TEST NUMBER FA-2

UNION CARBIDE CORPORATION

FERROALLOYS DIVISION

MARIETTA, OHIO

by

R. N. Allen

Resources Research, Inc.
A Subsidiary of TRW Inc.
7600 Colshire Drive
McLean, Virginia 22101

Contract Number CPA 70-81

No way Jose

Source Test Information Form

AP-42

Date: 7-14-92

Section: 7.4 FERROALLOYS — Silico-manganese 2% carbon grade

Firm/Company: UNION CARBIDE CORP.

Testing Group: Resources Research, Inc.

Test Date: 7/07/91 - 7/31/91

Special Processes/Conditions/Other Comments:

Variable scrubber pressures 57, 47 + 37 inches H_2O
EPA train described in E-1.
SO_2 measured using Shell Dev. method
Integrated gases sampled with a gas bag with analysis by standard Orsat.

Control Processes:

Scrubber.

Calibration Data: ___ Yes ✓ No See page 23

Sampling Method: 1971 Test

Production Rate: ___ Given ✓ Calculated → Estimated raw materials feed at 25.5 tons/hr.

See appendix C - tapping time, but not amounts, & strip chart of KW used [25-30 megawatts]

Production Rate Source:

Results:

Run #	Production Rate Mton/day	Production Rate Mton/year	Emission Factor kg/Mton	Emission Factor lbs/Mton
1				
2				
3				
Average				

Please see discussion page 24

Scrubber efficiency 99.1, 99.1, 96.3

Test Rating: ___

Problems - See page 33-35

Source Test Information Form

AP-42

Date: 7-14-92

Section: 7.4 - Ferroalloy - ferrosilicon

Firm/Company: Foote Mineral Company, ~~Graham~~, Graham, W.V.

Testing Group: GCA Corporation Technology Div.

Test Date: 3-17-81 to 3-18-81

Special Processes/Conditions/Other Comments:

Open submerged electric arc furnace

Control Processes: Baghouse

Reject - No real grounds for ~~not~~ justification of non-isokinetic sampling - can't find raw data for flowrates for inlet

Calibration Data: ✓ Yes ___ No See page 9 Methods 1-4 documentation

Sampling Method: Modified ~~EPA~~ Method 5

Production Rate: ✓ Given ___ Calculated Not a production Rate See pp 35

35 megawatts

Production Rate Source:

Results:

Run #	Production Rate Mton/day	Production Rate Mton/year	Emission Factor kg/Mton	Emission Factor lbs/Mton
1				
2	See page 21			
3				
Average				

Test Rating: ___

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II. INTRODUCTION

Source emission tests are being performed on a series of electric furnace installations, known as reactive metals or ferroalloys, for the Office of Air Programs, Environmental Protection Agency. These surveys include the determination of filterable and total particulate matter, sulfur dioxide, particle size analyses and chemical analyses for a variety of furnace formulations and control devices. The series of tests, contained in this report, were performed at the Union Carbide Corporation, Ferroalloys Division, P. O. Box 299, Marietta, Ohio, 45750.

Emissions from this particular plant were determined for a silicomanganese, 2% carbon grade furnace (No. 1). This unit was hooded, with two parallel Venturi type scrubbers leading to a single exhaust stack. Two draft fans, located after each scrubber, forced the scrubbed gases into the stack. The 8 foot diameter exhaust stack was provided with a single 3-inch sample port, while the horizontally mounted, rectangular inlet duct was sampled through five properly spaced ports for equal area sampling.

In addition, two parallel tapping exhausts were tested. These exhaust gases involved no scrubbing device and the stacks were sampled through the single port as provided. All sample locations are shown in Figure 1 on the following page. Further detailed diagrams and descriptions are included in Sections IV and V of this report (Process Description and Location of Sampling Points).

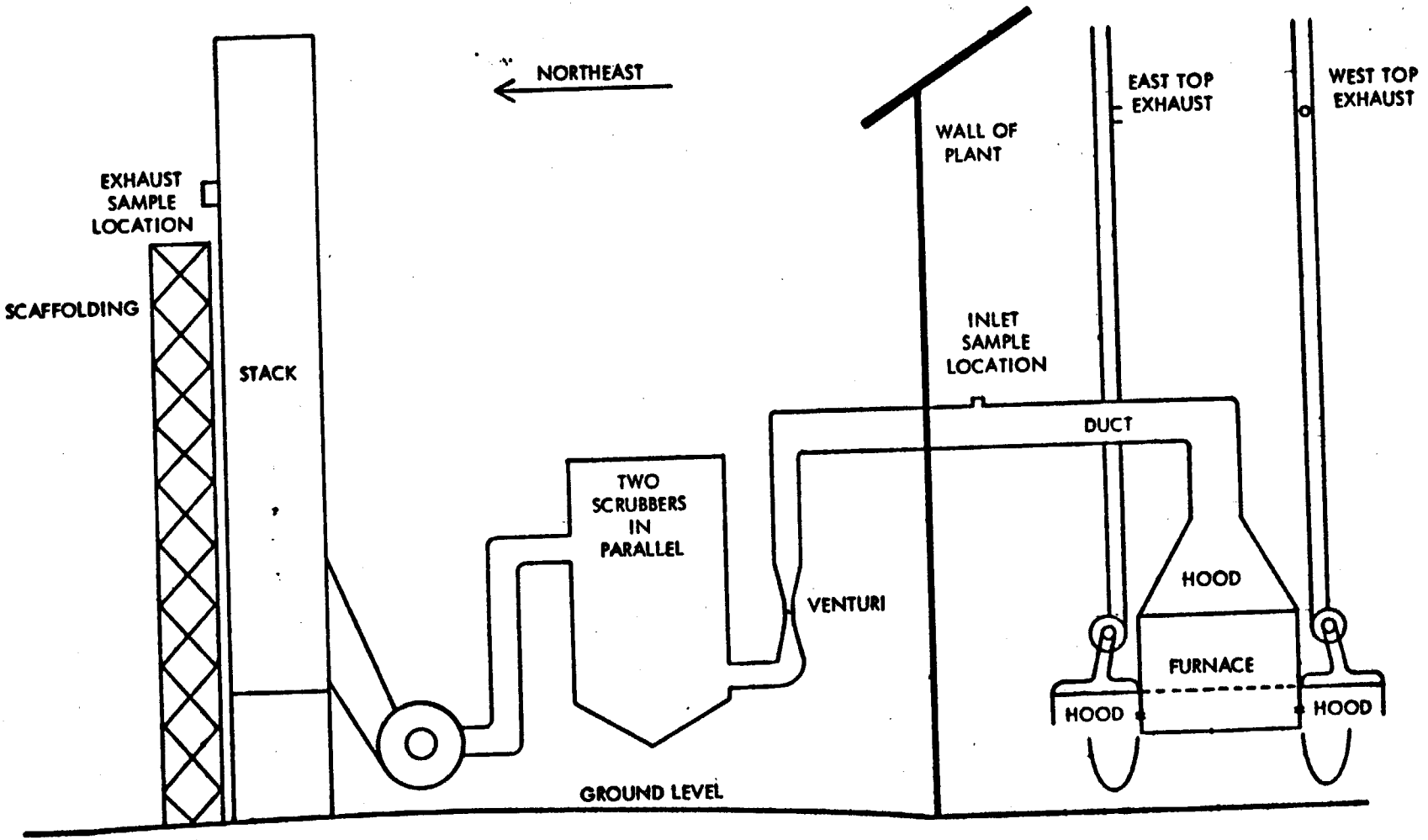


FIGURE 1. FLOW DIAGRAM, SAMPLE LOCATIONS

Within this survey period of July 27 to August 5, 1971, three different scrubber conditions were tested. Conditions A, B and C were set at scrubber pressure drops of 57, 47, and 37 inches of water, respectively. Normal scrubber operation employs the 57 inch setting.

During this particular survey particulate matter was sampled using the EPA train as described in Appendix E-1. Sulfur oxides were sampled using the Shell Development method and integrated combustion gases were sampled in a gas bag with analysis by standard Orsat. Particle size was measured in situ with an Andersen Sampler and a Brink Sampler. The overall survey included 26 particulate emission runs, 14 Orsat measurements, 11 sulfur dioxide samples, 6 metal filters and 23 particle size distribution analyses.

III. SUMMARY OF RESULTS

Shown below in Table 1 are the average results for each "in" and "out" scrubber condition and the corresponding collection efficiencies.

Table 1

SUMMARY OF RESULTS AND SCRUBBER EFFICIENCY

		Stack Exhaust (Outlet)			Inlet Duct		
Date(1971)	Scrubber Condition	Particulate grains/SCF	Particulate lb/hr	SO2 ppm	Particulate grains/SCF	Particulate lb/hr	Percent Efficiency
7/31-8/1	A, ΔP = 57" H_2O	0.0101	9.76	1.	1.25	1090	99.1
8/1-8/2	B, ΔP = 47" H_2O	0.0166	16.7	1.	2.05	1790	99.1
8/3-8/4	C, ΔP = 37" H_2O	0.0479	44.0	1.	1.53	1190	96.3

The apparent efficiencies were the same for Condition A and Condition B. However, note that the highest scrubber pressure drop, during Condition A, was coupled with the lowest inlet particulate loading. Condition C definitely indicated the lowest collection efficiency. During this particular condition, both the scrubber pressure drop and the inlet particulate loading were at very low levels.

Particulate and gaseous emission summaries for scrubber exhaust, scrubber inlet and tapping exhaust locations are shown in Tables 2, 3, and 4 on the following pages. Flue gas conditions are included and percent particulate matter in the impinger train has been calculated.

SO_2 emission levels were extremely low. Almost all individual results were less than 1. ppm. Other similar processes have indicated SO_2 emission levels up to 20 ppm with no scrubbing devices (i.e., Foote Mineral Company, Steubenville, Ohio). In this particular survey, there was no indication of any trend with SO_2 emission levels.

Gas temperatures and velocities during the exhaust sampling remained smooth, as expected for a location equipped with wet scrubber and constant speed draft fans. However, sharp variations were noted at the inlet duct, especially the wide variation in temperature. It is believed that these variations were inherent in the furnace design. Furthermore, the inlet sampling location was unusually close to the furnace itself.

The east and west tapping exhaust stacks, provided with no scrubbing devices, emitted average particulate levels of 19 and 48 pounds per hour, respectively, but these are not continuous emissions. Normal emission from the continuously operated scrubber is approximately 10 pounds per hour.

Particle size of emissions (usually sub microns) are shown in Appendix J and chemical analyses (quite variable) are shown in Appendix K.

TABLE 2

SUMMARY OF RESULTS - SCRUBBER EXHAUST

Run Number	M1E-1	M1E-2 **	M1E-3	M1E-4	M1E-5	M1E-6 *
Date	7/27/71	7/29/71	7/30/71	7/31/71	7/31/71	-
Stack Flow Rate - SCFM * dry	113,000	112,200	122,100	116,800	110,200	-
% Water Vapor - % Vol.	18.5	15.4	12.9	15.8	17.2	-
% CO_2 - Vol % dry	2.1	3.4	1.9	2.8	3.3	-
% O_2 - Vol % dry	19.2	18.3	18.6	18.8	18.4	-
% Excess air @ sampling point	1110	723	729	917	757	-
SO_2 Emissions - ppm dry	0.158	5.21	0	0.266	0.302	-
NO_x Emissions - ppm dry	-	-	-	-	-	-
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.0103	0.00710	0.0107	0.00813	0.00889	-
gr/CF @ Stack Conditions	0.00728	0.00520	0.00839	0.00594	0.00684	-
lbs./hr.	9.97	6.83	11.2	8.14	8.39	-
Particulate from Impinger Train (% of Total)	38.	35.	13.	16.	15.	
Total Catch gr /SCF * dry	0.0166	0.0110	0.0122	0.00967	0.0105	-
gr /CF @ Stack Conditions	0.0117	0.00805	0.00956	0.00706	0.00807	-
lbs./hr.	16.1	10.5	12.8	9.68	9.91	-
Stack Temperature	140	140	118	139	140	-

* Discarded

** Plant running at approximate one half-load.

* 70°F, 29.92" Hg

TABLE 2

SUMMARY OF RESULTS - SCRUBBER EXHAUST (CONTINUED)

Run Number	M1E-7	M1E-8	M1E-9	M1E-10	M1E-11	M1E-12
Date	8/1/71	8/2/71	8/2/71	8/3/71	8/3/71	8/4/71
Stack Flow Rate - SCFM * dry	118,100	115,000	121,100	114,300	112,000	103,200
% Water Vapor - % Vol.	16.1	18.2	15.3	17.6	16.7	17.6
% CO_2 - Vol % dry	3.0	3.2	3.4	3.2	3.2	3.1
% O_2 - Vol % dry	18.6	18.6	18.5	18.8	18.6	18.7
% Excess air @ sampling point	827	845	815	964	845	890
SO_2 Emissions - ppm dry	-	0.587	0.0340	0.737	-	-
NO_x Emissions - ppm dry	-	-	-	-	-	-
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.0150	0.0180	0.0114	0.0138	0.0369	0.0798
gr/CF @ Stack Conditions	0.0111	0.0132	0.00831	0.0100	0.0270	0.0576
lbs./hr.	15.2	17.7	11.8	13.5	35.4	70.6
Particulate from Impinger Train (% of Total)	12.	9.	13.	4.	17.	6.
Total Catch gr /SCF * dry	0.0170	0.0197	0.0131	0.0144	0.0445	0.0849
gr /CF @ Stack Conditions	0.0126	0.0144	0.00955	0.0104	0.0326	0.0613
lbs./hr.	17.2	19.4	13.6	14.1	42.7	75.1
Stack Temperature	135	127	134	130	133	132

* 70°F, 29.92" Hg

TABLE 3

SUMMARY OF RESULTS - SCRUBBER INLET

Run Number	M1D-4	M1D-5	M1D-6	M1D-7	M1D-8	M1D-9
Date	7/31/71	7/31/71	8/1/71	8/1/71	8/2/71	8/2/71
Stack Flow Rate - SCFM * dry	104,500	96,500	100,800	97,900	103,200	104,600
% Water Vapor - % Vol.	4.85	6.07	5.63	5.30	5.74	5.65
% CO_2 - Vol % dry	N/A	N/A	N/A	N/A	N/A	N/A
% O_2 - Vol % dry	"	"	"	"	"	"
% Excess air @ sampling point	"	"	"	"	"	"
SO_2 Emissions - ppm dry						
NO_x Emissions - ppm dry						
Particulates						
Probe, Cyclone, & Filter Catch						
gr/SCF* dry	1.05	0.423	2.22	1.92	2.10	2.06
gr/CF @ Stack Conditions	0.491	0.182	1.02	0.866	0.942	0.930
lbs./hr.	940.4	349.8	1918.	1611.	1857.	1846.
Particulate from Impinger Train (% of Total)	1.	9.	4.	1.5	1.	0.5
Total Catch						
gr /SCF * dry	1.06	0.464	2.23	1.95	2.12	2.07
gr /CF @ Stack Conditions	0.496	0.200	1.02	0.879	0.951	0.934
lbs./hr.	949.3	383.7	1926.	1636.	1875.	1856.
Stack Temperature	599	674	607	631	633	629

* 70°F, 29.92" Hg

TABLE 3

SUMMARY OF RESULTS - SCRUBBER INLET (CONTINUED)

Run Number	M1D-10	M1D-11	M1D-12			
Date	8/3/71	8/3/71	8/4/71			
Stack Flow Rate - SCFM * dry	91,000	85,000	94,900			
% Water Vapor - % Vol.	4.61	8.9	4.8			
% CO_2 - Vol % dry	N/A	N/A	N/A			
% O_2 - Vol % dry	"	"	"			
% Excess air @ sampling point	"	"	"			
SO_2 Emissions - ppm dry						
NO_x Emissions - ppm dry						
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.965	1.66	1.91			
gr/CF @ Stack Conditions	0.431	0.709	0.948			
lbs./hr.	752.6	1209.	1553.			
Particulate from Impinger Train (% of Total)	1.7	1.8	0.5			
Total Catch gr /SCF * dry	0.982	1.69	1.92			
gr /CF @ Stack Conditions	0.438	0.722	0.953			
lbs./hr.	765.9	1231.	1562.			
Stack Temperature	655	654	541			

* 70°F, 29.92" Hg

TABLE 4

SUMMARY OF RESULTS - TAPPING EXHAUST

Run Number	ETE-1	ETE-2	ETE-3	WTE-1	WTE-2	WTE-3
Date	8/5/71	8/5/71	8/5/71	8/5/71	8/5/71	8/5/71
Stack Flow Rate - SCFM * dry	70,100	70,000	69,700	64,250	61,800	64,700
% Water Vapor - % Vol.	4.95	4.12	3.74	3.11	3.32	2.72
% CO_2 - Vol % dry	-	-	-	0.2	0.1	0.1
% O_2 - Vol % dry	-	-	-	21.2	20.9	21.2
% Excess air @ sampling point	N/A	N/A	N/A	N/A	N/A	N/A
SO_2 Emissions - ppm dry	-	-	0.833	0.703	0.361	-
NO_x Emissions - ppm dry	-	-	-	-	-	-
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.0358	0.0249	0.0284	0.128	0.0483	0.0169
gr/CF @ Stack Conditions	0.0316	0.0224	0.0258	0.114	0.0428	0.0153
lbs./hr.	21.5	14.94	16.96	70.5	25.6	9.37
Particulate from Impinger Train (% of Total)	2.	10.	8.	20.	30.	48.
Total Catch gr /SCF * dry	0.0366	0.0275	0.031	0.160	0.0696	0.0329
gr /CF @ Stack Conditions	0.0323	0.0248	0.0282	0.1429	0.0616	0.0297
lbs./hr.	22.0	16.5	18.5	88.2	36.9	18.25
Stack Temperature	107	100	97	111	115	107

* 70°F, 29.92" Hg

IV. PROCESS DESCRIPTION

Reactive metals are generally ferroalloys which are produced in submerged arc electric furnaces. The facility under consideration in this report is an open furnace, with hooding and a scrubbing system to reduce the emission of fumes and dust following collection. Figure 2 is a cross sectional view process flow diagram indicating the actual furnace under test in this survey.

The electric arc is employed as a concentrated source of heat. Chrome, manganese and other ores are added to the surface of the furnace through mechanized equipment and chutes. Additional carbon in the form of coke, wood chips, etc., is an integral part of the furnace mix, along with specialized fluxes, etc. The mix is added directly to the surface of the furnace through chutes and is then spread over the surface with stoking machines.

The very high temperatures produced initiate a reaction in the bottom of the furnaces and form a layer of metal which is tapped at appropriate times. As the ores and carbonaceous materials gradually settle to the bottom of the furnace, the heat, in conjunction with a lack of oxygen, react with the oxide ores in order to remove oxygen and thus produce the elemental metal. Escaping gases, composed largely of carbon monoxide, are burned at the surface of the furnace in the so-called open units.

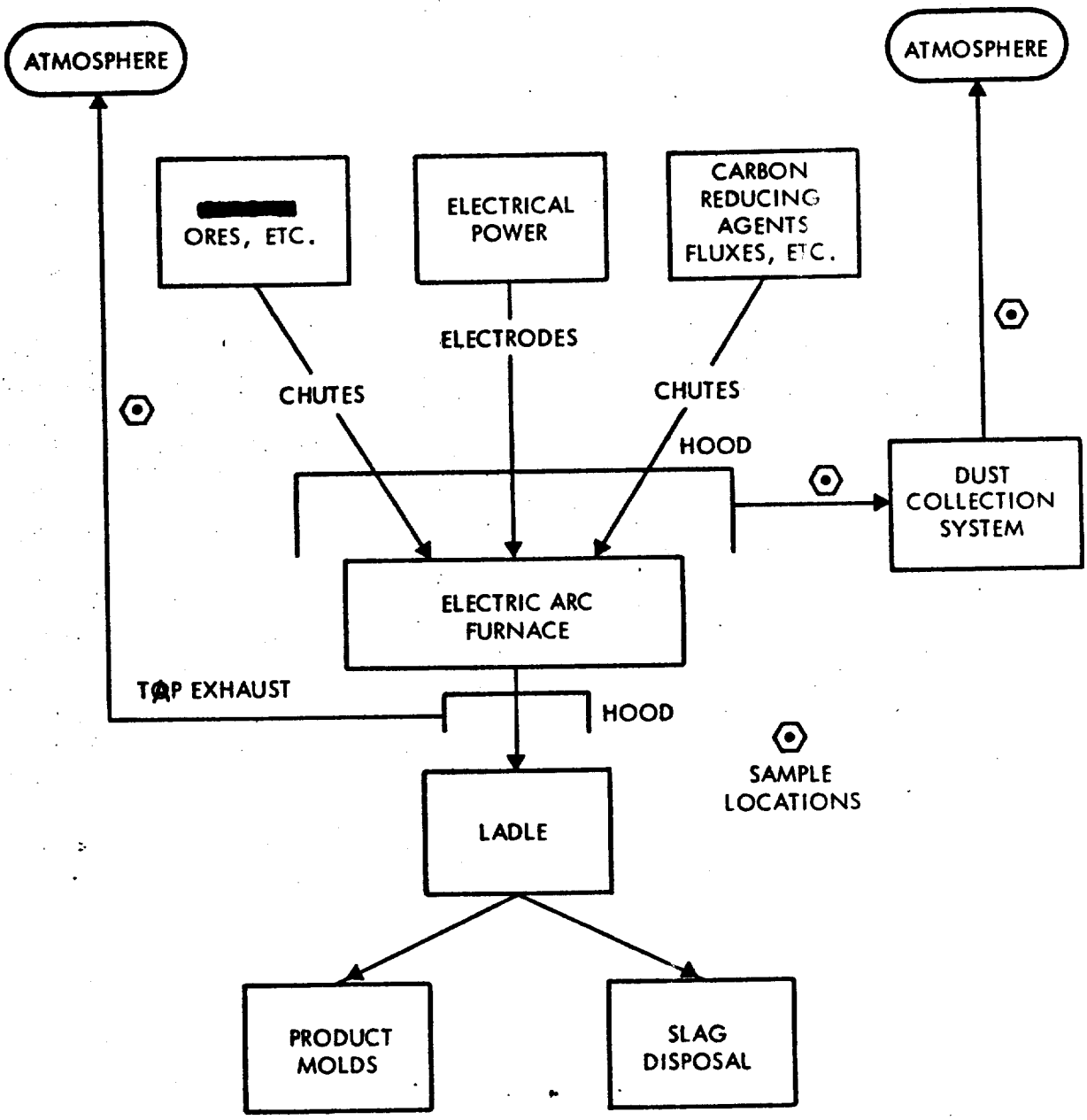


FIGURE 2. PROCESS FLOW DIAGRAM
FURNACE #1

Furnace 1 is a 27 megawatt furnace producing a silico-manganese product using Soderberg type electrodes, formed in place from a "paste", rather than using prebaked carbon electrodes. Induced draft fans are employed to pull fumes from various hoods into the exhaust system. Gases and fumes from the normal furnace operation are passed through two parallel venturi scrubber systems for cleaning, prior to discharge into the atmosphere. The collection of fumes around the furnace is almost 100 per cent effective during normal operation.

The furnace is tapped at intervals of approximately one and a half hours, depending upon the total power fed and thereby the amount of metal produced. Metal and slag pour into ladles and fumes are drawn off, without collection devices, by hoods and two exhaust systems. The slag is removed from the ladle and disposed of by various means. Molten product is poured into molds, after which it is broken into usable sizes.

Additional furnace and scrubber process data is shown in Table 5 on the following page.

TABLE 5

August 6, 1971

GENERAL DATA MCA-EPA TESTS

Furnace:	No. 1 - Marietta, Ohio
Product:	Silico-Manganese 2% Carbon Grade
Test Period:	July 27 to August 5, 1971. (See recording strip for actual dates)
Tap Time:	See Strip Chart for Particulate Tests and Tapping Data Sheet
Estimated Weight of Raw Materials Fed to Furnace During Test:	25.5 Net Tons Per Hour
Composition of Raw Material:	Manganese Ore and FeMn Slag, Coal and Coke, Gravel and Dolomite, Misc. Remelt Material.
KW on Furnace During Test:	25 - 30,000 - See Strip Chart
Water Recirculated to Each Venturi (2) - GPM:	800 - 900
Make Up Water Each Venturi - GPM:	360
Water Spray to Each Fan (2) - GPM:	40
Pressure Drop Across Venturi - Inches of H_2O:	Three Tests Made each at Approximately 57", 47", 37"
Opacity at Stack after Moisture Plume Dissipates:	From None to a Trace

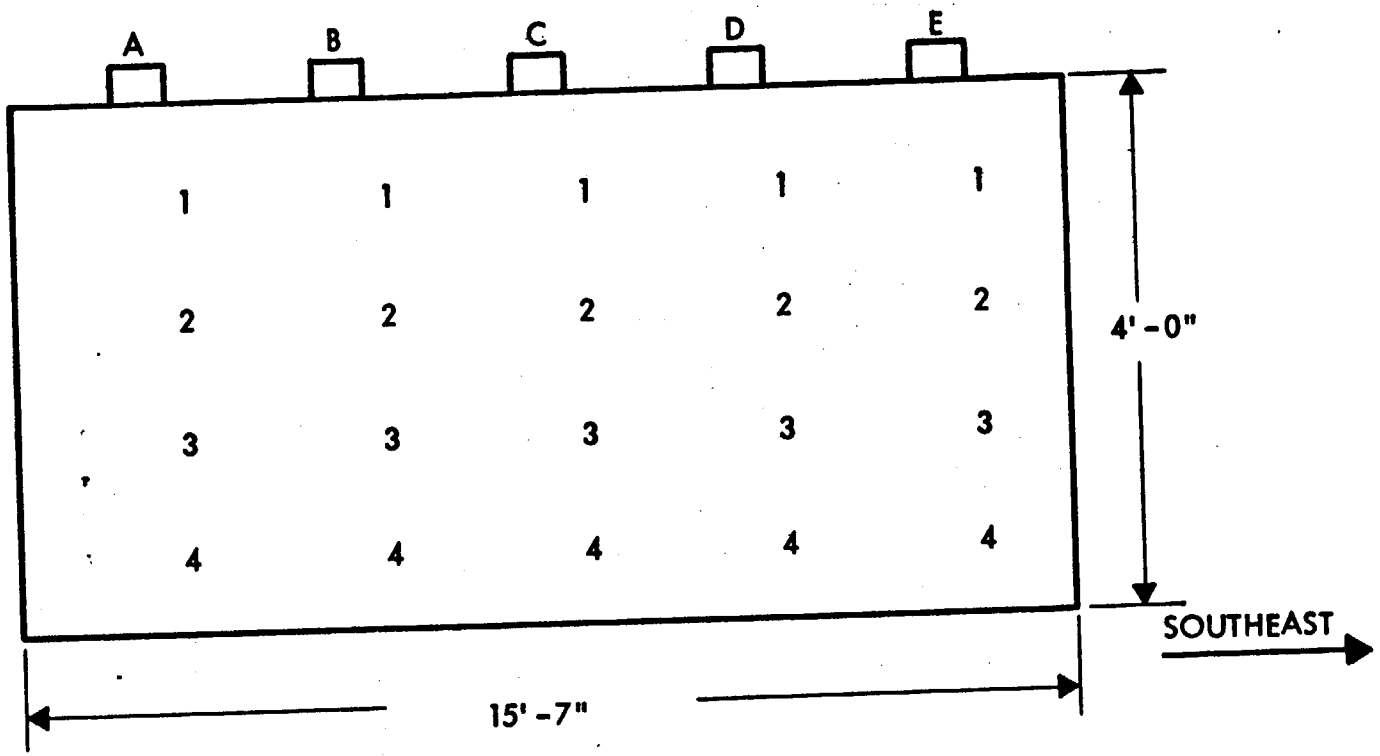
ERS:rb

V. LOCATION OF SAMPLING POINTS

Sample port locations were installed by plant personnel prior to the arrival of the test team, and approved by the EPA project officer. There were five sample ports across the top of the inlet duct to the scrubber. As shown in Figure 3 the cross section of this duct was divided into four one-foot layers, thus forming a 20 equal area profile. Particulate tests were conducted for 3 minutes at the centroid of each area. A pulley-trolley attachment, located approximately fifteen feet above the duct, provided vertical access to each sampling point in the duct.

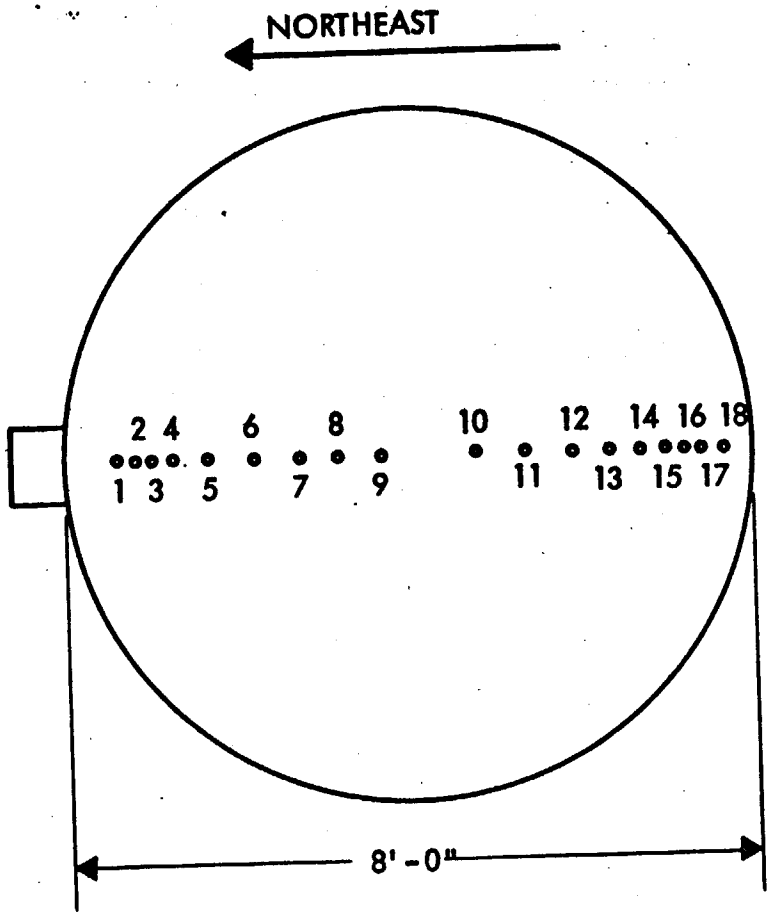
The single sample port at the exhaust stack was large enough to allow two sampling trains to be run simultaneously. The stack was eight feet in diameter at the sample profile and was divided into nine equal areas, as shown in Figure 4. Because the scaffolding was not long enough, points 1 and 2 could not be reached by the probe.

There were two identical exhaust stacks for the tapping operation and sample locations were placed on the fourth floor, inside the furnace building. The stacks were five feet in diameter, and were divided into five equal areas, as shown in Figure 5. Sampling trains rested on scaffolding about six feet above the floor level.



CROSS SECTIONAL VIEW OF DUCT,
WHEN FACING THE EXHAUST STACK

FIGURE 3. SCRUBBER INLET DUCT - SAMPLE POINT LOCATIONS



CROSS SECTIONAL VIEW

FIGURE 4. SCRUBBER EXHAUST DUCT - SAMPLE POINT LOCATIONS

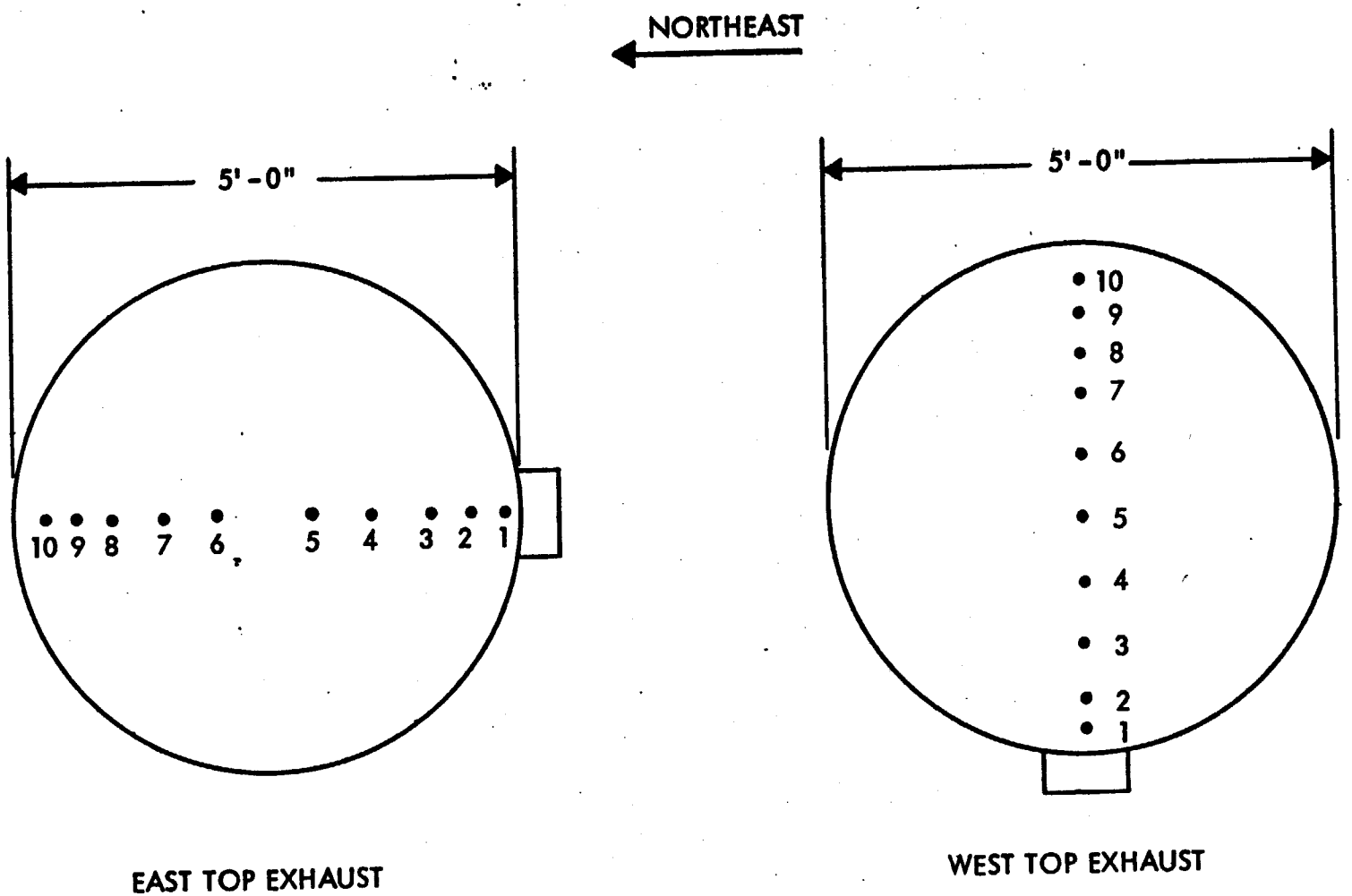


FIGURE 5. TAPPING EXHAUST - SAMPLE POINT LOCATIONS

VI. PROCESS OPERATION

Practically all sampling was carried out while the process was running normally. However, there were periods of furnace shut-downs or low process loads. These special conditions were rapidly communicated to the sampling team by either the EPA project engineer or the testing crew leader, in order to rapidly interrupt the sampling.

The furnace was down practically all day on July 28, a short period in the afternoon of July 29, and shortly before noon on July 31. Particulate run M1E-2 was conducted during a half-load operation on July 30.

Appendix C tabulates the tapping data and indicates the furnace load during the sampling periods. There were some fluctuations in the furnace load during testing, but these were considered to be within normal operating conditions. Normal operating levels were indicated when the furnace operated between 25 and 30 megawatts. Tapping was conducted as often as necessary, depending upon the total power input to the furnace.

VII. SAMPLING PROCEDURES

All test procedures were discussed with the Project Officer in advance. They were essentially the same as those being issued by the Environmental Protection Agency for source sampling.

Preliminary velocity and temperature readings were obtained in order to select nozzle sizes for isokinetic sampling. Particulate sampling was conducted using the EPA train as described in Appendix E-1. The metals sampling train was essentially the same as the ordinary particulate train, but it specifically called for a glass-lined probe.

Gas sampling was also conducted in accordance with the proposed EPA Standard Source Testing Methods. Sulfur dioxide was sampled with midget impingers using isopropyl alcohol and hydrogen peroxide solutions. Combustion gases were sampled in plastic bags for immediate analysis with an Orsat analyzer.

Particle sizing was performed using the Andersen sampler and the Brink impactor. Further information and details are included in Appendix J.

Special care was taken, not only to obtain all samples during normal operating conditions, but for each particulate test to include one tap cycle. Any deviation from the standard methods was either approved or recommended by the EPA project engineer at the site.

VIII. CLEANUP AND ANALYTICAL PROCEDURES

The methods employed for cleanup of the EPA particulate train have become relatively standardized through testing incinerators for government approval. Various sections of the sampling train were washed with acetone and water. The filter was removed carefully and each portion of the collected particulate matter was placed in separate containers. All portions were then dried at ambient conditions and the water was extracted for organic material, as well as being evaporated to dryness. These procedures are outlined in detail in Appendix E.2.

SO_2 samples used simple means of cleanup, using distilled deionized water as a rinsing medium. The analytical procedure is somewhat more involved and details are outlined in Appendix E.2. Both cleanup and analytical procedures were conducted in accordance with approved methods.

IX. DISCUSSION

A. RESULTS

Scrubber Efficiency

The efficiency of the venturi scrubber was determined under three conditions. Condition A employed a venturi pressure drop of 57 inches of water; Condition B, 47 inches H_2O; Condition C, 37 inches H_2O. Condition A, with the greatest pressure drop, was only slightly more efficient than Condition B, however, the inlet grain loading under the former condition was the lowest obtained at any time during the survey.

As shown in Table 1 under the Summary of Results, the percent efficiency at each successive condition was 99.1, 99.1, and 96.3. Because of the difference in flue gas volume at standard conditions, for the inlet and exhaust locations, the efficiencies were calculated on the basis of pounds per hour of total particulate matter.

During the 57" H_2O pressure drop, extra exhaust samples were obtained because the inlet duct sampling was plagued with major problems. Because extra results were available for the exhaust emission under this condition, some results were not included in the average. Run M1E-3 was omitted because the plant was not running at full capacity. Runs M1E-1 and M1E-2 were not employed since they were not taken simultaneously with the inlet samples.

Scrubber Emissions

Total particulate concentrations leaving the scrubber exhaust stack were approximately 0.010 grains per standard cubic foot under normal operating conditions (A, at 57 inches pressure drop). When the venturi pressure drop was reduced to 47" H_2O, the average emission concentration was 0.016 grains/SCF. At Condition C, with a pressure drop of 37" H_2O, there was a noticeable change in the emission concentrations and these averaged 0.048 grains/SCF. Although the exhaust grain loading concentrations gradually increased with the decreased pressure drop across the venturi, the inlet concentrations neither followed this pattern nor did they remain constant. Inlet grain loadings, respectively, were 1.25, 2.05 and 1.53 grains per standard cubic foot. Note that Condition A achieved its efficiency with this low inlet grain loading.

Tapping Emissions

Samples were obtained from the two tapping exhaust stacks simultaneously. Although the two systems were parallel, and apparently identical, the tap hole and ladle being filled were much closer to the west system. Emissions from the unscrubbed stacks were greater than those from the furnace gases that had been scrubbed in the venturi system. Emissions during the three taps sampled were not uniform either between exhaust stacks or between one tap and the next.

The first simultaneous tests were scheduled, and actually run, during a period in which no tapping was conducted. Due to some sort of process malfunction, the normal tap was omitted for that period of time. At the advice of the EPA project officer the equipment was simply sealed (not cleaned) and the following tapping cycle was sampled. Since no dust was emitted there should be little question about the sampling trains being clean for the second trial. However, the skipped cycle would have created an unusual condition within the furnace, and this is believed to have accounted for the unusual results obtained during the "first" tapping samples.

Emissions from Run WTE-1 were much greater than the comparable East sample or from any following West sample. Even during the following sample (WTE-2) the emissions were still apparently above normal. By the third set of samples emissions were similar in both exhaust ducts. It is believed that the third set of samples are more nearly "normal". Apparently when an unusual amount of fumes are produced the tendency is for this material to be ventilated through the nearest exhaust system; but when more normal quantities are produced at the ladle, the fumes have a chance to become more evenly dispersed, and thereby be emitted more or less equally from the two exhaust systems.

Particulate vs. Total Catch

The ratio of particulate trapped by the impingers, versus the total catch, was quite different for samples collected at different locations, or under different operating conditions. With one exception, the inlet duct samples contained less than 2 percent of the total catch as trapped by the impingers. These results are similar to those obtained on emissions from an uncontrolled reactive metals furnace.

The percentage of "condensible" material at the exhaust stack was considerably greater, and varied with the operation of the scrubber. With a scrubber pressure drop of 57" H_2O the condensibles ranged from one third of the total to greater than 10 percent of the total. At the 47 inch pressure drop the percentage was just slightly over 10 percent, and at the 37 inch pressure drop, was less than 10 percent soluble matter.

It is believed that the decreasing ratio of condensible material is due to the carry-over of small water droplets from the scrubber system. The water droplets would contain small amounts of soluble matter, and as the pressure drop was reduced there would be less tendency for these droplets to pass through the cyclonic collection chambers.

Fumes from the tapping operation have reason to be somewhat different from the average material emitted from the top of the furnace, but there are some very unusual results in regard to the solubility ratio observed. Those samples from the east exhaust duct were less than 10

percent soluble matter, yet the comparative samples (taken simultaneously) ranged from 20 to 50 percent soluble matter. In spite of the unusual process conditions associated with the tapping cycle there appears to be no logical explanation for the noted difference.

Flue Gas Conditions

Considering the normal variation in operating conditions, and observing gas flow from the furnace, the flue gas volume was considered to be relatively stable between equivalent test runs. There was a noticeable increase in flue gas volume, at the same standard conditions, between the inlet duct and exhaust stack locations. Although no physical examination was conducted it seems certain that there are minor points of air leakage. As the pressure drop was reduced across the venturi scrubber there was a decrease in the flue gas volume. This was not particularly noticeable at the exhaust stack location and did not become apparent at the inlet location until the lowest pressure drop was being evaluated.

Temperatures of the flue gas leaving the exhaust stack were rather stable during any particular test. There was relatively little variation during the entire survey, especially in light of the wild temperature variations which were encountered at the inlet duct. Average temperatures at the inlet duct were generally, and surprisingly, close together in most cases. The temperature at any particular moment could range from individual

readings between 400°F and 1300°F during operation which was considered to be normal. Temperature changes of several hundred degrees could occur within the space of 5 or 10 minutes.

Gaseous Emissions

With the exception of a single test, sulfur dioxide emissions were less than 1 percent at all stack exhausts. There was no appreciable difference between those SO_2 concentrations being emitted from the tapping stacks and those from the exhaust stack. It is doubtful that there was much scrubbing of sulfur dioxide accomplished by the venturi system. The SO_2 run, with its impinger train, corresponding to particulate test M1E-11, was accidentally dropped from the stack during a rainy period.

Carbon dioxide content from the tapping exhaust stacks was essentially negligible. These concentrations were so low, and the calculation so inaccurate under those conditions, that the percent excess air actually indicated negative in some instances. Excess air from a non-combustion process is simply not applicable. Carbon dioxide concentrations at the scrubber exhaust stack were relatively constant, although there seemed to be a decrease as the pressure drop across the unit was decreased. This would imply that either there was greater air leakage, or simply less furnace fumes being collected, as the pressure drop was reduced.

No carbon monoxide (CO) results are available. The infrared analyzer had been calibrated at the laboratory before the survey was begun, however, within ten minutes after having started operation in the field it failed to indicate properly. After two weeks of repair it was discovered that a completely new sensing unit was required and the unit was sent out for a major overhaul.

Particle Sizing

The particle size of material emitted from the exhaust stack is so small that major differences are hard to determine. The mass median diameter (MMD) ranged between approximately 0.2 microns and 0.6 microns in all tests. The MMD of material collected at the inlet duct varied from about 0.6 microns to 5. microns in diameter.

It must be remembered that the sample time at the inlet duct was only one or two minutes at a single point. It is quite unlikely that any single value would represent a true average of the material being emitted from the furnace.

Two simultaneously samples were obtained at each of the tapping ducts. During the first pair of tests the MMD ranged from 1.75 to 2.5 microns. During the next set of tests the particle size MMD was only 0.8 or 0.9 microns, indicating the variation that could occur between tapping cycles. Each of these tests was obtained for a duration of 20 minutes and would therefore be more representative of an average emission.

Exhaust samples were obtained during periods ranging from 10 minutes to 55 minutes. This time period was probably long enough for average results. However, the average particle size was so extremely small, that it was difficult to obtain wholly satisfactory results.

All of the above particle size results are explained in more detail in Appendix J. A graphical representation of each sample is available in Sub-appendix J-1 along with details of the date, operating condition and time sampled.

Chemical Analyses

Exhaust samples from the scrubber, and exhaust samples from tapping, were analyzed by microscope, by qualitative electron beam X-ray micro analysis and atomic absorption. All samples had a problem due to the very small quantities of material available for analysis. Due to the intermixing of the glass fiber in the filter with particulate matter imbedded in that filter, it was not possible to analyze for silicon. All samples obtained for these chemical analyses were obtained through all-glass pyrex probes. Details concerning the specific elements and quantities obtained are found in Appendix J.

B. OPERATING CONDITIONS

Venturi Scrubber

As far as can be determined there were no problems with the operation of the scrubber during this test survey. Whenever observed, the pressure drop instruments were holding steady at the proper ΔP for that series of tests.

Furnace 1

According to the megawatt chart, as shown in Appendix C, operating conditions of the furnace were fairly uniform. Furnace power was normally kept between 25 and 30 megawatts, with little fluctuation except for periods of down-time. Unfortunately, the periods of down-time, although low on an overall 24-hour basis, were very disruptive to the test program. Inlet and exhaust samples No. 2 and 4 were interrupted by plant shut-down; but where previous sampling had been satisfactory, these were continued until completion of the sample after restarting the furnace. There were several other periods in which sampling was delayed due to process shut-down. Every particulate sample was timed into the ordinary operating schedule, in order to include one tapping cycle during the middle of the sample period.

C. TEST CONDITIONS

Inlet Duct

There was no other feasible location for sampling the inlet duct, but this was a very poor location in nearly every respect. The duct work was obstructed by a series of I-beams about four feet above the top of the duct. There was little or no straight flow of gases prior to the sample point and very little straight flow following the sample location. The horizontal duct led to immediate stratification of the heavy particles, and created a very difficult sampling situation with the EPA train in the vertical position. In addition the location was dangerously hot, very dusty, and poorly lighted.

Due to a misunderstanding, between the presurvey date and the time of the test survey, many weeks later, the trolley rail was mounted too low for satisfactory handling of the EPA train. A bad pulley simply added to the problems, along with the tendency for filters to become clogged within minutes. Nearly four days were eventually required, including furnace down-time, before all equipment had been properly situated and the above problems had been solved. Meanwhile an ASME type alundum thimble was tried without success, along with other suggestions.

Until the trolley line was lifted to its proper position, a new pulley with multiple leverage was purchased, and a smaller size nozzle

was employed for the EPA train, no satisfactory samples were obtained. After the above corrections were completed, two inlet tests were conducted each day according to schedule, in spite of several plant operating delays.

Outlet Duct

The vertical exhaust stack, with long straight flow before and after the sampling location, should have provided good representative sampling. A newly constructed, temporary platform was satisfactory except that it was about one foot short, and therefore the first two positions inside the stack could not be reached with the long ten foot probe. The No. 3 position was sampled longer to represent the missed area. There was a problem in that only a single port was available for sampling, and this port was required for particulate samples, for metals samples, and for SO_2 sampling, as well as for particle size sampling. Only two probes would fit into the hole.

The platform was covered but there were several days of rain during the test survey, and there was a severe problem with electrical shocks and safety on this platform. A telephone system connected the exhaust stack location to the inlet location so that there were no problems of communication whenever troubles arose.

Tapping Stacks

Both tapping exhaust locations had excellent platforms located inside the building where rain was not a problem. The fine particles, and vertical flow, increased the possibility of representative sampling. Only a single hole was available at each stack but, because there were two parallel systems, the SO_2 sample could be obtained from one stack while the metals sample was obtained from the opposite stack.

Power Problems

Individual circuits were not available for testing equipment at this plant location. At the inlet duct there were power problems only on the first day or two when many simultaneous samples for particulate and particle size, etc., were combined. Subsequent to that time, all particle sizing was conducted when particulate matter samples were completed. No metals or gaseous samples were collected from that location.

The exhaust location had particulate, sulfur dioxide, metals and carbon dioxide sampling, to be conducted simultaneously and offered almost continuous problems. It was impossible to continue tests with the original power source, therefore, a second line was provided. However, at various times throughout the survey there were electrical failures that would delay sampling, especially during the rainy periods. There was a severe electrical safety problem during these rainy periods.

Filter Plugging

As was experienced during some samples at the Foote Mineral Company, in Steubenville, Ohio, there was a severe problem of plugging and vacuum buildup in the sample train because of the accumulation of fine particulate matter on the glass fiber filters. (Larger, four inch filter holders were ordered but were not available at this time). Although several solutions were suggested, the ultimate cure for the problem was to employ a small size nozzle (3/16 inch) so that less overall sample was obtained. Additional filter holders were prepared in advance, and these were changed whenever the pressure drop became too great for the maintenance of isokinetic conditions. By having pre-prepared filters, and placing them in the heated box for warmup, it was possible to continue sampling rapidly enough so that each test was completed before another tapping cycle would have forced shut-down of the train.

Particle Sizing

Analyses for the distribution of particle size were conducted with the Brink Cascade Impactor. These tests were conducted at both inlet and exhaust locations, as well as at both tapping exhausts. There were many delays due to the lack of sufficient power, and due to the lack of sufficient sample ports for simultaneous sampling with other tests. As discussed in Appendix J, there were problems of high temperature at the inlet duct and problems of high moisture content at the exhaust stack. The need for high temperature heating tapes at the exhaust stack simply increased problems of power failure and made it absolutely impossible for simultaneous tests to be conducted.

Tapping Samples

Appendix D includes raw data for samples ETE-1A and WTE-1A. These samples correspond to the expected particulate samples at both east and west tapping exhausts. As previously mentioned these were false runs because there was no tapping, as had been expected.

Each particulate test at the west tapping exhaust was accompanied with an Orsat analysis. Due to the rush, and short periods of tapping, no analyses were performed for the east exhaust. The west results were certainly satisfactory for any calculation of gas density, and as has been discussed, the Orsat results indicate that all analyses were unnecessary.

Miscellaneous Problems

Sulfur dioxide and metals runs were conducted only at the exhaust stack. These were obtained simultaneously with each particulate test, but they alternated with each other because of the lack of platform space and sample port size. Samples were alternated such that there was one SO_2 and one metals test conducted under each scrubber condition. The metals test corresponding to particulate test MlE-12 was repeated, after the filter was ruined by condensed moisture. Apparently the heated probe was not in operation and this allowed condensation to reach the filter.

Inlet samples M1D-1, -2, -3, were unsatisfactory due to the previously mentioned sampling problems. Samples for scrubber Condition A (57" H_2O) were begun with the inlet duct on sample No. 4. However, additional samples had already been satisfactorily obtained at the exhaust location. Sample M1E-6 from the exhaust stack, however, had to be discarded after there was an electrical short and rheostat failure in the middle of that run. With other satisfactory samples available, it was not considered necessary to repeat this test.

No preliminary moisture sample was conducted at the inlet duct after the sample train was destroyed due to unusually high heat on the duct. An estimate of only one or two percent was employed but results indicated that a greater moisture content was normally present. The measured moisture contents were greater than would be expected under the operating conditions of a furnace, but they were repeated in several successive samples. It is possible that part of this moisture was generated by the water leaks which were prevalent around the furnace, and also, both in and around the exhaust duct.

APPENDIX

APPENDIX A

COMPLETE PARTICULATE RESULTS WITH EXAMPLE CALCULATIONS

SUMMARY OF RESULTS - SCRUBBER EXHAUST

Run Number	M1E-1	M1E-2 **	M1E-3	M1E-4	M1E-5	M1E-6
Date	7/27/71	7/29/71	7/30/71	7/31/71	7/31/71	-
Stack Flow Rate - SCFM * dry	113,000	112,200	122,100	116,800	110,200	-
% Water Vapor - % Vol.	18.5	15.4	12.9	15.8	17.2	-
% CO_2 - Vol % dry	2.1	3.4	1.9	2.8	3.3	-
% O_2 - Vol % dry	19.2	18.3	18.6	18.8	18.4	-
% Excess air @ sampling point	1110	723	729	917	757	-
SO_2 Emissions - ppm dry	0.158	5.21	0	0.266	0.302	-
NO_x Emissions - ppm dry	-	-	-	-	-	-
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.0103	0.00710	0.0107	0.00813	0.00889	-
gr/CF @ Stack Conditions	0.00728	0.00520	0.00839	0.00594	0.00684	-
lbs./hr.	9.97	6.83	11.2	8.14	8.39	-
Particulate from Impinger Train (% of Total)	38.	35.	13.	16.	15.	
Total Catch gr /SCF * dry	0.0166	0.0110	0.0122	0.00967	0.0105	-
gr /CF @ Stack Conditions	0.0117	0.00805	0.00956	0.00706	0.00807	-
lbs./hr.	16.1	10.5	12.8	9.68	9.91	-
Stack Temperature	140	140	118	139	140	-

* Discarded

** Plant running at approximate one half-load.

* 70°F, 29.92" Hg

SUMMARY OF RESULTS - SCRUBBER EXHAUST (CONTINUED)

Run Number	M1E-7	M1E-8	M1E-9	M1E-10	M1E-11	M1E-12
Date	8/1/71	8/2/71	8/2/71	8/3/71	8/3/71	8/4/71
Stack Flow Rate - SCFM * dry	118,100	115,000	121,100	114,300	112,000	103,200
% Water Vapor - % Vol.	16.1	18.2	15.3	17.6	16.7	17.6
% CO_2 - Vol % dry	3.0	3.2	3.4	3.2	3.2	3.1
% O_2 - Vol % dry	18.6	18.6	18.5	18.8	18.6	18.7
% Excess air @ sampling point	827	845	815	964	845	890
SO_2 Emissions - ppm dry	-	0.587	0.0340	0.737	-	-
NO_x Emissions - ppm dry	-	-	-	-	-	-
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.0150	0.0180	0.0114	0.0138	0.0369	0.0798
gr/CF @ Stack Conditions	0.0111	0.0132	0.00831	0.0100	0.0270	0.0576
lbs./hr.	15.2	17.7	11.8	13.5	35.4	70.6
Particulate from Impinger Train (% of Total)	12.	9.	13.	4.	17.	6.
Total Catch gr /SCF * dry	0.0170	0.0197	0.0131	0.0144	0.0445	0.0849
gr /CF @ Stack Conditions	0.0126	0.0144	0.00955	0.0104	0.0326	0.0613
lbs./hr.	17.2	19.4	13.6	14.1	42.7	75.1
Stack Temperature	135	127	134	130	133	132

* 70°F, 29.92" Hg

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SOURCE TESTING CALCULATION FORMS

Test. No. No. Runs 11

Name of Firm Union Carbide

Location of Plant Marietta, Ohio

Type of Plant Ferro Alloy

Control Equipment Scrubber - Venturi - Type

Sampling Point Locations Scrubber Exhaust Stack

Pollutants Sampled Particulate

Time of Particulate Test:

Run No.	M1E-1	Date	7/27/71	Begin	1840	End	2112
Run No.	M1E-2	Date	7/29/71	Begin	1035	End	1451
Run No.	M1E-3	Date	7/30/71	Begin	1815	End	1940
	M1E-4		7/31/71		1034		1252
	M1E-5		7/31/71		1545		1713

PARTICULATE EMISSION DATA

Run No.	M1E-1	M1E-2	M1E-3	M1E-4	M1E-5	M1E
P_b barometric pressure, "Hg Absolute	29.5	29.5	29.5	29.5	29.5	
P_m orifice pressure drop, "H_2O	2.03	2.03	2.20	2.04	2.05	
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	58.61	63.60	64.09	74.15	70.31	
T_m Average Gas Meter Temperature, ^oF	84	84	92	95	106	
$V_{m_{std.}}$ Volume of Dry Gas Sampled @ Standard conditions, ft.^{3}	56.6	61.4	61.10	70.10	65.15	
V_w Total H_2O collected, ml., Impingers & Silical Gel.	269.	234.	190.9	276.5	285.	
$V_{w_{gas}}$ Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	12.8	11.1	9.05	13.1	13.5	

* Discarded

* 70°F, 29.92" Hg.

REPORT NO. _____ PAGE OF PAGES

SOURCE TESTING CALCULATION FORMS

Test. No. _____ No. Runs _____

Name of Firm _____

Location of Plant _____

Type of Plant _____

Control Equipment _____

Sampling Point Locations _____

Pollutants Sampled _____

Time of Particulate Test:

Run No. M1E-7	Date 8/1/71	Begin 1540	End 1655
Run No. M1E-8	Date 8/2/71	Begin 0945	End 1115
Run No. M1E-9	Date 8/2/71	Begin 1805	End 2000
M1E-10	8/3/71	1010	1140
M1E-11	8/3/71	1400	1530
M1E-12	8/4/71	1115	1245

PARTICULATE EMISSION DATA

Run No.	M1E-7	M1E-8	M1E-9	M1E-10	M1E-11	M1E-1
P_b barometric pressure, "Hg Absolute	29.7	29.7	29.7	29.6	29.6	29.5
P_m orifice pressure drop, "H_2O	2.19	2.02	2.01	2.10	2.0	1.7
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	68.99	67.96	70.95	68.72	67.79	62.39
T_m Average Gas Meter Temperature, ^oF	110	107	106	91	99	90
$V_{m_{std.}}$ Volume of Dry Gas Sampled @ Standard conditions, ft.^{3}	64.0	63.40	66.25	65.75	63.60	59.30
V_w Total H_2O collected, ml., Impingers & Silical Gel.	259.2	298.2	253.2	295.4	260.7	268.2
$V_{w_{gas}}$ Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	12.3	14.1	12.0	14.0	12.7	12.7

* 70^{o}F, 29.92" Hg.

PARTICULATE EMISSION DATA (CONT'D)

Run No.	M1E-1	M1E-2	M1E-3	M1E-4	M1E-5	M1E-6*
%M - % Moisture in the stack gas by volume	18.5	15.4	12.9	15.8	17.2	
M_d - Mole fraction of dry gas	0.815	0.846	0.871	0.842	0.828	
% CO_2	2.1	3.4	1.9	2.8	3.3	
% O_2	19.2	18.3	18.6	18.8	18.4	
% N_2	78.7	78.3	79.5	78.4	78.3	
M W_d - Molecular weight of dry stack gas	29.07	29.15	29.04	29.20	29.28	
M W - Molecular weight of stack gas	27.04	27.42	27.62	27.44	27.35	
ΔP_s - Velocity Head of stack gas, In.H_2O	0.71	0.66	0.72	0.72	0.66	
T_s - Stack Temperature, °F	140	140	118	139	140	
$\sqrt{\Delta P_s X(T_s + 460)}$	20.6	19.9	20.4	20.8	19.9	
P_s - Stack Pressure,"Hg.Absolute	29.38	29.38	29.38	29.38	29.39	
V_s - Stack Velocity @ stack conditions, fpm	3180.	3050.	3105.	3185.	3055.	
A_s - Stack Area, $in.^2$	7235.	7235.	7235.	7235.	7235.	
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	113,000	112,200	122,100	116,800	110,200	
T_t - Net Time of Test, min.	80	80	80	95	90	
D_n - Sampling Nozzle Diameter, in.	0.25	0.25	0.25	0.25	0.25	
%I - Percent isokinetic	96.	96.	96.	98.	104.	
m_f - Particulate - probe, cyclone and filter, mg.	38.0	28.3	42.5	37.0	37.6	
m_t - Particulate - total, mg	61.0	43.9	48.3	44.0	44.3	
C_{an} - Particulate - probe, cyclone, and filter, gr/SCF	0.0103	0.00710	0.0107	0.00813	0.00889	
C_{ao} - Particulate - total, gr/SCF	0.0166	0.0110	0.0122	0.00967	0.0105	
C_{at} - Particulate - probe, cyclone, and filter, gr/cf @ stack conditions	0.00728	0.00520	0.00839	0.00594	0.00684	

PARTICULATE EMISSION DATA (CONT'D)

Run No.	M1E-7	M1E-8	M1E-9	M1E-10	M1E-11	M1E-12
%M - % Moisture in the stack gas by volume	16.1	18.2	15.3	17.6	16.7	17.6
M_d - Mole fraction of dry gas	0.839	0.818	0.847	0.824	0.833	0.824
% CO_2	3.0	3.2	3.4	3.2	3.2	3.1
% O_2	18.6	18.6	18.5	18.8	18.6	18.7
% N_2	78.4	78.2	78.1	78.0	78.2	78.2
$M W_d$ - Molecular weight of dry stack gas	29.22	29.29	29.32	29.23	29.26	29.14
M W - Molecular weight of stack gas	27.45	27.23	27.56	27.22	27.43	27.17
Δ Ps - Velocity Head of stack gas, In.H_2O	0.73	0.72	0.76	0.71	0.67	0.58
T_s - Stack Temperature, °F	135	127	134	130	133	132
$\sqrt{\Delta P_s X(T_s + 460)}$	20.8	20.55	21.2	20.42	19.9	18.5
P_s - Stack Pressure,"Hg.Absolute	29.6	29.6	29.6	29.49	29.47	29.38
V_s - Stack Velocity @ stack conditions, fpm	3180.	3140.	3230.	3120.	3040.	2845.
A_s - Stack Area, $in.^2$	7235.	7235.	7235.	7235.	7235.	7235.
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	118,100	115,000	121,100	114,300	112,000	103,200
Tt - Net Time of Test, min.	90	90	90	90	90	90
D_n - Sampling Nozzle Diameter, in.	0.25	0.25	0.25	0.25	0.25	0.25
%I - Percent isokinetic	95.	96.	95.	98.	99.	99.
m_f - Particulate - probe, cyclone and filter, mg.	62.4	74.3	49.2	58.8	152.4	307.0
m_t - Particulate - total, mg	70.9	81.3	56.2	61.6	184.1	326.9
C_{an} - Particulate - probe, cyclone, and filter, gr/SCF	0.0150	0.0180	0.0114	0.0138	0.0369	0.0798
C_{ao} - Particulate - total, gr/SCF	0.0170	0.0197	0.0131	0.0144	0.0445	0.0849
C_{at} - Particulate - probe, cyclone, and filter, gr/cf @ stack conditions	0.0111	0.0132	0.00831	0.0100	0.0270	0.0576

PARTICULATE EMISSION DATA (cont'd)

Run No.	M1E-1	M1E-2	M1E-3	M1E-4	M1E-5	M1E-6
C_{au} - Particulate, total, gr/cf @ stack cond.	0.01170	0.00805	0.00956	0.00706	0.00807	
C_{aw} - Particulate, probe, cyclone, and filter, lb/hr.	9.97	6.83	11.2	8.14	8.39	
C_{ax} - Particulate - total, lb/hr.	16.1	10.5	12.8	9.68	9.91	
% EA - % Excess air @ sampling point	1110.	723.	729.	917.	757.	

*70°F. 29.92" Hg.

PARTICULATE EMISSION DATA (cont'd)

Run No.	M1E-7	M1E-8	M1E-9	M1E-10	M1E-11	M1E-12
C_{au} - Particulate, total, gr/cf @ stack cond.	0.0126	0.014	0.00955	0.0104	0.0326	0.0613
C_{aw} - Particulate, probe, cyclone, and filter, lb/hr.	15.2	17.7	11.8	13.5	35.4	70.6
C_{ax} - Particulate - total, lb/hr.	17.2	19.4	13.6	14.1	42.7	75.1
% EA - % Excess air @ sampling point	827.	845.	815.	964.	845.	890

*70°F. 29.92" Hg.

SUMMARY OF RESULTS - SCRUBBER INLET

Run Number	M1D-4	M1D-5	M1D-6	M1D-7	M1D-8	M1D-9
Date	7/31/71	7/31/71	8/1/71	8/1/71	8/2/71	8/2/71
Stack Flow Rate - SCFM * dry	104,500	96,500	100,800	97,900	103,200	104,600
% Water Vapor - % Vol.	4.85	6.07	5.63	5.30	5.74	5.65
% CO_2 - Vol % dry	N/A	N/A	N/A	N/A	N/A	N/A
% O_2 - Vol % dry	"	"	"	"	"	"
% Excess air @ sampling point	"	"	"	"	"	"
SO_2 Emissions - ppm dry						
NO_x Emissions - ppm dry						
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	1.05	0.423	2.22	1.92	2.10	2.06
gr/CF @ Stack Conditions	0.491	0.182	1.02	0.866	0.942	0.930
lbs./hr.	940.4	349.8	1918.	1611.	1857.	1846.
Particulate from Impinger Train (% of Total)	1.	9.	4.	1.5	1.	0.5
Total Catch gr /SCF * dry	1.06	0.464	2.23	1.95	2.12	2.07
gr /CF @ Stack Conditions	0.496	0.200	1.02	0.879	0.951	0.934
lbs./hr.	949.3	383.7	1926.	1636.	1875.	1856.
Stack Temperature	599	674	607	631	633	629

* 70°F, 29.92" Hg

SUMMARY OF RESULTS - SCRUBBER INLET (CONTINUED)

Run Number	M1D-10	M1D-11	M1D-12			
Date	8/3/71	8/3/71	8/4/71			
Stack Flow Rate - SCFM * dry	91,000	85,000	94,900			
% Water Vapor - % Vol.	4.61	8.9	4.8			
% CO_2 - Vol % dry	N/A	N/A	N/A			
% O_2 - Vol % dry	"	"	"			
% Excess air @ sampling point	"	"	"			
SO_2 Emissions - ppm dry						
NO_x Emissions - ppm dry						
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.965	1.66	1.91			
gr/CF @ Stack Conditions	0.431	0.709	0.948			
lbs./hr.	752.6	1209.	1553.			
Particulate from Impinger Train (% of Total)	1.7	1.8	0.5			
Total Catch gr /SCF * dry	0.982	1.69	1.92			
gr /CF @ Stack Conditions	0.438	0.722	0.953			
lbs./hr.	765.9	1231.	1562.			
Stack Temperature	655	654	541			

* 70°F, 29.92" Hg

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SOURCE TESTING CALCULATION FORMS

Test. No. No. Runs 9

Name of Firm Union Carbide

Location of Plant Marietta, Ohio

Type of Plant Ferro Alloy

Control Equipment Scrubber

Sampling Point Locations Inlet duct to scrubber

Pollutants Sampled Particulate

Time of Particulate Test:

Run No.	M1D-4	Date	7/31/71	Begin	1030	End	1257
Run No.	M1D-5	Date	7/31/71	Begin	1500	End	1626
Run No.	M1D-6	Date	8/1/71	Begin	1100	End	1247
	M1D-7		8/1/71		1525		1700
	M1D-8		8/2/71		0945		1115
	M1D-9		8/2/71		1810		1929

PARTICULATE EMISSION DATA

Run No.	M1D-4	M1D-5	M1D-6	M1D-7	M1D-8	M1D-9
P_b barometric pressure, "Hg Absolute	29.5	29.5	29.5	29.7	29.7	29.7
P_m orifice pressure drop, "H_2O	0.40	0.31	0.42	0.41	0.38	0.37
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	21.66	19.72	21.54	20.02	20.05	20.96
T_m Average Gas Meter Temperature, ^oF	90	90	90	98	94	94
$V_{m_{std.}}$ Volume of Dry Gas Sampled @ Standard conditions, ft.^{3}	20.6	18.7	20.4	18.9	19.05	19.85
V_w Total H_2O collected, ml., Impingers & Silical Gel.	22.2	25.5	25.7	22.5	24.6	25.2
$V_{w_{gas}}$ Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	1.05	1.21	1.22	1.06	1.16	1.19

* 70^{o}F, 29.92" Hg.

SOURCE TESTING CALCULATION FORMS

Test. No. No. Runs

Name of Firm

Location of Plant

Type of Plant

Control Equipment

Sampling Point Locations

Pollutants Sampled

Time of Particulate Test:

Run No. M1D-10 Date 8/3/71 Begin 1006 End 1122

Run No. M1D-11 Date 8/3/71 Begin 1400 End 1527

Run No. M1D-12 Date 8/4/71 Begin 1048 End 1212

PARTICULATE EMISSION DATA

Run No.	M1D-10	M1D-11	M1D-12			
P_b barometric pressure, "Hg Absolute	29.6	29.6	29.5			
P_m orifice pressure drop, "H_2O	0.31	0.27	0.31			
V_m volume of dry gas sampled @ meter conditions, ft.^{3}	20.65	17.93	18.02			
T_m Average Gas Meter Temperature, ^oF	91	92	86			
$V_{m_{std.}}$ Volume of Dry Gas Sampled @ Standard conditions, ft.^{3}	19.65	17.0	17.23			
V_w Total H_2O collected, ml., Impingers & Silical Gel.	20.0	34.9	18.6			
$V_{w_{gas}}$ Volume of Water Vapor Collected ft.^{3} @ Standard Conditions*	0.95	1.66	0.87			

* 70^{o}F, 29.92" Hg.

PARTICULATE EMISSION DATA (CONT'D)

Run No.	M1D-4	M1D-5	M1D-6	M1D-7	M1D-8	M1D-9
%M - % Moisture in the stack gas by volume	4.85	6.07	5.63	5.30	5.74	5.65
M_d - Mole fraction of dry gas	0.952	0.939	0.944	0.947	0.942	0.944
% CO_2	-	-	-	-	-	-
% O_2	-	-	-	-	-	-
% N_2	-	-	-	-	-	-
M W_d - Molecular weight of dry stack gas	29.14	29.23	29.18	29.22	29.26	29.24
M W - Molecular weight of stack gas	28.36	28.50	28.71	28.65	28.63	28.61
ΔP_s - Velocity Head of stack gas, In.H_2O	0.53	0.50	0.50	0.58	0.55	0.56
T_s - Stack Temperature, °F	599	674	607	631	633	629
$\sqrt{\Delta P_s X(T_s + 460)}$	23.62	23.79	23.1	25.15	24.6	24.7
P_s - Stack Pressure,"Hg.Absolute	29.42	29.42	29.42	29.42	29.42	29.42
V_s - Stack Velocity @ stack conditions, fpm	3580	3590	3500	3460	3700	3710
A_s - Stack Area, $in.^2$	8976	8976	8976	8976	8976	8976
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	104,500	96,500	100,800	97,900	103,200	104,600
Tt - Net Time of Test, min.	60	60	60	60	60	60
D_n - Sampling Nozzle Diameter, in.	0.187	0.187	0.187	0.187	0.187	0.187
%I - Percent isokinetic	112	110	115	112	95	108
m_f - Particulate - probe, cyclone and filter, mg.	1404.4	514.6	2942.6	2362.4	2597.6	2654.9
m_t - Particulate - total, mg	1416.3	563.3	2954.9	2394.4	2628.9	2667.9
C_{an} - Particulate - probe, cyclone, and filter, gr/SCF	1.05	0.423	2.22	1.92	2.10	2.06
C_{ao} - Particulate - total, gr/SCF	1.06	0.464	2.23	1.95	2.12	2.07
C_{at} - Particulate - probe, cyclone, and filter, gr/cf @ stack conditions	0.491	0.182	1.02	0.866	0.942	0.930

PARTICULATE EMISSION DATA (CONT'D)

Run No.	M1D-10	M1D-11	M1D-12			
%M - % Moisture in the stack gas by volume	4.61	8.9	4.8			
M_d - Mole fraction of dry gas	0.954	0.911	0.952			
% CO_2	-	-	-			
% O_2	-	-	-			
% N_2	-	-	-			
M W_d - Molecular weight of dry stack gas	29.23	29.18	29.18			
M W - Molecular weight of stack gas	28.73	28.18	28.61			
Δ Ps - Velocity Head of stack gas, In.H_2O	0.43	0.40	0.42			
T_s - Stack Temperature, °F	655	654	541			
$\sqrt{\Delta P_s X(T_s + 460)}$	21.9	21.1	20.5			
P_s - Stack Pressure,"Hg.Absolute	29.50	29.51	29.5			
V_s - Stack Velocity @ stack conditions, fpm	3260	3180	3060			
A_s - Stack Area, $in.^2$	8976	8976	8976			
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	91,000	85,000	94,900			
Tt - Net Time of Test, min.	60	60	60			
D_n - Sampling Nozzle Diameter, in.	0.187	0.187	0.187			
%I - Percent isokinetic	122	114	103			
m_f - Particulate - probe, cyclone and filter, mg.	1231.0	1836.2	2141.7			
m_t - Particulate - total, mg	1252.5	1862.8	2149.6			
C_{an} - Particulate - probe, cyclone, and filter, gr/SCF	0.965	1.66	1.91			
C_{ao} - Particulate - total, gr/SCF	0.982	1.69	1.92			
C_{at} - Particulate - probe, cyclone, and filter, gr/cf @ stack conditions	0.431	0.709	0.948			

PARTICULATE EMISSION DATA (cont'd)

Run No.	M1D-4	M1D-5	M1D-6	M1D-7	M1D-8	M1D-9
C_{au} - Particulate, total, gr/cf @ stack cond.	0.496	0.200	1.02	0.879	0.951	0.934
C_{aw} - Particulate, probe, cyclone, and filter, lb/hr.	940.4	349.8	1918.	1611.	1857.	1846.
C_{ax} - Particulate - total, lb/hr.	949.3	383.7	1926.	1636.	1875.	1856.
% EA - % Excess air @ sampling point	N/A	N/A	N/A	N/A	N/A	N/A

*70°F. 29.92" Hg.

PARTICULATE EMISSION DATA (cont'd)

Run No.	M1D-10	M1D-11	M1D-12			
C_{au} - Particulate, total, gr/cf @ stack cond.	0.438	0.722	0.953			
C_{aw} - Particulate, probe, cyclone, and filter, lb/hr.	752.6	1209.	1553.			
C_{ax} - Particulate - total, lb/hr.	765.9	1231.	1562.			
% EA - % Excess air @ sampling point	N/A	N/A	N/A			

*70°F. 29.92" Hg.

SUMMARY OF RESULTS - TAPPING EXHAUST

Run Number	ETE-1	ETE-2	ETE-3	WTE-1	WTE-2	WTE-3
Date	8/5/71	8/5/71	8/5/71	8/5/71	8/5/71	8/5/71
Stack Flow Rate - SCFM * dry	70,100	70,000	69,700	64,250	61,800	64,700
% Water Vapor - % Vol.	4.95	4.12	3.74	3.11	3.32	2.72
% CO_2 - Vol % dry	-	-	-	0.2	0.1	0.1
% O_2 - Vol % dry	-	-	-	21.2	20.9	21.2
% Excess air @ sampling point	N/A	N/A	N/A	N/A	N/A	N/A
SO_2 Emissions - ppm dry	-	-	0.833	0.703	0.361	-
NO_x Emissions - ppm dry	-	-	-	-	-	-
Particulates Probe, Cyclone, & Filter Catch gr/SCF* dry	0.0358	0.0249	0.0284	0.128	0.0483	0.0169
gr/CF @ Stack Conditions	0.0316	0.0224	0.0258	0.114	0.0428	0.0153
lbs./hr.	21.5	14.94	16.96	70.5	25.6	9.37
Particulate from Impinger Train (% of Total)	2.	10.	8.	20.	30.	48.
Total Catch gr /SCF * dry	0.0366	0.0275	0.031	0.160	0.0696	0.0329
gr /CF @ Stack Conditions	0.0323	0.0248	0.0282	0.1429	0.0616	0.0297
lbs./hr.	22.0	16.5	18.5	88.2	36.9	18.25
Stack Temperature	107	100	97	111	115	107

* 70°F, 29.92" Hg

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SOURCE TESTING CALCULATION FORMS

Test. No. No. Runs 6

Name of Firm Union Carbide

Location of Plant Marietta, Ohio

Type of Plant Ferro Alloy - Reactive Metals

Control Equipment Scrubber

Sampling Point Locations East and West Tapping Exhausts

Pollutants Sampled Particulate, SO_2

Time of Particulate Test:

Run No. ETE-1 WTE-1 Date 8/5/71 8/5/71 Begin 1130 1130 End 1207 1207

Run No. ETE-2 WTE-2 Date 8/5/71 8/5/71 Begin 1430 1430 End 1501 1500

Run No. ETE-3 WTE-3 Date 8/5/71 8/5/71 Begin 1602 1604 End 1632 1634

PARTICULATE EMISSION DATA

Run No.	ETE-1	ETE-2	ETE-3	WTE-1	WTE-2	WTE-3
P_b barometric pressure, "Hg Absolute	29.7	29.7	29.7	29.7	29.7	29.7
P_m orifice pressure drop, "H_2O	1.76	1.76	1.74	1.34	1.26	1.33
V_m volume of dry gas sampled @ meter conditions, $ft.^3$	30.19	22.65	21.89	22.77	17.91	18.63
T_m Average Gas Meter Temperature, ^oF	104	96	97	106	97	101
$V_{m_{std.}}$ Volume of Dry Gas Sampled @ Standard conditions, $ft.^3$	28.22	21.48	20.74	21.22	16.96	17.52
V_w Total H_2O collected, ml., Impingers & Silical Gel.	31.0	19.5	17.0	14.4	12.3	10.4
$V_{w_{gas}}$ Volume of Water Vapor Collected $ft.^3$ @ Standard Conditions*	1.47	0.924	0.806	0.682	0.583	0.493

* 70^oF, 29.92" Hg.

PARTICULATE EMISSION DATA (CONT'D)

Run No.	ETE-1	ETE-2	ETE-3	WTE-1	WTE-2	WTE-3
%M -% Moisture in the stack gas by volume	4.95	4.12	3.74	3.11	3.32	2.72
M_d - Mole fraction of dry gas	0.950	0.959	0.963	0.969	0.967	0.973
% CO_2	-	-	-	0.2	0.1	0.1
% O_2	-	-	-	21.0	20.8	21.1
% N_2	-	-	-	78.8	79.1	78.8
M W_d - Molecular weight of dry stack gas	28.9	28.85	28.86	28.88	28.85	28.86
M W - Molecular weight of stack gas	28.34	28.41	28.46	28.54	28.49	28.57
Δ Ps - Velocity Head of stack gas, In.H_2O	1.28	1.24	1.22	1.05	0.98	1.05
T_s - Stack Temperature, °F	107	100	97	111	115	107
$\sqrt{\Delta P_s X(T_s + 460)}$	27.0	26.4	26.1	24.5	23.8	24.4
P_s - Stack Pressure,"Hg.Absolute	29.7	29.7	29.7	29.7	29.7	29.7
V_s - Stack Velocity @ stack conditions, fpm	4052	3962	3905	3666	3561	3650
A_s - Stack Area, $in.^2$	2826	2826	2826	2826	2826	2826
Q_s - Stack Gas Volume @ Standard Conditions, *SCFM	70,100	70,000	69,700	64,250	61,800	64,700
Tt - Net Time of Test, min.	37	31	30	37	30	30
D_n - Sampling Nozzle Diameter, in.	0.187	0.187	0.187	0.187	0.187	0.187
%I - Percent isokinetic	119	106	107	97.7	98.3	98.6
m_f - Particulate - probe, cyclone and filter, mg.	65.6	34.7	38.2	176.9	53.2	19.2
m_t - Particulate - total, mg	67.2	38.4	41.8	220.5	76.7	37.4
C_{an} - Particulate - probe, cyclone, and filter, gr/SCF	0.0358	0.0249	0.0284	0.128	0.0483	0.0169
C_{ao} - Particulate - total, gr/SCF	0.0366	0.0275	0.031	0.160	0.0696	0.0329
C_{at} - Particulate - probe, cyclone, and filter, gr/cf @ stack conditions	0.0316	0.0224	0.0258	0.114	0.0428	0.0153

PARTICULATE EMISSION DATA (cont'd)

Run No.	ETE-1	ETE-2	ETE-3	WTE-1	WTE-2	WTE-3
C_{au} - Particulate, total, gr/cf @ stack cond.	0.0323	0.0248	0.0282	0.1429	0.0616	0.0297
C_{aw} - Particulate, probe, cyclone, and filter, lb/hr.	21.5	14.94	16.96	70.5	25.6	9.37
C_{ax} - Particulate - total, lb/hr.	22.0	16.5	18.5	88.2	36.9	18.25
% EA - % Excess air @ sampling point	N/A	N/A	N/A	N/A	N/A	N/A

*70°F. 29.92" Hg.

EXAMPLE PARTICULATE CALCULATIONS

ETE-1

1. Volume of dry gas sampled at standard conditions - 70°F, 29.92" Hg, ft^3.

$$V_{m_{std}} = \frac{17.7 \times V_m \left(P_B + \frac{P_m}{13.6}\right)}{(T_m + 460)} = Ft.^3$$

$$= \frac{(17.7)(30.19)\left(29.7 + \frac{1.76}{13.6}\right)}{564}$$

$$= 28.22$$

2. Volume of water vapor at 70°F and 29.92" Hg, $Ft.^3$

$$V_{w_{gas}} = 0.0474 \times V_w = ft.^3$$

$$= (0.0474)(31.0)$$

$$= 1.47$$

3. % moisture in stack gas

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} = \%$$

$$= \frac{(100)(1.47)}{28.22 + 1.47}$$

$$= 4.95$$

4. Mole fraction of dry gas

$$M_d = \frac{100 - \%M}{100}$$

$$= \frac{100 - 4.95}{100} = 0.950$$

5. Average molecular weight of dry stack gas

$$MW_d = (\%CO_2 \times \frac{44}{100}) + (\%O_2 \times \frac{32}{100}) + (\%N_2 \times \frac{28}{100})$$

$$= (0.2)(\frac{44}{100}) + (21.0)(\frac{32}{100}) + (78.8)(\frac{28}{100}) = 28.9$$

For this calculation, data from WTE-1 was used, as an Orsat analysis was not taken for ETE-1.

6. Molecular weight of stack gas

$$MW = MW_d \times M_d + 18\,(1 - M_d)$$

$$= (28.9)(.950) + 18(1 - .950)$$

$$= 28.34$$

7. Stack velocity @ stack conditions, fpm

$$V_s = 4350 \times \sqrt{\Delta P_s \times (T_s + 460)} \left\{ \frac{1}{P_s \times MW} \right\}^{1/2} = \text{fpm}$$

$$= (4350)(27.0)\left[\frac{1}{(29.7)(28.34)}\right]^{1/2}$$

$$= 4052$$

8. Stack gas volume @ standard conditions, SCFM

$$Q_s = \frac{0.123 \; X \; V_s \quad X \; A_s \; X \; M_d \; X \; P_s}{(T_s + 460)} = \text{SCFM}$$

$$= \frac{(0.123)(4052)(2826)(0.950)(29.7)}{567}$$

$$= 70{,}100$$

9. Percent isokinetic

$$\%I = \frac{1032 \; X \; (T + 460) \; X \; V_m}{V_s \; X \; T_t \; X \; P_s \; X \; M_d \; X \; (D_n)^2} = \%$$

$$= \frac{(1032)(567)(30.19)}{(4052)(37)(29.7)(.950)(0.0351)}$$

$$= 119$$

10. Particulate - probe, cyclone, and filter, gr/SCF

$$C_{an} = 0.0154 \; X \; \frac{M_f}{V_{m_{std}}} = \text{gr/scf}$$

$$= \frac{(0.0154)(65.6)}{28.22}$$

$$= 0.0358$$

11. Particulate total, gr/SCF

$$C_{ao} = 0.0154 \; X \; \frac{M_t}{V_{m_{std}}} = \text{gr/SCF}$$

$$= \frac{(0.0154)(67.2)}{28.22}$$

$$= 0.0366$$

12. Particulate - probe, cyclone and filter, gr/CF at stack conditions

$$C_{at} = \frac{17.7 \times C_{an} \times P_s \times M_d}{(T_s + 460)} = \text{gr/CF}$$

$$= \frac{(17.7)(0.0358)(29.7)(.950)}{567}$$

$$= 0.0316$$

13. Particulate - total, gr/CF @ stack conditions

$$C_{au} = \frac{17.7 \times C_{ao} \times P_s \times M_d}{(T_x + 460)} = \text{gr/CF}$$

$$= \frac{(17.7)(0.0366)(29.7)(.950)}{567}$$

$$= 0.0323$$

14. Particulate - probe, cyclone and filter, lb/hr.

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = \text{lb/hr.}$$

$$= (0.00857)(0.0358)(70,100)$$

$$= 21.5$$

15. Particulate - total, lb/hr.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = \text{lb/hr.}$$

$$= (0.00857)(0.0366)(70,100)$$

$$= 22.0$$

16. % excess air at sampling point

$$\% \text{ EA} = \frac{100 \times \% O_2}{(0.266 \times \% N_2) - \% O_2} = \%$$

$$= \frac{(100)(19.2)}{(0.266)(78.7) - 19.2}$$

$$= 1110$$

For this calculation, data from M1E-1 was used as % Excess air at sampling point is not applicable for the tapping exhausts.

APPENDIX B

COMPLETE GASEOUS RESULTS WITH EXAMPLE CALCULATIONS

SO_2 EMISSION DATA

Run No.	1-E	2-E	3-E	4-E	5-E
Date	7/27/71	7/29/71	7/30/71	7/31/71	7/31/71
mg SO_2	0.31	2.5	0	0.19	0.19
T_m - Average Gas Meter Temperature, ^oF	75	68	66	77	88
P_b - Barometric Pressure, "Hg abs.	29.5	29.5	29.5	29.5	29.5
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	31.64	6.98	10.38	11.00	9.62
ppm SO_2	0.158	5.21	0	0.266	0.302
Vacuum	5.0	2.9	3.4	3.7	3.0
Vstd - Volume of sampled gas converted to standard conditions	25.7	6.21	9.14	9.96	8.24

$$ppm\ SO_2 = \frac{0.7332 \times mg\ SO_2 \times (T_m + 460)}{P_b \times V_m}$$

Not used because the meter was under vacuum.

1-E

$$Vstd = (V_m)\left(\frac{530}{T_m}\right)\left(\frac{P_b - P_m}{29.92}\right)$$

$$Vstd = (31.64)\left(\frac{530}{535}\right)\left(\frac{29.5-5.0}{29.92}\right) = 25.7$$

$$ppm\ SO_2 = \left(\frac{mg\ SO_2}{Vstd}\right)\ (13.1) =$$

1-E

$$ppm\ SO_2 = \frac{(0.31)(13.1)}{25.7} = 0.158$$

SO_2 EMISSION DATA

Run No.	8-E	9-E	10-E			
Date	8/2	8/2	8/3			
mg SO_2	0.28	0.06	0.19			
T_m - Average Gas Meter Temperature, ^oF	79	81	68			
P_b - Barometric Pressure, "Hg abs.	29.7	29.7	29.6			
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	6.97	24.70	3.69			
ppm SO_2	0.587	0.0340	0.737			
Vacuum	2.4	1.2	2.3			
Vstd - Volume of sampled gas converted to standard conditions	6.25	23.1	3.38			

$$\text{ppm } SO_2 = \frac{0.7332 \times \text{mg } SO_2 \times (T_m + 460)}{P_b \times V_m}$$

SO_2 EMISSION DATA

Run No.	WTE-1	WTE-2	ETE-3			
Date (1971)	8/5	8/5	8/5			
mg SO_2	0190	0.060	0.060			
T_m - Average Gas Meter Temperature, ^oF	75	79	75			
P_b - Barometric Pressure, "Hg abs.	29.6	29.6	29.6			
V_m - Volume of dry gas sampled @ meter conditions, $ft.^3$	3.95	2.45	1.0			
ppm SO_2	0703	0.361	0.833			
Vacuum	2.5	2.5	1.1			
Vstd - Volume of dry gas converted to standard conditions	3.54	2.18	0.944			

$$\text{ppm } SO_2 = \frac{0.7332 \times \text{mg } SO_2 \times (T_m + 460)}{P_b \times V_m}$$

ORSAT RESULTS

Test Number	Date	% CO_2	% O_2	% CO
M1E- 1	7/27/71	2.1	19.2	Negligible
- 2	7/29/71	3.4	18.3	"
- 3	7/30/71	1.9	18.6	"
- 4	7/31/71	2.8	18.8	"
- 5	7/31/71	3.3	18.4	"
- 6	Discarded	-	-	-
- 7	8/1/71	3.0	18.6	Negligible
- 8	8/2/71	3.2	18.6	"
- 9	8/2/71	3.4	18.5	"
-10	8/3/71	3.2	18.8	"
-11	8/3/71	3.2	18.6	"
-12	8/4/71	3.1	18.7	"
WTE- 1	8/5/71	0.2	21.2	Negligible
- 2	8/5/71	0.1	20.9	"
- 3	8/5/71	0.1	21.2	"

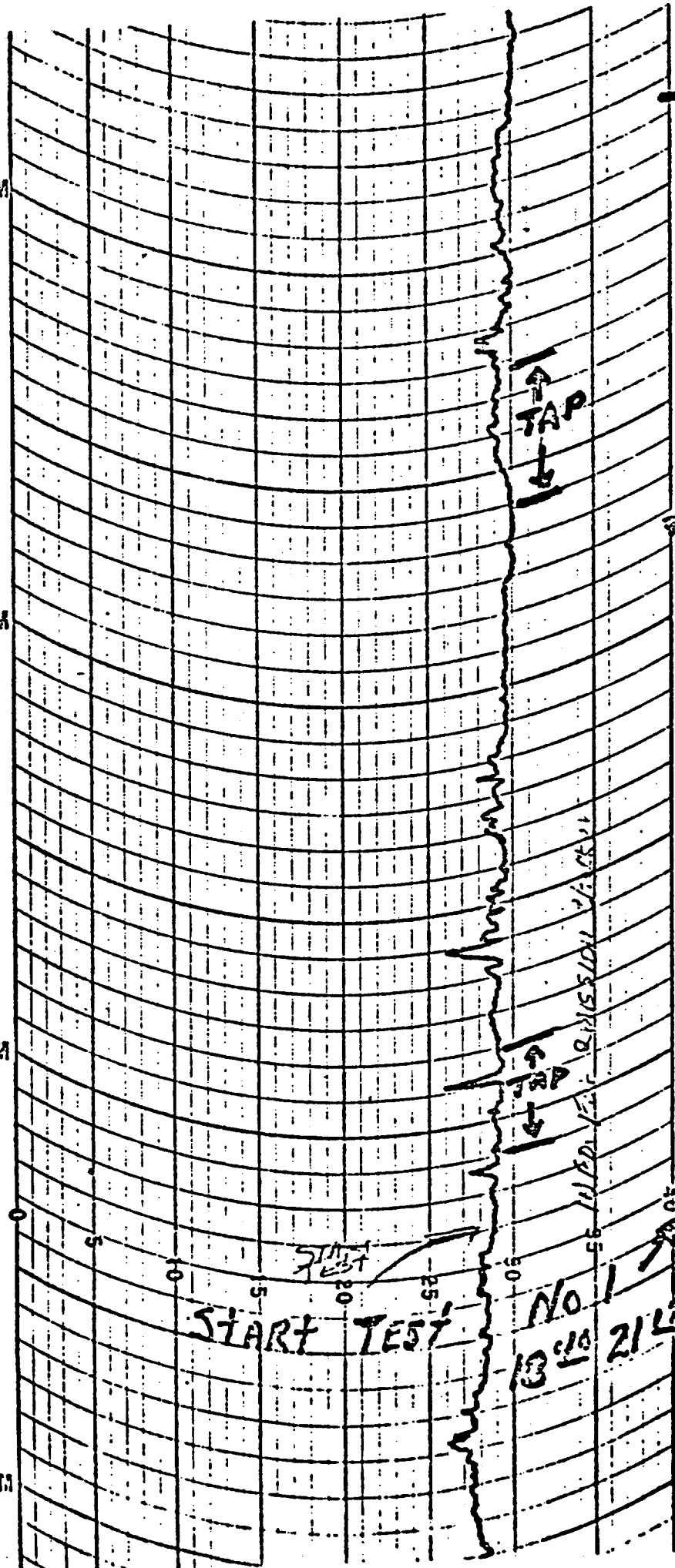
APPENDIX C

COMPLETE OPERATION RESULTS WITH EXAMPLE CALCULATIONS

TAP DATA - NO. 1 FURNACE - MARIETTA, OHIO

Tap No.	Shift	Date	Time
1	8/4	7/27	8:50
2	8/4	7/27	10:15
3	8/4	7/27	11:45
4	8/4	7/27	1:10
5	8/4	7/27	2:45
6	8/4	7/27	3:55
7	4/12	7/27	5:30
8	4/12	7/27	6:55
9	4/12	7/27	8:25
10	4/12	7/27	9:45
11	4/12	7/27	11:10
12	12/8	7/28	12:35
13	12/8	7/28	2:10
14	12/8	7/28	3:40
15	12/8	7/28	5:15
16	12/8	7/28	6:45
17	4/12	7/28	4:00
18	4/12	7/28	5:30
19	4/12	7/28	7:10
20	4/12	7/28	8:35
21	4/12	7/28	10:05
22	4/12	7/28	11:30
23	12/8	7/29	1:00
24	12/8	7/29	2:25
25	12/8	7/29	3:55
26	12/8	7/29	5:15
27	12/8	7/29	6:45
28	8/4	7/29	8:10
29	8/4	7/29	9:30
30	8/4	7/29	11:10
31	8/4	7/29	12:50
32	8/4	7/29	2:10
33	4/12	7/29	4:30
34	4/12	7/29	6:00
35	4/12	7/29	7:30
36	4/12	7/29	8:50
37	4/12	7/29	10:20
38	12/8	7/30	3:00
39	12/8	7/30	5:45
40	12/8	7/30	7:25
41	8/4	7/30	5:00
42	8/4	7/30	7:25
43	8/4	7/30	9:15
44	8/4	7/30	10:40
45	8/4	7/30	12:20
46	8/4	7/30	1:40
207	8/4	7/30	3:15
208	4/12	7/30	4:50
207	4/12	7/30	6:20
210	4/12	7/30	7:45
211	8/4	7/31	9:20
212	8/4	7/31	10:45
213	8/4	7/31	1:00
214	8/4	7/31	2:20
215	8/4	7/31	3:50
216	4/12	7/31	5:20
217	4/12	7/31	7:00
218	4/12	7/31	8:25
219	4/12	7/31	10:00
220	4/12	7/31	11:25
221	12/8	8/1	1:25
222	12/8	8/1	2:20
223	12/8	8/1	5:00
224	12/8	8/1	7:10
225	8/4	8/1	10:50
226	8/4	8/1	11:35
227	8/4	8/1	1:05
228	8/4	8/1	2:35
229	4/12	8/1	4:10
230	4/12	8/1	5:45
231	4/12	8/1	7:05
232	4/12	8/1	9:05
233	4/12	8/1	10:35
234	12/8	8/2	1:10
235	12/8	8/2	3:10
236	12/8	8/2	4:40
237	12/8	8/2	6:10
238	12/8	8/2	7:40
239	8/4	8/2	9:10
240	8/4	8/2	11:00
241	4/12	8/2	5:35
242	4/12	8/2	7:05
243	4/12	8/2	8:40
244	4/12	8/2	10:05
245	4/12	8/2	11:40
246	12/8	8/3	1:10
247	12/8	8/3	2:40
248	12/8	8/3	4:10
249	12/8	8/3	5:45
250	12/8	8/3	7:10
251	8/4	8/3	8:45
252	8/4	8/3	10:15
253	8/4	8/3	11:45
254	8/4	8/3	1:20
255	8/4	8/3	2:55
256	4/12	8/3	4:30
257	4/12	8/3	6:00
258	4/12	8/3	7:25
259	4/12	8/3	11:00
260	12/8	8/4	12:35
261	12/8	8/4	2:15
262	12/8	8/4	3:25
263	12/8	8/4	5:15
264	12/8	8/4	6:40
265	8/4	8/4	8:15
266	8/4	8/4	9:35
267	8/4	8/4	11:30
268	8/4	8/4	1:00
269	8/4	8/4	2:45
270	4/12	8/4	4:45
271	4/12	8/4	6:35
272	4/12	8/4	8:05
273	4/12	8/4	9:50
274	4/12	8/4	11:20
275	12/8	8/5	1:00
276	12/8	8/5	2:25
277	12/8	8/5	4:05
278	12/8	8/5	5:40
279	12/8	8/5	7:15
280	8/4	8/5	8:40
281	8/4	8/5	10:00
282	8/4	8/5	11:34
283	8/4	8/5	1:10
284	8/4	8/5	2:30
285	8/4	8/5	3:55
286	4/12	8/5	5:15
287	4/12	8/5	7:10
288	4/12	8/5	8:55
289	4/12	8/5	10:05
290	4/12	8/5	11:30
291	12/8	8/6	1:30
292	12/8	8/6	3:10
293	12/8	8/6	4:40
294	12/8	8/6	6:15
295	12/8	8/6	7:40

12-8 Shift starts at 12:01 a.m. on the Date Indicated

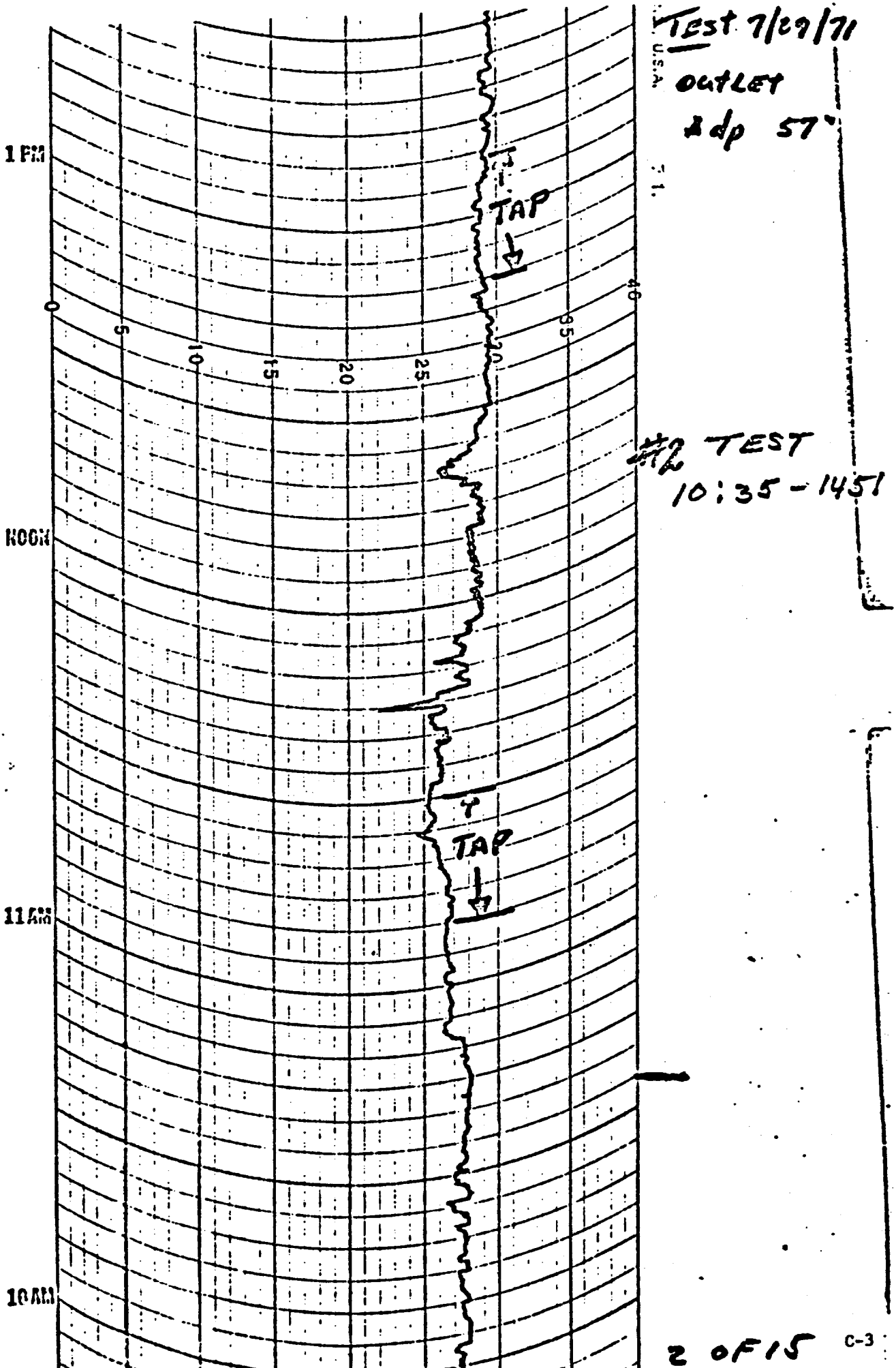


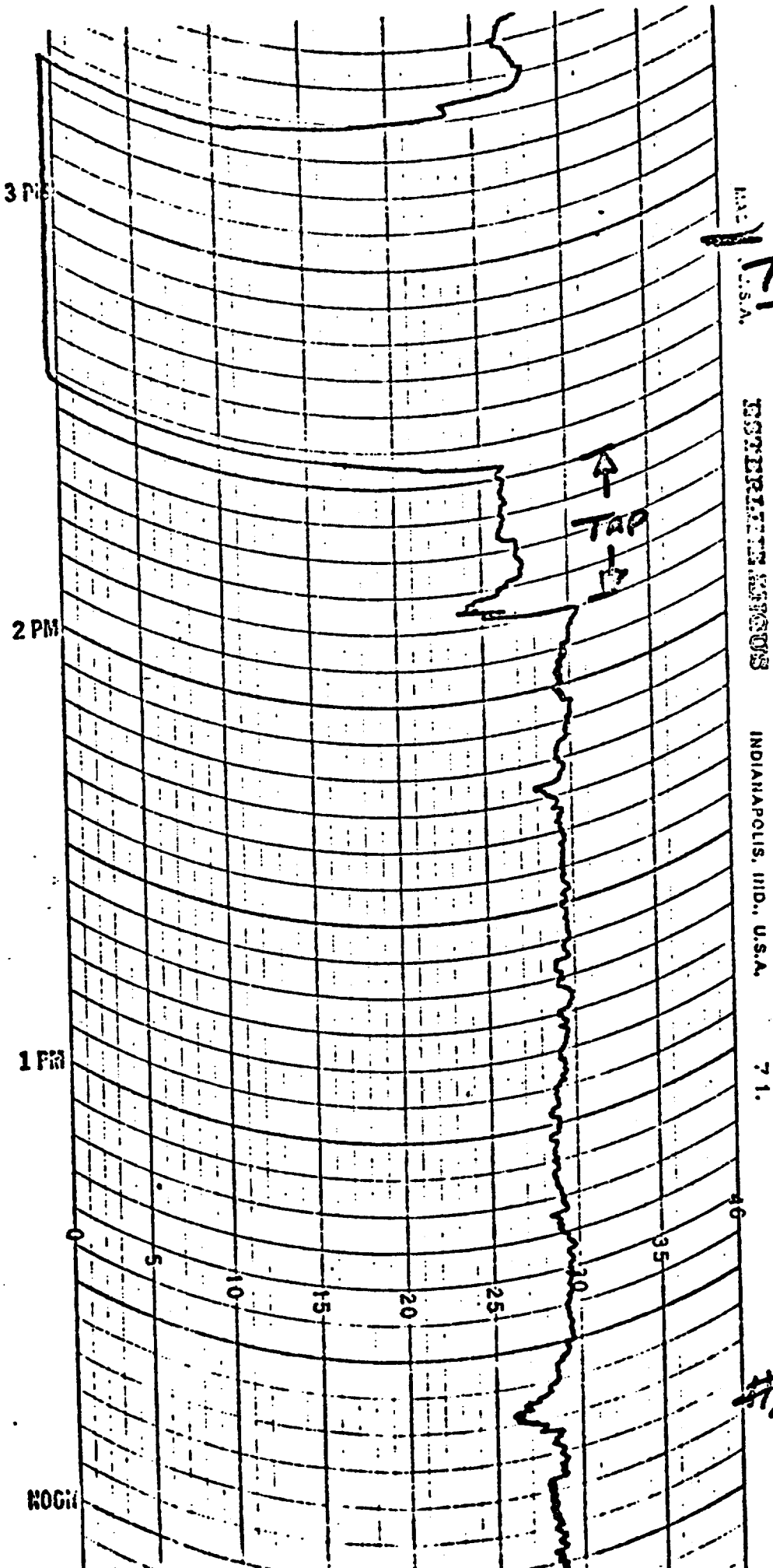
Test 7/27/71
outlet
Δdp 57"

TEST
1240-2112

START TEST No 1
13 to 21

1 OF 15

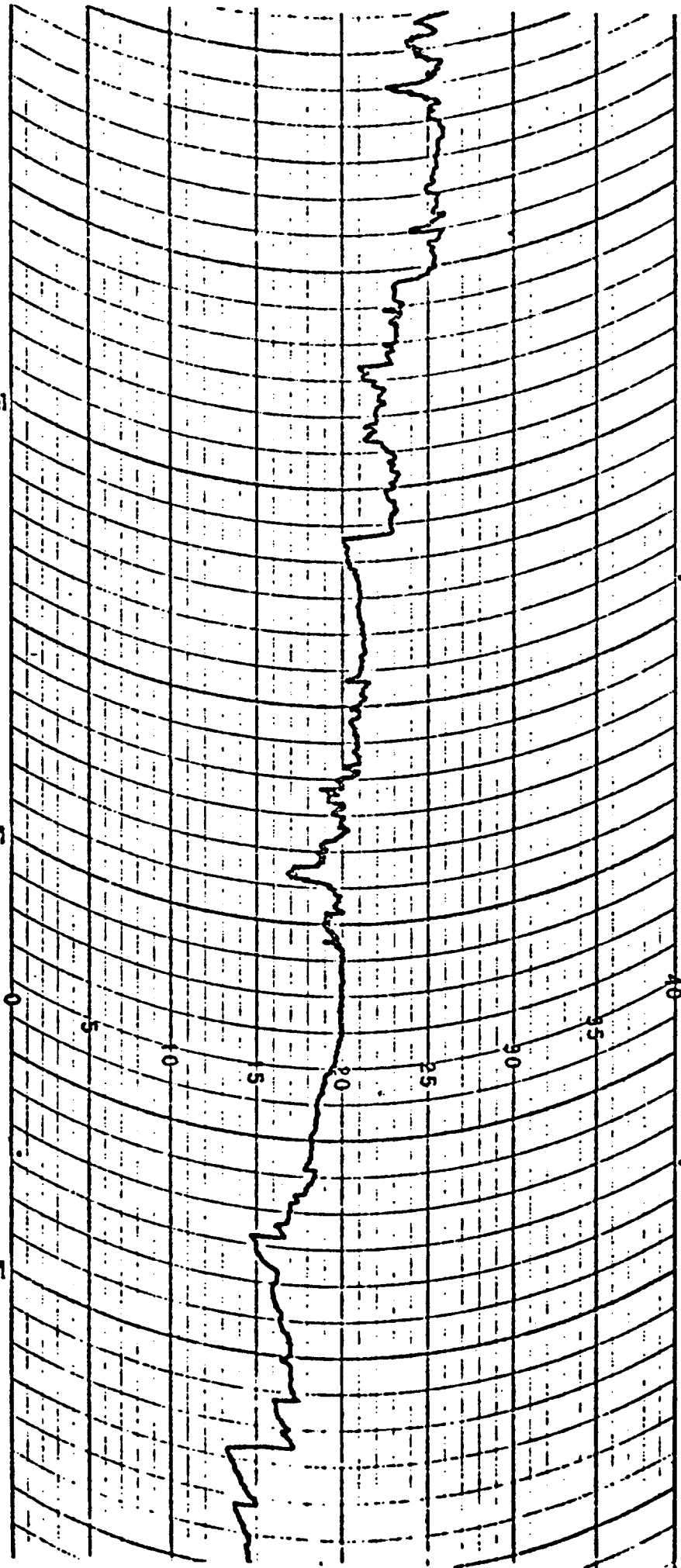

Test 7/29/71
outlet
Δp 57"
TAP
#2 TEST
10:35 - 1451
TAP
1 PM
NOON
11 AM
10 AM
0
5
10
15
20
25
30
35
40



TEST 7/29/71
OUTLET
Δp 57"

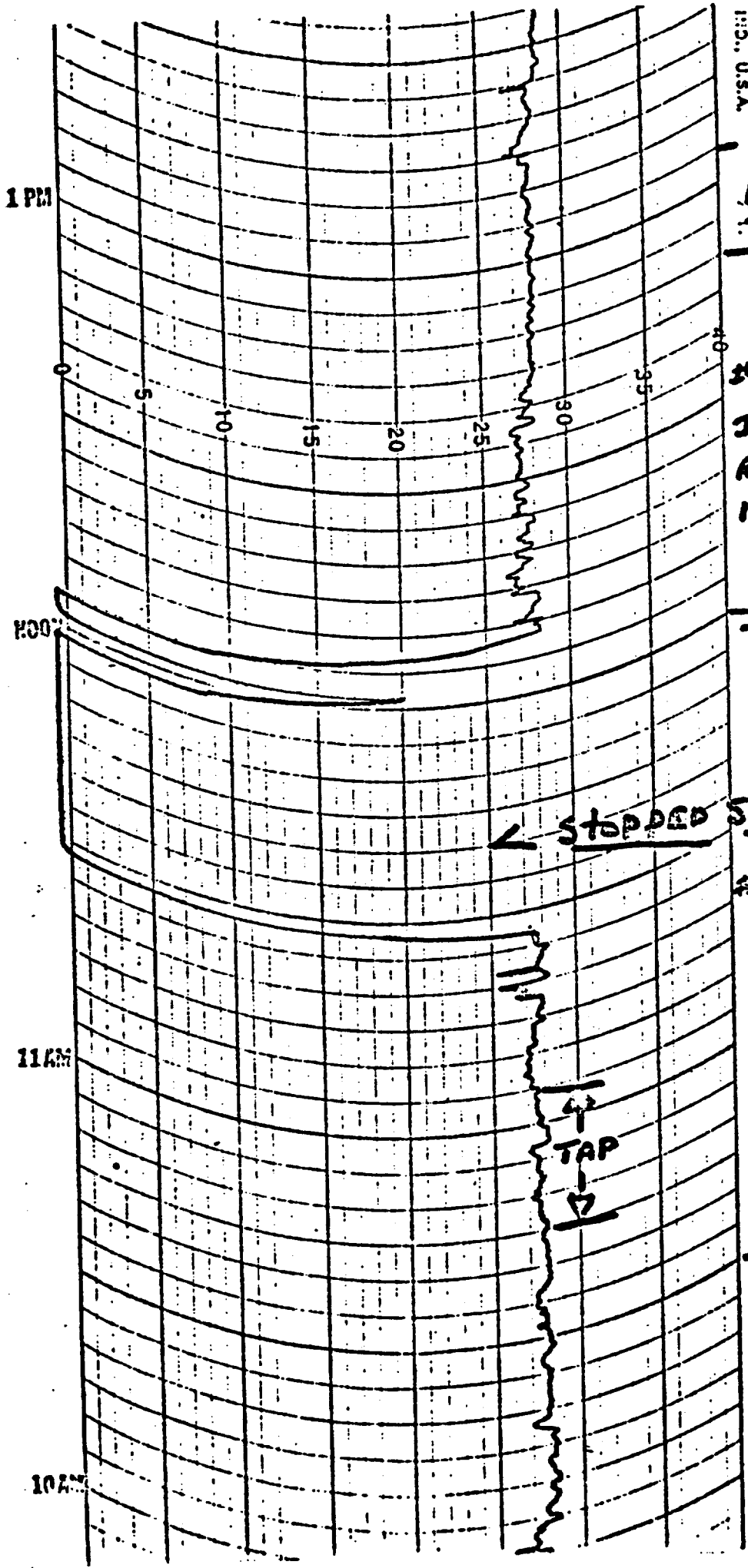
#2 TEST
1035 - 1451

3 OF 15

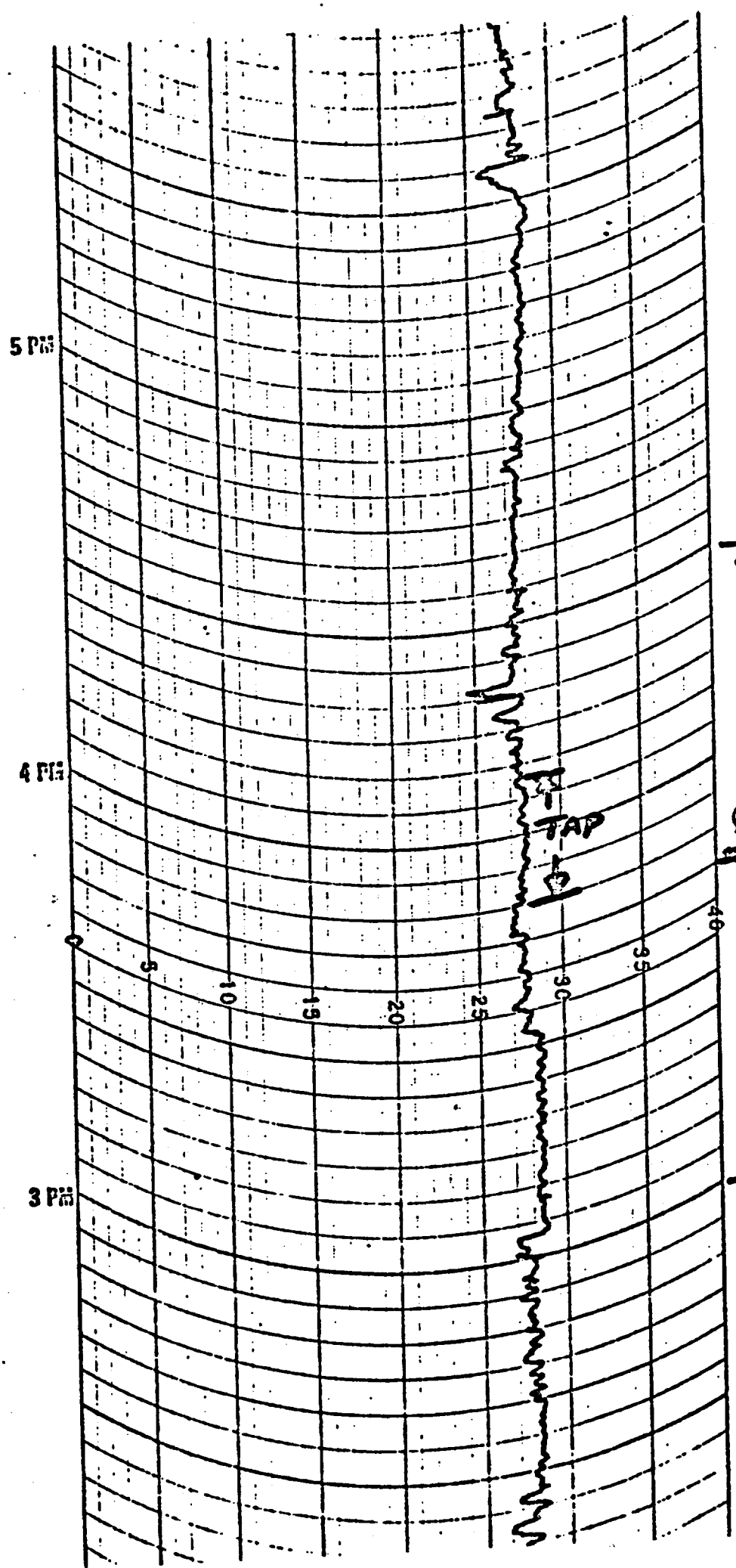


TEST 7/30/71
Inlet & outlet
Δdp 57"
#3
TEST
1815-1940

4 OF 15 C-5


U.S.A.
#4 TEST RESUMED SAMPLING
1 PM
0
5
10
15
20
25
30
35
40
#4 TEST INTERRUPTED RESUMED TESTING 1250 - 105
TEST 7/31/71
INLET & OUTLET
Δdp 57"
STOPPED SAMPLING
#1 TEST
11AM
TAP
10AM

5 OF 15

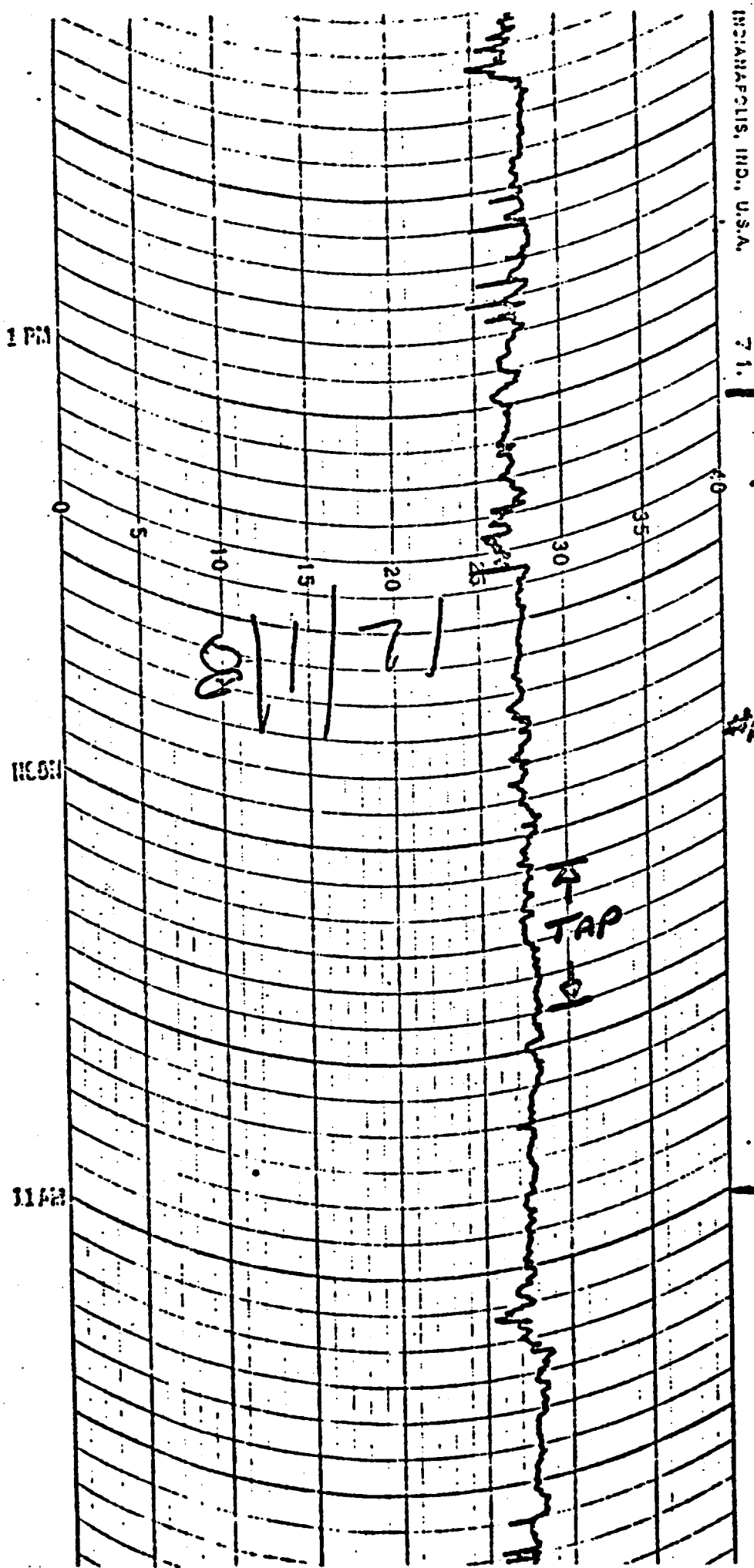


Test 7/31/71
Inlet & outlet
Δdp 57"

#5 TEST
1500-1630

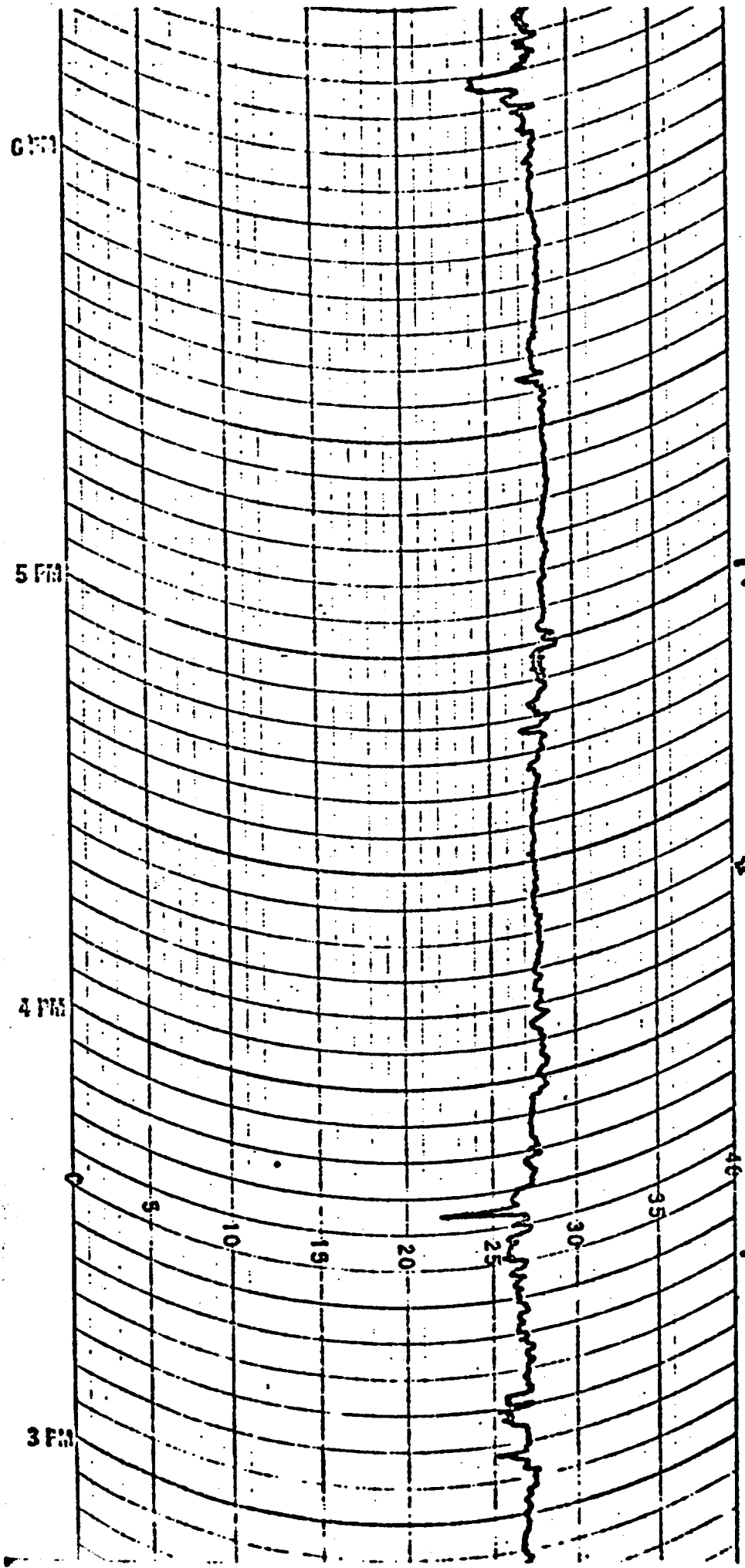
6 OF 15

C-7



Test 8/1/71
Inlet & outlet
Adp 57"

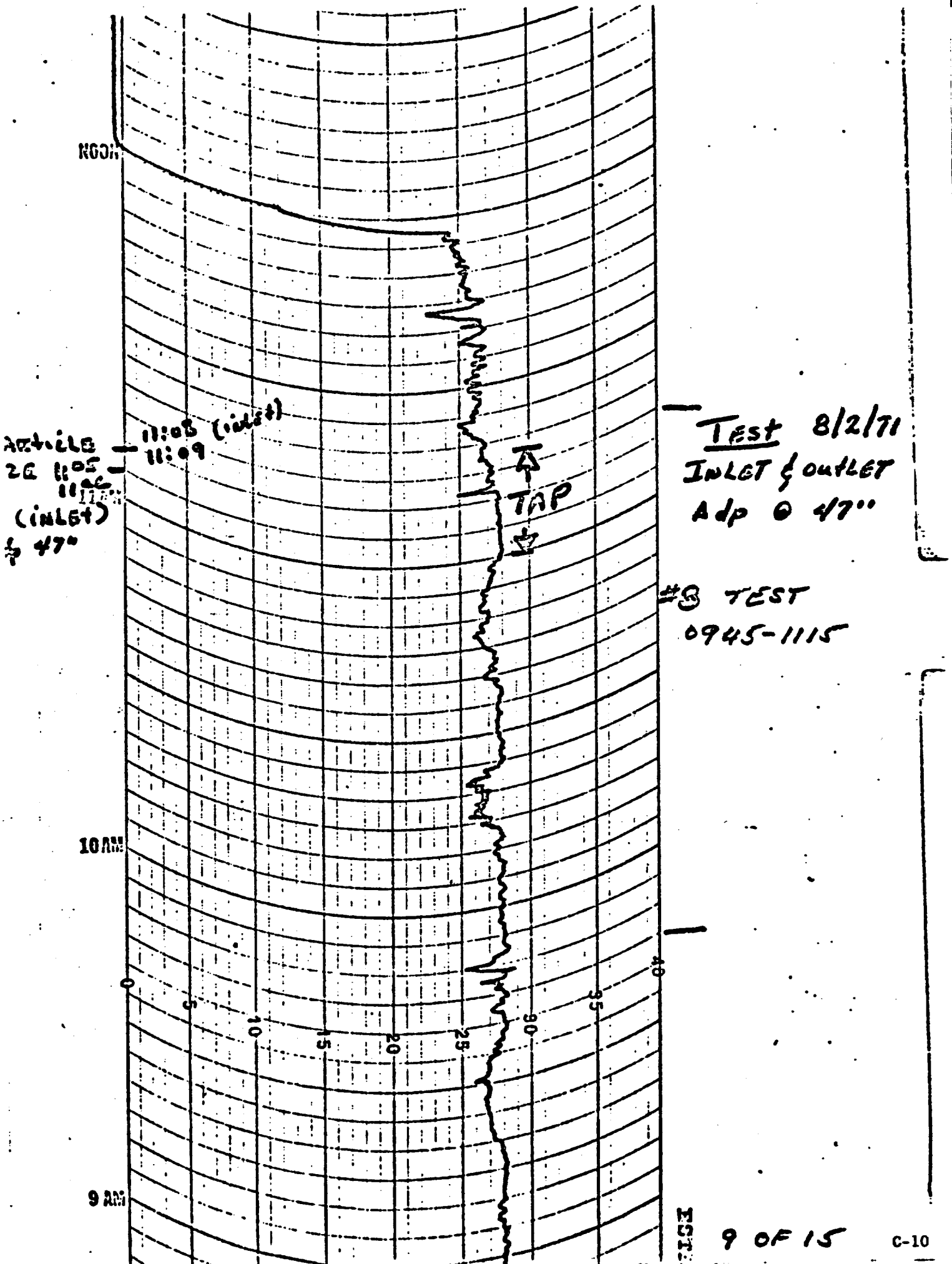
#6 TEST
1100-1250



TEST 8/1/71
INLET & OUTLET
Adp @ 47"

#7 TEST
1525-1700

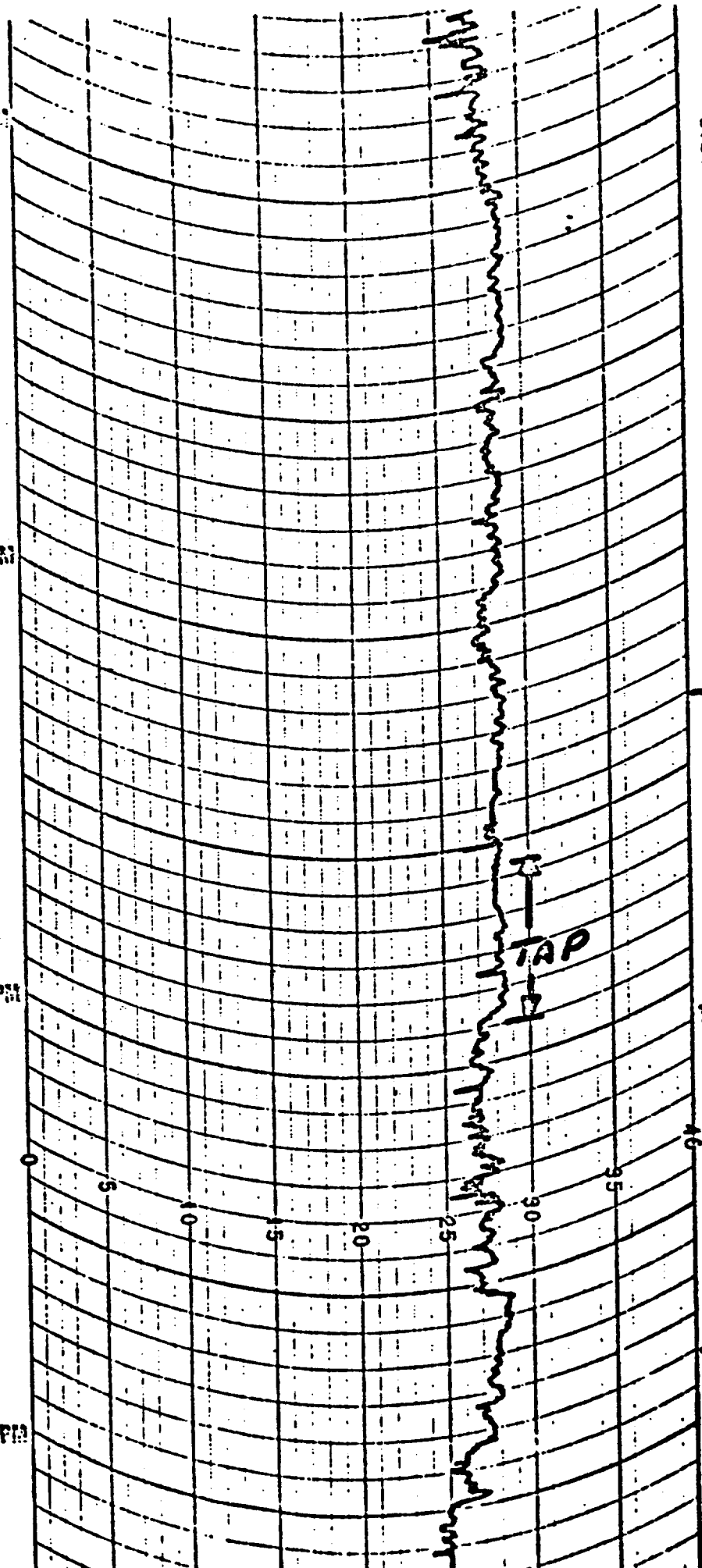
8 OF 15



Test 8/2/71
Inlet & outlet
Adp @ 47"

#8 TEST
0945-1115

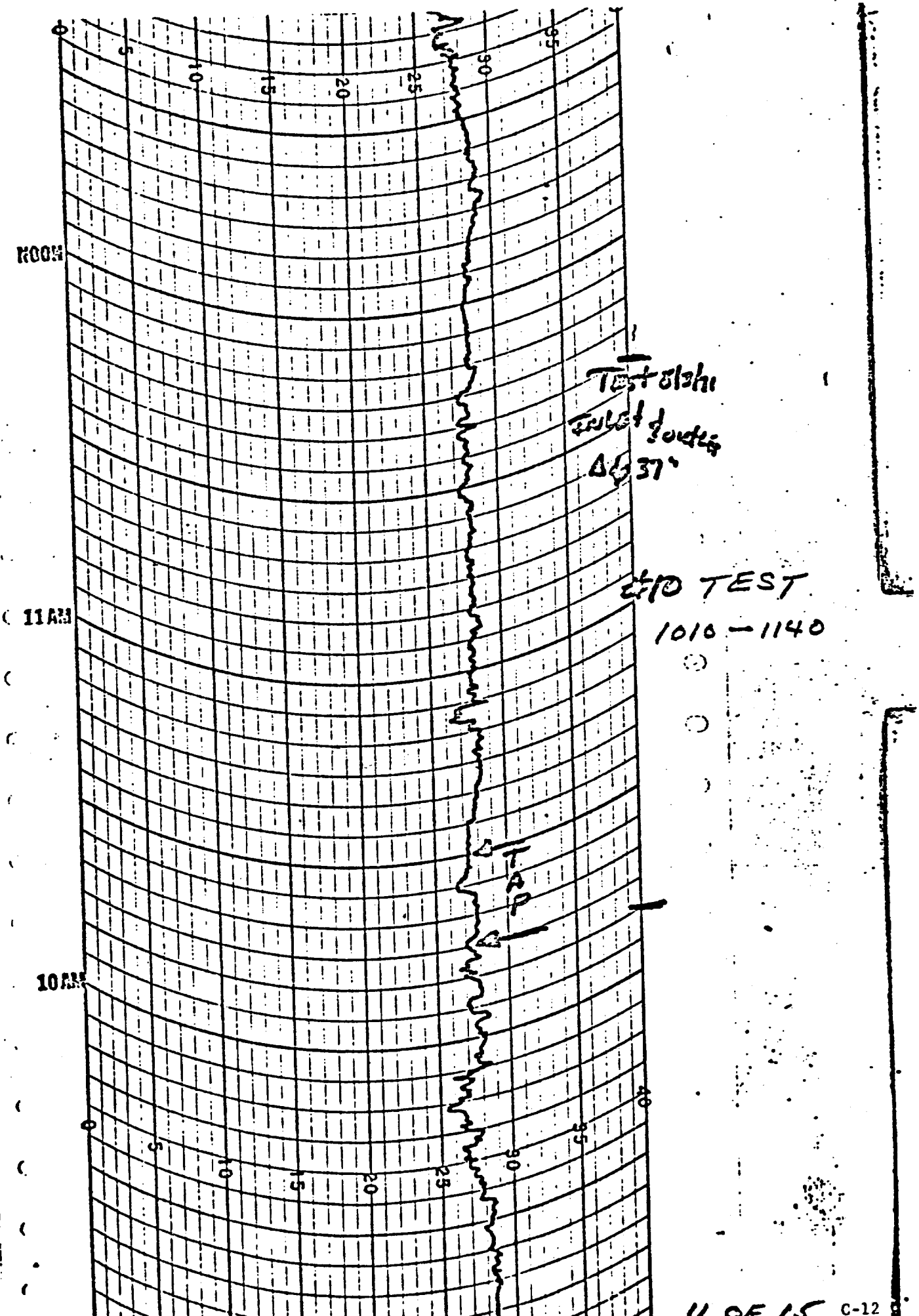
9 OF 15

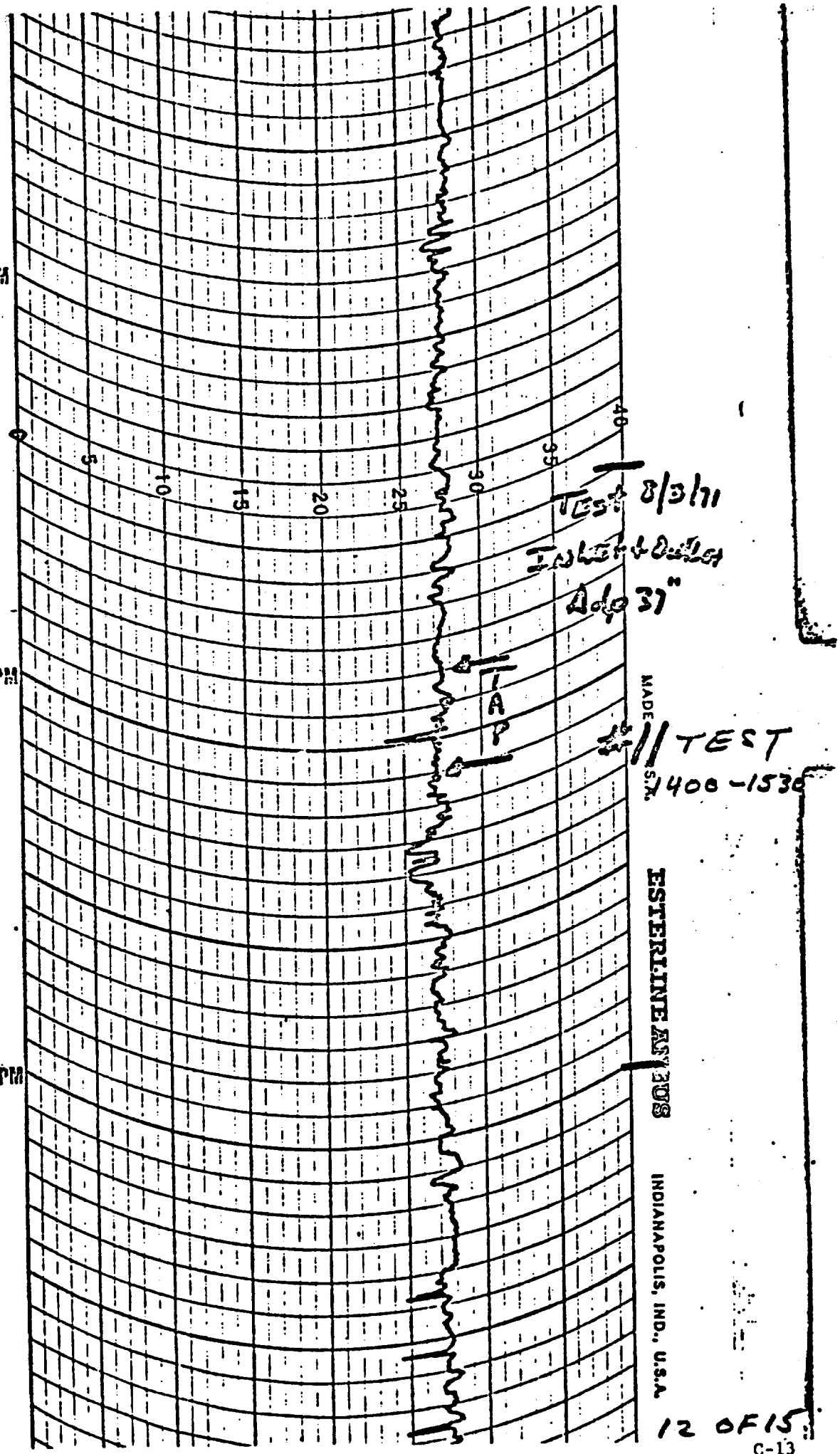


TEST 8/2/71
INLET & OUTLET
Δ dp @ 47"

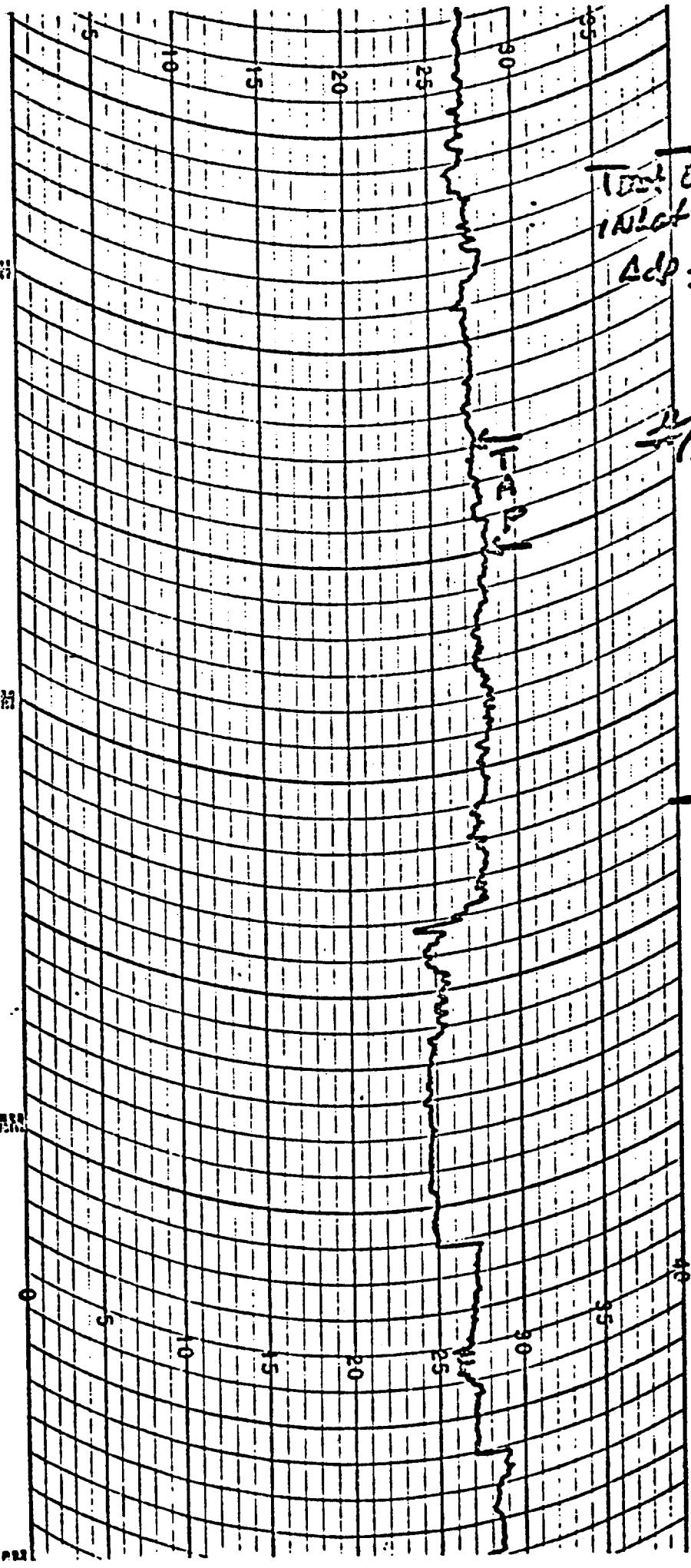
#9 TEST
1810-1910

10 OF 15

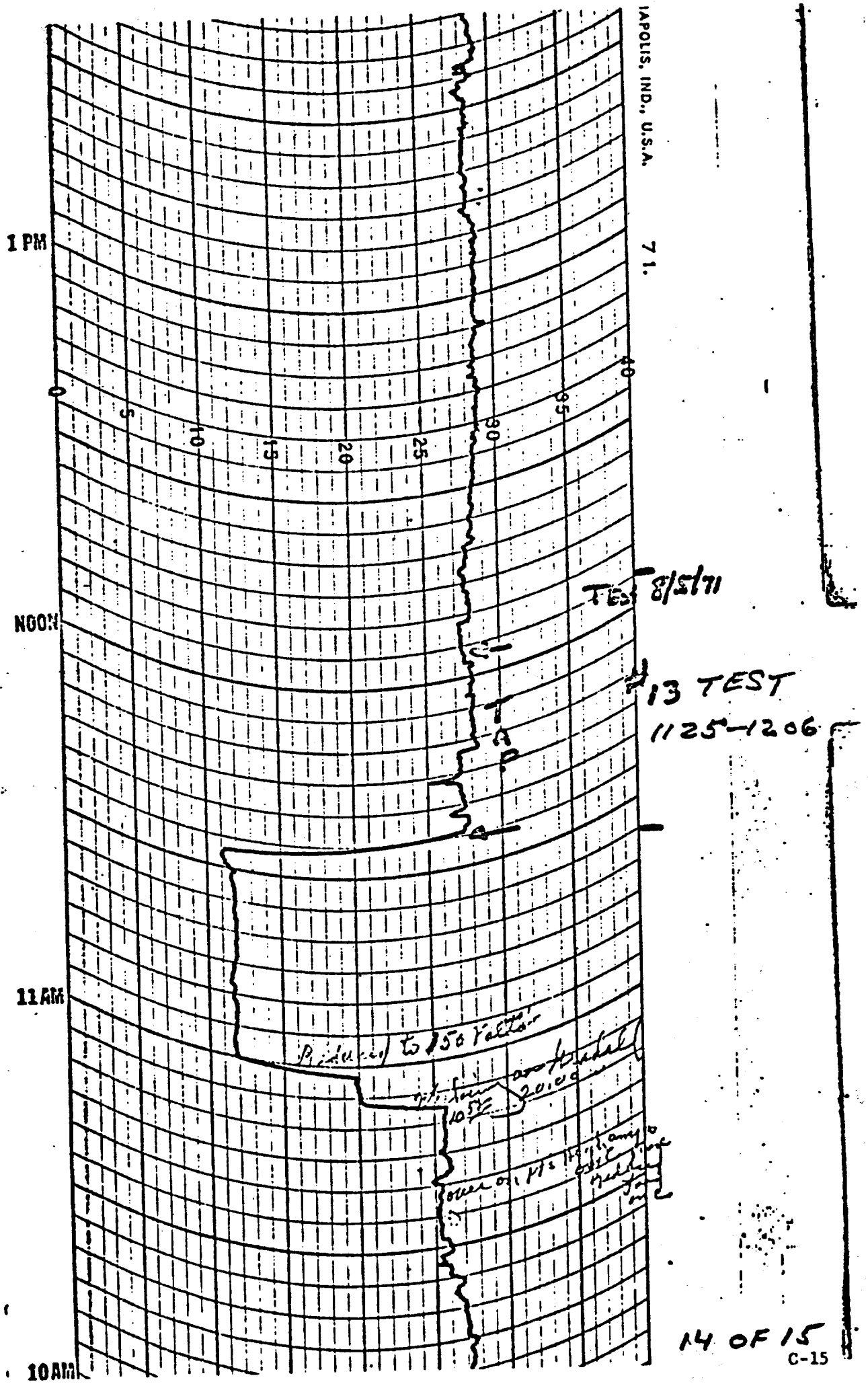

ROOM
11AM
10AM
Test start
Test ends
ΔG 37'
EPD TEST
1010 — 1140
TAP

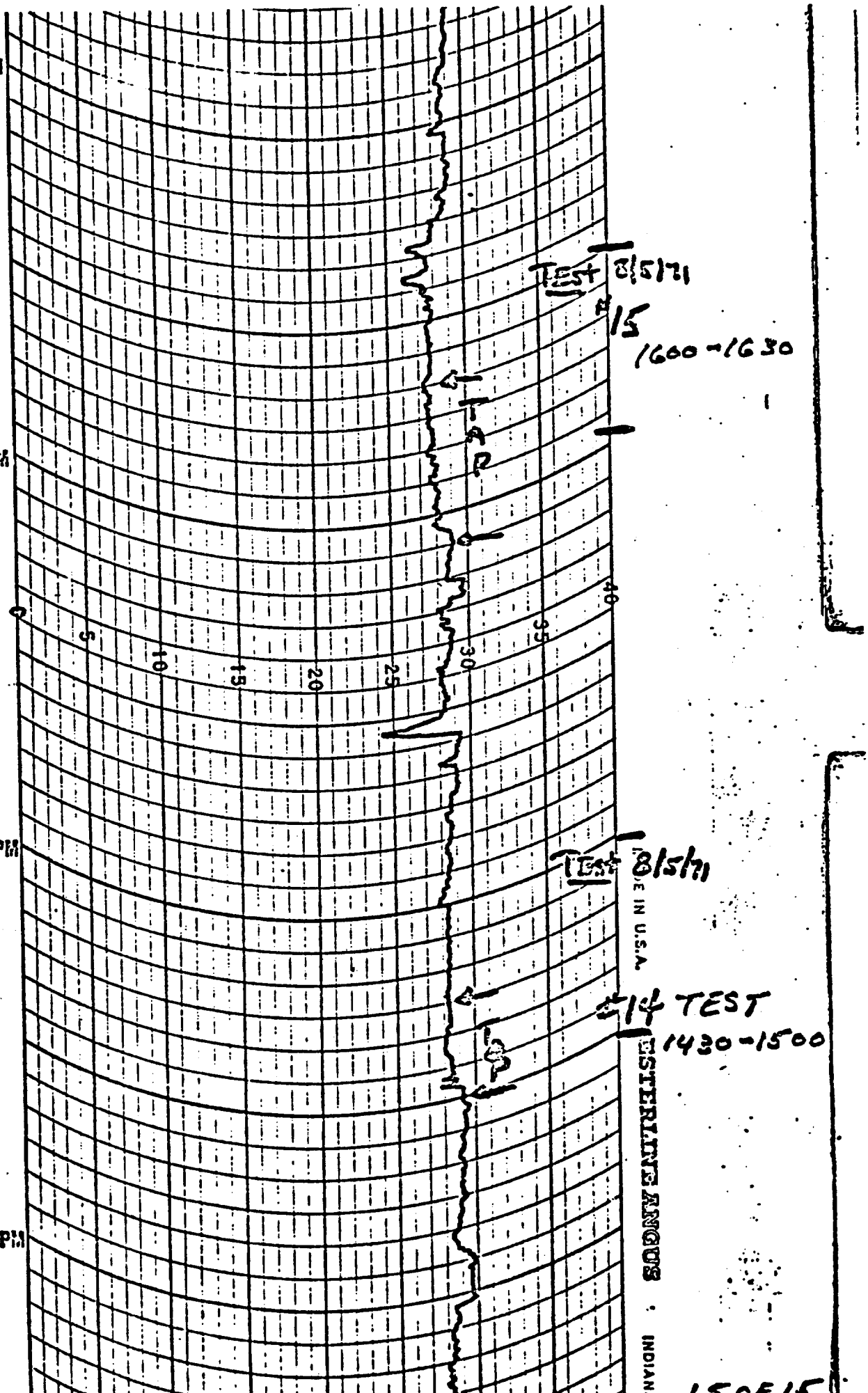

4 PM
3 PM
2 PM
0
5
10
15
20
25
30
35
40
Test 8/3/11
Inlet Orifice
Δp 31"
#11 TEST
1400-1530
MADE IN U.S.A.
ESTERLINE ANGUS
INDIANAPOLIS, IND., U.S.A.

12 OF 15


NOON
11AM
10AM
0
5
10
15
20
25
30
35
40
TAP
Test 6/1/11
Inlet tower
Δdp 37"
#12 TEST
1045-1215

13 OF 15


IAPOLIS, IND., U.S.A.
71.
1 PM
NOON
11 AM
10 AM
0
5
10
15
20
25
30
35
40
TEST 8/5/71
#13 TEST
1125-1206
TAP
Reduced to 150 Factor
14 OF 15
C-15


5 PM
4 PM
3 PM
2 PM
0
5
10
15
20
25
30
35
40
Test 8/5/71
#15
1600-1630
Test 8/5/71
#14 TEST
1430-1500
MADE IN U.S.A.
ESTERLINE ANGUS
INDIAN

APPENDIX D

FIELD DATA

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant U/C - RM - Marietta

Run No. Preliminary Traverse

Location M1E

Date 7/27/71

Operator CCG & LWB

Sample Box No. _____

Meter Box No. _____

Probe Length _____

Probe Heater Setting _____

Ambient Temp °F _____

Bar. Press. "Hg _____

Assumed Moisture % _____

Heater Box Setting, °F _____

Probe Tip Dia., In. _____

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
1	Every 6 in		0.68									140
2			0.72									140
3			0.73									140
4			0.72									140
5			0.73									140
6			0.73									140
7			0.73									140
8			0.73									140
9			0.73									140
10			0.76									140
11			0.76									140
12			0.78									140
13			0.80									140
14			0.80									140
15			0.78									140
16			0.74									
Avg.			0.75									
Static			+1.04									

I-D

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant U/C - RM

Run No. Moisture

Location Marietta #1 Exhaust

Date 7/27/71

Operator CCG & LWB

Sample Box No. Reg. Imp. Meter & Pump

Meter Box No. _____

Probe Length 6' - ½ in.

Probe Heater Setting _____

Ambient Temp °F 74

Bar. Press. "Hg 29.5

Assumed Moisture % _____

Heater Box Setting, °F _____

Probe Tip Dia., In. _____

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
3' in	1149	012.04					75	6.0		70		140
"							75	6.0		70		140
"	1201	022.60					75	6.0		70		140
		10.56					75	6.0		70		140
	Condensate: 30 ml											

D-2

MlE - Moisture Calculation 7/27/71

1. Isokinetic Sampling (Dry Gas) (cfm)

$$R_m = .33 \times \frac{T_m}{T_s} \times V_s \times d^2 \times \frac{P_s}{P_b - P_m} \quad : \quad Rm \text{ (corrected)} = Rm \times Mc$$

Estimated Value:

Calculated Value:

2. Water Vapor Volume (cu. ft.)

$$V_v = .00267 \times \frac{V_w \times T_m}{P_b - P_m} \qquad \frac{.00267 \times 30 \times 535}{23.5} = 1.83$$

3. Condensate Correction for Meter Rate

$$M_c = \frac{V_m}{V_m + V_v}$$

4. Moisture in Metered Gas (cu. ft.)

$$M_m = \frac{V.P. \times V_m}{P_b - P_m} \qquad \frac{.739 \times 10.56}{23.5} = .33$$

5. Percent Moisture (%) Stack Gas

$$\% \text{ Moisture} = \frac{V_v + M_m}{V_v + V_m} \times 100 \qquad \frac{1.83 + .33}{1.83 + 10.56} = \frac{2.16}{12.39} = 17.4\%$$

Saturated at _____ %

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1E-1

Location Stack Exhaust

Date 7/27/71

Operator CCG & LWB

Sample Box No. 2

Meter Box No. 3

Probe Length 10 ft.

Probe Heater Setting 50

Ambient Temp °F 72

Bar. Press. "Hg 29.5

Assumed Moisture % 17.4

Heater Box Setting, °F 250

Probe Tip Dia., In. ¼

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
E - 3	1840	321.33	.55	1.60	1.60	76	76	-	250	70	1.60	140
E - 4	1845	324.49	.55	1.60	1.60	76	76	-	250	70	1.60	140
E - 5	1859	328.22	.83	2.30	2.30	76	76	-	250	70	1.60	140
E - 6 off	1909	330.99	.65	1.85	1.85	76	76	-	250	70	1.60	140
E - 7 on	1915-20	334.32	.60	1.70	1.70	90	80	4.0	250	70	1.60	140
E - 8	1925	337.90	.67	1.90	1.90	98	84	4.0	250	70	1.60	140
E - 9	1930	341.62	.70	2.00	2.00	102	84	4.0	250	70	1.60	140
E - 10	1935	345.20	.62	1.80	1.80	106	86	4.0	250	70	1.60	140
(E - 11 off	1939											
(E - 11 on	2030-31	348.00	.64	1.90	1.90	108	88	4.0	250	70	1.60	140
E - 12	2037	351.84	.74	2.10	2.10	80	80	5.0	250	70	1.60	140
E - 13	2042		.68	1.90	1.90	80	80	5.0	250	70	1.60	140
E - 14	2047		.70	2.00	2.00	98	70	5.0	250	70	1.60	140
E - 15	2052		.85	2.45	2.45	102	80	7.0	250	70	1.60	140
E - 16	2057		.78	2.20	2.20	104	80	7.0	250	70	1.60	140
E - 17	2002		.76	2.18	2.18	108	84	7.0	250	70	1.60	140
E - 18	2107		.88	2.50	2.50	108	84	9.0	250	70	1.60	140
	2112	379.94	.88	2.50	2.50	108	84	9.0	250	70	1.60	140
	Avg.	58.61	.71	2.03	2.03	88	80	5.7	250	70	1.60	140
		ANY INTERRUPTION OTHER THAN POWER FAILURE DUE TO INLET FILTER CLOG OR PULLEY										
		TROUBLE AT INLET.										

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1E-2

Location Exhaust

Date 7/29/71

Operator Gonzalez & Baxley

Sample Box No. 2

Meter Box No. 3

Probe Length 11' plus

Probe Heater Setting 50

Condensate +210 ml

Ambient Temp °F 68

Bar. Press. "Hg 29.5

Assumed Moisture % 17.4

Heater Box Setting, °F 250

Probe Tip Dia., In. .25 (¼")

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
3	1035	383.72	0.73	2.10	2.10	72	90	4.0	250	60		140
*4	1038	386.02	0.73	2.10	2.10	72	90	4.0	250	60		140
5	1050	389.91	0.73	2.10	2.10	72	90	4.0	250	60		140
*6	1110	393.40	0.76	2.20	2.20	84	72	4.0	250	60		140
7	1115	397.50	0.76	2.20	2.20	84	72	4.0	250	60		140
8	1120	400.52	0.51	1.45	1.45	84	72	4.0	250	60		140
*9	1125	403.62	0.51	1.45	1.45	84	72	4.0	250	60		140
10	1155	407.50	0.71	2.00	2.00	86	74	4.0	250	60		140
**11	1205	411.50 420.07	0.63	1.80	1.80	86	74	4.0	250	60		140
(1416) 12	1421	424.42	0.73	2.10	2.10	86	70	6.0	250	60		140
13	1426	428.05	0.73	2.10	2.10	90	76	6.0	250	60		140
14	1431	431.50	0.76	2.15	2.15	98	80	8.0	250	60		140
15	1436	435.17	0.82	2.40	2.40	102	80	9.0	250	60		140
16	1441	439.20	0.73	2.10	2.10	108	80	8.0	250	60		140
17	1446	443.20	0.76	2.20	2.20	108	80	8.0	250	60		140
18	1451	447.32	0.70	2.00	2.00	108	80	9.0	250	60		140
	(80 Min.)	63.60	0.66	2.03	2.03	89	78	5.6	250	60		140

* Power Off.

** Sampling interrupted - Complete Power Failure.

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1E-3

Location Exhaust

Date 7/30/71

Operator Gonzalez and Baxley

Sample Box No. 3

Meter Box No. 2

Probe Length 11'4"

Probe Heater Setting 50

Condensate 160 ml

Ambient Temp °F 68

Bar. Press. "Hg 29.5

Assumed Moisture % 17.4

Heater Box Setting, °F 250

Probe Tip Dia., In. .25

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1815	484.37										
3	1820	487.53	0.65	2.00	2.00	70	70	3.0	250	65		110
4	1825	491.40	0.65	2.00	2.00	70	70	3.0	250	65		110
5	1830	495.09	0.55	1.70	1.70	72	74	2.5	250	65		110
Off 6	1835											
On 6	1840	498.99	0.75	2.30	2.30	74	74	3.5	250	65		110
7	1845	503.36	0.78	2.40	2.40	74	74	3.5	250	65		110
8	1850	507.48	0.78	2.40	2.40	74	74	3.5	250	65		110
9	1855	511.89	0.80	2.40	2.40	110	80	4.0	250	65		115
10	1900	516.17	0.78	2.40	2.40	114	84	4.0	250	65		120
11	1905	520.27	0.73	2.20	2.20	118	86	3.5	250	65		120
12	1910	524.24	0.68	2.10	2.10	118	86	4.0	250	65		120
13	1915	528.37	0.73	2.20	2.20	118	88	5.0	250	65		130
14	1920	532.43	0.73	2.20	2.20	120	90	5.5	250	65		130
15	1925	536.49	0.73	2.20	2.20	122	90	5.5	250	65		130
16	1930	540.53	0.75	2.20	2.20	122	90	5.5	250	65		130
17	1935	544.50	0.73	2.20	2.20	122	90	6.0	250	65		120
18	1940	548.46	0.73	2.20	2.20	122	90	6.0	250	65		120
AVG.	80 Min.	64.09	0.72	2.20	2.20	101	82	4.3	250	65		118

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1E-4

Location Exhaust

Date 7-31-71

Operator Baxley and Gonzalez

Sample Box No. 3

Meter Box No. 3

Probe Length 11'

Probe Heater Setting 70

Condensate +240 ml

Ambient Temp °F 80

Bar. Press. "Hg 29.5

Assumed Moisture % 17.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 0.25

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1029	549.14										
3	1034	553.47	0.73	2.00	2.00	80	80	6.0	250	65		140
4	1039	557.20	0.73	2.00	2.00	88	80	6.0	250	65		140
5	1044	561.20	0.78	2.20	2.20	98	80	7.0	250	65		135
6	1049	565.17	0.73	2.00	2.00	102	84	6.5	250	65		135
7	1054	569.04	0.70	2.00	2.00	108	86	6.5	250	65		135
8	1059	572.88	0.73	2.00	2.00	110	88	6.5	250	65		135
9	1104	576.80	0.70	2.00	2.00	112	88	6.5	250	65		135
10	1109	579.60	0.75	2.20	2.20	116	90	7.0	250	65		140
11	1114	584.14	0.73	2.00	2.00	116	92	7.5	250	65		140
12	1119	588.28	0.76	2.20	2.20	116	92	8.5	250	65		140
13	1124	592.36	0.70	2.00	2.00	120	94	8.0	250	65		140
14	1129	596.27	0.70	2.00	2.00	120	94	8.0	250	65		140
15	1134	600.41	0.75	2.20	2.20	120	96	9.5	250	65		120
16	1139	604.50	0.70	2.00	2.00	124	98	9.5	250	65		120
17	1144	607.40	0.66	1.90	1.90	124	98	9.0	250	65		120
18	1149	612.37	0.68	2.00	2.00	126	100	9.0	250	65		120
		(Plant shut down on last two points. Re-ran last three points + 15 mins.)										
Start	1237	612.37										135
	1242	616.20	0.73	2.00	2.00	90	90	9.0	250	65		135
	1247	620.00	0.73	2.00	2.00	92	92	10.0	250	65		135
	1252	623.79	0.73	2.00	2.00	92	92					139
	95 min.	74.15	0.72	2.04	2.04	108	95					

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1E-5

Location Exhaust

Date 7-31-71

Operator Baxley and Gonzalez

Sample Box No. 2

Meter Box No. 3

Probe Length 11'4"

Probe Heater Setting 70

Condensate +254 ml

Ambient Temp °F 70

Bar. Press. "Hg 29.5

Assumed Moisture % 17.6

Heater Box Setting, °F 250

Probe Tip Dia., In. .25

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1530	623.61										
3	1545	635.10	0.65	1.90	1.90	84	84	3.0	250	65	0.11	140
4	1550	638.59	0.65	1.90	1.90	104	88	3.0	250	65		140
5	1555	642.49	0.75	2.20	2.20	110	90	4.0	250	65		140
6	1600	646.47	0.70	2.00	2.00	110	90	4.0	250	65		140
7	1605	650.34	0.70	2.00	2.00	116	96	4.0	250	65		140
8	1610	654.14	0.64	1.85	1.85	116	96	4.5	250	65		140
9	1615	657.97	0.65	1.90	1.90	120	98	5.0	250	65		140
10	1620	661.62	0.65	1.90	1.90	120	98	5.0	250	65		140
11	1625	665.32	0.62	1.80	1.80	120	98	5.0	250	65		140
12	1630	669.50	0.80	2.30	2.30	120	98	6.0	250	65		140
Pwr.Off 13	1634											
Pwr.On 13	1647-48	673.80	0.94	2.60	2.60	122	100	7.0	250	65		140
14	1653	677.99	0.75	2.20	2.20	126	100	6.0	250	65		140
15	1658	682.17	0.73	2.10	2.10	126	100	6.0	250	65		140
16	1703	686.17	0.73	2.10	2.10	124	100	6.0	250	65		140
17	1708	690.00	0.73	2.10	2.10	120	98	6.0	250	65		140
18	1713	693.92	0.65	1.90	1.90	118	96	6.0	250	65		
AVG.		70.31	0.66	2.05	2.05	116	96	5.0	250	65		140

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1E-7

Location Exhaust

Date 8-1-71

Operator Schroeder and Gonzalez

Sample Box No. 2

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 70

Ambient Temp °F 86

Bar. Press. "Hg 29.70

Assumed Moisture % 17.4

Heater Box Setting, °F 250

Probe Tip Dia., In. .250

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
	1525	455.83				98	86					
3	1540	-	0.75	2.10	2.10	112	89	4.5	250	70	0.10	135
4	1545	-	0.75	2.10	2.10	116	90	4.5	250	75	-	135
5	1550	-	0.75	2.10	2.10	115	91	5.0	-	75	-	140
6	1555	-	0.75	2.10	2.10	118	93	5.0	-	75	-	140
7	1600	-	0.75	2.10	2.10	123	96	5.0	-	75	-	135
8	1605	-	0.75	2.10	2.10	126	97	5.0	-	75	-	135
9	1610	-	0.75	2.10	2.10	127	100	5.5	-	75	-	135
10	1615	-	0.68	1.90	1.90	132	103	6.0	-	75	-	135
11	1620	-	0.68	1.90	1.94	134	103	6.0	-	80	-	135
12	1625	-	0.70	1.95	1.95	134	105	6.0	-	80	-	135
13	1630	-	0.70	1.95	1.95	136	107	6.2	-	75	-	135
14	1635	-	0.73	2.05	2.05	137	108	6.5	-	75	-	135
15	1640	-	0.75	2.10	2.10	135	109	6.7	-	75	-	135
16	1645	-	0.70	2.00	2.00	136	109	7.0	-	75	-	135
17	1650	-	0.70	2.00	2.00	133	108	7.0	-	75	-	135
18	1655	524.82	0.80	2.30	2.30	135	109	7.5	-	75	-	135
AVG.		68.99	0.73	2.19	2.19	119	101	5.2		75		135

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate +265 ml

Plant UC/RM - Marietta

Run No. M1E-8

Location Exhaust

Date 8-2-71

Operator Schroeder and Avery

Sample Box No. 2

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 60

Ambient Temp °F 78

Bar. Press. "Hg 29.70

Assumed Moisture % 14.7

Heater Box Setting, °F 250

Probe Tip Dia., In. 0.25

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
	0945	525.91				72	70					
3	1000	536.48	0.6	1.7	1.7	94	74	5	250	75	0.10	120
4	1005	539.62	0.7	7.0	7.0	102	76	5	250	75	0.10	125
5	1010	542.84	0.7	2.0	2.0	110	80	5	250	80	0.10	125
6	1015	547.27	0.75	2.1	2.1	115	82	6	250	80	0.10	125
7	1020	550.32	0.75	2.1	2.1	117	88	7	250	86	0.10	135
8	1025	554.61	0.80	2.2	2.2	120	88	8	250	86	0.10	135
9	1030	558.73	0.80	2.2	2.2	120	90	7	250	80	0.10	125
10	1035	563.34	0.75	2.1	2.1	120	90	7	250	80	0.10	130
11	1040	566.69	0.75	2.1	2.1	125	92	7	250	80	0.10	130
12	1045	570.47	0.75	2.1	2.1	129	94	8	300	80	0.10	130
13	1050	574.30	0.67	1.9	1.9	132	96	7.5	300	80	0.10	125
14	1055	578.15	0.70	2.0	2.0	134	99	7.5	300	74	0.10	125
15	1100	583.00	0.75	2.1	2.1	135	100	7.5	300	90	0.10	125
16	1105	586.78	0.68	2.0	2.0	136	102	8	300	95	0.10	125
17	1110	589.88	0.70	2.0	2.0	138	105	8.5	300	95	0.10	125
18	1115	593.87	0.63	1.8	1.8	139	106	8	300	95	0.10	125
AVG.		67.96	0.72	2.02	2.02	123	91	6.6		83	0.10	127

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate +220 ml

Plant UC/RM - Marietta

Ambient Temp °F 78

Run No. MIE-9

Sample Box No. 2

Bar. Press. "Hg 29.70

Location Scrubber Exhaust

Meter Box No. 4

Assumed Moisture % 14.7

Date 8-2-71

Probe Length 11'

Heater Box Setting, °F 300

Operator Schroeder and Avery

Probe Heater Setting 70

Probe Tip Dia., In. 0.25

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
	1805	593.97				77	76					
3	1820		0.86	2.40	2.40	110	80	4.5	300	80	0.10	140
4	1825		0.84	2.35	2.35	115	82	4.8	-	80	-	130
5	1830		0.82	2.30	2.30	120	85	5.0	-	80	-	130
6	1835		0.80	2.25	2.25	122	90	6.0	-	80	-	125
7	1840		0.98	2.80	2.80	124	91	6.5	-	80	-	150
* 8	1910		0.84	2.35	2.35	103	89	6.5	-	90	-	135
9	1915		0.65	1.85	1.85	108	89	5.5	-	90	-	130
10	1920		0.65	1.85	1.85	109	90	6.0	-	85	-	125
11	1925		0.75	2.10	2.10	111	90	6.5	-	85	-	135
12	1930		0.78	2.15	2.15	115	90	7.0	-	90	-	135
13	1935		0.75	2.10	2.10	117	91	7.5	-	90	-	135
14	1940		0.60	1.70	1.70	118	91	6.5	-	90	-	135
15	1945		0.70	2.00	2.00	115	91	7.0	-	95	-	135
16	1950		0.63	1.80	1.80	120	92	7.5	-	95	-	133
17	1955		0.75	2.10	2.10	124	93	8.0	-	100	-	135
18	2000	664.92	0.80	2.25	2.25	122	95	8.0	-	100	-	133
AVG.		70.95	0.76	2.01	2.01	115	96	6.4		88		134

* Stopped to clean pitot lines.

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

C = 0.8

Filter Number - 2FN-30A

Condensate +262 ml

Plant UC/RM - Marietta

Run No. M1E - 10

Location Exhaust

Date 8-3-71

Operator Blessing

Sample Box No. 3

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 80

Ambient Temp °F 75

Bar. Press. "Hg 29.6

Assumed Moisture % 17.4

Heater Box Setting, °F 200

Probe Tip Dia., In. 1/4

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1010	665.87	0.68	2.0	2.0	70	70	3.0	300	75	2.0	120
3	1025	676.51	0.65	1.9	1.9	93	72	3.5	300	75	2.0	130
4	1030	-	0.70	2.1	2.1	96	72	4.0	300	75	1.8	130
5	1035	-	0.65	1.9	1.9	96	74	4.0	300	75	1.8	130
6	1040	687.82	0.70	2.1	2.1	98	76	4.5	300	75	1.8	130
7	1045	691.57	0.65	1.9	1.9	98	76	5.0	300	75	1.9	130
8	1050	695.64	1.00	2.9	2.9	102	78	7.0	300	75	1.7	135
9	1055	700.07	0.90	2.6	2.6	101	80	6.5	300	75	1.7	135
10	1100	-	0.75	2.2	2.2	101	80	6.0	300	75	1.0	130
11	1105	708.11	0.75	2.2	2.2	105	82	6.5	300	75	1.2	130
12	1110	711.70	0.60	1.8	1.8	106	94	6.0	300	80	1.1	135
13	1115	715.32	0.60	1.8	1.8	104	96	6.0	300	90	1.1	135
14	1120	719.18	0.70	2.1	2.1	105	96	7.0	300	90	1.2	130
15	1125	723.12	0.70	2.1	2.1	104	86	7.5	300	75	1.2	135
16	1130	727.20	0.75	2.2	2.2	105	85	8.0	300	75	1.1	130
17	1135	731.00	0.65	1.9	1.9	105	85	7.5	300	75	1.0	130
18	1140	734.59	0.60	1.8	1.8	106	85	7.0	300	75	1.1	130
AVG.		68.72	0.71	2.1	2.1	100	82	5.8	300	81	1.5	130

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

C = .8

Filter Number - 2FN-31A

Condensate +248 ml

Plant UC/RM - Marietta

Run No. M1E-11

Location Exhaust

Date 8-3-71

Operator Blessing and Avery

Sample Box No. 4

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 100

Ambient Temp °F 75

Bar. Press. "Hg 29.6

Assumed Moisture % 17.4

Heater Box Setting, °F 300

Probe Tip Dia., In. 1/4

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1400	735.36	0.95	2.8	2.8	76	76	9.0	300	70	1.8	130
3	1415	746.70	0.65	1.9	1.9	100	78	6.0	300	75	1.6	130
4	1420	749.87	0.60	1.7	1.7	104	82	6.0	300	75	1.7	135
5	1425	753.61	0.65	1.85	1.85	107	84	6.5	300	70	1.6	130
6	1430	756.98	0.60	1.75	1.75	108	86	6.5	300	70	1.8	135
7	1435	761.10	0.75	2.2	2.2	110	87	6.0	300	65	1.6	130
8	1440	-	0.65	1.9	1.9	111	88	7.5	300	65	1.7	130
9	1445	768.82	0.70	2.05	2.05	112	90	8.5	300	70	1.7	135
10	1450	772.85	0.70	2.05	2.05	114	91	8.0	300	70	2.0	130
11	1455	776.72	0.65	1.9	1.9	112	91	8.5	300	70	1.9	130
12	1500	780.30	0.60	1.75	1.75	112	92	7.5	300	70	1.8	135
13	1505	784.16	0.65	1.9	1.9	114	93	7.5	300	70	1.8	135
14	1510	787.72	0.65	1.9	1.9	115	93	8.5	300	70	1.8	135
15	1515	-	0.70	2.05	2.05	116	94	10.0	300	75	1.8	135
16	1520	-	0.70	2.05	2.05	116	94	10.0	300	75	1.9	135
17	1525	799.22	0.70	2.05	2.05	118	95	10.5	300	75	1.7	135
18	1530	803.15	0.70	2.05	2.05	118	95	10.5	300	75	1.6	135
Avg.		67.79	0.67	2.0	2.0	109	89				1.8	133

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate +233 ml

Plant UC/RM - Marietta

Run No. M1E-12

Location Exhaust

Date 8/4/71

Operator Blessing

Sample Box No. 3

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 90

Ambient Temp °F 75

Bar. Press. "Hg 29.5

Assumed Moisture % 17.4

Heater Box Setting, °F 300

Probe Tip Dia., In. 1/4

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1115	803.25	0.60	1.8	1.8	66	66	4.5	300	70	1.8	135
3	1130	-	0.60	1.8	1.8	86	68	5.0	300	70	1.7	130
4	1135	816.82	0.60	1.8	1.8	88	68	5.0	300	70	1.7	130
5	1140	-	0.60	1.8	1.8	90	70	5.5	300	70	1.5	130
6	1145	824.07	0.60	1.8	1.8	88	71	5.5	300	70	1.5	130
7	1150	827.02	0.60	1.8	1.8	94	74	6.5	300	80	1.4	130
8	1155	830.52	0.55	1.6	1.6	94	74	6.0	300	80	1.3	135
9	1200	-	0.50	1.5	1.5	98	76	6.0	300	75	1.4	130
10	1205	-	0.50	1.5	1.5	104	78	7.0	300	70	1.8	135
11	1210	-	0.50	1.5	1.5	106	78	7.0	300	70	1.6	130
12	1215	843.70	0.60	1.5	1.5	106	78	7.5	300	75	1.7	130
13	1220	-	0.65	1.9	1.9	108	78	9.5	300	75		130
14	1225	854.30	0.65	1.9	1.9	116	86	9.5	300	85		130
15	1230	854.72	0.60	1.8	1.8	116	88	10.0	300	90		130
16	1235	858.43	0.55	1.6	1.6	118	88	9.0	300	90		130
17	1240	862.00	0.60	1.8	1.8	118	90	10.0	300	95		130
18	1245	865.61	0.60	1.8	1.8	118	90	10.0	300	95		135
		62.36	0.58	1.7	1.7	101	78	72	300	78		132

VELOCITY TRAVERSE FIELD DATA

Plant UC/RM - Marietta

Test M1D

Location Duct Inlet

Date 7/28/71

Operator Blessing & Schroeder

A to E = Left to right, facing exhaust stack.

Depth Feet	Clock Time	Point	ΔP, in. H_2O	Stack Temp., °F	Stack Pres., In. Hg	ΔP x (T+460)**	$\sqrt{\Delta P \times (T+460)}$**
0.5		A-1	0.58	603			
1.5		A-2	0.57	522			
2.5		A-3	0.48	598			
3.5		A-4	0.42	608			
		B-1	0.38	698			
		B-2	0.48	705			
		B-3	0.58	648			
		B-4	0.53	562			
		C-1	0.24	726			
		C-2	0.33	751			
		C-3	0.33	829			
		C-4	0.32	805			
		D-1	0.48	772			

** - Calculation columns, not Field data

Comments:

NCAP-29 (12/67)

VELOCITY TRAVERSE FIELD DATA

Plant _____

Test _____

Location Duct #1 Continued

Date 7/28/71

Operator _____

Clock Time	Point	ΔP, in. H_2O	Stack Temp., °F	Stack Pres., In. Hg	ΔP x (T+460)**	$\sqrt{\Delta P \times (T+460)}$**
	D-2	0.48	780			
	D-3	0.56	888			
	D-4	0.55	835			
	E-1	0.72	810			
	E-2	0.70	810			
	E-3	0.72	820			
	E-4	0.63	780			
AVG.		0.50	725			

** - Calculation columns, not Field data

Comments:

NCAP-29 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

+ 12 ml Condensate

Plant UC/RM - Marietta

Run No. M1D-4

Location Inlet to Scrubber

Date 7-31-71

Operator Blessing

Sample Box No. 2

Meter Box No. 2

Probe Length 11'

Probe Heater Setting 65

Ambient Temp °F 80

Bar. Press. "Hg 29.5

Assumed Moisture % 2.0

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1030	174.44	0.63	0.55	0.55	84	82	3.0	250	-	1.2	500
A-4		175.78	0.63	0.55	0.55	85	83	3.0	250	-	-	495
A-3		177.00	0.58	0.50	0.51	87	83	2.5	250	-	-	480
A-2		178.35	0.68	0.59	0.59	90	83	3.0	250	-	-	480
A-1	1042	179.38	0.41	0.36	0.36	90	84	2.0	250	-	-	475
-	12	4.94	0.59	0.51	0.51	87	83	2.7	250	90	1.2	486
0	1046	179.38	0.64	0.45	0.45	88	84	2.0	250	-	-	505
B-4		180.56	0.64	0.45	0.45	90	84	2.0	250	-	-	555
B-3		181.72	0.58	0.45	0.45	91	85	2.5	250	-	-	630
B-2		182.80	0.45	0.33	0.33	94	86	2.0	250	-	-	680
B-1		183.60	0.24	0.18	0.18	95	86	1.5	250	-	-	680
-	1055	4.22	0.50	0.37	0.37	92	85	2.0	250	100	1.2	600
0	1105	183.60	0.35	0.23	0.23	90	86	1.5	250	-	1.1	800
C-4		184.47	0.35	0.23	0.23	91	88	1.5	250	-	-	775
C-3		184.40	0.35	0.23	0.23	92	88	1.5	250	-	-	775
C-2		186.22	0.35	0.23	0.23	93	89	1.5	250	-	-	750
C-1		186.80	0.13	0.10	0.10	93	89	1.0	250	-	-	725
-	1117	3.20	0.31	0.20	0.20	92	88	1.4	250	90	1.1	765
0	1129	186.80	0.73	0.51	0.51	90	90	2.5	250	-	1.2	695
D-4		188.00	0.62	0.43	0.43	92	90	2.0	250	-	-	650
D-3		189.20	0.55	0.39	0.39	94	90	2.0	250	-	-	325
D-2		190.32	0.48	0.49	0.49	97	90	2.5	250	-	-	280
D-1		191.12	0.15	0.16	0.16	98	91	1.0	250	-	-	280
-	1141	4.32	0.53	0.40	0.40	94	90	2.0	250	90	1.2	446

M1D-4 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1245	191.40	0.60	0.46	0.46	86	87	2.5	250	-	0.90	625
E-4		192.56	0.60	0.46	0.46	88	87	2.5	250	-		680
3		193.74	0.82	0.59	0.60	90	87	3.0	250	-	-	710
2		195.20	0.87	0.62	0.62	94	88	3.0	250	-	-	710
1	1257	196.38	0.61	0.44	0.44	95	88	2.5	250	-	-	268
-	12	4.98	0.70	0.51	0.52	91	87	2.7	250	80	0.90	699
	60	21.66	0.53	0.40	0.40	92	87	2.2	250	90	1.12	599

Comments:

Assumed moisture %- 2.0

T_m = 80°

Ps/Pm = 99 29.49/29.50

Static = 0.007

C Factor - 1.35

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

+ 1 ml Condensate

Plant UC/RM - Marietta

Run No. M1D-5

Location Inlet to Scrubber

Date 7-31-71

Operator Blessing

Sample Box No. 2

Meter Box No. 2

Probe Length 11'

Probe Heater Setting 65

Ambient Temp °F 90

Bar. Press. "Hg 29.5

Assumed Moisture % 6.4 (FROM CALC. M1B-4)

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1500	196.85	0.50	0.38	0.38	90	88	2.0	250	-	1.1	515
A-4		197.90	0.52	0.40	0.40	90	88	2.0	250	-	1.1	560
A-3		199.98	0.53	0.38	0.38	91	88	2.5	250	-	1.1	540
A-2		-	0.65	0.48	0.48	94	89	3.0	250	-	1.1	560
A-1	1512	201.05	0.36	0.27	0.27	94	89	2.5	250	-	1.1	560
-	12	4.20	0.52	0.38	0.38	92	88	2.4	250	80	1.1	547
0	1516	201.05	0.65	0.46	0.46	94	90	3.0	250	-	1.1	635
B-4		202.20	0.63	0.44	0.44	96	90	3.0	250	-	1.1	615
B-3		203.30	0.56	0.40	0.40	98	91	4.0	250	-	1.1	605
B-2		204.26	0.41	0.28	0.28	98	91	4.0	250	-	1.1	655
B-1	1528	204.96	0.21	0.14	0.14	98	92	3.0	250	-	1.1	620
-	(12)	3.91	0.49	0.34	0.36	97	91	3.4	250	100	1.1	626
0	1540	204.96	0.28	0.16	0.16	95	92	2.0	250	-	1.0	738
C-4		205.70	0.26	0.16	0.16	96	94	2.0	250	-	1.0	780
C-3		206.51	0.35	0.22	0.22	96	94	3.5	250	-	1.0	780
C-2		-	0.28	0.18	0.18	98	94	3.0	250	-	1.0	814
C-1	52	207.88	0.15	0.10	0.10	98	94	2.0	250	-	1.0	610
-	12	2.92	0.26	0.16	0.16	97	94	2.5	250	100	1.0	744
0	1555	207.88	0.60	0.38	0.38	98	94	3.0	250	-	1.1	725
D-4		208.90	0.58	0.37	0.37	99	94	3.0	250	-	-	740
D-3		210.08	0.66	0.43	0.43	101	95	8.5	250	-	-	694
D-2		211.07	0.54	0.35	0.35	102	96	8.0	250	-	-	635
D-1	1607	211.79	0.20	0.14	0.14	102	96	5.0	250	-	-	700
-	12	3.91	0.52	0.33	0.33	100	95	5.5	250	100	1.1	699

M1D-5 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1614	211.79	0.65	0.42	0.42	100	96	9.0	250	-	1.1	737
E-4		213.00	0.65	0.42	0.42	100	96	12.0	250	-	-	745
E-3		214.13	0.78	0.51	0.51	103	96	17.5	250	-	-	710
E-2		215.39	0.88	0.56	0.52	105	97	25.0	250	-	-	795
E-1	1626	216.57	0.60	0.32	0.40	106	97	20.0	250	-	-	795
-	12	4.78	0.71	0.46	0.46	107	96	16.7	250	-	1.1	756
	60	19.72	0.50	0.31	0.31	98	93	6.1	250	-		674

Comments:

NCAP-37 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

+ 12 ml Condensate

Plant UC/RM - Marietta

Run No. M1D-6

Location Inlet to Scrubber

Date 8-1-71

Operator Blessing

Sample Box No. 2

Meter Box No. 2

Probe Length 11'

Probe Heater Setting 65

Ambient Temp °F 78

Bar. Press. "Hg 29.5

Assumed Moisture % 6.0

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1100	217.84	0.61	0.48	0.48	82	80	3.0	250	-	1.2	555
A-4		219.00	0.61	0.48	0.48	83	81	3.0	250	-	-	495
A-3		220.20	0.61	0.52	0.52	85	81	4.5	250	-	-	500
A-2		-	0.68	0.58	0.58	88	81	6.0	250	-	-	505
A-1		202.53	0.40	0.35	0.35	90	82	5.5	250	-	-	465
-	1112	4.69	0.58	0.48	0.48	86	81	4.4	250	90	1.2	504
0	1125	222.53	0.63	0.54	0.54	86	84	6.0	250	-	1.2	485
B-4		-	0.65	0.56	0.56	88	84	9.5	250	-	-	550
B-3		-	0.60	0.47	0.47	90	85	9.0	250	-	-	495
B-2		226.00	0.46	0.39	0.39	92	85	9.5	250	-	-	555
B-1		226.27	0.25	0.18	0.18	93	86	6.5	250	-	-	565
-	1137	4.24	0.57	0.43	0.43	90	85	8.1	250	100	1.2	530
0	1150	226.77	0.32	0.24	0.24	90	87	6.5	250	-	1.0	715
C-4		227.70	0.32	0.24	0.24	92	87	9.0	250	-	-	785
C-3		228.50	0.32	0.22	0.22	92	88	10.0	250	-	-	805
C-2		229.35	0.28	0.20	0.20	94	88	10.0	250	-	-	690
C-1		229.87	0.15	0.11	0.11	94	89	8.0	250	-	-	703
-	1202	3.10	0.28	0.20	0.20	92	88	9.1	250	100	1.0	740
0	1208	229.87	0.69	0.48	0.48	93	90	14.0	-	-	1.2	755
D-4		231.03	0.69	0.48	0.48	94	90	20.5	250	-	-	625
D-3	*	237.24	0.73	0.54	0.52	96	90	24.5	250	-	-	625
D-2		233.43	0.67	0.50	0.50	93	91	5.0	250	-	-	665
D-1	1220	234.36	0.26	0.19	0.19	94	91	3.5	250	-	-	665
-		4.49	0.61	0.44	0.44	94	90	3.5	250	100	1.2	667

M1D-6 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1235	234.36	0.60	0.44	0.44	93	90	7.0	250	-	1.4	680
E-4		-	0.60	0.44	0.44	95	91	7.5	250	-	-	650
E-3		236.61	0.82	0.60	0.60	98	91	10.0	250	-	-	595
E-2		238.10	0.85	0.57	0.57	102	92	11.0	250	-	-	520
E-1		239.38	0.70	0.58	0.58	103	92	12.5	250	-	-	515
-		5.02	0.71	0.53	0.53	98	91	9.6	250	100	1.4	592
	60	21.54	0.50	0.42	0.42	92	87	8.9	250	98	1.2	607

* Filter Changed.

Comments:

C = 1.13
% Moisture = 6.0
T_m = 780
ΔH @ = 1.95
PS/Pm = .997

NCAP-37 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

+ 10 ml Condensate

Pb = 29.7-

Plant UC/RM - Marietta

Run No. M1D-7

Location Inlet to Scrubber

Date 8/1/71

Operator Blessing

Sample Box No. 2

Meter Box No. 2

Probe Length 11'

Probe Heater Setting 65

Ambient Temp °F 90

Bar. Press. "Hg 29.7

Assumed Moisture % 6.0

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1525	239.45	0.66	0.48	0.48	92	91	3.0	250	-	1.3	430
A-4		-	0.61	0.44	0.44	92	91	3.0	250	-	-	540
A-3		241.71	0.63	0.49	0.49	95	91	6.0	250	-	-	515
A-2		242.98	0.75	0.47	0.47	96	91	6.0	250	-	-	454
A-1		244.06	0.45	0.38	0.38	97	91	5.5	250	-	-	454
-		4.61	0.62	0.45	0.45	94	91	4.7	250	100	1.3	479
0		244.06	0.60	0.45	0.45	98	92	6.0	250	-	1.1	550
B-4		-	0.63	0.47	0.47	98	92	7.0	250	-	-	510
B-3		246.37	0.60	0.47	0.47	101	93	9.0	250	-	-	505
B-2		247.44	0.50	0.34	0.34	102	93	8.5	250	-	-	550
B-1		248.15	0.22	0.16	0.16	103	94	5.5	250	-	-	550
-		4.07	0.51	0.38	0.38	100	93	7.2	250	100	-	593
0		248.13	0.32	0.26	0.26	103	96	8.0	250	-	1.1	520
C-4		249.04	0.32	0.26	0.26	103	96	8.5	250	-	-	720
C-3		249.90	0.32	0.22	0.22	103	96	8.5	250	-	-	650
C-2		250.67	0.28	0.20	0.20	104	96	9.0	250	-	-	705
C-1		251.27	0.15	0.10	0.10	104	92	7.0	250	-	-	705
-		3.14	0.28	0.21	0.21	103	96	8.2	250	90	1.1	660
0		251.27	0.72	0.48	0.48	100	97	16.5	250	-	0.90	725
D-4		252.45	0.72	0.48	0.48	102	98	20.5	250	-	-	705
D-3		* 253.65	0.78	0.52	0.46	103	98	25.0	250	-	-	727
D-2		254.60	0.73	0.49	0.49	98	96	4.0	250	-	-	695
D-1		255.41	0.29	0.20	0.20	100	97	3.0	250	-	-	680
-	1645	3.14	0.65	0.43	0.43	101	97	13.8	250	90	0.90	706

D-23

M1 D-7 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0		255.41	0.85	0.59	0.59	98	97	7.0	250	-	1.1	670
E-4		-	0.85	0.59	0.59	100	97	8.0	250	-	-	800
E-3		258.03	0.85	0.56	0.56	103	98	10.5	250	-	--	730
E-2		-	0.90	0.61	0.61	104	99	15.5	250	-	-	730
E-1		260.47	0.72	0.50	0.50	104	99	15.5	250	-	-	660
-	1700	5.06	0.83	0.57	0.57	102	98	11.3	250	85	1.1	718
		20.02	0.58	0.41	0.41	100	95	9.0	250	93		631

* Filter Changed

Comments:

Assumed moisture %- 6.0
T_m = 90
Ps/Pm = 1.0
C Factor - 1.09

NCAP-37 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

+ 12 Condensate

Plant UCRM

Run No. M1D-8

Location Inlet to Scrubber

Date 8/2/71

Operator Blessing

Sample Box No. 2

Meter Box No. 2

Probe Length 11'

Probe Heater Setting 65

Ambient Temp °F 80

Bar. Press. "Hg 29.7

Assumed Moisture % 6.0

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	0945	260.65	0.55	0.43	0.43	82	82	2.0	250	80	1.3	490
A-4		261.70	0.55	0.43	0.43	87	85	2.5	250	-	-	545
A-3		262.85	0.62	0.46	0.46	88	85	3.5	250	-	-	625
A-2		264.05	0.73	0.52	0.52	90	85	5.0	250	-	-	800
A-1		264.94	0.40	0.25	0.25	92	85	4.0	250	-	-	492
-	0957	4.29	0.57	0.42	0.42	88	84	3.4	250	90	1.3	492
0		264.94	0.73	0.54	0.54	91	86	6.5	250	-	1.2	550
B-4		266.17	0.70	0.25	0.52	93	87	9.0	250	-	-	545
B-3		267.38	0.70	0.52	0.52	94	87	10.0	250	-	-	670
B-2		-	0.43	0.30	0.30	97	88	10.5	250	-	-	700
B-1		269.00	0.21	0.14	0.14	97	89	7.5	250	-	-	810
-		4.06	0.55	0.40	0.40	94	87	8.7	250	90	1.2	655
0		269.00	0.30	0.15	0.15	95	90	6.0	250	-	1.1	1120
C-4		269.65	0.30	0.15	0.15	97	90	8.0	250	-	-	1050
C-3		270.38	0.35	0.18	0.18	97	91	8.5	250	-	-	845
C-2		-	0.25	0.14	0.14	98	91	8.0	250	-	-	445
C-1		271.61	0.17	0.10	0.10	98	91	6.5	250	-	-	300
-		2.61	0.26	0.14	0.14	97	91	7.4	250	100	1.1	797
0		271.61	0.80	0.53	0.53	98	94	17.0	250	-	1.1	700
D-4		272.83	0.80	0.53	0.53	100	95	21.5	250	-	-	640
D-3		274.13	0.90	0.65	0.59	100	95	25.0	250	-	-	750
D-2		275.16	0.55	0.32	0.32	98	95	1.5	250	-	-	640
D-1		275.90	0.24	0.17	0.17	99	96	2.0	250	-	-	650
-		4.29	0.66	0.44	0.43	99	95	13.4	250	100	1.1	672

M1D-8 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O Desired	Orifice ΔH in H_2O Actual	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
0	1103	275.90	0.80	0.55	0.55	98	95	4.0	250	-	1.3	650
E-4		277.16	0.80	0.55	0.55	100	96	6.0	250	-	-	750
E-3		278.40	0.80	0.52	0.52	103	97	7.0	250	-	-	455
E-2		279.68	0.85	0.56	0.56	104	97	10.0	250	-	-	450
E-1		280.70	0.40	0.33	0.33	104	98	9.0	250	-	-	450
-	1115	4.80	0.73	0.50	0.50	102	97	7.2	250	90	1.3	551
	60	20.05	0.55	0.38	0.38	96	91	8.0	250	94	1.2	633

* Filter Changed.

Comments:

NCAP-37 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate + 14 ml

Plant UC/RM - Marietta

Ambient Temp °F 85

Run No. M1D-9

Sample Box No. 2

Bar. Press. "Hg 29.7

Location Duct Inlet

Meter Box No. 2

Assumed Moisture % 6

Date 8-2-71

Probe Length 11'

Heater Box Setting, °F 250

Operator Blessing

Probe Heater Setting 65

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1810	280.70	0.58	0.42	0.42	85	85	2.5	250	90		580
A-4		281.87	0.58	0.42	0.42	87	86	2.5	250	90		425
3		283.10	0.51	0.52	0.52	89	86	2.5	250	90		435
2		284.29	0.60	0.52	0.52	92	86	2.5	250	90		455
1	1822	285.21	0.32	0.27	0.27	93	87	2.0	250	90		320
		4.51	0.52	0.43	0.43	89	86	2.4	250	90		445
0	1828	285.21	0.70	0.67	0.67	93	87	4.0	250	90		290
B-4		286.57	0.70	0.67	0.67	94	88	5.0	250	90		725
3		-	0.70	0.45	0.45	95	88	5.0	250	90		550
2		288.78	0.45	0.34	0.34	96	89	5.0	250	90		555
1	1840	289.58	0.22	0.20	0.20	96	89	4.0	250	90		510
		4.37	0.55	0.42	0.47	95	88	4.6	250	90		526
0	1845	289.58	0.43	0.26	0.26	96	90	5.0	250	90		895
C-4		290.46	0.43	0.26	0.26	96	90	5.0	250	90		900
3		291.33	0.40	0.25	0.25	97	91	5.0	250	90		665
2		292.13	0.30	0.22	0.22	98	91	5.0	250	90		695
1		292.70	0.16	0.10	0.10	98	92	4.5	250	90		445
	1857	3.12	0.34	0.22	0.22	97	91	4.9	250	90		720
0	1902	292.70	0.68	0.48	0.48	96	92	7.0	250	95		650
D-4		293.90	0.68	0.48	0.48	97	92	10.0	250	95		695
3		295.04	0.65	0.45	0.45	101	94	12.0	250	95		695
2		296.17	0.65	0.45	0.45	102	94	14.5	250	95		710
1		297.33	0.65	0.45	0.45	104	95	15.5	250	95		710
Avg.	1914	4.63	0.66	0.46	0.46	100	93	11.8	250	95		692

M1D-9 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1917	297.33	0.65	0.42	0.42	100	95	14.5	250	100		700
E-4		298.43	0.65	0.42	0.42	101	95	19.0	250	100		730
3			0.84	0.58	0.47	102	96	25.0	250	100		730
2			0.70	0.44	0.37	102	96	25.0	250	100		810
1	1929	301.66	0.78	0.50	0.30	103	92	26.0	250	100		850
		4.33	0.72	0.49	0.39	102	96	21.4	250	100		764
Avg.		20.96	0.56	0.41	0.37	97	91	9.1	250	95		629

Comments:

NCAP-37 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1D-10

Location No. 1 Duct Inlet

Date 8/3/71

Operator Gonzalez

Sample Box No. 3

Meter Box No. 3

Probe Length 11' plus

Probe Heater Setting 65

Condensate 8 ml

Ambient Temp °F 80

Bar. Press. "Hg 29.6

Assumed Moisture % 6

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1006	301.80	0.60	0.49	0.49	80	80	2.5	250	80	0.1	480
A-1	1009		0.68	0.58	0.58	84	82	4.0	250	80	0.1	540
A-2	1012		0.72	0.59	0.59	86	82	4.0	250	80	0.1	540
A-3	1015		0.35	0.30	0.30	88	82	4.0	250	80	0.1	375
A-4	1018	306.81	0.35	0.30	0.30	88	82	4.0	250	80	0.1	375
0	1021	-	0.55	0.42	0.42	84	82	4.0	250	80	0.1	545
B-1	1024		0.50	0.39	0.39	88	84	5.0	250	80	0.1	580
B-2	1027		0.35	0.27	0.27	88	84	5.0	250	80	0.1	600
B-3	1030		0.14	0.12	0.12	88	84	3.0	250	80	0.1	610
B-4	1033	310.51	0.15	0.12	0.12	92	85	3.0	250	80	0.1	610
0	1038	-	0.32	0.22	0.22	90	86	3.5	250	80	0.1	670
C-1	1041		0.34	0.24	0.24	90	86	4.0	250	80	0.1	710
C-2	1044		0.30	0.20	0.20	92	86	3.5	250	80	0.1	815
C-3	1047		0.15	0.10	0.10	94	86	2.5	250	80	0.1	810
C-4	1050	313.60	0.14	0.10	0.10	94	86	2.5	250	80	0.1	800
0	1053	-	0.70	0.45	0.45	92	88	6.0	250	85	0.1	760
D-1	1057		0.72	0.52	0.52	96	90	7.0	250	85	0.1	640
D-2	1100		0.52	0.39	0.39	96	90	7.0	250	85	0.1	740
D-3	1103		0.15	0.11	0.11	98	90	4.0	250	85	0.1	580
D-4	1106	318.10	0.15	0.11	0.11	98	90	4.0	250	85	0.1	580
				(CONTINUED ON NEXT PAGE)								

M1D-10 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1110		0.52	0.38	0.38	94	88	6.0	250	90	0.1	680
E-1	1113		0.80	0.48	0.49	96	90	10.0	250	90	0.1	805
E-2	1116		0.66	0.41	0.41	98	92	9.5	250	90	0.1	850
E-3	1119		0.45	0.28	0.28	98	94	8.0	250	90	0.1	875
E-4	1122	322.45	0.46	0.28	0.28	98	94	8.0	250	90	0.1	875
		20.65	0.43	0.31	0.31	92	90	5.0	250	85	0.1	655

Comments:

NCAP-37 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. MID-11

Location No. 1 Duct Inlet

Date 8/3/71

Operator Gonzalez

Sample Box No. 3

Meter Box No. 3

Probe Length 11'

Probe Heater Setting 65

Condensate + 7 ml

Ambient Temp °F 85

Bar. Press. "Hg 29.6

Assumed Moisture % 6

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1400	322.45	0.45	0.27	0.27	86	86	2.5	250	95	0.09	480
A-4	1403		0.50	0.38	0.38	88	88	3.0	250	95	0.09	490
3	1406		0.56	0.43	0.43	90	88	4.0	250	95	0.09	490
2	1409		0.37	0.28	0.28	90	88	4.5	250	95	0.09	500
1	1412	326.59	0.36	0.28	0.28	92	88	4.5	250	95	0.09	500
0	1415		0.53	0.41	0.41	92	88	5.5	250	95	0.09	500
B-4	1418		0.57	0.38	0.38	94	88	7.5	250	95	0.09	655
3	1421		0.35	0.24	0.24	94	88	7.0	250	95	0.09	600
2	1424		0.22	0.12	0.12	94	90	5.0	250	95	0.09	670
1	1427	330.06	0.20	0.12	0.12	94	90	5.0	250	95	0.09	660
0	1430		0.34	0.23	0.23	94	90	7.5	250	95	0.09	660
C-4	1433		0.30	0.20	0.20	96	90	7.5	250	95	0.09	650
3	1436		0.28	0.17	0.17	96	90	7.5	250	95	0.09	690
2	1439		0.15	0.09	0.09	96	90	6.0	250	95	0.09	710
1	1442		0.15	0.09	0.09	96	90	6.0	250	95	0.09	710
0	1457	-	0.58	0.38	0.38	94	92	10.5	250	95	0.09	710
D-4	1500		0.60	0.39	0.39	94	94	15.0	250	95	0.09	700
3	1503		0.32	0.21	0.21	94	94	24.0	250	95	0.09	690
2	1506		0.25	0.17	0.17	94	94	20.0	250	95	0.09	595
1	1509		0.25	0.17	0.17	96	94	20.0	250	95	0.09	560
				CONTINUED TO NEXT PAGE								

M1D-11 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1415		0.62	0.43	0.43	96	94	23.0	250	95	0.09	670
E-4	1418		0.75	0.51	0.51	96	94	24.0	250	95	0.09	720
3	1421		0.50	0.33	0.33	96	94	25.0	250	95	0.09	550
2	1424		0.45	0.31	0.30	96	94	25.0	250	95	0.09	570
1	1427	340.38	0.45	0.31	0.30	96	94	25.0	250	95	0.09	605
Avg.		17.93	0.40	0.27	0.27	95	90		250	95	0.09	654

Comments:

NCAP-37 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate 6 ml

Plant UC/RM - Marietta

Run No. M1D-12

Location No: 1 Inlet Duct

Date 8/4/71

Operator Gonzalez

Sample Box No. 2

Meter Box No. 2

Probe Length 11' plus

Probe Heater Setting 65

Ambient Temp °F 80

Bar. Press. "Hg 29.58

Assumed Moisture % 6

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
0	1048	340.92	0.40	0.35	0.35	80	80	2.5	250	80	0.08	370
A-4	1051		0.48	0.34	0.34	82	82	4.0	250	80	0.08	550
A-3	1054		0.58	0.42	0.42	82	82	5.0	250	80	0.08	600
A-2	1057		0.40	0.29	0.29	84	82	5.5	250	80	0.08	570
A-1	1100	344.78	0.38	0.28	0.28	84	82	5.5	250	80	0.08	560
0	1103	-	0.56	0.42	0.42	84	82	8.0	250	80	0.08	520
B-4	1106		0.48	0.36	0.36	86	82	8.5	250	80	0.08	595
B-3	1109		0.39	0.28	0.28	86	82	9.0	250	80	0.08	640
B-2	1112		0.35	0.26	0.26	88	82	9.0	250	80	0.08	525
B-1	1115	348.50	0.35	0.26	0.26	88	82	9.0	250	80	0.08	520
0	1117	-	0.32	0.23	0.23	88	82	7.0	250	80	0.08	600
C-4	1120		0.30	0.21	0.21	88	82	9.0	250	80	0.08	625
C-3	1123		0.25	0.17	0.17	88	84	9.0	250	80	0.08	655
C-2	1126		0.14	0.13	0.13	88	84	9.0	250	80	0.08	330
C-1	1129	351.18	0.12	0.11	0.11	88	84	8.5	250	80	0.08	325
0	1132	-	0.56	0.38	0.38	88	84	15.0	250	85	0.08	670
D-4	1135		0.62	0.41	0.41	90	85	20.0	250	85	0.08	715
D-3	1138		0.52	0.34	0.34	90	85	25.0	250	85	0.08	735
D-2	1141		0.22	0.19	0.19	92	86	19.0	250	85	0.08	330
D-1	1144	354.91	0.23	0.20	0.20	92	86	19.0	250	85	0.08	330
0	1200		0.50	0.30	0.30	86	86	20.0	250	85	0.08	720
E-4	1203		0.65	0.47	0.47	88	88	25.0	250	85	0.08	610
				(Continued on next page)								

M1D-12 CONTINUED

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
E-3	1206		0.78	0.57	0.57	88	88	26.0	250	85	0.08	590
E-2	1209		0.56	0.46	0.46	88	88	26.0	250	85	0.08	410
E-1	1212	358.94	0.50	0.41	0.41	88	88	26.0	250	85	0.08	410
		18.02	0.42	0.31	0.31	86	85		250	85	0.08	541

Comments:

NCAP-37 (12/67)

VELOCITY TRAVERSE FIELD DATA

Plant UC/RM - Marietta

Test Preliminary Traverse (ETE)

Location East Tapping Exhaust

Date 8/4/71

Operator Schroeder

STATIC PRESSURE = .51

Clock Time	Point	ΔP, in. H_2O		Stack Temp., °F			AVG.		$\sqrt{\Delta P \times (T+460)}$ *
1505	1	1.35	1.25	90	99		1.30	94	
	2	1.50	1.20	95	99		1.35	97	
	3	1.45	1.45	98	99		1.45	98	
	4	1.55	1.40	99	99		1.48	99	
	5	1.50	1.35	99	99		1.42	99	
	6	1.20	1.20	99	99		1.20	99	
	7	1.20	1.10	99	99		1.15	99	
	8	1.20	1.20	99	99		1.20	99	
	9	1.14	1.20	99	99		1.17	99	
1515	10	1.15	1.20	99	99		1.18	99	
AVG.							1.29	98	

* - Calculation columns, not Field data

Comments:

NCAP-29 (12/67)

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

(False Tap Run)
No Tapping

Plant UC/RM - Marietta

Run No. ETE-1A

Location East Tapping Exhaust

Date 8/5/71

Operator Baxley & Avery

Sample Box No. 3

Meter Box No. 2

Probe Length 11'4"

Probe Heater Setting 50

Ambient Temp °F 90

Bar. Press. "Hg 29.7

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1015	360.43										
1	1018	362.70	1.20	1.60	1.60	68	68	7.0	250	65		130
2	1021	364.14	1.30	1.80	1.80	68	68	7.0	250	65		125
3 Off	1028											
3 On	1031	366.80	1.40	1.85	1.85	76	70	7.2	250	65		130
4	1034	369.00	1.40	1.85	1.85	86	70	7.2	250	65		130
5	1037	370.56	1.40	1.85	1.85	90	72	7.2	250	65		130
6	1040	373.50	1.40	1.85	1.85	90	72	7.2	250	65		130
7	1043	375.63	1.20	1.60	1.60	90	72	6.5	250	65		130
8	1046	377.80	1.20	1.60	1.60	100	76	6.5	250	65		130
9	1049	380.70	1.10	1.45	1.45	102	76	6.2	250	65		130
10	1052	382.30	1.10	1.45	1.45	102	76	6.2	250	65		130
4	1055	384.55	1.40	1.85	1.85	104	76	9.0	250	65		130
4	1058	387.25	1.40	1.85	1.85	112	76	9.0	250	65		130
4	1101	389.75	1.40	1.85	1.85	114	80	9.5	250	65		130
4	1104	392.30	1.40	1.85	1.85	114	84	10.0	250	65		130
4	1107	394.78	1.40	1.85	1.85	116	86	10.0	250	65		130
4	1110	397.32	1.40	1.85	1.85	116	86	10.0	250	65		130
4	1113	399.80	1.40	1.85	1.85	118	88	10.0	250	65		130
4	1116	403.20	1.40	1.85	1.85	120	88	10.0	250	65		130
4	1119	405.70	1.40	1.85	1.85	120	88	10.0	250	65		130
4	1120	406.95	1.40	1.85	1.85	120	88	10.0	250	65		125

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. ETE-1

Location East Tapping Exhaust

Date 8/5/71

Operator Baxley & Avery

Sample Box No. 3

Meter Box No. 2

Probe Length 11'4"

Probe Heater Setting 50

Condensate +6 ml

Ambient Temp °F 90

Bar. Press. "Hg 29.7

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1130	406.95										
1	1133	409.30	1.30	1.75	1.75	104	90	10.0	250	65		100
2	1136	412.75	1.30	1.75	1.75	108	92	10.0	250	65		100
3	1139	414.50	1.30	1.75	1.75	108	92	10.0	250	65		105
4	1142	417.00	1.40	1.85	1.85	112	90	10.0	250	65		105
5	1145	419.47	1.40	1.85	1.85	114	90	10.0	250	65		105
6	1148	422.20	1.30	1.75	1.75	114	90	12.0	250	65		105
7	1151	424.78	1.10	1.60	1.60	118	92	13.0	250	65		105
8	1154	428.00	1.10	1.60	1.60	122	92	13.0	250	65		105
9	1157	429.38	1.10	1.60	1.60	122	92	7.0	250	65		110
10	1200	431.45	1.10	1.60	1.60	122	94	7.0	250	65		115
4	1203	433.60	1.40	1.95	1.95	120	92	8.0	250	65		115
4	1206	435.82	1.40	1.95	1.95	120	92	8.0	250	65		115
4	1207	437.14	1.40	1.95	1.95	120	92	9.0	250	65		
AVG.	37	30.19	1.28	1.76	1.76	116	92	9.8	250	65		107

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate +8 ml

Plant UC/RM - Marietta

Run No. ETE-2

Location East Tapping Exhaust

Date 8/5/71

Operator Baxley & Avery

Sample Box No. 3

Meter Box No. 2

Probe Length 11'4"

Probe Heater Setting 50

Ambient Temp °F 90

Bar. Press. "Hg 29.7

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1430	437.23										
1	1433	439.58	1.20	1.70	1.70	80	80	6.2	250	65		100
2	1436	441.22	1.30	1.85	1.85	86	80	6.2	250	65		100
3	1439	443.65	1.40	2.00	2.00	90	80	7.2	250	65		100
4	1442	446.11	1.40	2.00	2.00	96	80	7.2	250	65		100
5	1445	448.55	1.40	2.00	2.00	98	82	7.2	250	65		100
6	1448	450.76	1.20	1.70	1.70	102	82	5.2	250	65		100
7	1451	453.00	1.20	1.70	1.70	110	84	5.2	250	65		95
8	1454	455.02	1.10	1.60	1.60	112	84	5.0	250	65		100
9	1457	457.10	1.10	1.60	1.60	114	84	5.0	250	65		100
10	1501	459.88	1.05	1.50	1.50	116	86	5.0	250	65		100
AVG.	31	22.65	1.24	1.76	1.76	100	82	5.9	250	65		100

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. ETE-3

Location East Tapping Exhaust

Date 8/5/71

Operator Avery & Baxley

Sample Box No. 3

Meter Box No. 2

Probe Length 11'4"

Probe Heater Setting 50

Condensate +4 ml

Ambient Temp °F 90

Bar. Press. "Hg 29.7

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1602	459.88				85	85	5.0	250	65		100
1	1605	461.96	1.20	1.70	1.70	85	85	5.0	250	65		100
2	1608	464.18	1.40	2.00	2.00	88	86	5.5	250	65		100
3	1611	466.58	1.40	2.00	2.00	90	90	6.0	250	65		100
4	1614	468.74	1.40	2.00	2.00	100	90	6.0	250	65		95
5	1617	471.15	1.30	1.85	1.85	110	92	6.0	250	65		95
6	1620	473.30	1.20	1.70	1.70	110	92	6.0	250	65		95
7	1623	475.50	1.20	1.70	1.70	110	92	6.0	250	65		95
8	1626	477.64	1.05	1.50	1.50	116	94	5.0	250	65		95
9	1629	479.70	1.05	1.50	1.50	120	92	5.0	250	65		95
10	1632	481.77	1.05	1.50	1.50	120	90	5.0	250	65		95
AVG.	30	21.89	1.22	1.74	1.74	103	90	5.5	250	65		97

VELOCITY TRAVERSE FIELD DATA

Plant UC/RM - Marietta

Test Preliminary Traverse (WTE)

Location West Tapping Exhaust

Date 8/4/71

Operator Schroeder

STATIC = -0.44 in. H_2O

Clock Time	Point	ΔP, in. H_2O		Stack Temp., °F					$\sqrt{\Delta P \times (T+460)}$**
1440	1	1.05	0.76	110	110	Avg.	0.90	110	
	2	0.83	0.75	110	110	"	0.79	110	
	3	0.86	0.55	115	110	"	0.70	112	
	4	0.78	0.86	115	110	"	0.82	112	
	5	1.00	0.84	115	110	"	0.92	112	
	6	1.20	1.25	115	110	"	1.22	112	
	7	1.10	1.10	119	110	"	1.1	115	
	8	1.20	1.20	119	115	"	1.2	115	
	9	1.40	1.40	119	115	"	1.4	115	
1500	10	1.60	1.60	119	119	"	1.6	119	
	AVG.						1.06	113	

** - Calculation columns, not Field data

Comments:

NCAP-29 (12/67)

RESOURCES RESEARCH, INC. PAGE 1 OF 2

Personnel Baxley Entered

Checked

Plant Conditions, etc.

Plant UC/RM - Marietta Date 8/4/71

Sample Location WTE - Moisture Determination

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg	Imp. Temp.	Thimble Number
1443		585.40				68	8.0	60	
1453		597.10		10		70	8.0	60	
~~1503~~		608.10		10		74	8.0	60	
1513		618.10		10		74	8.0	60	
AVG		32.70		30		72	8.0	60	

Stack/Duct Measurement

Stack Diameter, inches (D)

Stack Area, Ft^2, (A)

Final Gas Temp °F

Starting Gas Temp °F+460=Ts °R

Barometric Pressure,"Hg,(Pb) 29.6

Stack Static Pressure, In.H_2O +-

Condensate,ml (Vw) 5 ml

Estimated Mc- Actual -

Estimated Rm(Corrected)

Calculated Rm(Corrected)

Sample Nozzle Dia.,In.(d)

% Moisture of Gas

Avg.Gas Velocity,fpm(Vsx60)

$Vs=(2.9 \times F_s) \times \sqrt{H} \times \sqrt{T}$ or 2.46

WTE- 4
TRIAL MOISTURE CALCULATIONS

1. Isokinetic Sampling (Dry Gas) (cfm)

$R_m = .33 \times \frac{Tm}{T_s} \times V_s \times d^2 \times \frac{P_s}{P_b - P_m}$: Rm (corrected) = Rm x Mc

Estimated Value: ------------------------------------

Calculated Value:

2. Water Vapor Volume (cu. ft.)

$Vv = .00267 \times \frac{Vw \times Tm}{P_b - P_m}$ $.00267 \times \frac{-5 \times 532.}{27.6} = 0.329$

3. Condensate Correction for Meter Rate

$M_c = \frac{Vm}{Vm + V_v}$ $\frac{32.70}{32.70} = \frac{32.70}{32.37} = 1.01$

4. Moisture in Metered Gas (cu. ft.)

$M_m = \frac{V.P. \times Vm}{P_b - P_m}$ $\frac{.522 \times 32.70}{21.6} = .79$

5. Percent Moisture (%) Stack Gas

$\%\ Moisture = \frac{V_v + M_m}{V_v + V_m} \times 100$ $\frac{.33 + .79}{.33 + 32.70} = \frac{1.12}{33.03} = 3.38$

Saturated at ________ %

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

(False Tap Run)
No Tapping

Plant UC/RM - Marietta

Run No. WTE-1A

Location West Tapping Exhaust

Date 8/5/71

Operator Schroeder & Hall

Sample Box No. 2

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 60

Ambient Temp °F 70

Bar. Press. "Hg 29.60

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1045	865.12				73	70					
1		867.20	1.15	1.45	1.45	75	72	1.5	200			65
2	*		1.10	1.40	1.40	75	72	1.5	200			81
3			1.10	1.40	1.40	84	73	1.5	200			90
4			0.90	1.15	1.15	90	75	1.2	200			90
5			0.87	1.10	1.10	93	75	1.0	200			90
6			0.98	1.25	1.25	98	76	1.2	200			90
7			1.20	1.50	1.50	103	77	1.5	200			90
8			1.25	1.55	1.55	106	80	1.75	200			90
9		884.40	1.25	1.55	1.55	111	83	1.75	200			90
10		888.60	1.30	2.65	2.65	114	86	2.0	200			90
7			1.20	1.50	1.50	120	93	1.5	200			85
7	1120	903.78	1.20	1.50	1.50	120	95	1.5	200			90
				3 min. per point except 7								
				* Stopped 5 min.								

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate -12 ml

Plant UC/RM - Marietta

Run No. WTE-1

Location West Tapping Exhaust

Date 8/5/71

Operator Schroeder

Sample Box No. 2

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 60

Ambient Temp °F 70

Bar. Press. "Hg 29.60

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1130	903.78										
1			1.20	1.50	1.50	107	93	1.5	250			77
2			1.20	1.50	1.50	109	94	1.5	250			95
3			0.85	1.15	1.15	112	94	2.0	250			105
4			1.00	1.25	1.25	115	96	3.5	250			120
5			0.90	1.20	1.20	116	96	3.0	250			126
6			0.95	1.23	1.23	118	94	4.0	250			120
7			1.00	1.25	1.25	119	95	4.0	250			118
8			1.10	1.40	1.40	121	95	4.5	250			115
9			1.10	1.40	1.40	122	96	4.5	250			115
10	1200		1.15	1.45	1.45	123	95	4.5	250			115
7	1207	926.55	1.10	1.40	1.40	123	95	4.5	250			118
AVG.	37	22.77	1.05	1.34	1.34	116	95	3.4	250			111

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate -2 ml

Plant UC/RM - Marietta

Run No. WTE-2

Location West Tapping Exhaust

Date 8/5/71

Operator Schroeder

Sample Box No. 2

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 60

Ambient Temp °F 75

Bar. Press. "Hg 29.60

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1430	926.45										
1			1.20	1.50	1.50	86	84	4.0	250			105
2			1.20	1.50	1.50	91	84	4.0	250			115
3			1.10	1.40	1.40	98	85	4.0	250			125
4			0.95	1.25	1.25	105	85	4.0	250			128
5			0.89	1.15	1.15	105	85	3.5	250			125
6			0.90	1.15	1.15	110	87	3.5	250			120
7			0.95	1.25	1.25	112	89	3.5	250			115
8			0.87	1.15	1.15	118	90	3.5	250			112
9			0.85	1.10	1.10	120	91	3.5	250			110
10	1500	944.36	0.90	1.15	1.15	120	90	3.5	250			108
AVG.	30	17.91	0.98	1.26	1.26	106	87	3.7	250			115

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate +2 ml

Plant UC/RM - Marietta

Run No. WTE-3

Location West Tapping Exhaust

Date 8/5/71

Operator Schroeder

Sample Box No. 2

Meter Box No. 4

Probe Length 11'

Probe Heater Setting 60

Ambient Temp °F 70

Bar. Press. "Hg 29.60

Assumed Moisture % 3.4

Heater Box Setting, °F 250

Probe Tip Dia., In. 3/16

Point	Clock Time	Dry Gas Meter, CF.	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
Start	1604	944.36										
1			1.05	1.30	1.30	96	90	1.5	250			85
2			1.05	1.30	1.30	99	90	1.5	250			85
3			1.05	1.30	1.30	104	90	1.5	250			117
4			1.05	1.30	1.30	106	91	1.5	250			117
5			0.97	1.25	1.25	111	92	2.0	250			115
6			0.95	1.25	1.25	113	92	2.0	250			113
7			1.00	1.28	1.28	117	93	2.0	250			112
8			1.10	1.40	1.40	119	95	2.0	250			112
9			1.10	1.40	1.40	121	95	2.0	250			106
10	1634	962.99	1.20	1.50	1.50	120	96	2.2	250			105
AVG.	30	18.63	1.05	1.33	1.33	110	92	1.8	250			107

RESOURCES RESEARCH, INC.

Personnel _____ Entered _____

Checked _____

Plant Conditions, etc. Metals Run

Plant UC/RM-Marietta Date 8-1-71

Sample Location M1E - 6M

APCO Sample Box #4

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg	IMP.	Thimble Number
1100		289.55	-		-	76	5.0	65	
1110	M1E-6			10		76	5.0	65	
1120				10		78	5.5	65	
1130				10		84	6.0	65	
1140				10		98	5.5	65	
1150				10		100	5.5	65	
1200									
1210									
1220									
1230									
1240						100	6.5		
1245		365.92				100	6.5		
		76.37							

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Condensate +240 ml

Plant UC/RM - Marietta

Run No. M1E- 7 Metal Test

Location Taken along with M1E-7 Particulate Test

Date 8-1-71

Operator

Sample Box No.

Meter Box No.

Probe Length

Probe Heater Setting

Ambient Temp °F

Bar. Press. "Hg

Assumed Moisture %

Heater Box Setting, °F

Probe Tip Dia., In.

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
3 feet	1525	374.96					80	3.5		75		
from	1535						82	3.6		75		
edge	1545						86	3.8		75		
	1555						90	4.0		75		
	1605						92	4.2		75		
	1615						86	4.6		75		
	1625						86	5.0		75		
	1635						86	5.0		75		
	1645						86	5.0		75		
	1655	453.71					86	5.2		75		
		78.75										

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point or, if single point sampling, read and record every 5 minutes.

Plant UC/RM - Marietta

Run No. M1E-12 Metal

Location Exhaust

Date 8-4-71

Operator Blessing

Sample Box No. -

Meter Box No. -

Probe Length -

Probe Heater Setting 90

Ambient Temp °F -

Bar. Press. "Hg 29.5

Assumed Moisture % -

Heater Box Setting, °F 250

Probe Tip Dia., In. -

Point	Clock Time	Dry Gas Meter, CF	Pitot in. H_2O ΔP	Orifice ΔH in H_2O		Dry Gas Temp. °F		Pump Vacuum In. Hg Gauge	Box Temp. °F	Impinger Temp °F	Stack Press in. Hg	Stack Temp °F
				Desired	Actual	Inlet	Outlet					
	1411	573.87					66	7.0				
	1450	619.82					82	11.4				

RESOURCES RESEARCH, INC.

Personnel Avery & Baxley Entered

Checked

Plant Conditions, etc. Metals Run

Plant UC/RM - Marietta Date 8/5/71

Sample Location East Tap Exhaust

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg		Thimble Number
1015	ETE-1A	783.46		0		66	5.5	130	
1022-Power Off		790.37		7		66	5.5	130	
1027-Power On		790.37				66	5.5		
1040		807.44		13		66	5.3	130	
1054		823.73		14		66	5.0		
1105		837.93		11		66	5.0		
1115		850.20		10		66	4.8		
1120		859.14		5		66	4.8	130	
			FALSE TAP RUN						
1130	ETE-1	859.14		0		66	4.9	105	
1140		872.40		10		66	5.5	105	
1150		883.80		10		67	5.8	105	
1200		900.30		10		68	5.9	105	
1206		908.51		6		68	5.9	105	

RESOURCES RESEARCH, INC.

Personnel Avery & Baxley Entered

Checked

Plant Conditions, etc. Metals Run

Plant UC/RM - Marietta Date 8/5/71

Sample Location East Tap Exhaust 2

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg	Stack Temp.	Thimble Number
1430	ETE-2	908.52		0		75	5.3	105	
1440		921.84		10		75	5.3	105	
1450		934.12		10		74	5.3	105	
1500		949.29		10		74	5.2	105	

RESOURCES RESEARCH, INC.

Personnel Schroeder Entered

Checked

Plant Conditions, etc. Metals Runs

Plant UC/RM - Marietta Date 8/5/71

Sample Location West Tapping Exhaust

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg		Thimble Number
1610	WTE-3	34.83				80	5.0		
1640		77.02				80	5.0		

RESOURCES RESEARCH, INC.

Personnel Gonzalez & Baxley Entered

Checked

Plant Conditions, etc. SO_2

Plant U/C - RM - Marietta Date 7/27/71

Sample Location SO_2 - 1E

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg	Imp. Temp.	Thimble Number
1505		030.61				78	5.5	70 Assumed	
1515	SO_2-1			10		78	5.5		
1525				10		78	5.0		
1535				10		76	5.0		
1545				10		76	5.0		
1555				10		76	5.0		
1605				10		76	5.0		
1615				10		74	5.0		
1625				10		74	5.0		
1635				10		74	5.0		
1645				10		72	5.0		
1655				10		72	5.0		
1705				10		72	5.0		
1715				10		72	5.0		
1725		062.25		10		72	5.0		
AVG.		31.64		140		75	5.0		

RESOURCES RESEARCH, INC.

Personnel Gonzalez & Baxley Entered

Checked

Plant Conditions, etc. SO_2

Plant UC/RM - Marietta Date 7/29/71

Sample Location Exhaust SO_2-2E

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg		Thimble Number
1015		65.30		-		66	2.0		
1025		66.00		10		66	3.0		
1035				10		66	3.0		
1045				10		66	3.0		
1055		68.00		10		68	3.0		
1105				10		68	3.0		
1115				10		70	3.0		
1125				10		70	3.0		
1135				10		70	3.0		
1145				10		70	3.0		
1155				10		70	3.0		
1205				10		70	3.0		
1215		72.28		10		70	3.0		
AVG.		6.98				68	2.9		
		Power went off and on 3 times during this test.							

RESOURCES RESEARCH, INC.

Personnel Gonzalez & Baxley Entered

Checked

Plant Conditions, etc. SO_2

Plant UC/RM - Marietta Date 7/30/71

Sample Location M1E-3 Exhaust

SO_2-3E

Time	Sample Number	Meter # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	GAS METER CONDITIONS (+460=Tm) Temp °F	Pump # (Pm) Vacuum"Hg	Imp. Temp.	Thimble Number
1815		072.28		-		64	3.2	60	Assumed
1825				10		64	3.2	60	
1835				10		64	3.0	60	
1845				10		66	3.0	60	
1855				10		66	3.5	60	
1905	M1E-3			10		66	3.5	60	
1915				10		66	3.0	60	
1925				10		66	3.5	60	
1935				10		66	4.0	60	
1945		82.60		10		66	4.0	60	
AVG.				90				60	

RESOURCES RESEARCH, INC.

Personnel Gonzalez Entered

Checked

Plant Conditions, etc. SO_2

Plant UC/RM - Marietta Date 7-31-71

Sample Location M1E-4 SO_2 - 4E

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg	IMP.	Thimble Number
0940		082.95				70	3.0	60	
0950				10		70	3.0	60	
1000				10		72	3.2		
1010	M1E-4			10		74	3.2		
1020	SO_2			10		76	3.2		
1030				10		76	3.2		
1040				10		76	3.4		
1050				10		76	4.0		
1100				10		78	4.0		
1110				10		78	4.0		
1120				10		80	4.2		
1130				10		80	4.2		
1140		093.95		10		80	4.2		
		11:00		120					

RESOURCES RESEARCH, INC.

Personnel Gonzalez Entered

Checked

Plant Conditions, etc. SO_2

Plant UC/RM - Marietta Date 7-31-71

Sample Location SO_2 - E5 M1E-5

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg	IMP	Thimble Number
1440		275.29				86	3.0	70	
1450	M1E-5			10		86	3.0		
1500	SO_2			10		86	3.0		
1510				10		88	2.8		
1520				10		88	2.8		
1530				10		88	2.8		
1540				10		90	3.0		
1550				10		90	3.0		
1600				10		90	3.0		
1610				10		88	3.0		
1620				10		88	3.0		
1630		284.91		10		88	3.0		
		9.62		110		88	3.0		

RESOURCES RESEARCH, INC.

Personnel Schroeder Entered

Checked

Plant Conditions, etc.

Plant UC/RM Exhaust Date 8-2-71

Sample Location M1E-8 SO_2

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg		Thimble Number
0920	M1E-8	458.10				70	2.0		
0940	SO_2					75	2.8		
1010						79	2.8		
1030						82	2.2		
1050						84	2.2		
1110		465.07				84	2.0		

RESOURCES RESEARCH, INC.

Personnel Schroeder Entered

Checked

Plant Conditions, etc. SO_2

Plant UC/RM - Marietta Date 8-2-71

Sample Location Exhaust M1E-9 SO_2

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg		Thimble Number
1730		466.08				78	1.6		
1805		473.61				79	1.6		
1850		479.57				84	1.5		
1917		482.96				82	1.0		
1942		488.84				82	1.0		
1952		490.78				80	0.8		

RESOURCES RESEARCH, INC.

Personnel Blessing Entered

Checked

Plant Conditions, etc. SO_2

Plant UC/RM - Marietta Date 8-3-71

Sample Location M1E-10 SO_2

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg		Thimble Number
0957		497.91				66	2.6		
1025		499.92				68	2.4		
1055		501.00				69	2.2		
1130		501.60				68	2.0		
									D-60

RESOURCES RESEARCH, INC.

Personnel Schroeder & Avery Entered

Checked

Plant Conditions, etc. SO_2 Field Data

Plant UC/RM - Marietta Date 8/5/71

Sample Location Tapping Exhausts

Time	Sample Number	Meter # GAS METER CONDITIONS Pump # Cu.Ft. Reading	Cu.Ft.(Vm) Difference	Elaps. Min.	(Rm) C.F.M.	(+460=Tm) Temp °F	(Pm) Vacuum"Hg	Pb	Thimble Number
1128	WTE-1	28.40				73	3.0	29.60	
1140		30.50				76	2.5	29.60	
1207		32.35				77	2.0	29.60	
1430	WTE-2	32.38				78	2.5	29.60	
1500		34.83				79	2.5	29.60	
1607	ETE-3	962.77				75	1.0	29.60	
1620		963.16				75	1.0	29.60	
1630		963.55				75	1.2	29.60	
1635		963.77				75	1.2	29.60	

ORSAT FIELD DATA

Location M1E-1

Date 7/27/71

Time With Particulate

Operator Gonzalez

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E-1A	2.1	19.2	Nil
M1E-1B	2.1	19.3	Nil
AVG.	2.1	19.2	Nil

ORSAT FIELD DATA

Location M1E-2

Date 7/29/71

Time With Particulate

Operator Gonzalez

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E-2A	3.2	18.4	Nil
M1E-2B	3.6	18.2	Nil
M1E-2C	3.6	18.2	Nil
AVG.	3.4	18.3	Nil

ORSAT FIELD DATA

Location M1E-3

Date 7/30/71

Time With Particulate

Operator Gonzalez

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E-3A	1.9	18.6	Nil
M1E-3B	1.9	18.6	Nil
AVG.	1.9	18.6	Nil

ORSAT FIELD DATA

Location Exhaust M1E-4

Date 7/31/71

Time With Particulate

Operator Gonzalez

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E-4A	2.8	18.8	Nil
M1E-4B	2.8	18.8	Nil
AVG.	2.8	18.8	Nil

ORSAT FIELD DATA

Location Exhaust M1E-5

Date 7-31-71

Time With Particulate

Operator Gonzalez

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E- 5A	3.2	18.5	Nil
- 5B	3.4	18.3	"
	3.3	18.4	"

ORSAT FIELD DATA

Location M1E- 7

Date 8-1-71

Time With Particulate

Operator Gonzalez

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E - 7A	3.0	18.6	Nil
- 7B	3.0	18.6	Nil
AVG.	3.0	18.6	Nil

ORSAT FIELD DATA

Location UC/RM - Marietta
Scrubber Exhaust
Date 8-2-71
Time 0945 - 1100
Operator Schroeder

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E- 8	3.2	21.7	Negligible
	3.2	21.8	"
	3.2	21.8	"

ORSAT FIELD DATA

Location Scrubber Exhaust

Date 8-2-71

Time 6.15 - 8:15

Operator Schroeder

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E- 9A	3.4	18.5	Negligible
-9B	3.4	18.5	"
Avg.	3.4	18.5	"

ORSAT FIELD DATA

Location Scrubber Exhaust
UC/RM - Marietta

Date 8-3-71

Time 1010-1110

Operator Blessing

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E-10-A	3.2	22.0	-
-B	3.2	22.0	-
AVG.	3.2	22.0	Nil

ORSAT FIELD DATA

Location Exhaust M1E-11

Date 8-3-71

Time 1400 - 1530

Operator Blessing and Avery

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
M1E-11A	3.2	18.6	-
B	3.2	18.6	-
AVG.	3.2	18.6	Nil

ORSAT FIELD DATA

Location Scrubber Exhaust

Date 8/4/71

Time With Particulate

Operator Gonzalez

Comments:

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
MIE - 12	3.1	18.7	Nil

ORSAT FIELD DATA

Location WTE-1 Comments:

Date 8/5/71

Time With Particulate

Operator Schroeder

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
WTE-1	0.2	21.2	Nil

ORSAT FIELD DATA

Location WTE-3 Comments:

Date 8-5-71

Time During particulate

Operator Schroeder

Test	(CO_2) Reading 1	(O_2) Reading 2	(CO) Reading 3
WTE-3A	0.1	21.2	Nil
-3B	0.1	21.2	Nil
AVG	0.1	21.2	Nil

APPENDIX E

STANDARD SAMPLING PROCEDURES

APPENDIX E-1

STANDARD SAMPLING PROCEDURES

PARTICULATE SAMPLING

With an unstable plant operation a trial run is often conducted. If the trial turns out to be satisfactory it may be considered a part of the final testing. Preliminary data is obtained for gas velocity, temperature, moisture content and other variables which might affect the isokinetic sampling rate. Each sample port traverse is divided into a number of equal areas for each location. Each test run is designed to obtain simultaneous samples at each location, for such a period of time that plant operation will be representative, and that sufficient material will have been obtained for accurate analysis.

Particulate samples are obtained using the equipment and test procedures as stipulated in "Sample Collection Procedures," published by OAP. The sampling train is basically the same as that designed by the Control Development Program of OAP (formerly the Air Pollution Control Office), "Gas Stack Sampling Improved and Simplified with New Equipment," and described in Paper No. 67-119, presented at the Air Pollution Control Association meeting at Cleveland, Ohio, in June, 1967.

The above sample equipment is referred to in this report as the EPA train. It is essentially the same as that recently described in Federal Register, Volume 36, Number 159, August 17, 1971, Part II as Test Method 5. Its operation, briefly, is as follows:

determined by using the nomographs presented in APCA Paper No. 67-119. This nomograph relates stack gas velocity, temperature, and moisture content to the flow rate required for isokinetic sampling.

The ASME train, run in parallel with the EPA train, consists of a stainless steel filter holder containing a pre-weighed alundum filter. Its operation, briefly, is as follows:

Sample gases are drawn through a stainless steel nozzle and filter holder, placed within the stack, into a set of water filled Greenburg-Smith impingers. Isokinetic sampling rates are not determined during the test but are precalculated from initial pitot and temperature readings. Only the material collected by the alundum filter is normally considered as particulate. No ASME train was employed during this survey.

SULFUR DIOXIDE SAMPLING

Sulfur dioxide emission tests are normally conducted at the same location as the exhaust particulate tests. Sample gas is drawn through a glass wool filter into an electrically heated glass probe, followed by a coarse frit midget impinger and a second glass wool filter. The filter leads to three midget impingers in an ice bath, followed in turn by a silica gel tube drier, vacuum gauge, dry gas meter and vacuum pump.

The midget bubbler contains 15 milliliters of 80 percent isopropyl alcohol. The first two impingers contain 15 milliliters of three percent hydrogen peroxide solution and the third is operated dry. Equipment is leak tested before each run. The three percent hydrogen peroxide is prepared the day of the test by dilluting 10 milliliters of 30 percent reagent grade hydrogen peroxide with 90 milliliters of distilled water.

Temperatures, vacuum and gas meter readings are taken and tabulated in order to calculate standard volumes. After sampling, the train is purged with clean air in order to carry over any SO_2 trapped in the isopropyl alcohol.

NITROGEN OXIDES SAMPLING

Nitrogen oxides sampling is normally carried out at the same exhaust location as the sulfur dioxide and particulate tests. The sample gas is pulled through a glass wool filter and a glass probe into an evacuated two-liter flask containing dilute sulfuric acid-hydrogen peroxide solution. This is prepared according to EPA directions for nitrogen oxides sampling. The flask is fitted with a three-way stopcock and a pump is employed to evacuate the flask and purge the probe lines. Vacuum present in the flask is measured by a vacuum gauge and the sampling train is leak tested by pulling a vacuum of 27 inches Hg and observing the pressure gauge. Initial and final readings of pressure, flask temperature and atmospheric pressure are recorded after the probe is purged. After collecting the sample the flask is sealed and shaken for 5 minutes, then allowed to stand overnight, before being washed into sample containers for transfer to the laboratory.

ORSAT SAMPLING

An integrated gas sample is obtained with a mylar bag and a peristaltic pump with adjustable flow rate. The gases are filtered and cooled prior to reaching an all plastic and glass flow meter where the sampling rate is monitored. Gas samples are taken during the same period during which velocities, temperatures, and particulate samples are obtained. Analyses are performed at the site immediately after each sample is collected.

APPENDIX E.2

CLEANUP AND ANALYTICAL PROCEDURES

CLEANUP (EPA PARTICULATE TRAIN)

Probe, Nozzle, Cyclone, and Front Half of Filter Holder

The nozzle, probe, cyclone, flask, and front half of the filter holder are washed with reagent grade acetone, the washings collected in a container and transported to the laboratory for analysis. A brush and/or rubber policeman is used with the acetone to remove any particles adhering to the cyclone walls or the flask. The reagent acetone used for washing is tested to determine the blank or residue upon evaporation.

Filter

The tared circular MSA type 1106BH filter paper is carefully removed from the fritted glass support and transferred to a glass petri dish for later weighing.

Impingers

Water in the first three impingers (the original water plus the condensate) is measured, then emptied into a polyethylene container. The impingers are then water washed and the washings combined with the condensate and original water.

Acetone Train Wash

The rear half of the filter holder, including the fritted glass support, the impingers, and impinger connections up to but excluding the

fourth impinger, are washed with acetone. These washings are collected in a polyethylene (since changed to glass) bottle and sealed for later analysis.

Silica Gel

Silica gel is transferred (dry) from the fourth impinger to an air-tight container and sealed. The impinger is then washed with acetone, the acetone being discarded because it contains fine silica gel particles.

CLEANUP (SO_2 TRAIN)

The impinger containing 80 percent isopropyl alcohol is discarded and the impingers containing three percent hydrogen peroxide are saved. These latter impingers contain SO_2 gas in the form of H_2SO_4. A glass jar is used as a sample container for transportation to the laboratory.

CLEANUP (NO_x TRAIN)

After storage overnight and shaking for another two minutes the contents are rinsed into glass containers for shipment to the laboratory.

ANALYTICAL PROCEDURES (EPA PARTICULATE TRAIN)

Acetone Washings

The acetone washings from the nozzle, probe, cyclone, flask, and filter front; from the fritted glass, filter back and impinger train; are analyzed separately by evaporation and drying at ambient temperatures.

Filter Particulate

The filter and particulate collected thereon are dried for 24 hours in a desiccator at ambient temperature and weighed. Tare weight of the filter is then deducted.

Impinger Water

Water collected in the impingers, along with the water washings of the impingers, is extracted with ether and chloroform. The extracts are transferred to a tared dish and evaporated to dryness at room temperature. After extraction, the remaining water and solvent are evaporated to dryness on a steam bath and this additional net weight is added to the total weight of particulate matter.

SPECIAL NOTE

All samples are now dried in 250 ml beakers to a constant weight.

ANALYSIS (ORSAT MEASUREMENTS)

Orsat measurements for determination of carbon dioxide, oxygen and carbon monoxide are made using a Burrell Industrial Gas Analyzer or equivalent.

ANALYSIS (SO_2 TRAIN)

SO_2 samples are analyzed by the modified Shell Development method. Barium perchlorate is used instead of barium chloride (as in the new EPA source testing Method 6) because of the sharper titration end point obtainable with the former reagent.

ANALYSIS (NO_x TRAIN)

Samples are analyzed by the standard phenoldisulfonic acid method. This is now incorporated in the new EPA source testing Method 7.

APPENDIX F

LABORATORY REPORT

ACETONE
BEFORE

Total wt.

SAMPLES U/C - R.M. Manitta, OHIO

CR NO.	LOCATION and SAMPLE NO.	Volume mls	SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.			Net wt.
11	M1E - 1	60	89.7786 89.7612 0.0174	89.7769 89.7612 0.0157	89.7771 89.7612 0.0159	✓		0.0159 0.0102 0.0057	0.0057
12	- 2	60	85.1497 85.1324 0.0113	85.1402 [illegible] [illegible]	[illegible] [illegible] 0.0082	✓		0.0089 0.0102 0	0
13	- 3	60	91.3590 91.3392 0.0198	91.3562 [illegible] 0.0170	91.3571 91.3392 0.0199	✓		0.0199 0.0102 0.0097	0.0097
14	- 4	80	90.8557 90.84[illegible] 0.0199	90.8543 90.84[illegible] [illegible]	90.8558 90.8[illegible]8 0.0134	✓		0.0134 0.0136 0	0
15	- 5	110	88.5339 88.5148 0.0191	88.5310 88.5[illegible] 0.01[illegible]	88.5320 88.5148 0.0172	✓		0.0172 0.0187 0	0
	- 6			SAMPLE NOT RECEIVED TROUBLE				EVOD	
16	- 7	50	91.8520 91.8195 0.0325	91.8521 91.8195 0.0326	✓			0.0326 0.0085 0.0241	0.0241
17	- 8	175	83.6140 83.5468 0.0678	83.6133 83.5468 0.0665	83.6145 0.0677	✓		0.0677 0.0298 0.0379	0.0379
18	- 9	150	86.1680 86.1320 0.0360	86.1716 86.1320 0.0396	86.1708 1320 0.0388	✓		0.0388 0.0255 0.0133	0.0133
19	- 10	125	88.3547 88.3204 0.0343	88.3539 88.3204 0.0335	✓			0.0335 0.0213 0.0122	0.0122
20	- 11	150	92.1604 92.0268 0.1336	92.1621 92.0268 0.1353	1624 0268 0.1356	✓		0.1356 0.0255 0.1101	0.1101
21	- 12	60	90.9268 90.9259 0.0009	90.9278 90.9239 0.0039	9468 9359 0.0109	✓		0.0109 0.0102 0.0007	0.0007
60	Acetone BLANK 1+ 2 mls 9/1/71 To Milk taster	320	850607 850061	0604 0561 0.0543	✓	= 0.0170/100 ml			

Project No. 859490

Collection Date 7/27 - 8/5

Analysis Date 9/7/71

ACETONE
BEFORE

Total wt.

SAMPLES V/C - R.M. Marietta, Ohio

A1109

Beaker NO.	CR	LOCATION and SAMPLE NO.	Volume mL.	SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.		Dif. - blank	Net wt.
		M1D-1			SAMPLE NOT GOOD					
		-2			SAMPLE NOT GOOD					
1		-3	400	90.6527 89.7913 0.9216	90.6594 89.7315 0.9231	90.6535 89.7313 0.9222	✓		0.9222 0.0680 0.8542	0.8542
2		-4	250	88.0172 87.7916 0.2856	88.0145 87.7916 0.2829	88.0138 87.7916 0.2817	0137 0.2821		0.2821 0.0425 0.2396	0.2396
3		-5	340	90.1750 89.6500 0.5250	90.1678 89.6500 0.5178	90.1756 6860 0.5256	✓		0.5256 0.0578 0.4678	0.4678
4		-6	300	88.6618 87.3158 1.3460	88.6667 87.3156 1.3511	88.6641 87.3158 1.3483	89.2643 1.3487	✓	1.3487 0.0510 1.2977	1.2977
5		-7	260	93.9112 92.6624 1.2488	93.9149 92.6624 1.2525	93.9114 92.6624 1.2490	✓		1.2490 0.0442 1.2048	1.2048
6		-8	260	94.2146 92.9437 1.2709	94.2177 92.9437 1.2740	94.2140 92.9437 1.2703	✓		1.2703 0.0442 1.2261	1.2261
7		-9	300	91.3105 89.6503 1.6602	91.3157 89.6503 1.6654	91.3125 89.6503 1.6622	3107 1.6604	✓	1.6604 0.0510 1.6094	1.6094
8		-10	280	90.1280 89.8617 0.2663	90.1283 89.8617 0.2666	✓			0.2666 0.0476 0.2190	0.2190
9		-11	240	86.4733 85.8177 0.6556	86.4754 85.8177 0.6577	86.4747 85.8177 0.6570	✓		0.6570 0.0408 0.6162	0.6162
10		-12	150	87.3884 87.1020 0.2864	87.3895 87.1040 0.2855	✓			0.2855 0.0255 0.2600	0.2600
				Ave Acet.			bk =		0.0170/100 ml	
		BLANK 2 rinse	340	89.6731 89.6082 0.0649	89.6702 89.6082 0.0620	89.6682 89.6082 0.0600	6710 6082 0.0628	✓	= 0.0185/100 ml	
		KOC Acet. #39 from Lot-Usm	250	82.2184 82.1797	2183 1796 0.0387	✓			= 0.0155/100 ml	

Project No. 859 490

Collection Date 7/27 - 8/5

Analysis Date 9/7/71

ACETONE BEFORE

Total wt.

SAMPLES V/C - R.M. Marietta, OHIO

NO. CR	LOCATION and SAMPLE NO.	Volume	SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.		wt -bk	Net wt
22	ETE-1	125	91.5885 91.5394 0.0485	91.5900 91.5394 0.0506	91.5900 0.0506	✓		0.0506 -0.0213 0.0293	0.0293
23	-2	100	91.2230 91.1835 0.0438	91.2192 91.1835 0.0357	91.2264 1835 0.0429	✓		0.0429 -0.0170 0.0259	0.0259
24	-3	125	92.3471 92.2904 0.0567	92.3439 92.2907 0.0532	2439 2904 0.0532	✓		0.0532 -0.0213 0.0319	0.0319
25	WTE-1	105	89.4948 89.3826 0.1122	89.4968 89.3826 0.1142	4976 3826 0.1150			0.1150 -0.0179 0.0971	0.0971
26	-2	75	82.6793 82.6293 0.0480	82.6769 82.6293 0.0470				0.0470 -0.0128 0.0342	0.0342
27	-3	75	85.6983 85.6736 0.0247	85.6996 85.6736 0.0260	6990 6736 0.0254	—		0.0254 -0.0128 0.0126	0.0126
	BLANK Acetone								

Project No. 859490

Collection Date 7/27 - 8/5

Analysis Date 9/7/71

SAMPLES U/C - R. M. -

CR NO.	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.			
	Contra C Beaker	89.5202 89.5175 0.0027	89.5202 89.5175 0.0025	89.520 0.0025	89.5[illegible] 0.0031	[illegible] .03			

A-11
109

Project No. _____

Collection Date _____

Analysis Date _____

G. F. FILTER

Total Wt.

SAMPLES U/C - R. M. Marietta, OHio.

NO.	CR DIST	LOCATION and SAMPLE NO.	Tare Wt. Filter	SAMPLE WEIGHT	TIT. ALIQ.	Reading Blank	MG in ALIQ.			
	2	M1E-1 (2FN-40A)	0.1750	0.1750 26.2260 26.4010	26.4328 26.4010 0.0318	26.4347 26.4013 0.0334	26.4333 26.4010 0.0323			
	3	(2FN-40A)2	0.1747	0.1747 29.2590 29.2337	29.2629 29.2937 0.0283	29.2647 29.2984 0.0363	29.2650 29.2959 0.0283			
	4	(2FN-39A)3	0.1748	0.1748 23.8606 24.0354	24.0680 24.0354 0.0326	24.0697 24.0334 0.0339	24.0682 24.0354 0.0328			
	5	(2FN-X)4	0.2893	0.2893 25.3666 25.6559	25.6922 25.6559 0.0363	25.6937 25.6567 0.0370				
	6	(2FN-TA)5	0.1862	0.1862 27.3194 27.5056	27.5403 27.5056 0.0347	27.5421 27.5056 0.0368	27.5405 27.5056 0.0349	27.5432 27.5056 0.0376		
		-6		Sample Lost			Not OK		0.004	
	1	(2FN-1A)	0.1764	0.1764 26.9181 27.0948	27.1308 27.0948 0.0360	27.1327 27.0948 0.0384	27.1311 27.0948 0.0383			
	8	(2FN-8A)	0.1767	0.1767 26.3004 26.4771	26.5138 26.4771 0.0357	26.5157 26.4771 0.0364				
	9	(2FN-29A)	0.1744	0.1744 26.9196 27.0940	27.1301 27.0940 0.0136	27.1319 27.0940 0.0353	OK		27.1300 26.9174 0.2126 1744 0.0382	
	10	(2FN-30A)	0.1785	0.1785 25.9746 26.1531	26.1964 26.1531 0.0433	26.1982 26.1531 0.0463	26.1971 26.1531 0.0440			
	11	(2FN-31A)	0.1763	0.1763 30.8191 30.9954	31.0377 30.9954 0.0425	31.0396 30.9954 0.0423				
	12	(2FN-32A)	0.1761	0.1761 29.1725 29.3486	29.6555 29.3486 0.3069	29.6574 29.3486 0.3063			2225 1761 0.0464	264257
	1	BLANK (2FN-44A)	0.1764	0.1764 28.2513 28.4277	28.4277 28.4277 0.0000	28.4296 28.4277 0.0019	28.4282 28.4277 0.0005	28.4295 28.4277 0.0018	28.4303 28.4277 0.0026	4273 4277 0.0000

All 100

Project No. 859490

Collection Date 7/27 - 8/5

Analysis Date 9/2/71

G. F. FILTER

Total wt.

SAMPLES U/C - R. M. Marietta, OHIO

CR. NO.	LOCATION and SAMPLE NO.	Tare Wt. Filter	SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.			
13	(2FN-21A) (2FN-1D-1) (2FN-8A) (2FN-1A)	0.1723 0.1786 0.1762 0.5321	0.5821 30.0155 30.5976	31.3786 30.5476 0.8310	31.3759 30.5476 0.8274	31.3593 30.5476 .8308	31.3784 30.5476 0.8308		
	-2		— NOT GOOD —						
89	2FN-22-3A	0.1774	0.1774 28.7167 28.8941	29.5790 28.8941 0.6829	29.5776 28.8941 0.6835				
14	(2FN-2A) -4	0.1792	0.1792 26.4143 26.5935	27.7934 26.5935 1.1999	27.7911 26.5935 1.1976	27.7611 26.5935 1.1676	27.7583 26.5935 1.1648		
15	(2FN-25A) -5	0.1744	0.1744 26.2054 26.3798	26.4266 26.3798 0.0468	26.4282 26.3798 0.0485	26.4266 26.3798 0.0468			26.4257 26.
16	2FN-10A -6 2FN-19A	0.1799 0.1778 0.3582	0.3582 26.7257 27.0839	28.7119 27.0839 1.6278	28.7094 27.0839 1.6255	28.7368 27.0839 1.6529	28.5284 27.0839 .455	28.7269 27.0839 1.6427	28.7268 27.0839 1.6449
17	2FN-17A -7 2FN-23A	0.1772 0.1779 0.3551	0.3551 25.4831 25.8382	26.9938 25.8382 1.1556	26.9968 25.8392 1.1586	26.9958 25.8382 1.1576			
18	2FN-13A -8 2FN-9A	0.1760 0.1810 0.3570	0.3570 25.6124 25.9694	27.3410 25.9694 1.3716	27.3409 25.9694 1.3715				
19	2FN-6A -9	0.1794	0.1794 26.3331 26.5125	27.5612 26.5125 1.0487	27.5586 26.5125 1.0460	27.5580 26.5125 1.0455			
20	(2FN-38-10A)	0.1739	0.1739 28.6288 28.8027	29.2087 28.8027 1.0060	29.1833 28.8027 1.0106	29.1801 28.8027 1.0174	29.9146 28.8027 1.0119	29.8147 28.8027 1.0120	
21	(2FN-35-11A)	0.1759	0.1759 27.9264 28.1023	29.3152 28.1023 1.2129	29.3223 28.1023 1.2199	29.3313 28.1023 1.2290	29.3247 28.1023 1.2224	29.3222 28.1023 1.2200	
22	(2FN-41-12A)	0.1771	0.1771 26.9860 27.0631	29.0189 27.0631 1.9557	29.0211 27.0631 1.9580	29.0162 27.0631 1.9531	28.9936 27.0631 1.9179	28.9980 27.0631 1.9349	27.9778 27.0631 1.9145
	11			29.0098 27.0631 1.9467	29.0074 27.0631 1.9340	28.9996 27.0631 1.9365	28.9705	28.9819	
	11 Transferred to small desiccator →			28.9604	28.9548 27.0631 1.8917	28.9656 27.0631 .9025	28.9544		

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Collection Date 7/27 - 8/5

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G.F. FILTER

Total wt.

SAMPLES U/C - R.M. Marietta, OHIO

NO. CR DBA	LOCATION and SAMPLE NO.	Tare Wt. Filter	SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	Reading / Tare			
23	ETE-1 (2FN-9[illegible])	0.1762	0.1762 28.9917 29.1679	29.2049 29.1679 0.0370	29.2077 29.1679 0.0398	29.1042 29.1679 0.0637	→ grams		
24	000080-2	0.1782	0.1782 26.3962 26.5544	26.5598 26.5544 0.0054	26.5654 26.5544 0.0083	26.5522 26.5540 0.0088			
25	000079-3	0.1783	0.1793 26.0486 26.2269	26.2326 26.2269 0.0057	26.2331 26.2269 0.0062	26.2332 26.2269 0.0063			
26	WTE-1 (2FN-49A)	0.1772	0.1772 29.0547 29.2319	29.3124 29.2319 0.0805	29.3134 29.2319 0.0820	29.3117 29.2319 0.0798			
27	000081-2	0.1741	0.1741 25.1519 25.3260	25.3441 25.3260 0.0181	25.3453 25.3260 0.0190				
28	000082-3	0.1781	0.1781 27.7124 27.8905	27.8972 27.8905 0.0068	27.8977 27.8905 0.0066				
	BLANK								

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Collection Date 7/27 - 8/5

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ACETONE
AFTER

Total wt.

U/C - R.M. Marietta, OHIO

SAMPLES

All 109

CR NO.	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading Blank	MG in ALIQ.		wt − bk	Net wt.
28	M1E-1	50	81.4715 0.0227	81.4949 81.4715 0.0234	✓			0.0234 0.0085 0.0149	0.0149
29	-2	50	86.5567 0.0144	86.5705 86.5567 0.0138	✓			0.0138 0.0085 0.0053	0.0053
30	-3	50	79.2640 0.5097	79.2730 79.2640 0.0090	✓			0.0090 0.0085 0.0005	0.0005
31	-4	25	82.5747 0.0375	82.5828 82.5747 0.0081	✓			0.0081 0.0043 0.0038	0.0038
32	-5	25	75.8409 0.0363	75.8487 75.8409 0.0078	8470 8409 0.0061	✓		0.0061 0.0043 0.0018	0.0018
✓	-6		Sample RHS	✓	Not Good Trouble				
33	-7	25	86.1750 0.0560	86.1826 86.1750 0.0076	86.1838 86.1750 0.0083	✓		0.0083 0.0043 0.0040	0.0040
34	-8	10	86.0762 0.0043	86.0821 86.0762 0.0059	86.0826 0762 0.0064	✓		0.0064 0.0017 0.0047	0.0047
35	-9	10	85.5951 0.0013	85.5967 85.5951 0.0016	✓			0.0016 0.0017 0	0
36	-10	110	90.8373 0.0177	90.8534 90.8373 0.0161	8534 0.0166	✓		0.0166 0.0187 0	0
37	-11	125	83.2142 0.0269	83.2460 83.2142 0.0318	83.2442 2142 0.0300	83.2484 .2142 0.0294	✓	0.0294 0.0213 0.0081	0.0081
38	-12	185	82.7443 0.0439	82.7877 82.7443 0.0434		✓		0.0434 0.0315 0.0119	0.0119
	BLANK								

Project No. 859490

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Ave Acet. bk. = 0.0170/100ml

ACETONE
AFTER

Total wt.

SAMPLES U/C - R.M. Marietta, OHIO

Beaker NO. / CR Ref	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.		WT -bk	Net wt.
	M1D-1			Sample Not Good					
	-2			Sample Not Good					
39	-3	130	78.2180 78.1951 0.0229	78.2171 145 0.0220	✓			0.0220 0.0221 0	0
40	-4	70	86.2955 86.2950 0.0005	86.2984 86.2950 0.0034	86.2978 86.2950 0.0028	✓		0.0028 0.0119	0
41	-5	70	86.2685 86.2191 0.0494	86.269 0.0494	✓			0.0494 0.0119 0.0375	0.0375
42	-6	115	84.8880 84.8636 0.0244	84.6683 0.0247	✓			0.0247 0.0196 0.0051	0.0051
43	-7	105	84.1962 84.6930 0.0432	1350 0930 0.0420	84.13 0.03	84.1351 0.0421	✓	0.0421 0.0179 0.0242	0.0242
44	-8	50	87.6753 87.6582 0.0171	6759 6582 0.0177	✓			0.0177 0.0085 0.0092	0.0092
45	-9	55	80.1448 80.1281 0.0167	80.1457 1281 0.0176	✓			0.0176 0.0094 0.0082	0.0082
46	-10	45	84.3967 84.3847 0.0120	3958 3847 0.0111	✓			0.0111 0.0077 0.0034	0.0034
47	-11	35	84.5719 84.5695 0.0024	5719 0.0024	✓			0.0024 0.0060	0
48	-12	60	86.8878 86.8780 0.0098	8878 0.0098	✓			0.0098 0.0102	0
	BLANK								

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ACETONE AFTER

Total wt.

SAMPLES U/C - R.M. Manitou, OHIO

CR NO.	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading Blank	MG in ALIQ.			Net wt.
49	ETE - 1	25	90.2819 90.2785 0.0034	2818 0.0033	✓			0.0033 0.0043 0	0
50	-2	25	77.3165 77.3200 0.0035	77.3227 3200 0.0027	77.3234 3200 0.0034	✓		0.0034 0.0043 0	0
51	-3	40	84.0921 84.0857 0.0064	84.0912 0857 0.0055	✓			0.0055 0.0068 —	0
52	WTE - 1	150	83.0199 82.9784 0.0415	83.0205 82.9784 0.0421	✓			0.0421 0.0255 0.0166	0.0166
53	-2	85	80.0891 80.0689 0.0202	80.0891 0689 0.0207	✓			0.0207 0.0145 0.0062	0.0062
54	-3	30	76.9129 76.9125 0.0033	9165 .25 0.0040	✓			0.0040 0.0057 0	0
	BLANK								

Project No. 859490

Collection Date 7/27 - 8/5

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ETHER - CHLORO EXTRACT.

Total wt.

SAMPLES U/C - R.M. Marietta, OHIO

All 109

NO.	CR Bro Rev	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Readings / Blank	MG in ALIQ.			Net wt.
55	CE	M1E-1	120	79.8750 79.8745 0.0005	8762	8760 8745 0.0015	✓			0
56	CB	-2	115	87.6610 87.6607 0.0003	87.6633	6632 6607 0.0025	✓			0.0010
57	CE	-3	125	86.9648 86.9645 0.0003	9647 9645 0.0002	✓				0
58	CE	-4	110	77.6040 77.6107 - 0.0017	77.6123 6107 0.0016	6125 6107 0.0018	✓			0.0003
59	CE	-5	110	77.5181 77.5176 0.0005	77.5193	5194 76 0.0018	✓			0.0003
		-6			Sample Not Found					
61	CB	-7	125	77.9872 77.9845 0.0027	77.9872 0.0027	✓				0.0012
62	CE	-8	115	80.1503 80.1517 - 0.0014	80.1538 1517 0.0021	1540 1517 0.0023	✓			0.0008
63	CE	-9	115	80.1839 80.1846 - 0.0007	1859	1861 46 0.0015	✓			0
64	CE	-10	150	88.7797 88.7826 - 0.0031	7837	7837 7826 0.0011	✓			0
65	CE	-11	125	88.6170 88.6179 - 0.0009	6185	6185 6173 0.0012	✓			0
66	CE	-12	105	85.3587 85.3588 - 0.0001	3605	3611 3588 0.0023	✓			0.0008
		Hyflo-Chloro BLANK	125	84.9533 84.9533 - 0.0000	9543 33 0.0010	9559 9543 0.0017	✓	= 0.0014 / 100 ml		
		Ether-Chloro Blank	150	69.7843 69.7843 0.0000	69.7858	7858 7843 0.0015	✓	0.0015 Total		

Project No. 859490

Collection Date 7/27 - 8/5

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ETHER-CHLORO EXTRACT.

Total wt.

SAMPLES U/C - R.M. Marietta, OHIO

NO.	CR	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.			
67	CE	MID-1				Sample Lost				
68	CE	-2				Sample Lost				
69	CE	-3	110	84.3177 84.3231 0.0054	3218	3218 3231 0.0012	MINUS			0
70	CE	-4	125	76.4662 76.4682 0.0020	76.4697	4696 4682 0.0014				0
71	CE	-5	110	77.6449 77.6456 0.0613	6478	6478 56 0.0022				0.0007
72	CE	-6	125	79.3682 79.3733 0.0051	3718	3716 3733 0.0017	MINUS			0
73	CE	-7	125	83.5344 83.5382 0.0038	5385	5365 5368 0.0003				0
74	CE	-8	135	82.2269 82.2291 0.0025	2266 2291	MINUS				0
75	CE	-9	120	78.3529 78.3500	3521 00 0.0021					0.0006
76	CE	-10	125	74.5365 74.5327	5360 27 0.0033					0.0018
77	CE	-11	125	80.7241 80.7273	7293 73 0.0019					0.0004
78	CE	-12	125	84.7171 84.7137	7171 7137 0.0034					0.0019
		BLANK								

Project No. 859 490

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ETHER-CHLORO EXTRACT.

Total wt.

SAMPLES v/e - R.M. Marietta, OHIO

NO.	CR	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.			Net wt.
79	CE	ETE-1	120	75.4482 75.4504 0.0022	4517	4517 4504 0.0013	✓			0
80	CE	-2	155	79.4429 79.4428 0.0005	70.4446	4449 28 0.0021	✓			0.0006
81	CE	-3	135	80.9569 80.9401 0.0034	9415	9406 9401 0.0005				0
82	CE	WTE-1	120	77.7156 77.7150	7157 50 0.0007	✓				0
83	CE	-2	125	79.1434 79.1423	1441 23 0.0018	✓				0.0003
84	CE	-3	125	83.4096 83.4100	4103 4 0.0003	✓				0
		BLANK								

Project No. 859490

Collection Date 7/27 - 8/5

Analysis Date 9/7/71

WATER IMP.
REMAINDER

Total wt.

SAMPLES U/C - R.M. Marietta, OHIO

Beg CR / End CY NO.	LOCATION and SAMPLE NO.	Vol, ml	SAMPLE WEIGHT	TIT. ALIQ.	Reading Blank	MG in ALIQ.			Net wt.
55	M1E-1	580 0.0012	86.1797 86.1712 0.0083	1795 1712 0.0083	✓				0.0081
56	-2	610 0.0012	81.5037 81.4966 0.0071	81.5061	5061 4966 0.0095	✓			0.0093
57	-3	550 0.0011	82.4346 82.4288	4343 4288 0.0055	✓				0.0053
58	-4	640 0.0013	78.0718 78.0694	6725 6694 0.0031	✓				0.0029
59	-5	650 0.0013	86.3697 86.3649 0.0048	3697 3649 0.0048	✓				0.0046
	-6			Sample Not Taken					
61	-7	560 0.0011	84.2724 84.2687 0.0037	84.2722 2687 0.0035	✓				0.0033
62	-8	660 0.0013	84.9004 84.8988	9005 8988 0.0017	✓				0.0015
63	-9	580 0.0012	75.1488 75.1422	1494 22 0.0072	✓				0.0070
64	-10	600 0.0012	77.5700 77.5664	77.5694 5664 0.0030	✓				0.0028
65	-11	600 0.0012	77.6893 77.6646	6884 6646 0.0238	✓				0.0236
66	-12	610 0.0012	71.0934 71.0860	0934 0860 0.0074	✓				0.0072
	H_2O BLANK	500	82.4159 82.4157 0.0002	4167 4157 0.0010	✓	= 0.00004	100 ml		

Project No. 859 490

Collection Date 7/27 - 8/5

Analysis Date 8/31/71

WATER IMP.
REMAINDER

Total wt.

SAMPLES U/C - R.M. Marietta, OHIO

CR NO.	LOCATION and SAMPLE NO.	Vol., Ml	SAMPLE WEIGHT	TIT. ALIQ.	Reading Blank	MG in ALIQ.			
67	M1D-1		80.3981		D.(	Not Good			
68	-2		84.3896	3	.,	Not	Good	D	
69	-3	410	77.4623 72.4523	4632 5790 0.0104	✓				0.0102
70	-4	420	75.4092 75.4123 0.0031	75.4243	4244 4123 0.0121	✓			0.0119
71	-5	480	78.5766 78.5659 0.0107	78.5766 5659 0.0107	✓				0.0105
72	-6	350	78.2407 78.2337	2410 2337 0.0073	✓				0.0072
73	-7	450	77.9870 77.9785 0.0085	9865 9785 0.0080	✓				0.0076
74	-8	400	75.7435 75.7362 0.0073	7437 7364 0.0073	✓				0.0071
75	-9	340	81.3024 81.2983 0.0041	3026 2983 0.0043	✓				0.0042
76	-10	360	68.9101 68.8930 0.0171	9094 8930 0.0164	✓				0.0163
77	-11	310	80.1240 80.0979 0.0261	1253	1242 0979 0.0263	✓			0.0262
78	-12	370	79.0438 79.0384 0.0054	0445 3900 0.0061	✓				0.0060
	BLANK		0.00004/100 ml						

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Collection Date 7/27 - 8/5

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WATER IMP
REMAINDER

Total wt.

SAMPLES U/C - R.M. Marietta, OHIO

CR NO.	LOCATION and SAMPLE NO.	Vol., ml	SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.			Net wt
79	ETE - 1	360	79.3625 79.3516	3633 3516 0.0117	✓				0.0016
80	- 2	280	77.2420 77.2391 0.0029	2430 39 0.0049	2423 2391 0.0032	✓			0.0031
81	- 3	360	77.2563 77.2527	2565 2528 0.0037	✓				0.0036
82	WTE - 1	360	77.1693 77.1395	77.1674	1658	1666 1395 0.0271	✓		0.0270
83	- 2	440	71.0288 71.0108	0280 168 0.0172	✓				0.0170
84	- 3	270	79.3868 79.3656	3849	3837	3839 3656 0.0183	✓		0.0182
	BLANK		0.0004	4/100 ml					

Project No. 859490

Collection Date 7/27 - 8/5

Analysis Date 8/31/71

Silica Gel

Total wt. of H_2O

SAMPLES U/C - R.M. Marietta, OHIO

CR NO.	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading Blank	MG in ALIQ.			
	M1E-1	177.9 202.4 380.3	Dry Gel Bottle Net wt.	408.9 380.3 28.6	Net wt. - wet gel + Bott " " - Dry " + " Gain in Wt.				28.6
	-2	194.6 202.4 397.0	Dry Gel Bott Net wt.	422.7 397.0 23.7		"			23.7
	-3	179.8 202.4 382.2	Dry Gel Bott. Net wt.	413.1 382.2 30.9		"			30.9
	-4	187.6 194.3 381.9	Dry Gel Bott Net wt.	418.4 381.9 36.5		"			36.5
	-5	186.9 194.6 381.5	Dry Gel Bott. Net wt.	412.5 381.5 31.0		"			31.0
	-6			Sample Not Good RH ST Trouble					
	-7	189.8 199.9 389.7	Dry Gel Bott. Net wt.	422.9 389.7 33.2	Net wt - Wet Gel + Bott " " - Dry " + " Gain				33.2
	-8	184.9 194.4 379.3	Dry Gel Bott. Net wt.	412.5 379.3 33.2		"			33.2
	-9	182.6 196.0 378.6	Dry Gel Bott Net wt.	413.6 378.6 35.0		"			35.0
	-10	182.8 202.4 385.2	Dry Gel Bott. Net wt.	418.6 385.2 33.4		"			33.4
	-11	183.4 202.4 385.8	Dry Gel Bott. Net wt.	398.5 385.8 12.7		"			12.7
	-12	182.1 202.4 384.5	Dry Gel Bott. Net wt.	419.7 384.5 35.2		"			35.2

Project No. 859490

Collection Date 7/27 - 8/5

Analysis Date August 16, 1971

Silica Gel

Total wt. of H_2O

SAMPLES U/C - R.M. Marietta, OHIO

CR NO.	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading Blank	MG in ALIQ.			
	M1D-1			Sample Not Good					
	-2			Sample Not Good					
	-3	188.7 - dry Gel 195.2 - Bottle 383.9 - Net wt.		397.8 383.9 13.9	Net wt. Wt. Gel + Bot " " - Dry Gel " Gain in wt.				13.9
	-4	182.6 - dry Gel 204.1 - Bottle 386.7 - Net wt.		396.9 386.7 12.2	Net wt. Wt Gel + Bot " " - Dry Gel " Gain in wt.				10.2
	-5	183.1 - dry Gel 195.6 - Bottle 389.3 - Net wt.		402.8 389.3 13.5	Net wt. Wt Gel + Bot " " - Dry " - " Gain in wt.				13.5
	-6	181.4 - dry Gel 200.4 - Bottle 381.8 - Net wt.		395.5 381.8 13.7	Net wt. - Wt. Gel + B " " - Dry Gel + B Gain in wt.				13.7
	-7	185.1 - dry Gel 195.6 - Bottle 380.7 - Net wt.		393.2 380.7 12.5	"				12.5
	-8	185.0 - dry Gel 203.0 - Bottle 388.0 - Net wt.		400.6 388.0 12.6	"				12.6
	-9	190.9 - Dry Gel 194.2 - Bottle 385.1 - Net wt		396.3 385.1 11.2	"				11.2
	-10	186.2 - Dry Gel 202.3 Bottle 388.5 Net wt.		400.5 388.5 12.0	"				12.0
	-11	186.7 Dry Gel 202.4 Bottle 389.1 Net wt.		417.0 389.1 27.9	"				27.7
	-12	183.9 Dry Gel 202.4 Bottle 386.3 Net wt.		398.9 386.3 12.6	"				12.6
									--

Project No. 859 490

Collection Date 7/27 - 8/5

Analysis Date August 16, 1991

SO_2 *

Total mg SO_2

SAMPLES U/C - R.M. Marietta, OHIO

Low $Ba(ClO_4)_2$ ⇒ 0.00492 M

NO.	CR	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ. Net			Total mg SO_2
		M1E-1			1.5 / 100	0.3 /	0.25		1.234	0.31
		-2			x	2.05 /	2.00			2.5
		-3				0.05 /	0.00			0
		-4				0.20 /	0.15			0.19
		-5				0.20 /	0.15			0.19
		-6		NOT TAKEN (METAL)						
		-7		NOT TAKEN (METAL)						
		-8		0.275	<	0.30 / 0.25	0.23			0.28
		-9				0.1 /	0.05			0.06
		-10				0.2 /	0.15			0.19
		-11		LOST		/				
		-12		NOT TAKEN (METAL)						
						/				
		BLANK				/				
						/				

Project No. 859 490

Collection Date 7/27 - 8/5

Analysis Date 8/26/71

* Using Barium Perchlorate - thorin indicator method only

SO_2 *

Total SO_2

SAMPLES U/C - R.M. Marietta, OHIO

CR NO.	LOCATION and SAMPLE NO.		SAMPLE WEIGHT	TIT. ALIQ.	Reading / Blank	MG in ALIQ.			
	ETE-1		NOT TAKEN (METAL)						
	-2		NOT TAKEN (METAL)						
	-3				0.1	0.05			0.06
	WTE-1				0.2	0.15			0.19
	-2				0.1	0.05			0.06
	-3		NOT TAKEN (METAL)						

Project No. 859 490

Collection Date 7/27 - 8/5

Analysis Date 8/26/71

* Using Barium Perchlorate - Thorin indicator method only.

APPENDIX G

TEST LOG

APPENDIX G - TEST LOG

Date(1971)	Location	Sample No.	Particulate	Orsat	SO2	Metal	Particle Size
7/27	Exhaust	M1E-1	x	x	x		
	Inlet	M1D-1	*	-	-	-	
7/29	Exhaust	M1E-2	x	x	x	-	
	Inlet	M1D-2	*	-	-	-	
7/30 ***	Exhaust	M1E-3	x	x	x		
	Inlet	M1D-3	*	-	-	-	
7/31	Exhaust	M1E-4,5	xx	xx	xx		xx
	Inlet	M1D-4,5	xx	--	--	--	
8/1	Exhaust	M1E-6,7	**x	**x		xx	x
	Inlet	M1D-6,7	xx	--	--	--	x
8/2	Exhaust	M1E-8,9	xx	xx	xx		x
	Inlet	M1D-8,9	xx	--	--	--	xxx
8/3	Exhaust	M1E-10,11	xx	xx	x Lost		xx
	Inlet	M1D-10,11	xx	--	--	--	xxxxx
8/4	Exhaust	M1E-12	x	x		x	xxxx
	Inlet	M1D-12	x	-	-	-	
8/5	East Tapping Exh.	ETE-1,2,3	xxx	---	--x	xx-	xx on 8/4
	West Tapping Exh.	WTE-1,2,3	xxx	xxx	xx-	--x	xx on 8/4

Note: All tests except particle sizing follow the order of each sample number, as shown. On 7/28 plant was down.

* : Filter and pulley problems.

** : Meter box failure. Sampling interrupted shortly after started.

*** : Plant operation at one-half load. Exhaust tests conducted anyway.

APPENDIX H

RELATED REPORTS

Related reports covering emissions from reactive metals furnaces, under this same contract for the Environmental Protection Agency, are as follows:

Test Number	Survey Location	Emission Control Device	Status
FA-1	Foote Mineral Co., Steubenville, Ohio	None	Issued Aug.,1971
FA-2	Union Carbide Corp., Marietta, Ohio	Venturi Scrubber	This Report
FA-3	Airco Alloys and Carbide, Niagara Falls, N.Y.	Baghouse	Issued Oct.,1971
FA-4	Airco, Charleston, S.C.	Electrostatic Precipitator	In Progress
FA-5			Future
-			Future

APPENDIX I

PROJECT PARTICIPANTS AND TITLES

PROJECT PARTICIPANTS AND TITLES

R. N. Allen, P.E., Project Leader

N. A. Blessing, Chemist

C. C. Gonzalez, Chemist

W. E. Schroeder, Chemist

J. R. Avery, Technician

L. W. Baxley, Technician

W. C. Hall, Technician

G. Hogan, M.S., (Particle Size Determination)

G. Patchell, Senior Technician,
(Particle Size Determination)

T. J. Wright, PhD., (Particle Size Determination)

APPENDIX J

PARTICLE SIZING SAMPLES

PARTICLE SIZE DISTRIBUTION OF METAL FUME

INTRODUCTION

Determinations of particle size distribution of fume emissions at the Ferroalloy Division Plant of Union Carbide, in Marietta, Ohio, were conducted from July 27 through August 4, 1971. Emissions from the No. 1 furnace were evaluated at the following points: in the furnace hood exhaust duct prior to emission control, in the exhaust stack after emission control, and in the two stacks from the tap exhaust hood.

METHODS

A Brink cascade impactor was employed to obtain data on size distribution in this study. Two samples were collected using the Andersen Stack Sampler but 90 percent of the particles gathered on the filter and not enough data points were available to provide the desired information. As a result the Andersen Stack Sampler was discarded in favor of the Brink cascade impactor.

The Brink impactor, followed by a 47 millimeter glass fiber filter, was mounted on a probe and connected to a vacuum pump by a length of rubber tubing. The inlet side of the pump was fitted with a vacuum gauge, calibrated in inches of mercury, and a flow controlling valve. The outlet side of the pump was connected to a dry gas meter whenever samples were collected for periods longer than two minutes.

Prior to collecting samples in the field, the impactor was calibrated to determine air flow rates at various operating conditions. Rates were determined by assembling the particle sizing train as shown in Figure 1. Air was drawn through the impactor for 10 minutes at each pressure drop (ΔP) of five inches of Hg, seven inches of Hg, and 10 inches of Hg. The corresponding volume of air flow for each sample was measured by the dry gas meter. A calibration curve was constructed by plotting the pressure drop across the impactor versus the air flow rate.

Volumetric flow rates for the short duration samples, of one and two minutes, were measured by the ΔP across the impactor. For samples of longer duration than two minutes, volume was measured by a dry gas meter. A ΔP of five inches of Hg was maintained during all sampling. The impactor was grounded, either to the stack or building, to prevent electrostatic deposition of particles.

As high temperatures were encountered, in the furnace hood exhaust duct, the plugged impactor was inserted into the duct for at least five minutes, to allow time for thermal equilibrium. The impactor was then removed from the duct, the plug removed, and reinserted into the duct for sample collection. Samples were collected from each of the five ports on the upper surface of the duct, at a depth of 24 inches into the duct. Difficulties were experienced in collecting these samples due to the dense concentration of the particles in that duct. Samples were first collected for 10 minutes, but these were not satisfactory because too many particles deposited on the collection plates. Sampling time was then reduced to five minutes with the results being the same.

A dilution air apparatus was placed in series with the Brink impactor to dilute the particles before they entered the first stage. This process also proved unsatisfactory because the extreme temperatures in the duct (up to 1300°F) melted the silver soldered joints of the dilution air apparatus as well as oxidizing the inner surfaces of the unit. Finally, the sampling time was reduced to one and two minutes without dilution, and this procedure was found to be satisfactory.

In order to prevent condensation, with the high moisture content of the furnace exhaust gases, following passage through the venturi scrubber/cyclone control device, it was necessary to preheat the impactor and filter holder to a temperature above the dew point. This was accomplished by wrapping the entire impactor and filter holder assembly with electrical heating tape, insulated with asbestos tape and aluminum foil. The tape was plugged into a 120 volt AC line and allowed to heat the sampling device for at least 15 minutes prior to sampling.

Exhaust emission samples were collected from a 3 inch port approximately 70 feet above ground level, and 36 inches into the stack, for periods of 30 to 55 minutes. At least two samples were taken at pressure drops of 37 inches of water, 47 inches of water, and 57 inches of water across the venturi scrubbers.

Simultaneous samples were collected for 20 minutes, in each of the two tap hood exhaust stacks, during furnace tapping. These samples were collected at ports located on the fourth floor of the furnace building, at a distance of 30 inches into the stacks.

RESULTS

Graphical results are shown in Sub Appendix 1 and the field data sheets are included in Sub Appendix 2. The characteristic diameter of an aerosol particle for each impactor stage (Dpc) has been calculated for a pressure drop across the impactor of five inches of mercury, assuming particles of unit density (1 gram/cubic centimeter), using the equation described by * J. A. Brink, Jr. The characteristic diameters are as follows:

Stage No.	Dpc, microns
1	3.40
2	2.00
3	1.36
4	0.69
5	0.42

Graphical presentation of the data, that is, log-probability plots of cumulative percent less than stated micron size versus the Dpc for each stage in microns, is shown for each sample in the following section. A graphically determined mass median diameter (MMD) and geometric standard deviation (σ_g) for each sample are presented in the following Table A.

* Industrial Engineering and Chemistry, Vol. 50, April 1958, pp 645-648.

TABLE A

Date	Sample Number	Location of Sample	Port Number	Duration of Sampling (Min.)	ΔP Across Venturi Scrubber ($in.H_2O$)	MMD microns	σ_g microns	Remarks
7/31/71	A	Exhaust Stack		10	57	0.325	3.85	
7/31/71	C	"		30	"	0.21	2.19	Furnace tapped during sample collection
8/1/71	E	"		34	"	<< 0.42*	*	
8/3/71	N	"		45	"	<< 0.42*	*	
8/3/71	P	"		50	"	0.68	1.80	
8/2/71	H	"		30	47	0.34	3.59	Furnace tapped during sample collection
8/4/71	DD	"		50	"	0.31	3.06	
8/4/71	U	"		55	37	0.57	2.41	
8/4/71	W	"		45	"	0.44	2.78	
8/4/71	AA	"		55	"	0.60	2.27	
8/2/71	I	Inlet Duct	1	1	47	0.82	2.23	
8/2/71	J	"	1	1	"	0.56	2.63	
8/2/71	L	"	2	1	"	5.4	4.50	
8/1/71	D	"	3	2	?	<< 3.4*	*	
8/3/71	U	"	3	2	?	0.9	2.14	
8/3/71	O	"	4	2	37	0.79	3.80	
8/3/71	R	"	5	2	57	2.35	1.45	
8/3/71	S	"	5	2	"	0.60	1.25	
8/4/71	X	Tapping Ducts	East	20	57	1.75	3.60	
8/4/71	EE	"	"	20	"	0.86	3.90	
8/4/71	Y	"	West	20	"	2.50	4.28	
8/4/71	ZZ	"	"	20	"	0.83	3.86	

* Data points are at the extremities of the graphs, either less than 15%, or greater than 85% of stated size. Reliable particle sizes could therefore not be determined from this data.

SUB-APPENDIX J-1

GRAPHICAL PRESENTATION OF RESULTS

PARTICLE SIZE SAMPLES

EXHAUST STACK

$\Delta P = 57" H_2O$	Sample Number	Date	Time Sampled	Time
	A	7/31	1340-1350	10 min.
	C	7/31	1720-1750	30 min.
	E	8/1	0803-0837	34 min.
	N	8/3	0755-0840	45 min.
	P	8/3	1709-1759	50 min.
$\Delta P = 47" H_2O$	H	8/2	2025-2055	30 min.
	DD	8/4	1857-1947	50 min.
$\Delta P - 37" H_2O$	U	8/4	0740-0835	55 min.
	W	8/4	0847-0932	45 min.
	AA	8/4	1621-1706	45 min.

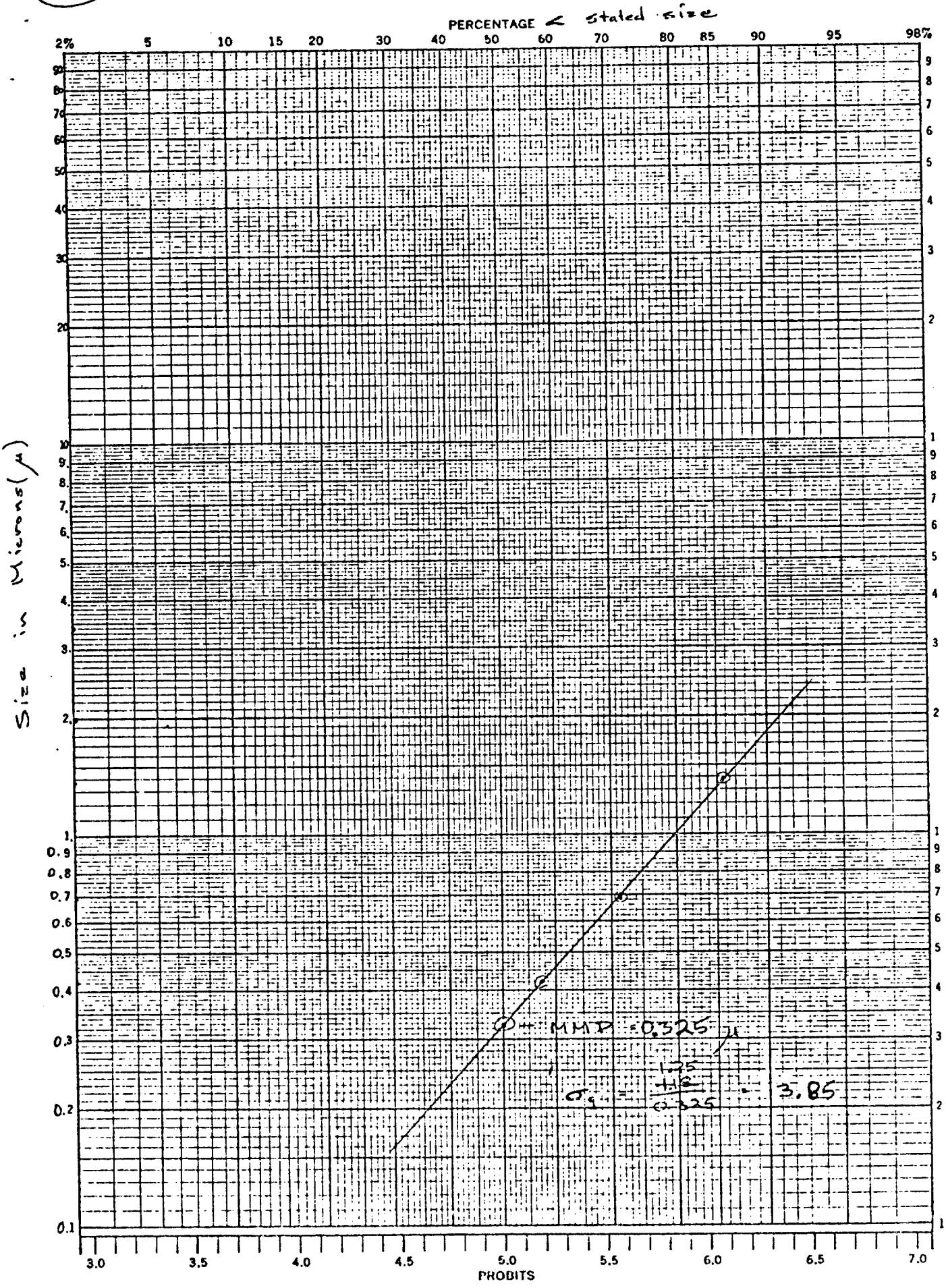
INLET DUCT

Port #1	Sample Number	Date	Time Sampled	Time
	I	8/2	1105-1106	1 min.
	J	8/2	1108-1109	1 min.
Port #2	L	8/2	1852-1853	1 min.
Port #3	D	8/1	1720-1722	2 min.
	T	8/3	1945-1947	2 min.
	U	8/3	1950-1952	2 min.
Port #4	O	8/3	1410-1412	2 min.
Port #5	R	8/3	1738-1740	2 min.
	S	8/3	1742-1744	2 min.

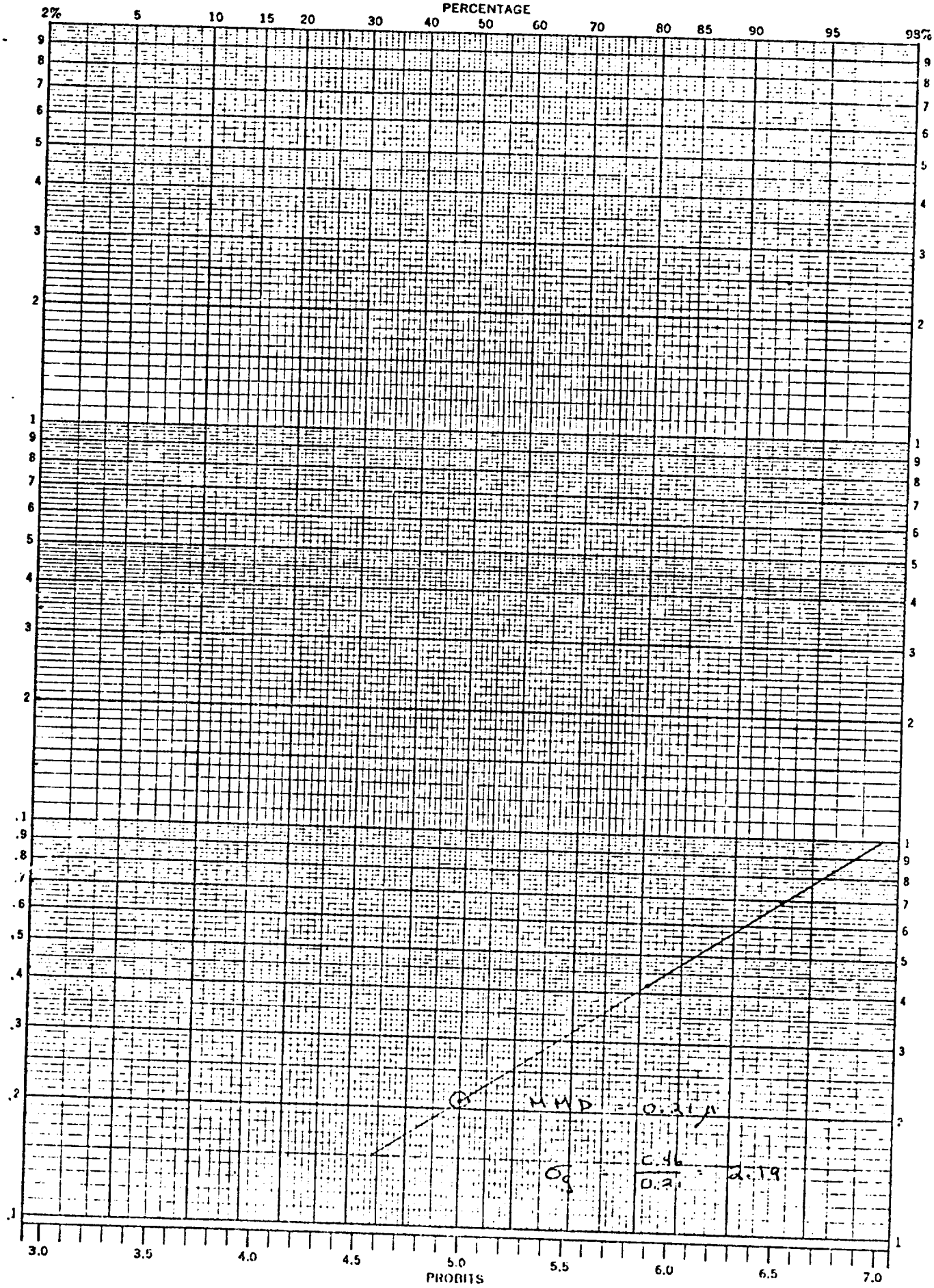
TAPPING EXHAUSTS

East	Sample Number	Date	Time Sampled	Time
	X	8/4	1642-1702	20 min.
	EE	8/4	2010-2030	20 min.
West	Y	8/4	1641-1701	20 min.
	Z	8/4	2010-2030	20 min.

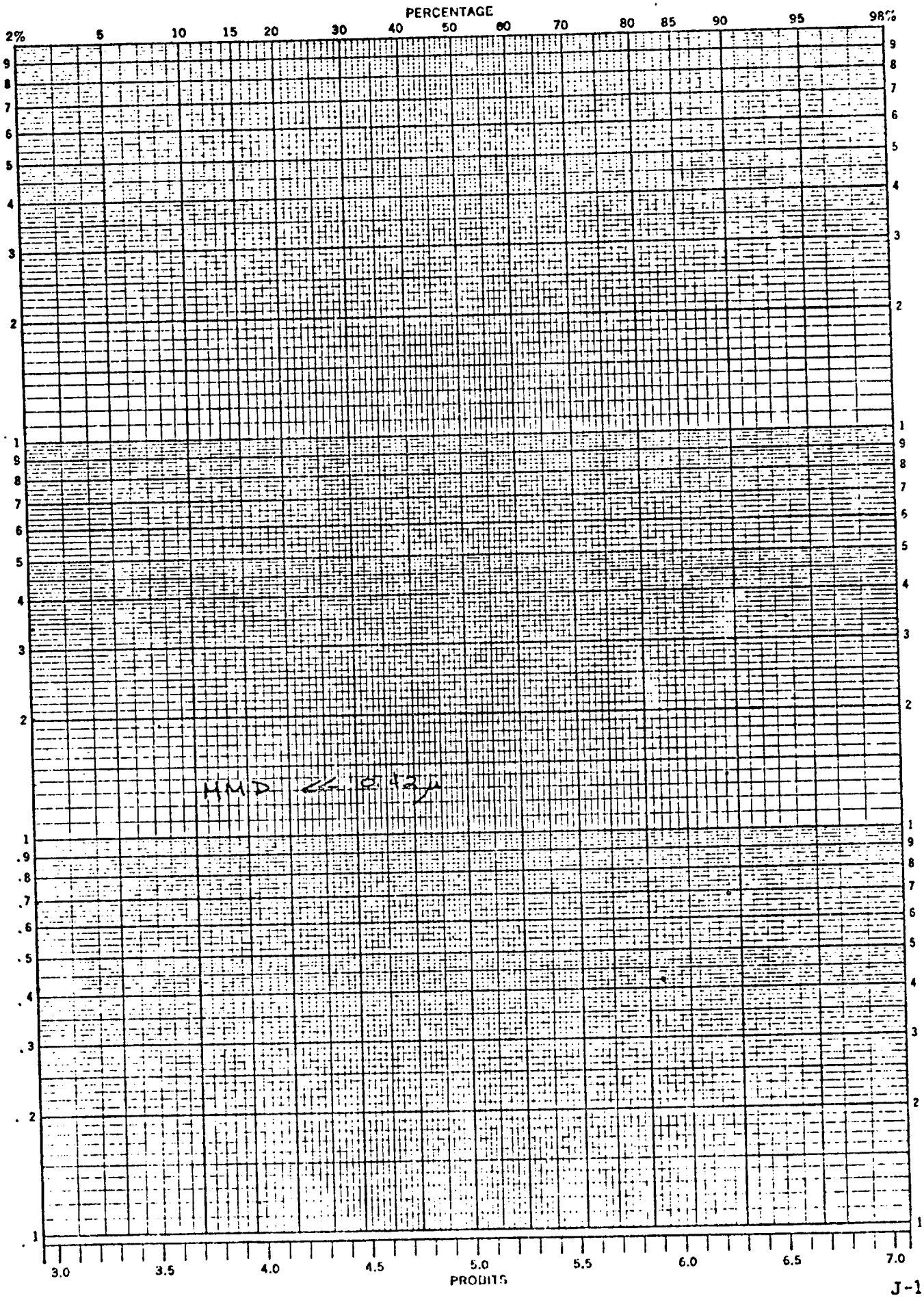
(A)


PERCENTAGE < stated size
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
Size in Microns (μ)
PROBITS
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
MMD = 0.325 μ
$\sigma_g = \frac{1.75}{0.325} = 3.85$

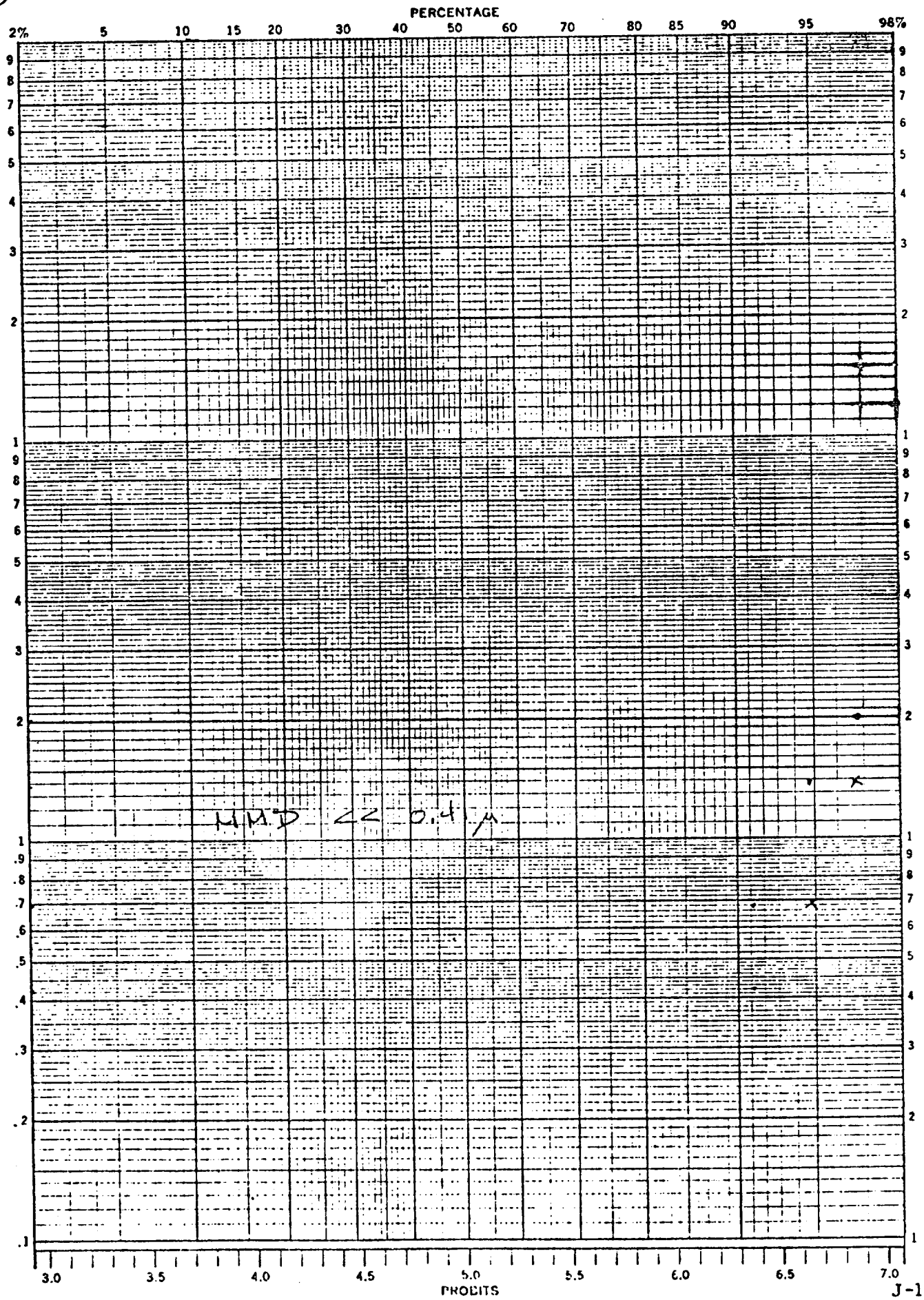
(C)


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD = 0.21 μ
σg = 2.19

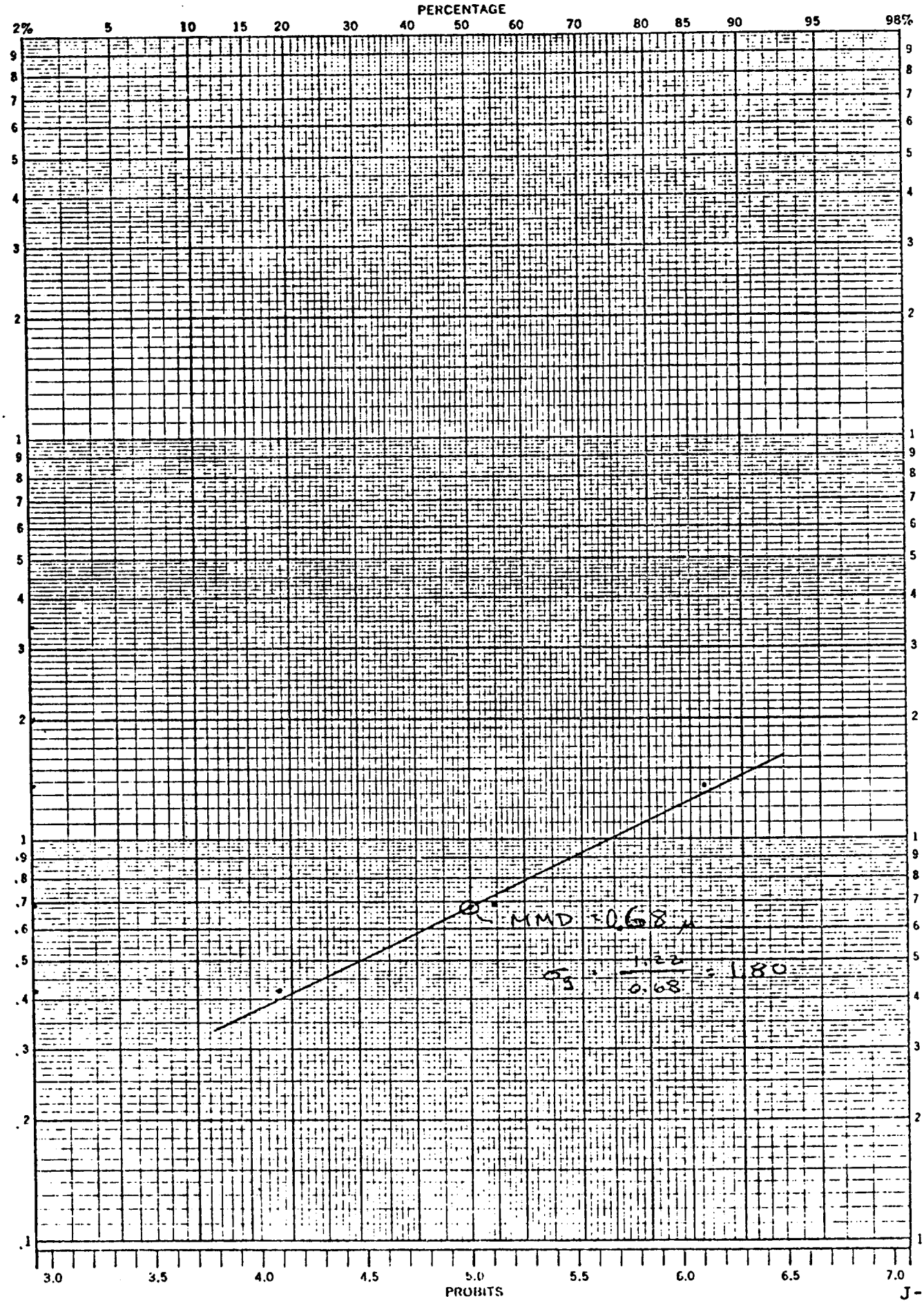
(E)


PERCENTAGE
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
PROBITS
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
MMD < 0.42μ

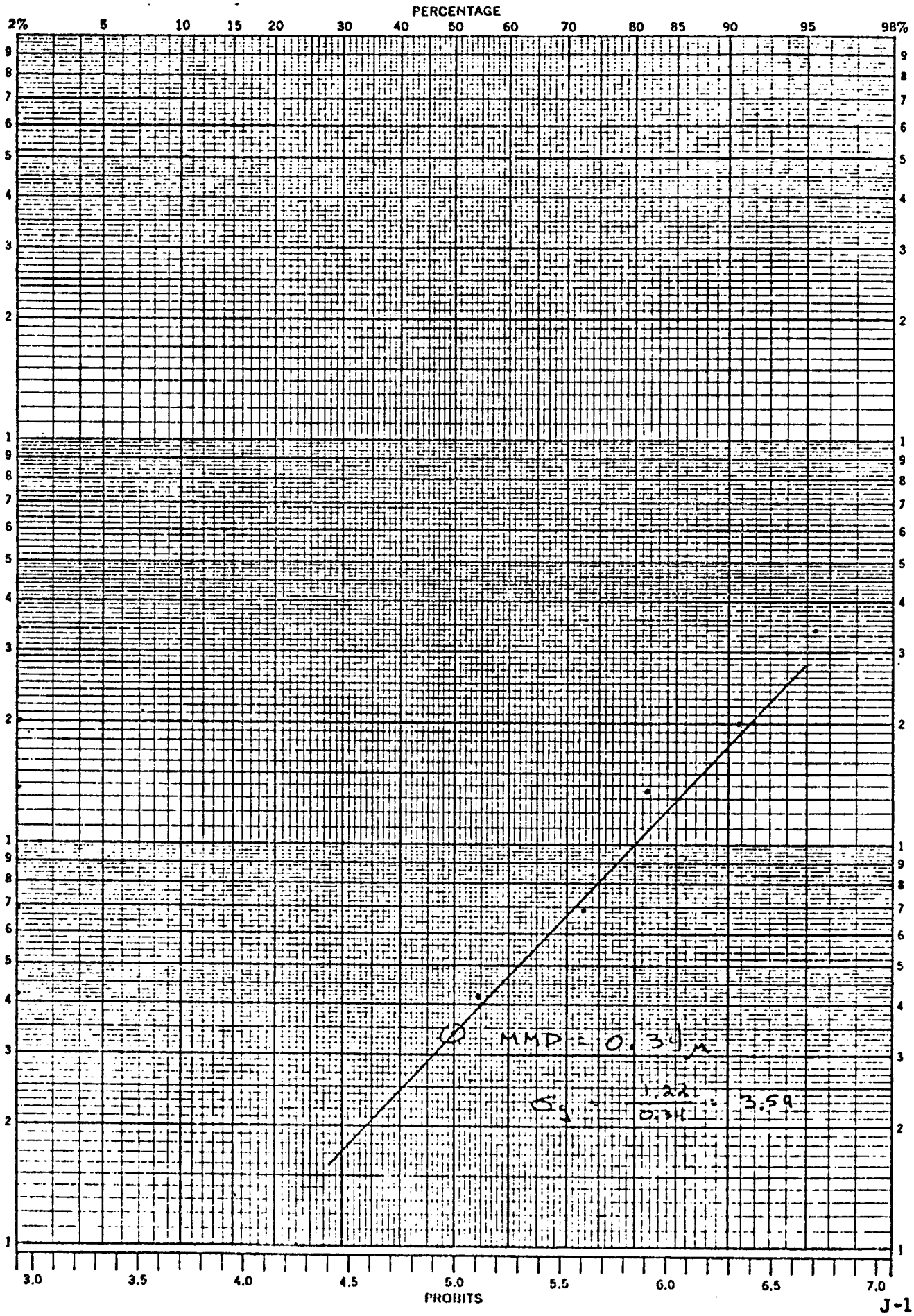
(2)


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
MMD << 0.4 μ
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
PROBITS

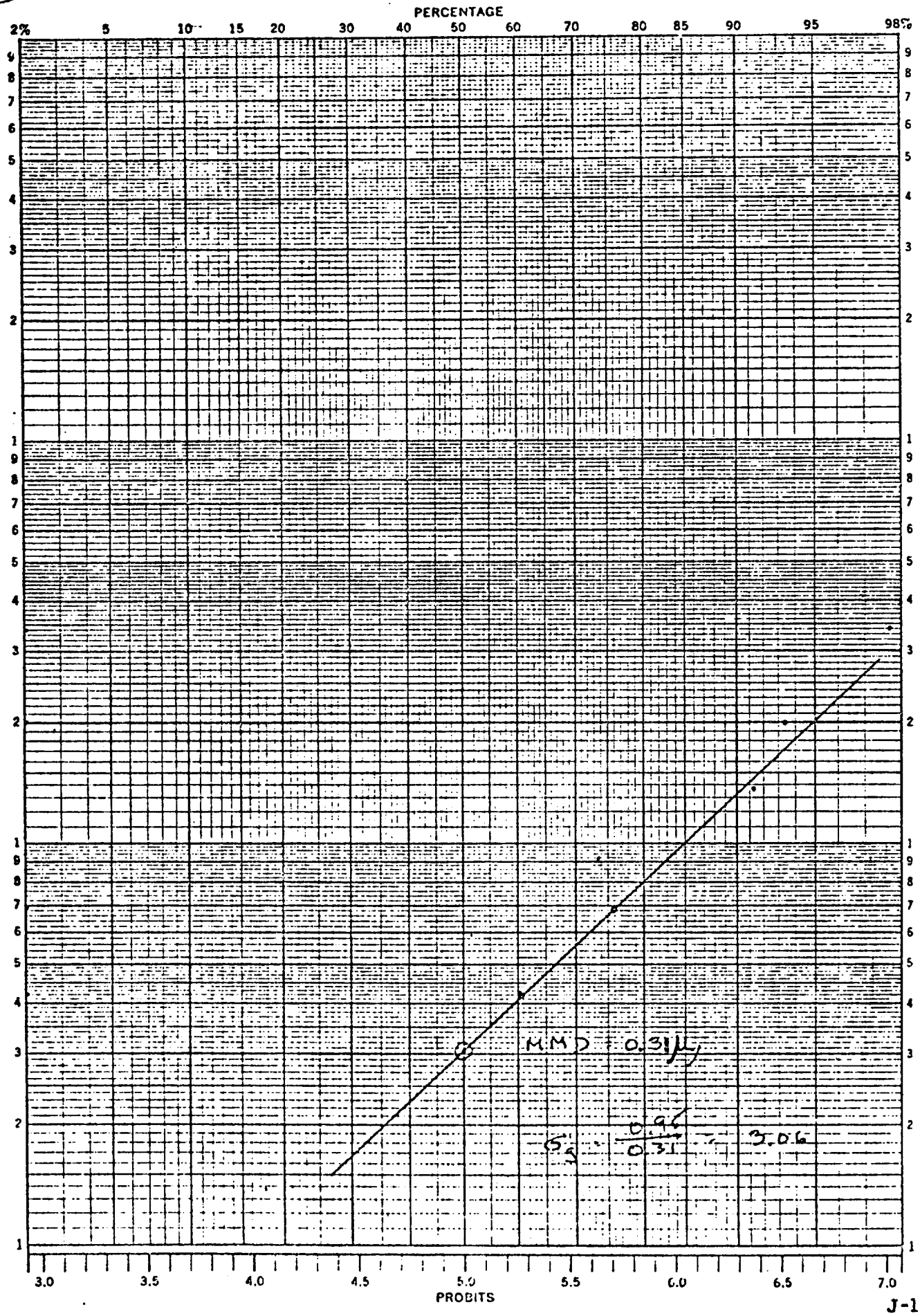
(P)


PERCENTAGE
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
PROBITS
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
MMD = 0.68 μ
σg = 1.22 / 0.68 = 1.80

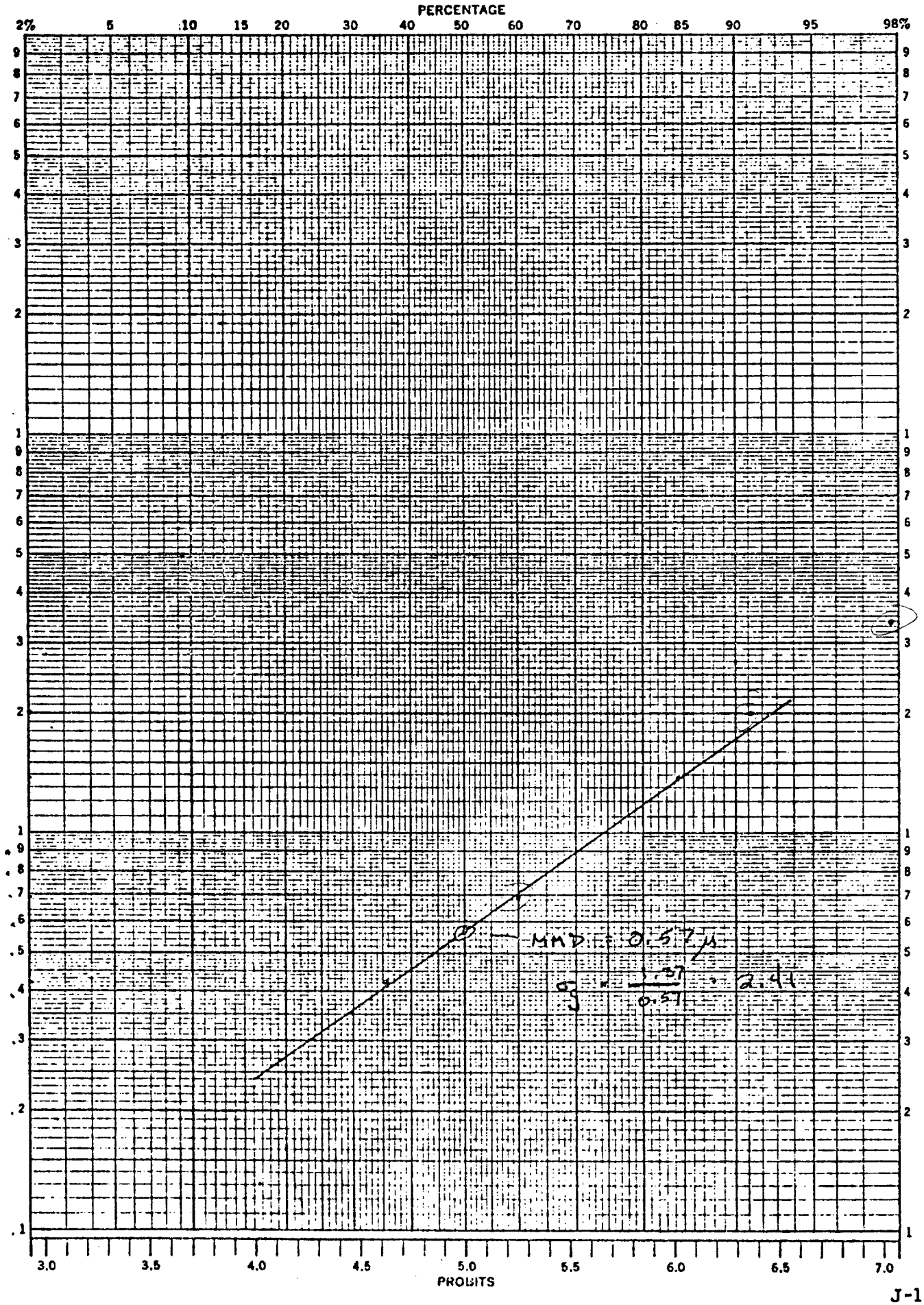
(H)


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
PROBITS
MMD = 0.34 μ
$\sigma_g = \frac{1.22}{0.34} = 3.59$

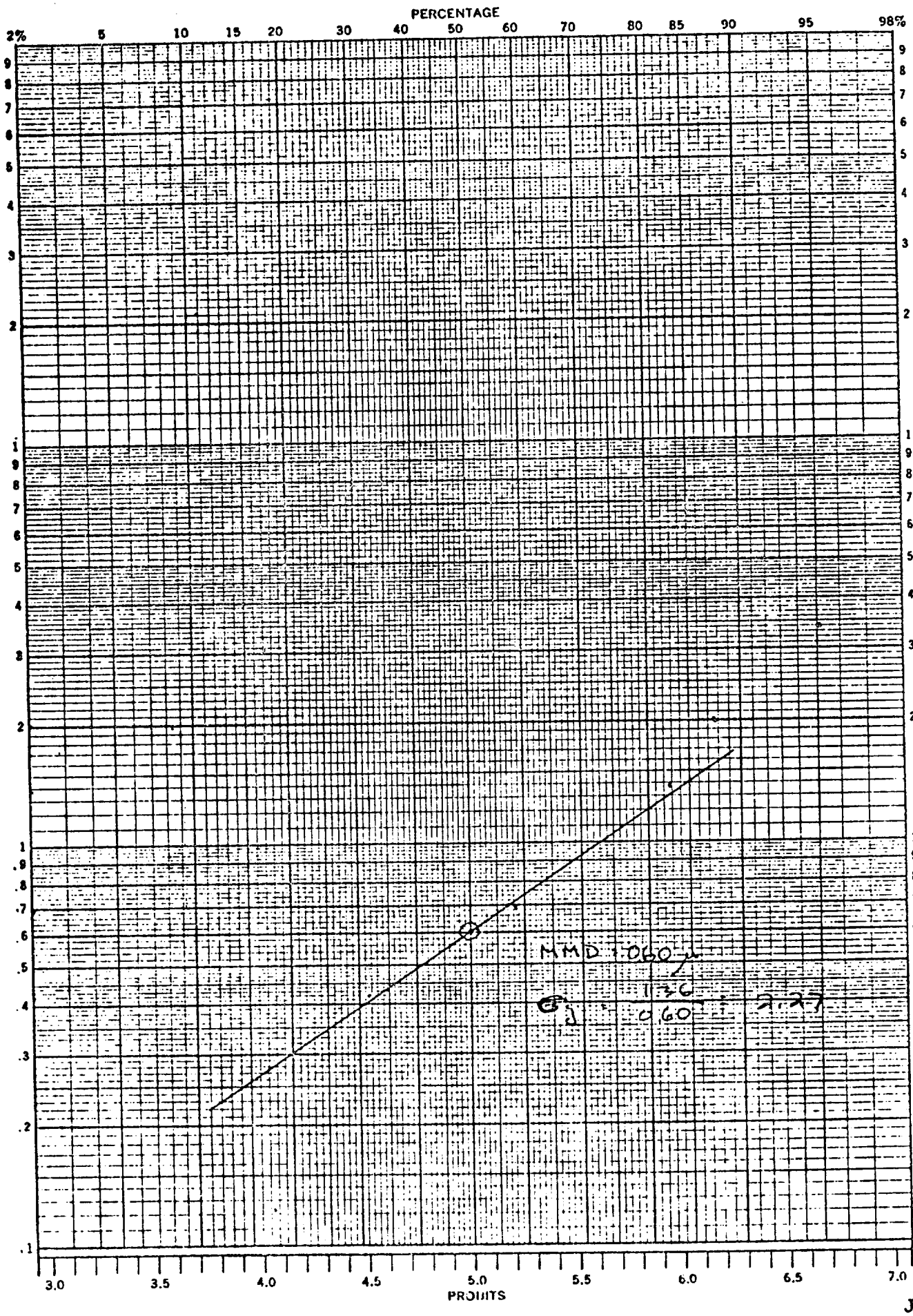
DD


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD = 0.31μ
$\sigma_g = \frac{0.96}{0.31} = 3.06$

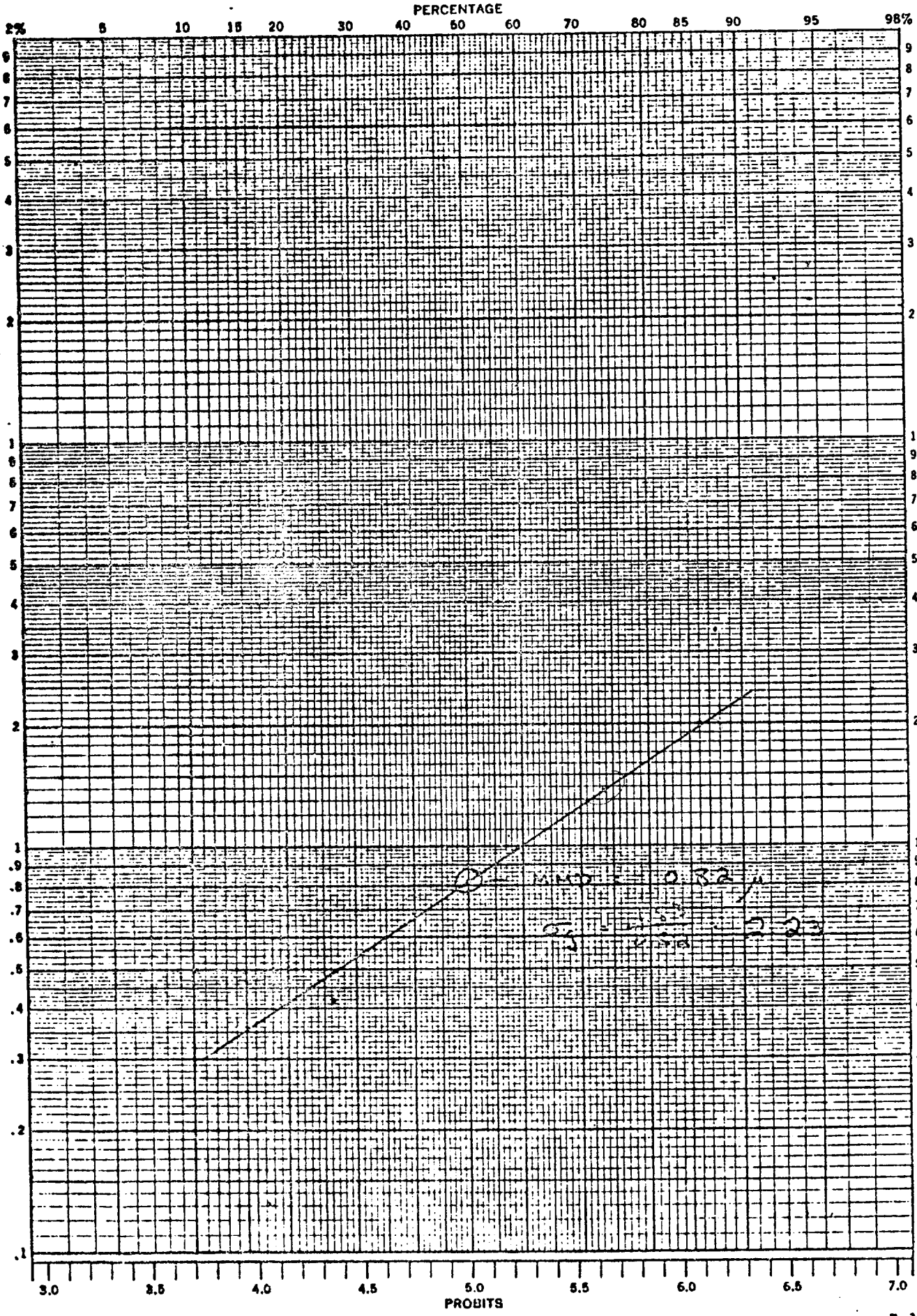
(U)


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD = 0.57 μ
σg = 1.37 / 0.57 = 2.41

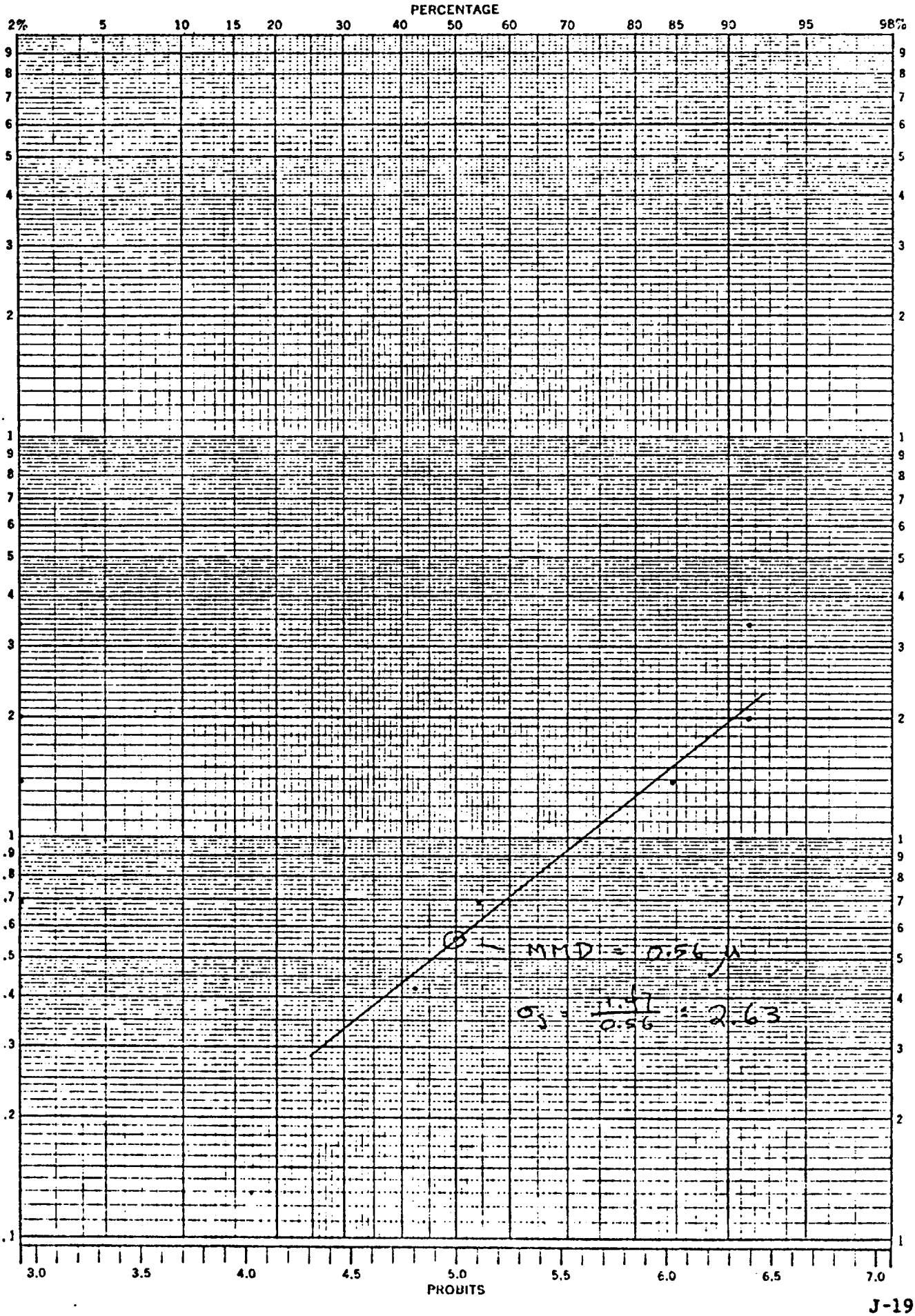
AA


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD = 0.60 μ
σg = 2.27

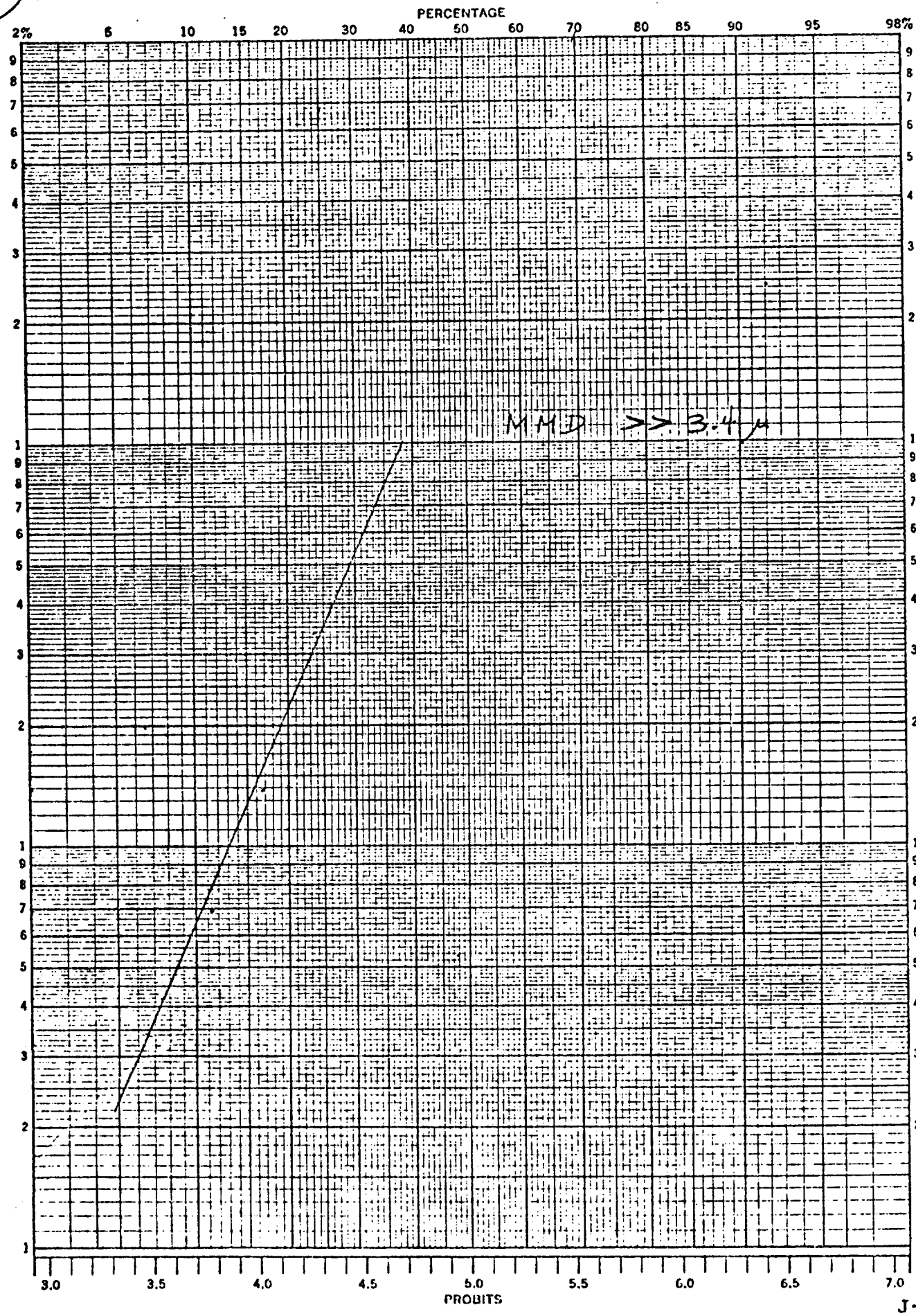
(I)


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0

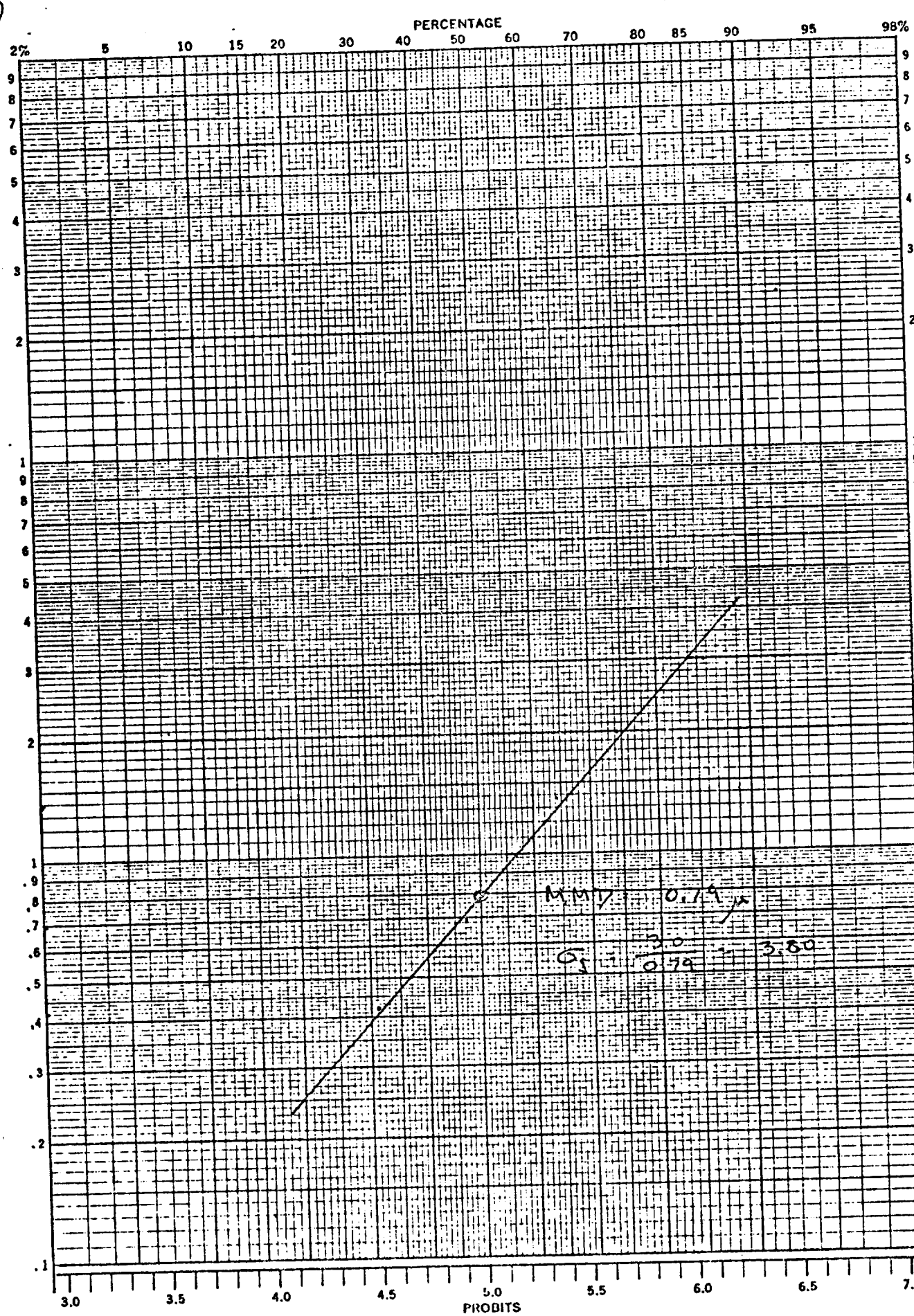
J


PERCENTAGE
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
PROBITS
3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0
MMD = 0.56 μ
$\sigma_g = \frac{1.47}{0.56} = 2.63$

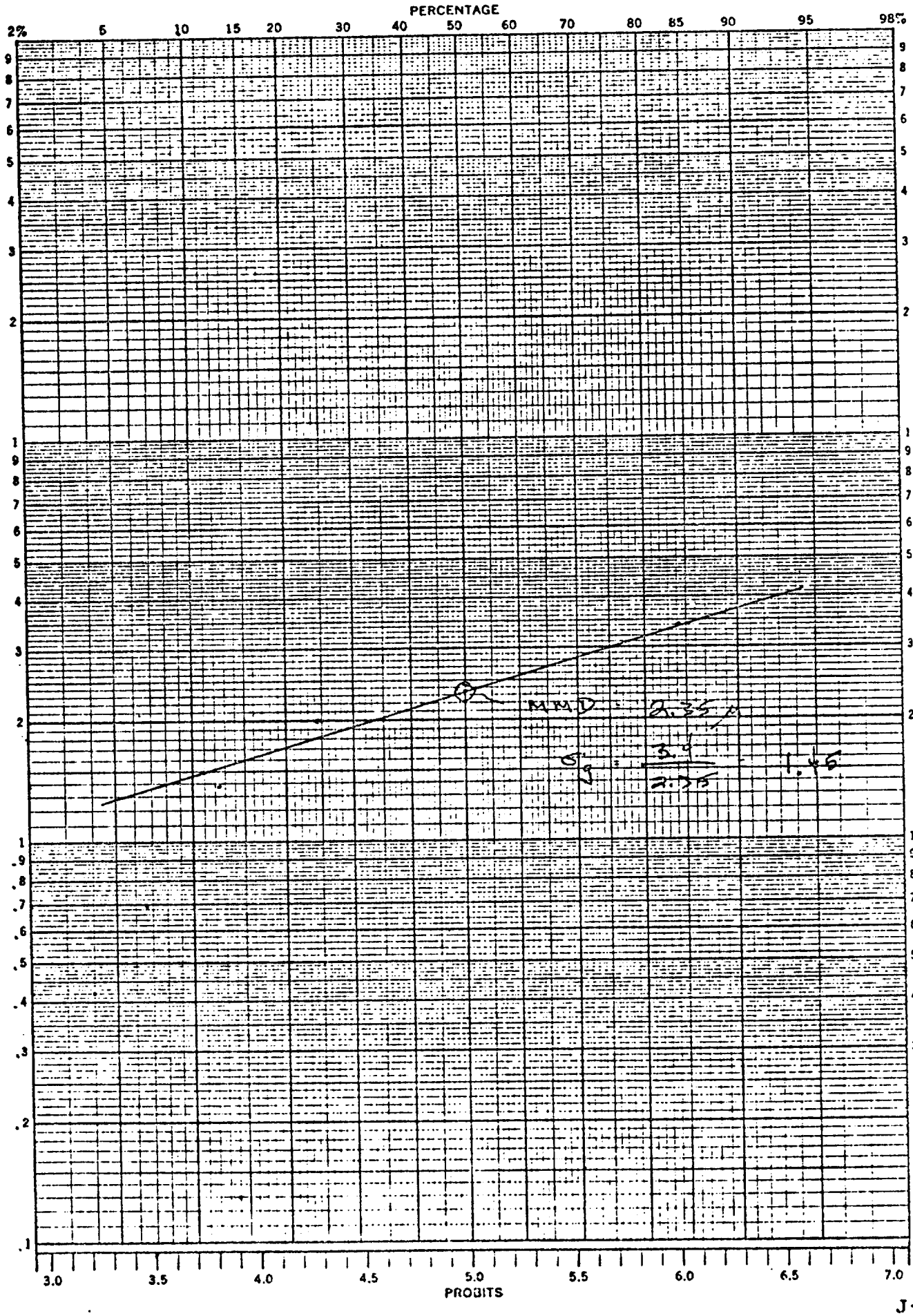
D



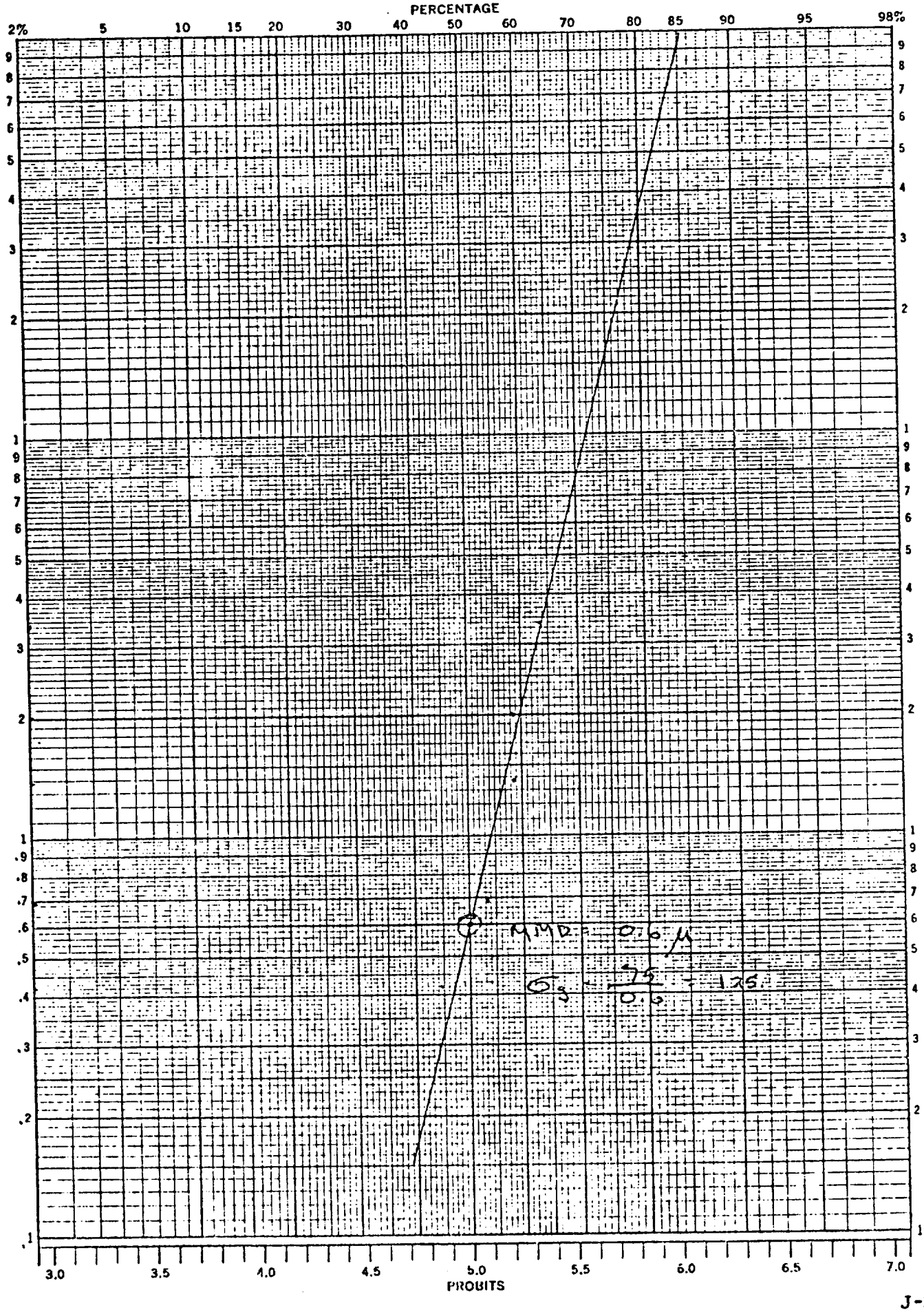
KEUFFEL & ESSER CO.


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD 0.19 μ
σg = 3.0
0.79 = 3.80

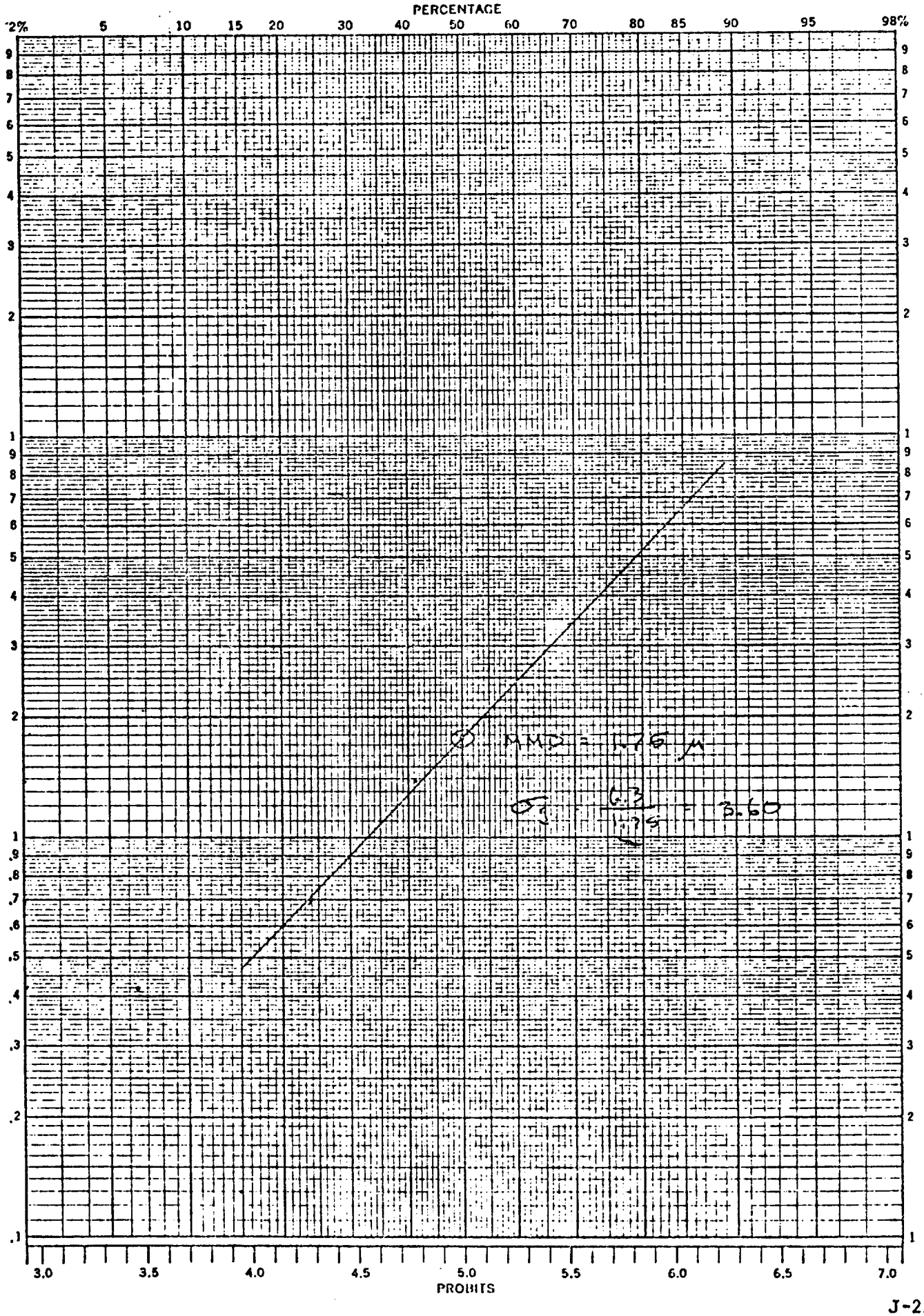
(R)



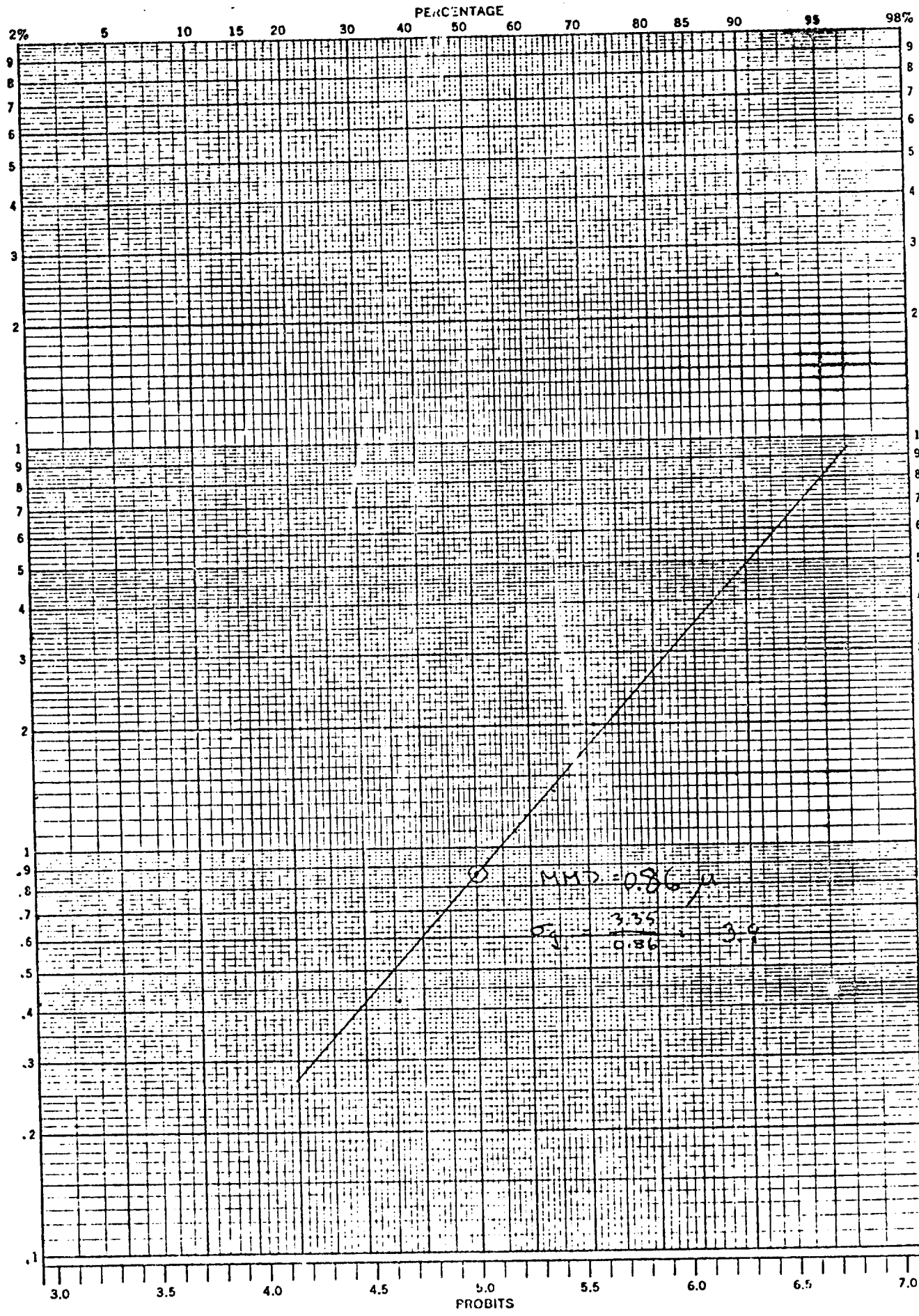
(5)


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD = 0.6 μ
σg = 75/0.6 = 125

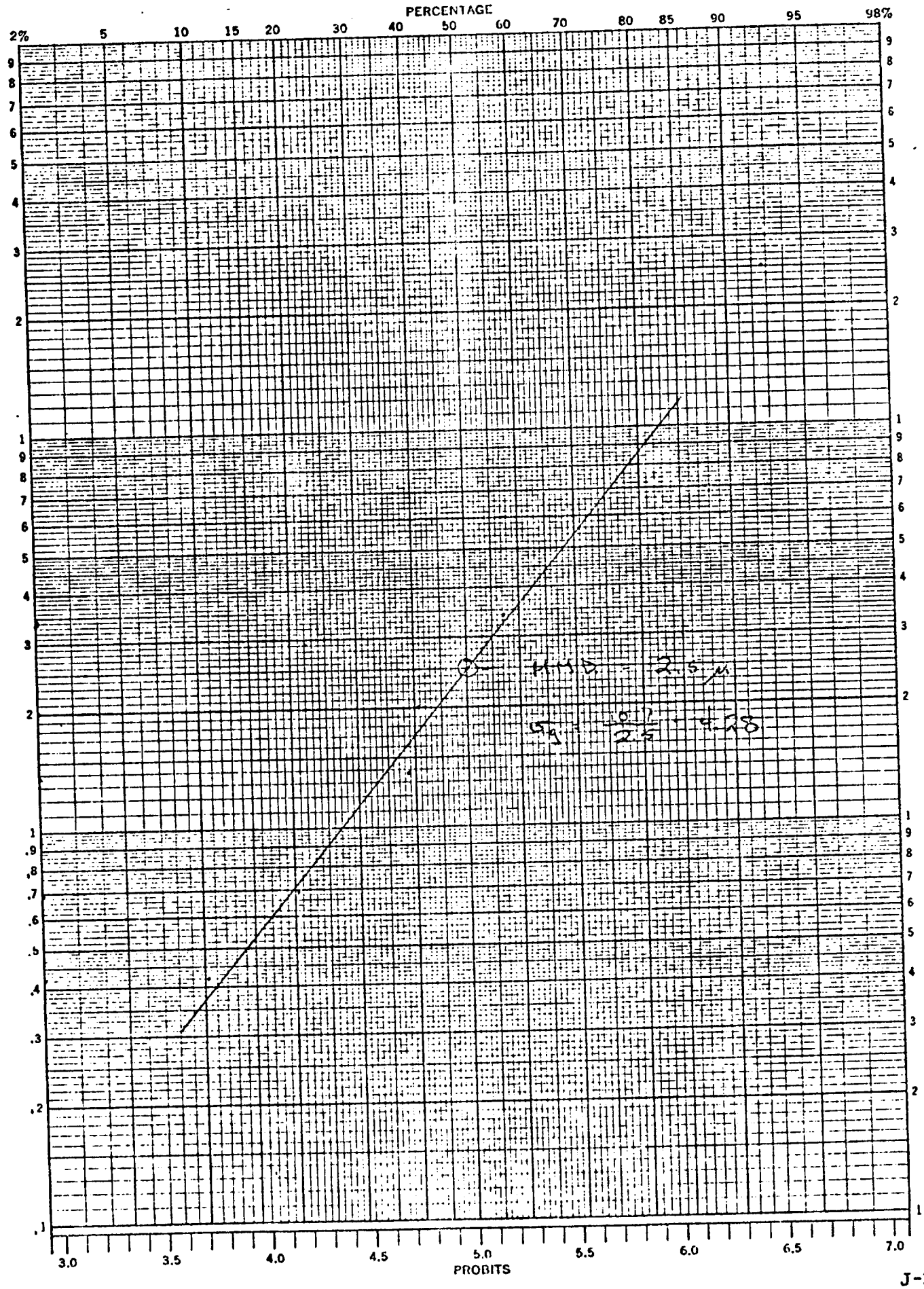
(X)

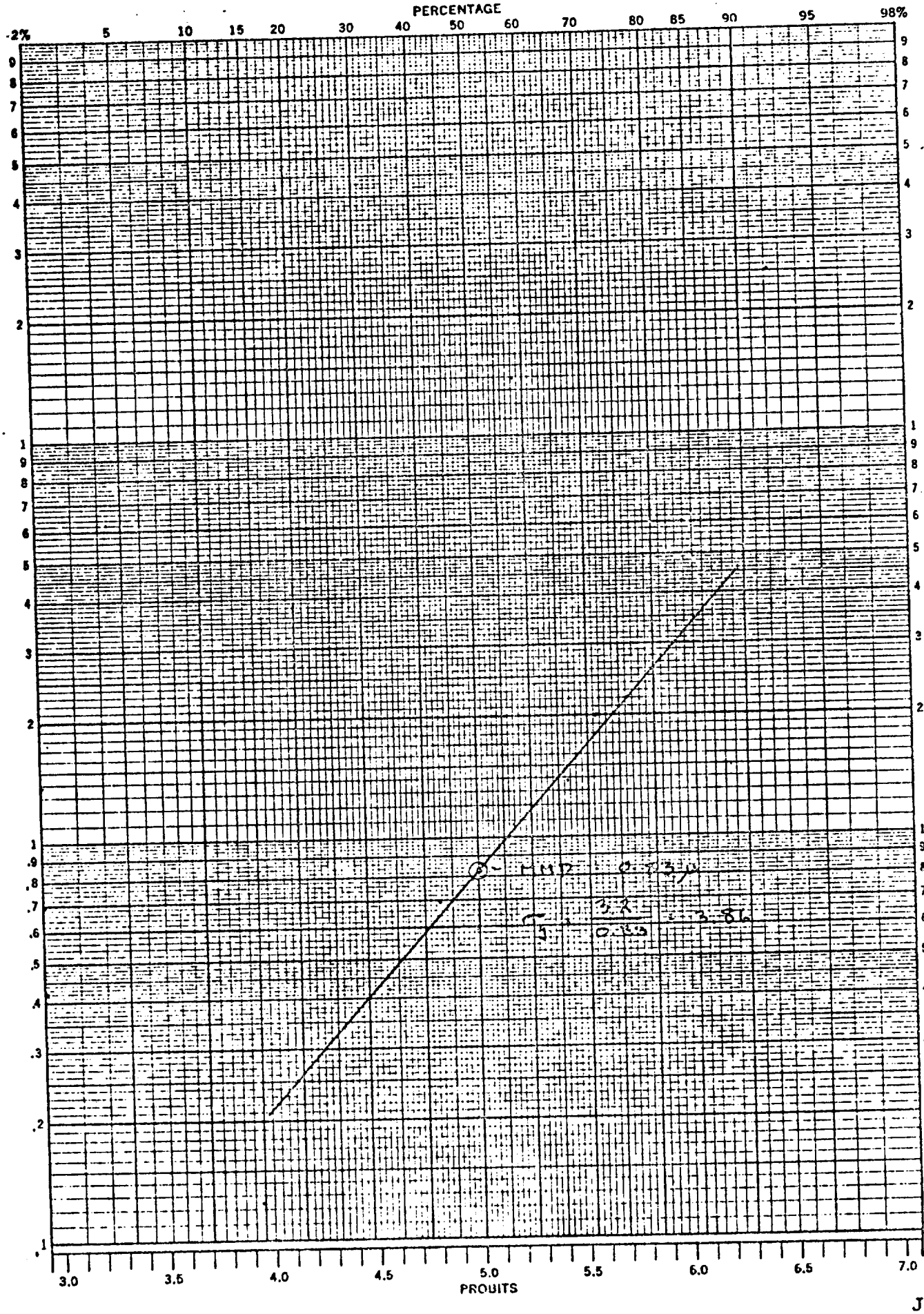

PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
CMD = 1.76 μ
σg = 1.76 = 3.60

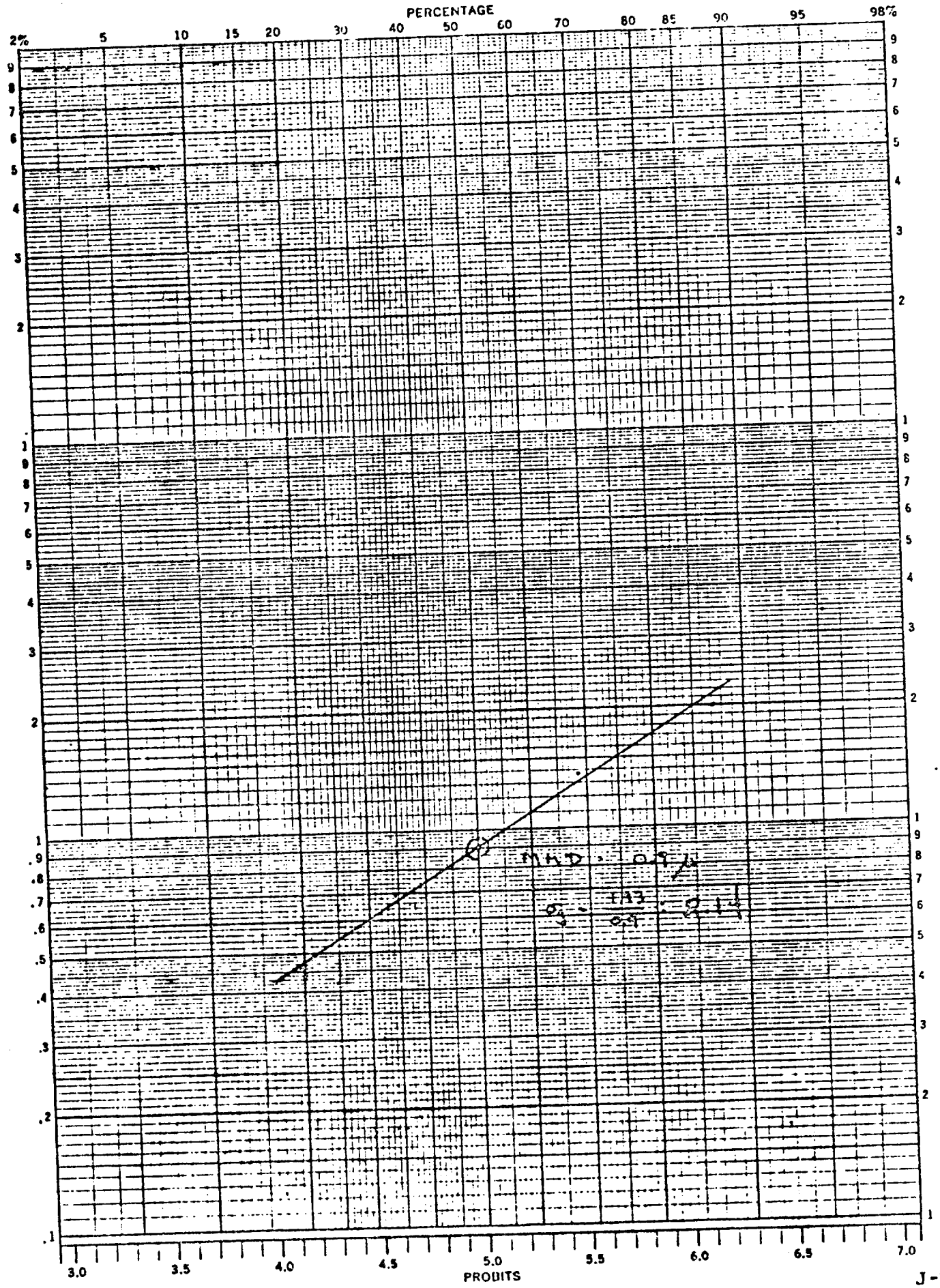
EE


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD = 0.86 μ
σg = 3.35 / 0.86 = 3.9

(7)


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
MMD = 2.5 μ
σg = 0.1 / 2.5 = 4.28


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
PROBITS


PERCENTAGE
2%
5
10
15
20
30
40
50
60
70
80
85
90
95
98%
PROBITS
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0

SUB-APPENDIX J-2

FIELD DATA

(A)

Stack No. Stack ou outlet @ 57" ΔP

Date 7/31

Sample No. _____

Start @ 1:40 pm ≈ 15 min preheat

10 min { Sampled "Normal" operating conditions
Finish @ 1:50

sample taken @ 5" Hg

STAGE	POST. WT.	PRE. WT.	WT. GAIN mg	%	CUM. % LESS THEN Dpc
0					
1	3.7291	3.7291	—	—	
2	3.6199	3.6199	—	—	
3	3.5837	3.5835	0.2	14.3	85.8
4	3.5998	3.5996	0.2	14.3	71.5
5	3.6196	3.6194	0.2	14.3	57.2
6	~~0.1005~~				
7					
8					
Filter	0.1005	0.0997	0.8	57.2	
			1.4		

(C)

Tap between S15 & S16

Stack No. Stack or outlet @ 57" ΔP

Sample No. _____

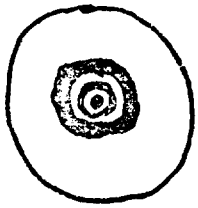
30 min sample
5:20 P.M. → 5:50 P.M.
5" H_g

Date 7/31 ~~7/28~~

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6382	3.6383	~~any~~ small particulate material <0.1mg		
2	3.6087	3.6087	—		
3	3.6403	3.6403	—		
4	3.5655	3.5653	0.2mg	6.3	93.5
5	3.4734	3.4730	0.4mg	12.5	81.0
6					
7					
8					
Filter 1 2 3		0.1156	2.6mg / 3.2	81.0	

1.5749 filter & filter backing
1.4567 backing
.1182
1156
2.6

.0202 gram/cf = 3.2mg / 2.450 cf (64.8 mg/cf gain)



at 7:30 min into run started Dry Test Meter

Start 284.908

after 23.5 min	286.185	.165
25.5	286.350	.167
27.5	286.517	.184
29.5	286.691	
30.0 min	286.744	

256.744
284.908
1.836 cf in 22.5 min

.17/2 min
0.081/min

(7.5)(0.085/min) = .637 cf/7.5 min

$\frac{30}{22.5}(1.836) = 2.425$ cf ≈ 2473

(E)

Stack No. Stack or Duct @ 57" H_2O ΔP Date 8/1

Sample No. _____ Full power ~~Start~~ 803

~~Start~~ at 5" ΔP (leak?) @ filter "no test" "∴ no operation" Sim. 0.27

STAGE	POST. WT.	PRE. WT.	WT. GAIN Mg	%	CUM. % LESS THEN Dpc
0					
1	3.5935	3.5932	0.3 ?	7.2	93.6
2	3.6238	3.6237	0.1	2.3	91.3
3	3.6259	3.6259	—		89.0
4	3.5253	3.5252	0.1	2.3	89.0
5	3.5323	3.5320	0.3	7.2	81.8
6					
7					
8					
Filter	.1047	0.1011	3.6	81.8	
			4.4		

1.6282 filter + backing to filter
1.5235
.1047
.1011
3.6 Mg

back of filter is broken, probably happened when adjusting the flow rate (broke vacuum between pump and probe) prior to sampling; at 31 min into run cut back to 15 MW, ran for 4 min at 15 MW (the ΔP on furnace drops down to 40 in H_2O); response of furnace to new conditions is within a few minutes

288.592
286.747
1.845 cf / 36 min

$\frac{4.0 \text{ Mg}}{(1.845 \text{ cf})(64.8 \text{ Mg/grain})} = \boxed{0.0335 \text{ grain/cf}}$

avg rate = 1.845 / 36 = .051 c.f.m.

N - 137

N

normal

Stack No. 1-Outlet - Δp = 57 in hg

Date 3 Aug 71

Sample No. _____

755 AM

15 min warmup

840

45 min

Union Carbide - Marietta, Ohio

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6033	~~3.6035~~ 3.6032	0.1	1.8	98.4
2	3.5786	~~3.5787~~ 3.5785	0.1	1.8	96.6
3	3.5814	~~3.5814~~ 3.5813	0.1	1.8	94.8
4	3.6842	~~3.6843~~ 3.6842	—	—	91.3
5	3.6022	~~3.6023~~ 3.6020	0.2	3.5	91.3
6					
7					
8					
Filter	.1072	0.1020	~~5.2~~ 5.7	91.3	

2.4328
o-ring ~~2.4381~~
.0017

1.5566
backup 1.4511
1055

.0017
.1055
.1072

Elapsed Time (min)	dry gas meter (CF)	vac press (in. hg)	time
~~45~~ 40	497.780	5.0	8:40 - FINISH
35	497.297	5.0	
30	496.825	5.0	
25	496.350	5.0	
20	495.884	5.0	8:12 - Zapped furnace
15	495.412	5.0	
10	494.924	5.0	
5	494.420	5.5	
0	493.920	5.0	7:55 AM - START

P

137 P

Stack No. Stack exit @ ΔP = 57 "H_2O Date 8/3

Sample No. _____

normal operation (no tap)

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6266	3.6256	—		
2	3.6069	3.6069	—		
3	3.5840	3.5837	0.3	13.6	86.4
4	3.5261	3.5254	0.7	31.8	54.6
5	3.6205	3.6197	0.8	36.4	18.2
6					
7					
Filter	0.1628	0.1624	0.4	18.2	
			2.2		

1.6140
1.4512
.1628

Elapsed Time (min)	Furnace Temp. (°F)		
60			
55			
50	512.128		
45	511.645	5.0	
40	511.196	5.0	
35	510.750	5.0	
30	510.305	5.0	
25	[illegible]	5.0	
20	509.411	5.0	→ 5:20 TO 5:23 FURNACE TAKES
15	508.966	[illegible]	
10	508.510	[illegible]	
5	508.033	6.0	
0	507.530	5.0	START → 5:04 1-181

5:2[illegible] 1-50 [illegible]

(H) 137
inches tap

Stack No. outlet on stack @ 47 " H_2O ΔP Date 8/2

Sample No. _____

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.1493	3.1492	0.1	4.5	95.4
2	3.3847	3.3846	0.1	4.5	90.9
3	3.2431	3.2429	0.2	9.1	81.8
4	3.2472	3.2470	0.2	9.1	72.7
5	3.2880	3.2876	0.4	18.2	54.5
6					
7					
8					
Filter	.1027	0.1015	1.2 Σ= 2.2	54.5	

2.5335
2.4308
.1027

Also used no inst nipple.
sealing filter holder with ⊗ "O" ring to prevent loosening.
→ no moisture at end of test

test data

Elapsed time (min)	dry gas meter read. (CF)	vac press (in hg)	actual time
30	493.406	5.0	finish → 8:55 AM
25	492.958	5.0	
20	492.541	5.0	
15	492.090	5.0	
10	491.656	5.0	
5	491.220	5.0	
0	490.784	5.0	starting time 8.25 PM

DD

Stack No. station at the ΔP = 47" Date 8/4

651 - 747 PM

Sample No. _____

Stage	Post Wt.	Pre Wt.	Wt Gain	%	Cum. % less than Dae
1	3.6097	3.6096	0.1	2.2	97.7
2	3.6647	3.6645	0.2	4.3	93.4
3	3.4516	3.4515	0.1	2.2	91.2
4	3.5661	3.5654	0.7	15.2	76.0
5	3.3582	3.3575	0.7	15.2	60.8
filter	0.1660	0.1632	2.8	60.8	
			4.6		

4.0329
3.8668
.1660

Stage	gram/min. (CF)	
45	777.391	
40	776.878	5
35	776.369	5
30	775.860	5
25	775.346	5
20	774.840	5
15	774.328	5
10	773.818	5
5	773.315	5
0	772.814	5"

STOP - 7 47

start - 6 57 PM

(V)

Stack No. stack @ outlet @ ΔP = 37" Hg Date 8/4

Sample No. _____ normal operation

	STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
Dpc	0					
3.4 μ	1	3.5987	3.5986	0.1	2.2	97.8
2.0	2	3.5522	3.5519	0.3	6.7	91.1
1.38	3	3.6382	3.6379	0.3	6.7	84.4
.69	4	3.1565	3.1554	1.1	24.4	60.0
.42	5	3.6529	3.6518	1.1	24.4	35.6
	6					
	7					
1.6170 1.4510 .1660	8					
	Filter	0.1660	0.1644	1.6	35.6	
		~~1.6359~~		4.5		

Etimé cf vac (mmHg)

~~55~~		
50	516.494	5
45	516.048	5
40	515.600	5
35	515.155	5
30	514.705	5
25	514.267	5
20	513.825	5
15	513.390	5
10	512.980	5
5	512.545	5
0	512.152	5

8:35 AM - Stop.

Start 7:40 AM

(W) .136

Stack No. slurry exit of cy. "37" Date 8/4

Sample No. _____

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.7291	3.7290	0.1	2.6	97.3
2	3.6437	3.6436	0.1	2.6	94.7
3	3.6405	3.6402	0.3	7.9	86.8
4	3.6661	3.6654	0.7	18.4	68.4
5	3.4739	3.4731	0.8	21.0	47.4
6					
7					
8					
Filter	0.1649	0.1631	1.8	47.4	

2.5874
2.4225
.1649

3.8

50

45 521.263 5.0 2.32 - 5.1

40 520.743 5.0

35 520.315 5.0

30 [illegible] 5.0

25 519.496 5.5

20 514.063 5.5

15 518.644 5.5

10 — —

5 517.185 5

0 517.468 5 Start 847 AM

AA 139

Stack No. #1 [illegible] Date 3/4

Sample No. _____

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.5638	3.5630 ~~3.5633~~	0.2	4.9	95.1
2	3.6087	3.6084 ~~3.6088~~	0.3	7.3	87.8
3	3.5777	3.5775 ~~3.5777~~	0.2	4.9	82.9
4	3.6489	3.6479 ~~3.6482~~	1.0	24.4	58.5
5	3.3657	3.3646 ~~3.3651~~	1.1	26.8	31.7
6					
7					
8	1.8357 1.6713				
Filter	0.1644	0.1631	1.3	31.7	
			4.1		

~~1.8357~~ ~~1.6702~~

[illegible]

ET	CF	Vac	
			Temp 596
45	623.231	5	
40	623.466	5	
35	623.000		
30	622.520	5	
25	621.078	5	
20	621.570	5	
15	621.105	5	
10	620.610	5	
5	620.237	5	
0	619.817	5	Start @ 1:21

northmost (closest to catwalk) (I) 11.138

Port # 1

Stack No. inlet or duct ΔP during test = 47" Date 8/2

Sample No. _____ 1 min @ 5" Hg 1105

normal operating conditions 1106

no sparks or flare

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6103 ~~3.6098~~	3.6096	0.7 mg	12.3	87.8
2	3.5523	3.5522	0.1	1.8	86.0
3	3.6012	3.6005	0.7	12.3	73.7
4	3.1572	3.1553	1.9	33.4	40.3
5	3.3657	3.3649	0.8	14.0	26.3
6					
7					
8					
Filter	0.1063	0.1048	1.5	26.3	
			5.7		

(T) 136

$\Delta P = 47$ "H_2O

Run #1

Stack No. inlet to duct — 1 min @ 5" Hg normal operating conditions — Date 8/2

Sample No. _____ — no sparks or flame — 1108 / 1109

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.1321	3.1316	0.5	8.5	91.6
2	3.5895	3.5895	—		91.6
3	3.5820	3.5816	0.4	6.8	84.8
4	3.4572	3.4554	1.8	30.5	54.3
5	3.6526	3.6519	0.7	11.9	42.4
6					
7					
8					
Filter	.1178	0.1153	2.5	42.4	
			5.9		

L 138

Pat #2

Stack No. Inlet duct vent @ 47" H_2O Date 8/2

Sample No. _____ Normal operating conditions 6 52 PM 6 57

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6389	~~3.6341~~ 3.6335	5.4	62.1	37.9
2	3.6200	~~3.6196~~ 3.6189	1.1	12.6	25.3
3	3.5948	~~3.5952~~ 3.5942	0.6	6.9	18.4
4	3.5879	~~3.5884~~ 3.5875	0.4	4.6	13.8
5	3.5871	~~3.5873~~ 3.5865	0.6	6.9	6.9
6					
7					
8					
Filter	0.1115	0.1109	0.6	6.9	
			8.7		

(D)

Stack No. inlet to duct

Date 8/1 ~~7/28~~

Sample No. _____

5 min warm up

start ≤ 20 } 2 min
Sun ≤ 23

6" Hg

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6935	3.6265	67.0	76.5	23.7
2	3.6693	3.6646	4.7	5.4	18.3
3	3.4530	3.4516	1.4	1.6	16.7
4	3.6700	3.6653	4.7	5.4	11.3
5	3.3607	3.3575	3.2	3.7	7.6
6					
7					
8					
Filter	.1148	0.1081	6.7	7.6	
			87.7		

note: deposit on inner sides of cups observed on all stages

Sparks noted in the duct during sampling period.

(T)-138

T

Sample Time
7:45 - 7:47 [illegible]

Stack No. PORT #3 ON INLET DUCT Date 3 AUG 71

Sample No. _____

5.5 IN. H2O @ [illegible] correcting conditions
no [illegible] corrected

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6114	3.6095	1.9		
2	3.6659	3.6646	1.3		
3	3.4552	3.4516	3.6		
4	3.5725	3.5753	(-3.8)	weighing error	
5	3.3598	3.3575	2.3		
6					
7					
8					
Filter	No 8 0.1673	0.1627	4.5		

(4)

Sampling Time
7:50 – 7:52 PM

Stack No. PORT # 3 ON INLET DUCT Date 3 AUG 77

Sample No. _____

5.5 cfm @ nominal operating conditions
(no visible emissions)

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6393	3.6383	1.0	4.8	95.2
2	3.6255	3.6238	1.7	8.1	87.2
3	3.6297	3.6258	3.9	18.6	68.6
4	3.4628	3.4556	7.2	34.3	34.3
5	3.6102	3.6082	2.0	9.5	24.8
6					
7					
8					
Filter # 11	0.1689	0.1637	5.2	24.8	
			21.0		

C-159

Port # of
Stack No. inlet or duct ΔP = 37" H_2O Date 8/3

Sample No. _____ 5" H_g 5 min warmup 2:10 - 2:13

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.5957	3.5936	2.1mg	14.2	85.8
2	3.6218	3.6201	1.7	11.5	74.3
3	3.6024	3.6009	1.5	10.1	64.2
4	3.6025	3.6000	2.5	16.9	47.3
5	3.4624	3.4600	2.4	16.2	31.1
6					
7					
8					
Filter	0.1925	0.1879	.6	31.1	
			14.8		

R-138

Port #5 R

Stack No. inlet or duct ΔP = 57 normal conditions Date 8/3

Sample No. _____ 5" Hg S 538 F 540

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.5712	3.5634	7.8	15.8	84.1
2	3.6383	3.6089	29.4	59.5	24.6
3	3.5837	3.5777	6.0	12.1	12.5
4	3.6512	3.6483	2.9	5.9	6.6
5	3.3665	3.3652	1.3	2.6	4.0
6					
7					
8					
Filter	0.1658	0.1638	2.0	4.0	
			49.4		

v. heavy loading on plate 2, i.e. larger particles than typically found on 2

∴ over-loaded ?

5-139 Port #5

S

Stack No. inlet on duct ΔP = 57 Date 8/3

Sample No. _____ 5" Hg round conds S 542 F 544

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.1342	3.1321	2.1	36.2	63.8
2	3.5901	3.5898	0.3	5.2	58.6
3	3.5820	3.5820	—		58.6
4	3.6376	3.6373	0.3	5.2	53.4
5	3.5796	3.5791	0.5	8.6	44.8
6					
7					
8					
Filter	0.1660	0.1634	2.6	44.8	
			5.8		

considerable diff ≥ sample R (plates not overloaded

(X) 136

Stack No. Tap Exhaust - Tap East

Sample No. _____

Date 8/4

Start 442 PM

502

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6349	3.6335	1.4	30.4	69.5
2	3.6196	3.6189	0.7	15.2	54.3
3	3.5948	3.5942	0.6	13.0	41.3
4	3.5883	3.5875	0.8	17.4	23.9
5	3.5873	3.5865	0.8	17.4	6.5
6					
7					
8					
Filter	0.1643	0.1640	03	6.5	
			4.6		

(EE) 137

Date 8/4

Stack No. Top exhaust - East

8:10 PM

Sample No. Top exhaust

x30

Stage	Post Wt.	Pre Wt.	Wt Gain	%	Cum. % less than Dae
1	3.6385	3.6383	0.2	14.3	85.6
2	3.6239	3.6237	0.2	14.3	71.3
3	3.6259	3.6258	0.1	7.1	64.2
4	3.4559	3.4556	0.3	21.4	42.8
5	3.6085	3.6084	0.1	7.1	35.7
filter	0.1678	0.1673	0.5	35.7	

1.8416
1.6738
.1678

1.4

(Y) 137

Stack No. Tap exhaust - West (Tap)

Date 8/4

Sample No. _____

441
50'

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6053	3.6032	2.1	42.8	57.1
2	3.5793	3.5785	0.8	16.3	40.8
3	3.5814	3.5813	0.1	2.0	38.8
4	3.6851	3.6842	0.9	18.4	20.4
5	3.6025	3.6020	0.5	10.2	10.2
6					
7					
8					
Filter	0.1631	0.1626	0.5	10.2	
			4.9		

(2) 138

Stack No. Tap exhaust West

Date 5/4

Sample No. _____

8 10 PM
8 30

STAGE	POST. WT.	PRE. WT.	WT. GAIN	%	CUM. % LESS THEN Dpc
0					
1	3.6270 ~~3.6260~~	3.6264	0.6 ~~0.3~~	28.6	—
2	3.6067	3.6067	—	—	71.4
3	3.5838	3.5837	0.1	4.8	66.6
4	3.5257	3.5252	0.5	23.8	42.8
5	3.6197	3.6195	0.2	9.5	33.3
6					
7					
8	1.8075 1.6418				
Filter	.1659	0.1652	0.7	33.3	
			2.1		

APPENDIX K

CHEMICAL ANALYSIS OF EMISSIONS

PREFACE

The following report, covering chemical analysis of emissions from reactive metal smelting operations at Marietta, Ohio, has been prepared by the technical staff of TRW Systems Group, One Space Park, Redondo Beach, California.

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Approved By: J. R. Ogren

CHEMICAL ANALYSIS OF EMISSIONS

FROM

REACTIVE METAL SMELTING OPERATIONS

1. INTRODUCTION

Particulate fumes and gaseous emissions are generated during the smelting and pouring of a commercially important class of ferro alloy materials called reactive metals. The particulate portion of these emissions has been collected on glass fiber filters, strategically placed in the air stream of an exhaust system. Six such filters from the Union Carbide Corporation (Marietta, Ohio) were analyzed microscopically, by qualitative electron beam X-ray microanalysis, and atomic absorption. The analytical results are presented in the following sections.

2. TEST RESULTS

2.1 Optical Examination

The specimens were examined at magnifications up to 30X. The particulate matter could be seen intimately mixed with the quartz filter fibers and it was obvious that the particulate matter could not be physically separated from the filter pad upon which it had been collected. Under tungsten filament the specimens appeared as follows: M1E-6 (light gray), M1E-7 (dark gray), M1E-12 (yellow-brown) and ETE-2 (partly dark brown, partly light brown).

2.2 Electron Beam X-Ray Microanalysis

The electron microprobe is an advanced piece of equipment which uses a small beam of electrons to produce characteristic X-ray emissions from a sample volume with a radius of ~1 micron. Curved crystal X-ray spectrometers are used to analyze the resultant characteristic X-ray spectra. In these analyses, the electron beam was defocused to a diameter of 150 microns (0.006 inch) to cover a relatively large area of each specimen and thereby obtain data which would be representative of the entire sample. The electron beam impinged in vacuum upon the untouched sample surface. An examination was made of the complex spectrum of X-rays given off by the specimen under electron beam excitation, and it was found that the entire spectrum could be identified uniquely on the basis of the elements shown in Table 1. All portions of the X-ray spectrum in the wavelength range 1-100A covering all elements except H, He, Li, and Be were taken into account.

The analyses were conducted on small portions of the filter pads which were not later digested for the atomic absorption analyses. The small samples for electron probe analyses are still intact. The qualitative analysis results are summarized in Table 1. Several points seem germane:

1. The major elements are manganese, magnesium, calcium, and potassium. The silicon signal could have come from either the filter pad or from the particulate matter. The fibers of the pad were visible in the optical microscope which is attached to the electron probe.

2. Distinct signals, equivalent to several weight percent, were found for sulfur, chlorine, carbon, sodium, and potassium.

3. The presence of sodium and chlorine frequently suggests salt and could have come from handling with bare hands. However, it must be stated that the filters were not handled with bare hands during the chemical analysis effort.

2.3 Atomic Absorption Analyses

Atomic Absorption (A.A.) means that a cloud of atoms in the un-ionized and unexcited state is capable of absorbing radiation at wavelengths that are specific in nature and characteristic of the element in consideration. The atomic absorption spectrophotometer used in these analyses consists of a series of lamps which emit the spectra of the elements determined, a gas burner to produce an atomic vapor of the sample, a monochromator to isolate the wavelengths of interest, a detector to monitor the change of absorption due to the specimen, and a readout meter to visualize this change in absorption.

The filters with samples were weighed, and the sample weights calculated by subtracting the tare weights written on the outside of the Petri dish sample containers from the total weights. Specimen identifications were as follows: M1E-6, M1E-7, M1E-12, and a composited specimen consisting of filters WTE-3, ETE-1, and ETE-2.

Table 1. Qualitative Electron Beam X-Ray Microanalyses

Specimen No.	Cr	Mn	Mg	Fe	Al	Ca	Ba	Na	K	Zn	Cl	S	Si	C
M1E-6	-	H	M	L	T	H	-	M	H	L	H	M	M	L-M
M1E-7	-	H	H	L	M	H	T	H	H	T	H	H	H	L-M
M1E-12	-	H	H	L	H	H	M	H	H	-	L	L	H	L-M
ETE-2	T	H	H	L	H	H	M	H	H	T	L	M	H	L-M

KEY: H = greater than 20 wt%

M = 10-20 wt%

L = 1-10 wt%

T = less than 1 wt%

NOTE: Sample ETE-2 was later composited with WTE-2 and ETE-1 in the atomic absorption analyses. The compositing operation in this particular case involved digesting three filter pads, with their particulate matter, in one common acid solution. The microprobe analyses were performed on a portion of ETE-2 that was not digested.

The filters (both pad and particulate) were extracted for 2 hours with 50 mls of 1:1 H_2SO_4; this solution was decanted and saved. The filters were then extracted for 2 hours with a boiling dilute Aqua Regia solution.* This solution was then combined with the H_2SO_4 solution, filtered, taken to constant volume in a volumetric flask, and analyzed by A.A. The instrumental parameters used for the individual elements are given in Table 2, and the results of the A.A.** analyses are shown in Table 3.

The A.A. results are normalized to compensate for the portion removed for electron beam X-ray microanalyses. Silica (SiO_2) analyses were not performed since the entire SiO_2 filter pad with the intimately mixed specimen was digested in acid in each case. In order to determine if the acid digestion process chemically attacks the SiO_2 filter, an unused filter will be exposed to the digestion process and A.A. analyses run on a blank to determine background concentrations. A remote possibility exists that some K or Na could have come from the filter material if it is not pure SiO_2.

Note also that in Table 3 only one specimen (M1E-6) adds up to 100%. The other specimens most likely consist of metal oxides or a mixture of metals and metal oxides; oxygen and silicon are therefore the likely missing chemical components needed to bring the totals in all four cases to 100%.

A comparison of these results with the results reported in Part 1 (Foote Mineral Corporation-Steubenville, Ohio) immediately brings to light certain differences between the two emissions. The Union Carbide (Marietta, Ohio) emissions contain, in general, less chromium but more manganese, sodium, potassium, chlorine, and to be particularly noted, sulfur, than do the Foote Mineral Corporation emissions.

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* R. J. Thompson, G. B. Morgan, and L. J. Purdue, "Analysis of Selected Elements in Atmospheric Particulate Matter by Atomic Absorption", Atomic Absorption NEWS Letter, Volume 9, No. 3, 1970

** Walter Slavin, Atomic Absorption Spectroscopy, Interscience Publishers, New York, New York, pp 79-189, 1968.

Table 2. Instrumental Parameters

Element	Wavelength (Å)	Fuel Oxidizer System	Slit Width (Å)	Hollow Cathode Current (Ma)
Cr	3579	Air-Acetylene	2	10
Mn	2801	Air-Acetylene	2	10
Mg	2852	N_2O-Acetylene	7	4
Fe	2483	Air-Acetylene	2	12
Al	3093	N_2O-Acetylene	7	13
Ca	4227	N_2O-Acetylene	7	8
Ba	5536	N_2O-Acetylene	7	7
Na	5890	Air-Acetylene	20	10
K	7665	Air-Acetylene	20	10
Zn	2139	Air-Acetylene	7	8

Table 3. Atomic Absorption Analysis Results Elemental Concentration (Wt%)

Specimen No.	Cr	Mn	Mg	Fe	Al	Ca	Ba	Na	K	Zn	Total (%)
M1E-6	0.09	27.6	2.3	1.0	0.6	0.6	-	21.3	37.3	1.9	94.2
M1E-7	0.04	7.6	1.2	0.2	0.6	0.9	-	44.4	18.2	0.2	73.3
M1E-12	0.09	7.7	1.2	0.3	0.9	0.4	-	37.8	14.8	<0.01	63.2
Composite (WTE-3, ETE-1, and ETE-2)	0.1	21.8	0.6	1.0	0.7	0.4	-	<0.05	6.0	0.3	30.9

NOTE: Silicon analyses not performed.

SPECIAL NOTE: The values have been corrected, at the last minute, to account for contributions from the collector pad.