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.

RESULTS OF PARTICULATE AND SO_2 STACK EMISSION TESTS DURING A 48 HOUR COKING CYCLE (#3-C COKE BATTERY) VDAPC Registration No. 10200

Prepared For:

Mr. Wayne Pruitt
JEWELL COAL AND COKE COMPANY
Dismal Route, P.O. Box 70
Vansant, VA 24656

Prepared By:

IT - AIR QUALITY SERVICES
312 Directors Drive
Knoxville, TN 37923
IT Project No. 406253.06

May 8, 1991

CERTIFICATION

I certify that the testing described in this report was performed under my direction or supervision in accordance with the reference test methods. The information contained in this report accurately describes the procedures employed and, to the best of my knowledge and belief, the results are true, accurate, and complete.

M. Blake Shirley

Test Team Leader

CERTIFICATION

I certify that I have reviewed the information contained in this report. To the best of my knowledge and belief, the information is true, accurate, and complete. Furthermore, to the best of my knowledge, the stack test information was obtained using appropriate procedures and, except as noted in the report, conforms to all requirements of the test methods cited.

John Carson, P.E.

John Carson

Project Manager

Certificate No. 17,618

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Table

Table 1. Stack Test Results Summary

1.0 INTRODUCTION

This report contains the results of stack tests performed on March 19, 1991 by IT - Air Quality Services at the #3-C Coke Battery at JEWELL COAL and COKE COMPANY in Vansant, Virginia. The purposes of these tests were to measure the total particulate matter and sulfur dioxide (SO_2) emission rates during typical 48 hour coal carbonization cycles. All measurements were made using EPA Reference Methods. The testing was observed by representatives of the Virginia Department of Air Pollution Control (VDAPC).

The personnel involved were:

Test Team:	Blake Shirley, IT-AQS Brian Gregory Tony Simpson John Carson
Coordinators:	Wayne Pruitt, JEWELL Jerry Daniels
Observers:	Daryl Addison, VDAPC Don Hilt
Report Preparation:	Alice Gaylor, IT-AQS John Carson Blake Shirley Brian Gregory

2.0 SUMMARY OF RESULTS

The results of the Battery #3-C emission testing are summarized in Table 1. Forty (40) tons of coal were charged into each of the ovens below the test stack.

The average particulate emission rate from the stack was 3.3 lbs/hr which is equivalent to 0.44 lbs/ton coal charged. On a per oven basis, the average particulate emission rate was 0.36 lbs/hr/oven. The average SO_2 concentration was 406 ppm, with a mass emission rate of 72 lbs/hr. This is equivalent to 9.7 lbs/ton coal charged. On a per oven basis, the average SO_2 rate was 8.0 lbs/hr/oven.

Visible emissions were evaluated by VDAPC's Don Hilt. Stack Visible Emissions (VEs) were <20% opacity. The VE Evaluation Record is included in the appendix.

The allowable coke oven emissions are established in the March 7, 1990 permit to construct and operate issued by the VDAPC. For 48 hour coking cycles, the allowable emissions and operating conditions are:

Particulate - 1.21 lbs/hr/oven
SO_2 - 9.17 lbs/hr/oven
Stack Visible Emissions - 20% opacity
Maximum coal charge - 40 tons/oven

Based on the stack test results and visible emissions evaluations, the ovens are in compliance with VDAPC permit conditions and regulations.

3.0 PROCESS DESCRIPTION

The design of the coke ovens at the #3-C battery is the "seventh generation" in operation at JEWELL COAL and COKE COMPANY. As with the earlier designs, these ovens use non-recovery coking technology where the combustibles produced during the coking process are oxidized in the gas flues, producing heat, carbon dioxide, and water vapor. The major difference between oven Batteries #3-C and #3-B and the earlier designs is that individual oven draft is controlled by uptake dampers. Figure 1 schematically illustrates the configuration of the oven. Primary combustion air enters the oven crown through door dampers and secondary combustion air enters through the sole flue dampers. If needed, tertiary combustion air can be added to the uptakes and afterburner tunnel. As with previous designs, the ovens operate under negative pressure at all times which insures that oven exhaust gases pass through the sole flues, afterburner tunnel, and stack.

Battery #3-C operates on a 48 hour coking cycle. That is, coke is pushed and fresh coal is charged to any given oven every other day. Oven charging/coke pushing is staggered 24 hours between the odd numbered ovens and the even numbered ovens. As far as stack emissions are concerned, these ovens operate on a 24 hour cycle, with half the ovens being charged every 24 hours. In order to obtain an average emission rate, three stack test runs were performed during early, middle, and late portions of the cycle.

The ovens in the #3-C Coke Battery are served by a common afterburner tunnel and stack system. The exhaust from the 36 ovens is distributed among 4 stacks. Therefore, the exhaust gas flowrate through each stack represents the combined exhaust from 9 ovens.

4.0 PARTICULATE/SO_2 SAMPLING PROCEDURES

The location and number of particulate sample and velocity traverse points were determined as established in EPA Reference Method 1. Figure 2 schematically illustrates the locations of the test ports and the traverse points. The sampling time at each traverse point was 3 minutes. The gas volumetric flowrate was determined as established in EPA Reference Method 2. During each run, a sample was obtained by pumping stack gas into a Mylar® bag with a squeeze bulb. These samples were analyzed for CO_2 and O_2 with a Fyrite analyzer.

To determine the SO_2 emission rates, EPA Reference Methods 6C was used. A Western Research Model 721AT ultraviolet continuous SO_2 gas analyzer was employed. A gas sample was continually extracted from the center of the stack using a quartz probe and immediately cooled in a water cooled condenser to remove moisture as shown in Figure 3. The gas stream was then conveyed directly to the analyzer using Teflon tubing.

Gas standards for the SO_2 analyzer were National Bureau of Standards (NBS) traceable using EPA Protocol 1 calibration procedures. An analyzer calibration error check was performed prior to the testing. EPA Reference Method 6C specifications require that the upper, mid-range, and zero gases be within 2% of the span. This requirement was met.

Before and after each test run, a sampling system bias check was performed by removing the connector from the probe and introducing gas standards at the condenser inlet. The mid-range calibration gas, due to it's closer approximation of the effluent stream, and ambient air were used. The bias check is a comparison of instrument response to gases introduced directly into the analyzer with gases routed throughout the entire sampling system. The maximum allowable bias is 5% of span. After initial calibration, the analyzer was not adjusted during each run. The maximum allowable calibration drift is 3% of span. Calibration drift was determined by comparing the before and after bias check values. Both of these criteria were met. Note that the reported SO_2 values have been corrected for bias and calibration drift.

The particulate concentration, volume proportion of water vapor in the gas stream, and the percent isokinetic were determined from the EPA Method 5 (M5) train. The required minimum sample time of 60 minutes and the minimum sample volume of 30 cubic feet were met for all three tests. A water cooled probe was used due to the high stack temperatures (>1500 degrees Fahrenheit) along with a quartz nozzle. Note that the last 3 or 4 points on each velocity traverse could not be reached without overheating the water cooled probe. However, the effect of this should be negligible due to the flat velocity profile. A heated filter holder, which contained a pre-weighed quartz filter, was connected to the end of the probe. A silicone line was used to connect the filter holder to the impingers.

The sampling train was connected to the control box with a flexible umbilical cord. The control box consisted of a fiber vane rotary pump, a dry gas meter with inlet and outlet thermometers, dual inclined manometer, probe and filter oven temperature controllers, and a calibrated orifice to enable isokinetic sampling. An oil filled micro-manometer or electronic manometer was used to read velocity pressures < 0.25 in.w.c. The probe and filter temperatures were maintained above the water vapor dew point to prevent condensation. Leak checks were performed at the beginning and end of each test to be sure that no leakage occurred during testing. All leak checks were less than 0.02 cfm. Figure 4 is a schematic of the M5 sampling train.

At the conclusion of each test run, a clean-up was conducted on the sampling train. The clean-up procedures were as follows:

Probe Rinse - The nozzle, probe, and front half of the filter were brushed and rinsed with acetone into a polyethylene bottle.

Particulate Filter - The filter was removed from the filter holder, placed into a petri dish, and sealed.

The laboratory analysis procedures used for the M5 train were as follows:

Probe Rinse - Each probe rinse was placed into a pre-weighed beaker and evaporated to dryness at ambient conditions. The beaker was then placed into a desiccator for 24 hours and then weighed at intervals of 6 or more hours to a constant weight (to the nearest 0.1 mg).

Particulate Filter - Each particulate filter was placed in a desiccator and dried at ambient temperature for 24 hours. The filter was then weighed at intervals of 6 or more hours until a constant weight (to the nearest 0.1 mg) was determined. The weights of the probe wash and filter were combined to determine the particulate emissions.

Impingers - All impingers were weighed before and after each run to the nearest 0.1 gram to measure moisture gain.

Field and laboratory data sheets and copies of the SO_2 strip charts are included in the appendix of this report along with the calibration records of the equipment used.

TABLE 1

STACK TEST RESULTS SUMMARY[a]
48-HOUR COKING CYCLE
BATTERY #3-C (STACK #1)
JEWELL COAL AND COKE CO.
REGISTRATION NO. 10200
MARCH 19, 1991
IT PROJECT NO. 406253.06

Time in Cycle	Run #1 Middle	Run #2 Late	Run #3 Early	Average
Test Date	3/19/91	3/19/91	3/19/91	
Net Test Time (Min)	72	72	72	
Vol. Sampled at STP (FT^3)	33.8	30.2	39.9	34.7
Stack Gas Temp (F)	1,693	1,566	1,676	1,645
Moist. Content (% Vol)	13.4	11.1	14.9	13.1
CO_2 (% Vol - Dry Basis)	6.5	7.0	7.0	6.8
O_2 (% Vol - Dry Basis)	10.5	10.5	10.5	10.5
Stack Vel. (Ft/Min)	1,746	1,300	2,049	1,699
Gas Flow Rate (ACFM)[b]	87,671	65,311	102,921	85,301
Gas Flow Rate (DSCFM)[c]	18,005	14,627	20,952	17,861
%Isokinetic	96	106	97	100
Part. Con. (GR/DSCF)	0.0207	0.0154	0.0261	0.0207
Part. Mass Rate (Lbs/Hr)	3.2	1.9	4.7	3.3
SO_2 Conc. (ppm - Dry Basis)	427	389	401	406
SO_2 Mass Rate (Lbs/Hr)	76.7	56.7	83.8	72.4
Number of Ovens				9
Coking Rate (Tons/Hr)[d]	7.50	7.50	7.50	7.50
Part. Rate				
-Lbs/Hr/Oven	0.36	0.21	0.52	0.36
-Lbs/Ton Coal	0.43	0.26	0.63	0.44
SO_2 Rate				
-Lbs/Hr/Oven	8.5	6.3	9.3	8.0
-Lbs/Ton Coal	10.2	7.6	11.2	9.7

(a) Average charge per oven = 40 tons
(b) At stack temperature and pressure (wet basis)
(c) 68 degrees F, 29.92 in. Hg (dry basis)
(d) For 9 ovens below stack (total of 360 tons)

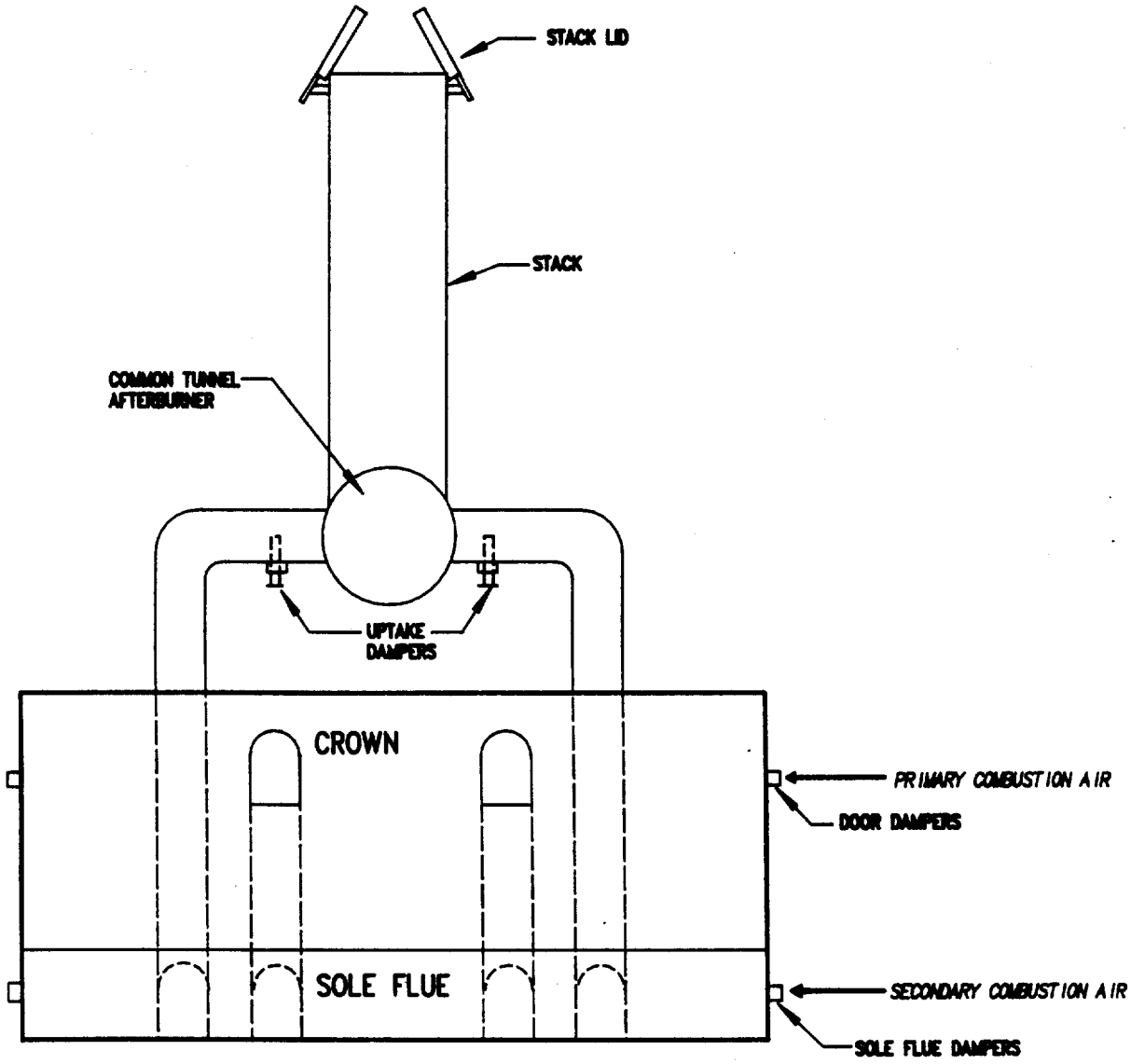
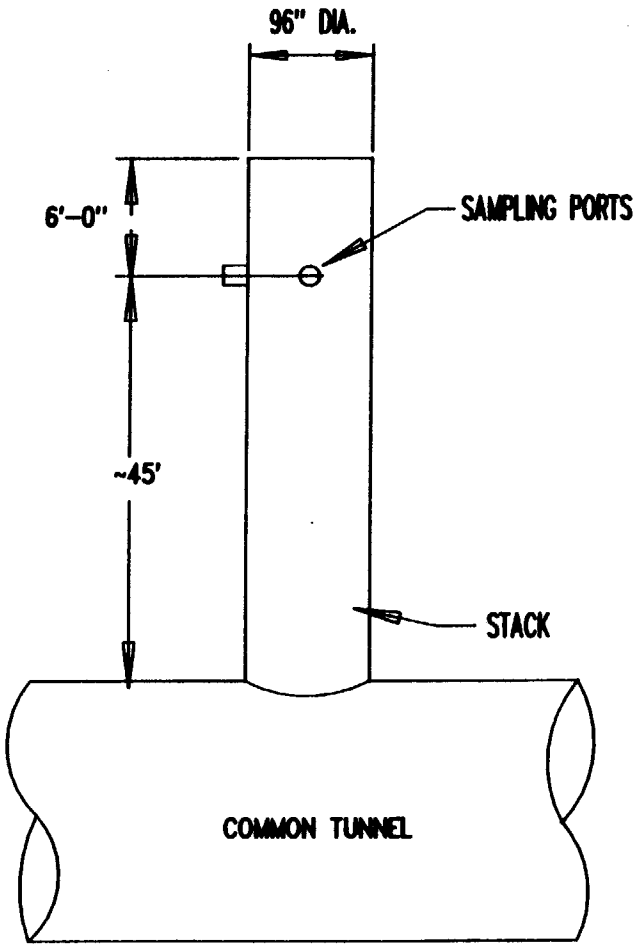
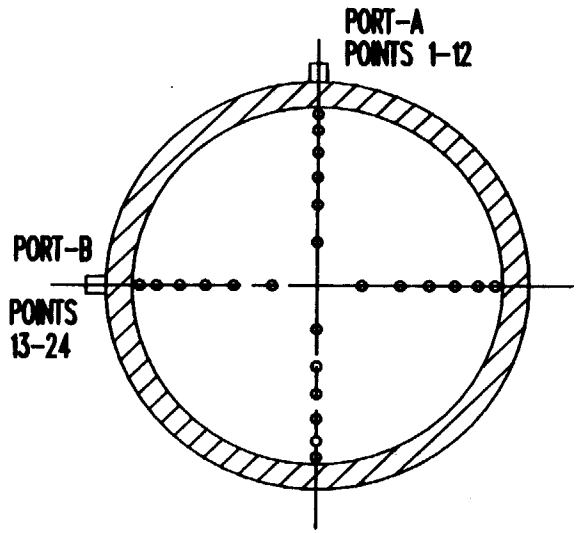


FIGURE 1.
JEWELL NON-RECOVERY COKE OVEN SCHEMATIC





CROSS SECTION

TRAVERSE POINT NO.	DISTANCE FROM WALL (inches)
1/13	2.01
2/14	6.43
3/15	11.33
4/16	17.00
5/17	24.00
6/18	34.08
7/19	61.92
8/20	72.00
9/21	79.00
10/22	84.67
11/23	89.57
12/24	93.98

FIGURE 2.
SCHEMATIC OF BATTERY 3-C STACK

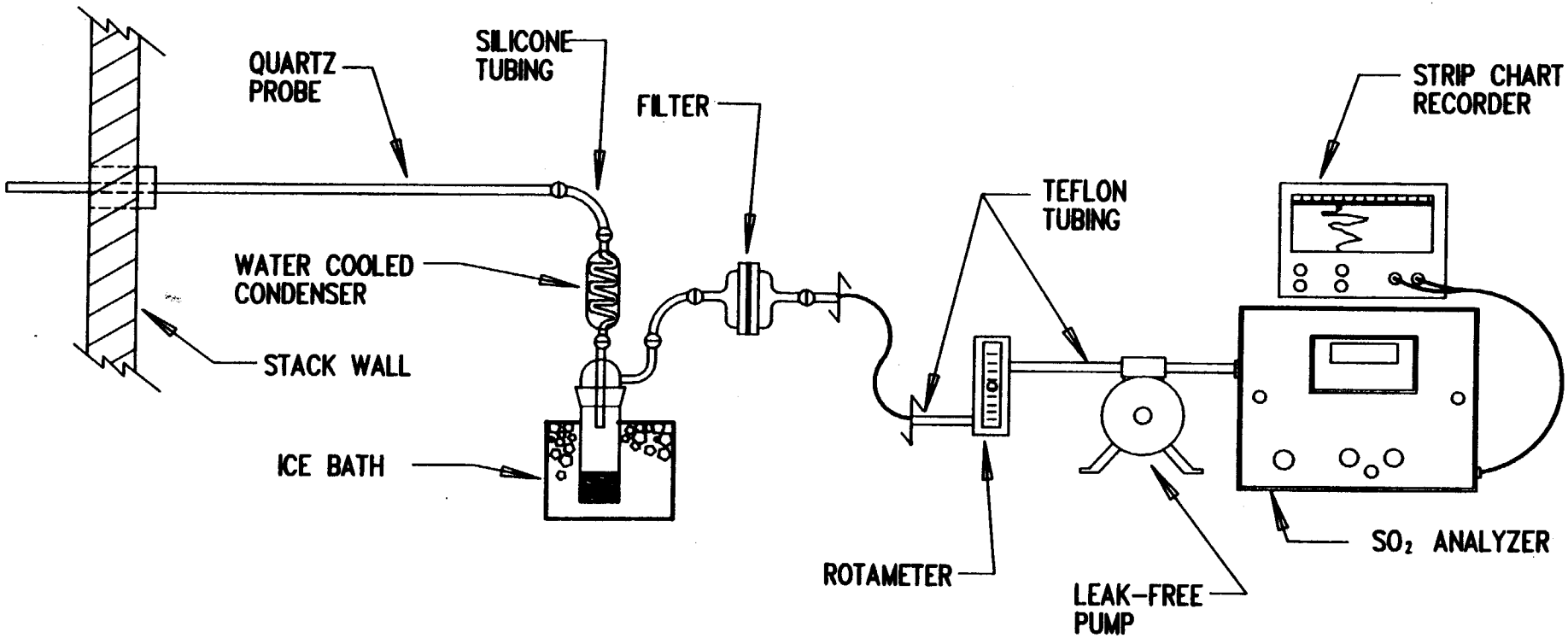


FIGURE 3.

SULFUR DIOXIDE SAMPLING SYSTEM

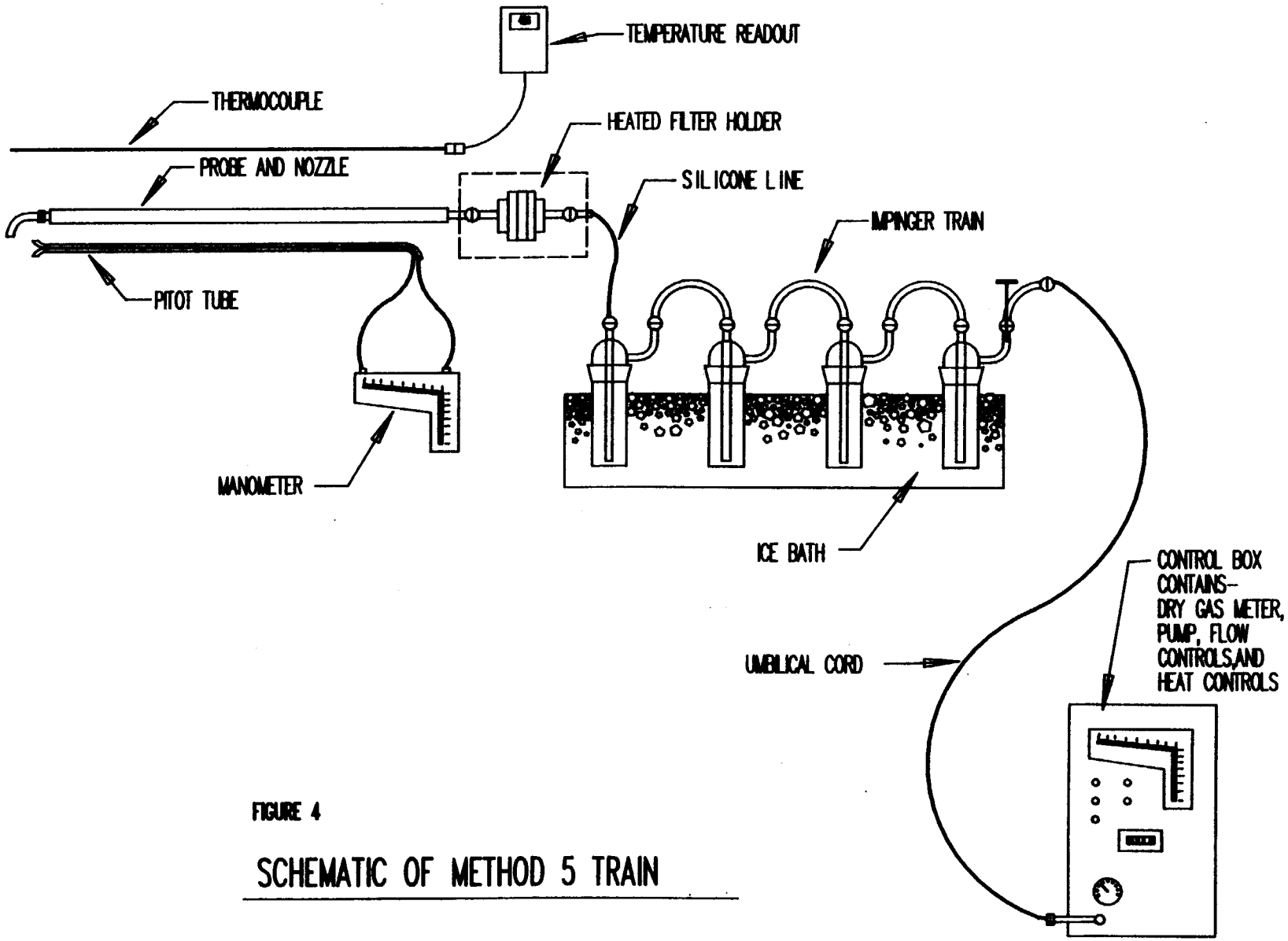


FIGURE 4

SCHEMATIC OF METHOD 5 TRAIN

APPENDIX A

OVEN CHARGE DATA AND VISIBLE EMISSIONS EVALUATION

Moisture = 12.0%
(ovens 2-8)

JEWELL COAL AND COKE COMPANY

Date: 3-19-91

Coke Plant - Battery 3-C

DAILY OPERATING SUMMARY

OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	TONS	OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	TONS
1					19				
2	5:54	5:56		40.0	20	7:00	7:02		38.
3					21				
4	6:01	6:03		40.0	22	7:08	7:10		38
5					23				
6	6:08	6:10		40.0	24	7:16	7:18		38
7					25				
8	6:16	6:18		40.0	26	7:24	7:26		38
9					27				
10	6:21	6:23		38.4	28	7:31	7:33		38
11					29				
12	6:29	6:31		38.4	30	7:40	7:42		38.
13					31				
14	6:37	6:39		38.4	32	7:49	7:51		38
15					33				
16	6:45	6:47		38.4	34	7:52	7:54.		38.
17					35				
18	6:53	6:55		38.4	36	8:07	8:09		38.

Remarks:

Moisture = 11.59%
(ovens 1-9)

JEWELL COAL AND COKE COMPANY

Date: 3-18-91

Coke Plant - Battery 3-C

DAILY OPERATING SUMMARY

OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	TONS	OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	TONS
1	6:15	6:17		40.0	19	7:23	7:25		38.
2					20				
3	6:25	6:27		40.0	21	7:30	7:32		38.
4					22				
5	6:31	6:33		40.0	23	7:36	7:38		38.
6					24				
7	6:38	6:40		40.0	25	7:45	7:47		38.
8					26				
9	6:45	6:47		40.0	27	7:53	7:55		38.
10					28				
11	6:51	6:53		38.4	29	8:00	8:02		38.4
12					30				
13	7:00	7:02		38.4	31	8:07	8:09		38.
14					32				
15	7:07	7:09		38.4	33	8:15	8:17		38.4
16					34				
17	7:15	7:17		38.4	35	8:23	8:25		38.4
18					36				

Remarks:

Moisture = 12.44%
(ovens 2-8)

JEWELL COAL AND COKE COMPANY

Date: 3-17-91

Coke Plant - Battery 3-C

DAILY OPERATING SUMMARY

OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	TONS	OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	TONS
1					19	7:20	7:22		38.4
2	5:54	5:56		40.0	20				
3					21	7:26	7:28		38.4
4	6:12	6:14		40.0	22				
5					23	7:30	7:32		38.
6	6:21	6:23		40.0	24				
7					25	7:38	7:40		38.4
8	6:29	6:31		40.0	26				
9					27	7:43	7:45		38.
10	6:38	6:40		38.4	28				
11					29	7:50	7:52		38
12	6:46	6:48		38.4	30				
13					31	7:57	7:59		38.
14	6:54	6:56		38.4	32				
15					33	8:04	8:06		38.
16	7:06	7:08		38.4	34				
17					35	8:11	8:13		38.
18	7:14	7:16		38.4	36				

Remarks:

VIRGINIA STATE AIR POLLUTION CONTROL BOARD
VISIBLE EMISSION EVALUATION RECORD

VEE #1

DATE March 19 1991

COMPANY Jewell Coal + Coke

REGISTRATION NO. 10200

LOCATION Vansant, Va. Jct. Rt 460 + 638

EMISSION POINT NAME Coke oven stack (3c) #1

HEIGHT TO DISCHARGE POINT ~70 ft stack

OBSERVER Don Hiet

CERTIFICATION EXPIRATION DATE 4-30-91

CLOCK TIME: INITIAL 8 : 10 A.M. FINAL 9 : 10 A.M.

VISIBLE EMISSION READINGS

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
9	0	0	0	0	0			
	1	0	0	0	0			
	2	0	0	0	0			
	3	0	0	0	0			
	4	0	0	0	0			
	5	0	0	0	0			
	6	0	0	0	0			
	7	0	0	0	0			
	8	0	0	0	0			
9	9	0	0	0	0			
8	10	0	0	0	0			
	11	0	0	0	0			
	12	0	0	0	0			
	13	0	0	0	0			
	14	0	0	0	0			
	15	0	0	0	0			
	16	0	0	0	0			
	17	0	0	0	0			
	18	0	0	0	0			
	19	0	0	0	0			
	20	0	0	0	0			
	21	0	0	0	0			
	22	0	0	0	0			
	23	0	0	0	0			
	24	0	0	0	0			
	25	0	0	0	0			
	26	0	0	0	0			
	27	0	0	0	0			
	28	0	0	0	0			
8	29	0	0	0	0			

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
8	30	0	0	0	0			
	31	0	0	0	0			
	32	0	0	0	0			
	33	0	0	0	0			
	34	0	0	0	0			
	35	0	0	0	0			
	36	0	0	0	0			
	37	0	0	0	0			
	38	0	0	0	0			
	39	0	0	0	0			
	40	0	0	0	0			
	41	0	0	0	0			
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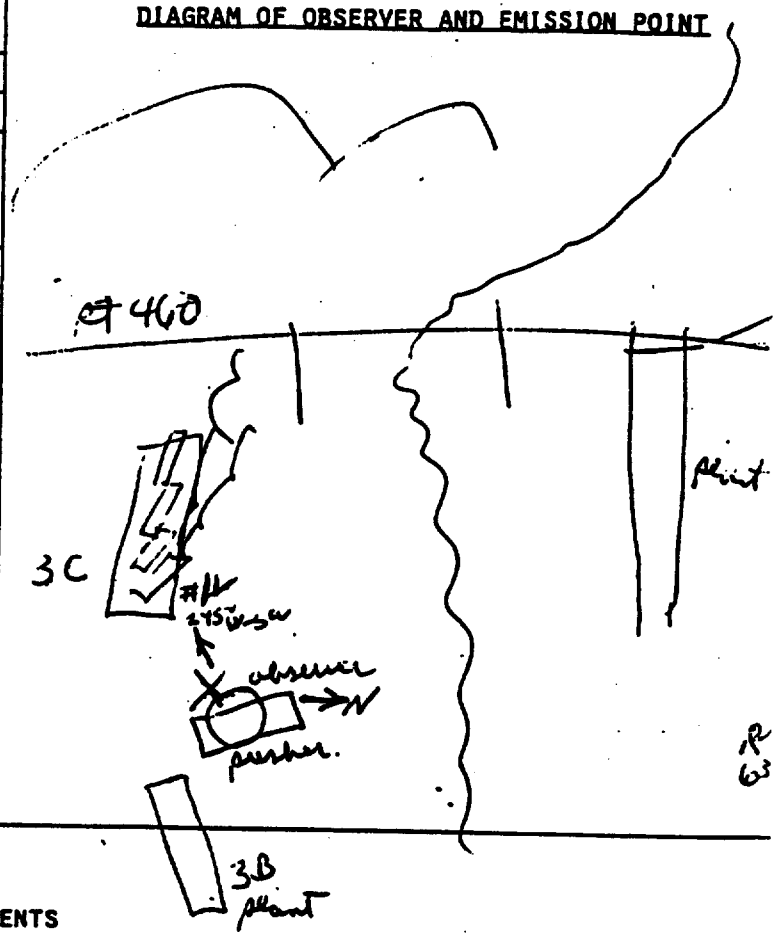
	53	0	0	0	0			
	54	0	0	0	0			
	55	0	0	0	0			
	56	0	0	0	0			
	57	0	0	0	0			
	58	0	0	0	0			
9	59	0	0	0	0			

RECEIVED
MAR 19 1991
Department of Air Pollution Control
Region I Office

	INITIAL	FINAL
OBSERVER LOCATION		
DISTANCE TO DISCHARGE	~200 feet	same
DIRECTION TO DISCHARGE	245° W-SW	"
HEIGHT OF OBSERVATION POINT	20 ft high	"
BACKGROUND DESCRIPTION	on pusher	"
	tree tops	"
	then sky	"
WEATHER CONDITIONS		
WIND DIRECTION	variable calm	"
WIND SPEED	0-3 MPH	"
AMBIENT TEMPERATURE	40°F	"
SKY CONDITIONS		
	cloudy	mostly cloudy
PLUME DESCRIPTION		
COLOR	—	same
DISTANCE VISIBLE	—	"

DIAGRAM OF OBSERVER AND EMISSION POINT



COMMENTS

Run #1

Gerald E. Hiet 3-19-91

OBSERVER SIGNATURE

VIRGINIA STATE AIR POLLUTION CONTROL BOARD
VISIBLE EMISSION EVALUATION RECORD

VEE #2

DATE March 19, 1991

COMPANY Jewell Coal and Coke

REGISTRATION NO. 10200

LOCATION Vansant, Va. Jct Rt 460 + 638

EMISSION POINT NAME Coke oven stack (3c) #1

HEIGHT TO DISCHARGE POINT ~70 ft sto

OBSERVER Don Hiet

CERTIFICATION EXPIRATION DATE 4-30-9

CLOCK TIME: INITIAL 9 : 10 A.M./~~P.M.~~ FINAL 10 : 10 A.M./~~P.M.~~

VISIBLE EMISSION READINGS

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
10	0	0	0	0	0			
	1	0	0	0	0			
	2	0	0	0	0			
	3	0	0	0	0			
	4	0	0	0	0			
	5	0	0	0	0			
	6	0	0	0	0			
	7	0	0	0	0			
	8	0	0	0	0			
10	9	0	0	0	0			
9	10	0	0	0	0			
	11	0	0	0	0			
	12	0	0	0	0			
	13	0	0	0	0			
	14	0	0	0	0			
	15	0	0	0	0			
	16	0	0	0	0			
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	23	0	0	0	0			
	24	0	0	0	0			
	25	0	0	0	0			
	26	0	0	0	0			
	27	0	0	0	0			
	28	0	0	0	0			
9	29	0	0	0	0			

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
9	30	0	0	0	0			
	31	0	0	0	0			
	32	0	0	0	0			
	33	0	0	0	0			
	34	0	0	0	0			
	35	0	0	0	0			
	36	0	0	0	0			
	37	0	0	0	0			
	38	0	0	0	0			
	39	0	0	0	0			
	40	0	0	0	0			
	41	0	0	0	0			
	42	0	0	0	0			
	43	0	0	0	0			
	44	0	0	0	0			
	45	0	0	0	0			
	46	0	0	0	0			
	47	0	0	0	0			
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	55	0	0	0	0			
	56	0	0	0	0			
	57	0	0	0	0			
	58	0	0	0	0			
	59	0	0	0	0			

	INITIAL	FINAL
OBSERVER LOCATION		
DISTANCE TO DISCHARGE		
DIRECTION TO DISCHARGE		
HEIGHT OF OBSERVATION POINT		
BACKGROUND DESCRIPTION		
WEATHER CONDITIONS		
WIND DIRECTION		
WIND SPEED		
AMBIENT TEMPERATURE		
SKY CONDITIONS		
	Partly	
	Cloudy	
PLUME DESCRIPTION		
COLOR		
DISTANCE VISIBLE		

DIAGRAM OF OBSERVER AND EMISSION POINT

Same as VEE #1

COMMENTS

Run #1 9:10 Am Start

Donald E. Hiet 3-19-91

OBSERVER SIGNATURE

VIRGINIA STATE AIR POLLUTION CONTROL BOARD
VISIBLE EMISSION EVALUATION RECORD

VEE #3

DATE March 19, 1991

COMPANY Jewell Coal + Coke REGISTRATION NO. 10200

LOCATION Vansant, Va. Jct. 460 + 638

EMISSION POINT NAME Coke oven stack (3c) #1 HEIGHT TO DISCHARGE POINT ~70 ft. St.

OBSERVER Don Hart CERTIFICATION EXPIRATION DATE 4-30-91

CLOCK TIME: INITIAL 10 : 10 A.M./~~P.M.~~ FINAL 11 : 10 A.M./~~P.M.~~

VISIBLE EMISSION READINGS

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
11	0	0	0	0	0			
	1	0	0	0	0			
	2	0	0	0	0			
	3	0	0	0	0			
	4	0	0	0	0			
	5	0	0	0	0			
	6	0	0	0	0			
	7	0	0	0	0			
	8	0	0	0	0			
11	9	0	0	0	0			
10	10	0	0	0	0			
	11	0	0	0	0			
	12	0	0	0	0			
	13	0	0	0	0			
	14	0	0	0	0			
	15	0	0	0	0			
	16	0	0	0	0			
	17	0	0	0	0			
	18	0	0	0	0			
	19	0	0	0	0			
	20	0	0	0	0			
	21	0	0	0	0			
	22	0	0	0	0			
	23	0	0	0	0			
	24	0	0	0	0			
	25	0	0	0	0			
	26	0	0	0	0			
	27	0	0	0	0			
	28	0	0	0	0			

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
10	30	0	0	0	0			
	31	0	0	0	0			
	32	0	0	0	0			
	33	0	0	0	0			
	34	0	0	0	0			
	35	0	0	0	0			
	36	0	0	0	0			
	37	0	0	0	0			
	38	0	0	0	0			
	39	0	0	0	0			
	40	0	0	0	0			
	41	0	0	0	0			
	42	0	0	0	0			
	43	0	0	0	0			
	44	0	0	0	0			
	45	0	0	0	0			
	46	0	0	0	0			
	47	0	0	0	0			
	48	0	0	0	0			
	49	0	0	0	0			
	50	0	0	0	0			
	51	0	0	0	0			
	52	0	0	0	0			
	53	0	0	0	0			
	54	0	0	0	0			
	55	0	0	0	0			
	56	0	0	0	0			
	57	0	0	0	0			
	58	0	0	0	0			

	INITIAL	FINAL
OBSERVER LOCATION		
DISTANCE TO DISCHARGE		
DIRECTION TO DISCHARGE		
HEIGHT OF OBSERVATION POINT		
BACKGROUND DESCRIPTION		
WEATHER CONDITIONS		
WIND DIRECTION		
WIND SPEED		
AMBIENT TEMPERATURE		
SKY CONDITIONS		
PLUME DESCRIPTION		
COLOR		
DISTANCE VISIBLE		

DIAGRAM OF OBSERVER AND EMISSION POINT

Same as VEE #1

COMMENTS

Run #1 940 am start

Donald E. Hilt 3-19-91

OBSERVER SIGNATURE

VIRGINIA STATE AIR POLLUTION CONTROL BOARD
VISIBLE EMISSION EVALUATION RECORD

VEE #4

DATE March 19, 1991

COMPANY Jewell Coal + Coke Co. REGISTRATION NO. 10200

LOCATION Vansant, Va. Jct. Rt 460 + 638

EMISSION POINT NAME Coke oven stack (3c) #1 HEIGHT TO DISCHARGE POINT ~70 ft Sto

OBSERVER Don Hilt CERTIFICATION EXPIRATION DATE 4-30-91

CLOCK TIME: INITIAL 3 : 05 ~~A.M.~~/P.M. FINAL 4 : 05 ~~A.M.~~/P.M.

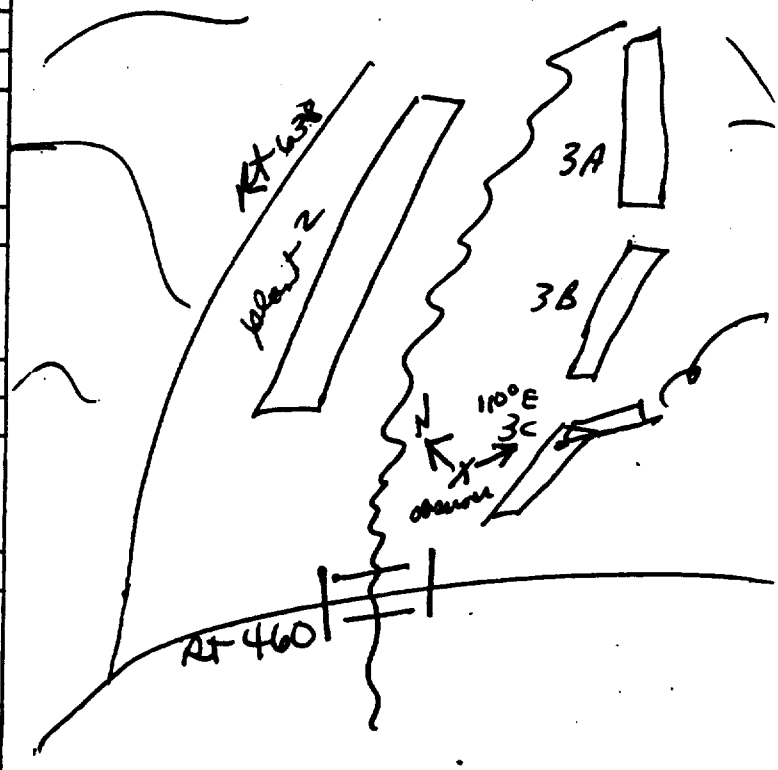
VISIBLE EMISSION READINGS

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
4	0	0	0	0	0			
	1	0	0	0	0			
	2	0	0	0	0			
	3	0	0	0	0			
4	4	0	0	0	0			
3	5	0	0	0	0			
	6	0	0	0	0			
	7	0	0	0	0			
	8	0	0	0	0			
	9	0	0	0	0			
	10	0	0	0	0			
	11	0	0	0	0			
	12	0	0	0	0			
	13	0	0	0	0			
	14	0	0	0	0			
	15	0	0	0	0			
	16	0	0	0	0			
	17	0	0	0	0			
	18	0	0	0	0			
	19	0	0	0	0			
	20	0	0	0	0			
	21	0	0	0	0			
	22	0	0	0	0			
	23	0	0	0	0			
	24	0	0	0	0			
	25	0	0	0	0			
	26	0	0	0	0			
	27	0	0	0	0			
	28	0	0	0	0			
3	29	0	0	0	0			

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME CHECK IF APPLICABLE DET.	ATT.	COMMENT
3	30	0	0	0	0			
	31	0	0	0	0			
	32	0	0	0	0			
	33	0	0	0	0			
	34	0	0	0	0			
	35	0	0	0	0			
	36	0	0	0	0			
	37	0	0	0	0			
	38	0	0	0	0			
	39	0	0	0	0			
	40	0	0	0	0			
	41	0	0	0	0			
	42	0	0	0	0			
	43	0	0	0	0			
	44	0	0	0	0			
	45	0	0	0	0			
	46	0	0	0	0			
	47	0	0	0	0			
	48	0	0	0	0			
	49	0	0	0	0			
	50	0	0	0	0			
	51	0	0	0	0			
	52	0	0	0	0			
	53	0	0	0	0			
	54	0	0	0	0			
	55	0	0	0	0			
	56	0	0	0	0			
	57	0	0	0	0			
	58	0	0	0	0			
3	59	0	0	0	0			

	INITIAL	FINAL
OBSERVER LOCATION		
DISTANCE TO DISCHARGE	~200 ft	Same
DIRECTION TO DISCHARGE	110° East	"
HEIGHT OF OBSERVATION POINT	ground level	"
BACKGROUND DESCRIPTION		
	tree tops	"
	then sky	"
WEATHER CONDITIONS		
WIND DIRECTION	variable calm	"
WIND SPEED	0-3 mph	"
AMBIENT TEMPERATURE	45°F	"
SKY CONDITIONS		
	cloudy	mostly cloudy
PLUME DESCRIPTION		
COLOR	—	Same
DISTANCE VISIBLE	—	"

DIAGRAM OF OBSERVER AND EMISSION POINT



COMMENTS

Run #2

Jerrold Efferet 3-19-91

OBSERVER SIGNATURE

APPENDIX B

FIELD AND LABORATORY DATA AND CALCULATIONS

ITAQS STACK SAMPLING CALCULATIONS
COMPUTER RUN DATE - 4-19-91
RUN BY - M. BLAKE SHIRLEY
PROJECT NAME - JEWELL COAL AND COKE
PROJECT NUMBER - 406253.06

SOURCE - 3-C
ANALYSIS -PARTICULATE
TEST DATE - 3-19-91

	TEST 1	TEST 2	TEST 3	AVERAGE
NET TEST TIME (MIN)	72.00	72.00	72.00	
VOL. SAMPLED AT STP FT3	33.8	30.2	39.9	34.7
STACK GAS TEMP (F)	1,693	1,566	1,676	1,645
MOIST. CONTENT (%VOL)	13.4	11.1	14.9	13.1
CO2 (%VOL - DRY BASIS)	6.5	7.0	7.0	6.8
O2 (%VOL - DRY BASIS)	10.5	10.5	10.5	10.5
CO (%VOL-DRY BASIS)	0.0	0.0	0.0	0.0
STACK VEL. (FT/MIN)	1,746	1,300	2,049	1,699
GAS FLOW RATE (ACFM)	87,671	65,311	102,921	85,301
GAS FLOW RATE (DSCFM)	18,005	14,627	20,952	17,861
%ISOKINETIC	96	106	97	100
PART. CON. (GR/DSCF)	0.0207	0.0154	0.0261	0.0207
PART. MASS RATE-LBS/HR	3.2	1.9	4.7	3.3

PARAMETER SHEET

JEWELL COAL AND COKE

PARAMETER	TEST 1	TEST 2	TEST 3
H	0.8040	0.5430	1.0800
P	0.2486	0.1920	0.2925
PB	28.9500	28.9300	28.9500
PS	28.9419	28.9219	28.9419
TM	529.1200	524.2901	532.7000
TSR	2,152.7000	2,025.6000	2,135.6000
VM	36.4400	32.2900	43.2400
VMSTD	33.8350	30.2170	39.9070
VLO	111.6000	80.3000	148.2000
VWSTD	5.2530	3.7797	6.9758
BWO	0.1344	0.1112	0.1488
MD	29.4600	29.5400	29.5400
MS	27.9199	28.2570	27.8229
VS	1,745.7450	1,300.4990	2,049.4120
QA	87,671.3400	65,311.0800	%102,921.5000
QSTD	18,005.1300	14,626.7100	20,951.8000
MN	0.0454	0.0302	0.0675
CS	0.0207	0.0154	0.0261

%IS	0.9613	1.0568	0.9743
AS	50.2200	50.2200	50.2200
CP	0.8400	0.8400	0.8400
E	72.0000	72.0000	72.0000
Y	0.9597	0.9597	0.9597
AN	0.001364	0.001364	0.001364
%CO2	6.5000	7.0000	7.0000
%O2	10.5000	10.5000	10.5000
PMR	3.1957	1.9337	4.6876

NOMECLATURE

AN - CROSS SECTIONAL AREA OF NOZZLE, SQ. FT.
AS - CROSS SECTIONAL AREA OF STACK, SQ. FT.
BWO - FRACTION BY VOLUME OF WATER VAPOR IN GAS STREAM.
CP - PITOT TUBE COEFFICIENT, DIMENSIONLESS.
CS - CONCENTRATION OF PARTICULATE MATTER IN STACK GAS, GR./DSCF.
H - AVERAGE PRESSURE DROP ACROSS THE ORIFICE, INCHES H2O.
P - AVERAGE SQ. ROOT VELOCITY HEAD OF STACK GAS, INCHES H2O.
IS - PERCENT OF ISOKINETIC SAMPLING .
MD - DRY MOLECULAR WEIGHT OF STACK GAS, LB/LB. MOLE.
MN - TOTAL AMOUNT OF PARTICULATE MATTER COLLECTED, G.
MS - MOLECULAR WEIGHT OF STACK GAS (WET BASIS), LB/LB. MOLE.
PB - BAROMETRIC PRESSURE, INCHES HG.
PS - ABSOLUTE STACK GAS PRESSURE, INCHES HG.
PMR - PARTICULATE MASS RATE, LBS/HR.
QA - VOLUMETRIC FLOW RATE, ACTUAL CONDITIONS FT3/MIN.
QSTD - VOLUMETRIC FLOW RATE AT STANDARD CONDITIONS, (DRY BASIS) FT3/MIN.
TM - AVERAGE DRY GAS METER TEMPERATURE, *R.
TSR - AVERAGE STACK TEMPERAATURE, *R.
E - TOTAL SAMPLING TIME, MIN.
VLO - TOTAL VOLUME OF LIQUID COLLECTED IN IMPINGERS AND SILICA GEL, ML.
VM - VOLUME OF GAS SAMPLE THROUGH THE DRY GAS METER (METER CONDITIONS), CUBIC FT.
VMSTD - VOLUME OF GAS SAMPLE THROUGH THE DRY GAS METER AT STANDARD CONDITONS FT3.
VWSTD - VOLUME OF WATER COLLECTED AT 29.92 IN. HG. AND 70* F CUBIC FT.
VS - STACK GAS VELOCITY, ACTUAL FT. PER MINUTE.
Y - DRY METER GAS CALIBRATION FACTOR.

COMPUTER RUN DATE -3-27-91
RUN BY -M. BLAKE SHIRLEY
PROJECT NAME -JEWELL COAL & COKE
PROJECT NUMBER -406253 .06
FIELD DATA TEST 1

TRAVERSE POINTS	VELOCITY HEAD (IN. W.C.)	ORIFICE METER (IN. W.C.)	GAS SAMPLE TEMP (DEG. F)		STACK TEMP (DEG. F)
1	0.08	1.00	60	56	%1700
2	0.04	0.51	70	60	%1750
3	0.07	0.90	72	60	%1750
4	0.06	0.78	74	60	%1750
5	0.03	0.38	78	62	%1750
6	0.08	1.00	78	60	%1750
7	0.09	1.15	80	62	%1725
8	0.11	1.40	80	62	%1725
9	0.11	1.40	80	62	%1700
10	0.06	0.78	80	62	%1675
11	0.06	0.78	78	62	%1675
12	0.09	1.15	80	64	%1680
13	0.05	0.62	68	60	%1660
14	0.06	0.78	72	64	%1670
15	0.07	0.90	74	65	%1675
16	0.05	0.65	76	64	%1670
17	0.06	0.78	80	64	%1675
18	0.05	0.62	80	64	%1660
19	0.05	0.62	80	64	%1660
20	0.05	0.62	80	64	%1660
21	0.05	0.62	80	64	%1670
22	0.05	0.62	80	64	%1675
23	0.05	0.62	80	64	%1670
24	0.05	0.62	80	64	%1660
TOTAL *	5.969	19.300	3337.000		40635.000
AVERAGE	0.249	0.804	69.521		1693.125

36.44 MDS 9-5-91

NET GAS SAMPLE VOLUME IS ~~35.09~~ (FT.CUBED).
* AVERAGE OF VELOCITY HEAD SQUARE ROOTS.

COMPUTER RUN DATE -3-27-91
RUN BY -M. BLAKE SHIRLEY
PROJECT NAME -JEWELL COAL & COKE
PROJECT NUMBER -406253 .06
FIELD DATA TEST 2

TRAVERSE POINTS	VELOCITY HEAD (IN. W.C.)	ORIFICE METER (IN. W.C.)	GAS SAMPLE TEMP (DEG. F)		STACK TEMP (DEG. F)
1	0.03	0.44	56	52	%1550
2	0.03	0.44	59	52	%1580
3	0.04	0.59	62	52	%1570
4	0.04	0.59	62	54	%1565
5	0.05	0.72	63	54	%1570
6	0.05	0.72	64	54	%1570
7	0.05	0.72	67	56	%1570
8	0.05	0.72	69	57	%1570
9	0.04	0.59	70	58	%1570
10	0.05	0.72	70	58	%1570
11	0.04	0.59	73	59	%1570
12	0.04	0.59	74	60	%1570
13	0.02	0.29	68	60	%1570
14	0.03	0.42	71	61	%1570
15	0.03	0.42	73	62	%1570
16	0.03	0.42	74	62	%1565
17	0.04	0.59	73	63	%1562
18	0.04	0.59	75	63	%1562
19	0.04	0.59	76	62	%1562
20	0.03	0.42	77	63	%1562
21	0.03	0.42	76	64	%1568
22	0.03	0.42	77	64	%1559
23	0.03	0.42	77	65	%1560
24	0.04	0.59	79	65	%1559
TOTAL *	4.618	13.020	3105.000		37594.000
AVERAGE	0.192	0.543	64.688		1566.417

32.29 mas 4-89

NET GAS SAMPLE VOLUME IS ~~30.89002~~ (FT.CUBED).
* AVERAGE OF VELOCITY HEAD SQUARE ROOTS.

COMPUTER RUN DATE -3-27-91
RUN BY -M. BLAKE SHIRLEY
PROJECT NAME -JEWELL COAL & COKE
PROJECT NUMBER -406253 .06
FIELD DATA TEST 3

TRAVERSE POINTS	VELOCITY HEAD (IN. W.C.)	ORIFICE METER (IN. W.C.)	GAS SAMPLE TEMP (DEG. F)		STACK TEMP (DEG. F)
1	[.06	0.76	60	58	%1698
2	[.08	1.00	60	57	%1679
3	[.07	0.89	65	57	%1675
4	[.08	1.00	71	57	%1674
5	[.10	1.25	72	58	%1677
6	[.11	1.39	77	59	%1678
7	[.10	1.25	80	60	%1681
8	[.10	1.25	84	60	%1680
9	[.09	1.12	85	61	%1680
10	[.09	1.12	87	63	%1681
11	[.10	1.25	88	63	%1680
12	[.10	1.25	90	65	%1684
13	[.05	0.62	78	64	%1660
14	[.07	0.89	85	68	%1671
15	[.08	1.00	86	69	%1671
16	[.07	0.89	89	70	%1672
17	[.09	1.12	90	70	%1672
18	[.10	1.25	90	70	%1674
19	[.11	1.40	90	70	%1670
20	[.09	1.12	90	70	%1676
21	[.08	1.00	85	70	%1670
22	[.08	1.00	83	70	%1671
23	[.09	1.12	85	70	%1677
24	[.08	1.00	88	70	%1677
TOTAL *	[.020	25.940	3507.000		40228.000
AVERAGE	[.293	1.081	73.063		1676.167

43.24 SC 4/8/91

NET GAS SAMPLE VOLUME IS ~~41.54999~~ (FT.CUBED).
* AVERAGE OF VELOCITY HEAD SQUARE ROOTS.

JEWELL COAL AND COKE - CALCULATIONS-TEST 1

VOLUME OF WATER COLLECTED

VWSTD = (VLO)(0.04707)
VWSTD = 111.6 * .0474
VWSTD = 5.253012

VOLUME OF GAS METERED, STANDARD CONDITIONS

VMSTD = ((528/29.92)(VM)(PB + H / 13.6)(Y)) / TM
VMSTD = (17.64706 * 36.44 * (28.95 + .804 / 13.6) * .9597) / 529.12
VMSTD = 33.83503

MOISTURE CONTENT

BWO = VWSTD / (VMSTD + VWSTD)
BWO = 5.253012 / 33.83503 + 5.253012
BWO = .1343893

MOLECULAR WEIGHT OF DRY GAS STREAM

MD = (0.44)(%CO2) + (.32)(%O2) + (0.28)(%CO + %N2)
MD = .44 * 6.5 + .32 * 10.5 + .28 *(0 + 83)
MD = 29.46

MOLECULAR WEIGHT OF STACK GAS

MS = MD(1 - BWO) + 18(BWO)
MS = 29.46 *(1 - .1343893) + 18 * .1343893
MS = 27.9199

VELOCITY OF STACK GAS

VS = 174 * CP * P * SQR (TS * (29.92 / PS) * (28.96 / MS))
VS = 174 * .84 * .2486 *SQR(2152.7 *(29.92 / 28.94191)*(28.96 / 27.9199))
VS = 1745.745

TOTAL FLOW OF STACK GAS

QA = AS * VS
QA = 50.22 * 1745.745
QA = 87671.34
QS = QA * (528 / TSR) * (PS / 29.92)
QS = 87671.34 * (528 / 2152.7)*(28.94191 / 29.92)
QS = 20800.5
QSTD = QS(1 - BWO)
QSTD = 20800.5 (1 - .1343893)
QSTD = 18005.13

TEST 1

PARTICULATE CONCENTRATION

CS = (15.43)(MN) / VMSTD
CS = (15.43 * .0454) / 33.83503
CS = 2.070405E-02

PARTICULATE MASS RATE

PMR = (MN)(QSTD)(60) / (VMSTD)(453.6)
PMR = (.0454 * 18005.13 * 60) / (33.83503 * 453.6)
PMR = 3.195685

PERCENT ISOKINETIC OF TEST

IS = VMSTD / (AN * E * VSSTD)
IS = 33.83503 / (1.363542E-03 * 72 * 358.5252)
IS = .9612713

JEWELL COAL AND COKE - CALCULATIONS-TEST 2

VOLUME OF WATER COLLECTED

VWSTD = (VLO)(0.04707)
VWSTD = 80.3 * .0474
VWSTD = 3.779721

VOLUME OF GAS METERED, STANDARD CONDITIONS

VMSTD = ((528/29.92)(VM)(PB + H / 13.6)(Y)) / TM
VMSTD = (17.64706 * 32.29 * (28.93 + .543 / 13.6) * .9597) / 524.2901
VMSTD = 30.21702

MOISTURE CONTENT

BWO = VWSTD / (VMSTD + VWSTD)
BWO = 3.779721 / 30.21702 + 3.779721
BWO = .1111789

MOLECULAR WEIGHT OF DRY GAS STREAM

MD = (0.44)(%CO2) + (.32)(%O2) + (0.28)(%CO + %N2)
MD = .44 * 7 + .32 * 10.5 + .28 *(0 + 82.5)
MD = 29.54

MOLECULAR WEIGHT OF STACK GAS

MS = MD(1 - BWO) + 18(BWO)
MS = 29.54 *(1 - .1111789) + 18 * .1111789
MS = 28.257

VELOCITY OF STACK GAS

VS = 174 * CP * P * SQR (TS * (29.92 / PS) * (28.96 / MS))
VS = 174 * .84 * .192 *SQR(2025.6 *(29.92 / 28.92191)*(28.96 / 28.257))
VS = 1300.499

TOTAL FLOW OF STACK GAS

QA = AS * VS
QA = 50.22 * 1300.499
QA = 65311.08
QS = QA * (528 / TSR) * (PS / 29.92)
QS = 65311.08 * (528 / 2025.6)*(28.92191 / 29.92)
QS = 16456.31
QSTD = QS(1 - BWO)
QSTD = 16456.31 (1 - .1111789)
QSTD = 14626.71

Test 2

PARTICULATE CONCENTRATION

CS = (15.43)(MN) / VMSTD
CS = (15.43 * .0302) / 30.21702
CS = 1.542131E-02

PARTICULATE MASS RATE

PMR = (MN)(QSTD)(60) / (VMSTD)(453.6)
PMR = (.0302 * 14626.71 * 60) / (30.21702 * 453.6)
PMR = 1.933661

PERCENT ISOKINETIC OF TEST

IS = VMSTD / (AN * E * VSSTD)
IS = 30.21702 / (1.363542E-03 * 72 * 291.2528)
IS = 1.056771

JEWELL COAL AND COKE - CALCULATIONS-TEST 3

VOLUME OF WATER COLLECTED

VWSTD = (VLO)(0.04707)
VWSTD = 148.2 * .0474
VWSTD = 6.975774

VOLUME OF GAS METERED, STANDARD CONDITIONS

VMSTD = ((528/29.92)(VM)(PB + H / 13.6)(Y)) / TM
VMSTD = (17.64706 * 43.24 * (28.95 + 1.08 / 13.6) * .9597) / 532.7
VMSTD = 39.907

MOISTURE CONTENT

BWO = VWSTD / (VMSTD + VWSTD)
BWO = 6.975774 / 39.907 + 6.975774
BWO = .1487919

MOLECULAR WEIGHT OF DRY GAS STREAM

MD = (0.44)(%CO2) + (.32)(%O2) + (0.28)(%CO + %N2)
MD = .44 * 7 + .32 * 10.5 + .28 *(0 + 82.5)
MD = 29.54

MOLECULAR WEIGHT OF STACK GAS

MS = MD(1 - BWO) + 18(BWO)
MS = 29.54 *(1 - .1487919) + 18 * .1487919
MS = 27.82294

VELOCITY OF STACK GAS

VS = 174 * CP * P * SQR (TS * (29.92 / PS) * (28.96 / MS))
VS = 174 * .84 * .2925 *SQR(2135.6 *(29.92 / 28.94191)*(28.96 / 27.82294))
VS = 2049.412

TOTAL FLOW OF STACK GAS

QA = AS * VS
QA = 50.22 * 2049.412
QA = 102921.5
QS = QA * (528 / TSR) * (PS / 29.92)
QS = 102921.5 * (528 / 2135.6)*(28.94191 / 29.92)
QS = 24614.19
QSTD = QS(1 - BWO)
QSTD = 24614.19 (1 - .1487919)
QSTD = 20951.8

Test 3

PARTICULATE CONCENTRATION

CS = (15.43)(MN) / VMSTD
CS = (15.43 * .0675) / 39.907
CS = 2.609881E-02

PARTICULATE MASS RATE

PMR = (MN)(QSTD)(60) / (VMSTD)(453.6)
PMR = (.0675 * 20951.8 * 60) / (39.907 * 453.6)
PMR = 4.68764

PERCENT ISOKINETIC OF TEST

IS = VMSTD / (AN * E * VSSTD)
IS = 39.907 / (1.363542E-03 * 72 * 417.2003)
IS = .9743243

STACK SAMPLING CALCULATIONS INPUT DATA

1. Project Name Jewell Coal & Coke
2. Source 3-C
3. Computer Run Date 3-27-91
4. Operators Name M. Blake Shirley
5. Date Test was Run 3-19-91
6. Project Number 406253 .06
7. Analysis Type Particulate
8. Test Number 1 no(1) no(2) no(3)
9. Volume of Liquid Collected (ml). 111.6 mL(1)
10. Volume of Meter (ft. cubed) 36.44
11. Barometric Pressure 28.95
12. Aver. Delta H (in. water - orifice meter) 0.804
13. Meter Calibration Factor .9597
14. Temp. of Meter, (degrees f)(Gas Sample Temp) 69.52 °F
15. % CO2 6.5
16. % O2 10.5
17. % CO 0
18. Pitot Calibration Factor .84
19. Average (SQR) Delta P (Velocity Head) 0.2486
20. Temp. of Stack, (Degrees F) 1693.1
21. Gage Stack Pressure (in. water) -.11
22. Stack Area (Sq. Ft.) 50.22
23. Particulate Collected (Grams) 0.0454
24. Nozzle Diameter (Inches) 0.5 "
25. Sampling Time (Min.) 72 minutes

STACK SAMPLING CALCULATIONS INPUT DATA

1. Project Name Sewell Coal & Coke
2. Source 3-C
3. Computer Run Date 3-27-91
4. Operators Name M. Blake Shirley
5. Date Test was Run 3-19-91
6. Project Number 406253.06
7. Analysis Type Particulate
8. Test Number 2 no(1) no(2) no(3)
9. Volume of Liquid Collected (ml). 80.3 ml(1)
10. Volume of Meter (ft. cubed) 32.29
11. Barometric Pressure 28.93
12. Aver. Delta H (in. water - orifice meter) ~~.56~~ .543
13. Meter Calibration Factor .9597
14. Temp. of Meter, (degrees f)(Gas Sample Temp) 64.69
15. % CO2 7.0
16. % O2 10.5
17. % CO 0
18. Pitot Calibration Factor .84
19. Average (SQR) Delta P (Velocity Head) 0.192
20. Temp. of Stack, (Degrees F) 1566
21. Gage Stack Pressure (in. water) -.11
22. Stack Area (Sq. Ft.) 50.22
23. Particulate Collected (Grams) 0.0302
24. Nozzle Diameter (Inches) .5
25. Sampling Time (Min.) 72

STACK SAMPLING CALCULATIONS INPUT DATA

1. Project Name Jewell Coal & Coke
2. Source 3-C
3. Computer Run Date 3-27-91
4. Operators Name M. Blake Shirley
5. Date Test was Run 3-19-91
6. Project Number 406253 .06
7. Analysis Type Particulate
8. Test Number 3 no(1) no(2) no(3)
9. Volume of Liquid Collected (ml). 148.2 mL(1)
10. Volume of Meter (ft. cubed) 43.24
11. Barometric Pressure 28.95
12. Aver. Delta H (in. water - orifice meter) 1.08
13. Meter Calibration Factor .9597
14. Temp. of Meter, (degrees f)(Gas Sample Temp) ~~74.8~~ 73.1 mass
15. % CO2 7.0
16. % O2 10.5
17. % CO 0
18. Pitot Calibration Factor .84
19. Average (SQR) Delta P (Velocity Head) .2925
20. Temp. of Stack, (Degrees F) 1676
21. Gage Stack Pressure (in. water) -.11
22. Stack Area (Sq. Ft.) 50.22
23. Particulate Collected (Grams) .0675
24. Nozzle Diameter (Inches) .5
25. Sampling Time (Min.) 72

INTERNATIONAL TECHNOLOGY CORPORATION

By ABS Date 5-9-91 Subject Sewell Coal & Coke Sheet No. 1 of 1
Chkd. By JC Date 5/9/91 Coal Coking Rates Proj. No. 906257.06

INTENT: Calculate Average 9 oven Coal Coking Rate

KNOWN:

Coal Charges	OVENS	DATE
40 tons/oven	2,4,6,8	3/17/91
40 tons/oven	1,3,5,7,9	3/18/91
40 tons/oven	2,4,6,8	3/19/91

ASSUME: All stack gases from OVENS 1-9 exhaust through stack #1 (48 hr cycle)

CALC:

Date Charged	Wet Tons	# OVENS	Coking Rate - Ovens Charged
3-17-91	40 tons/oven	4	(40 tons/oven * 4 ovens)/48 hrs = 3.33 tons/hr
3-18-91	40 tons/oven	5	(40 tons/oven * 5 ovens)/48 hr = 4.17 tons/hr
3-19-91	40 tons/oven	4	(40 tons/oven * 4 ovens)/48 hrs = 3.33 tons/hr

Coking RATE - 9 OVENS

3-17/3-18 = 3.33 tons/hr + 4.17 tons/hr = 7.5 tons/hr.

3-18/3-19 = 4.17 tons/hr + 3.33 tons/hr = 7.5 tons/hr

INTERNATIONAL TECHNOLOGY CORPORATION

By MBS Date 5-9-91 Subject Jewell Coal & Coke Sheet No. 1 of 1
Chkd. By [illegible] Date 5/9/91 Part. Mass Emission Rate Calc. Proj. No. 406253.06

INTENT: Calculate Particulate Mass Emission Rates

KNOWN:

TEST	Coking Rate	Mass Rate
1	7.5 tons/hr	3.20 lbs/hr
2	7.5 tons/hr	1.93 lbs/hr
3	7.5 tons/hr	4.69 lbs/hr

ASSUME 9 ovens per stack
36 ovens in battery 3-C
40 tons per oven charged (wet basis)

Calc:

lbs/hr/oven

Test 1 = 3.20 lbs/hr ÷ 9 = 0.36 lbs/hr/oven

Test 2 = 1.93 lbs/hr ÷ 9 = 0.21 lbs/hr/oven

Test 3 = 4.69 lbs/hr ÷ 9 = 0.52 lbs/hr/oven

lbs/ton COAL

Test 1 = 3.20 lbs/hr ÷ 7.5 tons coal/hr = 0.43 lbs/ton coal

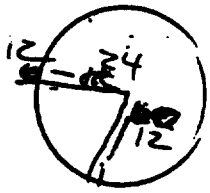
Test 2 = 1.93 lbs/hr ÷ 7.5 tons coal/hr = 0.26 lbs/ton coal

Test 3 = 4.69 lbs/hr ÷ 7.5 tons coal/hr = 0.63 lbs/ton coal

PROJECT NAME Jewell 3C Mid-Cycle

PROJECT NUMBER 406253

SCHEMATIC OF STACK



RUN NO. 1
DATE 3/19
FILTER NO. 7021
METER BOX NO. 2
SAMPLE BOX NO. 1
PROBE HEATER SETTING 75%
PERSONNEL JC, BS, TS, BC

BAROMETRIC PSR. 28.95
STATIC PSR. -.11
PROBE LENGTH 80 ft. 9½"
PROBE LINER SS
PORT LENGTH 14"
PORT DIAMETER 4"

ΔH@ - 1.87
γ = 0.985

TRAVERSE POINT NUMBER	SAMPLING TIME CLOCK	SAMPLE	VELOCITY HEAD Δ Ps	√Δ Ps	ORIFICE METER ΔH in. H2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft	GAS SAMPLE TEMP. AT DRY GAS METER INLET F	OUTLET F	SAMPLE BOX TEMP. F	TEMP. OF GAS IN LAST IMPINGER	STACK TEMP. F	PUMP VACUUM GAUGE in. Hg	Pitot Test
1	9:40	3	.08		1.0	1.0	311.09	60	56	[illegible]	50	1700	0	18
2		6	.04		.51	.51	313.00	70	60	255	50	1750	0	
3		9	.07		.90	.90	314.07	72	60	260	50	1750	0	
4		12	.06		.78	.78	315.63	74	60	260	50	1750	0	
5		15	.03		.38	.38	317.13	78	62	275	40	1750	0	20
6		18	.08		1.0	1.0	318.25	78	60	270	40	1750	1	
7		21	.09		1.15	1.15	320.00	80	62	270	40	1725	1	
8		24	.11		1.40	1.40	321.93	80	62	282	40	1725	3	20
9		27	.11		1.40	1.40	323.90	80	62	280	40	1700	3	
10		30	.06		.78	.78	325.80	80	62	265	40	1675	0	
11		33	.06		.78	.78	327.39	78	62	265	40	1675	0	21
12		36	.09		1.15	1.15	328.70	80	64	258	40	1640	3	
13		39	.05		.62	.62	330.72	68	60	260	45	1660	0	20
14		42	.06		.78	.78	332.16	72	64	265	40	1670	0	
15		45	.07		.90	.90	334.00	74	65	265	45	1675	0	20
16		48	.05		.68	.68	335.30	76	64	260	45	1670	0	
17		51	.06		.78	.78	336.57	80	64	270	45	1675	0	
18		54	.05		.62	.62	338.00	80	64	280	45	1660	0	21
19		57	.05		.62	.62	339.54	80	64	270	50	1660	0	
20		60	.05		.62	.62	340.83	80	64	270	50	1660	0	
21		63	.05		.62	.62	342.00	80	64	275	50	1670	0	
22		66	.05		.62	.62	343.40	80	64	275	50	1675	0	2
23		69	.05		.62	.62	344.85	80	64	270	50	1670	0	
24		72	.05		.62	.62	346.18	80	64	275	50	1660	0	2
	11:16			0.249	.804	.804	347.53	76.67	62.37			1693		

Mid stop: 10:16 restart: 10:40

Pitot check downstream

Stop 10:16 Start 10:40

Repeat Pitot check

STATIC PITOT LEAK-CHECK @ 15 SEC.	OK
IMPACT PITOT LEAK-CHECK @ 15 SEC.	OK
TRAIN LEAK RATE @60 SEC.	0 cfm 15 in.
TRAIN LEAK RATE @60 SEC.	0.007 cfm 5 in.

STACK GAS ANALYSIS			
CO2	O2	CO	N2

NOZZLE CALIBRATION I.D. NO.			
PRE-TEST		POST-TEST	
DIA. 1	.50	DIA. 1	.50
DIA. 2	.50	DIA. 2	.50
DIA. 3	.50	DIA. 3	.50
AVERAGE	.50	AVERAGE	.50

INTERNATIONAL TECHNOLOGY CORPORATION

SIGNATURE [signature]

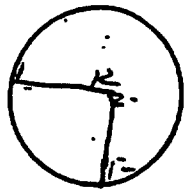
Late Cycle

ASSUME
70-
12%-
1550-
.50"-

PROJECT NAME Jewell 3C

PROJECT NUMBER 406253.06

SCHEMATIC OF STACK



RUN NO. 2

DATE 3/19

FILTER NO. 7002

METER BOX NO. 2

SAMPLE BOX NO. 2

PROBE HEATER SETTING 75%

PERSONNEL J-BS, TS, BG

BAROMETRIC PSR. 28.93

STATIC PSR. -.11

PROBE LENGTH 8'10"

PROBE LINER SS

PORT LENGTH 8'

PORT DIAMETER 4"

ΔH@ 1.87

γ = .985

TRAVERSE POINT NUMBER	SAMPLING TIME CLOCK	SAMPLE	VELOCITY HEAD ΔPs	√ΔPs	ORIFICE METER ΔH in. H2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft	GAS SAMPLE TEMP. AT DRY GAS METER INLET F	OUTLET F	SAMPLE BOX TEMP. F	TEMP. OF GAS IN LAST IMPINGER	STACK TEMP. F	PUMP VACUUM GAUGE in. Hg	Pt Te
1	~~2:55~~	0	0.03		0.44	0.44	348.71	56	52	255	50	1550	C	22
2	14:3	3	0.03		0.44	0.44	349.90	59	52	264	45	1560	C	
3		6	.04		.59	.59	351.10	62	52	268	44	1570	0	
4		9	.04		.59	.59	352.41	62	54	265	45	1565	0	
5		12	.05		.72	.72	353.87	63	54	255	42	1570	C	
6		15	.05		.72	.72	355.35	64	54	260	40	1570	0	21
7		18	.05		.72	.72	356.83	67	56	258	41	1570	C	
8		21	.05		.72	.72	358.30	69	57	260	43	1570	0	
9		24	.04		.59	.59	359.90	70	58	258	43	1570	0	
10		27	.05		.72	.72	361.32	70	58	255	44	1570	0	
11		30	.04		.59	.59	362.75	73	59	275	45	1570	0	21
12	15:0	33	.04		.59	.59	364.20	74	60	270	45	1570	0	
	~~3:46~~						365.61							
13	~~3:42~~	36	.02		.29	.29		68	60	272	45	1570	0	
14	15:1	39	.03		.42	.42	366.75	71	61	265	45	1570	0	
15		42	.03		.42	.42	368.00	73	62	270	45	1570	0	21
16		45	.03		.42	.42	369.15	74	62	268	45	1565	C	
17		48	.04		.59	.59	370.45	73	63	258	52	1562	C	
18		51	.04		.59	.59	371.86	75	63	258	50	1562	0	
19		54	.04		.59	.59	373.32	76	62	260	53 45	1562	0	
20		57	.03		.42	.42	374.55	77	63	260	45	1562	0	
21		60	.03		.42	.42	375.88	76	64	258	46	1568	0	
22		63	.03		.42	.42	377.09	77	64	259	45	1559	0	
23		66	.03		.42	.42	378.29	77	65	256	45	1560	0	
24	15:4	69	.04		.59	.59	379.60	79	65	258	45	1559	0	
	~~3:46~~	72			4.62	.549	381.00	70.21	59.17			1566		

Stack

Stack

STATIC PITOT LEAK-CHECK @ 15 SEC.	ok ✓ 0.192
IMPACT PITOT LEAK-CHECK @ 15 SEC.	ok ✓
TRAIN LEAK RATE @ 15 in.	.007 cfm
TRAIN LEAK RATE @ 6 in.	.006 cfm

STACK GAS ANALYSIS 37.29/43			
CO2	O2	CO	N2

NOZZLE CALIBRATION I.D. NO.			
PRE-TEST		POST-TEST	
DIA. 1	.50	DIA. 1	.50
DIA. 2	.50	DIA. 2	.50
DIA. 3	.50	DIA. 3	.50
AVERAGE	.50	AVERAGE	.50

INTERNATIONAL TECHNOLOGY CORPORATION

SIGNATURE [signature] DTA-VAOAPC

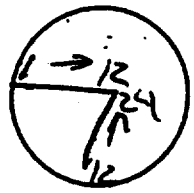
Early Cycle

assume 1700-stc 18% moi .5-MAC

PROJECT NAME Jewell SC

PROJECT NUMBER 406253.06

SCHEMATIC OF STACK



RUN NO. 3
DATE 3/19
FILTER NO. 7003
METER BOX NO. 2
SAMPLE BOX NO. 3
PROBE HEATER SETTING 75%
PERSONNEL JC, BS, TS, BG

BAROMETRIC PSR. 28.95
STATIC PSR. -.11
PROBE LENGTH 10'
PROBE LINER SS
PORT LENGTH 8'-96"
PORT DIAMETER 4"

ΔHe - 1.87
θ = .985

TRAVERSE POINT NUMBER	SAMPLING TIME CLOCK	SAMPLE	VELOCITY HEAD Δ Ps	√Δ Ps	ORIFICE METER ΔH in. H2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm) ft	GAS SAMPLE TEMP. AT DRY GAS METER INLET F	OUTLET F	SAMPLE BOX TEMP. F	TEMP. OF GAS IN LAST IMPINGER	STACK TEMP. F	PUMP VACUUM GAUGE in. Hg
1	2000	0	0.06		0.76	.76	381.5	60	58	265	45	1658	0
2		3	.08		1.0	1.0	383.00	60	57	279	45	1675	0
3		6	.07		.89	.89	384.75	65	57	278	45	1675	0
4		9	.08		1.0	1.0	386.40	71	57	271	45	1674	3
5		12	.10		1.25	1.25	388.25	72	58	270	47	1677	5
6		15	.11		1.39	1.39	390.30	77	59	274	48	1678	5
7		18	.10		1.25	1.25	393.43	80	60	274	46	1679	6
8		21	.10		1.25	1.25	394.20	84	60	276	47	1680	6
9		24	.09		1.12	1.12	395.93	85	61	277	47	1680	4
10		27	.09		1.12	1.12	398.30	87	63	276	48	1681	4
11		30	.10		1.25	1.25	399.75	88	63	276	45	1680	5
12		33	.10		1.25	1.25	401.88	90	65	268	45	1684	4
	2037						403.45						
13	2045	36	.05		.62	.62	403.45	78	64	242	44	1660	0
14		39	.07		.89	.89	404.50	85	68	242	45	1671	3
15		42	.08		1.0	1.0	406.68	86	69	247	48	1671	4
16		45	.07		.89	.89	408.90	89	70	250	41	1672	3
17		48	.09		1.12	1.12	410.00	90	70	283	40	1672	5
18		51	.10		1.25	1.25	411.70	90	70	284	40	1674	5
19		54	.11		1.40	1.40	413.52	90	70	281	41	1670	6
20		57	.09		1.12	1.12	415.60	90	70	280	40	1676	4
21		60	.08		1.0	1.0	417.68	85	70	278	41	1670	4
22		63	.08		1.0	1.0	419.80	83	70	268	41	1671	4
23		66	.09		1.12	1.12	421.10	85	70	266	42	1673	4
24		69	.08		1.0	1.0	423.05	88	70	265	42	1677	4
	2121	72	0.305		1.08		424.74	85.7	69.5			1676	

Steam

STATIC PITOT LEAK-CHECK @ 15 SEC.	OK
IMPACT PITOT LEAK-CHECK @ 15 SEC.	OK
TRAIN LEAK RATE @60 SEC. .01 cfm	16 in.
TRAIN LEAK RATE @60 SEC. .013 cfm	7 in.

STACK GAS ANALYSIS

CO2	O2	CO	N2

NOZZLE CALIBRATION I.D. NO.

PRE-TEST		POST-TEST	
DIA. 1	.50	DIA. 1	.50
DIA. 2	.50	DIA. 2	.50
DIA. 3	.50	DIA. 3	.50
AVERAGE	.50	AVERAGE	.50

INTERNATIONAL TECHNOLOGY CORPORATION

SIGNATURE Brian Lindsay

INTERNATIONAL
TECHNOLOGY
CORPORATION
AIR QUALITY SERVICES
KNOXVILLE, TENNESSEE

PARTICULATE TEST LAB DATA SHEET

PROJECT: Jewell Coal & Coke JOB NO.: 406253.06
SOURCE: 3-C DATE: 3-13-91
TRAIN I.D.: 1 TEST NO.: 1
COLLECTED BY: MBSHIRLEY CHKD. BY:

CONDENSATION

IMPINGER NO.	INITIAL VOL., ml/g	FINAL VOL., ml/g	NET GAIN, ml/g
1	590.7	697.9	107.2
2	591.2	592.3	1.1
3	477.6	478.0	0.4
4	671.2	674.1	2.9
5			
6			
7			
TOTAL			111.6

PARTICULATE

SAMPLE I.D. NO.	INITIAL WT., g	FINAL WT., g	NET WT., g
PROBE WASH	25.3364	25.3688	0.0324
REAGENT BLANK	25.1133	25.1158	0.0025
CORRECTED PROBE WASH*			0.0299
#1 FILTER	0.4541	0.4698	0.0157
#2 FILTER			
IMPINGERS			

*subtract reagent blank from probe wash

TOTAL PARTICULATED COLLECTED

PARTICULATE COLLECTED (excluding impinger catch)	0.0459 *
PARTICULATE COLLECTED (including impinger catch)	

QA PROBE WASH (as required)

SAMPLE I.D. NO.	INITIAL WT., g	FINAL WT., g	NET WT., g

COMMENTS: Filter Blank IW 0.4538 FW 0.4540 0.0002

* with Probe wash blank & Filter blank subtracted out

INTERNATIONAL TECHNOLOGY CORPORATION
AIR QUALITY SERVICES
KNOXVILLE, TENNESSEE

PARTICULATE TEST LAB DATA SHEET

PROJECT: Jewell Coal & Coke JOB NO.: 406253.06
SOURCE: 3-C DATE: 3-13-91
TRAIN I.D.: 2 TEST NO.: 2
COLLECTED BY: MB SMALEY CHKD. BY:

CONDENSATION

IMPINGER NO.	INITIAL VOL., ml/g	FINAL VOL., ml/g	NET GAIN, ml/g
1	558.7	633.3	74.6
2	580.5	589.9	1.4
3	460.3	461.0	0.7
4	696.5	700.1	3.6
5			
6			
7			
TOTAL			80.3

PARTICULATE

SAMPLE I.D. NO.	INITIAL WT., g	FINAL WT., g	NET WT., g
PROBE WASH	25.3578	25.3812	0.0234
REAGENT BLANK	25.1133	25.1158	0.0025
CORRECTED PROBE WASH*			0.0209
#1 FILTER	0.4580	0.4683	0.0095
#2 FILTER			
IMPINGERS			

*subtract reagent blank from probe wash

TOTAL PARTICULATED COLLECTED

PARTICULATE COLLECTED (excluding impinger catch)	0.0802 ‡
PARTICULATE COLLECTED (including impinger catch)	

QA PROBE WASH (as required)

SAMPLE I.D. NO.	INITIAL WT., g	FINAL WT., g	NET WT., g

COMMENTS: Filter Blank I.W. 0.4538 F.W. 0.4540 0.0002

‡ with Probe wash blank & Filter blank subtracted out

INTERNATIONAL TECHNOLOGY CORPORATION
AIR QUALITY SERVICES
KNOXVILLE, TENNESSEE

PARTICULATE TEST LAB DATA SHEET

PROJECT: Jewell Coal & Coke JOB NO.: 406253 .06
SOURCE: 3-C DATE: 3-13-91
TRAIN I.D.: 3 TEST NO.: 3
COLLECTED BY: MB SHIRLEY CHKD. BY:

CONDENSATION

IMPINGER NO.	INITIAL VOL., ml/g	FINAL VOL., ml/g	NET GAIN, ml/g
1	578.1	716.6	138.5
2	562.0	564.5	2.5
3	981.7	983.1	1.4
4	676.5	682.3	5.8
5			
6			
7			
TOTAL			148.2

PARTICULATE

SAMPLE I.D. NO.	INITIAL WT., g	FINAL WT., g	NET WT., g
PROBE WASH	25.3172	25.3792	0.062
REAGENT BLANK	25.1133	25.1158	0.0025
CORRECTED PROBE WASH*			0.0595
#1 FILTER	0.4598	0.4680	0.0082
#2 FILTER			
IMPINGERS			

*subtract reagent blank from probe wash

TOTAL PARTICULATED COLLECTED

PARTICULATE COLLECTED (excluding impinger catch)	0.0675 *
PARTICULATE COLLECTED (including impinger catch)	

QA PROBE WASH (as required)

SAMPLE I.D. NO.	INITIAL WT., g	FINAL WT., g	NET WT., g

COMMENTS: Filter Blank I ~ 0.4538 0.4540 mg F ~ 0.4540 0.0002

* With Probe Wash blank & Filter blank subtracted out

STACK GAS ANALYSIS FORM

PROJECT NAME Jewell Coal & Coke
PROJECT NO. 40625-3.06
DATE 3/19/21
PROCESS #3C Stack #1
ANALYTICAL METHOD Grab / Fyrite
ANALYZED BY JC

COMMENTS:

TEST NO.	BAG NO.	CO_2 %	O_2 %	CO %	N_2 %	DRY MOLECULAR WEIGHT g/g-mole	EXCESS AIR %
1		6.5	10.5				
~~3~~ 1		6.5	10.5				
2		7.0	10.5				
2		7.0	10.5				
3		6.0	10.5				
		7.0	10.5				

DRY MOLECULAR WEIGHT = 0.440(%CO2) + 0.320(%O2) + 0.280(%N2 + %CO)

PERCENT N2 = (%CO2 + %O2 + %CO) - 100%

$$\text{PERCENT EXCESS AIR} = \frac{\%O_2 - 0.5\%CO}{0.264\%N_2(\%O_2 - 0.5\%CO)} \times 100$$

INTERNATIONAL TECHNOLOGY CORPORATION

By MBS Date 3-28-91 Subject Jewell Coal & Coke SO_2 Conc. Sheet No. 1 of 2

Ckd. By JC Date 4/6/91 Proj. No. 906253.0

Intent: Calculate SO_2 Calculated Concentrations for 3 Runs at Jewell Coal & Coke

Reference: EPA Reference Method 6C

Summary: Average Data at two minute interval & Calculate concentration from the following equation:

$$C_{gas} = (\bar{C} - C_o)\frac{C_{ma}}{C_m - C_o}$$

Calc: Test 1

$$C_{gas} = (416 - (-2.5))\frac{553\,ppm}{540\,ppm - (-2.5)}$$

$$C_{gas} = 426.6 = 427$$

Test 2

$$C_{gas} = (391 - 2.5)\frac{553\,ppm}{555 - 2.5}$$

$$C_{gas} = 388.85 = 389$$

INTERNATIONAL TECHNOLOGY CORPORATION

By MAS Date 3-28-91 Subject Jewell Coal & Coke Sheet No. 2 of 2

Chkd. By JC Date 4/6/91 SO_2 Conc. Proj. No. 906253

TEST 3

$$C_{gas} = (400 - 2.5)\frac{553}{550 - 2.5}$$

$$C_{gas} = 401.49 = 401 \text{ ppm}$$

INTERNATIONAL TECHNOLOGY CORPORATION

By MAS Date 5-9-91 Subject Jewell Coal & Coke Sheet No. 1 of 2
Chkd. By JC Date 5/9/91 SO_2 Mass Emission Rate Calc. Proj. No. 401253.06

Intent: Calc. SO_2 Mass Emission Rate

Known:

Test No	Conc (ppm)	Flow (DSCFM)	Coking Rate (wet basis)
1	427	18,005	7.5
2	389	14,627	7.5
3	401	20,952	7.5

molecular wt SO_2 = 64 9 ovens per stack

$$lbs/ft^3 = ppm\left(\frac{MW}{385.1 \times 10^6}\right)$$

Calc:

lbs/hr

$$\text{Test 1} = \left[\left[427\left(\frac{64}{385.1\times10^6}\right)\right] * 18{,}005\right] * 60 \text{ minutes} = 76.7 \text{ lbs/hr}$$

$$\text{Test 2} = \left[\left[389\left(\frac{64}{385.1\times10^6}\right)\right] * 14{,}627\right] * 60 \text{ minutes} = 56.7 \text{ lbs/hr}$$

$$\text{Test 3} = \left[\left[401\left(\frac{64}{385.1\times10^6}\right)\right] * 20{,}952\right] * 60 \text{ minutes} = 83.8 \text{ lbs/hr}$$

Avg = 72.4 lbs/hr

lbs/hr/oven

Test 1 = 76.7 lbs/hr ÷ 9 = 8.5 lbs/hr/oven

Test 2 = 56.7 lbs/hr ÷ 9 = 6.3 lbs/hr/oven

Test 3 = 83.8 lbs/hr ÷ 9 = 9.3 lbs/hr/oven

INTERNATIONAL TECHNOLOGY CORPORATION

By MGS Date 5-9-91 Subject Jewell Coal & Coke Sheet No. 2 of 2

Chkd. By JC Date 5/9/91 SO_2 Mass Emission Rate Proj. No. 406257.06

Calculate lbs/ton/coal (wet basis)

Test 1 : 76.7 lbs/hr ÷ 7.5 ton coal/hr = 10.2 lbs/ton coal

Test 2 = 56.7 lbs/hr ÷ 7.5 ton coal/hr = 7.6 lbs/ton coal

Test 3 = 83.8 lbs/hr ÷ 7.5 ton coal/hr = 11.2 lbs/ton coal

Avg = 9.7 lbs/ton coal

CEM
ANALYZER CALIBRATION DATA

PROJECT NAME: Jewell #3 Tests

PERSONNEL: JC

PROJECT NUMBER: 406253.06

SOURCE ID: Battery #3C, Stack #1

DATE: 3/19/91

GAS MEASURED: SO_2

APPLICABLE EMISSION STANDARD: ~500 ppm

*SPAN TO BE USED: 1000 ppm

* - THIS IS ONLY APPLICABLE FOR INSTRUMENTS WITH MORE THAN ONE RANGE TO CHOOSE FROM. THE SPAN IS DEFINED AS THE UPPER LIMIT OF THE GAS CONCENTRATION MEASUREMENT RANGE. THE SPAN SHALL BE SELECTED SUCH THAT THE POLLUTANT GAS CONCENTRATION EQUIVALENT TO THE EMISSION STANDARD IS NOT LESS THAN 30% OF THE SPAN.

NBS Traceable

EPA PROTOCAL 1 CALIBRATION STANDARDS

	CYLINDER NUMBER	GAS CONCENTRATION (INDICATE UNITS)
ZERO GAS - LESS THAN 0.25% OF SPAN	Ambient Air	~ 0 ppm
MID-RANGE GAS - 50% TO 60% OF SPAN	AAL 9313 (Scott)	553 ppm
HIGH-RANGE GAS - 80% TO 90% OF SPAN	AAL 9232 (Scott)	844 ppm

ANALYZER CALIBRATION ERROR CHECK

THESE TESTS ARE TO BE PERFORMED BEFORE EACH TEST SERIES. THE GASES ARE INTRODUCED THREE TIMES EACH, ANYWHERE UPSTREAM OF THE ANALYZER. THE CHECK IS CONSIDERED INVALID IF THE GAS CONCENTRATION DISPLAYED BY THE ANALYZER EXCEEDS 2% OF THE SPAN FOR ANY OF THE CALIBRATION GASES.

	CYLINDER VALUE (INDICATE UNITS)	ANALYZER RESPONSE (INDICATE UNITS)	ABSOLUTE DIFF. (INDICATE UNITS)	DIFFERENCE (% OF SPAN)
ZERO GAS	0 ppm	0 ppm	0 ppm	0 %
MID-RANGE GAS	553 ppm	560 ppm	7 ppm	0.7%
High Range	844 ppm	850 ppm	6 ppm	0.6%

CEM
ANALYZER CALIBRATION DATA

PROJECT NAME: Jewell Coal & Coke

PERSONNEL: JC

PROJECT NUMBER: 406253 .06

SOURCE ID: Bailey 3C, stack 1

DATE: 3/19/91

GAS MEASURED: SO_2

SPAN: 1000 ppm

TEST 1

SYSTEM CALIBRATION BIAS & DRIFT DATA

THESE CHECKS ARE TO BE PERFORMED BEFORE AND AFTER EACH TEST IS PERFORMED ON THE SOURCE. THE GASES ARE TO BE INTRODUCED AT THE PROBE INLET.

		INITIAL VALUES		FINAL VALUES		
	ANALYZER RESPONSE (INDICATE UNITS)	SYSTEM RESPONSE (INDICATE UNITS)	SYSTEM BIAS (% OF SPAN)	SYSTEM RESPONSE (INDICATE UNITS)	SYSTEM BIAS (% OF SPAN)	DRIFT (% OF SPAN)
ZERO GAS	0	5	0.5%	-10	1.0%	1.5%
UPSCALE GAS *	560	550	1.0%	530	3.0%	2.0%

* - WHICHEVER GAS MOST CLOSELY APPROXIMATES THE EFFLUENT CONCENTRATION

$$\text{SYSTEM CALIBRATION BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL SYSTEM CAL. RESPONSE}}{\text{SPAN}} \times 100$$

THE BIAS CHECK SHALL BE CONSIDERED INVALID IF IT EXCEEDS 5% FOR EITHER THE UPSCALE OR ZERO GAS.

THE DRIFT SHALL NOT EXCEED 3% OF THE SPAN FOR THE ZERO OR UPSCALE GAS.

CEM
ANALYZER CALIBRATION DATA

PROJECT NAME: Sewell Coal & Coke

PERSONNEL: SC

PROJECT NUMBER: 406253 .06

SOURCE ID: Battery 3C, stack 1

DATE: 3-19-91

GAS MEASURED: SO_2

SPAN: 1000 ppm

Test 2

SYSTEM CALIBRATION BIAS & DRIFT DATA

THESE CHECKS ARE TO BE PERFORMED BEFORE AND AFTER EACH TEST IS PERFORMED ON THE SOURCE. THE GASES ARE TO BE INTRODUCED AT THE PROBE INLET.

	INITIAL VALUES			FINAL VALUES		
	ANALYZER RESPONSE (INDICATE UNITS)	SYSTEM RESPONSE (INDICATE UNITS)	SYSTEM BIAS (% OF SPAN)	SYSTEM RESPONSE (INDICATE UNITS)	SYSTEM BIAS (% OF SPAN)	DRIFT (% OF SPAN)
ZERO GAS	0	0	0	5	0.5 %	0.5 %
UPSCALE GAS *	560	550	1.0%	560	0.0 %	1.0 %

* - WHICHEVER GAS MOST CLOSELY APPROXIMATES THE EFFLUENT CONCENTRATION

$$\text{SYSTEM CALIBRATION BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL SYSTEM CAL. RESPONSE}}{\text{SPAN}} \times 100$$

THE BIAS CHECK SHALL BE CONSIDERED INVALID IF IT EXCEEDS 5% FOR EITHER THE UPSCALE OR ZERO GAS.

THE DRIFT SHALL NOT EXCEED 3% OF THE SPAN FOR THE ZERO OR UPSCALE GAS.

CEM
ANALYZER CALIBRATION DATA

PROJECT NAME: Jewell Coal & Coke

PERSONNEL: JC

PROJECT NUMBER: 406253.06

SOURCE ID: Battery 3C, Stack 1

DATE: 3-19-91

GAS MEASURED: SO_2

SPAN: 1000 ppm

Test 3

SYSTEM CALIBRATION BIAS & DRIFT DATA

THESE CHECKS ARE TO BE PERFORMED BEFORE AND AFTER EACH TEST IS PERFORMED ON THE SOURCE. THE GASES ARE TO BE INTRODUCED AT THE PROBE INLET.

	INITIAL VALUES			FINAL VALUES		
	ANALYZER RESPONSE (INDICATE UNITS)	SYSTEM RESPONSE (INDICATE UNITS)	SYSTEM BIAS (% OF SPAN)	SYSTEM RESPONSE (INDICATE UNITS)	SYSTEM BIAS (% OF SPAN)	DRIFT (% OF SPAN)
ZERO GAS	0	0	0.0%	5	0.5%	0.5%
UPSCALE GAS *	560	545	1.5%	555	0.5%	~~0.5%~~ 1.0% 4/3/91

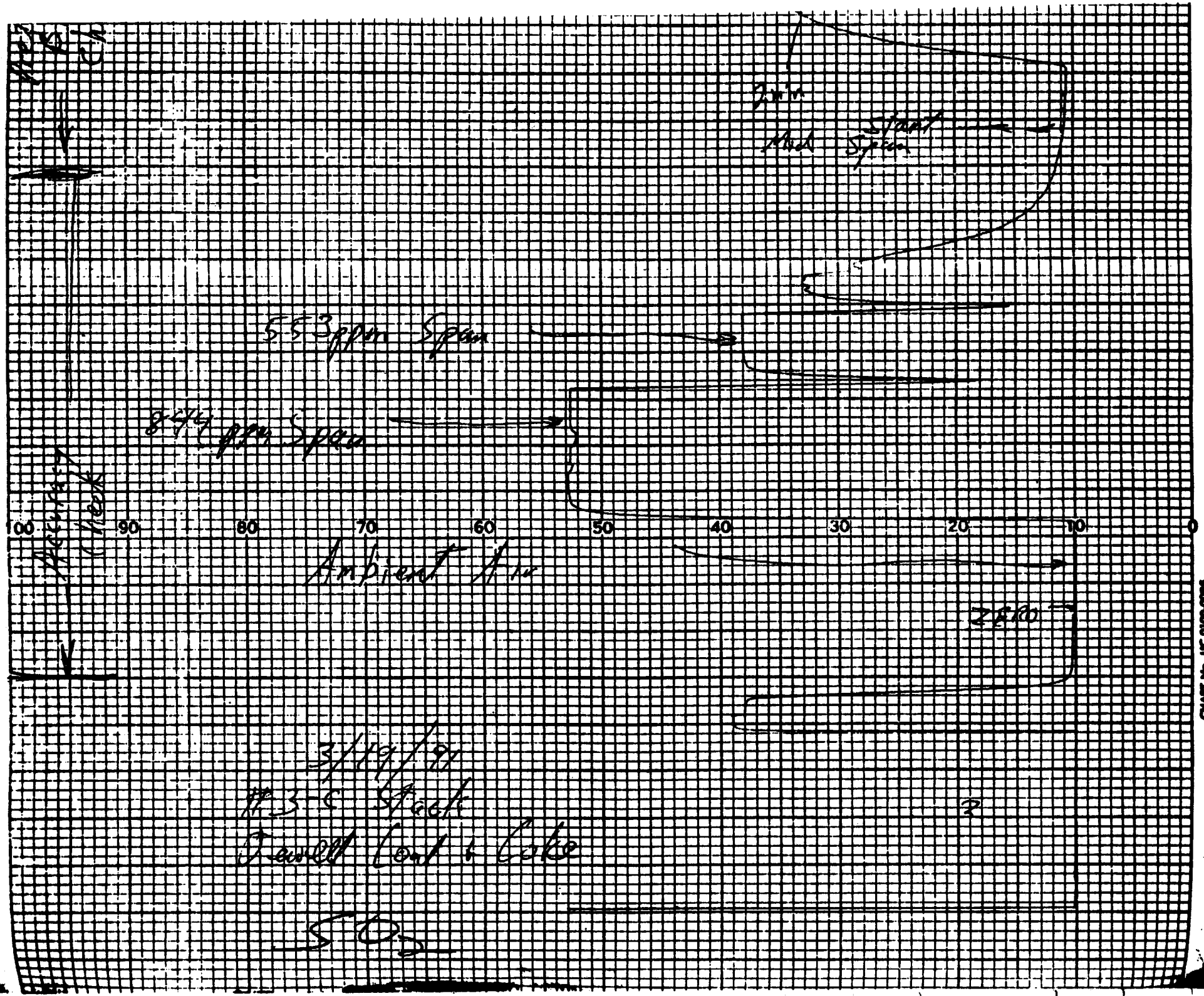
* - WHICHEVER GAS MOST CLOSELY APPROXIMATES THE EFFLUENT CONCENTRATION

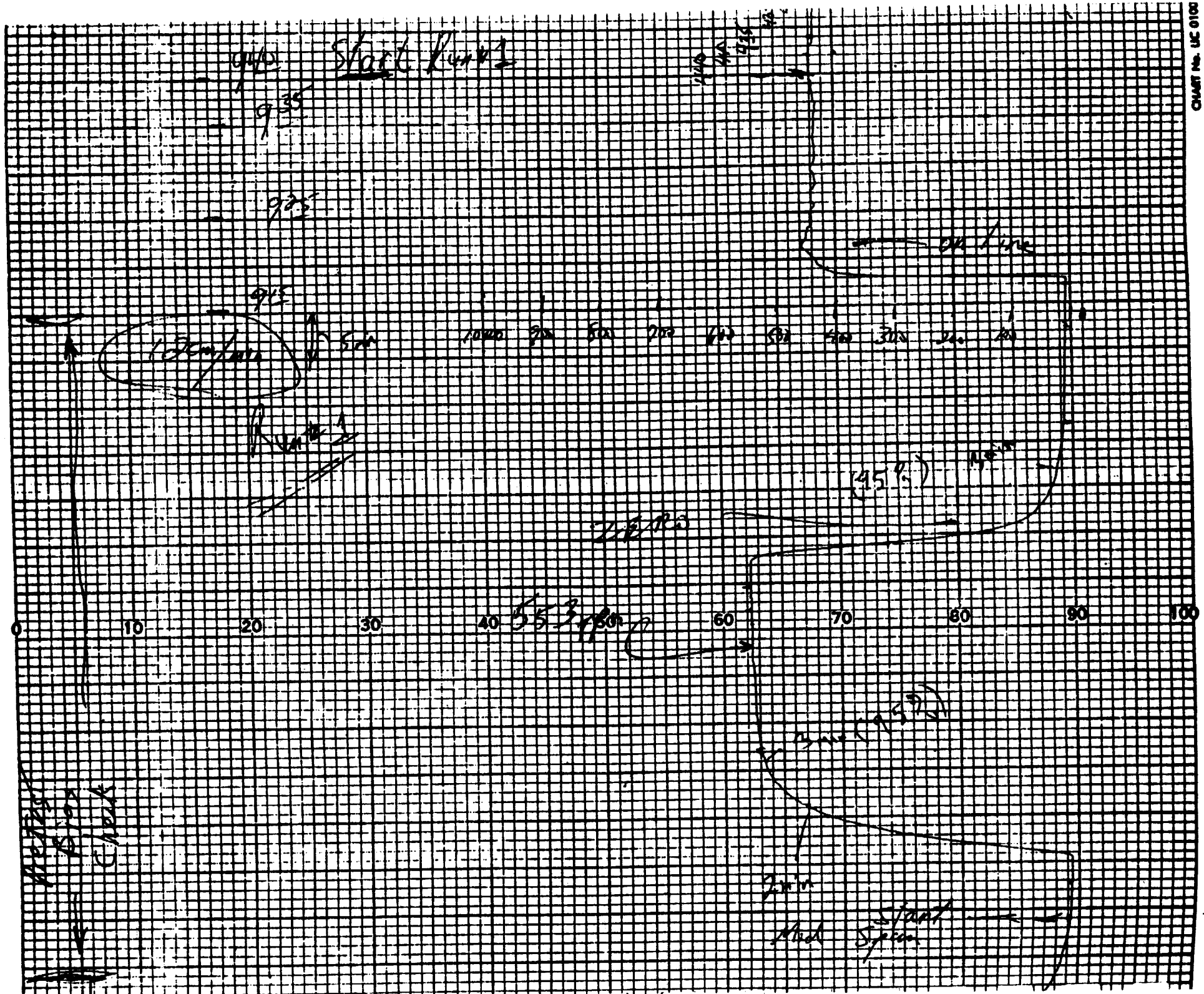
$$\text{SYSTEM CALIBRATION BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL SYSTEM CAL. RESPONSE}}{\text{SPAN}} \times 100$$

THE BIAS CHECK SHALL BE CONSIDERED INVALID IF IT EXCEEDS 5% FOR EITHER THE UPSCALE OR ZERO GAS.

THE DRIFT SHALL NOT EXCEED 3% OF THE SPAN FOR THE ZERO OR UPSCALE GAS.


Mercury Head
100
90
80
70
60
50
40
30
20
10
0
Ambient Air
Zero
Mid Span
Start Span
553 ppm Span
874 ppm Span
3/19/91
#3-C Stack
Powell Coal & Coke
SO2


Start Run 1
9:35
9:25
9:15
Run #1
(45%)
14 min
0
10
20
30
40
50
60
70
80
90
100
2 min
Mid Stream
Start
CHART No. LC 0100
PRINTED IN U.S.A.

0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
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340
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360
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380
390
400
410
420
430
440
450
460
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760
770
780
790
800
810
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890
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910
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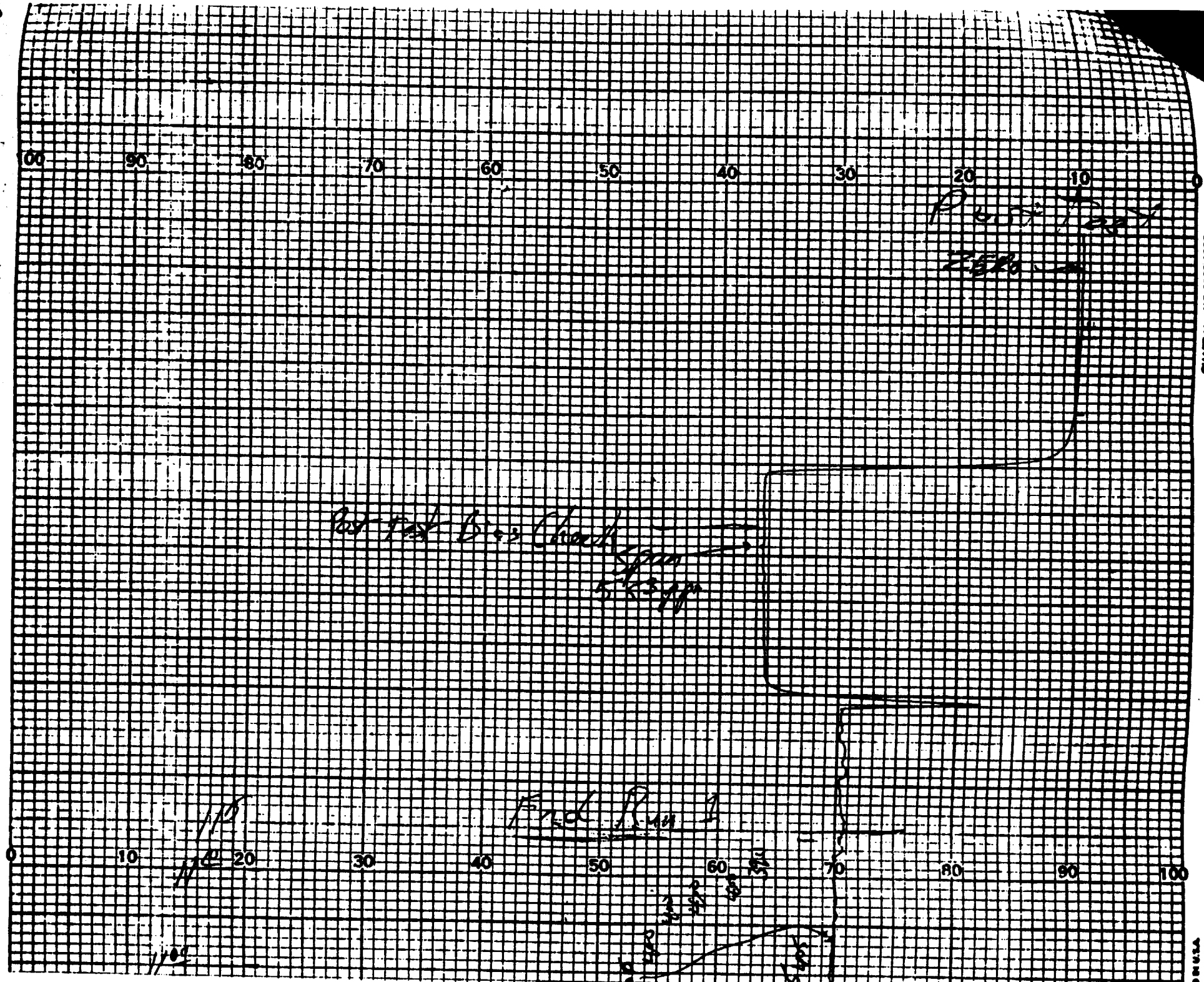
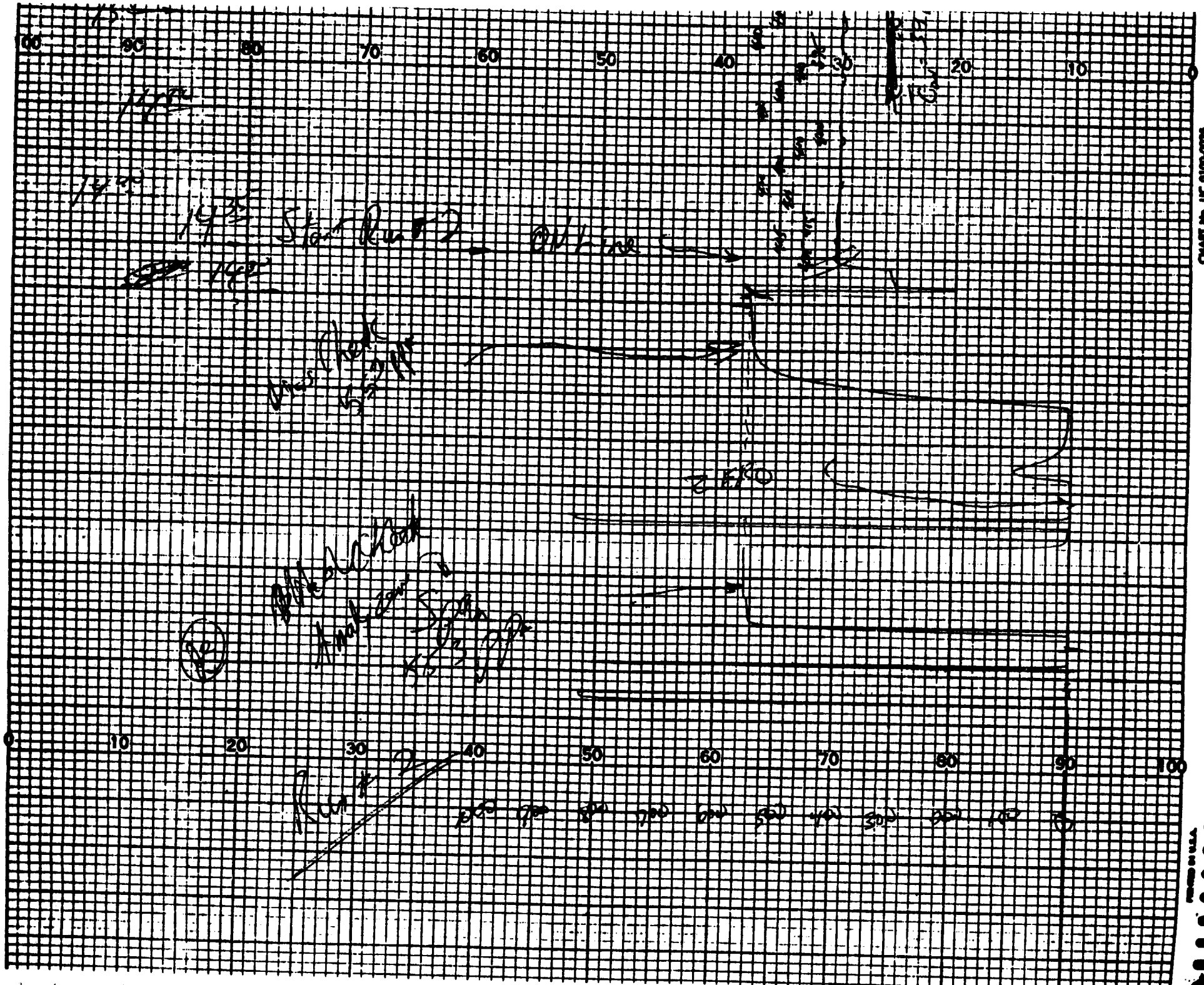
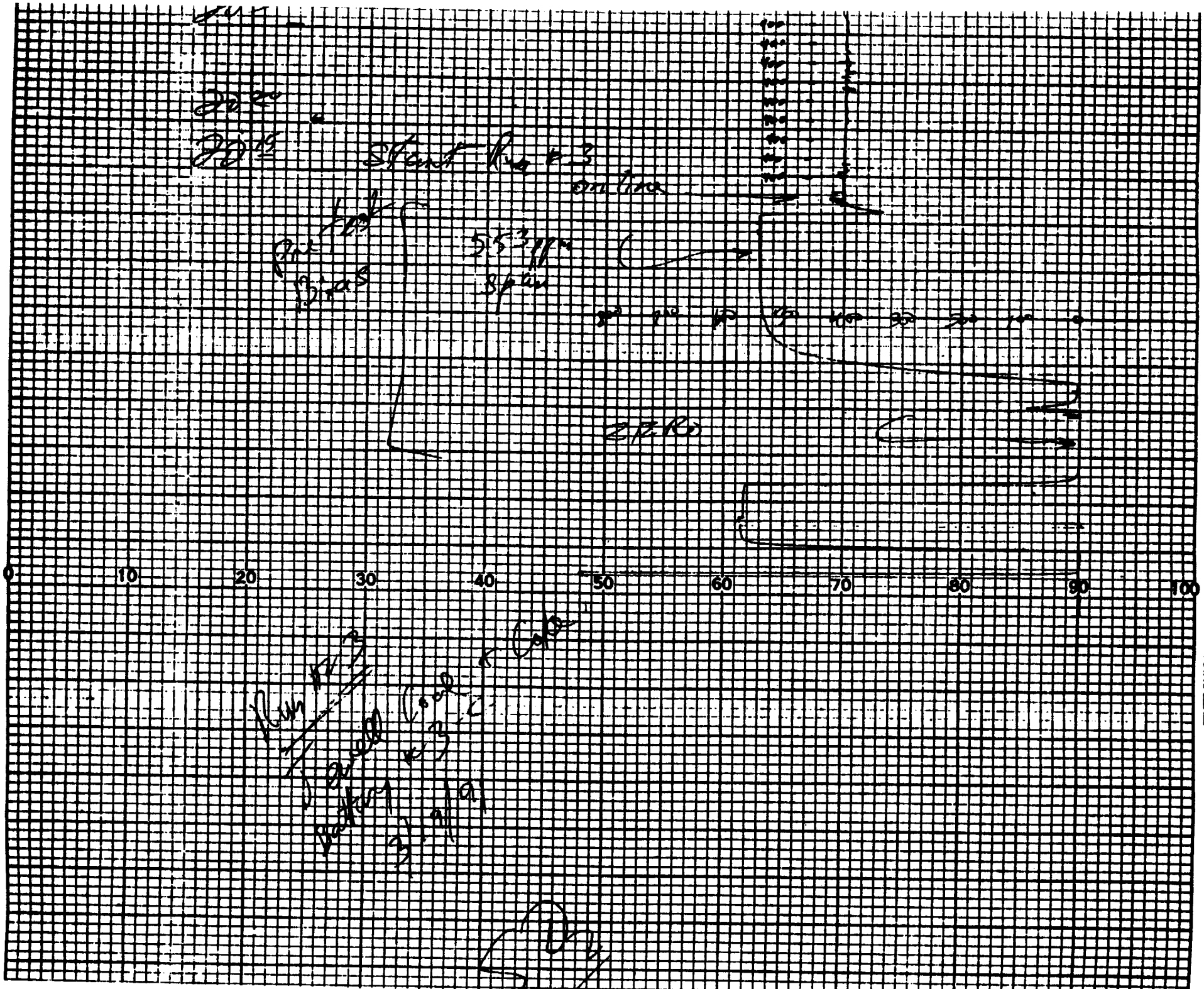
930
940
950
960
970
980
990
1000


100
90
80
70
60
50
40
30
20
10
0
Test Run 1
0
10
20
30
40
50
60
70
80
90
100
CHART No. LIC 01000-0005


100
90
80
70
60
50
40
30
20
10
0
CHART No. UC 0100-0025
PRINTED IN U.S.A.

PRINTED IN U.S.A.


0
10
20
30
40
50
60
70
80
90
100
ZERO

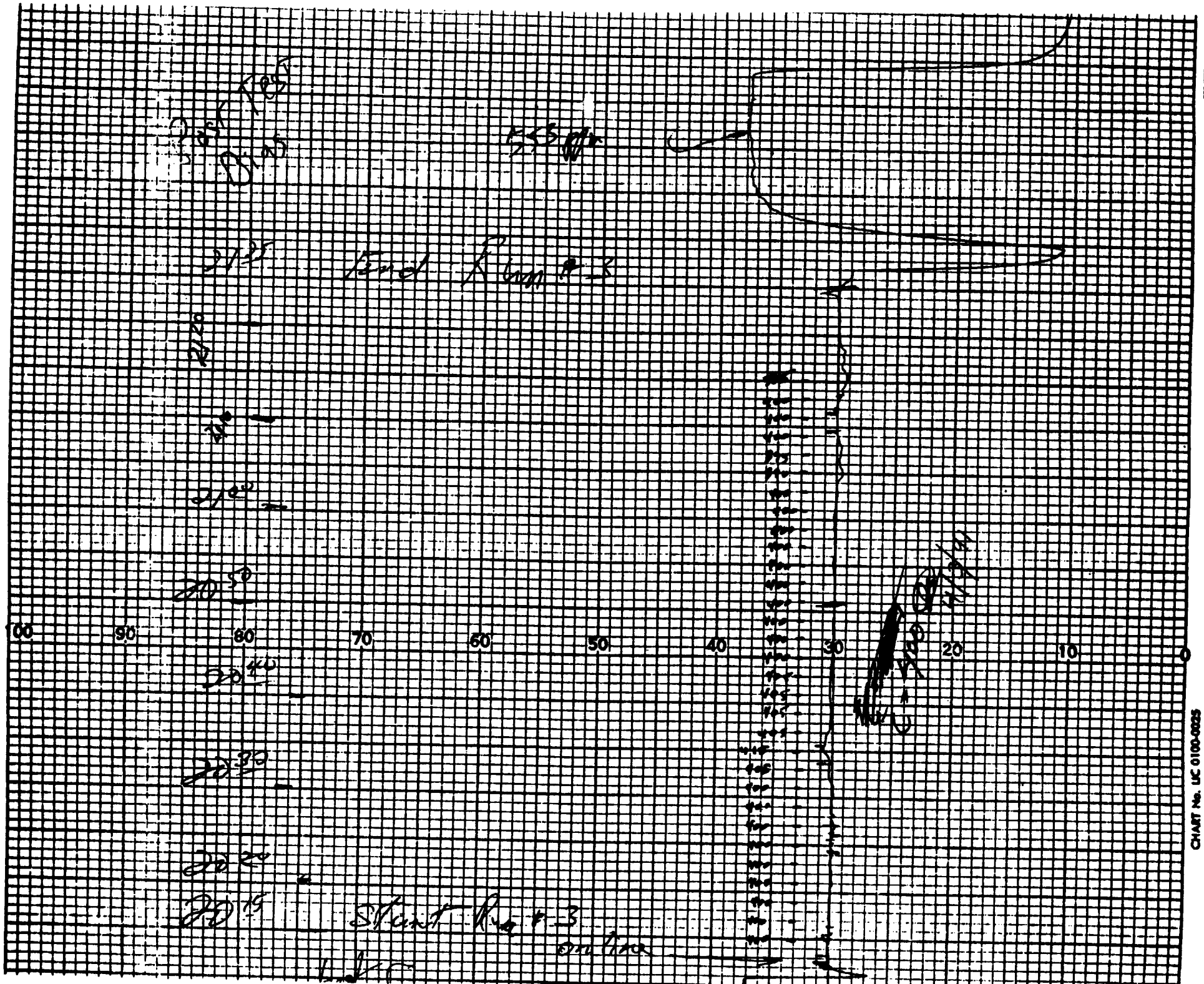
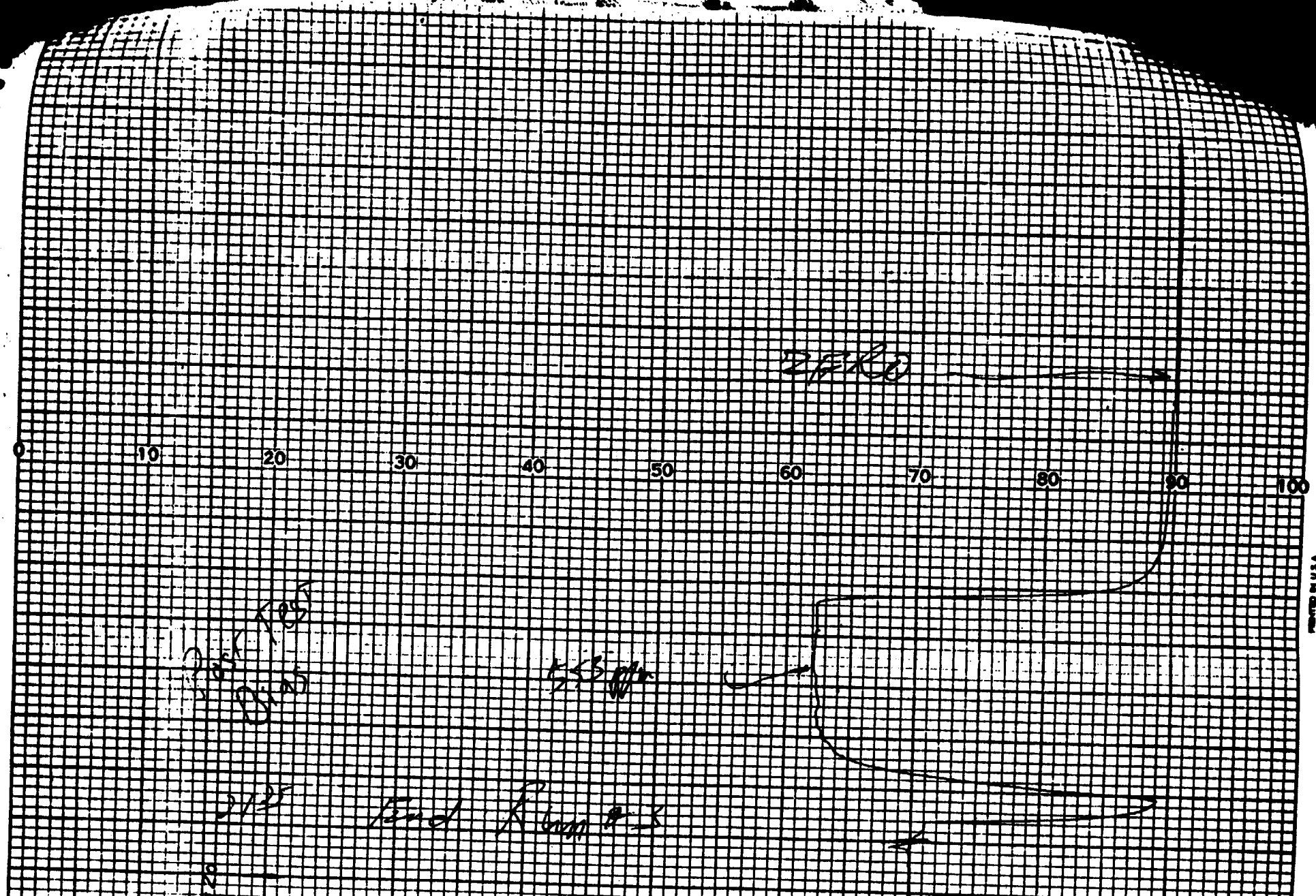


CHART No. LIC 0100-0025
PRINTED IN U.S.A.


0
10
20
30
40
50
60
70
80
90
100

INTERNATIONAL TECHNOLOGY
AIR QUALITY SERVICES

CONTROL BOX CALIBRATION SPREADSHEET
PRIMARY STANDARD: WET TEST METER

Orifice Manometer Setting (delta H)	Wet Test Meter Gas Volume (ft3) Actual Vw	Control Box Gas Volume (ft3) Vd	Calibrator Temp (F) Tw	Control Box Inlet (F) Tdi	Control Box Outlet (F) Tdo	Control Box Avg Temp (F) Td	Time Tenths (min)	Gamma (Y)	Delta H@	Barometric Pressure(in.Hg)
0.5	5	5.37	72	90	70	80	12.5	0.943917	1.884233	29.92
1	5	5.48	72	118	88	103	9.2	0.96316	1.890487	
2	10	11.04	72	129	97	113	13.25	0.970736	1.928068	
4	10	11.17	72	132	102	117	9.75	0.961338	2.070887	
								Avg Y	Avg Delta H@	
								0.959708	1.923519	
								0.959708	1.723519	
								0.979708	2.123519	

BOX ID NUMBER - 2
CALIBRATION STANDARD - PRIMARY
CALIBRATION STANDARD ID - WTM-1
DATE CALIBRATED - 3-25-91

CALIBRATED BY - LARRY MOORE

SIGNATURE - Larry S. Moore

APPROVAL SIGNATURE - Michael Mowery

Y - RATIO OF ACCURACY OF WET TEST METER
TOLERANCE = +/- 0.02

DELTA H@ - ORIFICE PRESSURE DIFFERENTIAL THAT YIELDS 0.75 CFM OF AIR AT 70 DEGREES F AND 29.92 INCHES OF MERCURY
TOLERANCE = +/- 0.20

IS THE UNIT WITHIN CALIBRATION TOLERANCES? YES

INTERNATIONAL TECHNOLOGY
AIR QUALITY SERVICES

CONTROL BOX CALIBRATION SPREADSHEET
PRIMARY STANDARD: WET TEST METER

Orifice Manometer Setting(Delta H)	Wet Test Meter Gas Volume (ft3) Actual Vw	Control Box Gas Volume (ft3) Vd	Calibrator Temp (F) Tw	Control Box Inlet (F) Tdi	Control Box Outlet (F) Tdo	Control Box Avg Temp (F) Td	Time Tenths(min)	Gamma (Y) Y	Delta H@ Delta H@	Barometric Pressure(in.Hg)
0.5	5	5.46	73	94	88	91	12.4	0.945490	1.724800	29.3
1	5	5.36	73	104	90	97	8.9	0.972399	1.770611	
2	10	10.86	73	120	92	106	13.2	0.972937	1.940371	
4	10	11.02	73	132	98	115	9.7	0.969217	2.073076	
								Avg Y	Avg Delta H@	
								0.965011	1.877215	
								0.945011	1.677215	
								0.985011	2.077215	

BOX ID NUMBER - 2
CALIBRATION STANDARD - PRIMARY
CALIBRATION STANDARD ID - WTM-1
DATE CALIBRATED - 1-24-91

CALIBRATED BY - LARRY MOORE

SIGNATURE - Larry J. Moore

Y - RATIO OF ACCURACY OF WET TEST METER
TOLERANCE =+/-0.02 of the average

DELTA H@ - ORIFICE PRESSURE DIFFERENTIAL THAT YIELDS 0.75 CFM OF AIR AT 70 DEGREES F AND 29.92 INCHES OF MERCURY
TOLERANCE = +/- 0.20

TYPE S PITOT CALIBRATION STANDARDS

Construction Standards:

1. Dt - between 0.48 and 0.95 centimeters

2. Pa = Pb $1.05\ Dt \leq P \leq 1.50\ Dt$

3. a1, a2 < 10°

4. B1, B2 < 5°

5. $Z \leq 0.32$ cm

6. $W \leq 0.08$ cm

Pitot Alignment Standards:

1. $X \geq 1.90$ cm

2. Ip must be higher than Np

3. $W \geq 7.62$ cm

4. $Z \geq 1.90$ cm

5. $Y \geq 7.62$ cm

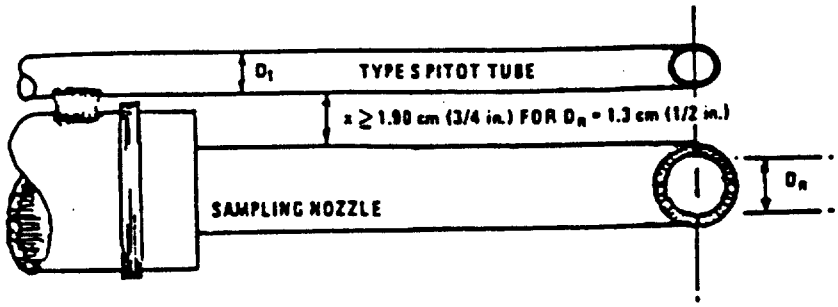
INTERNATIONAL TECHNOLOGY CORPORATION

PITOT ALIGNMENT CALIBRATIONS

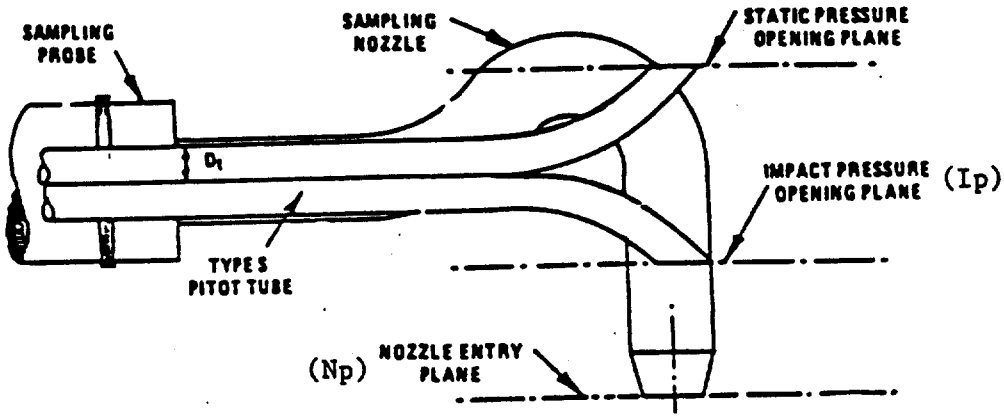
TYPE S PITOT TUBE

Pitot I.D. No. 10' water cooled Date 4-16-91 Performed By MBS

Pitot Alignment Calibrations



X = 1.91 (X≥1.90 cm)
1.3 cm 1/2" nozzel



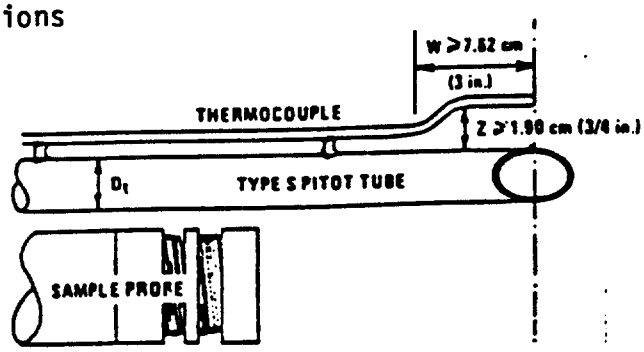
Is Ip higher than Np YES (Ip must be than Np)

INTERNATIONAL TECHNOLOGY CORPORATION

PITOT ALIGNMENT CALIBRATIONS
TYPE S PITOT TUBE

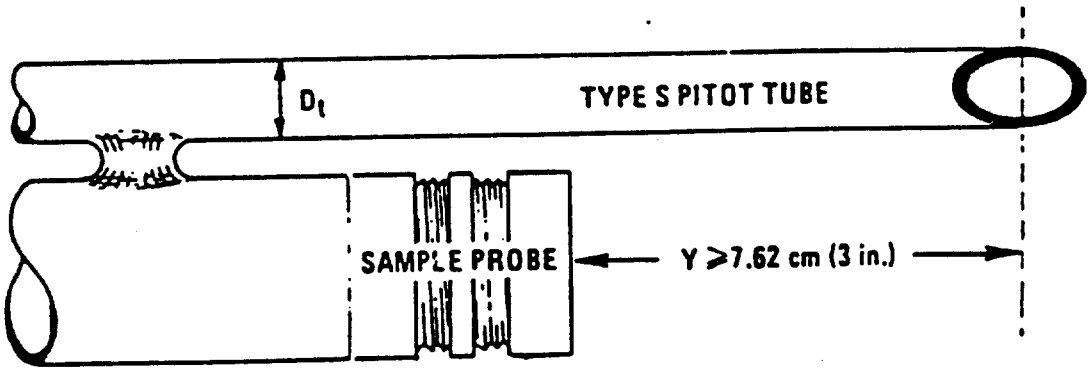
Pitot I.D. No. 10' WATER COOLED Date 4-16-91 Performed BY MBS

Pitot Alignment Calibrations



W = > 10.0 (W≥7.62 cm)

Z = 2.5 (Z≥1.90 cm)



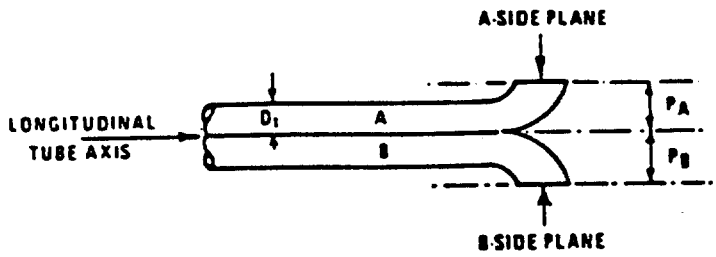
Y = 7.75 (Y≥7.62 cm)

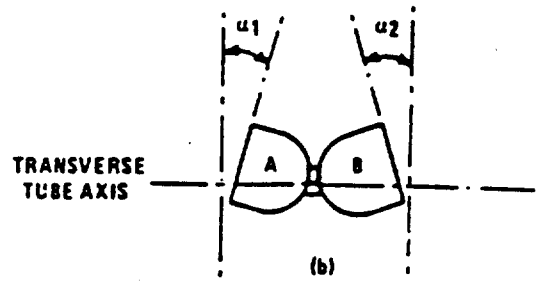
Determined Coefficient 0.84

INTERNATIONAL TECHNOLOGY CORPORATION

TYPE S PITOT TUBE
CONSTRUCTION CALIBRATIONS

Pitot I.D. No. 1D' WATER COOLED Date 4-16-91 Performed By MB





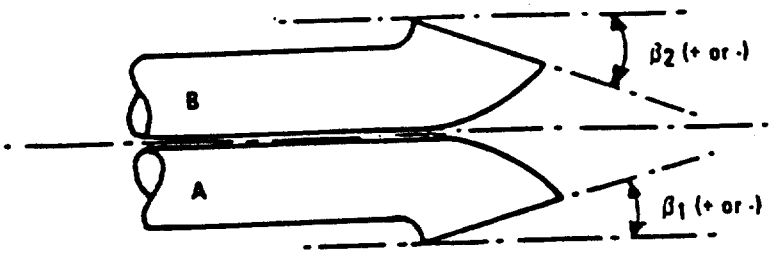
Dt = 0.62 (0.48 to 0.95 cm)

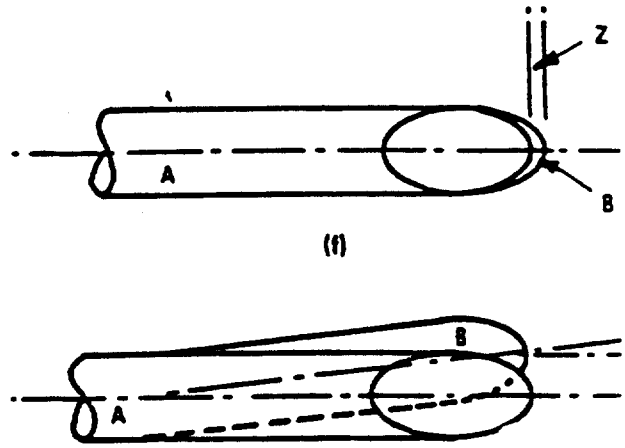
Pa = 1.25 (1.05 Dt≤P≤1.50 Dt)

Pb = 1.25 (1.05 Dt≤P≤1.50 Dt)

a1 = 1.0 (<10°)

a2 = 1.0 (<10°)





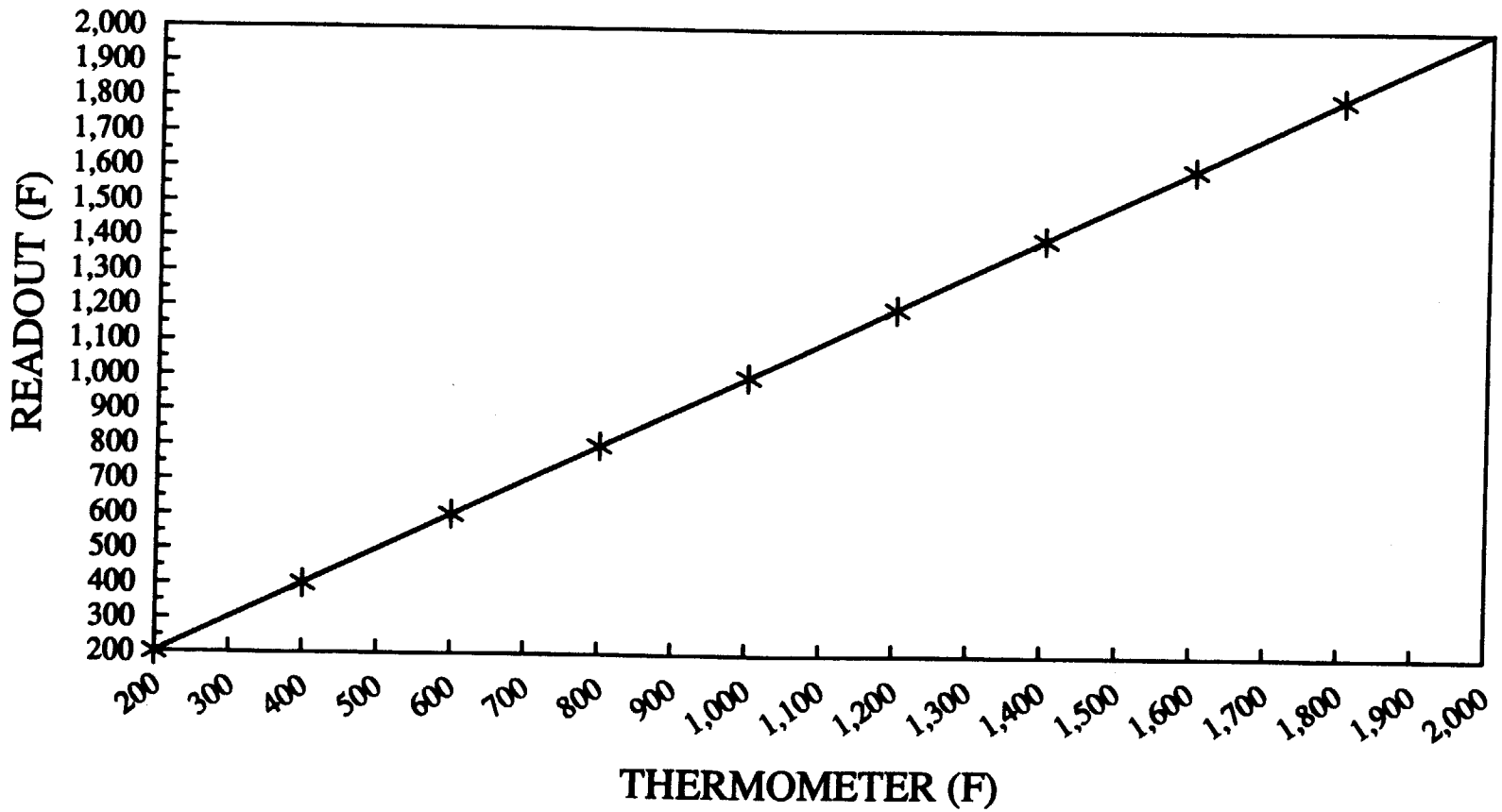
B1 = <1.0 (<5°)

B2 = <1.0 (<5°)

Z = <0.1 (≤0.

W = 0 (≤0.

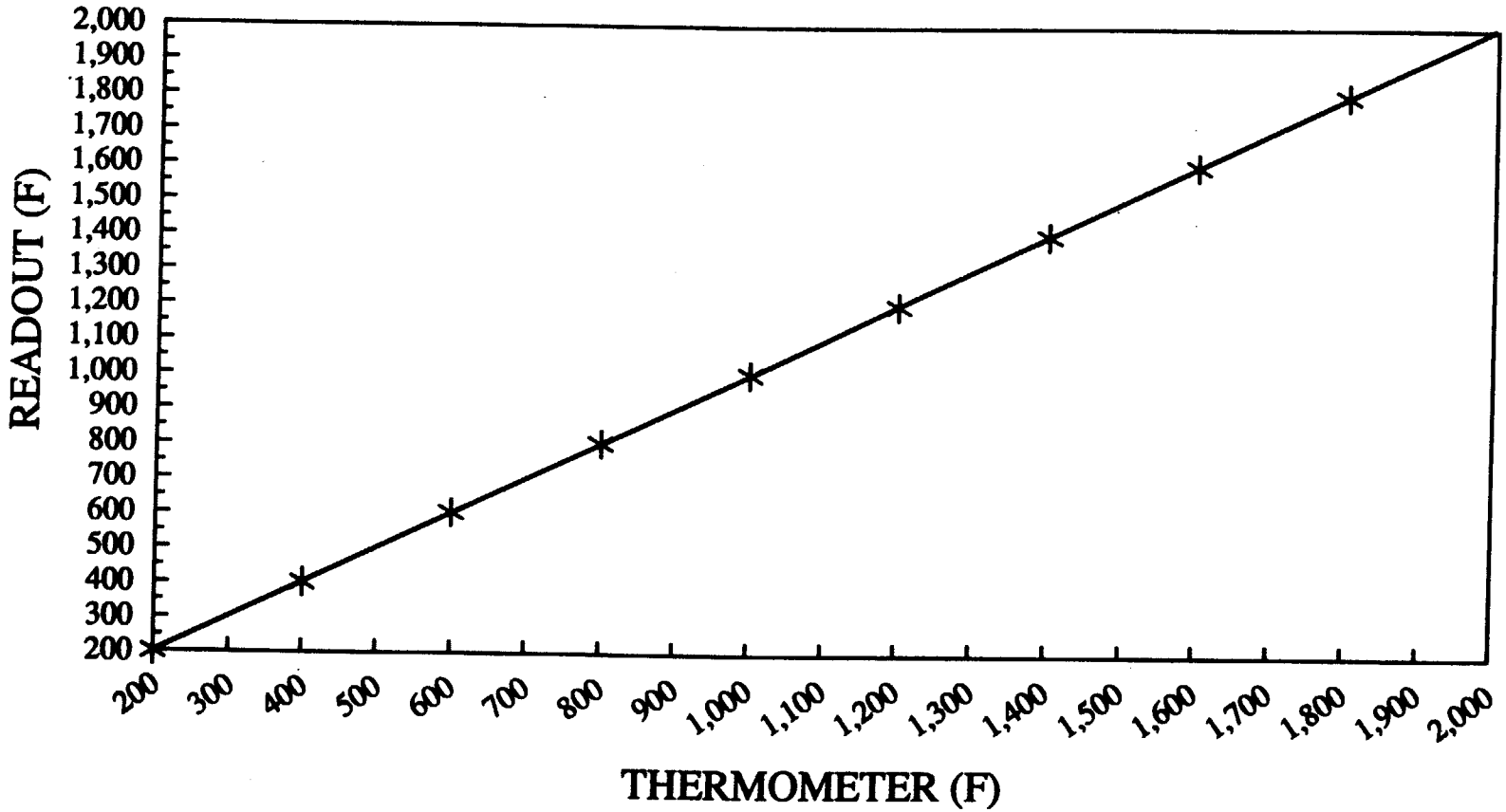
THERMOCOUPLE READOUT CALIBRATION



OMEGA 450 AKT 002 with TC12
S/N 9110466
Y=0.9998(X)+0.333

CALIBRATION DATE 4-27-91
BY: M.B.S.

THERMOCOUPLE READOUT CALIBRATION



OMEGA 450 AKT 004 with TC21
S/N 710746
Y=1.003(X)-0.133

CALIBRATION DATE 4-27-91
BY: M.B.S.

MEMORANDUM TO : Director, Region I

FROM : Environmental Engineer, Region I DTA

SUBJECT : Stack test results for

Jewell Coal & Coke Company
P.O. Box 70
Vansant, Virginia 24565
Registration No. 10200

DATE : May 22, 1991

INTRODUCTION

On March 19, 1991, IT - Air Quality Services of Knoxville, Tennessee conducted quantitative tests for particulate and sulfur dioxide emissions from the first stack serving the coke ovens in battery #3C at Jewell Coal & Coke's coal coking facility located in Vansant, Virginia. The tests were conducted to determine Jewell's permit compliance with the ovens operating on 48 hour cycles.

BACKGROUND

Jewell Coal & Coke operates a coal coking facility on State Route 460 in Vansant, Virginia. On March 7, 1990, The Virginia Department of Air Pollution Control (VDAPC) issued Jewell a permit to construct and operate 36 Thompson sole flue coke ovens (battery #3C) at their facility. Previous to the March 1990 permit, Jewell had operated 134 ovens on a combination of 24 and 48 hour cycles. Presently, they are operating all 150 ovens on 48 hour cycles. The permit allowed the construction of the newer ovens while retiring 20 older ovens in battery 2 and maintaining the same daily coal charge rate of 2774 tons.

Particulate and PM-10 emissions from battery 3C are controlled by sole flues and a common tunnel afterburner, coke side shed and a baffled quench tower using clean water. Backdraft fugitive emissions from the charging of the ovens are controlled by a Joy Technologies wet scrubber connected to the charger and run when extracting the charging boom from the ovens. Sulfur dioxide emissions are controlled by a 0.94% sulfur limit in the coal. Visible emissions are limited to 10 percent for charging and their is no specific limit for the coke oven common tunnel stacks, but is limited to 20 percent by 120-05-0103 in the State Regulations.

Specific condition number 26 of the March 7, 1990 permit specifies stack testing to determine compliance with particulate (or PM-10) and sulfur dioxide emission limits for the ovens at battery 3 while operating on 48 hour cycles. This test satisfies this requirement but Specific Condition number 25, which specifies that stack testing be conducted on battery 3C while operating on 24 hour cycles, has yet to be fulfilled since the ovens have not been charged on 24 hour cycles to date.

TESTING SUMMARY

Tests for particulate and sulfur dioxide emissions from the first stack serving battery #3C were performed in accordance with EPA Methods 1-5 and 6C, respectively. Three seventy-two minute test runs were made on the stack. The runs were made at 9:40 A.M., 2:30 P.M. and 8:00 P.M. Since alternate ovens are charged each 24 hours, with charging taking place from 6:00 to 8:00 P.M., these times correspond to one run each at the middle of the cycle, the end of the cycle and the beginning of the cycle. Some of the collected data and calculated results are as follows:

	Run 1	Run 2	Run 3	Avg
Stack flow - ACFM	87,671	65,311	102,291	85,301
Stack flow - DSCFM	18,005	14,627	20,952	17,861
Stack velocity - fpm	1,746	1,300	2,049	1,699
Stack temp. - °F	1,693	1,566	2,676	1,645
Moisture content - % vol	13.4	11.1	14.9	13.1
TSP mass rate - lb/hr	3.2	1.9	4.7	3.3
TSP emissions - lb/T coal	0.43	0.26	0.63	0.44
TSP emissions - lb/hr/oven	0.36	0.21	0.52	0.36
SO_2 mass rate - lb/hr	76.7	56.7	83.8	72.4
SO_2 emissions - lb/T coal	10.2	7.6	11.2	9.7
SO_2 emissions - lb/hr/oven	8.5	6.3	9.3	8.0

The charging rate to the ovens was determined to be 7.5 tons per hour or 40 tons per oven per 48 hour charge.

Visible emissions evaluations were conducted on the first stack of battery 3C in accordance with EPA Method 9 simultaneously with stack sampling during runs 1 and 2. The evaluations indicated zero opacity throughout the day.

ENGINEERING EVALUATION

The testing was conducted in an acceptable manner and the results were obtained using correct calculation procedures. A comparison of the test results to current permit limits and the previous test on battery 2 with 48 hour cycles follows:

	March 1991 Battery 3C	October 1989 Battery 3B
TSP - lb/hr/oven	0.36	0.90
Permit limit	1.21	2.30
% of limit	30	39
SO_2 - lb/hr/oven	8.00	6.46
Permit limit	9.17	9.60
% of limit	87	67

CONCLUSION

Based on the test results submitted and VDAPC staff observations, it is concluded that Jewell Coal & Coke Company was operating in compliance with Specific Condition 18 on the day of the test and has satisfied Specific Condition 26 of their March 7, 1990 permit.