		PP1		365	246
83	Dec.15		Coal	11.17		
88	Dec.7		PPO		365	531
90	Dec.7		PP1		350	131

C. PAH ANALYSES

Analysis of PAH's in the extracted sample was performed using a liquid chromatography (LC) fluorescence technique. The LC determination is according to Appendix 3 of the work program prepared by MOE. The PAH compounds requested for analysis are as follows: B(a)A, chrysene, B(k)F, B(e)P, perylene, B(a)P and dibenz(ah)A.

Our earlier work with PAH's using a Vydac C_{18} reverse phase column (LC Model Spectra Physics 3500B) and fluorescence detector (Schoffel) gave good separation of the seven PAH's in a standard mixture with detectability at sub-picogram levels. However, studies with Dofasco samples showed large interference from strongly fluorescent impurities. A clean-up procedure was therefore required to remove the impurities prior to PAH analysis. To date, "clean-up" methodology using florisil with various degrees of deactivation were found unsatisfactory for removal of the interfering impurities. Also, poor recovery of certain PAH's [e.g. perylene and B(a)P] in the standard mixture was encountered.

New methodology has been developed for the separation and quantitation of PAH's in the environmental samples analysed. The method uses a Zorbax ODS (C_{18} reverse phase) column and gives good separation of B(a)A, B(k)F, B(e)P, B(a)P and dibenz(ah)A from each other, but fails to resolve chrysene from B(a)A and perylene from B(e)P. However, by judicious selection of fluorescence (excitation and emission) wavelengths, a high degree of detector specificity is obtained, making it possible to detect and quantitate both chrysene and B(a)A and both perylene and B(e)P when present in a mixture. An important feature of the method is that it does not necessitate any "clean-up" of the sample prior to injection into the LC. This is achieved by maintaining LC conditions that permit the highly fluorescent interfering impurities to be eluted within the first 10-15 minutes (in a 60 minute chromatographic run) before the appearance of PAH's of interest. The methodology (funded by the Ministry of Industry and Tourism, Province of Ontario) is now being written up for publication.

The particulate and process samples from Dofasco were analysed by this procedure. A solution of the seven PAH's at concentration of 3-5 picograms (each) per microlitre [B(e)P 30 pg/µl] was used as a standard reference and 10 µl was used as the injection volume. The sample peaks were identified by retention time and spiking, and the peak height method was used for calibration and calculation. The results are shown in Tables III and IV. Of the seven PAH's requested for analysis, only three PAH's, e.g. B(a)A, B(k)F and B(a)P were found to be present in the samples as major polycyclic aromatic hydrocarbons. Chrysene, perylene and B(e)P were not detected even in trace amounts in any of the samples at dilutions necessary for quantitation of the three major PAH's. Dibenz(ah)A was observed in trace amounts in some of the samples. Accurate quantitation would require LC analysis of a more concentrated aliquot.

G.H.S. Thomas
Principal Research Scientist

B.S. Das
Research Scientist

Department of Applied Chemistry

BSD:GHST:J

Table III

Analysis of PAH's in Samples from Particulate Train

(Envirocon Samples)

Run #	Sample Type	Total Cyclohexane Extract/Rinse (ml)	PAH's present in Total Extract/Rinse (μg)		
			B(a)A	B(k)F	B(a)P
1	SA*	50	2.95	3.73	4.82
2	"	"	1.52	1.68	4.47
3	"	"	33.09	28.55	55.86
4	"	"	2.33	2.19	2.08
5	"	"	141.15	126.54	270.77
6	"	"	171.08	118.44	248.28
7	"	"	10.18	8.94	11.78
8	"	"	5.34	4.86	5.27
1	Tenax SB**	5.5 ml MOE → 50 ml	1.78	0.75	x
2	"	20 " " → "	3.34	1.30	1.61
3	"	25 " " → "	2.94	0.45	0.15
4	"	5.0 " " → "	0.36	x	x
5	"	5.0 " " → "	22.18	3.54	0.89
6	"	19.5 " " → "	x	x	x
7	"	6.0 " " → "	x	x	x
8	"	4.5 " " → "	x	x	x
1	SC***	50	0.27	0.30	0.27
2	"	"	2.28	2.47	4.73
3	"	"	0.39	0.39	0.56
4	"	"	0.19	0.16	0.09
5	"	"	13.87	6.60	8.56
6	"	"	0.70	0.52	0.81
7	"	"	1.89	1.94	2.12
8	"	"	1.07	1.03	0.91

* SA samples are mixture of filter particulate extract and combined acetone and benzene probe rinses. See Table I for dry weight of SA samples.

** TENAX SB samples are Tenax extracts received from Ministry of Environment (MOE). See Table I for dry weight of SB samples.

*** SC samples are combined acetone and benzene rinses between filter/Tenax. See Table I for dry weight of SC samples.

x Not detectable

Table IV

ACS1-7784

Analysis of PAH's in Process Samples

Sample Number	Sample Type *	Total Cyclohexane Extract (ml)	PAH's present in Total Extract (μg)		
			(B(a)A	B(k)F	B(a)P
60	Coal	50	1.25	1.10	3.13
70	"	"	34.36	40.44	108.60
83	"	"	1.22	1.09	3.10
52	Coke	"	x	x	x
71	"	"	0.0018	0.0004	0.0004
50	FG1,2	"	0.12	0.13	0.19
37	"	"	0.34	0.32	0.53
72	"	"	0.77	0.63	0.95
51	FG3	"	0.05	0.02	0.03
58	"	"	0.08	0.03	0.04
73	"	"	0.57	0.33	0.50
81	"	"	0.69	0.44	0.68
56	PPI	"	2.67	21.52	42.22
62	"	"	3.12	14.59	26.99
65	"	"	11.04	14.19	25.51
67	"	"	31.20	26.0	46.09
82	"	"	13.52	48.07	87.80
90	"	"	36.07	30.58	55.56
54	PPO	"	12.75	30.51	57.41
63	"	"	8.25	19.16	35.81
66	"	"	3.18	11.58	22.38
68	"	"	33.12	42.74	82.39
80	"	"	59.85	82.27	161.82
88	"	"	114.18	91.30	192.69
64	PPS	"	11.58	12.65	22.58
69	"	"	17.82	16.71	30.50

* For identification of sample type, refer to Table II.

x Not detectable

APPENDIX 3

PITOT CALIBRATION DATA

023.72.14

NOZZLE CALIBRATION (DR. CURRIE U of T)

Date of Calibration: November 25 and 26, 1976

In the following tables, the symbols listed below have been used.

ΔH = pressure differential as indicated by nozzle (cm water)

Δh = pressure differential as indicated by standard pitot tube whose coefficient is unity (cm water)

Press = static pressure in wind tunnel relative to atmospheric value (cm water)

Temp = temperature of air in wind tunnel (°F)

$K = \Delta h/\Delta H$ so that $V = \sqrt{2gK\Delta H}$

$C = \sqrt{K}$ so that $V = C\sqrt{2g\Delta H}$

V = velocity being measured when ΔH is converted to units of ft or m of fluid flowing (ft/sec or m/sec)

(1) 7' Probe (new) with 1/4" Nozzle (plain shank) (EXHAUST STACK)

Barometric Pressure: 29.640 inches mercury

ΔH	Δh	Press	Temp	K	C
0.229	0.150	-0.159	79.5	0.655	0.809
0.415	0.266	-0.284	80.0	0.641	0.801
0.670	0.432	-0.460	80.5	0.645	0.803
1.055	0.689	-0.734	80.5	0.653	0.808
1.495	0.985	-1.050	81.0	0.659	0.812
2.100	1.385	-1.472	81.5	0.660	0.812
2.275	1.510	-1.614	82.0	0.664	0.815

(2) 7' Probe (new) with 3/8" Nozzle (plain shank)

Barometric Pressure: 29.640 inches mercury

ΔH	Δh	Press	Temp	K	C
0.223	0.141	-0.152	79.5	0.632	0.795
0.420	0.264	-0.280	81.0	0.629	0.793
0.732	0.458	-0.486	82.0	0.626	0.791
1.090	0.683	-0.730	82.0	0.627	0.792
1.525	0.980	-1.045	82.0	0.643	0.802
2.130	1.365	-1.450	82.5	0.641	0.801
2.340	1.505	-1.6[illegible]0	82.5	0.643	0.802

(3) 10' Probe (new) with 1/4" Nozzle (plain shank) (LEAKAGE RUNS)

Barometric Pressure: 29.640 inches mercury

ΔH	Δh	Press	Temp	K	C
0.224	0.137	-0.156	82.0	0.612	0.782
0.404	0.250	-0.277	82.5	0.619	0.787
0.716	0.444	-0.486	83.0	0.620	0.787
1.065	0.658	-0.729	83.0	0.618	0.786
1.515	0.940	-1.037	83.0	0.620	0.788
2.128	1.320	-1.460	83.0	0.620	0.788
2.320	1.440	-1.590	83.0	0.621	0.789

(4) 10' Probe (new) with 3/8" Nozzl (plain shank)

Barometric Pressure: 29.640 inches mercury

ΔH	Δh	Press	Temp	K	C
0.234	0.138	-0.156	82.0	0.590	0.768
0.420	0.246	-0.276	82.0	0.586	0.765
0.746	0.449	-0.491	82.5	0.602	0.776
1.103	0.656	-0.733	82.5	0.595	0.771
1.570	0.946	-1.040	82.5	0.603	0.776
2.130	1.285	-1.424	83.0	0.603	0.777
2.390	1.440	-1.588	83.0	0.603	0.776

(5) 10' Probe (old) with 5/32" Nozzle (enlarged shank) (PUSH RUN)

Barometric Pressure: 29.410 inches mercury

ΔH	Δh	Press	Temp	K	C
0.220	0.143	-0.152	80.0	0.650	0.806
0.411	0.263	-0.278	81.0	0.640	0.800
0.695	0.445	-0.466	82.0	0.640	0.800
1.060	0.687	-0.720	82.5	0.648	0.805
1.490	0.982	-1.028	82.5	0.659	0.812
2.045	1.352	-1.420	83.0	0.661	0.813
2.270	1.494	-1.568	83.0	0.658	0.811

(6) 10' Probe (old) with 7/32" Nozzle (enlarged shank)

Barometric Pressure: 29.410 inches mercury

ΔH	Δh	Press	Temp	K	C
0.232	0.146	-0.154	80.0	0.629	0.793
0.410	0.259	-0.274	80.5	0.632	0.795
0.705	0.446	-0.470	82.0	0.633	0.795
1.055	0.688	-0.718	82.0	0.652	0.808
1.484	0.974	-1.016	82.0	0.656	0.810
2.000	1.348	-1.410	82.5	0.674	0.821
2.245	1.510	-1.580	82.5	0.673	0.820

.801

(7) 10' Probe (old) with 7/16" Nozzle (enlarged shank)

Barometric Pressure: 29.410 inches mercury

ΔH	Δh	Press	Temp	K	C
0.230	0.141	-0.150	79.0	0.613	0.783
0.428	0.261	-0.274	81.0	0.610	0.781
0.706	0.434	-0.486	81.5	0.615	0.784
1.095	0.680	-0.713	82.0	0.621	0.788
1.532	0.968	-1.018	82.0	0.632	0.795
2.110	1.340	-1.410	82.5	0.635	0.797
2.330	1.495	-1.572	82.5	0.642	0.801

.710

APPENDIX 4

COKE OVEN OPERATING DATA

AVERAGE FLUE TEMPERATURES FOR SOUTH BATTERIES

DATE	AVERAGE FLUE TEMPERATURES (°C)			
	BATTERY 1	BATTERY 2	BATTERY 3	AVERAGE
Dec. 1/76	1286	1281	1263	1277
Dec. 9/76	1272	1276	1252	1267
Dec. 14/76	1265	1267	1256	1263
Dec. 15/76	1272	1275	1258	1269

AVERAGE COKING TIMES FOR SOUTH BATTERIES

DATE	AVERAGE COKING TIME (HRS) BATTERIES 1 & 2	BATTERY 2	AVERAGE
Dec. 1/76	16.0	15.9	16.0
Dec. 2/76	16.6	16.5	16.6
Dec. 9/76	16.2	16.2	16.2
Dec. 10/76	16.2	16.2	16.2
Dec. 13/76	16.2	16.3	16.2
Dec. 14/76	16.1	16.2	16.1
Dec. 15/76	16.4	16.4	16.4
			16.2

AVERAGE COKING TIMES FOR SOUTH BATTERIES

DATE	AVERAGE COKING TIME (HRS) BATTERIES 1 & 2	BATTERY 2	AVERAGE
Dec. 1/76	16.0	15.9	16.0
Dec. 2/76	16.6	16.5	16.6
Dec. 9/76	16.2	16.2	16.2
Dec. 10/76	16.2	16.2	16.2
Dec. 13/76	16.2	16.3	16.2
Dec. 14/76	16.1	16.2	16.1
Dec. 15/76	16.4	16.4	16.4
			16.2

PUSHING AND CHARGING REPORT

1 & 2 BATTERY

DATE Dec. 1/76

8 - 4						4 - 12						12 - 8					
OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
1		815				9		406				1	1200	1227	15	45	180
11		825				29		415				11	1209	1236	15	44	170
21		834				39		425				21	1218	1245	15	44	180
31	800	842	15	07	180	49	404	432	16	40		31	1227	1254	15	45	180
41	810	848	15	10		54	412	440	16	41		41	1236	103	15	45	
51	820	855	15	14		2	455	523	16	37	180	51	245	112	15	50	
61	827	901	15	13		12	505	534	16	35	170	61	254	121	15	53	
						22	512	542	16	36	170	3	145	217	15	53	180
3	925	955	15	45	180	32	519	548	16	36		13	152	224	15	53	170
13	933	1004	15	45	180	42	526	555	16	37		23	200	233	15	53	170
23	946	1012	15	44	170	52	533	603	16	38		33	215	239	15	55	170
33	948	1020	15	45	160	62	540	610	16	37		43	224	251	15	57	
43	955	1027	15	45		4	625	652	16	19	180	53	233	300	15	59	
53	1004	1034	15	47		14	632	655	16	20	160	63	242	310	15	59	
63	1012	1043	15	48		24	639	705	16	21	170	5	402	427	15	52	180
						34	645	712	16	21		15	409	436	15	49	170
5	1125	1210	16	06	170	44	652	720	16	19		25	418	450	15	50	200
15	1133	1220	16	04	200	54	700	728	16	18		35	427	457	15	50	
(25)	1205	1228	16	06	160	64	710	804	16	18		45	436	507	15	52	
(35)	1214	1255	16	06		6	830	854	17	30	170	55	445	515	15	54	
(45)	1225	1244	16	03		16	838	903	17	28	180	65	454	521	15	54	
(55)	1240	1257	16	11		26	845	912	17	30	170	7	548	615	15	45	170
(65)	1248	100	16	12		36	854	921	17	24		17	557	624	15	47	160
						46	903	930	16	57		27	606	633	15	44	170
(7)	143	200	16	22	170	56	912	939	16	54		37	615	642	15	43	180
(17)	150	210	16	20	150	66	921	948	16	38		47	624	651	15	36	
(27)	155	222	16	20	180	8	1024	1049	16	39	170	57	633	700	15	33	
(37)	220	232	16	35	170	18	1032	1055	16	38	170	9	730	758	15	33	150
(47)	230	248	16	37		28	1040	1102	16	37	170	19	736		15	30	160
(57)	240	300	16	40		38	1046	1110	16	31	180	29	742		15	27	190
						48	1052	1120	16	28		39	750		15	25	190
(9)	330	357	16	38	180	58	1100	1130	16	27		49	758		15	26	
19	340		16	39	160												
29	348		16	38	180												
(39)	356		16	39													
49																	
59																	
SHIFT TOTALS	28 / 29						29						32				
OVENS DELAYED (30 MIN.)	7-57 25-65; 9-39					49, 59;											
NO. HARD PUSHES (200 AMP.)																	
TIME TILLAGE EMPTIED												1:30					
OPER.	W. Harlow 6660					B. Hetman 6664						G. Hanson 6129					

3 BATTERY

DATE Dec 1/76

8 - 4						4 - 12						12 -					
OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
71	8.35	9.09	15	15	120	(59)	4.22	4.43	16	42	110	88		1200			
1	8.42	9.17	15	15	130	(70)	4.32	4.51	16	39	100	98		1209			
91	8.50	9.23	15	15	110	(59)	4.37	5.03	16	26	100	108		1218			
101	8.55	9.45	15	16	100	(99)	4.44	5.10	16	27	110						
111	9.08	9.49	15	20	100	(69)	4.52	5.18	16	26	90	71	103	130	15	54	130
13	10.20	10.41	15	40	110	72	5.47	6.19	16	35	110	81	114	140	15	55	130
61	10.39	10.55	15	43	110	82	5.55	6.26	16	35	100	91	121	148	15	53	130
92	10.38	11.10	15	43	100	92	6.02	6.33	16	29	100	101	130	157	15	50	130
102	10.51	11.17	15	48	120	102	6.10	6.40	16	29	100	111	139	206	15	50	130
112	11.01	11.25	15	49	120	112	6.17	6.47	16	27	100						
(73)	12.57	1.09	16	17	100	74	7.20	7.12	15	05	110	73	251	315	16	04	130
(83)	1.05	1.18	16	18	100	84	7.30	7.20	14	40	110	83	300	326	16	05	130
(93)	1.14	1.25	16	19	110	94	7.40	7.28	15	05	120	93	310	140	16	00	130
(103)	1.24	1.40	16	21	110	104	7.44	7.33	15	02	100	103	318		16	01	130
(113)	1.33	1.50	16	21	110	114	7.55	7.45	15	01	110	113	326	412	16	01	130
(63)	2.50	3.10	16	43	110	76	9.42	10.00	15	00	100						
(73)	3.00	3.25	16	46	100	86	9.50	10.06	15	00	110	75	503	532	15	54	130
(83)	3.08	3.33	16	47	100	96	9.59	10.23	15	00	100	85	510	540	15	54	130
(93)	3.13	3.40	16	47	100	106	10.10	10.33	15	03	100	95	521	548	15	53	130
(103)	3.23	3.48	16	48	110	116	10.17	10.40	15	00	120	105	530	557	15	50	130
69						68	11.10	11.40	15	44	130	115	539	606	15	49	130
79						78	11.20	11.50	15	46	140						
						88	11.30		15	41	130	62	642	704	15	32	130
						98	11.40		15	50	130	72	651	723	15	28	130
						108	11.50		15	53	140	82	700	733	15	27	130
												92	710	744	15	30	130
												102	720	755	15	32	
	20						25						20				
SHIFT TOTALS	65																
OVENS DELAYED (30 MIN.)												NO HARD PUSHES					
NO. HARD PUSHES (600 AMP.)												AMPERES NOT WORKING					
TIME DRILLAGE ATTEMPTED																	
OPER.																	

PUSHING AND CHARGING REPORT

182 BATTERY

DATE Dec 2/76

8 - 4						4 - 12						12 - 8					
OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
14		805				8		420				27		1207			
24		814				18		430				37		1216			
34		821				28		437				47		1225			
44		829				(38)	400	445	16	50	180	57		1230			
54	805	835	19	25		48	408	453	16	43	170	9	1233	1216	16	35	180
						58	415	500	16	45	190	19	1242	1225	16	37	180
2	900	933	15	37	180							29	1249	1237	16	35	170
12	907	942	15	32	180	1	500	548	16	33	180	39	1255	1245	16	34	170
22	915	950	15	32	180	11	508	600	16	32	190	49	1303	1253	16	34	180
32	922	1000	15	33	190	21	515	600	16	30	180	59	1310	1259	16	35	190
42	930	1012	15	34		31	523	615	16	29	180	2	1357	226	16	24	150
52	942	1020	15	38		41	530	621	16	27	190	12	206	235	16	24	160
62	950	1040	15	39		51	540	626	16	28	180	22	215	242	16	25	170
						61	547	634	16	26		32	224	300	16	24	180
4	1000	1055	15	08	180							42	233	306	16	21	180
14	1007	1105	15	09	180	3	650	707	16	33	180	52	242	312	16	22	
24	1013	1115	15	08	180	13	657	715	16	33	190	62	251	320	16	11	
34	1020	1125	15	08	180	23	704	722	16	31	180	4	300	327	16	05	180
44	1035	1205	15	15		33	711	730	16	32		14	310	403	16	05	170
54	1050	1215	15	22		43	720	805	16	29		24	320	411	16	05	180
64	1104	1223	15	00		53	726	812	16	26		34	330	418	16	05	
						63	733	822	16	23		44	445	512	16	40	170
6	150	218	16	56	170							54	454	520	16	32	190
16	200	225	16	57	180	5	845	930	16	18	190	64	503	530	16	40	180
26	205	233	16	56	180	15	900	1000	16	24	180	6	557	626	15	39	180
36	215	242	16	54		25	908	1010	16	18	180	16	606	633	15	41	170
46	223	255	16	53		(35)	955	1020	16	55		26	615	642	15	42	180
56	230	305	16	51		(45)	1003	1020	16	56		36	624	651	15	42	190
66	240	330	16	52		(55)	1010	1036	16	55		46	633	700	15	38	
						(65)	1020	1042	16	59		56	642	745	15	37	
(8)	335		16	46	180							66					
(18)	345		16	50	170	(7)	1110	1147	16	55	150	8					
(28)	355		16	53	180	(17)	1119	1155	16	55	170						
38						(27)	1125		16	50	180						
48						(37)	1131		16	49	180						
58						47	1138		16	47	180						
						57	1145		16	45							
	25						30						26				

SHIFT TOTALS	81		
OVENS DELAYED (30 MIN.)	8-28	38, 35-65, 7-37	
NO. HARD PUSHES (200 AMP.)		1-210	
TIME SPILLAGE EMPTIED			
OPER.	M. Gailow 6660	D. Graham 0751	A. Hoffman 6629

...AND CHARGING REPORT

3 BATTERY

DATE Dec. 2 76

8 - 4					4 - 12						12 - 8					
Time Pushed	Time Charged	Coke Time Hrs.	Coke Time Min.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	Coke Time Hrs.	Coke Time Min.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	Coke Time Hrs.	Coke Time Min.	AMPS.
19	8.44	15	33	135	106		4.09				67	1153	1234			130
	8.53	15	33	150	116		4.17				77	1202	1242	16	39	136
8.33	9.03	15	31	150	68	4.24	5.07	16	44	120	87	1211	1253	16	38	136
8.42	9.15	15	33	150	78	4.32	5.14	16	42	130	97	1218	1302	16	38	136
8.54	9.22	15	36	140	88	4.40	5.20	16	40	160	107	1225	111	16	30	136
					98	4.47	5.29	16	38	120						
12.08	12.32	17	49	100	105	4.54	5.42	16	36	160	69	118	205	16	34	136
12.17	12.43	17	51	100	71	5.56	6.08	16	26	120	79	125	211	16	27	136
12.30	12.50	17	57	90	81	6.03	6.20	16	23	110	89	132	219	16	24	136
12.40	1.03	18	00	100	91	6.17	6.30	16	29	110	99	139	231	16	24	136
12.53	1.12	18	06		101	6.32	6.45	16	35	110	109	145	231	16	26	136
					111	6.50	6.54	16	34	100						
1.02	1.27	16	50		73	8.00	8.33	16	45	120	72	400	445	15	28	136
1.12	1.37	16	52		83	8.09	8.42	16	43	120	82	409	457	15	29	136
1.22	1.46	16	54		93	8.15	8.51	16	15	160	92	415	453	15	25	136
1.32	1.55	16	59		103	—	9.00	—	—	—	102	424	500	15	24	136
1.40	2.03	16	55		113	8.36	9.10	16	24	120	112	436	507	15	24	140
2.49	3.37	16	49	160	75	10.25	1101	16	56	130						
2.55	3.45	16	45	120	85	1052	1104	16	57	130	74	513	539	15	16	130
3.04	3.57	16	46	160	95	1105	1119	17	00	130	84	522	550	15	45	140
3.17		16	44	200	105	1107	1127	17	00	130	94	530	558	15	41	130
3.26		16	44	150	115	1105	1135	16	58	130	104	539	606	15	49	130
					61	1105		16	51	130	114	548	615	15	45	140
					77											
					87											
											76					
											86					
											96					
											106					
											116					
20					20						19					

...ET ...ALS 59

...ONS ...LAYED ...MIN.) 75-115-67-

...HARD ...SHES ...AMP.)

...IME ...LAGE ...TIED

...ER. O. Johnson 6729 R. A. Hansen 6634 Fr. Forbes, 1690

Comments
Please fix the amps it is not pushing no load pushes
Fred Forbes

1 & 2 BATTERY

DATE Dec. 9/76

8 – 4						4 – 12						12 – 8					
OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
47		800				8	420	442	16	27	180	7		1205			
57		807				18	428	450	16	28	180	17		1213			
						28	435	456	16	25	180	27		1222			
9	918	947	16	35	170	38	442	505	16	24		37	1222	1230	16	12	170
19	927	955	16	37	170	48	450	514	16	23		47	1230	1239	16	10	
29	934	1005	16	36	180	58	456	523	16	20		57	1238	1248	16	11	
39	942	1013	16	37	160												
49	953	1022	16	39		1	548	610	16	15	200	9	112	142	15	25	190
59	1003	1024	16	42		11	557	615	16	15	180	19	121	151	15	24	190
						21	606	624	16	15		29	130	200	15	25	180
2	1015	1048	16	00	180	31	615	633	16	17		39	139	208	15	26	170
12	1022	1057	16	00	190	41	624	642	16	19		49	148	212	15	26	
22	1033	1103	16	03	230	51	633	656	16	19		59	157	219	15	23	
32	1042	1110	16	04	190	61	645	709	16	22							
42	1051	1120	16	06								2	257	320	16	09	180
52	1100	1127	16	10		3	805	827	16	45	180	12	306	330	16	09	190
62	1110	1204	16	15		13	812	836	16	42	170	22	313	405	16	12	180
						23	821	845	16	16	170	32	320	413	16	13	
4	1120	1215	15	02	220	33	827	854	16	07		42	330	420	16	10	
14	1128	1223	15	03	200	43	836	903	16	06		52	400	428	16	33	
24	1203	1232	15	30	180	53	845	912	16	05		62	409	436	16	05	
34	1211	1240	15	31	180	63	854	921	16	04							
44	1220	1248	15	35								4	503	533	16	48	180
54	1227	1255	15	22		5	948	1015	16	16	180	14	519	540	16	49	170
64	1236	105	15	33		15	957	1024	16	09	180	24	521	549	16	49	180
						25	1006	1033	16	08	170	34	530	558	16	50	160
6	215	251	16	18	180	35	1015	1042	16	05		44	539	607	16	51	
16	224	300	16	18	180	45	1024	1051	16	06		54	548	615	16	53	
26	233	310	16	18	150	55	1033	1100	16	05		64	557	624	16	52	
36	242	320	16	18	170	65	1042	1110	16	07							
46	251	330	16	18								6	651	725	16	00	160
56	300	340	16	15		7	1135		16	15	170	16	700	735	16	00	160
66	310	350	16	15		17	1145		16	15	150	26	710	743	16	00	170
					*	27	1155		16	15	100	36	720	748	16	00	160
												46	730	753	16	00	
												56	740	758	16	00	
												66	750		16	00	
	27						30						30				
SHIFT TOTALS	87																

OVENS DELAYED (>30 MIN.)	9-59, PUSHED 69-109 ON #3 BATTERY FIRST.		
NO. HARD PUSHES (>200 AMP.)	22-230 4-220 ~~14-200~~		
TIME SPILLAGE EMPTIED			
OPER.	F. Antinetta 6681	R. Harlow 6660	W. Brown 6751

3 BATTERY

DATE December 9-14/19

	8 - 4						4 - 12						12 - 8					
	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
1	67		817				54	1.02	3.06				115		12.00			
2	77	800	829	15	54	140	96		3.11				67	12.27	12.54	16	10	130
3	57	811	834	15	53	140	66	1.03	4.22	16	39		77	12.36	1.03	16	07	110
4	77	819	848	15	55	130	116	1.09	4.35	16	29	150	87	12.45	1.12	16	05	170
5	107	828	854	15	53	130	15	5.05	5.30	16	20	160	97	12.54	1.21	16	06	160
6							78	5.13	5.39	16	19	130	107	1.03	1.30	16	04	120
7	69	836	909	15	02	130	55	5.21	5.47	16	15	130	69	2.06		16	57	150
8	79	845	915	15	02	130	98	5.33	5.57	16	21	110	79	2.15	2.35	16	57	170
9	89	854	930	15	03	140	168	5.40	6.06	16	19	120	89	2.24	2.45	16	54	170
10	99	903	934	15	03	150	71	6.55	7.20	16	23	100	99	2.35	2.53	16	56	170
11	109	912	948	15	03	140	81	7.00	7.30	16	29	100	109	2.34	3.02	16	56	170
12							91	7.10	8.05	16	19	130	72	4.15	4.45	16	04	120
13	72	1.50	1.14	17	41	130	101	7.20	8.14	16	20	130	82	4.27	4.54	15	05	120
14	82	1.58	1.22	17	41	140	111	7.30	8.22	16	20	130	92	4.36	5.03	15	04	150
15	92	1.05	1.32	17	41	130	72	9.03	9.30	16	21	120	102	4.45	5.10	15	04	170
16	102	1.13	1.41	17	41	130	53	9.13	9.38	16	02	110	112	4.56	5.17	14	58	170
17	112	1.21	1.56	17	35	130	93	9.21	9.48	16	01	130	74	5.06	5.33	16	00	170
18							103	9.30	9.54	16	03	100	84	5.15	5.48	16	01	170
19	74	1.32	2.06	16	25	130	113	9.39	10.03	16	05	120	94	5.24	6.56	15	59	120
20	84	1.40	2.14	16	24	130	75		10.20				104	6.33	7.04	15	59	120
21	94	1.49	2.25	16	22	130	85	11.00	11.30	16	06	150	114	6.42	7.14	15	54	150
22	104	1.57	2.34	16	22	130	95	11.10	11.40	16	02	140						
23	114	2.06	2.45	16	23	130	105	11.20	11.50	16	02	130						
24							115	11.30		16	01	130						
25	76	3.35	3.57	16	35													
26	86	3.45		16	35													
27	96	3.58		16	34													
28	106																	
29																		
30																		
31																		
32																		
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40		22						21						20				
SHIFT TOTALS		63																
OVENS DELAYED (+30 MIN.)																		
NO. HARD PUSHES (+200 AMP.)																		
TIME SPILLAGE EMPTIED																		
OPER.		F. Fabbs 6690.						O. Johnson 6729						R. Ransom 6634				

...NG AND CHARGING REPORT

1 - 2 BATTERY

DATE Dec. 10/-

PUSHI

	8 - 4					4 - 12						12 - 8					
	TIME PUSHED	Time Charged	OPENING TIME HRS.	OPENING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	OPENING TIME HRS.	OPENING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	OPENING TIME HRS.	OPENING TIME MIN.	AMPS.
00		805				7	416	448	16	13	180	6		1203			
10	922	950	16	40	160	17	427	454	16	14	160	16		1213			
20	930	958	16	40	160	27	436	503	16	14	150	26		1223			
30	938	1005	16	42	190	37	445	512	16	15	160	36	1200	1223	16	12	
40	945	1014	16	40		47	454	521	16	15		46	1208	1236	16	16	
50	952	1021	16	38		57	503	530	16	15		56	1218	1245	16	20	
59	1000	1028	16	37								66	1227	1254	16	20	
1	1000	1043	15	54	230	9	557	624	16	15	150						
11	1015	1053	16	00	170	19	606	633	16	15	180	8	121	145	15	31	18
21	1023	1100	15	59	170	29	615	642	16	15	200	18	130	157	15	32	18
31	1032	1120	15	59		39	624	651	16	18		28	139	206	15	34	18
41	1040	1203	15	58		49	633	700	16	21		38	148	215	15	34	17
51	1047	1213	15	51		59	642	709	16	25		48	157	224	15	36	
61	1055	1220	15	46								58	206	233	15	38	
3	1243	118	16	16	160	2	725	818	16	05	150						
13	1253	125	16	17	160	12	803	827	16	33	160	1	300	330	16	17	240
23	103	133	16	18	170	22	810	836	16	05	180	11	310	400	16	17	19
33	113	140	16	19		32	818	845	16	05		21	320	409	16	20	17
43	123	148	16	20		42	827	854	16	07		31	330	418	16	10	
53	133	158	16	21		52	836	903	16	08		41	400	427	15	57	
63	143	206	16	22		62	845	912	16	09		51	409	436	15	56	
5	233	305	16	15	180							61	418	445	15	58	
15	242	312	16	18	180	4	939	1006	16	06	150						
25	251	320	16	18	160	14	948	1015	16	08	160	3	512	542	15	52	19
35	300	330	16	18		24	957	1024	16	08	160	13	521	550	15	56	18
45	306	340	16	15		34	1006	1033	16	08		23	530	559	15	57	17
55	315	348	16	15		44	1015	1042	16	08		33	539	600	15	58	18
65	325	358	16	15		54	1024	1051	16	09		43	548	615	16	00	
						64	1033	1100	16	09		53	557	624	15	59	
												63	606	633	16	00	
						6	1130		16	05	180						
						16	1140		16	05	170	5	[illegible]	735	15	55	[illegible]
						26	1150		16	07	190	15	[illegible]	745	15	50	[illegible]
												25	[illegible]	[illegible]	16	00	170
												35	750		16	00	150
												45	710		16	00	
												55	750		16	02	
	27					29						30					
...HEET TOTALS	86																
...ENS LAYED ...MIN.)																	
...HARD ...HES ...AMP.)	4											1-240,					
TOTAL ...AGE ...PLIED												1.00					
OPER.	B. Hetman 6664					R. Harlow 6660						N. Barham 6751					

ING AND CHARGING REPORT

_____ BATTERY

DATE Dec. 10/76.

8 - 4						4 - 12						12 - 8					
	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
76	8.00	8.18	16	03	130	75		4.04				76	12.36	1.03	16	15	150
86	8.07	8.30	16	03	140	85		4.12				86	12.45	1.12	16	15	130
96	8.18	8.40	16	04	130	95		4.20				96	12.54	1.21	16	14	160
106	8.26	8.48	16	03	150	105	4.04	4.26	16	14	130	106	1.03	1.30	16	15	180
116	8.32	8.57	16	02	170	115	4.12	4.38	16	13	140	116	1.12	1.39	16	15	170
68	8.40	9.08	15	10		67	5.12	5.35	16	15	140	68	2.15	2.42	17	07	180
78	8.48	9.20	15	09		77	5.21	5.42	16	13	120	78	2.25	2.51	17	05	170
88	8.55	9.27	15	11		87	5.30	5.51	16	15	150	88	2.34	3.00	17	07	130
98	9.08	9.35	15	11	130	97	5.39	6.00	16	15	130	98	2.42	3.10	17	07	130
108	9.15	9.42	15	09	150	107	5.45	6.10	16	15	140	108	2.51	3.20	17	09	150
71	12.04	12.26	16	44	130	69	[illegible]	7.04			[illegible]	71	4.27	4.54	16	01	150
81	12.13	12.35	16	43	110	79	6.51	7.17	16	16	150	81	4.36	5.07	16	01	120
91	12.20	12.45	16	15	120	89	7.00	7.27	16	15	130	91	4.45	5.17	16	00	130
101	12.27	12.55	16	13	110	99	7.10	8.05	16	17	110	101	4.54	5.24	15	59	160
111	12.35	1.06	16	13	110	109	7.20	8.15	16	15	120	111	5.03	5.32	15	57	150
73	1.52	2.13	16	22	120	72	8.54	9.26	16	09	140	73	6.15	6.45	16	02	130
83	1.59	2.24	16	21	110	82	9.03	9.35	16	09	110	83	6.24	6.56	16	00	110
93	2.08	2.33	16	20	100	92	9.12	9.53	16	09	120	93	6.33	7.05	16	00	120
103	2.16	2.42	16	22	140	102	9.21	9.57	16	11	150	103	6.42	7.14	16	00	140
113	2.23	2.51	16	21	120	112	9.30	10.04	16	13	130	113	6.51	7.21	16	00	160
75	3.34		16	14	130	74	10.42	11.10	16	09	170						
85	3.45		16	15	120	84	10.51	11.20	16	09	170						
95	2.55		16	15	130	94	11.00	11.30	16	04	170						
						104	11.10	11.40	16	06	160						
						114	11.20	11.50	16	06	120						
	23						21						20				
	68																

950

S. Hawgale 6474 | O. Zatarain 4729 | H. Ramson 6634

ING AND CHARGING REPORT

1-2 BATTERY

DATE Dec. 13/-76

8 - 4						4 - 12						12 - 8					
	TIME PUSHED	Time Charged	CORRECT TIME HRS.	CORRECT TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	CORRECT TIME HRS.	CORRECT TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	CORRECT TIME HRS.	CORRECT TIME MIN.	AMPS.
3		800				32		400				3	1218	1248	16	15	150
3		810				33		410				13	1227	1254	16	17	150
3		820				43		424				23	1236	230	16	16	170
3	800	828	16	20	160	52	425	438	16	30		33	1245	103	16	17	150
3	809	836	16	19		63	400	440	16	30		43	1254	112	16	15	
3	818	845	16	12		7	453	500	16	30	150	53	103	121	16	15	
3	827	854	16	11		14	457	500	16	31	160	63	112	130	16	15	
5	921	955	16	08	180	24	507	530	16	23	150						
5	930	1012	16	11	170	34	513	545	16	17	160	1	206	235	16	11	150
5	939	1018	16	12	190	44	521	551	16	16		15	215	244	16	13	170
5	948	1023	16	15		54	530	551	16	16		25	224	251	16	16	150
5	957	1035	16	17		64	539	606	16	16		35	233	300	16	17	
5	1006	1043	16	18		6	633	700	16	25	180	45	242	308	16	19	
5	1015	1050	16	20		16	642	710	16	28	190	55	251	315	16	20	
7	1110	1230	16	17	190	26	651	700	16	15	170	65	300	327	16	22	
17	1120	1238	16	20	180	36	700	730	16	15	160						
17	1130	1246	16	20	180	46	710	800	16	16		7	418	454	15	48	150
37	1200	1254	16	40	170	56	720	809	16	17		17	427	503	15	49	150
47	1209	102	16	41	170	66	730	815	16	15		27	436	512	15	50	170
57	1218	110	16	16	180	8	945	9 15	16	07	170	37	445	521	15	51	160
9	121	208	16	25	170	18	954	921	16	07	180	47	454	530	15	52	
19	133	218	16	30	180	28	903	930	16	03	170	57	503	534	15	53	
29	143	225	16	31	180	38	912	939	16	00							
39	154	232	16	34	170	48	921	955	16	08		9	537	630	15	51	150
49	205	241	16	23	170	58	930	957	16	10		19	600	638	15	50	150
59	220	243	16	31		1	1034	1053	16	19	150	29	615	645	15	50	170
2	317	346	16	37	170	11	1043	1100	16	15	170	39	624	655	15	52	170
12	324	357	16	36	160	21	1042	1110	16	17	160	49	633	704	15	52	
22	331		16	36	170	31	1051	1120	16	17		59	642	712	15	54	
32	339		16	33	190	41	1100	1130	16	18							
42	345		16	33		51	1110	1140	16	19		2	738		15	52	170
52	353		16	33		61	1120	1156	16	20		12	747		15	50	170
62												22	755		15	48	160

27

26

28

29

ET ES			
ING ED (HRS.)			
ARD ES (AMPS.)			
TIME AGE ED		6:30	
	B. Hetman 6664	A. Hoffman 6629	D. Harlow 6666

COKE AND CHARCOAL [illegible]

B. BATTERY

DATE Dec. 13 / 76.

8 - 4						4 - 12						12 - 8					
OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
73	8.36	9.03	16	08	140	72	443	445	16	35	130	71		12.00			
83	8.45	9.12	16	09	150	82	451	453	16	31	130	81		12.11			
93	8.54	9.21	16	09	140	92	459	501	16	27	130	91		12.19			
103	9.03	9.30	16	09	130	102	506	509	16	22	130	101	12.00	12.27	16	12	115
113	9.12	9.39	16	10	160	112	514	517	16	26	130	111	12.09	12.32	16	13	13.
76	10.24	11.00	16	19	130							73	1.21	1.39	16	15	12
86	10.33	11.10	16	18	130	74	553	615	16	20	150	83	1.30	1.43	16	13	14
96	10.42	11.22	16	20	180	84	603	625	16	18	170	93	1.39	1.59	16	20	12
106	10.51	11.32	16	20	150	94	606	633	16	18	180	103	1.45	2.03	16	18	110
116	11.00	12.16	16	20	200	104	615	642	16	18	140	113	1.57	3.18	16	15	15
77	12.27	1.14	16	18	160	114	624	651	16	18	130	75	3.16	4.04	16	10	13.
77	12.36	1.25	16	17	140							85	3.20	4.13	16	10	11
87	12.45	1.36	16	18	140	76	800	829	16	40	160	95	3.28	4.22	16	07	16
97	1.00	1.45	16	24	130	86	809	837	16	39	140	105	4.02	4.32	16	30	14
107	1.10	2.00	16	25	140	96	818	845	16	18	130	115	4.09	4.45	16	53	15
69	2.28	3.04	16	32	150	106	827	854	16	18	140	67	5.12	5.39	15	58	16
79	2.38	3.14	16	32	140	116	836	903	16	18	250	77	5.21	5.55	15	56	13
89	2.49	3.20	16	34	150							87	5.30	6.10	15	54	18
99	2.56	3.31	16	35	140	68	939	1001	16	18	130	97	5.39	[illegible]	15	54	17
109	3.07	3.40	16	36	130	78	948	1011	16	18	130	107	5.45	6.20	15	45	14
						88	957	1024	16	18	130	69	6.57	7.20	15	48	130
						98	1006	1033	16	18	130	79	7.00	7.30	15	46	140
						108	1015	1042	16	18	140	89	7.10	7.40	15	47	130
												99	7.20	7.50	15	49	120
						71	11.30		16	20	110	109	7.32		15	50	130
						81	11.40		16	14	120						
						91	11.50		16	15	100						
	20						23						22				

SHIFT TOTALS	65
OVENS LAYED (MIN.)	
HARD PUSHES (AMP.)	
TIME LEAGE POSTED	
FOR.	S. Kowczak, 6674. / F. Forbes, 6690. / C. Jackson 6220

1-2 BATTERY

DATE Dec 14/-76

8 - 4					4 - 12						12 - 8					
OVEN NO.	TIME PUSHED	Time Charged	COOKING TIME HRS.	COOKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COOKING TIME HRS.	COOKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COOKING TIME HRS.	COOKING TIME MIN.	AMPS.
		805				21		400				2	1230	1255	16	25	180
		813				31		407				12	1238	105	16	25	180
		822				41		415				22	1245	112	16	23	160
	803	832	15	47		51	400	427	16	26		32	1253	120	16	21	
	811	837	15	47		61	407	436	16	29		42	100	128	15	23	
	813	844	15	45		3	500	533	16	15	170	52	105	135	15	21	
	827	850	15	47		13	510	539	16	18	160	62	113	146	15	22	
1	920	1000	15	58	170	23	521	548	17	31	180						
11	928	1010	15	58	160	33	530	557	16	27	160	4	206	233	16	06	180
21	936	1018	15	59	160	43	537	606	16	27		14	213	242	16	05	180
31	949	1027	16	04	170	53	548	615	16	27		24	224	251	16	06	180
41	955	1034	16	04		63	557	624	16	27		34	233	300	16	06	
51	002	1040	16	05		3	651	700	16	16	170	44	242	309	16	05	
61	1010	1048	16	04		13	700	730	16	16	160	54	251	315	16	11	
6	1020	1100	15	20	170	23	710	740	16	19	160	64	300	327	16	12	
16	1027	1120	15	17	190	33	720	807	16	23	160						
26	1035	1203	15	18	170	43	730	815	16	21		6	424	445	17	24	160
36	1045	1212	15	15	170	53	500	527	16	22		16	430	454	17	10	170
46	1052	1221	14	52		63	503	536	16	19		26	436	503	16	33	160
56	1243	115	16	34	180	7	903	932	16	09	160	36	445	512	16	33	
66	1250	123	16	32	180	17	912	942	16	09	170	46	454	520	16	33	
8	141	213	16	29	170	27	921	948	16	09	190	56	503	521	16	48	
18	148	220	16	27	160	37	930	957	16	07	160	66	512	530	15	49	
28	156	227	16	26	190	47	930	1000	16	07							
38	204	235	16	25	170	57	948	1015	16	07		8	606	633	15	53	170
48	212	246	16	24		7	1033	1104	16	03	170	18	615	642	15	55	170
58	220	254	16	23		17	1042	1110	16	04	180	28	624	651	15	57	180
1	310	344	16	17	220	27	1051	1120	16	06	160	38	633	700	15	55	
11	320	350	16	20	170	37	1100	1130	16	05	180	48	642	710	15	56	
21	330		16	20	160	47	1110	1140	16	06		58	651	720	15	57	
31	340		16	20	160	57	1120	1150	16	08							
41	350		16	20								1	750		16	06	180
	29						28						28				
	85																

OVENS PLAYED (MIN.)			
BOARD NUMBERS (AMP.)	#1-220		#1-210
TIME BATTERY ENDED			
INITIALS	B. Hetman 6664	A. Hoffman 6629	[illegible] 6660

3 BATTERY

DATE Dec. 14/76.

3 - 4						4 - 12						12 - 8					
OVEN NO.	TIME PUSHED	Time Charged	COOKING TIME Hrs.	COOKING TIME Min.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COOKING TIME Hrs.	COOKING TIME Min.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COOKING TIME Hrs.	COOKING TIME Min.	AMPS.
109		8.00				71	7.19	7.45	16	19	130	69		12.00			
72	8.35	8.57	15	50	110	81	7.25	7.55	16	17	140	79		12.07			
82	8.40	9.02	15	52	140	91	7.36	8.03	16	18	130	89		12.20			
92	8.53	9.12	15	52	130	101	7.45	8.12	16	18	130	99	12.23	12.38	16	33	110
102	9.00	9.20	15	51	120	111	7.54	8.21	16	18	130	109	12.10	12.43	16	10	
112	9.08	9.28	15	51	130							72	1.21	1.49	16	28	12
(74)	12.03	12.28	17	48	130	73	5.06	5.39	16	27	130	82	1.30	1.57	16	27	12
(84)	12.13	12.40	17	48	130	83	5.15	5.43	16	28	130	92	1.39	2.06	16	27	13
(94)	12.22	12.47	17	49	120	93	5.24	5.51	16	25	120	102	1.45	2.15	16	30	120
(104)	12.29	12.56	17	47	130	103	5.33	6.00	16	25	120	112	1.57	2.22	16	22	130
(114)	12.36	1.04	17	45	130	113	5.42	6.10	16	24	130	74	3.10	4.06	16	12	14
72	1.00	1.27	16	31	130							84	3.20	4.14	16	40	15
84	1.08	1.34	16	31	140	75	5.18	5.45	16	14	130	94	3.30	4.21	16	43	15
96	1.15	1.43	16	30	140	85	5.27	5.54	16	14	140	104	4.04	4.29	15	02	130
106	1.22	1.52	16	28	130	95	5.36	6.03	16	14	130	114	4.11	4.38	15	07	160
116	1.30	2.00	16	27	150	105	5.45	6.12	16	14	130	76	5.21	5.39	15	04	140
68	2.27	3.00	16	21	140	115	5.54	7.07	16	19	130	86	5.30	5.48	15	16	140
78	2.36	3.10	16	20	130							96	5.39	5.56	15	56	140
88	2.44	3.19	16	20	140	67	9.57	10.20	16	18	140	106	5.48	6.04	15	56	140
98	2.53	3.28	16	20	130	77	10.06	10.22	16	11	130	116	5.57	6.13	15	57	170
108	3.02	3.37	16	20	140	87	10.15	10.40	16	05	130	68	7.00	7.30	16	00	140
						97		10.51				78	7.10	7.40	16	00	160
						107	10.24	10.55	16	04	130	88	7.20	7.50	16	01	140
												98	7.30		16	02	150
						69	11.30		16	10	130	108	7.40		16	03	160
						79	11.40		16	10	130						
						89	11.50		16	10	130						
	20						20						20				
SHIFT TOTALS	64																

...ENS ...LAYED ...MIN.)			
...HARD ...USHES ...AMP.)			
...ME ...LLAGE ...TIED			
...ER.	S. Vourgak, 6674.	F. Tardos, 6690.	A. Jatanen, 6229

/28 BATTERY

DATE: Dec. 15/76

8 - 4						4 - 12						12 - 8					
OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COKING TIME HRS.	COKING TIME MIN.	AMPS.
1		821				17		400				48		1200			
11	800	830	16	10	190	27		407				58		1207			
21	807	839	16	09	180	37		4[illegible]									
31	818	848	16	09	170	47	400	407	16	20		1	1245	136	16	24	200
41	827	857	16	09		57	405	436	16	19		11	110	138	16	40	150
51	836	906	16	09								21	120	145	16	41	170
61	845	915	16	09		2	503	530	16	08	180	31	130	152	16	42	
						12	512	537	16	08	170	41	142	225	16	45	
3	945	1012	16	12	180	22	520	545	16	09	170	51	150	235	16	44	
13	953	1024	16	14	180	32	530	557	16	10	160	61	225	245	17	16	
23	1000	1032	16	12	190	42	540	600	16	11							
33	1010	1040	16	13		52	548	605	16	13		3	310	333	16	58	150
43	1022	1045	16	16		62	557	624	16	17		13	318	405	16	54	150
53	1030	1050	16	15								23	325	414	16	53	180
63	1038	1100	16	14		4	651	720	16	15	170	33	333	420	16	53	
						14	700	727	16	18	160	43	415	425	17	17	
5	1130	1223	16	10	190	24	710	802	16	19	160	53	412	435	17	22	
15	1200	1230	16	30	190	34	718	810	16	15		63	420	441	17	20	
25	1209	1240	16	09	180	44	729	818	16	20							
35	1218	1250	16	09	190	54	803	827	16	15		5	503	528	16	40	160
45	1227	100	16	09		64	809	830	16	12		15	510	534	16	40	170
55	1236	108	16	09								25	518	546	16	38	170
65	1245	116	16	09		6	903	933	16	15	160	35	524	545	16	35	
						16	912	939	16	15	190	45	530	552	16	31	
7	139	208	16	06	160	26	921	948	16	15	180	55	536	558	16	29	
17	148	217	16	09	150	36	930	957	16	15	170	65	544	604	16	29	
27	157	226	16	09	150	46	939	1006	15	19							
37	206	234	16	09		56	945	1015	16	07		7	624	655	16	16	180
47	215	243	16	09		66	951	1024	16	07		17	633	704	16	16	170
57	224	251	16	09								27	642	[illegible]	16	16	190
						8	1051	1120	16	18	150	37	651	715	16	18	170
9	330	350	16	20	180	18	1100	1130	16	18	170	47	700	722	16	18	
19	330		16	20	170	28	1110	1140	16	19	180	57	710	730	16	19	
29	340		16	20	170	38	1120	1150	16	20							
39	350		16	20	170	48	1130		16	20							
						58	1140		16	20							
	30						29						27				

SHIFT TOTALS	86		
OVENS CHARGED (NO.)			3-63
HARD CHARGES (AMPS.)			
TIME STAGE PERIOD			
SIGN.	N Bonham 6751	G Hoffman 6609	N Bonham 6660

BATTERY

Dec 15, 198

8 – 4						4 – 12						12 – 8					
	TIME PUSHED	Time Charged	COOLING TIME HRS.	COOLING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COOLING TIME HRS.	COOLING TIME MIN.	AMPS.	OVEN NO.	TIME PUSHED	Time Charged	COOLING TIME HRS.	COOLING TIME MIN.	AMPS.
		8:00				69	418	443	16	15	130	65		12.16			
		8:09				74	422	456	16	20	130	75	12.00	12.26	16	20	140
	8:54	9.30	16	09	150	89	436	504	16	16	140	88	12.09	12.36	16	19	130
	9.03	9.38	16	05	150	99	445	512	16	11	140	98	12.13	12.45	16	15	130
	9.12	9.51	16	09	160	109	454	521	16	11	130	108	12.27	12.58	16	15	140
	9.21	10.00	16	09	140							70	2.30	3.43	17	00	110
	9.35	10.09	16	14	130	77	606	633	16	17	130	60	2.37	3.56	16	59	120
	10.45	11.15	16	12	150	82	615	640	16	18	130	90	2.44	4.04	16	53	110
	10.53	11.23	16	10	130	92	624	651	16	18	130	100	2.51	4.13	16	51	110
	11.04	11.30	16	13	160	102	633	700	16	18	130	110	3.00	4.20	16	52	130
	11.11	12.00	16	11	160	112	642	710	16	20	130	73	4.25	5.05	17	10	150
	11.18	12.09	16	08	190							83	4.32	5.54	17	09	160
	12.59	1.29	16	14	120	74	818	845	16	13	130	93	4.39	5.02	17	09	120
	1.07	1.35	16	13	160	84	827	855	16	13	140	103	4.46	5.09	16	46	130
	1.18	1.43	16	15	140	94	836	903	16	15	130	113	4.54	5.16	16	45	150
	1.26	1.51	16	14	140	104	845	912	16	16	120	75	5.43	6.10	16	20	130
	1.33	2.00	16	06	160	114	854	920	16	16	150	85	5.56	6.17	16	21	130
	2.33	3.00	16	13	140							95	6.03	6.24	16	20	150
	2.44	3.10	16	15	140	76	1014	1033	16	30	150	105	6.10	6.33	16	19	140
	2.51	3.24	16	09	130	86	1023	1042	16	29	120	115	6.17	6.42	16	17	160
	3.00	3.33	16	09	130	96	1045	1051	16	29	130	67	7.20	7.50	16	20	170
	3.10	3.43	16	12	130	106	1053	1100	16	29	130	77	7.30		16	20	130
						116	1042	1109	16	29	150	87	7.40		16	16	140
												97	7.50		16	17	160
						68	11.50		16	20	150						

20

21

23

5-15

R. Larson 6634 | F. Foster 6690. | A. Jurewicz 6129.

1702. D. 3. e. 30. 207 MAT.

APPENDIX D

EXCERPTS FROM ONTARIO RESEARCH FOUNDATION
REPORT RE: TESTS ON MINISTER STRAIN SCRUBBER

(Complete report available through the Ontario Research Foundation)

004846

1700. D. 3. e. 30. 201. part.

Minister Stein Pushing Control Device

P-4641

Report P-3016/I-2

Determination of Emissions from the Coke Pushing Control System

for

Dominion Foundries and Steel Limited
P.O. Box 460
Hamilton, Ontario.
L8N 3J5

004846

J. A. Craigmile

Dept. of Environmental Chemistry

February 8, 1979.

1700. D. 3. e. 30. 201. part

ONTARIO RESEARCH FOUNDATION

SHERIDAN PARK RESEARCH COMMUNITY

MISSISSAUGA, ONTARIO, CANADA L5K 1B3 • (416) 822-4111 • TELEX 06-982311

ONTARIO RESEARCH FOUNDATION STIPULATE THAT THIS DOCUMENT IS SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS
PROPOSAL CONTAINED HEREIN WAS PREPARED FOR THE CONSIDERATION OF THE ADDRESSEE ONLY. ITS CONTENTS MAY NOT BE USED BY NOR DISCLOSED TO
OTHER PARTY WITHOUT OUR PRIOR WRITTEN CONSENT
TESTING, INSPECTION OR INVESTIGATION PERFORMED BY US WILL BE CONDUCTED IN ACCORDANCE WITH NORMAL PROFESSIONAL STANDARDS. NEITHER WE
OUR EMPLOYEES SHALL BE RESPONSIBLE FOR ANY LOSS OR DAMAGE RESULTING DIRECTLY OR INDIRECTLY FROM ANY DEFAULT, ERROR OR OMISSION
REPORT, PROPOSAL OR QUOTATION PREPARED BY US REFERS ONLY TO THE PARTICULAR MATERIAL, INSTRUMENT OR OTHER SUBJECT REFERRED TO IN IT. NO
REPRESENTATION IS MADE THAT SIMILAR ARTICLES WILL BE OF LIKE QUALITY
REPORT ISSUED BY US SHALL BE PUBLISHED IN WHOLE OR IN PART WITHOUT OUR PRIOR WRITTEN CONSENT
OUR NAME SHALL NOT BE USED IN ANY WAY IN CONNECTION WITH THE SALE, OFFER OR ADVERTISEMENT OF ANY ARTICLE, PROCESS OR SERVICE
RESERVE THE RIGHT NOT TO COMMENCE AND OR CONTINUE ANY WORK UNTIL PAYMENT ARRANGEMENTS SATISFACTORY TO US ARE ESTABLISHED.

Determination of Emissions
from Coke Pushing Control
System
(Proposal P-3016/I)

for

Dominion Foundries & Steel Ltd.

1. SUMMARY

A test programme has been carried out at Dofasco's #3 Coke Battery #6 Plant. The emission rate of particulate from the emission control system was determined and an estimate made of the venturi scrubber efficiency based on emission rate data and scrubber water solids content. Duplicate particulate tests were carried out with a second sampling train to provide the Ministry of the Environment with samples for polynuclear aromatic hydrocarbon (PAH) analysis.

The average particulate concentration and emission rate from the two particulate tests were determined to be 0.005 gr/scf and 5.4 lb/hr, respectively. This average loading is well below the designed outlet loading of 0.02 gr/scf.

Due to the variation of results obtained from analyses of scrubber water samples for solids content, the venturi efficiency was calculated to be in the range of ~~86%~~ to ~~98%~~. 98.3 to 99.3

When the Ministry of the Environment have completed PAH analyses, the results will be submitted directly to Dofasco.

Jim Craigmile

J. A. Craigmile
Technologist II
Dept. of Environmental Chemistry

JAC/id

January 22, 1979.

2. INTRODUCTION

At the request of Dominion Foundries and Steel Limited (Dofasco) and the Ontario Ministry of the Environment (MOE), a test programme was carried out during the period, December 1 - 5, 1978, on coke pushing emissions from #3 Coke Plant. The major objective of the test programme was to determine the emission rate of particulate from the emission control system.

In addition, inlet loadings to the venturi scrubber were to be estimated by measuring the solids contents of effluent water samples. The collection efficiency of the scrubber could then be calculated from inlet and outlet particulate loading data.

The analysis of all collected samples for particulate matter was performed by Ontario Research (ORF). The samples from two tests were then submitted to MOE for polynuclear aromatic hydrocarbon (PAH) analysis.

This report presents a detailed discussion of the process operation, emission rates and control system efficiency and includes descriptions of sampling and analytical procedures.

3. PROCESS DESCRIPTION

Coke, an essential raw material for blast furnace pig iron production, is produced by the destruction distillation of coal under a reducing atmosphere.

Coking is a batchwise operation and takes place in a series of slot-type coke oven batteries. The coking period is approximately 16 hours and temperatures reach 2000°F. Heat is supplied indirectly from a gas fired regenerative system located below the ovens with flues between the ovens.

A typical cycle would be as follows: an empty oven is charged with approximately 36 tons of coal by the larry car, travelling on rails on top of the battery, and the oven heated. During heating, volatiles

are driven off the coal. At the end of the coking cycle, the coked coal is removed. This involves close communication between the operators of the door machine, quench car locomotive (loco) and pusher. When the pusher is positioned in front of the oven to be pushed, the door machine is contacted by radio. The door machine mechanically removes the oven door. Once the door is removed, emissions leak from the oven. The door machine informs the loco that the oven is ready to be pushed. The loco positions the far end of the coke collection car (quench car) adjacent to the coke guide. Once in position, the loco contacts the pusher. The pusher, on the opposite side of the battery, will then proceed to push the coke out of the oven by a mechanized ram. As the incandescent coke is pushed, it breaks up and falls into the quench car. Once full, the loco travels to the quench station where the coke is cooled by water sprays. The time interval between removing the oven door and completing the coke push into the quench car is approximately two minutes. The actual pushing of the coke lasts approximately one minute.

Coke dusts and volatiles are carried upward by thermal rise when the oven door is removed and during pushing. In order to collect and control these emissions, a complex system of ductwork and venturi scrubber was installed during construction of the new battery.

A stationary gas collecting duct (approximately 4.5 ft diameter) is located above the loco tracks and extends from the quench station to the far end of the battery. The top of the duct is grating material and covered by a high temperature resistant rubber mat. The travelling hood, which collects the emissions, is attached to the collecting duct. A series of rollers picks up the rubber mat, allowing the collected emissions to enter the collecting duct anywhere between the quench station and the coke ovens. This allows the hood to be stationary at the door machine to collect the pushing emissions and, after the quench car is full of coke, the loco can pick up the hood and travel to the quench station so that emissions given off during this period are collected.

The collected emissions are cleaned by a venturi scrubber and exhausted through a 150' stack. A schematic of the system is shown in Figure 1.

4. SAMPLING LOCATION

Sampling was carried out from a platform around the 6'8" diameter stack at the 118' level above grade. All four ports were used when traversing the stack to allow the use of short probes. The sampling location was 7 stack diameters upstream of a flow disturbance and 5 stack diameters downstream of the stack outlet. A schematic of the stack and sampling location is given in Figure 2.

5. SAMPLING AND ANALYTICAL METHODOLOGY

The test programme consisted of three distinct procedures; source sampling at the scrubber outlet, water sampling of the scrubber effluent and analysis of water samples and particulate samples for PAH compounds.

Due to the nature of testing required, it was decided to operate two stack sampling trains simultaneously. One train was operated from the moment that the door machine removed the oven door until the quench car was full of coke (Train A). The particulate loadings determined from tests using train A could then be compared with the maximum loading guaranteed by the system supplier. It was intended to operate the other train (Train B) for an additional length of time as the coke car travelled to the quench station so that an average emission factor per push, as requested by MOE, could be obtained. However, because of problems with the travelling hood at the time of sampling, emissions from the travelling quench car could not be sampled. The two trains were, therefore, operated over the same time period.

Due to the short sampling duration (approximately 2 minutes) for Train A, it was intended to use a high-volume source assessment sampling

system (SASS) train. This equipment has the capability of sampling at four times the sampling rate of conventional equipment. However, during preliminary evaluation of equipment on the stack, it was discovered that too much time was required to move the SASS train from one port to another when sampling all four ports. Therefore, it was decided to use two conventional EPA Method 5 trains to complete the test programme.

Train B was modified to incorporate a tenax adsorbent tube in the heated oven after the filter. Samples from this train were submitted to MOE for PAH analysis.

5.1 Particulate Sampling

Two Joy Emission Parameter Analyzers were used to collect the samples. A schematic of the conventional train is shown in Figure 3 and Figure 4 shows a schematic of the modified train. A Tenax adsorbent tube was inserted in the oven between the filter and the impingers to collect vapor phase PAHs which penetrated the particulate filter. A drawing of the tube is shown in Figure 5. Five foot stainless steel lined probes with a calibrated S-type pitot tube and temperature measuring device attached were used with both trains.

Twelve points at distances representing the middle of equal areas across the stack diameter were calculated. The first six points were marked on each probe because all four ports were used and each traverse would be one half the stack diameter. Each point was sampled from the time the oven door was removed for a period of two minutes. Unless problems occurred at the oven being pushed, the end of the two minute sampling period coincided with the coke car being full of coked coal. Therefore, each test represents twenty-four pushes.

Isokinetic sampling was maintained throughout all tests, using a 3/16" diameter nozzle on each probe. An average sampling flowrate was approximately 0.7 cfm.

Particulate matter was collected on 125 mm diameter glass fibre filters in a heated oven. The filters used in the PAH train were pre-extracted with benzene by MOE. All filters were conditioned in the laboratory prior to both the initial and final weighing.

At the start of each test, 125 mls of distilled water was put into each of the first two impingers. The third impinger was left dry and the fourth contained 250 gm of indicating silica gel.

5.2 Water Sampling

During each particulate test, a composite water sample was obtained from the continuous blowdown line of the effluent venturi scrubber water. An automatic water sampler, equipped with a timer, was connected to the blowdown line and a flow of approximately 18 gpm of scrubber effluent was diverted through the sampler. A motor driven dipper, connected to a timer, took a 25 ml sample of the water every 1-1/2 minutes. Each sample drained into a glass jar and approximately every four hours the sample jar was changed. A schematic of the water sampler is shown in Figure 6.

5.3 Sample Recovery

5.3.1 Particulate Train

The conventional particulate sampling train was cleaned up at the end of each test using normal procedures. The volume of water in the impingers was measured and recorded. All glassware after the filter was rinsed with distilled water and added to the impinger solutions. The silica gel was removed from the fourth impinger and placed in a pre-weighed, capped, plastic sample bottle.

The particulate filter was carefully removed from the filter holder and placed in a plastic petri dish. The probe and nozzle were rinsed with distilled water. A brush assembly was used when cleaning the probe to aid in recovery of particulate lodged in the liner.

5.3.2 PAH Train

The entire train was rinsed with spectro-grade benzene and then acetone prior to the start of the test. A final rinse was taken and kept as a blank.

Glass sample bottles were rinsed with spectro-grade benzene and acetone in the laboratory prior to the test programme. The caps were lined with teflon.

The recovery procedure used, as specified by MOE, was as follows:

1. The nozzle, probe and first half of the filter holder were rinsed with spectro-grade acetone and kept in a teflon capped glass container (Container #1).

2. A second rinse of the above components was made using spectro-grade benzene and kept in a teflon capped glass container (Container #2).

3. To ensure complete recovery, a "ball" of Kimwipe tissue paper, which had been wetted by spectro-grade benzene, was pushed through the probe and nozzle. The tissue was placed in a teflon capped glass container (Container #3).

4. The filter was placed in an enclosed glass petri dish (Container #4).

5. The adsorbent tube was capped with glass plugs.

6. The first disc, back half of the filter holder, and the connection leading to the adsorbent tube were rinsed with spectro-grade benzene into a teflon capped glass container (Container #5).

7. A second rinse of the above components was made using spectro-grade acetone and kept in a teflon capped glass container (Container #6).

wash of the nozzle, probe and front half of the filter holder was filtered to obtain the insoluble fraction of particulate. The soluble fraction was not determined. The total weight gain of particulate was obtained by adding the filter weight gain and the acetone probe rinse insolubles.

5.4.3 Venturi Effluent Water Samples

In the laboratory, the samples were shaken well and an aliquot taken for PAH analysis. The remaining portion of each sample was filtered to obtain the amount of particulate collected. The total volume of each sample was measured.

6. RESULTS AND DISCUSSION

During the testing period, a record of the oven pushes and net coking times was gathered. This information is given in Tables 1 and 2 for Tests 1 and 2 respectively. Since the particulate train and PAH train were operated simultaneously, the process data acquired is applicable for both trains.

A summary of the particulate weight gain in both trains is given in Table 3. In each case, the particulate caught on the filter, in the probe and a total weight gain is provided.

The calculated particulate concentrations and emission rates are given in Table 4, along with the stack gas flowrates at reference temperatures and pressures. The stack emission results from all tests are very close, ranging from 3.3 lb/hr to 5.7 lb/hr. The average stack gas concentration was found to be 0.005 gr/scf. This is well below the designed stack gas concentration of 0.02 gr/scf. A detailed presentation of the stack sampling field test data, calculations and isokineticity are given in Appendix A.

Inlet particulate emission rates to the venturi were calculated by adding the emission rate determined from the scrubber water samples and the stack emission rate. The scrubber water emission rate was determined from the product of the effluent flowrate and the concentration of particulate

in the samples. Because the flowrate meter was downstream of the automatic sampler, the flowrate through the sampler was measured and added to flowrate determined by the meter. The results from the water samples are quite different, 48.0 lb/hr for test 1 and 111.8 lb/hr for test 2.

During test 1, the water flowrate through the sampler was uncontrollable and occasionally overflowed the sampling trough. By the time the flowrate problem was corrected, a sample was obtained only during the last six pushes of the test. Additional problems with the water sampling technique used are as follows:

(a) fluctuating effluent flow

(b) retention of scrubbed water in venturi tank

(c) portion of scrubbed water is recirculated

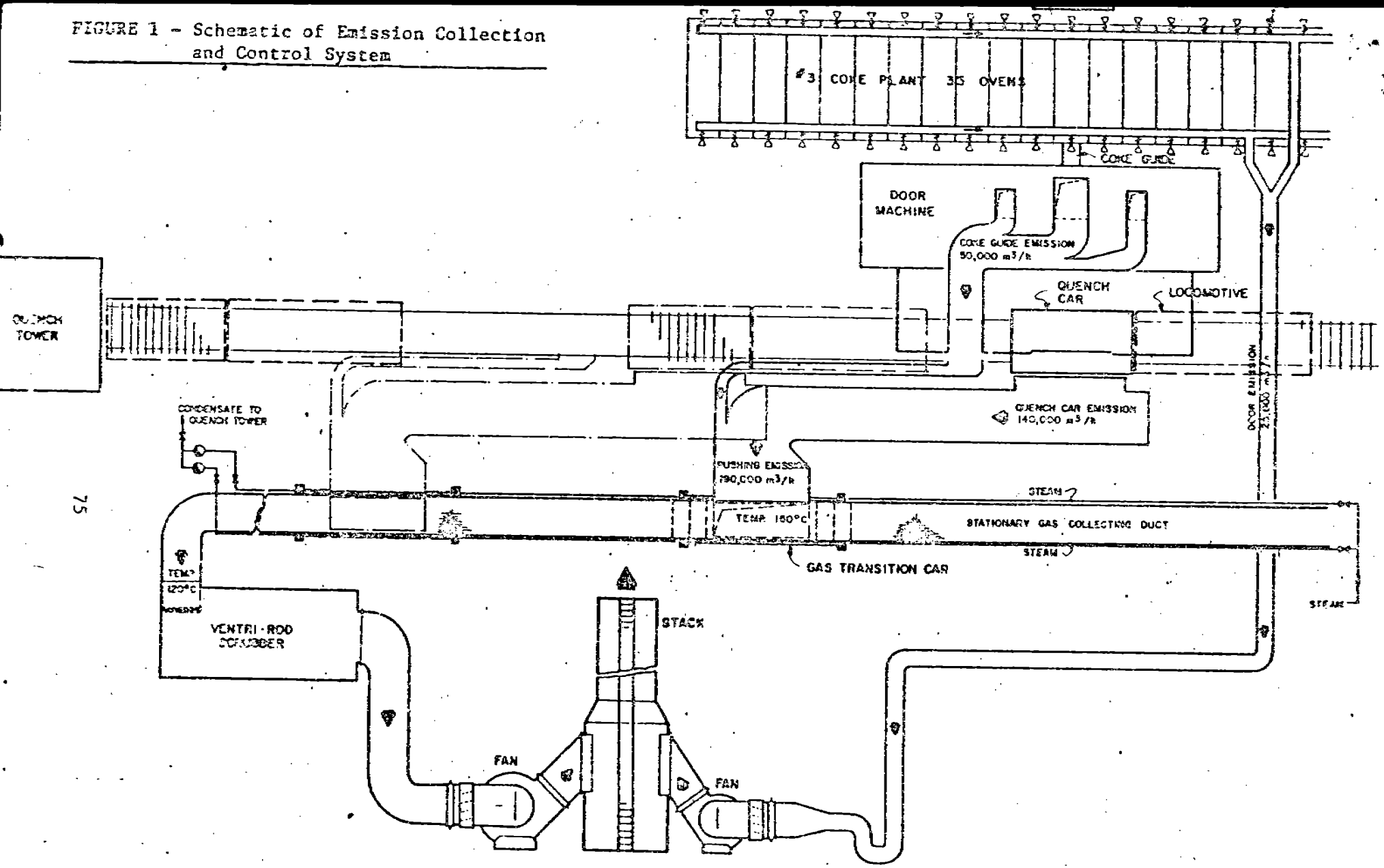
The efficiency of the scrubber, based on the average stack emission rate for the particulate train tests of 5.4 lb/hr, was determined to be between ~~86%~~ 98.3 and ~~96%~~ 99.3.

No PAH results are available at this time and, hence, will be submitted to Dofasco by MOE at a later date.

TABLE 4 - Particulate Emission Rate Data

Test #	Concentration gr/scf	Flowrate scfm	Emission Rate lb/hr
1 Particulate Train	.005	142,000	5.5
1 PAH Train	.004	148,000	3.3
2 Particulate Train	.004	140,000	5.3
2 PAH Train	.005	148,000	5.7

FIGURE 1 - Schematic of Emission Collection and Control System



ONTARIO RESEARCH FOUNDATION