AP42 Section

APPENDIX B.1
PARTICLE SIZE DISTRIBUTION DATA AND SIZED EMISSION FACTORS FOR SELECTED SOURCES

Originally "C.1" in 4th edition

References:

Assorted 1.8 through 12.xxx

Divided App. C.1, 1

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB
May

Air

Appendix
C.1
Reference 1

EPA

Nonfossil Fueled Boile

Emission Test Report
U.S. Sugar Company
Bryant, Florida

NONFOSSIL FUELED BOILERS

Emission Test Report
U.S. Sugar Company
Bryant, Florida

Project No.: 80-WFB-6

Prepared for

Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park
North Carolina 27711

by

James A. Peters and Charles F. Duncan

Contract 68-02-2818, Work Assignment No. 25

May 1980

MONSANTO RESEARCH CORPORATION
DAYTON LABORATORY
1515 Nicholas Road
Dayton, Ohio 45407

TABLE 4. SUMMARY OF INTEGRATED GAS ANALYSES, U.S. SUGAR-BRYANT MILL, DECEMBER 17-18, 1979

Run number	Date	CO_2, %	CO, %	O_2, %	N_2, %	MW lb/lb mole
1	12/17/79	10.8	0.0	9.2	80.0	30.1
2	12/18/79	11.1	0.0	9.0	79.9	30.1
3	12/18/79	11.3	0.0	9.4	79.3	30.2
Average		11.1	0.0	9.2	79.7	30.1

TABLE 5. SUMMARY OF ANDERSEN PARTICLE SIZING RESULTS, U.S. SUGAR-BRYANT MILL, DECEMBER 17-18, 1979

Run No. 1

Discarded

Run No. 2

Flow rate = 0.927 acfm
Isokinetic rate = 107.1%

Stage	Size range	Percent in size range	Cumulative % <size range
Preimpactor	>10.50	3.99	94.55
0	>10.50	1.46	94.55
1	6.50 - 10.50	3.06	91.52
2	4.30 - 6.50	7.98	83.54
3	2.95 - 4.30	11.30	72.24
4	1.88 - 2.95	12.40	59.94
5	0.94 - 1.88	12.90	46.94
6	0.58 - 0.94	19.15	27.79
7	0.39 - 0.58	16.49	11.30
Filter	0.0 - 0.39	11.30	0

Run No. 3

Flow rate = 0.908 acfm
Isokinetic rate = 105.5%

Stage	Size range	Percent in size range	Cumulative % <size range
Preimpactor	>10.60	6.56	91.43
0	>10.60	2.01	91.43
1	6.60 - 10.60	4.28	87.14
2	4.40 - 6.60	7.47	79.67
3	3.00 - 4.40	8.66	71.01
4	1.90 - 3.00	8.66	62.35
5	0.96 - 1.90	10.48	51.87
6	0.59 - 0.96	20.60	31.27
7	0.40 - 0.59	16.68	14.59
Filter	0.0 - 0.40	14.59	0

Corrected App. C1, Ref. 2 2.

United States Environmental Protection Agency
Office of Air Quality Planning and Standards Research Triangle Park NC 27711
EMB Report 80-WFB-1 February 1980
Air

EPA

Nonfossil Fueled Boile

Appendix C.1 Reference 2

Emission Test Report City of Salem Salem, Virginia

NONFOSSIL FUELED BOILERS

Emission Test Report
City of Salem
Salem, Virginia

5-8 November 1979

Project No.: 80-WFB-1

Prepared for

Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park
North Carolina 27711

by

James A. Peters and Windle H. McDonald

Contract 68-02-2818, Work Assignment No. 23

February 1980

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TABLE 4. SUMMARY OF INTEGRATED GAS ANALYSIS RESULTS, CITY OF SALEM WASTE DISPOSAL PLANT, NOVEMBER 6-7, 1979

Run no.	Date	CO_2, %	CO, %	O_2, %	N_2, %	Molecular weight, lb/lb•mole
6-1	11-6-79	7.8	0.0	11.0	81.2	29.69
7-1	11-7-79	6.2	0.0	13.2	80.6	29.52
7-2	11-7-79	7.2	0.0	12.0	80.8	29.63
Average		7.1	0.0	12.1	80.8	29.61

TABLE 5. SUMMARY OF PARTICLE SIZING RESULTS, WEST STACK, CITY OF SALEM WASTE DISPOSAL PLANT, NOVEMBER 6-7, 1979

Run: 1	Date: 11-6-79	Flow rate, acfm: 1.10	
Stage	Wt % in size range	Cum. %	Size range, microns
0	29.4	∞	>10.6
1	10.6	70.6	6.6 - 10.6
2	5.5	60.0	4.5 - 6.6
3	3.7	54.5	3.05 - 4.5
4	3.3	50.8	1.94 - 3.05
5	6.9	47.5	0.99 - 1.94
6	11.9	40.6	0.62 - 0.99
7	10.7	28.7	0.43 - 0.62
Backup filter	18.0	18.0	0 - 0.43

Run: 2	Date: 11-7-79	Flow rate, acfm: 1.01	
Stage	Wt % in size range	Cum. %	Size range, microns
0	7.0	∞	>11.1
1	3.1	93.0	6.9 - 11.1
2	0.7	89.9	4.7 - 6.9
3	4.7	89.2	3.19 - 4.7
4	5.9	84.5	2.04 - 3.19
5	7.5	78.6	1.03 - 2.04
6	13.1	71.1	0.65 - 1.03
7	14.6	58.0	0.43 - 0.65
Backup filter	43.4	43.4	0 - 0.43

Run: 3	Date: 11-7-79	Flow rate, acfm: 0.82	
Stage	Wt % in size range	Cum. %	Size range, microns
0	62.6	∞	>12.4
1	0.1	37.4	7.6 - 12.4
2	0.2	37.3	5.21 - 7.6
3	1.3	37.1	3.55 - 5.21
4	2.1	35.8	2.26 - 3.55
5	1.2	33.7	1.14 - 2.26
6	6.6	32.5	0.72 - 1.14
7	10.2	25.9	0.49 - 0.72
Backup filter	15.7	15.7	0 - 0.49

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE+10 CYC		
		STAGE/FILTER CUT SIZE:	8.30 UM
		STAGE WEIGHT:	1.30E+01 MG
2	3 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	1.90 UM
		STAGE WEIGHT:	4.90E+00 MG
3	1 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	.60 UM
		STAGE WEIGHT:	8.10E+00 MG
4	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	8.00E-01 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	8.30	1.90	.60	.01
STAGE WEIGHTS(MILLIGRAMS)	1.30E+01	4.90E+00	8.10E+00	8.00E-01
MICROGRAMS/DNCM/STAGE	2.41E+03	9.07E+02	1.50E+03	1.48E+02
NUMBER/DNCM/STAGE	4.15E+34	1.24E+36	8.37E+37	0.00E-0
CUM. %MASS<D50	51.49	33.21	2.99	
CUM. MICROGRAMS/ACM<D50	2.56E+03	1.65E+03	1.48E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.56E+03	1.65E+03	1.48E+02	0.00E+00
GEOM D50	1.82E+01	3.97E+00	1.07E+00	7.75E-02
DM/DLOGD-(UG/DNM3)	3.52E+03	1.42E+03	3.00E+03	8.33E+01
DN-LOGD/(NUMBER/DNM3)	3.96E+34	2.66E+36	1.67E+38	0.00E-0

Appendix C.1 Reference 4

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 PAGE 1 DATE 06/21/83

FI 234 DESCRIBES SAMPLING AT SITE FROM 02/14/78 TO 02/14/78 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY: FABRICATED MTL PROD
SOURCE TYPE: METAL PRODUCTS
PRODUCT/DEVICE: AUTOMOBILES
PROCESS TYPE: SURFACE COATING
DESIGN PROCESS RATE: 307 KG/HR
FEED MATERIAL CATEGORY: INORG CHEM
PRIMARY CONTROL DEVICE:

SOURCE NAME: CONFIDENTIAL
SITE NAME:
ADDRESS:
LOS ANGELES ,CA 00000

SIC CODE: 3449

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00086 SDDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN.
TABACK H.J.
KVB REPORT 5806-783 PB 293 923/AS FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL. EQUIPMENT TESTED IS CUSTOM MADE SPRAY BOOTH. PAINT USED IS A WATER-BASED ENAMEL.

App. C.1, Ref. 1

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE+10 CYC		
		STAGE/FILTER CUT SIZE:	9.20 UM
		STAGE WEIGHT:	1.18E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	41.500 MG
		CHEMICAL ANALYSIS LABORATORY NAME:	ARMAME
2	3 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	3.80 UM
		STAGE WEIGHT:	5.20E+00 MG
3	1 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	1.30 UM
		STAGE WEIGHT:	7.60E+00 MG
4	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	8.10E+00 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	9.20	3.80	1.30	.01
STAGE WEIGHTS(MILLIGRAMS)	1.18E+02	5.20E+00	7.60E+00	8.10E+00
MICROGRAMS/DNCM/STAGE	3.90E+03	1.72E+02	2.51E+02	2.68E+02
NUMBER/DNCM/STAGE	1.06E+10	1.59E+10	4.37E+11	3.45E+15
CUM. %MASS<D50	15.05	11.30	5.83	
CUM. MICROGRAMS/ACM<D50	4.23E+02	3.18E+02	1.64E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	6.91E+02	5.19E+02	2.68E+02	0.00E+00
GEOM D50	1.92E+01	5.91E+00	2.22E+00	1.14E-01
DM/DLOGD-(UG/DNM3)	6.12E+03	4.48E+02	5.40E+02	1.27E+02
DN-LOGD/(NUMBER/DNM3)	1.65E+10	4.14E+10	9.39E+11	1.63E+15

COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE+10 CYC	ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NITRATE & TOTAL CARBON. PROBE WT IS 76.7 MG & CYCLONE IS 41.5 MG.

App C-1 Ref 5

73-CBK-1
(REPORT NUMBE

Appendix
C.1
Reference 5

DUPE 0964

AIR POLLUTION EMISSION TEST

PHILLIPS PETROLEUM COMPANY
(PLANT NAME)

Carbon Black Division

Toledo, Ohio
(PLANT ADDRESS)

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Water Programs
Office of Air Quality Planning and Standards
Emission Standards and Engineering Division
Emission Measurement Branch
Research Triangle Park, N. C. 27711

EMB Test Number 73-CBK-1

Phillips Petroleum Company

Carbon Black Division

Toledo, Ohio

R E V I S I O N

September 1974

CUMULATIVE WEIGHT PERCENT LESS THAN STATED MICRON SIZE

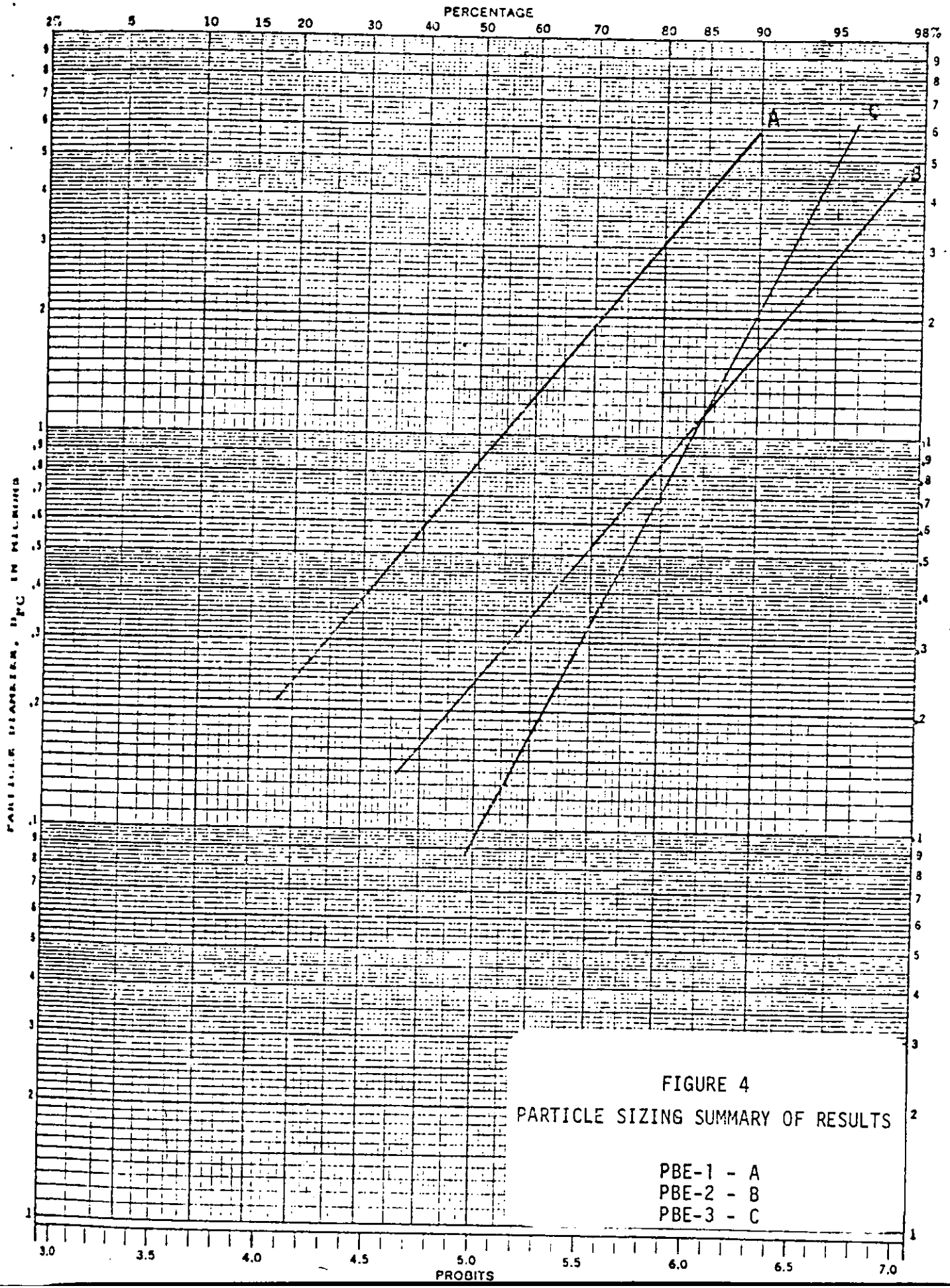


FIGURE 4

PARTICLE SIZING SUMMARY OF RESULTS

PBE-1 - A
PBE-2 - B
PBE-3 - C

App. C.1, Ref. . need primary reference)

Appendix
C.1
Reference 10

EPA-450/2-77-019
September 1977

FINAL GUIDELINE DOCUMENT: CONTROL OF SULFURIC ACID MIST EMISSIONS FROM EXISTING SULFURIC ACID PRODUCTION UNITS

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

EPA-450/2-77-019

FINAL GUIDELINE DOCUMENT: CONTROL OF SULFURIC ACID MIST EMISSIONS FROM EXISTING SULFURIC ACID PRODUCTION UNITS

Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

September 1977

6. Reference 3, above, p. 30.

7. Reference 2, above, p. III-9.

8. Reference 2, above, p. III-10.

9. Kurek, R.W. Special Report on EPA Guidelines for State Emission Standards for Sulfuric Acid Plant Mist dated June 1974. E.I. du Pont de Nemours & Co., Inc., Industrial Chemicals Department. Wilmington, Delaware. Prepared for U.S. Environmental Protection Agency, Office of Air Quality Planning & Standards. October 4, 1974. Exhibit 15.

10. Reference 3, above, p. 32.

11. Brink, J.A., Jr. Cascade Impactor for Adiabatic Measurements. Industrial & Engineering Chemistry. 50: 647, April 1958.

12. Reference 9, above, Exhibit 12.

13. Reference 2, above, pp. III-14, 15 and 22.

14. Reference 2, above, p. IV-15.

15. Brink, J.A., Jr. and C.N. Dougald. Particulate Removal from Process Exhaust Gases. Proceedings of International Sulfite Conference, TAPPI and CPPA, Boston, Mass., October 30 - November 1, 1972. October 30, 1972. pp. 377-389.

J. A. BRINK, Jr.[1]
Monsanto Chemical Co., Everett, Mass.

Cascade Impactor for Adiabatic Measurements

Data on development, design, and use of a practical instrument in the field make it possible to add a convenient tested device for special purposes. Particle-size measurements make possible determination of acceptable discharges of aerosols, evaluation of installed collection equipment, rational selection and design of equipment, and recognition of potential problems early in the development of new processes.

IMPINGEMENT DEVICES have been used for years for sampling gas-borne particles (5, 6). Owens (9) and Ferry, Farr, and Hartmann (1) used a single jet and a glass slide to collect samples of gas particles suspended in a gaseous medium, and measured the sizes of impinged particles with a microscope by particle counts. In May's cascade system of impactor stages (8) particles were separated into five fractions, ranging in particle size from 1 to 50 microns. Laskin (7) used May's impactor for heavy aerosol particles of micron and submicron sizes. A modified cascade impactor extended measurements into the submicron range (13).

Extensive theoretical and experimental work with cascade impactors has been done by Ranz and Wong (11, 12), Gillespie and Johnstone (2, 3), and others at the University of Illinois. Pilcher, Mitchell, and Thomas (10) and Wilcox (15) investigated the characteristics of impactors and made significant improvements in design.

In many industrial plants aerosols are formed in high concentrations in gases saturated with vapor at 30° to 200° C. For measuring particle-size distributions of aerosols in such gases, special equipment is required. An adiabatic cascade impactor and accessory equipment for adiabatic measurements on industrial aerosols were developed at Monsanto in 1954. They are small, light, and compact and can be carried to a site for testing [illegible] of the industry.

Impactor and Auxiliary Apparatus

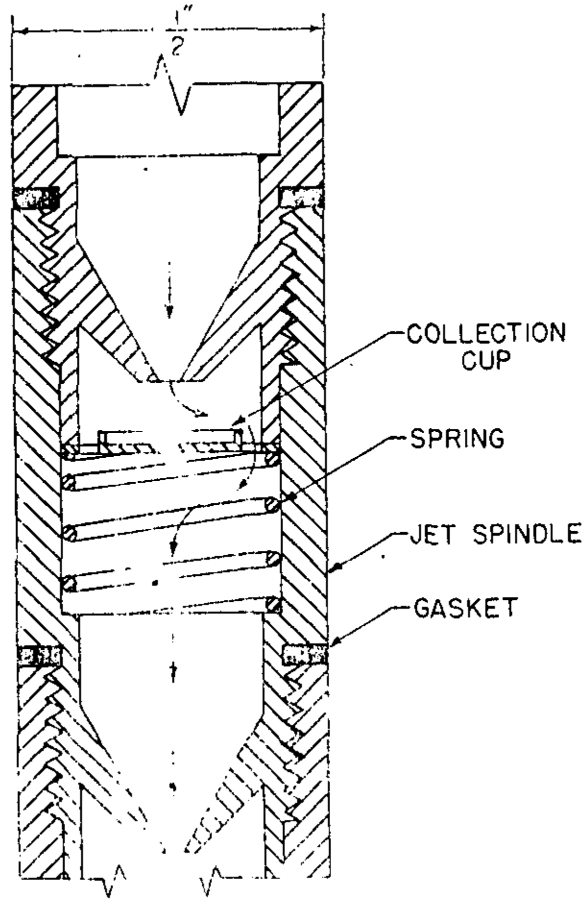
The cascade impactor has five in-line stages, each of which has a jet that utilizes a collection cup as an impaction plate. A spring holds each collection cup in place. The particles suspended in the gases pass through a jet, particles with sufficient inertia impact against a cup, and the remainder pass through annular slots located around the cup. Each collection cup has annular slots with a total cross-sectional area 30 times the area of the largest jet; turbulent effects at the slots were negligible with this design. The dimensions of the impactor jets (Table I) were selected as described by Ranz and Wong (11). The impactor is $15^1/_2$ inches long and was machined from 316 stainless steel. Particles in the 0.3- to 3.0-micron range are collected.

A glass cyclone, with the same dimensions as that described by Gillespie (2, 3), is used upstream from the impactor. Two filters, consisting of Corning No. 9480 filter tubes packed tightly with No. 800 Pyrex glass wool, collect particles less than 0.3 micron in diameter. The cyclone, impactor, and filters are mounted in a box with a removable side. A No. $2^1/_2$ L-R Manufacturing Co. blower, inside the box, is driven by a 8000 r.p.m. Fairchild Industries (Model

Table I. Dimensions of Cascade Impactor Jets

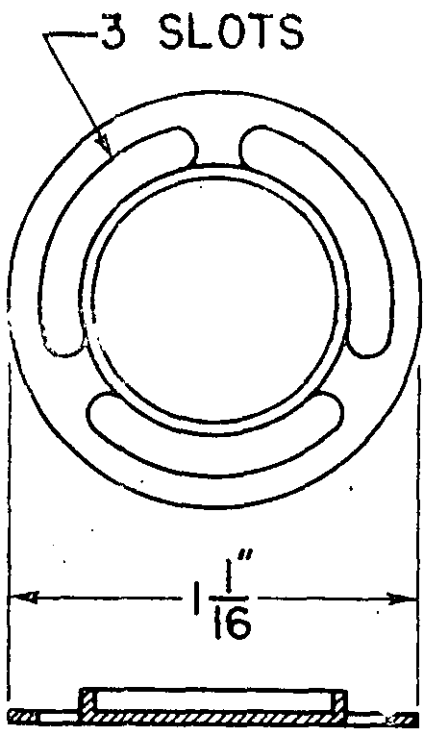
	Dimensions, Cm.	
Jet No.	Jet diam.	Spacing of jet opening[a]
1	0.249	0.747
2	0.1775	0.533
3	0.1396	0.419
4	0.0946	0.282
5	0.0731	0.220

[a] From collection cup surface



Five in-line impactor has five stages. Particles in the range of 0.3 to [illegible] microns are collected by [illegible] impingement

[1] Present address, Research Department, [illegible] Chemical Co., St. Louis, Mo.



Collection cups are positioned so that the distance from the jet decreases as the jet diameter becomes smaller. Annular slots around cup minimize turbulence

1401) motor on the back side of the box. A heater, consisting of three 12-inch sections of Nichrome resistance wire (Catalog No. 416, Size 1, coiled type, Lapp Electric Mfg. Co.), is mounted in the box. The three sections of the heater are connected in series and operated on 110 volts. The air temperature is controlled with a 100° to 400° F. thermostat (Penwalt, Inc., Catalog No. 1731-0). The box is designed so that air could be circulated at a high velocity past the cyclone, impactor, and filters. The blower discharges air through a duct below the heaters and then over the heater, impactor, and cyclone back to the blower inlet. Thermometers, mounted on the removable side of the box, indicate the temperature of the air entering the blower and leaving the heater. Two manometers, mounted on the removable side of the box and connected to the impactor, measure the static pressure at the inlet and the pressure drop across the impactor.

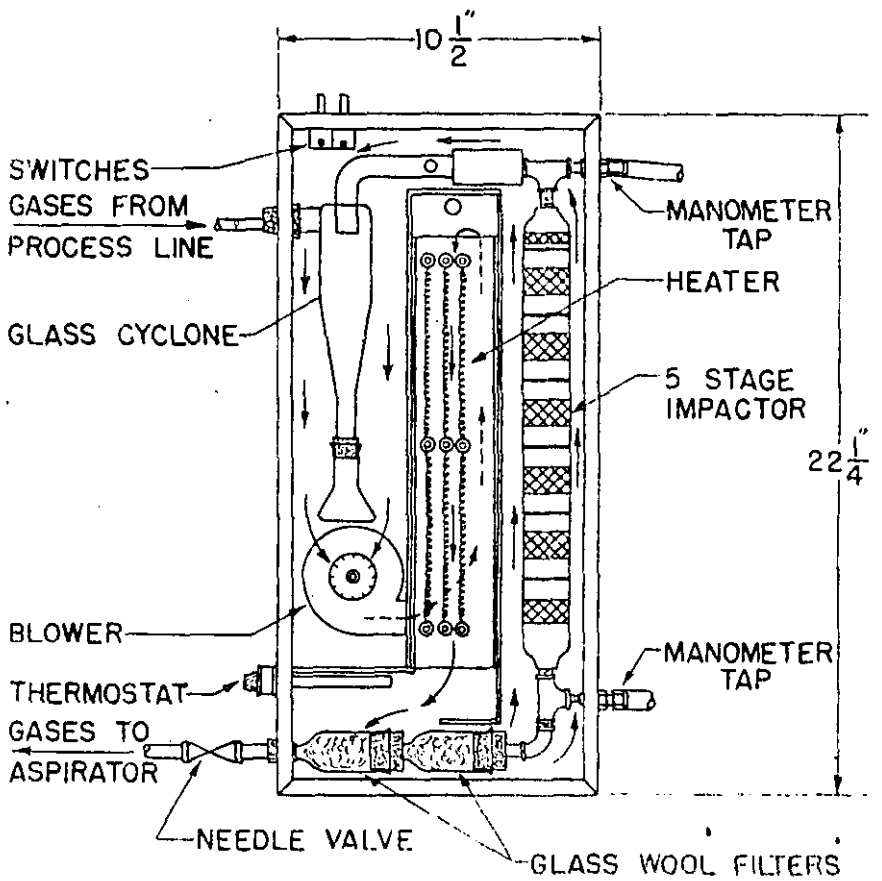
A sample line, heated with flexible tape heaters (electromagnetic heating tape, Howe and French), is controlled with a Variac. Sample probes and lines are sized for isokinetic sampling.

Experimental Procedure

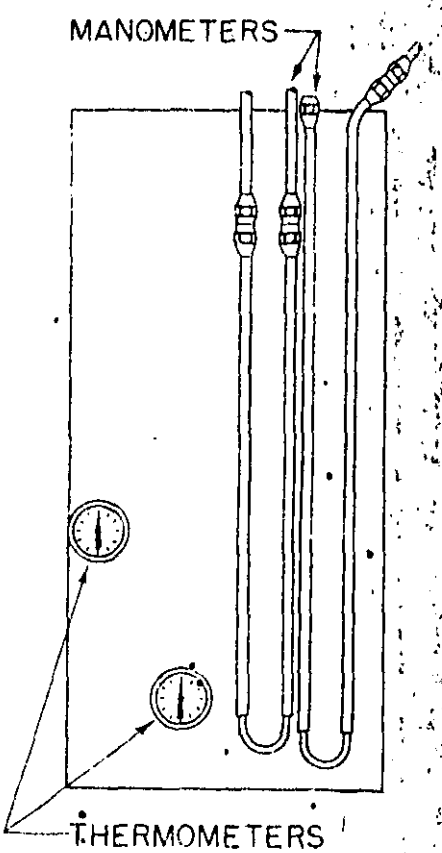
Prior to each test, the impactor and auxiliary apparatus were tested for leaks under 8-inch mercury vacuum. Then the sample line and the impactor box were heated to the temperature of the process stream. The sample probe was inserted in the process stream and gas flow through the impactor was started and held constant until the end of the test. A vacuum of 4 to 8 inches of mercury was usually required, giving flow rates of 2700 to 3700 cc. per minute.

A weighed 40 to 60% of the aerosol was collected on one cup or stage of the impactor. The sample time was limited by re-entrainment from this cup; a 25- to 50-mg. sample could be collected on one cup without re-entrainment. The maximum sample time was used, so that reasonable quantities were collected on other cups. With one trial run, the flow rate for subsequent runs was set at a level that would give maximum collection on the third or middle stage of the impactor, and the sample time was set at the maximum time feasible without re-entrainment.

After each test the sample cups were removed from the impactor with tweezers. The quantity collected on each cup was determined by weighing and/or by chemical analyses. The glass cyclone was washed with water and the solution analyzed. The glass wool filters were leached with water and the resulting solution was analyzed; or the glass wool was removed, the filter holder was rinsed, and the glass wool and solution were analyzed either volumetrically or gravimetrically, depending on the type of aerosol. Both weighing and chemical analyses were used when condensation or evaporation was a potential source of



Compact make-up of impactor and its auxiliary equipment make it suitable for tests throughout the plant



Temperature and pressure during sampling period are controlled by observing and adjusting instruments. Interpretation of data aids in identifying aerosols collected

error; double analyses showed that errors due to condensation or evaporation were negligible and sampling was adiabatic.

Calibration of Impactor

The in-line impactor was designed with the internal dimensions used by Ranz and Wong (*11*), except that the gases leaving any stage passed through annular slots around the collection cups rather than out the side. As the velocities through the slots were $^1/_{30}$ to $^1/_{350}$ the jet velocities, the in-line impactor was expected to perform in the same way as impactors used by Ranz and Wong.

Sulfuric acid mists were generated in the laboratory and passed through different retention chambers in the manner described by Gillespie (*2, 3*). Particle-size determinations were made on these mists with the in-line impactor (Figure 1). These data are in good agreement with data reported by Gillespie, who used impactors calibrated by Ranz and Wong (*11*). This work showed that the in-line impactor should have the same calibration as determined by them.

With a gas meter, the in-line impactor was calibrated as a flowmeter. The relationship between gas flow through the impactor and pressure drop across the impactor, for air at 25° C. and 14.7 p.s.i.a., was determined to be:

$$V_0 = 24.5\ (\Delta P)^{0.519} \qquad (1)$$

The gas flow, V_0, for process gases at different temperatures and pressures, was calculated from this equation, using suitable corrections for differences in gas density.

Particle-Size Distribution Calculations

Calculation of particle-size distributions was based on the generalized calibration curve determined by Ranz and Wong (*11*). The characteristic diameter, D_{pc}, for each stage of the impactor may be calculated from

$$D_{pc} = \left(\frac{18\,\mu D_c}{C\,\rho_p\,v_2}\right)^{1/2} (\psi_{50})^{1/2}\,(10)^4 \qquad (2)$$

where $(\psi_{50})^{1/2} = 0.38$ for round jets (*11*). However, as the C factor is a function of D_p, calculation of D_{pc} is not as straightforward as indicated by Equation 2. C is defined in general as:

$$C = 1 + \left(\frac{2L}{D_p}\right)[1.23 + 0.41\,e^{-0.44 D_p (10)^4 / 2L}]\,(10)^{-4} \qquad (3)$$

for $0.1 < [2L/(10)^4 D_p] < 134$

When

$$\left(\frac{D_p(10)^4}{L}\right) > 2.7,$$

the exponential term in Equation 3 may be neglected and

$$C = 1 + (2.46)(10)^{-4}(L/D_p) \qquad (4)$$

This condition existed in most applications of the impactor. For air at normal room temperature and pressures, Equation 4 becomes

$$C = 1 + 0.165/D_p \qquad (5)$$

When gases are expanded through a jet, the temperature change can be estimated on the basis of frictionless adiabatic flow for a perfect gas (*3*). However, in most cases this temperature change is negligible and the velocity of the gases at the jet throat, v_2, can be estimated as follows:

$$v_2 = \frac{4\,V_0}{\pi (D_c)^2}\,\frac{(P_0)}{(P_2)} \qquad (6)$$

When D_p is taken equal to D_{pc}, Equations 2, 4, and 6 can be combined to give

$$D_{pc} = \frac{-15.3\,\mu}{\sqrt{g_c \rho P_2}} + \sqrt{\frac{234\,\mu^2}{g_c \rho P_2} + \frac{(2.05)(10)^8 \mu D_c^3 P_2}{\rho_p V_0 P_0}} \qquad (7)$$

The characteristic diameters for each stage of the impactor can be calculated directly from Equation 7. When $D_p/L \times (10)^{-4} < 2.7$, Equations 2, 3, and 6 must be solved by approximation. For any test, after Dpc was calculated for

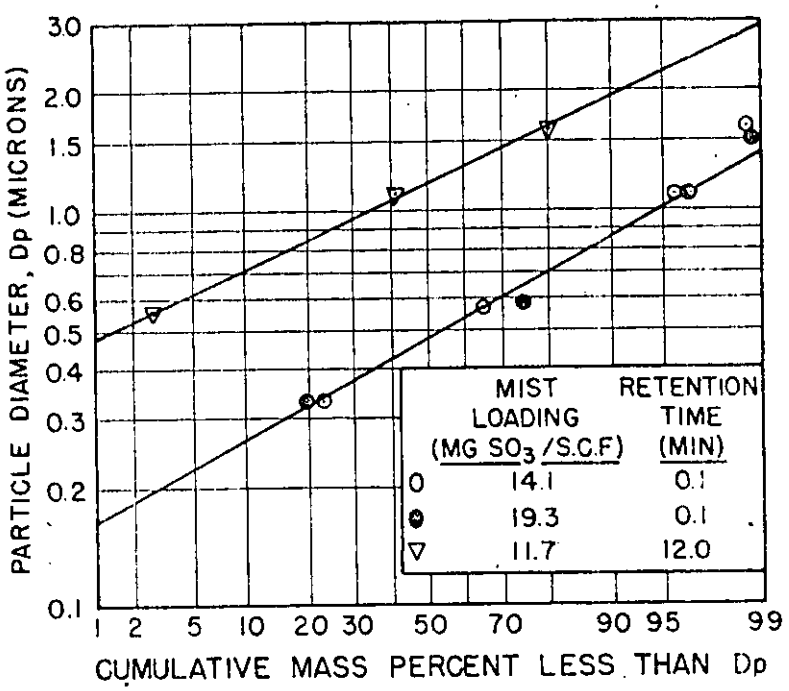


Figure 1. Cumulative particle size distribution of sulfuric acid mist generated in the laboratory is a function of mist loading and retention time

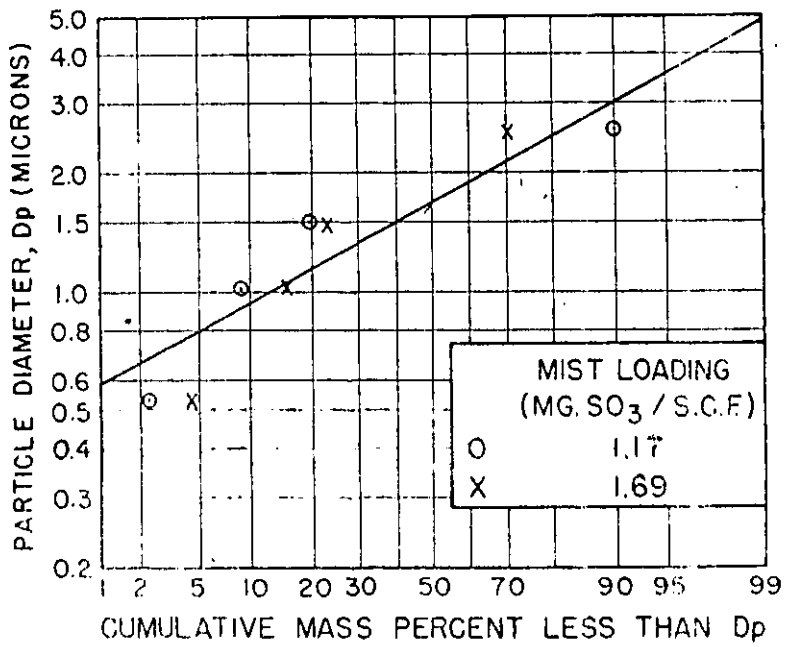


Figure 2. Cumulative particle size distribution of sulfuric acid plant aerosols

Table II. Particle-Size Distribution Curve Calculation

Jet No.	D_{pc}	% Collected	Cumulative % $< D_{pc}$
1	3.14	0.39	99.61
2	1.63	0.68	98.93
3	1.10	2.74	96.19
4	0.57	21.60	74.59
5	0.33	54.73	19.86
Glass filter			
		19.86	
		0	

each stage, cumulative distributions as shown in Figures 1 to 3 were calculated. For example, consider the curve given for a mist loading of 19.3 mg. of sulfur trioxide per standard cubic foot and a retention time of 0.1 minute in Figure 1. The data for this test are given in Table II. As 19.86% of the mist was not collected by the last stage, this percentage of the mist has diameters smaller than 0.33 micron, the D_{pc} for the last stage. The cumulative per cent not collected by stage 4 was 19.86% + 54.73% = 74.59%. This calculation was continued as shown in Table II and then the curve was plotted as shown in Figure 1.

Field Measurements

The impactor and auxiliary apparatus have been used extensively at plants throughout the country. Measurements of particle-size distributions of aerosols within and leaving eight different acid plants have been measured, and collection efficiencies of different types of full-scale dust and mist collectors for different particle sizes have shown that the impactor is a valuable and practical instrument for field use.

The particle-size distribution and loading of the gas leaving a new contact sulfuric acid plant are shown in Figure 2. This plant is of the Leonard-Monsanto design, a single unit with a rated capacity of 400 tons per day on a 100% sulfuric acid basis. Process gases in phosphoric acid plants are usually saturated with 5 to 40% water vapor, depending on the process design and operation, and adiabatic measurements are required. A typical particle-size distribution for the acid mist leaving a phosphoric acid plant is given in Figure 3.

Particle size determinations by chemical company personnel make possible determination of acceptable stack discharges of aerosols, evaluation of installed collection equipment, rational selection and design of equipment, and recognition of potential problems early in the development of new processes.

Acknowledgment

The many helpful suggestions made by H. F. Johnstone, W. E. Ranz, Herbert Kraemer, J. B. Wong, and G. R. Gillespie on the design and operation of cascade impactors are gratefully acknowledged.

H. P. Willett and other engineers at the Chemical Construction Corp. assisted in the design of the in-line impactor.

D. A. Moore assisted in the experimental aspects of the work and in the preparation of a company report on which this discussion is based. W. M. Davis made several helpful suggestions.

Nomenclature

C = empirical correction factor for resistance of gas to movement of small particles as defined in Equation A, 1, 0[illegible]

D_j = diameter of impactor jet, cm.

D_p = diameter of aerosol particle, microns

D_{pc} = characteristic diameter of aerosol particle for impactor stage, microns

g_c = 1 (g.) (atm.)/(cm.)(sec.)^2

l = mean free path for gas molecules, cm. $l = 2\mu/\rho\bar{v}$

P_1 = absolute pressure at inlet to impactor, atm.

P_2 = pressure after jet, atm.

ΔP = pressure drop across impactor, inches Hg

T_2 = temperature after jet, °K.

V_0 = gas flow at inlet to impactor, cc./second. $V_0 = 24.5\ (\Delta P)^{0.46}$ for air at 25° C. and 14.7 p.s.i.a.

v_2 = average linear velocity of gas through jet, at P_2 and T_2, cm. per second

$\bar{v}$ = average molecular velocity of gas, cm. per second $\bar{v} = (10)^2 \sqrt{\frac{8 g_c \bar{P}_2 (1.013)}{\pi \rho}}$

ψ = dimensionless inertial parameter, $= C\rho_p v_2 D_p^2 / 18\ \mu D_j$ (10)^2

ψ_{50} = inertial parameter for impactor efficiency of 50%

ρ = gas density after jet at T_2 and P_2, gram per cc.

ρ_p = density of aerosol particle, gram per cc.

μ = viscosity of gas after jet at T_2 and P_2, g./(cm.)(sec.)

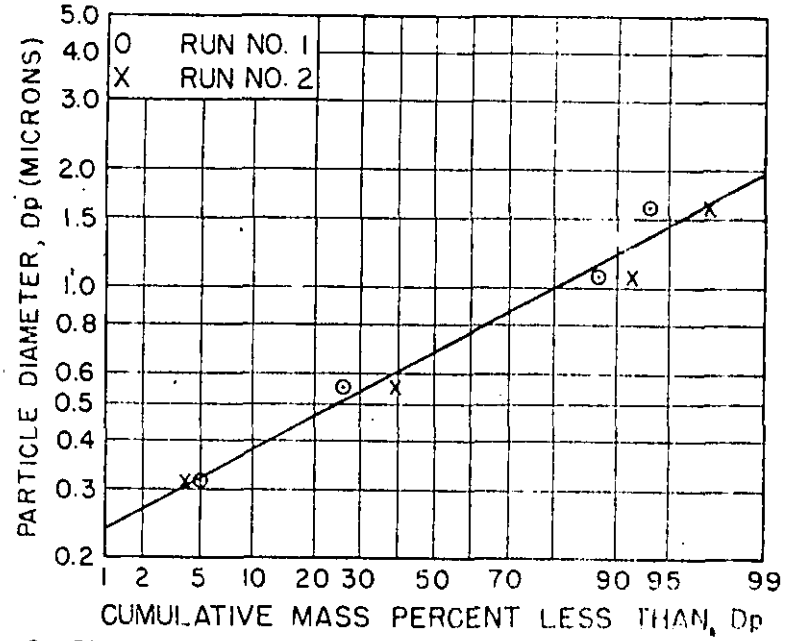


Figure 3. Distribution of phosphoric acid mist leaving typical plant can be used to control process. Analysis of aerosols under varying plant conditions aids in the selection of new equipment

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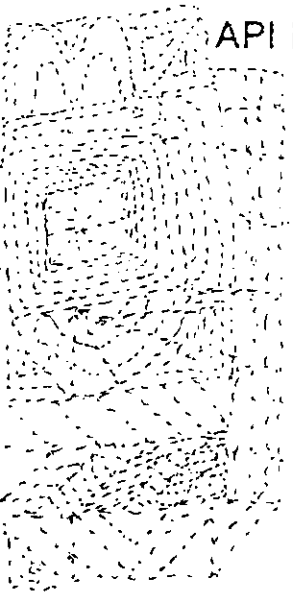
Appendix
C.1
Reference 13

PARTICULATE EMISSIONS FROM NON-FIRED SOURCES IN PETROLEUM REFINERIES: A REVIEW OF EXISTING DATA

API PUBLICATION NO. 4363



American Petroleum Institute
2101 L Street, Northwest
Washington, D.C. 20037

DCN-82-203-007-10

PARTICULATE EMISSIONS FROM NON-FIRED SOURCES IN PETROLEUM REFINERIES: A REVIEW OF EXISTING DATA

FINAL REPORT

Prepared for:

American Petroleum Institute
The Particulates Task Force

Prepared by:

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CORPORATION

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Those Radian employees who worked on this project and their contributions include: W. D. Balfour, review of test methods; M. A. Capalongan, data source reviews; S. R. Fernandes, program management; S. L. Henneman, report production; W. R. Hearn, engineering review; J. L. Meling, data source reviews; and the library staff, source identification and retrieval.

1.0 INTRODUCTION

This report presents the results of a study of particulate emissions from non-fired sources in petroleum refineries. These sources include catalytic cracking processes, coking, sulfur species control operations, cooling towers, asphalt blowing, solids handling, and other miscellaneous sources. The objective of this API-funded study was to gather and evaluate all available data on refinery non-fired particulate emissions. In addition to mass emission data, the particle size distribution (PSD) and the chemical composition of the particulate matter were of interest.

1.1 Technical Approach

The task of data collection was accomplished by a literature search for published data and a limited survey to find unpublished data. Published data were identified by a combination of computer based on-line searches and a manual search of recent issues of appropriate journals. The on-line data bases searched are listed in Table 1-1. After completing the collection of published literature, Radian sent a request for unpublished data to the EPA, several states, vendors, and six major oil companies. The unpublished data thus obtained were used to supplement the literature data and to provide an accurate picture of the available data on refinery non-fired particulate emissions.

Each piece of test data was carefully reviewed to determine whether or not it was suitable for inclusion in the data base. Review criteria included documentation of methodology, acceptability of test methods, documentation of process conditions, and representativeness of process conditions. Based on these criteria, each source was rated as good, fair, poor, unknown, or unacceptable quality. Only sources of good and fair quality were included in the final data base. Guidelines for assessing data quality are given in Table 1-2.

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TABLE 1-1. ON-LINE DATA BASES SEARCHED

Data Base	Description
APILIT	Worldwide refining literature.
APTIC	Broad air pollution data base.
CHEMICAL ABSTRACTS	Papers on pure and applied chemistry.
COMPENDEX	Worldwide coverage of major journals, publications, and societies.
COMPREHENSIVE DISSERTATION INDEX	Guide to doctoral dissertations from American Universities.
CONFERENCE PAPERS INDEX	Papers from technical meetings.
DOE ENERGY	Literature on all aspects of energy.
ENVIROLINE	Environmental literature.
NTIS	Government sponsored research.
POLLUTION	Worldwide environmental literature.

TABLE 1-2. CRITERIA FOR EVALUATING DATA

1. Good Quality - Well documented, standard procedures have been used to acquire these data; these data have withstood peer review (i.e., publication in a respect-journal); data precision and accuracy have been statistically evaluated.

2. Fair Quality - The procedure (or individual steps within a procedure) is either poorly defined, not well documented, or has been modified.

3. Poor Quality - Data need replacement; inappropriate or perhaps invalid procedures have been used in data acquisition; data does not withstand peer analysis; the accuracy and precision of the data are unknown or undefined.

4. Unknown Quality - Data require corroboration; sampling and/or analytical techniques are new or unknown; applicability of methods used for data acquisition to a specific problem is uncertain.

5. No Practical Utility - Data cannot be substantiated; data are known to be unreliable and should not be used; data lack some critical piece of information (for instance, if mass emission data is expressed in lb/hr and no process capacity is given, the data cannot be normalized for comparison to other units).

A worksheet was completed for each data source. These worksheets provided a quick summary of the data source, refinery source, emission data, and data quality rating. The completed worksheets are included as Appendix A, and the existing data base is summarized in Section 2.

1.2 Summary of Results

A large volume of data on particulate emissions from non-fired refinery sources was located. The existing data base was deemed to be adequate for the following sources:

- Fluid Catalytic Cracking Units (FCCU) with conventional control technology (cyclones, CO Boilers, electrostatic precipitators, and scrubbers)
- sulfuric acid plants, and
- cooling towers.

A second group of sources was found to be only partially characterized, but of little significance due to extremely low particulate emissions and/or unit populations. That group included:

- other cracking processes,
- sulfur recovery operations,
- asphalt blowing/incineration, and
- fluid coking.

A third group was identified as possibly needing further characterization. These units have little or no data in the existing data base and either have significant current populations or growth potential. Included

in this group are delayed cokers and FCCU's with emerging technology (heavy oil cracking, SO_2 adsorbing catalyst, etc.).

2.0 SUMMARY OF AVAILABLE DATA

Available published and unpublished data on particulate emissions from refinery non-fired sources have been reviewed for this study. Table 2-1 summarizes the resulting data base by source type/control technology categories. The term "data element," as used in the table, denotes an independent piece of data on a process unit. If one literature reference presented data on three different units, that was considered as three data elements. If a source was tested three times on successive days, the results were averaged and considered as one data element. If, however, that source was tested at three widely separated times (e.g., start-of-run, mid-run, end-of-run), each test was considered a data element.

The data have been sorted by the type of refinery process and, where appropriate, by the type of emission control applied. The data have been further subdivided into mass emission data, particle size distribution (PSD) data, and chemical composition data. The PSD data are presented in the range of 0.1 to 10 microns. This was done because most of the available data fell within that range. The following subsections summarize the data by those categories. More detailed data can be found in the individual worksheets in Appendix A. Each worksheet has a reference identification which corresponds to the reference list at the end of this section.

2.1 Available Data by Source Type

2.1.1 Catalytic Cracking Processes

Most of the data found in the open literature were associated with Fluid Catalytic Cracking Units (FCCU). The FCCU data are presented by control type, followed by a brief summary of data on other catalytic cracking processes.

TABLE 2-1. SUMMARY OF AVAILABLE PARTICULATE DATA FOR REFINERY NON-FIRED SOURCES

Source Type/Emission Control	Number of Acceptable Data Elements			Number of Unusable Data Elements
	Mass Emissions	Particle Sizes	Composition	
Fluid Catalytic Cracking Units (FCCU)/				
Internal Cyclones	9	14	1	14
External Cyclones	1	1	0	
CO Boiler	2	1	2	
Electrostatic Precipitator (ESP)	4	2	0	
ESP and CO Boiler	20	5	5	
CO Boiler and Wet Scrubber	3	1	0	
Granular Bed Filter	0	1	0	
Centrifugal Swirl Vane Separator	1	1	0	
High Temperature Regeneration and SO_2 Absorbing Catalyst	1	0	0	
Thermofor Catalytic Cracking Unit (TCCU)	3	0	3	1
Moving Bed Catalytic Cracking Unit	1	0	0	
Houdriflow Catalytic Cracking Unit (TCCU)	0	0	1	
Fluid Cokers	5	2	0	3
Sulfur Species Control Operations				
Claus Units	0	0	1	0
Claus plus Beavon/Stretford	2	0	0	
Sulfur storage vent	1	0	0	
Sulfuric Acid Plants	1	3	0	
Cooling Towers - Mechanical Draft	2	2	2	3
- Natural Draft	1	2	2	
Asphalt Blowing/Incineration	0	0	1	1
Other Miscellaneous Solids Handling	0	0	0	0

2.1.1.1 Fluid Catalytic Cracking Units (FCCU)

The FCCU is potentially the most significant particulate emitter of all refinery processes, but a variety of sophisticated emission control systems has greatly reduced those emissions. A large body of FCCU test data was found in both the open literature and from unpublished sources, but because of the many diverse emission controls, this source category is still only partially characterized.

The FCCU data have been subdivided into mass emission data, particle size distribution (PSD) data, and chemical composition data. The available mass emission data have been summarized in Table 2-2. Each mass emission data element is given along with its reference identification. The range and mean of the available data are also presented.

The available particle size distribution (PSD) data are presented graphically in Figures 2-1 through 2-10. Figures 2-1 through 2-3 present data for FCCU's with internal cyclones. Figures 2-4, 2-5, and 2-6 present data for external cyclones, CO Boiler, and ESP, respectively. Figure 2-7 presents PSD data for units with both an ESP and CO Boiler. Figure 2-8 presents data on FCC units with wet scrubbers. Figure 2-9 presents the range of PSD data for the two best characterized cases, units with internal cyclones and units with both ESP and CO boiler. Figure 2-10 presents a "typical" PSD for each control technology.

A few observations can be made concerning the FCCU PSD data. The median particle size ranged from under 1 to over 10 microns, with a mean value in the 2 to 3 micron range. Submicron particles accounted for from 10 to 50 percent of the total particulate mass, and that percentage increased with increasing control efficiency. Particles of greater than 10 microns were a significant component of uncontrolled FCCU emissions (15 to 60%), but were only a minor proportion when highly efficient controls were used (1 to 20%).

TABLE 2-2. FCCU MASS EMISSION DATA

lb/10^3 Bbl Fresh Feed

Emission Control System	Mass Emission Data Elements (Reference #)			Range (Mean)	AP-42 Emission Factor (Reference #)
Internal Cyclones	244 (U6) 16.8 - 49.5 (U9) 1440 (R#19)	87.5 (U7) 93 - 340 (R#5) 51 to 887 (R#18)	26 (U8) 155 (R#30)	16.8 - 1440 (303)	242 (R#30)
External Cyclone(s)	10.3 (U10)			(10.3)	-
CO Boiler	68.2 (U4)	10.8-657 (R#18)		10.8 - 657 (245)	-
Electrostatic Precipitators (ESP)	18.5 (U20) 96.9 (R#2)	70.6 (R#9)	4.1 (R#19)	4.1 - 96.9 (47.5)	-
ESP and CO Boiler	37 (R#34) 34 (R#34) 21.1 (R#23) 64.6 (R#31) 28.8 (R#31) 18.1 (R#31) 14.2 (R#33)	20 (R#34) 36 (R#34) 13.6 (R#31) 12.4 (R#31) 13.3 (R#31) 15.3 (R#31) 7 - 150 (R#5)	33 (R#34) 34.8 (U1) 20.9 (R#31) 9.1 (R#31) 10.9 (R#31) 33.5 (R#21)	9.1 - 150 (29.9)	45 (R#30)
CO Boiler and Scrubber	10 (R#34)	8.4 (R#34)	8.9 (U5)	8.4 - 10 (9.1)	-
Complete Regeneration and SO_2 Absorbing Catalyst	43.2 (R#3) 44.2 (R#3)			(43.7)	-

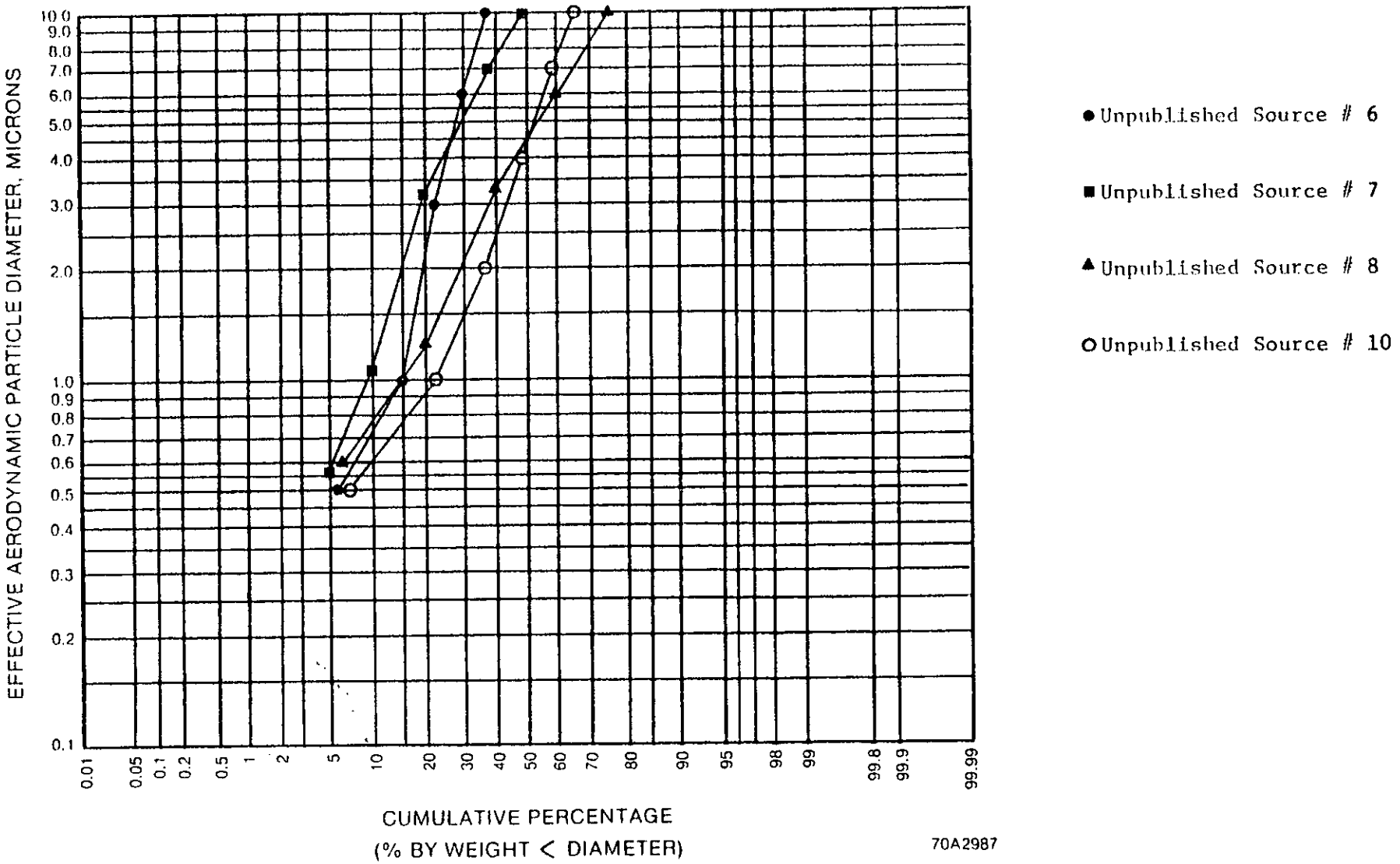


Figure 2-1. PSD for FCCU's with Internal Cyclones

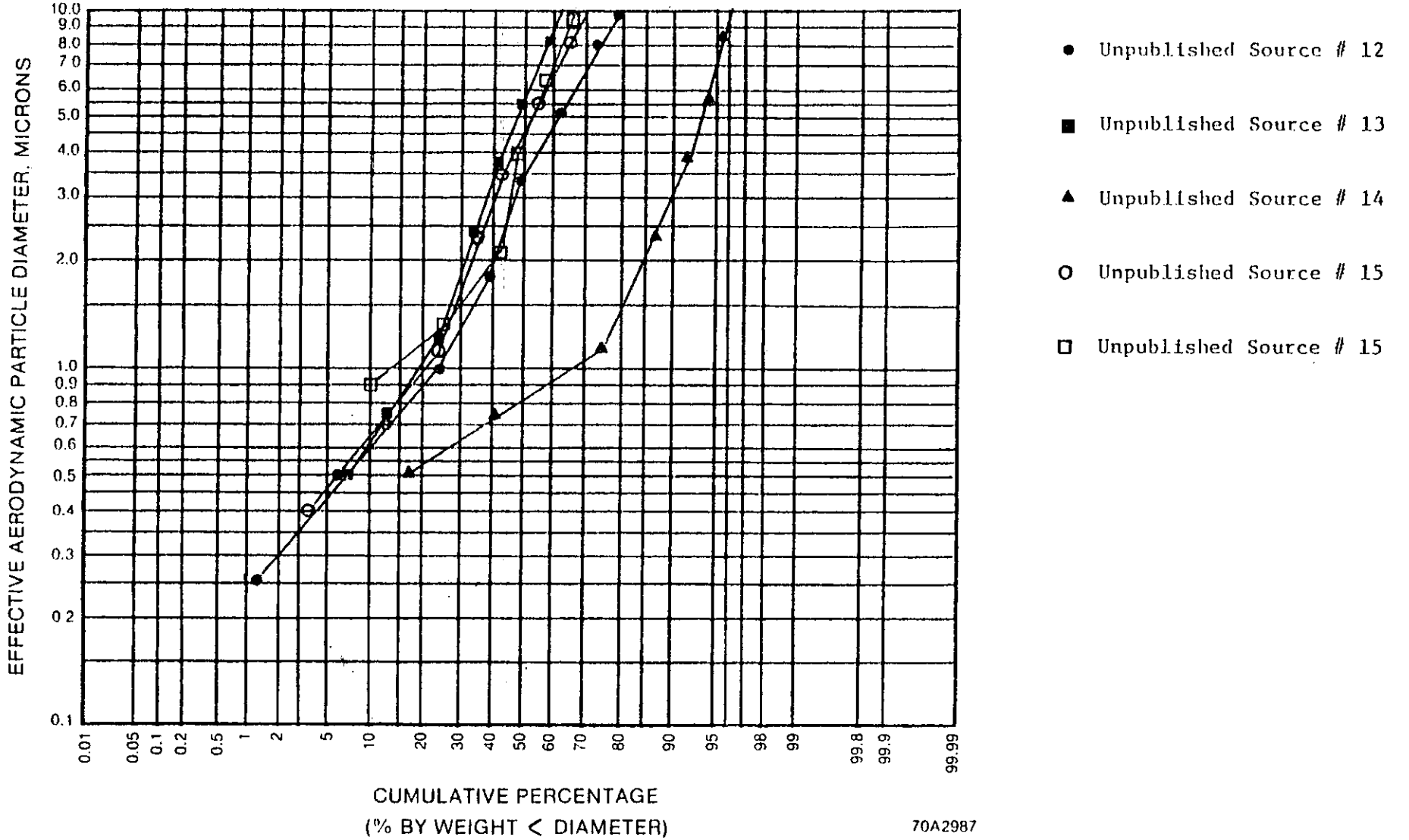


Figure 2-2. PSD for FCCU's with Internal Cyclones

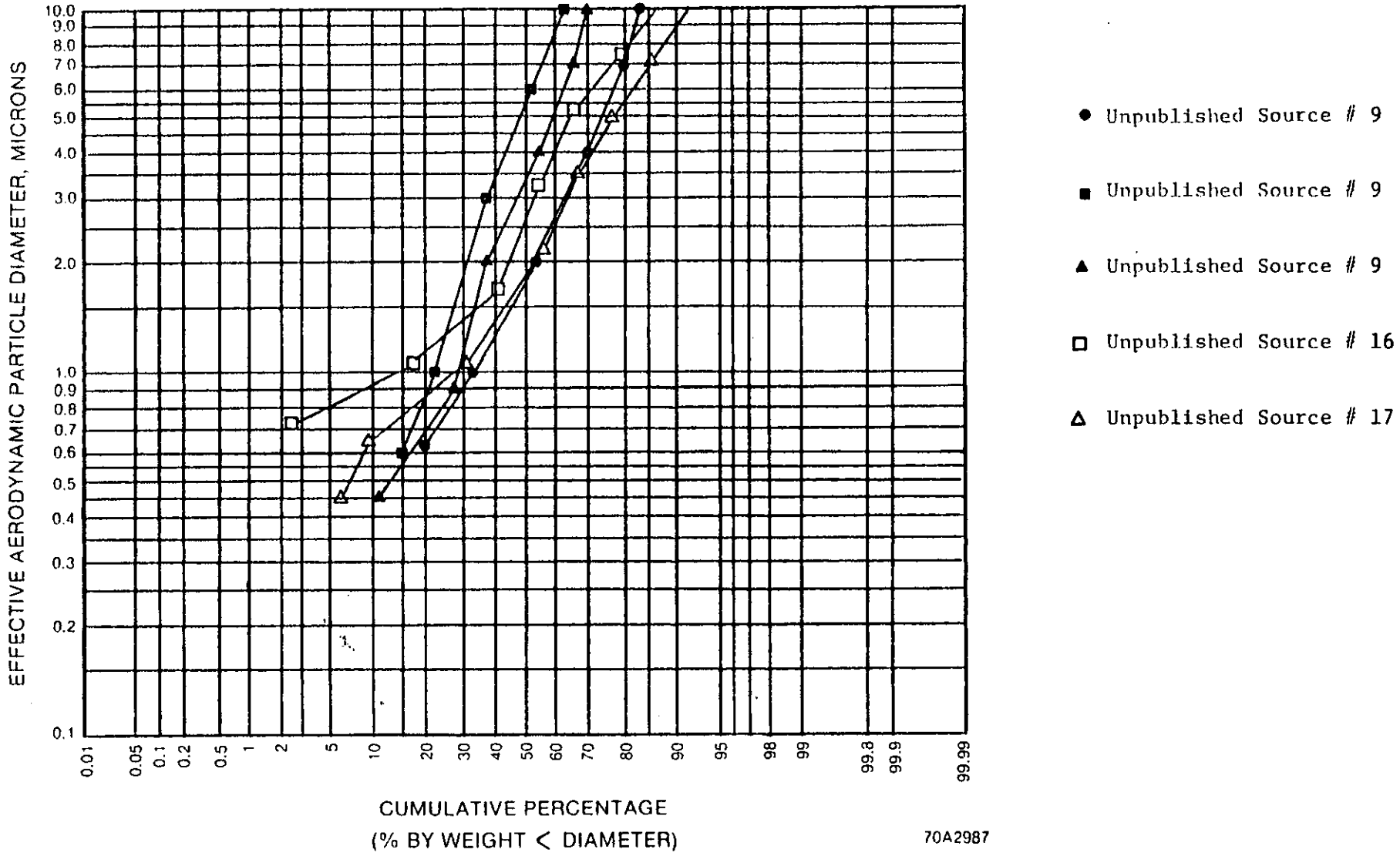
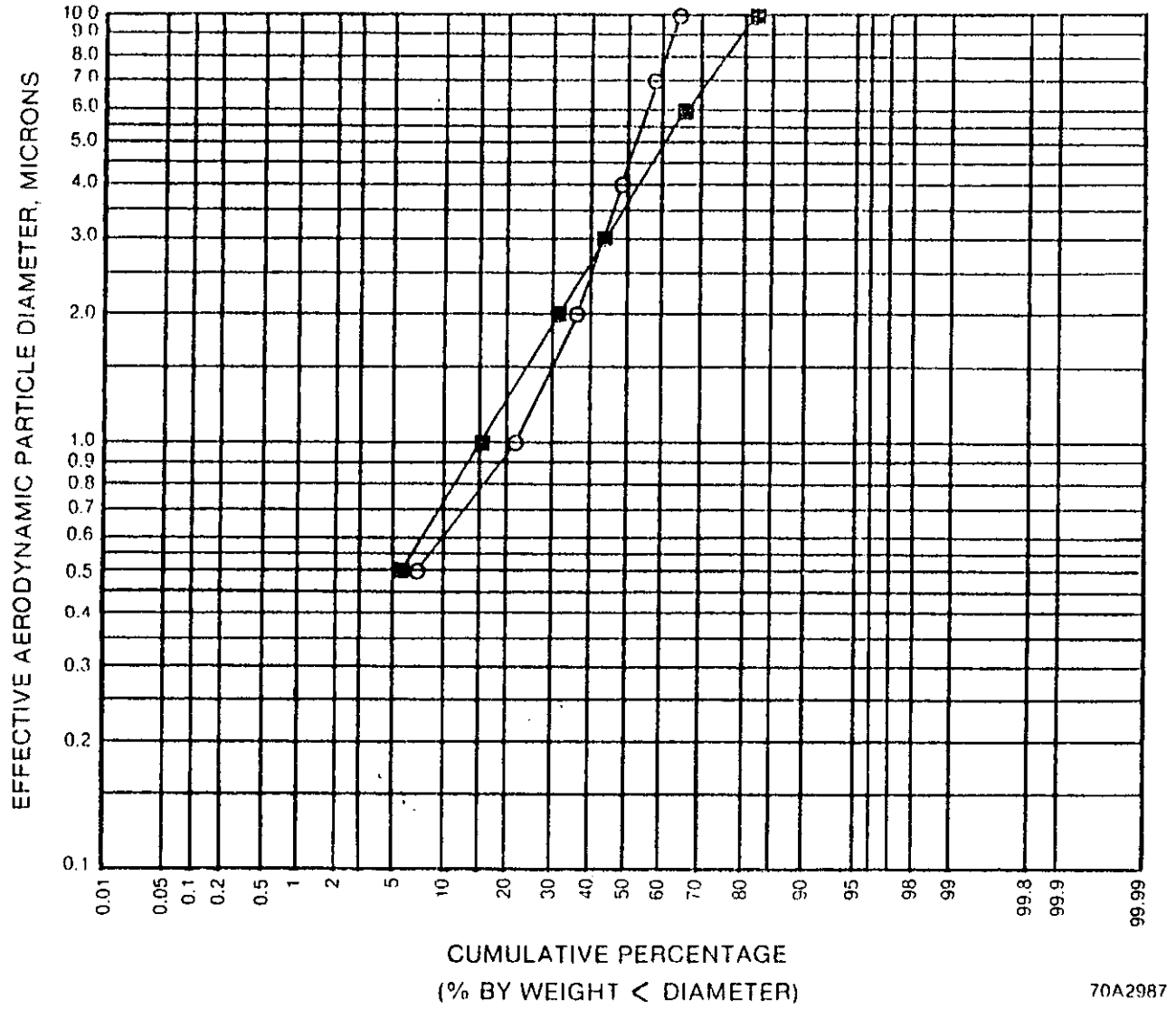


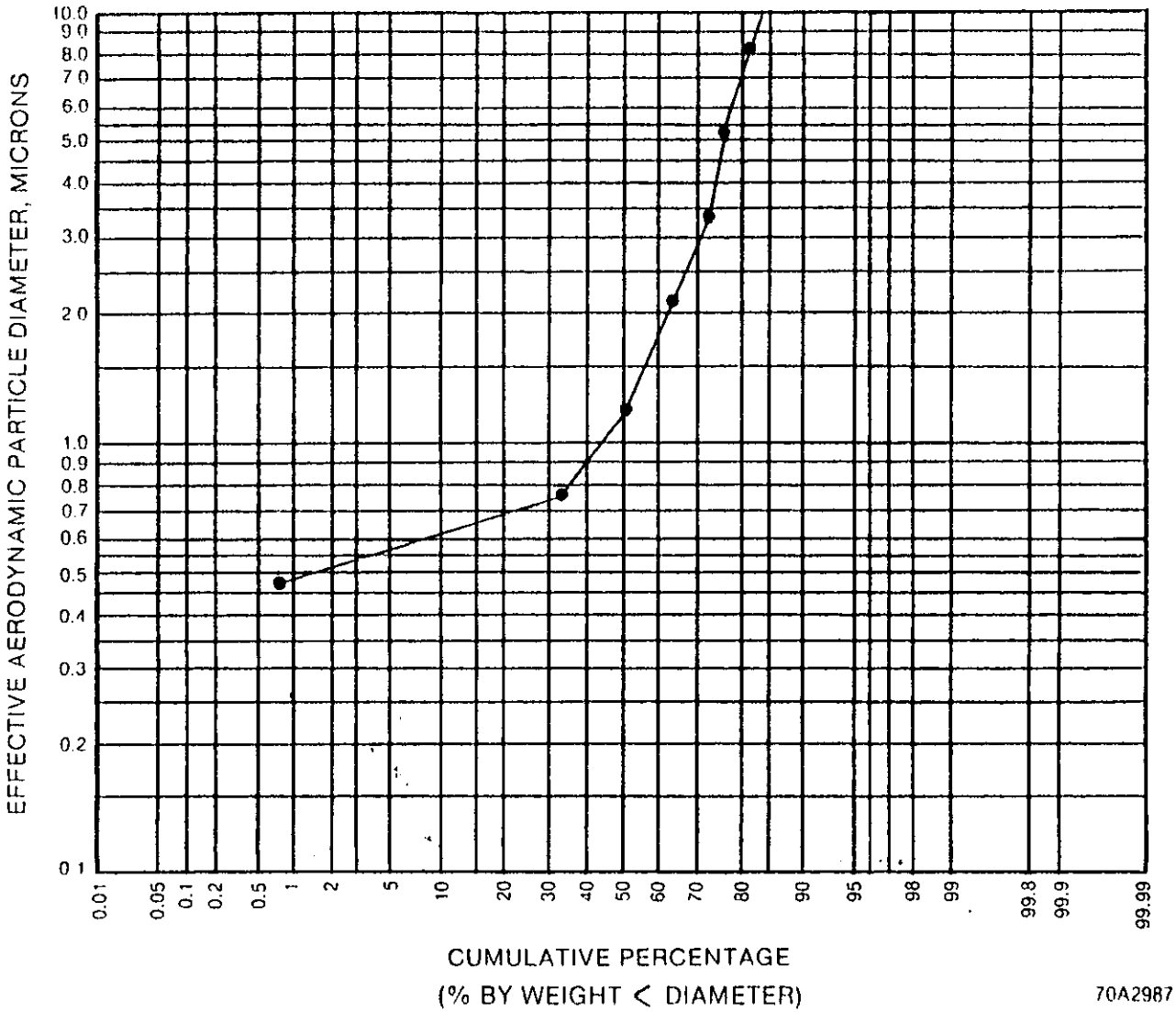
Figure 2-3. PSD for FCCU's with Internal Cyclones



■ Unpublished Source # 10 External Cyclone Exit

○ Unpublished Source # 10 Cyclone Inlet

Figure 2-4. PSD For FCCU with External Cyclone



● Unpublished Source # 4

Figure 2-5. PSD for FCCU with CO Boiler

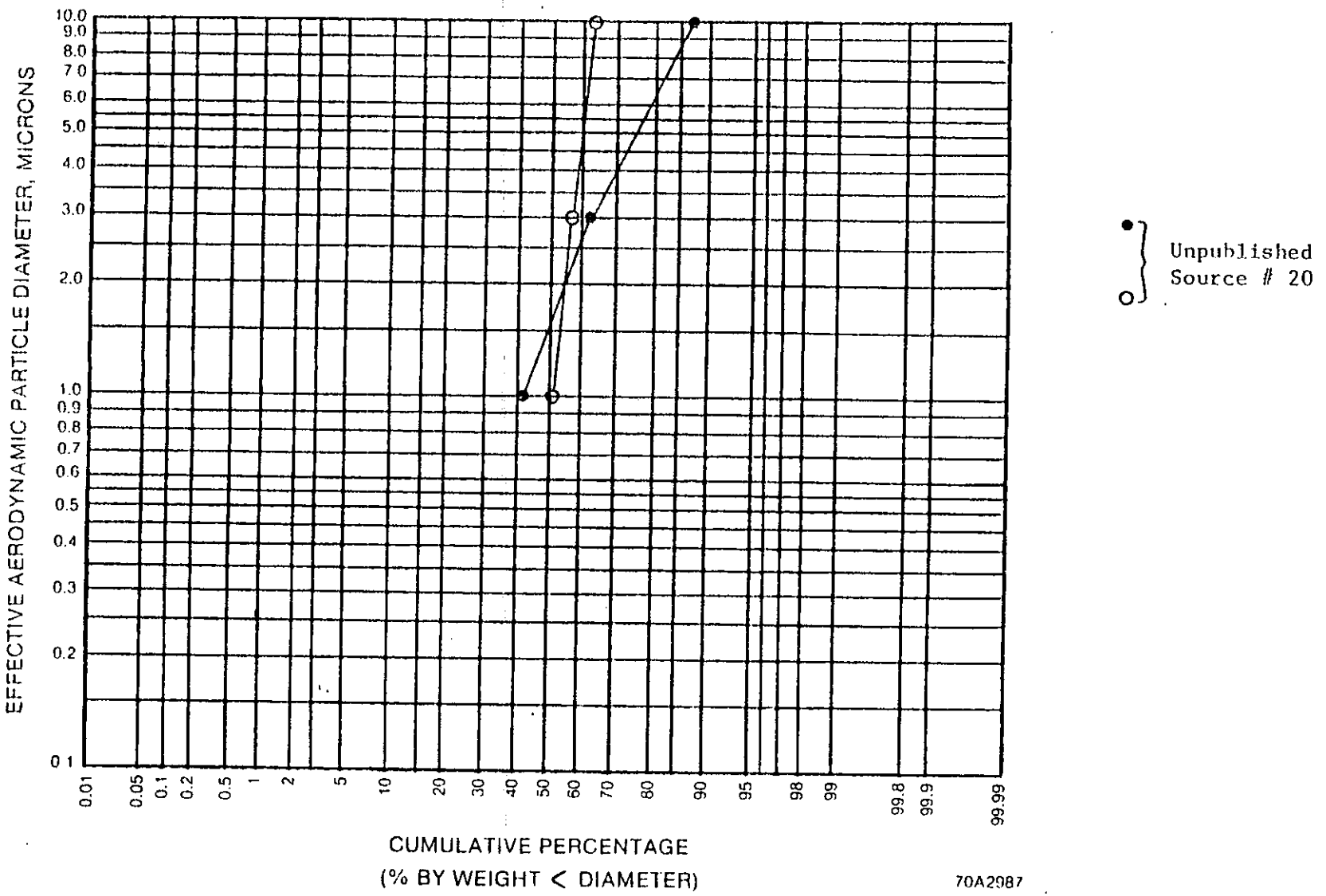


Figure 2-6. PSD for FCCU with ESP

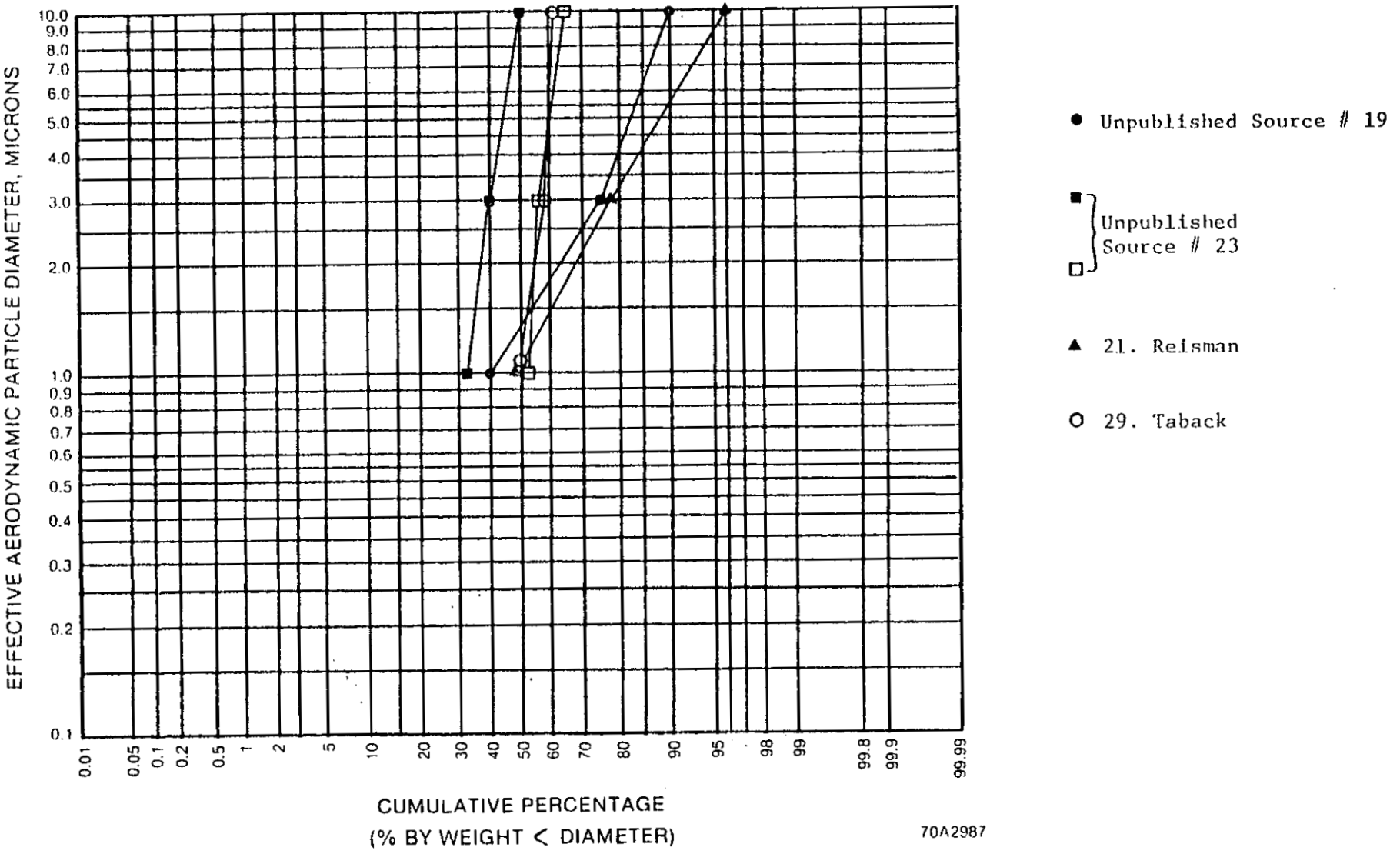


Figure 2-7. PSD for FCCU'S with ESP and CO Boiler

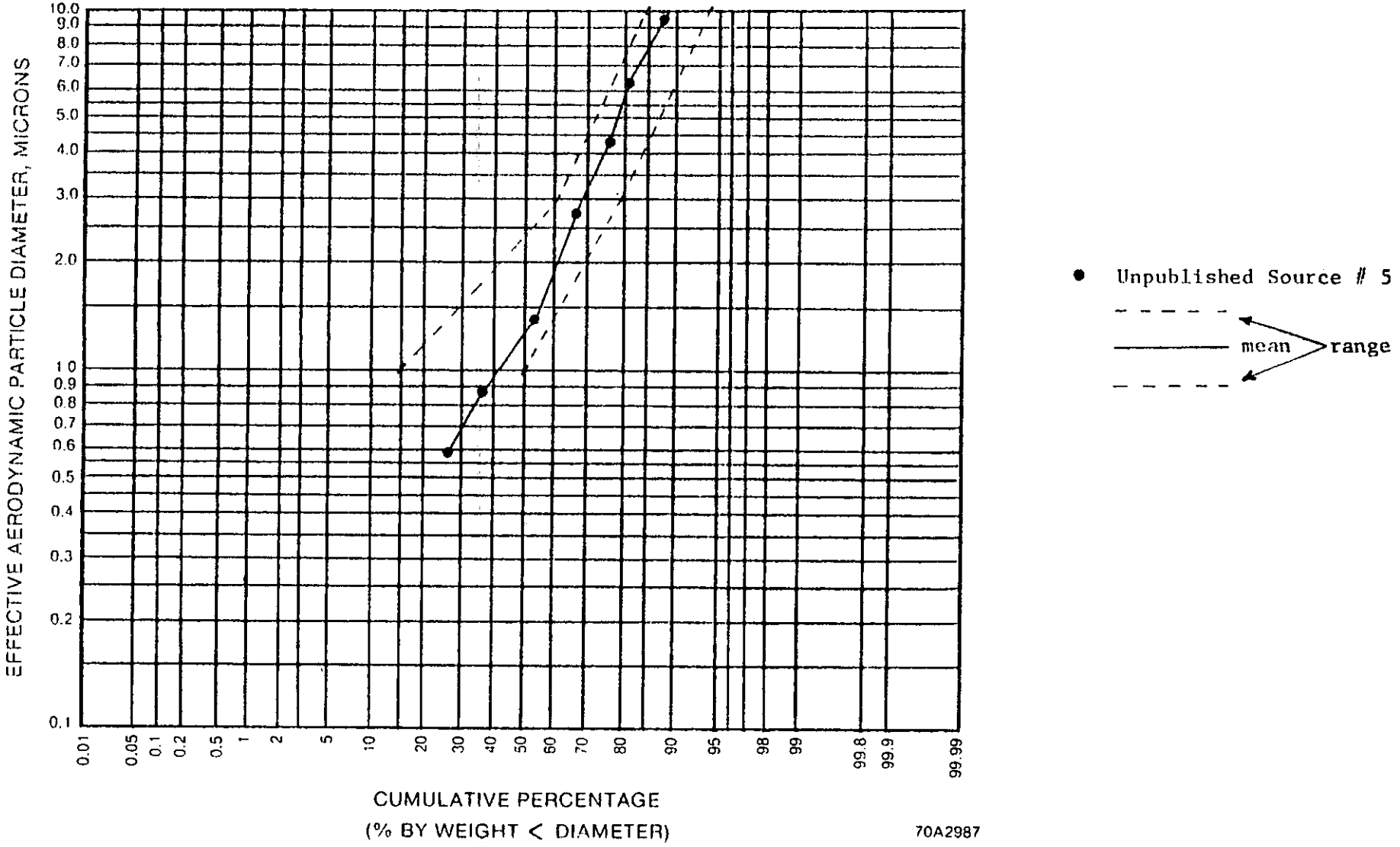


Figure 2-8. PSD for FCCU with CO Boiler and Scrubber

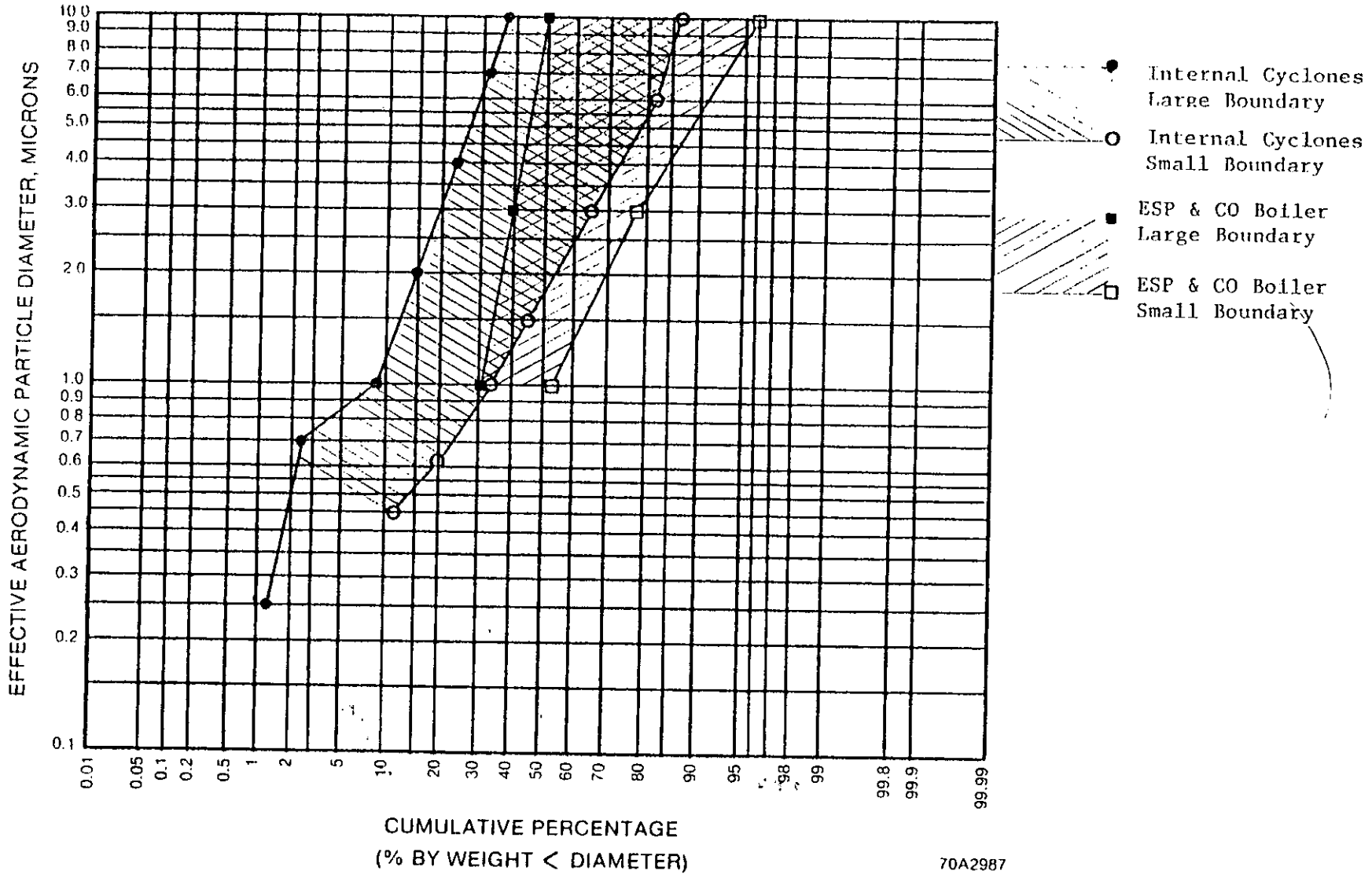


Figure 2-9. Comparison of FCCU PSD: Internal Cyclones vs ESP and CO Boiler

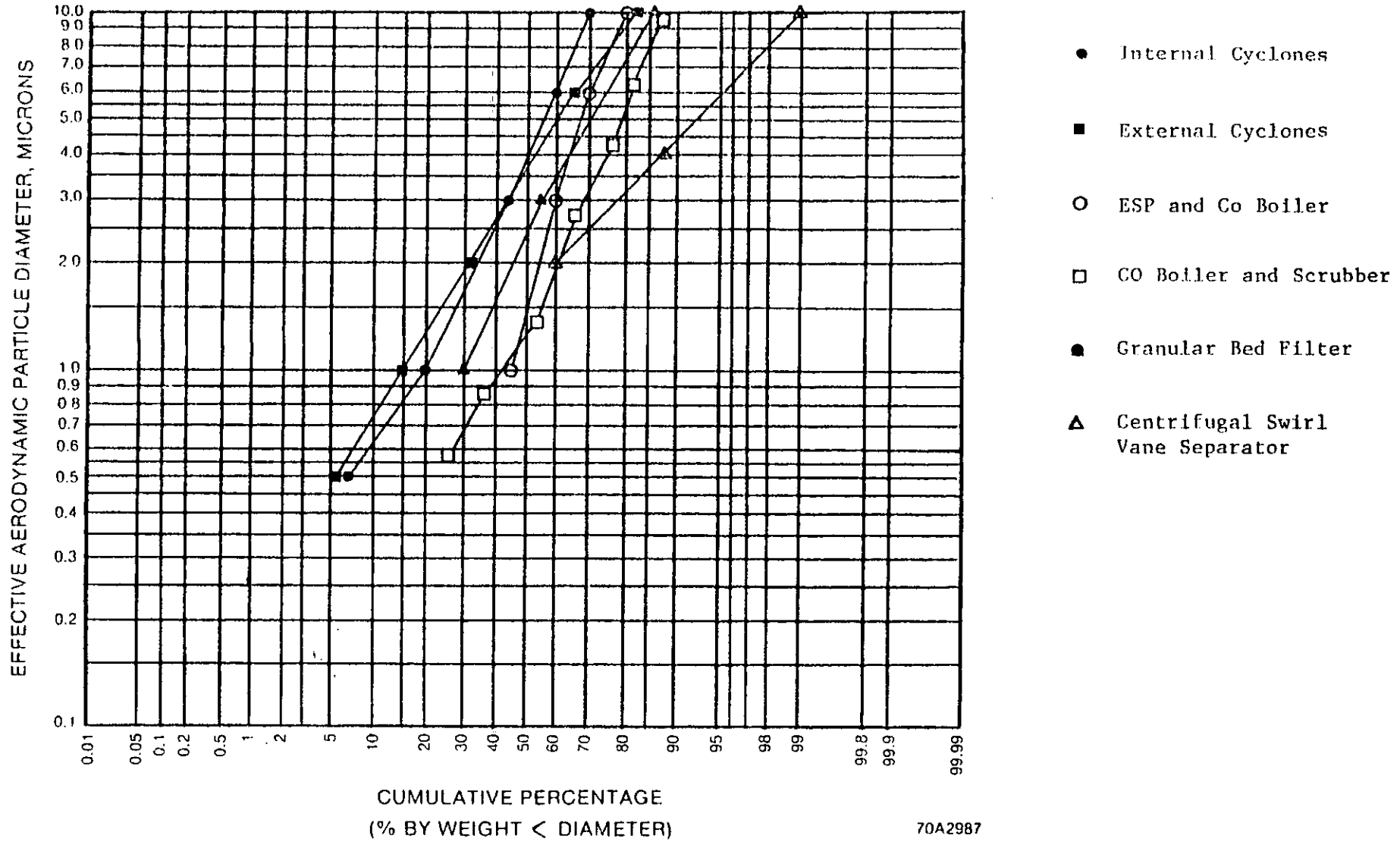


Figure 2-10. Mean PSD for FCCU's with Various Control Technologies

Data on the chemical composition of particulates from FCCU's were found for seven units. The majority of the data were inorganic elemental analysis, and these data are summarized in Table 2-3. Some data were also found concerning particulate polycyclic organic material (PPOM) which are presented in Table 2-4.

A brief discussion of the factors which can potentially affect particulate emissions from an FCCU is worthwhile at this point. The most significant factor is certainly the type of emission control equipment employed, and all of the data presented here are organized by type of particulate control. Particulate emissions can also be affected by the type of regeneration, the type of catalyst, and the feed to the FCCU. Since such detailed process information was not available for most of the test data, these factors cannot be accounted for quantitatively. The following general discussion will point out the directional effects of these factors.

Conventional operation of an FCCU regenerator combusts the coke on catalyst at temperatures ranging from 1000 to 1100°F and results in a flue gas with roughly equal concentrations of CO and CO_2. The combustion of the flue gas is often completed in a downstream CO Boiler. During the mid-1970's, refiners began to experiment with completing the flue gas combustion in the regenerator. This was initially accomplished by raising the regenerator temperature to the 1100 to 1350°F range and was called high temperature regeneration. This new type of regeneration offered many benefits, but its acceptance was slow because the regenerator metallurgy in many existing units could not withstand the higher temperatures. That problem was largely circumvented by the development of combustion promoters which allowed complete flue gas combustion at or near conventional regeneration temperatures. A breakdown of the type of regeneration used in August 1978 is presented below. Although more recent figures have not been located, it is anticipated that current operations have shifted to favor the promoted combustion type of regeneration.

Table 2-3. ELEMENTAL COMPOSITION OF FCCU PARTICULATE

Element	Reference Number					
	34 (Stack 11)*	34 (Stack 14)*	33 (A)	33 (B)	U 19	29
	ppmw	ppmw	Wt. %	Wt. %	Wt. %	Wt. %
Aluminum	MC**	MC	<0.01	-	NQ**	-
Arsenic	4	4	<0.01	0.01	-	d**
Barium	860	790	<0.01	0.02	-	-
Cadmium	≤0.3	≤0.5	<0.01	<0.01	-	-
Calcium	MC	MC	<0.01	-	NQ	t**
Chromium	MC	840	0.11	0.01	-	-
Copper	140	40	0.05	0.09	0.03	-
Iron	MC	MC	<0.01	-	0.95	t
Lead	29	54	<0.01	<0.01	-	d
Magnesium	200	MC	<0.01	-	-	-
Mercury	-	<0.3	<0.01	<0.01	-	-
Nickel	550	300	0.11	0.01	0.03	d
Potassium	MC	MC	<0.01	-	-	-
Selenium	5	36	0.01	<0.01	-	-
Silicon	MC	MC	<0.01	-	NQ	10
Silver	≤0.3	0.5	<0.01	-	-	-
Sodium	MC	MC	<0.01	-	NQ	-
Tin	4	5	<0.01	-	-	-
Vanadium	100	150	<0.01	0.01	<0.05	-
Zinc	130	260	0.07	0.13	0.3	-
Total Carbon	-	-	22.6	20.0	-	2
Volatile Carbon	-	-	-	-	-	1.5
Solvent Extractables	-	-	18.0	29.0	-	-
Hydrogen	-	-	5.9	1.8	-	-
Nitrogen	-	-	4.3	0.3	-	-

* Other rate earth elements listed on data worksheet.

** MC = major component; t = 0.1 to 1.0 wt. %; d = <0.1 wt. %; NQ = detected but not quantified.

TABLE 2-4. FCCU PARTICULATE POLYCYCLIC ORGANIC MATTER CONTENT

Component	Emission Factor $lb/10^6$ Bbl. of Fresh Feed			
	R#32. Facility #1		R#32. Facility #2	
	CO Boiler Inlet	CO Boiler Outlet	CO Boiler Inlet	CO Boiler Outlet
Benzo(α)Pyrene	3.52	0.24	10.13	0.483
Pyrene	3.74	1.92	616.7	3.74
Benzo(δ)Pyrene	1.17	0.46	79.29	0.4
Perylene	nd*	nd*	nd*	nd*
Benzo[ghi]Perylene	0.33	nd*	9.25	1.21
Anthrene	nd*	nd*	46.3	nd*
Coronene	nd*	nd*	nd*	nd*
Phenanthrene	nd*	nd*	8811	nd*
Fluoranthrene	3.52	1.59	440.5	1.87

*nd - not detected.

Regeneration Technique	% of US FCCU's Using That Technique August, 1978
Conventional Regeneration	53% (R#37)
High Temperature Regeneration	26%
Combustion Promoting Catalyst	10%
Combustion Promoters (separate from the catalyst)	11%

The type of regeneration can affect particulate emissions in several ways. The regeneration temperature has an effect on the rate of sintering of catalyst particles. It is this fracturing of catalyst particles which is largely responsible for the formation of particulate matter which is fine enough to escape the internal cyclones. Thus, the severity of regenerator conditions can affect both the particulate emission rate and size distribution. The particulate composition is also affected, since conventional regeneration results in a coke content on catalyst of 6 to 7 weight percent, while high temperature and combustion promoted regeneration can achieve coke levels below 5 weight percent.

FCCU catalyst has evolved significantly over the last 20 years, going from natural clays to synthetic zeolites to present day combustion promoted and/or SO_2 adsorbing catalyst. Each type of catalyst has different characteristics in terms of fracture resistance due to mechanical and thermal stresses. As previously explained, it is the rate and nature of the catalyst fracturing that largely determines the particulate emission rate and size distribution. Since each of these catalysts may have different formulations, the particulate composition is also affected.

The feedstock to be cracked can also have a noticeable effect on particulate emissions. A heavier (more refractive) feedstock is more difficult to crack and may require higher catalyst circulation rates. Heavier feedstocks tend to produce more coke, which requires more severe regeneration. Heavier feedstocks typically contain higher metals content, much of which is deposited on the catalyst as coke. The combined effects of higher catalyst circulation, higher coke yield, and higher metals content could cause a significant effect in particulate emissions rates, sizes, and compositions.

2.1.1.2 Other Catalytic Cracking Processes

Particulate emission data were also found for Thermofor Catalytic Cracking Units (TCCU), Moving Bed Catalytic Crackers, and Houdriflow Catalytic Cracking Units (HCCU). Most of the available data were in the form of mass emission factors and are summarized in Table 2-5. Some PPOM data were also identified and are presented in Table 2-6.

2.1.2 Fluid Coking

A limited amount of data were found on particulate emissions from fluid coking. The mass emissions data are summarized below:

Reference	Control	Emission Factor
R#30 (AP-42)	Internal Cyclone	523 lb/10^3 Bbl. Fresh Feed
R#34	Internal Cyclone	437
R#34	Scrubber and CO Boiler	153
R#5	Internal Cyclone	523
R#5	ESP and CO Boiler	6.85

In addition, PSD data from two sources are presented graphically in Figure 2-11. No composition data were found.

2.1.3 Sulfur Species Control Operations

Sulfur species, primarily H_2S from desulfurizing units, are typically controlled in refineries by either sulfur recovery or sulfuric acid plants. Both operations have some potential for producing particulate emissions.

2.1.3.1 Sulfur Recovery

Only very limited data on particulate emissions from sulfur recovery were found. Groenendaal (R#3) reported S_6 aerosols as 0.3 volume percent in Claus tail gas, but found none after incineration. An unpublished source

TABLE 2-5. MASS EMISSION DATA FOR OTHER CRACKING PROCESSES

Process	Emission Factors $lb/10^3 Bbl$ (Reference #)		Range (Mean)
Thermofor Catalytic Cracking			
Uncontrolled	17	(R#30)(AP-42)	15-18.3
Cyclones	18.3	(R#9)	(16.8)
CO Boiler	15	(R#34)	
Moving Bed Catalytic Cracking	17	(R#5)	(17)
Houdriflow Catalytic Cracking	No data		-

TABLE 2-6. OTHER CRACKING PARTICULATE POLYCYCLIC ORGANIC MATTER CONTENT

Component	Emission Factor lb PPOM/10^6 Bbl. Fresh Feed				
	(R#32) TCCU #1	(R#32) TCCU #2	(R#32) TCCU #3	(R#32) HCCU with CO Boiler	
	COB Outlet	COB Inlet	COB Outlet	COB Inlet	COB Outlet
Benzo(α)Pyrene	2643	1299	680	4515.4	0.99
Pyrene	-	5617	6170	2885	0.86
Benzo(α)Pyrene	-	1443	1810	6828	2.14
Perylene	-	157.5	-	748.9	0.11
Benzo[ghi]Perylene	-	1080	-	660.8	2.86
Anthrene	-	231.3	-	20.83	0.18
Coronene	-	7.93	-	242.3	0.18
Phenanthrene	-	7510	-	462.55	1.83
Fluoranthrene	-	440.5	-	182.82	0.51

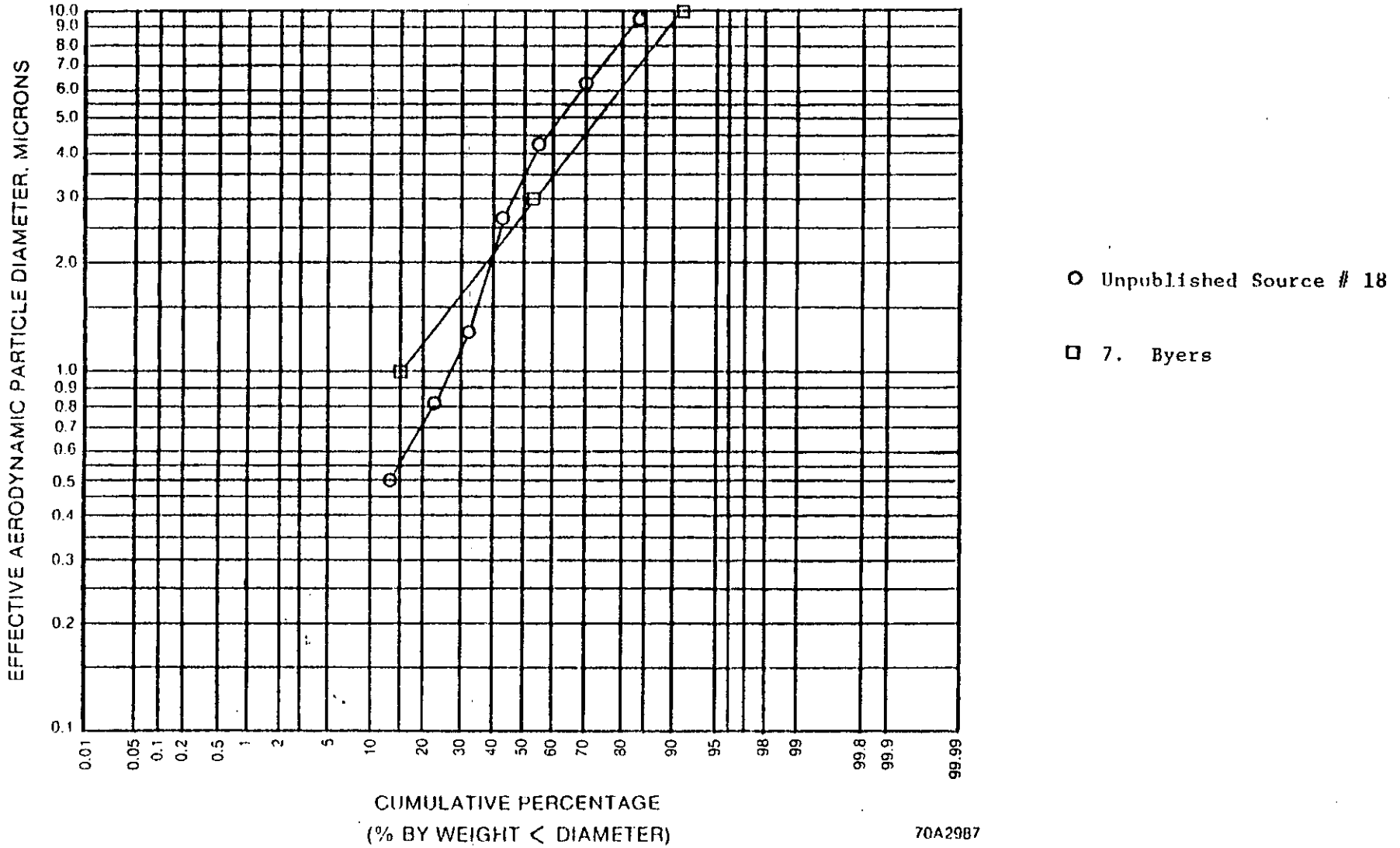


Figure 2-11. PSD for Fluid Cokers

(U24) reported 0.91 pounds per hour of particulate matter in a sulfur storage tank vent. Two other unpublished sources (U2, U3) reported 0.39 and 0.35 pounds particulate per ton of sulfur produced, respectively. These figures are for Claus units with Beavon/Stretford tail gas treating. There is no particulate matter emission factor for sulfur recovery units in AP-42.

2.1.3.2 Sulfuric Acid Production

Only one data element concerning mass emissions from sulfuric acid plants was located. Donovan (R#10) reported particulate emissions of 0.064 pounds per ton of acid produced, based on testing several units ranging from 800 to 2000 tons per day production. AP-42 (R#30) presents emission factors for 98% acid plants with ESP's as 0.10 lb/ton and for fiber mist eliminators as 0.02, 0.10, 0.11 lb/ton for tubular, panel, and dual pad configurations, respectively. Several sources presented PSD data which are graphically summarized in Figures 2-12, 2-13, and 2-14. No data were found pertaining to the chemical composition of the particulate from sulfuric acid plants, but it can be safely assumed that the bulk is sulfuric acid mist.

2.1.4 Cooling Towers

The literature contains many papers on cooling tower drift, but most of those are slanted toward plume deposition models and data. Most drift calculations are expressed as a percent of the circulating water lost. The accepted industry standard for drift was 0.2% loss, but advances in mist eliminator design and in direct measurement of drift rates have greatly reduced that factor. Roffman (R#24) reports a range of 0.001 to 0.02% loss for both mechanical and natural draft towers, based on a summary of previous testing. Furlong (R#12) reports on a mechanical draft cooling tower that was guaranteed by the manufacturer to have drift losses less than 0.008% of circulation. Holmberg (R#15) reported a 0.002% drift loss for a natural draft tower.

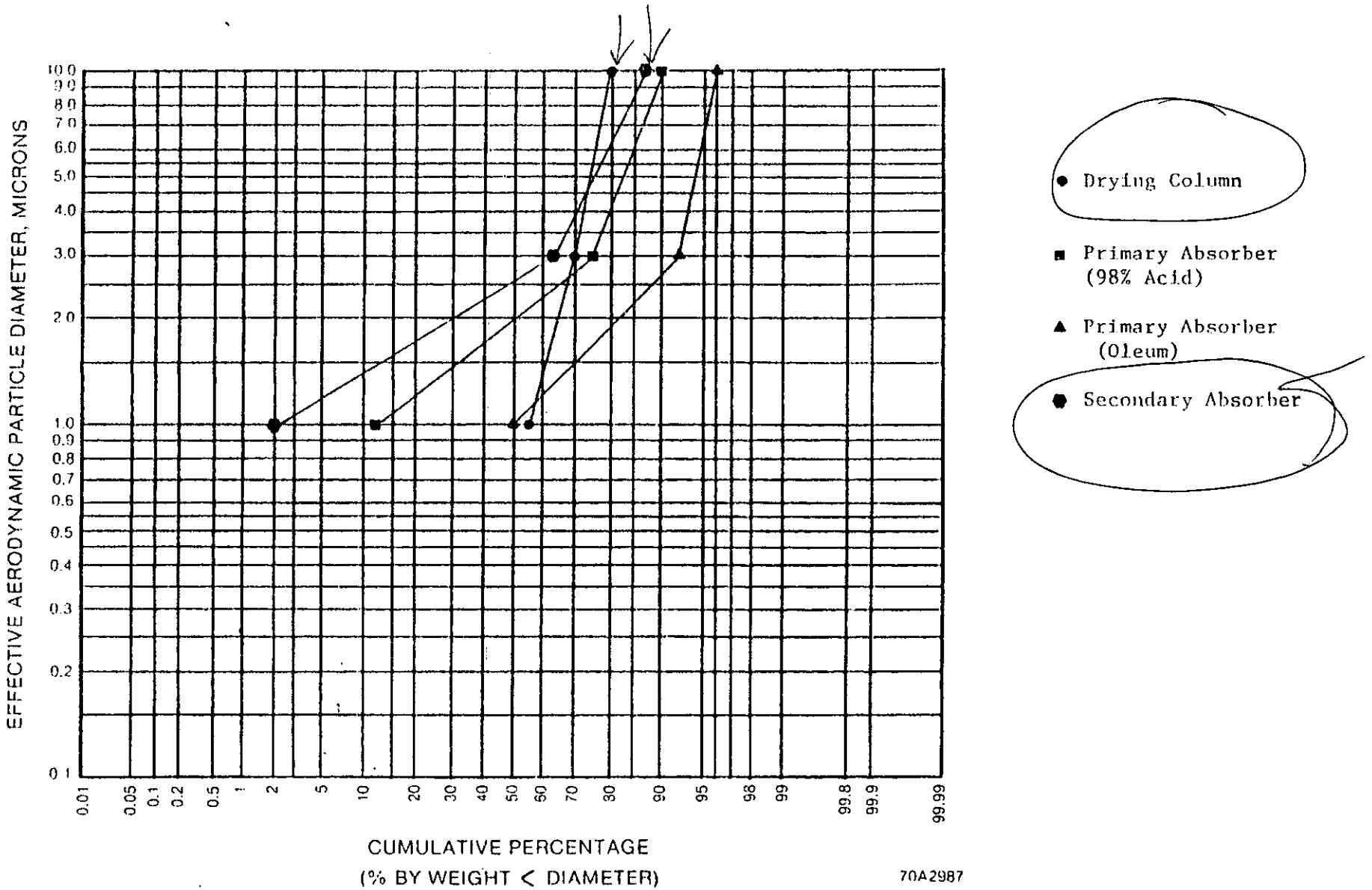


Figure 2-12. PSD for Sulfuric Acid Plants (Duros, R#11)

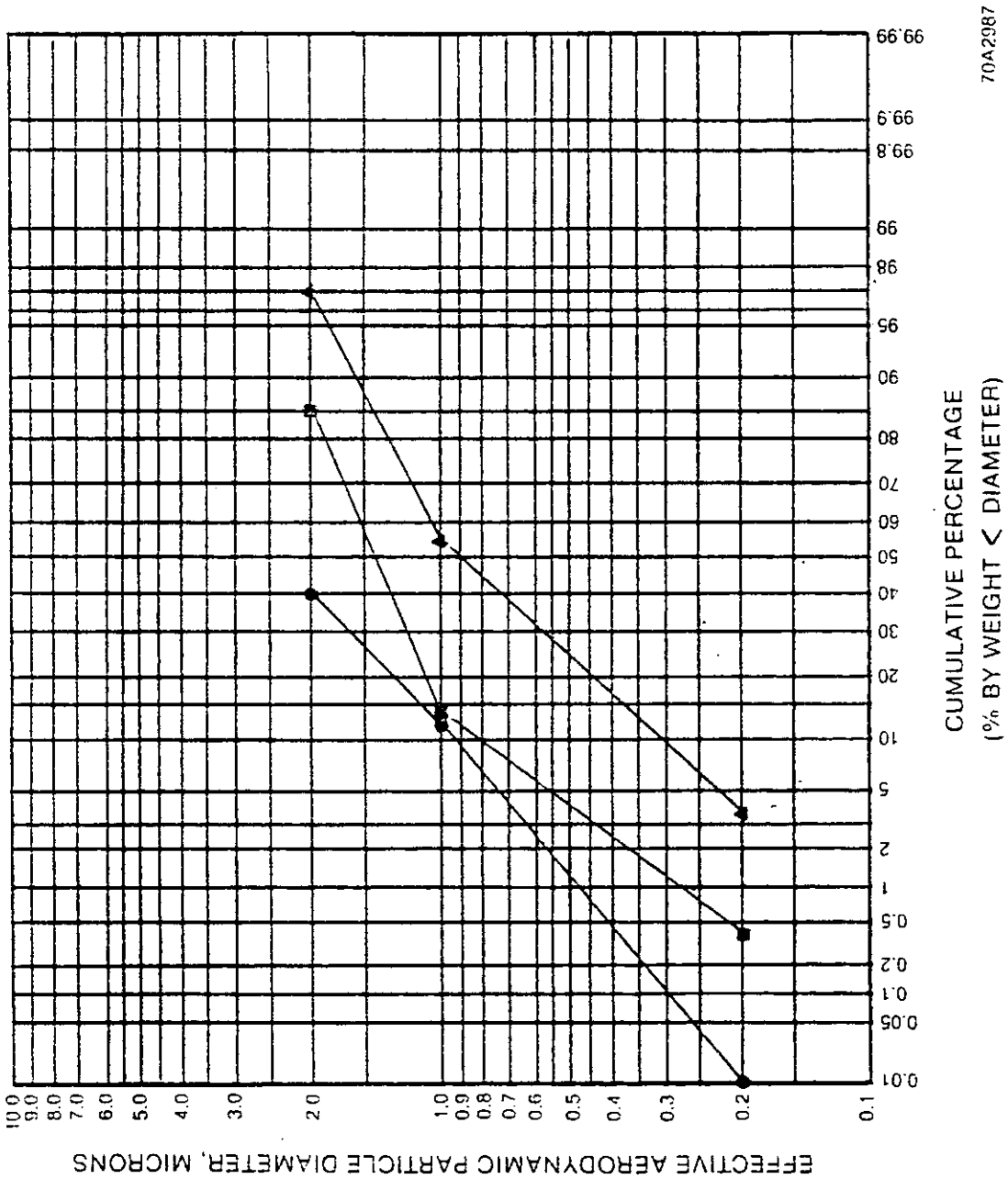


Figure 2-13. PSD for Sulfuric Acid Plants (Brink, R#4)

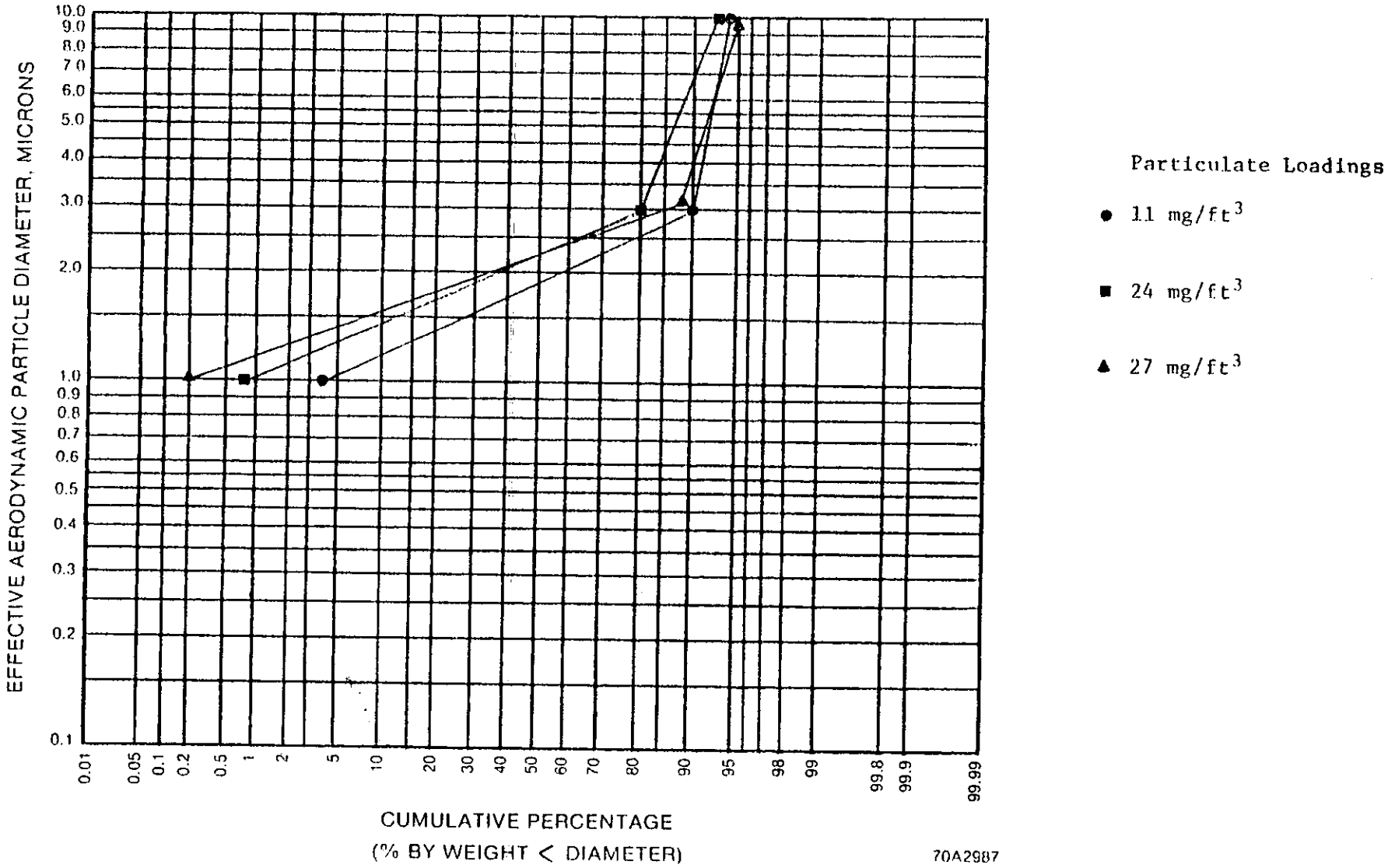


Figure 2-14. PSD for Sulfuric Acid Plants (Donovan, R#10)

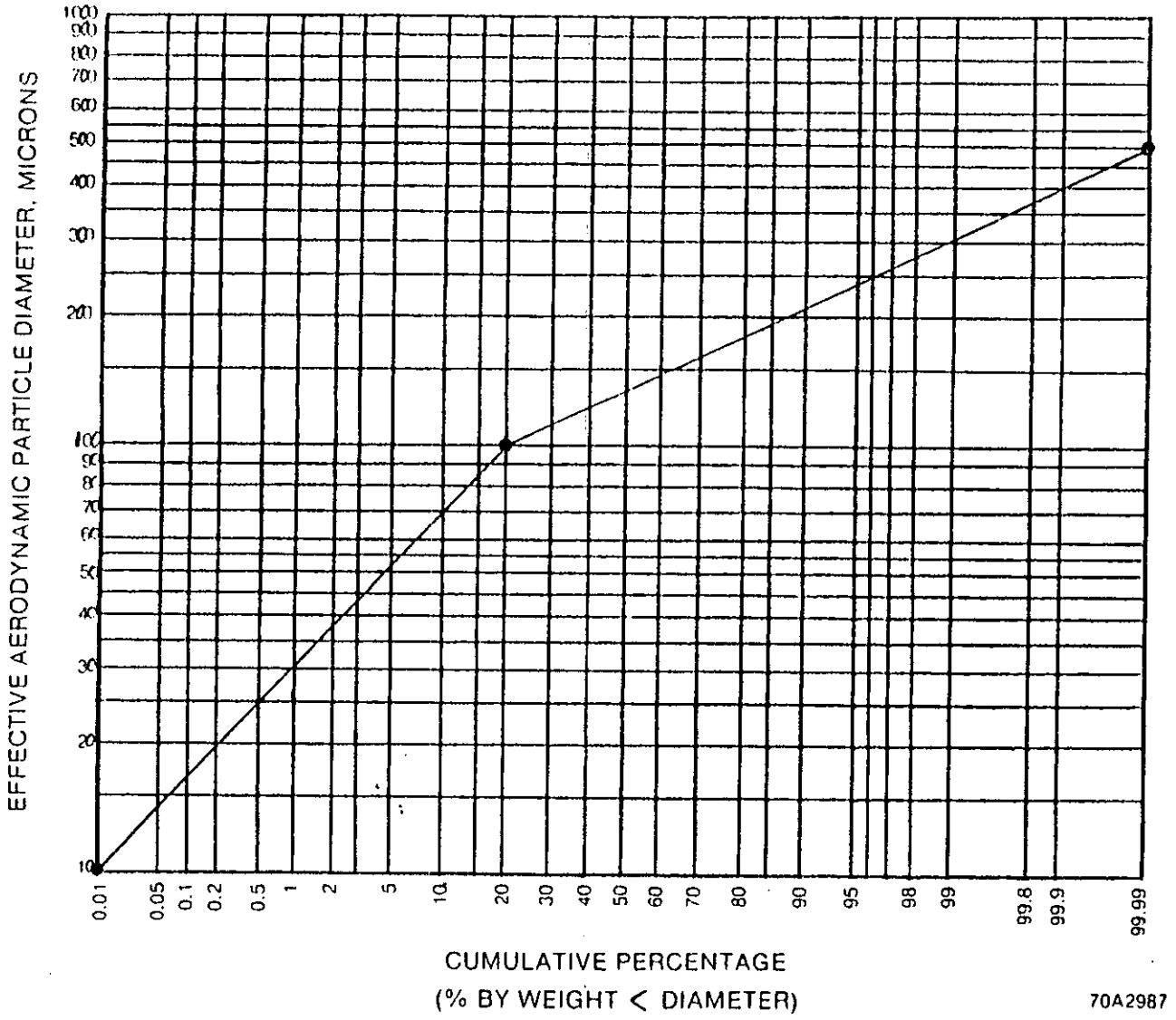
PSD data for mechanical draft cooling towers are presented in Figure 2-15. Similar data for natural draft towers are presented in Figure 2-16.

No data were found pertaining to the chemical composition of drift from cooling towers, but it can be assumed that the composition of the drift would be the same as that of the circulating water. Although a dedicated search was not performed for circulating water composition, two sources were found in the drift-related literature. Sussman (R#28) reported the following:

- pH = 4.3
- Chloride = 931 mg/l
- Sulfate = 3500 mg/l
- $CaCO_3$ = 860 mg/l
- Iron = 250 mg/l

Woffinden (R#36) presented a list of elements and classified them as trace quantities or predominant elements. The exact salts and their concentrations present in the drift will vary widely with chemical treatment, makeup water quality, and tower operation.

Cooling towers emit a different type of particulate than the other sources covered in this study. The bulk of cooling tower particulates are water droplets of comparatively large diameter (from 100 to 10,000 microns). The salt content of the circulating water will contribute some "permanent" particulate mass, but there are no data in the literature to characterize this. The range of cooling tower particulate impact is also small compared to other sources, with 80% of the particulate mass deposited within 500 feet (Reference #12). Of the smaller particulates which are dispersed in the plume, much is "fog" rather than drift. Here, drift is defined as a water particle sheared away from the circulating water and having much the same mineral concentration. Fog is a water particle which condenses in the air stream and is relatively pure water (Reference #14).



● 24. Roffman

Figure 2-15. PSD for Mechanical Draft Cooling Towers

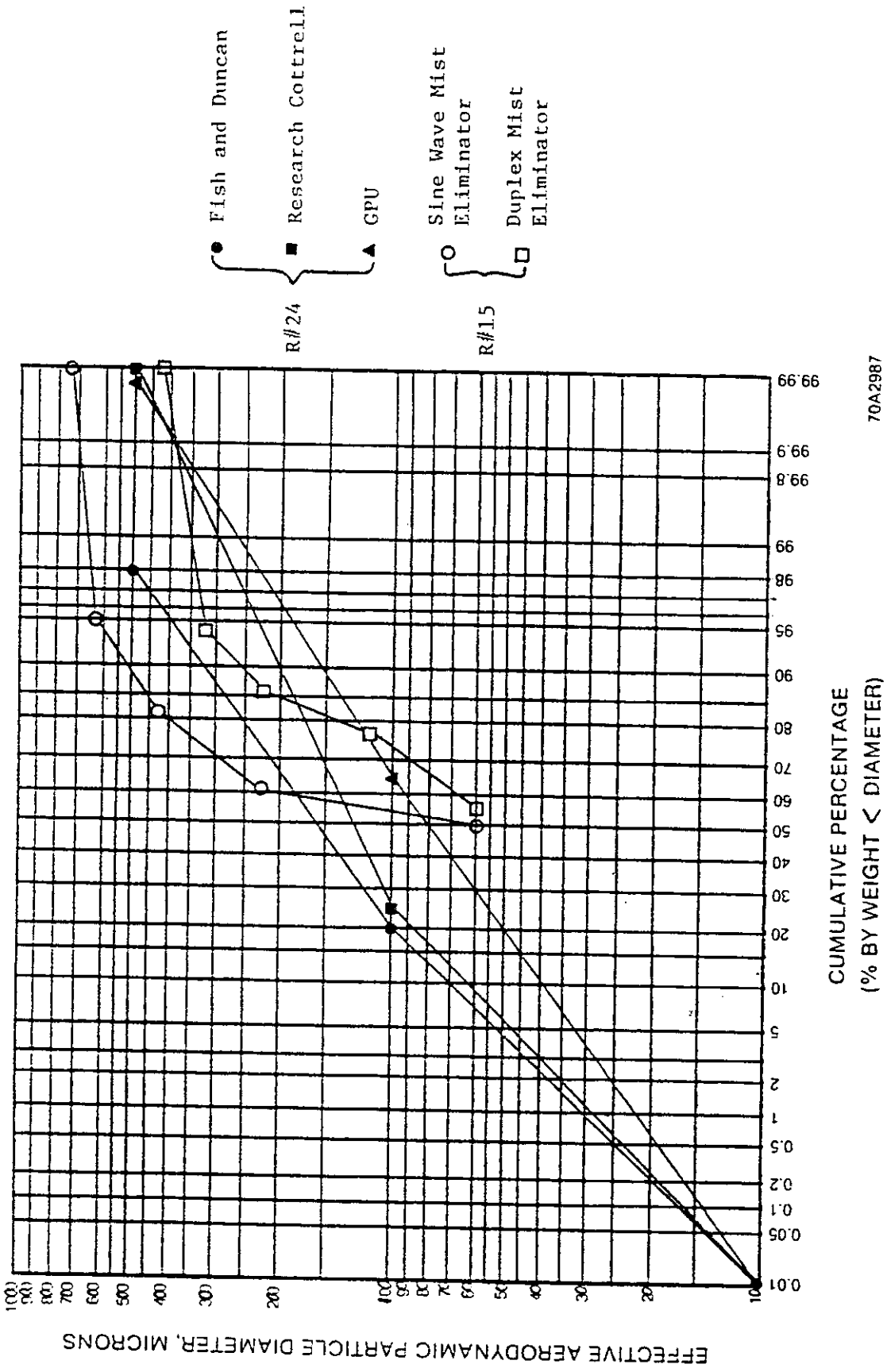


Figure 2-16. PSD for Natural Draft Cooling Towers

2.1.5 Asphalt Blowing

Very little data on particulates from asphalt blowing were located. An EPA report (R#32) gave emission factors for aerosols of pyrene and anthracene as 0.008 and 0.0006 pounds per ton of asphalt respectively.

2.1.6 Miscellaneous Solids Handling

No data were found to characterize particulate emissions from other solids handling processes in refineries.

2.2 Study Limitations

A significant effort was made to gather all available particulate emission data pertaining to non-fired sources in petroleum refineries. An extensive on-line search for published data was supplemented by a manual search of recent issues of major journals. In addition, a list of agencies and companies that would potentially have pertinent unpublished data was contacted. That group included the U.S. EPA, state air pollution control agencies in heavily industrialized states, vendors of emission control equipment, and six major oil companies. The result of these searches is a large, and fairly comprehensive, data base. In spite of this, some limitations to the data base should be noted.

The published data base should be relatively complete, especially for data sources specific to refining that were published in a major journal within the last 5 to 10 years. It is possible that some older publications, some foreign data, or some papers from minor conferences may have been missed. The one significant area where additional published data may exist is in other industries with similar sources. Such possibilities were investigated on a limited basis when little refinery-specific data were found. For instance, data from electric utility and other industries were used to supplement the cooling tower data base. The scope of this project, however, did not allow a full exploration of such "technology transfer" possibilities.

The search for unpublished data was also quite successful, yielding nearly as much quantity as published data, and much of it was of higher quality.

2.3 Data Source References

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U 2. Unpublished source # 2 (SRU with Beavon/Stretford).

U 3. Unpublished source # 3 (SRU with Beavon/Stretford).

U 4. Unpublished source # 4 (FCCU with COB).

U 5. Unpublished source # 5 (FCCU with COB and Scrubber).

U 6. Unpublished source # 6 (FCCU).

U 7. Unpublished source # 7 (FCCU).

U 8. Unpublished source # 8 (FCCU).

U 9. Unpublished source # 9 (FCCU).

U 10. Unpublished source # 10 (FCCU with External Cyclone).

U 11. Unpublished source # 11 (FCCU).

U 12. Unpubulished source # 12 (FCCU).

U 13. Unpublished source # 13 (FCCU).

U 14. Unpublished source # 14 (FCCU).

U 15. Unpublished source # 15 (FCCU).

U 16. Unpublished source # 16 (FCCU).

U 17. Unpublished source # 17 (FCCU).

U 18. Unpublished source # 18 (Fluid Coker).

U 19. Unpublished source # 19 (FCCU with ESP and COB).

U 20. Unpublished source # 20 (FCCU with ESP).

U 21. Unpublished source # 21 (FCCU with ESP).

U 22. Unpublished source # 22 (FCCU with ESP).

U 23. Unpublished source # 23 (FCCU with ESP and COB).

U 24. Unpublished source # 24 (SRU Storage Vent).

U 25. Unpublished source # 25 (HCCU)

Appendix C.1 Reference 14

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 DATE 06/21/83

ES NO: 236 DESCRIBES SAMPLING AT SITE FROM 12/14/77 TO 12/14/77 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY: CHEMICAL MANUFAC
SOURCE TYPE: INDUSTRIAL INORGANIC
PRODUCT/DEVICE: BORIC ACID
PROCESS TYPE: BORAX + SULFURIC
DESIGN PROCESS RATE: 10800 KG/HR
FEED MATERIAL CATEGORY: INORG CHEM
PRIMARY CONTROL DEVICE:

SOURCE NAME: CONFIDENTIAL
SITE NAME:
ADDRESS:
LOS ANGELES ,CA 00000

SIC CODE: 2819

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00088 SDDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN.
TABACK H.J.
KVB REPORT 5806-783 PB 293 923/AS FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL.

App. C1., Ref. 1

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE•10 CYC		
		STAGE/FILTER CUT SIZE:	8.30 UM
		STAGE WEIGHT:	1.41E+03 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	114.000 MG
		CHEMICAL ANALYSIS LABORATORY NAME:	ARMAME
2	3 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	1.90 UM
		STAGE WEIGHT:	6.00E-01 MG
3	1 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	.60 UM
		STAGE WEIGHT:	1.50E•00 MG
4	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	8.00E-01 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	8.30	1.90	.60	.01
STAGE WEIGHTS(MILLIGRAMS)	1.41E+03	6.00E-01	1.50E+00	8.00E-01
MICROGRAMS/DNCM/STAGE	9.77E+05	4.16E+02	1.04E+03	5.54E+02
NUMBER/DNCM/STAGE	3.08E+11	1.27E+10	1.63E+12	2.28E+15
CUM. %MASS<D50	.21	.16	.06	
CUM. MICROGRAMS/ACM<D50	1.23E+03	9.75E+02	3.39E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.01E+03	1.59E+03	5.54E+02	0.00E+00
GEOM D50	1.82E+01	3.97E+00	1.07E+00	7.75E-02
DM/DLOGD-(UG/DNM3)	1.43E+06	6.49E+02	2.08E+03	3.12E+02
DN-LOGD/(NUMBER/DNM3)	4.51E+11	1.98E+10	3.26E+12	1.28E+15

COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE•10 CYC	ARMAMENT LAB DID THE ELEMENTAL ANALYSIS AND ROCKWELL DID THE SULFATE, NITRATE & TOTAL CARBON. PROBE WT IS 1.3 G.

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE+10 CYC	STAGE/FILTER CUT SIZE:	9.20 UM
		STAGE WEIGHT:	2.25E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	154.000 MG
		CHEMICAL ANALYSIS LABORATORY NAME:	ARMAME
2	3 UM CYCLONE	STAGE/FILTER CUT SIZE:	3.80 UM
		STAGE WEIGHT:	5.50E+00 MG
3	1 UM CYCLONE	STAGE/FILTER CUT SIZE:	1.30 UM
		STAGE WEIGHT:	3.60E+00 MG
4	FILTER	STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	2.60E+00 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	9.20	3.80	1.30	.01
STAGE WEIGHTS(MILLIGRAMS)	2.25E+02	5.50E+00	3.60E+00	2.60E+00
MICROGRAMS/DNCM/STAGE	8.25E+03	2.02E+02	1.32E+02	9.54E+01
NUMBER/DNCM/STAGE	1.23E+35	7.79E+34	1.32E+36	5.31E+36
CUM. %MASS<D50	4.94	2.62	1.10	
CUM. MICROGRAMS/ACM<D50	2.58E+02	1.37E+02	5.73E+01	0.00E+00
CUM. MICROGRAMS/DNCM<D50	4.29E+02	2.27E+02	9.54E+01	0.00E+00
GEOM D50	1.92E+01	5.91E+00	2.22E+00	1.14E-01
DM/DLOGD-(UG/DNM3)	1.29E+04	5.25E+02	2.83E+02	4.51E+01
DN-LOGD/(NUMBER/DNM3)	1.50E+35	2.31E+35	2.66E+36	1.16E+36

COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE+10 CYC	ARMAMENT LAB DID THE ELEMENTAL ANALYSIS AND ROCKWELL DID THE SULFATE, NITRATE & TOTAL CARBON. PROBE WT IS 70.5 MG.

App. C 1, Ref. 15

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB Report 79-POT-4
April 1979

Air

EPA

Appendix
C.1
Reference 15

Potash

Emission Test Report
Kerr McGee
Trona, California

SET 2653-01-0679

FINAL REPORT

Particulate Emissions From A Potassium Chloride Drier Controlled By Two Cyclones And A Venturi Scrubber, And A Potassium Sulfate Drier Controlled By A Baghouse

EPA Contract No. 68-02-2813
Work Assignment No. 31

EMB Report No. 79-POT-4

Prepared for:

Environmental Protection Agency
Emissions Measurement Branch
ESED Mail Drop #13
Research Triangle Park, N.C. 27711

May 1, 1979

by

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.
2600 Cajon Boulevard
San Bernardino, California 92411

TABLE 2.3

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 4-18-79
Location: Kerr-McGee Plant
Sampling Location: Cyclone Inlet, Run No. 1
Traverse Point No. Sampled: 25

P_{bar} (in Hg)	28.14
Stack Temp. (^{o}F)	549
Sample Time (Min)	3
Sample Volume (cf)	1.79
Moisture (% H_2O)	11.9
Meter Temp (^{o}F)	91
Flow Setting, ΔH (in H_2O)	0.85
Nozzle Diameter (Inches)	0.250

Sample Flow Rate (at stack conditions): 0.72 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Microns)
1	1171.45[2]	97.91	100.00	14.46 and larger
2	1.10	0.09	2.08	8.96
3	4.60	0.38	1.98	5.89
4	6.15	0.51	1.60	4.35
5	3.90	0.32	1.09	2.69
6	4.90	0.40	0.76	1.38
7	4.25	0.35	0.35	0.86
8	0.00	0.00	0.00	0.56
Back-up Filter	0.00	0.00	0.00	<0.56
TOTAL	1196.35			

[1]ECD = Effective Cutoff Diameter of proceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle, cyclone and head of sampler upstream of the collection plates.

TABLE 2.4

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 4-19-79 Time: 1631
Location: Kerr-McGee Plant
Sampling Location: Cyclone Inlet, Run No. 2
Traverse Point No. Sampled: 30

P_{bar} (in Hg).....	28.25
Stack Temp. (^{o}F).....	494
Sample Time (Min).....	6
Sample Volume (cf).....	4.59
Moisture (% H_2O).....	18.0
Meter Temp (^{o}F).....	91
Flow Setting, ΔH (in H_2O)....	1.52
Nozzle Diameter (Inches).....	0.250

Sample Flow Rate (at stack conditions): 1.00 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Microns)
1	3219.2[2]	95.05	100.00	12.05 and larger
2	33.10	0.97	4.94	7.53
3	49.65	1.46	3.96	5.02
4	40.45	1.19	2.50	3.45
5	27.25	0.80	1.30	2.26
6	9.95	0.29	0.50	1.13
7	2.80	0.08	0.21	0.68
8	2.70	0.07	0.12	0.45
Back-up Filter	1.65	0.04	0.04	$<$0.45
TOTAL	3386.75			

[1]ECD = Effective Cutoff Diameter of proceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle, cyclone and head of sampler upstream of the collection plates.

TABLE 2.5

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 4-19-79 Time: 2125
Location: Kerr-McGee Plant
Sampling Location: Cyclone Inlet, Run No. 3
Traverse Point No. Sampled: 30

P_{bar} (in Hg).....	28.25
Stack Temp. (^{o}F).....	494
Sample Time (Min).....	6
Sample Volume (cf).....	4.45
Moisture (% H_2O).....	18.0
Meter Temp (^{o}F).....	91
Flow Setting, ΔH (in H_2O)....	1.52
Nozzle Diameter (Inches).....	0.250

Sample Flow Rate (at stack conditions): 0.97 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Microns)
1	3539.4[2]	93.72	100.00	12.05 and larger
2	21.80	0.57	6.27	7.66
3	73.60	1.94	5.70	5.08
4	71.35	1.88	3.75	3.51
5	47.90	1.26	1.86	2.26
6	15.05	0.39	0.59	1.15
7	2.15	0.05	0.19	0.68
8	3.60	0.09	0.14	0.46
Back-up Filter	1.70	0.04	0.04	< 0.46
TOTAL	3776.55			

[1]ECD = Effective Cutoff Diameter of proceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle, cyclone and head of sampler upstream of the collection plates.

TABLE 2.6

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 4-19-79 Time: 1951
Location: Kerr-McGee Plant
Sampling Location: Scrubber Outlet
Traverse Point No. Sampled: 9

P_{bar} (in Hg).....	28.35
Stack Temp. (^{o}F).....	141
Sample Time (Min).....	60
Sample Volume (cf).....	52.92
Moisture (% H_2O).....	14.4
Meter Temp (^{o}F).....	101
Flow Setting, ΔH (in H_2O)....	2.18
Nozzle Diameter (Inches).....	0.250

Sample Flow Rate (at stack conditions): 1.01 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Microns)
1	21.90[2]	21.54	100.00	10.02 and larger
2	0.25	0.24	78.45	6.39
3	0.25	0.24	78.20	4.20
4	1.00	0.98	77.96	2.90
5	1.80	1.77	76.97	1.86
6	10.15	9.98	75.20	0.94
7	13.50	13.28	65.22	0.56
8	15.70	15.44	51.94	0.38
Back-up Filter	37.10	36.49	36.49	<0.38
TOTAL	101.65			

[1]ECD = Effective Cutoff Diameter of proceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle, cyclone and head of sampler upstream of the collection plates.

TABLE 2.7

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 4-19-79 Time: 1745
Location: Kerr-McGee Potash Plant
Sampling Location: Baghouse Outlet
Traverse Point No. Sampled: 4

P_{bar} (in Hg).....	28.25
Stack Temp. (^{o}F).....	233
Sample Time (Min).....	50
Sample Volume (cf).....	41.03
Moisture (% H_2O).....	9.6
Meter Temp (^{o}F).....	106
Flow Setting, ΔH (in H_2O)....	1.80
Nozzle Diameter (Inches).....	0.250

Sample Flow Rate (at stack conditions): 0.91 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Microns)
1	55.95[2]	59.01	100.00	11.14 and larger
2	2.90	3.05	40.98	7.09
3	3.00	3.16	37.92	4.67
4	1.30	1.37	34.75	3.23
5	7.25	7.64	33.38	2.06
6	19.55	20.62	25.73	1.05
7	3.95	4.16	5.11	0.63
8	0.45	0.47	0.94	0.42
Back-up Filter	0.45	0.47	0.47	< 0.42
TOTAL	94.80			

[1]ECD = Effective Cutoff Diameter of proceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle, cyclone and head of sampler upstream of the collection plates.

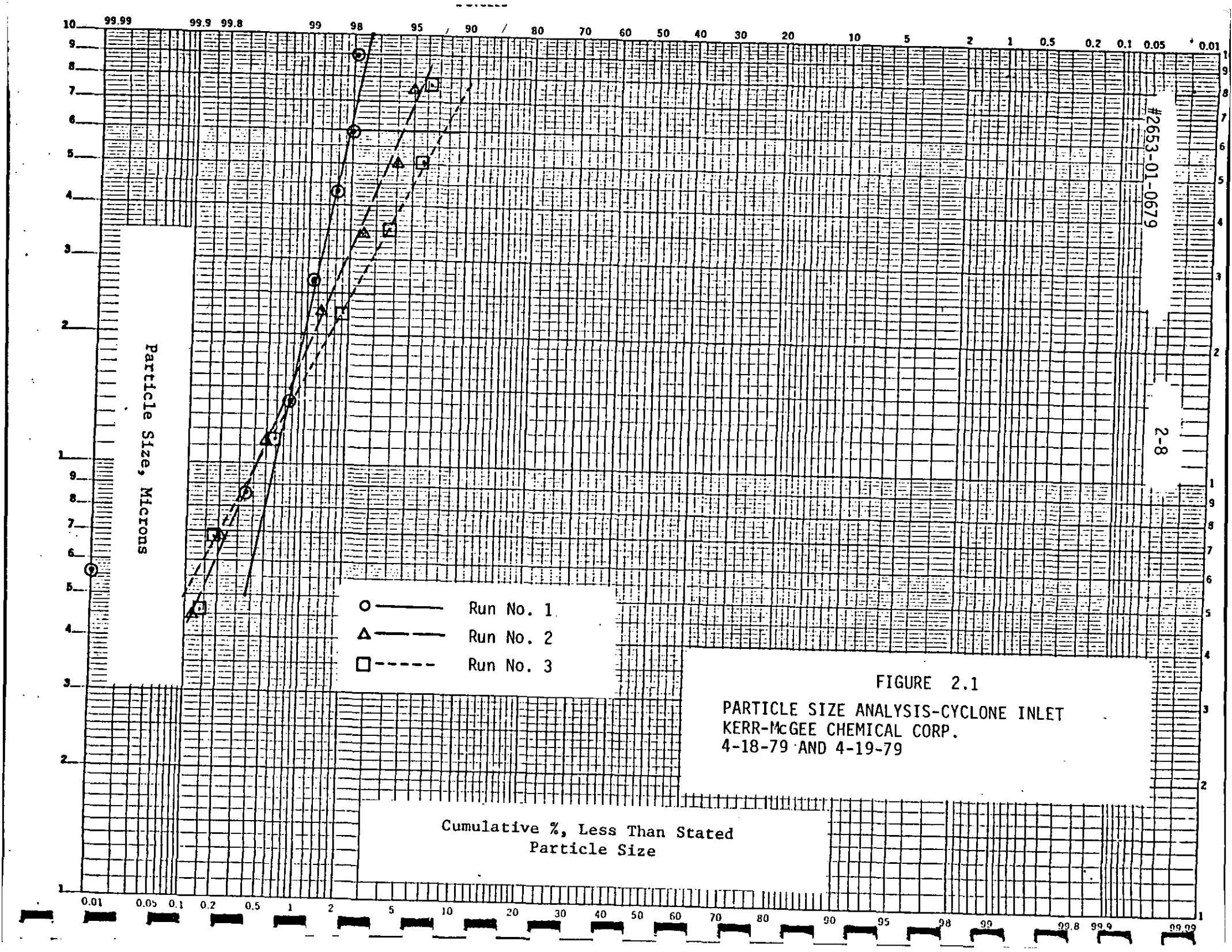


FIGURE 2.1

PARTICLE SIZE ANALYSIS-CYCLONE INLET
KERR-McGEE CHEMICAL CORP.
4-18-79 AND 4-19-79

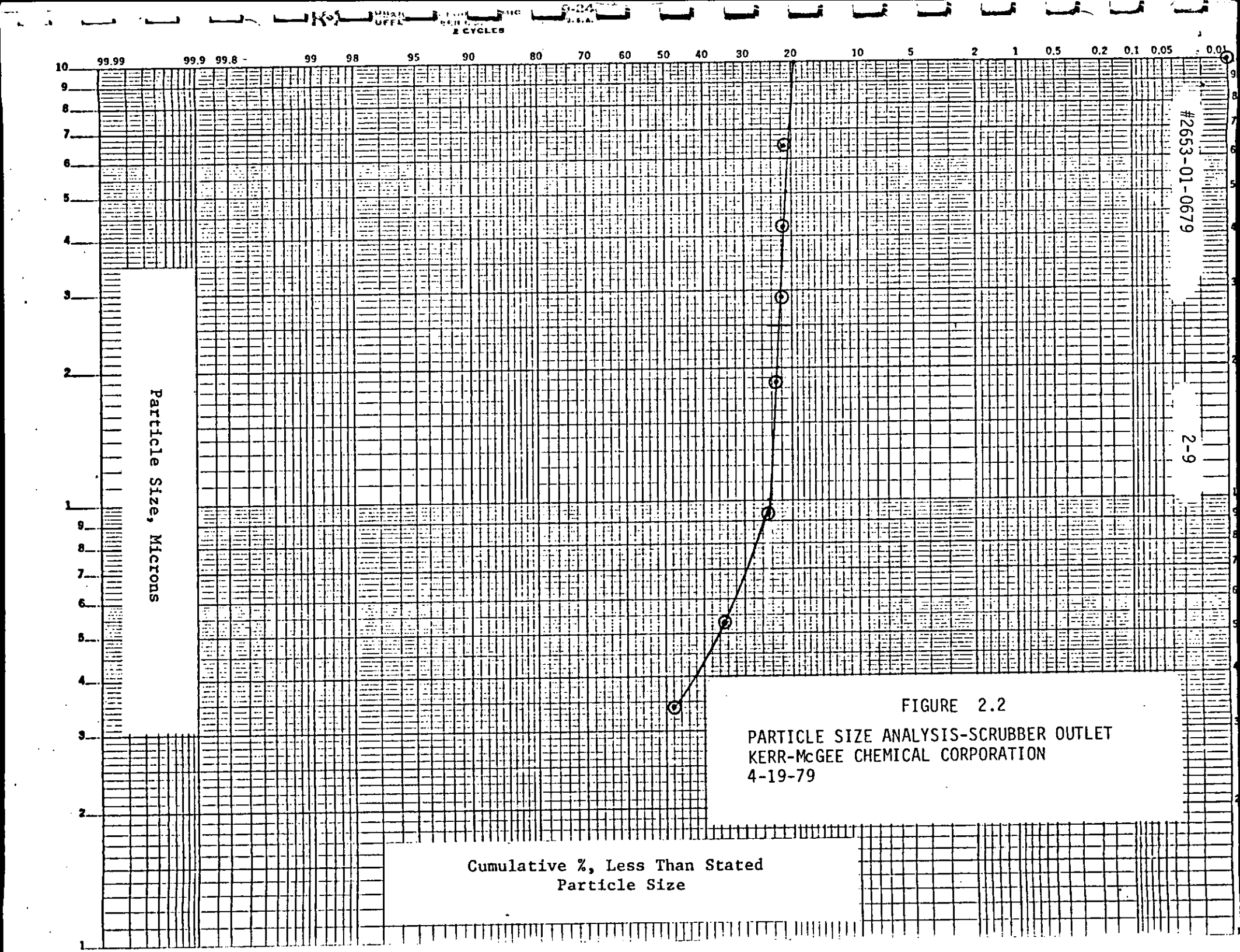


FIGURE 2.2

PARTICLE SIZE ANALYSIS-SCRUBBER OUTLET
KERR-McGEE CHEMICAL CORPORATION
4-19-79

App. C1 Ref. 16

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB Report 79-POT-5
April 1979

Air

EPA

Potash

Appendix
C.1
Reference 16

Emission Test Report
Kerr McGee
Trona, California

SET 2674-01-0979

FINAL REPORT

Particulate Emissions From A Potassium Chloride Drier Controlled By Two Cyclones And A Venturi Scrubber, And A Potassium Sulfate Drier Controlled By A Baghouse

EPA Contract No. 68-02-2813
Work Assignment No. 35
EMB Report No. 79-POT-5

Prepared For:

Environmental Protection Agency
Emissions Measurement Branch
ESED Mail Drop #13
Research Triangle Park, N.C. 27711

September 4, 1979

by

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.
2600 Cajon Boulevard
San Bernardino, California 92411

TABLE 2.4

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 7-10-79
Time: 1922
Sampling Location: Cyclone Inlet
Traverse Point No. Sampled: 15
Run No.: 1

P_{bar}(in. Hg): 28.15
Stack Temp. (^{o}F): 487
Sample Time (Min): 5
Sample Volume (cf): 3.57
Moisture (% H_2O): 12.0
Meter Temperature (^{o}F): 160
Flow Setting, ΔH (in. H_2O): 1.24
Nozzle Diameter (In.): [2] 0.250

Sample Flow Rate (at stack conditions) - 0.84 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Micrometers)
1	7895.7[2]	99.03	100.0	13.26 and larger
2	12.45	0.15	0.96	8.43
3	17.75	0.22	0.80	5.56
4	15.80	0.19	0.58	3.84
5	10.65	0.13	0.38	2.45
6	7.15	0.08	0.25	1.25
7	5.80	0.07	0.16	0.75
8	5.25	0.06	0.09	0.50
Back-up Filter	2.05	0.02	0.02	<0.50
Total	7972.6			

[1]ECD - Effective Cutoff Diameter of preceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle and head of sampler upstream of the collection plates.

TABLE 2.5

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 7-11-79
Time: 1255
Sampling Location: Cyclone Inlet
Traverse Point No. Sampled: 15
Run No.: 2

P_{bar}(in. Hg): 28.22
Stack Temp. (^{o}F): 466
Sample Time (Min): 5
Sample Volume (cf): 3.88
Moisture (% H_2O): 11.6
Meter Temperature (^{o}F): 147
Flow Setting, ΔH (in. H_2O): 1.40
Nozzle Diameter (In.): 0.250

Sample Flow Rate (at stack conditions) - 0.91 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Micrometers)
1	5291.2[2]	99.17	100.0	12.61 and larger
2	6.35	0.11	0.82	8.03
3	15.15	0.28	0.70	5.28
4	10.20	0.19	0.42	3.65
5	7.25	0.13	0.23	2.33
6	3.25	0.06	0.09	1.19
7	1.25	0.02	0.03	0.71
8	0.00	0.00	0.01	0.48
Back-up Filter	0.60	0.01	0.01	<0.48
Total	5335.25			

[1]ECD - Effective Cutoff Diameter of preceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle and head of sampler upstream of the collection plates.

TABLE 2.6

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 7-11-79
Time: 1937
Sampling Location: Cyclone Inlet
Traverse Point No. Sampled: 15
Run No.: 3

P_{bar} (in. Hg): 28.11
Stack Temp. (^{o}F): 431
Sample Time (Min): 5
Sample Volume (cf): 3.92
Moisture (% H_2O): 16.0
Meter Temperature (^{o}F): 150
Flow Setting, ΔH (in. H_2O): 1.62
Nozzle Diameter (In.): 0.250

Sample Flow Rate (at stack conditions) - 0.96

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Micrometers)
1	8160.4[2]	99.18	100.0	12.02 and larger
2	3.75	0.04	0.81	7.66
3	19.65	0.23	0.76	5.04
4	13.80	0.16	0.52	3.49
5	9.85	0.11	0.36	2.23
6	6.90	0.08	0.24	1.13
7	9.85	0.11	0.15	0.68
8	2.35	0.02	0.03	0.45
Back-up Filter	0.85	0.01	0.01	<0.45
Total	8227.4			

[1]ECD - Effective Cutoff Diameter of preceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle and head of sampler upstream of the collection plates.

TABLE 2.7

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 7-12-79
Time: 1206
Sampling Location: Cyclone Inlet
Traverse Point No. Sampled: 15
Run No.: 4

P_{bar}(in. Hg): 28.17
Stack Temp. (^{o}F): 454
Sample Time (Min): 5
Sample Volume (cf): 4.19
Moisture (% H_2O): 15.2
Meter Temperature (^{o}F): 134
Flow Setting, ΔH (in. H_2O): 1.70
Nozzle Diameter (In.): 0.250

Sample Flow Rate (at stack conditions) - 1.03

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Micrometers)
1	6345.9[2]	98.85	100.0	11.75 and larger
2	7.85	0.12	1.14	7.50
3	18.35	0.28	1.02	4.93
4	15.80	0.24	0.74	3.41
5	8.75	0.13	0.49	2.18
6	8.65	0.13	0.35	1.11
7	9.75	0.15	0.22	0.66
8	4.50	0.07	0.07	0.44
Back-up Filter	0.15	0.00	0.00	<0.44
Total	6419.7			

[1]ECD - Effective Cutoff Diameter of preceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle and head of sampler upstream of the collection plates.

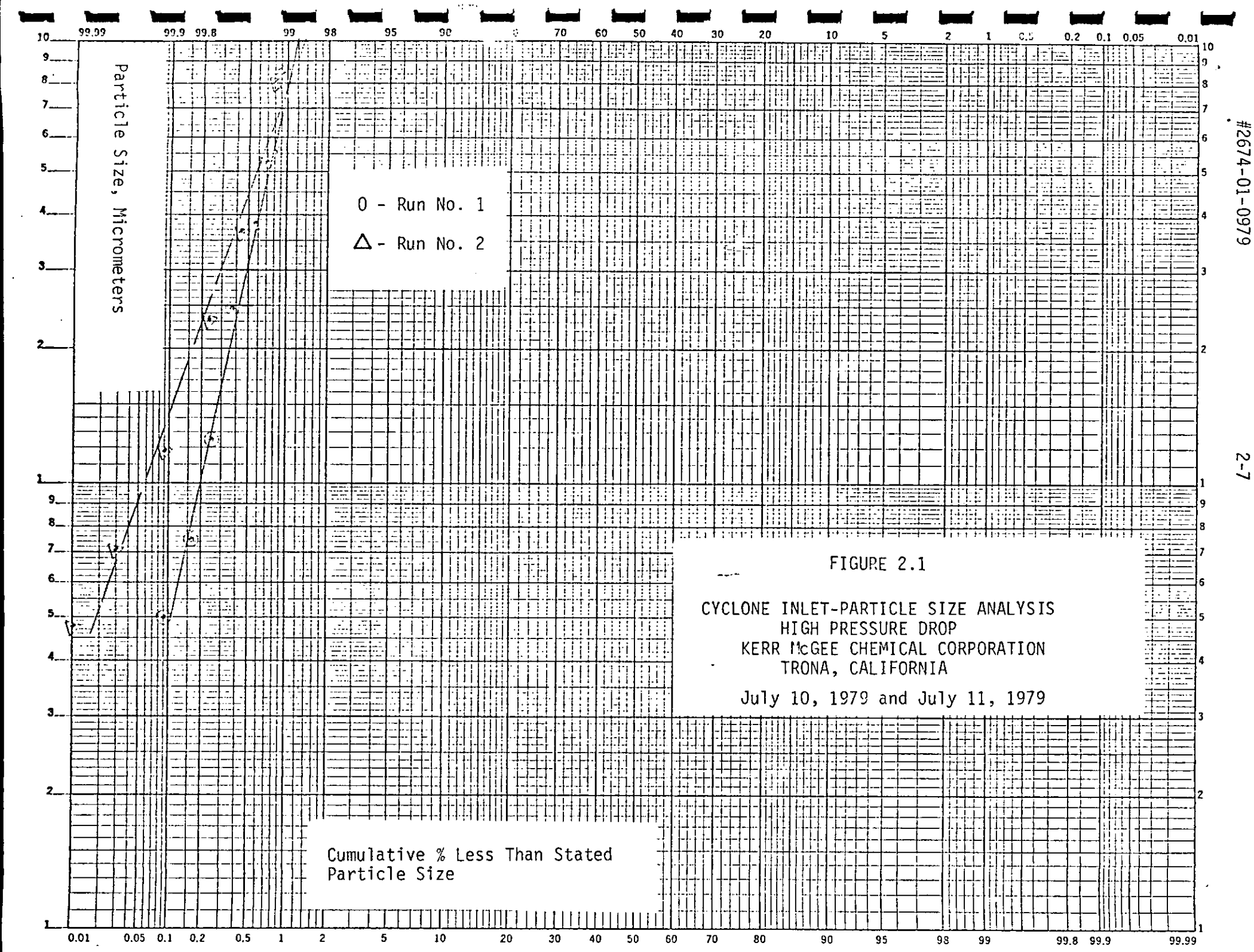


FIGURE 2.1

CYCLONE INLET-PARTICLE SIZE ANALYSIS
HIGH PRESSURE DROP
KERR McGEE CHEMICAL CORPORATION
TRONA, CALIFORNIA

July 10, 1979 and July 11, 1979

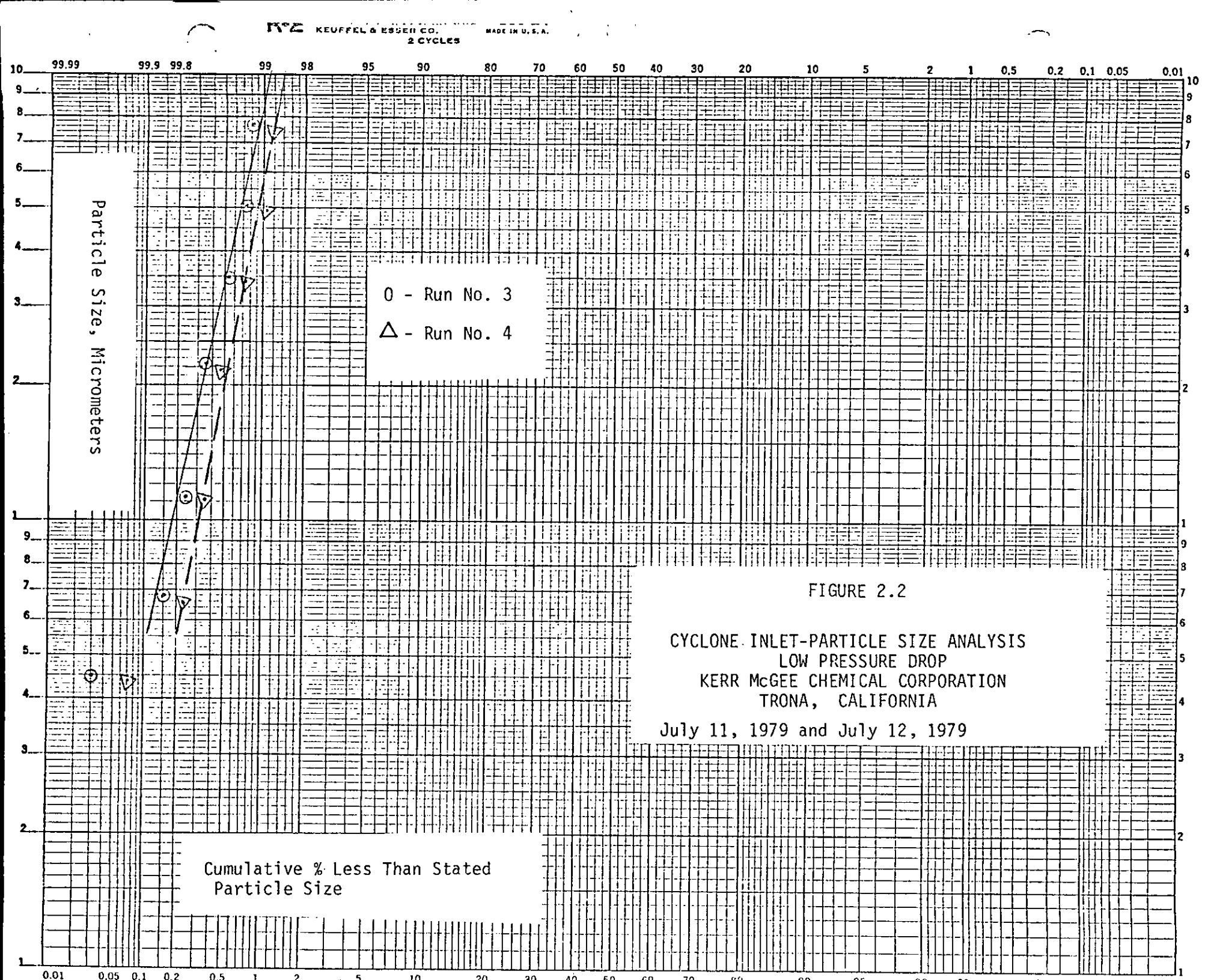


FIGURE 2.2

CYCLONE INLET-PARTICLE SIZE ANALYSIS
LOW PRESSURE DROP
KERR McGEE CHEMICAL CORPORATION
TRONA, CALIFORNIA

July 11, 1979 and July 12, 1979

TABLE 2.8

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 7-11-79
Time: 1510 to 1610
Sampling Location: Scrubber Outlet
Traverse Point No. Sampled: 23
Run No.: 1
High Pressure Drop

P_{bar}(in. Hg): 28.11
Stack Temp. (^{o}F): 139
Sample Time (Min): 60
Sample Volume (cf): 28.49
Moisture (% H_2O): 16.8
Meter Temperature (^{o}F): 145
Flow Setting, ΔH (in. H_2O): 0.56
Nozzle Diameter (In.): 0.1875[2]

Sample Flow Rate (at stack conditions) - 0.55 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Microns)
1	23.20	92.42	100.00	13.70 and larger
2	0.05	0.19	7.57	8.64
3	0.30	1.19	7.37	5.72
4	0.25	0.99	6.17	3.96
5	0.35	1.39	5.17	2.52
6	0.20	0.79	3.78	1.30
7	0.05	0.19	2.98	0.79
8	0.00	0.00	2.78	0.53
Back-up Filter	0.70	2.78	2.78	<0.53
Total	25.10			

[1]ECD - Effective Cutoff Diameter of preceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle and head of sampler upstream of the collection plates.

TABLE 2.9

PARTICLE SIZE DISTRIBUTION ANALYSIS

Date: 7-12-79
Time: 1245 to 1345
Sampling Location: Scrubber Outlet
Traverse Point No. Sampled: 23
Run No.: 2
Low Pressure Drop

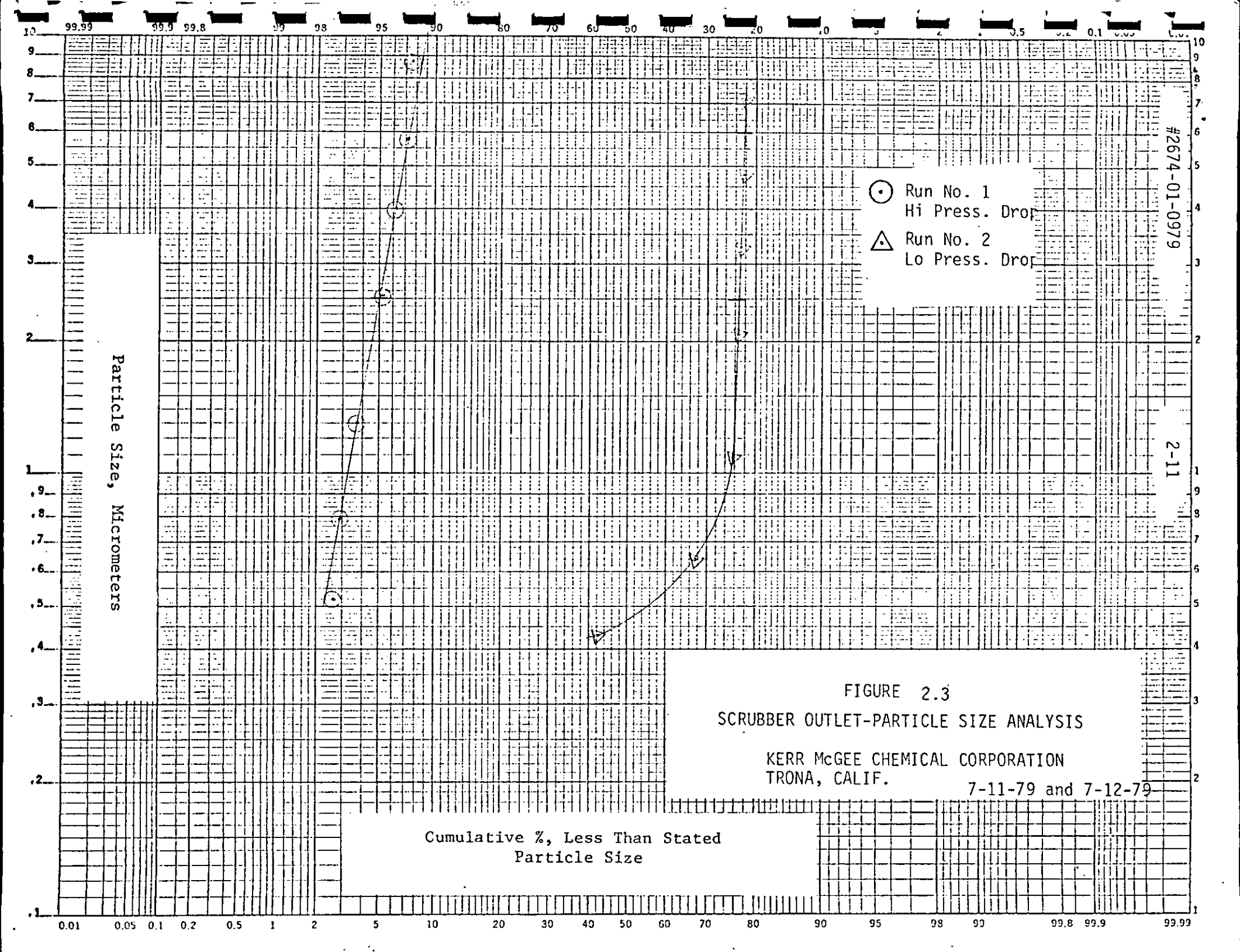
P_{bar} (in. Hg): 28.17
Stack Temp. (^{o}F): 141
Sample Time (Min): 60
Sample Volume (cf): 40.88
Moisture (% H_2O): 18.4
Meter Temperature (^{o}F): 148
Flow Setting, ΔH (in. H_2O): 1.10
Nozzle Diameter (In.): 0.1875

Sample Flow Rate (at stack conditions) - 0.80 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	ECD[1] (Microns)
1	18.20[2]	22.14	100.0	11.31 and larger
2	0.00	0.00	77.85	7.18
3	0.40	0.48	77.85	4.74
4	0.35	0.42	77.37	3.27
5	1.15	1.39	76.94	2.09
6	6.90	8.39	75.54	1.07
7	21.15	25.72	67.15	0.64
8	24.25	29.50	41.42	0.43
Back-up Filter	9.80	11.92	11.92	<0.45
Total	82.20			

[1]ECD - Effective Cutoff Diameter of preceding plate.

[2]Weight includes particulate collected on Plate No. 0 and in nozzle and head of sampler upstream of the collection plates.


Run No. 1
Hi Press. Drop
Run No. 2
Lo Press. Drop
#2674-01-0979
2-11
Particle Size, Micrometers
Cumulative %, Less Than Stated Particle Size
FIGURE 2.3
SCRUBBER OUTLET-PARTICLE SIZE ANALYSIS
KERR McGEE CHEMICAL CORPORATION
TRONA, CALIF.
7-11-79 and 7-12-79

Appendix C.1 Reference 17

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 DATE 06/20/83

ES NO: 27 DESCRIBES SAMPLING AT SITE FROM TO BY U.S. EPA

SPONSOR ORGANIZATION: U.S. EPA
CONTRACT NUMBER: PURPOSE OF TEST: SOURCE CHARACTERIZATION STUDY
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY:	NATURAL PRODUCTS	SOURCE NAME:	
SOURCE TYPE:	AGRICULTURAL	SITE NAME:	
PRODUCT/DEVICE:	COTTON	ADDRESS:	
PROCESS TYPE:	GINNING		,CA 00000 USA
DESIGN PROCESS RATE:	136 M6G/D		
FEED MATERIAL CATEGORY:	AGRI FEED		
PRIMARY CONTROL DEVICE:		SIC CODE:	724

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: SDDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

CONCENTRATION AND SIZE OF TRACE METAL EMISSIONS FROM A POWER PLANT, A STEEL PLANT, AND A COTTON GIN.
LEE,R.E.,ET.AL.
ENV.SCI. & TECH 9(7) JULY 1975

TEST SERIES COMMENTS----------

Appic 2, Ref. 5

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	STAGE 1	STAGE/FILTER CUT SIZE:	30.00 UM
		STAGE MASS:	1.98E+03 UG/DNM3
2	STAGE 2	STAGE/FILTER CUT SIZE:	20.00 UM
		STAGE MASS:	9.84E+02 UG/DNM3
3	STAGE 3	STAGE/FILTER CUT SIZE:	10.00 UM
		STAGE MASS:	5.25E+03 UG/DNM3
4	STAGE 4	STAGE/FILTER CUT SIZE:	5.00 UM
		STAGE MASS:	4.76E+03 UG/DNM3
5	STAGE 5	STAGE/FILTER CUT SIZE:	1.00 UM
		STAGE MASS:	2.62E+03 UG/DNM3
6	FILTER	STAGE/FILTER CUT SIZE:	.50 UM
		STAGE MASS:	8.20E+02 UG/DNM3

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6
D50(MICRONS)	30.00	20.00	10.00	5.00	1.00	.50
MICROGRAMS/DNCM/STAGE	1.98E+03	9.84E+02	5.25E+03	4.76E+03	2.62E+03	8.20E+02
NUMBER/DNCM/STAGE	6.51E+07	1.28E+08	3.54E+09	2.57E+10	4.48E+11	4.43E+12
CUM. %MASS<D50	87.94	81.94	49.96	20.96	5.00	
CUM. MICROGRAMS/ACM<D50	8.96E+03	8.35E+03	5.09E+03	2.14E+03	5.09E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.44E+04	1.34E+04	8.20E+03	3.44E+03	8.20E+02	0.00E+00
GEOM D50	3.87E+01	2.45E+01	1.41E+01	7.07E+00	2.24E+00	7.07E-01
DM/DLOGD-(UG/DNM3)	8.92E+03	5.59E+03	1.74E+04	1.58E+04	3.75E+03	2.72E+03
DN-LOGD/(NUMBER/DNM3)	2.93E+08	7.26E+08	1.18E+10	8.54E+10	6.40E+11	1.47E+13

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	STAGE 1	STAGE/FILTER CUT SIZE:	30.00 UM
		STAGE MASS:	5.52E+02 UG/DNM3
2	STAGE 2	STAGE/FILTER CUT SIZE:	20.00 UM
		STAGE MASS:	2.07E+02 UG/DNM3
3	STAGE 3	STAGE/FILTER CUT SIZE:	10.00 UM
		STAGE MASS:	6.67E+02 UG/DNM3
4	STAGE 4	STAGE/FILTER CUT SIZE:	5.00 UM
		STAGE MASS:	5.59E+02 UG/DNM3
5	STAGE 5	STAGE/FILTER CUT SIZE:	1.00 UM
		STAGE MASS:	3.22E+02 UG/DNM3
6	FILTER	STAGE/FILTER CUT SIZE:	.50 UM
		STAGE MASS:	2.30E+01 UG/DNM3

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6
D50(MICRONS)	30.00	20.00	10.00	5.00	1.00	.50
MICROGRAMS/DNCM/STAGE	5.52E+02	2.07E+02	6.67E+02	5.59E+02	3.22E+02	2.30E+01
NUMBER/DNCM/STAGE	1.81E+07	2.69E+07	4.50E+08	3.02E+09	5.50E+10	1.24E+11
CUM. %MASS<D50	76.31	67.42	38.80	14.81	.99	
CUM. MICROGRAMS/ACM<D50	1.10E+03	9.75E+02	5.61E+02	2.14E+02	1.43E+01	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.78E+03	1.57E+03	9.04E+02	3.45E+02	2.30E+01	0.00E+00
GEOM D50	3.87E+01	2.45E+01	1.41E+01	7.07E+00	2.24E+00	7.07E-01
DM/DLOGD-(UG/DNM3)	2.49E+03	1.18E+03	2.22E+03	1.86E+03	4.61E+02	7.64E+01
DN-LOGD/(NUMBER/DNM3)	8.18E+07	1.53E+08	1.50E+09	1.00E+10	7.87E+10	4.13E+11

M. N. Gillum

Appendix
C.1
Reference 18

PAPER NO.-

COLLECTING PARTICLES FROM GIN LINT CLEANER AIR EXHAUSTS

by

S. E. Hughs, M. N. Gillum, and B. M. Armijo
Research Leader, Agricultural Engineer, and Engineering Technician, respectively

For presentation at the 1981 Winter Meeting
AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

Palmer House
Chicago, Illinois
December 15-18, 1981

SUMMARY:

An evaluation was made of the effectiveness of cyclone collectors as primary, and a cyclone wet scrubber as a secondary particulate collector on a lint cleaner exhaust. The cyclone collectors captured an average of 90.8% by weight of the particles as a primary cleaner. The scrubber removed an average of 73.5% by weight as a secondary cleaner.

American Society of Agricultural Engineers
St. Joseph, Michigan 49085

COLLECTING PARTICLES FROM GIN LINT CLEANER AIR EXHAUSTS

by

S. E. Hughs, M. N. Gillum, and B. M Armijo

Introduction

The encroachment of cities into once rural areas coupled with the increased public concern about air pollution is putting pressure on the ginning industry to reduce particulate emissions. Gins have used or are using small-diameter cyclones (Harrell and Moore, 1962), skimmers (Kirk et al, 1976), and unifilter collectors (McCaskill and Wesley, 1976) on many of their high-pressure exhausts and unifilter collectors, screen cages (Harrell and Moore, 1962), and inline air filters (Alberson and Baker, 1964) on their low-pressure exhausts to reduce particulate emissions. However, very low permissible emission levels and increased public pressure is forcing the ginning industry to search for still better methods of particulate emission control.

The staff at the Southwestern Cotton Ginning Research Laboratory has been conducting research concentrating on finding new ways of applying current technology to the gin particulate emission problem. An earlier paper (Gillum et al, 1980) gave a preliminary report of the effectiveness of cyclone collectors as primary and a wet scrubber as a secondary particulate collector on a lint-cleaner exhaust. Gillum et al gave data of Environmental Protection Agency (EPA) source emission tests of cotton gins

in Arizona and California (see Table 1). The seed-cotton system or the lint system exhaust alone exceeded allowable emissions in the majority of the cases, shown in Table 1. In all cases, the sum of the emissions of the two systems exceeded allowable levels by factors anywhere from 1.26 to 3.38.

Gillum et al, showed preliminary results that indicated that unabated lint-cleaner exhaust emissions could be reduced by as much as 97%, and that controlled lint exhaust emissions could be further reduced by at least 50%. This paper gives a description of the emission control system tested by Gillum et al and the final test results.

Table 1.--Cotton gin source test results

State	Seed cotton process rate**	Lint process rate	Total emissions	Seed cotton system emissions	Lint system emissions	Total allowable emissions***
	kg/h(lb/h)	Bales/ hr	kg/h(lb/h)	kg/h(lb/h)	kg/h(lb/h)	kg/h(lb/h)
Arizona ----	2318(5100)	3.4	3.4(7.5)	1.9(4.1)c	1.5(3.4)l	2.7(6.0)
Arizona ----	5864(12900)	8.6	13.4(29.5)	7.3(16.1)c	6.1(13.5)l	5.1(11.2)
California--	8864(19500)	13.0	23.7(52.2)	11.9(26.2)c	11.8(26.0)l	7.0(15.4)
California--	14045(30900)	20.6	15.6(34.3)	10.0(22.0)u+c	5.6(12.4)*u+c	9.3(20.4)
California--	15682(34500)	23.0	18.0(39.6)	9.5(20.9)*u+c	8.5(18.8)u+c	9.9(21.8)

*Not measured, a calculated estimate, c = cyclones, l = lint cages, u = unifilter. Some of the low-pressure exhausts may have not been going into the unifilter.

**Using 682 kg(1500 lb) of seed cotton per bale of cotton lint.

***From process weight table for appropriate state, at time of test.

Test Installation

Figure 1 shows a schematic of the long-cone cyclone and cyclone wet-scrubber test installation at a commercial gin. A set of small-diameter (1D3D design) long-cone cyclone collectors were installed on the No. 1 lint-cleaner air exhaust to serve as primary collectors (see Fig. 2). A second vaneaxial fan was installed prior to the cyclones to overcome the additional back pressure created in the lint-cleaner exhaust line by the addition of the cyclones.

A cyclone wet scrubber was installed after the long-cone cyclones to serve as a secondary particulate collector. The scrubber consisted of a sheet metal cylinder 1.14 m (3.75 ft) in diameter and 4.88 m (16 ft) tall. The exhaust air from the primary long-cone cyclones was induced tangentially at the bottom of the scrubber with an average velocity of 384.6 m/min. (1262 ft/min.) and flowed out the top of the scrubber. The average pressure drop through the cyclone wet scrubber at the 384.6 m/min (1262 ft/min.) inlet air velocity was approximately 10 mm (0.4 in. of water). The air inlet section of the cyclone wet scrubber resembled the inlet section of a cyclone. There were two high-volume water-spray nozzles located along the center line of the cyclone wet scrubber. These nozzles sprayed downward against the airflow through the scrubber. The nozzles were 33 cm (13 in.) apart with the lower nozzle 45.7 cm (18 in.) above the top of the scrubber air inlet. The nozzles were rated at 76.8 l/min. (20.3 g.p.m.) at the operating pressure of 197 kPa (28.6 p.s.i.). Spray water collected

at the bottom of the scrubber and was drained by gravity to the settling tank. From the settling tank, the water was then recirculated by two 2-hp pumps back through the spray nozzles in the cyclone wet scrubber.

The test installation was constructed so that dust sampling could be done at the long-cone cyclone collectors, between the long-cone cyclone collectors and the cyclone wet scrubber, and after the wet scrubber. The dust-sampling station at the long-cone cyclone collectors consisted of a "Y-valve" installed at the bottom of each cyclone collector. Plastic bags were attached to the outlets of the valves. Dust and cotton lint removed from the exhaust air stream were collected in the plastic bags during sampling periods. The bags were removed at the end of each 4-hour test run and weighed to determine the total amount of trash caught by the cyclone collectors. Sampling at other points was done using Environmental Protection Agency (EPA) Method 5 procedures. A sampling station for a Method 5 sampling train was located on the air discharge duct of the long-cone cyclone collectors. Another Method 5 sampling station was located on the air discharge of the cyclone wet scrubber. The two Method 5 sampling stations were used simultaneously to determine the rate of particulate emissions from the long-cone collectors and the cyclone wet scrubber. Data from all three sampling points gave a complete picture of the rate of emissions and effectiveness of the devices used to control emissions. Measurements were taken during the ginning season and while processing both machine-picked and ground-harvested upland cotton.

Results and Discussion

The primary long-cone cyclones and secondary cyclone wet scrubber equipped with a recirculating water system and settling tank were operated 425 hours while ginning about 2500 bales. Tables 2 and 3 give the particulate emission test results. Table 2 shows that the long-cone cyclones collected an average of 0.689 g/s (5.47 lb/h) of trash and emitted an average of .069 g/s (0.549 lb/h) of trash at an average ginning rate of 6.8 bales of lint per hour. This collection rate yields an average cyclone collection efficiency of 90.85%.

Table 3 shows that of the average .069 g/s (0.549 lbs/h) of particulates emitted by the cyclones, the cyclone wet scrubber captured all but 0.017 g/s (0.135 lb/h) for an average collection efficiency of 73.53%. The average combined cyclone and cyclone wet scrubber system efficiency was 97.58%. This system collection efficiency did not vary appreciably through the ginning season on input material that varied from clean first-picked to late-season ground-harvested seed cotton. Total first lint-cleaner-exhaust loading rates varied during this time from 0.446 g/s (3.54 lb/h) to 1.585 g/s (12.58 lb/h).

Figure 3 gives the cumulative percentages of particle sizes determined by the Coulter counter from EPA Method 5 particulate samples taken from the long-cone-cyclone and wet-scrubber exhausts. There are virtually no particles greater than 32 microns exhausted from the cyclones and 95% of

Table 2.--Results of the eleven test runs of the long-cone cyclone on the first lint-cleaner exhaust

Lot No.	Cyclone outlet temperature Deg. C, (Deg. F)	Inlet velocity m/s(ft/min)	Airflow m^3/s(dscfm)	Air moisture by volume Pct	Isokinetic variation Pct	Exhaust particulate concentration mg/m^3	Ginning rate Bales/hr	Trash collected g/s(lb/hr)	Emission rate g/s(lb/hr)	Collector efficiency Pct
1	34(93)	13.5(2648)	2.62(5561)	0.8	104	16.48	8.5	0.431(3.42)	.0432(0.343)	90.86
2	28(83)	13.2(2592)	2.64(5598)	0.7	106	19.78	5.5	0.394(3.13)	.0523(0.415)	88.29
3	27(81)	13.1(2575)	2.59(5489)	0.8	104	29.06	5.3	0.605(4.80)	.0753(0.598)	88.93
4	28(82)	13.7(2700)	2.74(5802)	1.0	108	20.05	7.5	0.546(4.33)	.0549(0.436)	90.85
5	33(91)	13.5(2662)	2.65(5607)	1.1	107	23.06	7.8	0.743(5.90)	.0610(0.484)	92.41
6	27(80)	13.6(2673)	2.70(5727)	0.9	105	19.21	7.3	0.649(5.15)	.0519(0.412)	92.59
7	15(59)	13.0(2551)	2.73(5781)	0.6	100	15.98	6.5	0.592(4.70)	.0436(0.346)	93.14
8	14(58)	13.1(2570)	2.75(5824)	0.6	103	20.15	7.3	0.489(3.88)	.0554(0.440)	89.81
9	19(66)	12.7(2508)	2.63(5573)	0.8	103	23.86	8.3	0.706(5.60)	.0627(0.498)	91.83
10	20(68)	12.9(2549)	2.64(5602)	0.8	102	59.41	5.0	1.428(11.33)	.1571(1.247)	90.08
11	19(67)	12.6(2487)	2.58(5473)	0.8	102	40.05	6.3	0.993(7.88)	.1034(0.821)	90.56
Avg	24(75)	13.2(2592)	2.66(5640)	0.8	104	26.10	6.8	0.689(5.47)	.0692(0.549)	90.85

Table 3.--Results of the eleven test runs of the wet scrubber on the first lint-cleaner exhaust

Lot No.	Scrubber outlet temperature Deg. C, (Deg. F)	Inlet velocity m/s(ft/min)	Airflow m^3/s(dscfm)	Air moisture by volume Pct	Isokinetic variation Pct	Exhaust particulate concentration mg/m^3	Emission rate 1/ g/s(lb/hr)	Collector efficiency Pct	Combined efficiency Pct
1	18(65)	6.25(1231)	2.28(4822)	1.6	103	8.26	.0217(0.172)	49.91	95.42
2	15(59)	6.46(1272)	2.40(5087)	1.6	104	4.53	.0120(0.095)	77.11	97.32
3	16(61)	6.40(1259)	2.33(4940)	1.7	105	8.12	.0210(0.167)	72.07	96.91
4	16(61)	6.44(1267)	2.37(5016)	1.9	106	5.11	.0140(0.111)	74.53	97.67
5	19(66)	6.51(1282)	2.36(5002)	2.0	106	5.88	.0156(0.124)	74.49	98.07
6	17(62)	6.35(1250)	2.32(4918)	1.5	106	4.06	.0110(0.087)	78.84	98.43
7	9(49)	6.74(1326)	2.57(5456)	1.1	104	3.87	.0106(0.084)	75.80	98.34
8	8(46)	6.65(1309)	2.55(5402)	1.1	102	5.65	.0155(0.123)	71.95	97.14
9	13(55)	6.27(1235)	2.35(4979)	1.4	104	6.55	.0173(0.137)	72.53	97.76
10	12(54)	6.14(1209)	2.29(4850)	1.3	103	9.75	.0258(0.205)	83.58	98.37
11	12(53)	6.31(1242)	2.35(4985)	1.4	103	8.78	.0227(0.180)	78.07	97.93
Avg	14(57)	6.41(1262)	2.38(5042)	1.5	104	6.41	.0170(0.135)	73.53	97.58

1/ SCFM from cyclone exhaust and concentration from scrubber exhaust were used to find scrubber emission rate.

the particles have a diameter of approximately 22 microns or less. These data are in close agreement with Parnell and Davis (1979). Parnell and Davis found that long-cone cyclones did not emit particles above 18 microns in diameter when tested under different loading conditions using grain dust. Cotton trash emissions would probably tend to be made up of particles somewhat larger than grain dust which would account for the particle cutoff to be somewhat higher for the lint-cleaner exhaust emissions. Even at collection efficiencies above 99%, a few large particles will be emitted from a cyclone exhaust.

The cyclone wet scrubber greatly reduced the larger fraction of particles emitted from the cyclone. Referring to Figure 3, 95% of the particles emitted from the scrubber had a diameter of 12.7 microns or less compared to approximately 22 microns for the cyclone. Figure 4 shows the cumulative weight of particles emitted from both the cyclone and cyclone wet scrubber versus particle size. Figure 4 shows that the cyclone wet scrubber is not effective on particles 5 microns in diameter or less, but the scrubber's collection efficiency increases rapidly on particles whose diameter exceeds 5 microns. Figures 3 and 4 show that the cyclone wet scrubber collected virtually everything whose diameter exceede 12.7 microns.

Application

The first three gins shown in Table 1 used lint cages on their lint system exhausts. The particulate collection efficiency of screen cages is unknown but is undoubtedly low. This study shows that a cyclone-cyclone

wet-scrubber system added to an unabated lint system exhaust has a collection efficiency of 97%. It should be a reasonable assumption that replacing the lint cages on the first three gins in Table 1 with a cyclone-cyclone wet-scrubber system would result in at least an additional reduction in lint system emissions of 80%.

McCaskill and Wesley (1976) showed that the unifilter had an average particulate collection efficiency on cotton gin emissions of 99.5%. Gillum et al (1980) showed that high-efficiency cyclones had collection efficiencies that averaged 99.6% on gin trash. The size characteristics of the particulates emitted by cyclones and unifilters should be very similar given their nearly identical collection efficiencies. It has been shown that a cyclone wet scrubber has an average collection efficiency of 73.5% on cyclone particulate emissions. Therefore, a cyclone wet scrubber should have a collection efficiency of at least 70% on unifilter particulate emissions. The last two gins using unifilters shown in Table 1, should be able to reduce their emissions by 70% with the addition of a cyclone wet scrubber on their unifilter exhausts. The characteristics of the particulates in seed-cotton system and lint system exhausts using cyclones as collectors should be identical, other than perhaps for loading rates. Therefore, the gins in Table 1 using cyclones on their seed-cotton system exhaust should be able to reduce those emissions by an additional 70%.

Taken all assumptions together, 80% reduction of lint-cage emissions, 70% reduction of unifilter emissions and 70% reduction of seed-cotton

system cyclone emissions, the figures in Table 1 would look like the figures in Table 4. If the assumptions are correct, all the gins shown would be able to meet their total allowable emission requirements as shown in Table 1. It may not be necessary to install a cyclone wet scrubber or a cyclone-cyclone wet scrubber system of all gin exhausts to bring them in compliance with emission standards. Many gin exhausts such as the seed handling system and press-condenser exhausts are lightly loaded compared to seed-cotton unloading and number one lint cleaning exhausts. Additions of a cyclone wet scrubber or a cyclone-cyclone wet-scrubber system on only these more heavily loaded exhausts may bring a gin in compliance with emission standards.

Table 4.--Assumed gin source test results

State	Lint process rate	Seed cotton system emissions	Lint system emissions	Total emissions	Total allowable emissions*
	Bales/h	kg/h(lb/h)	kg/h(lb/h)	kg/h(lb/h)	kg/h(lb/h)
Arizona	3.4	.56(1.23)	.31(.68)	.87(1.91)	2.7 (6.0)
Arizona	8.6	2.19(4.83)	1.22(2.70)	3.42(7.53)	5.1(11.2)
California	13.0	3.56(7.86)	2.36(5.20)	5.92(13.06)	7.0(15.4)
California	20.6	2.99(6.60)	1.69(3.72)	4.68(10.32)	9.3(20.4)
California	23.0	2.84(6.27)	2.56(5.64)	5.40(11.91)	9.9(21.8)

*As shown in Table 1, current standards may have changed.

References

1 Harrell, E. A. and V. P. Moore. 1962. Trash collecting systems at cotton gins. USDA ARS 42-62. 22 p.

2 Kirk, I. W., A. L. Vandergriff, M. N. Gillum, and C. G. Leonard. 1976. An alternate method of emission control for cotton gin exhausts. Texas Cotton Ginners' Journal and Yearbook. March 1976.

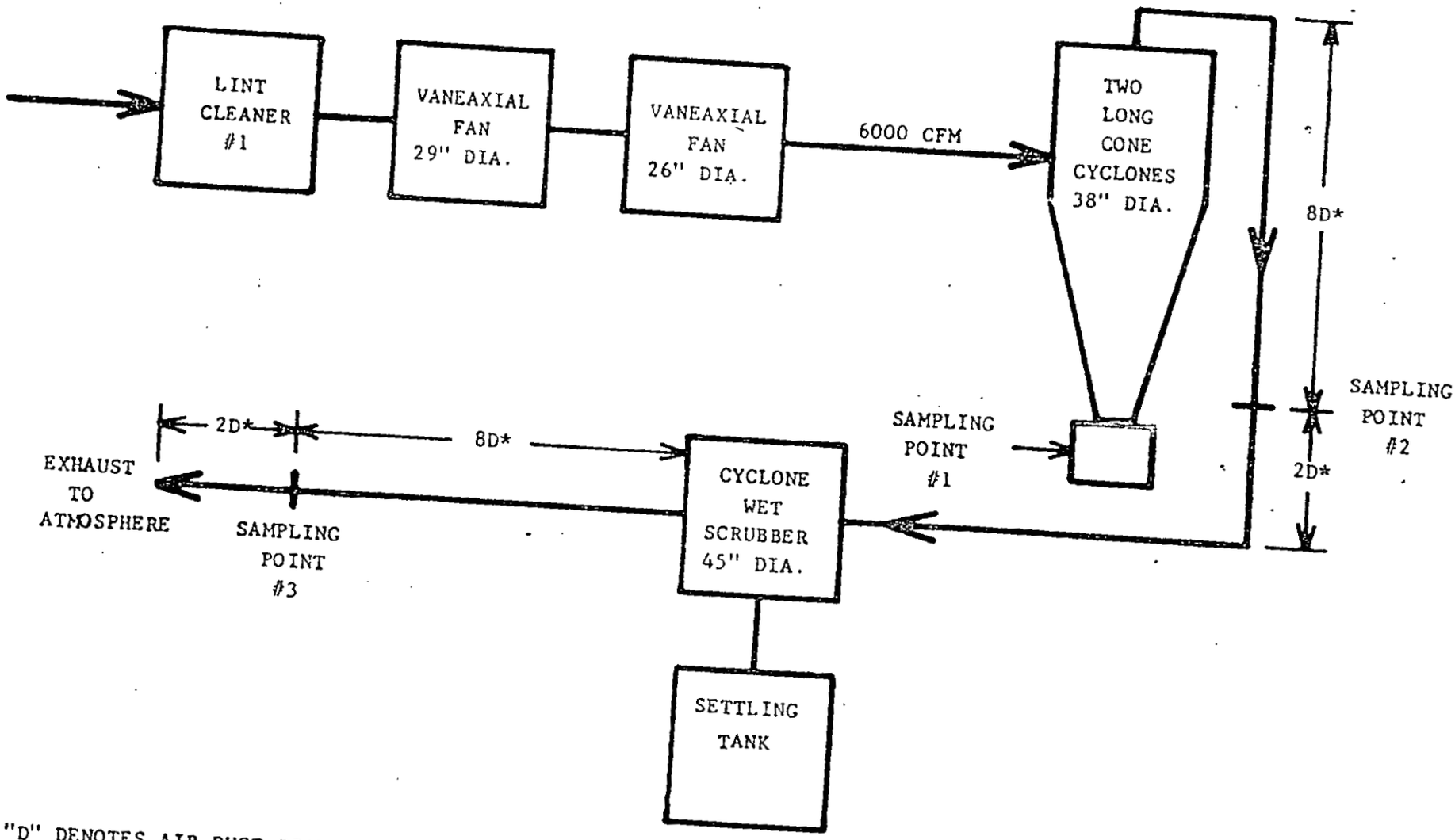
3 McCaskill, O. L. and R. A. Wesley. 1976. Unifilter collecting system for cotton-gin waste materials. USDA-ARS-S-144.

4 Alberson, D. M. and R. V. Baker. 1964. An inline air filter for collecting gin condenser air pollutants. USDA-ARS 42-103.

5 Gillum, M. N., S. E. Hughs, R. N. Rakoff, and T. E. Wright. 1980. Primary and secondary cleaning of lint cleaner exhaust air: a progress report. Presented at the 1980 Summer Meeting ASAE, San Antonio, Texas.

6 Parnell, C. B., Jr. and D. Davis. 1979. Predicted effects of the use of new cyclone designs on agricultural processing particulate emissions. Southwest Region Meeting, ASAE, Hot Springs, Ark.

FIGURE 1 - CYCLONE TEST INSTALLATION



* "D" DENOTES AIR DUCT DIAMETER

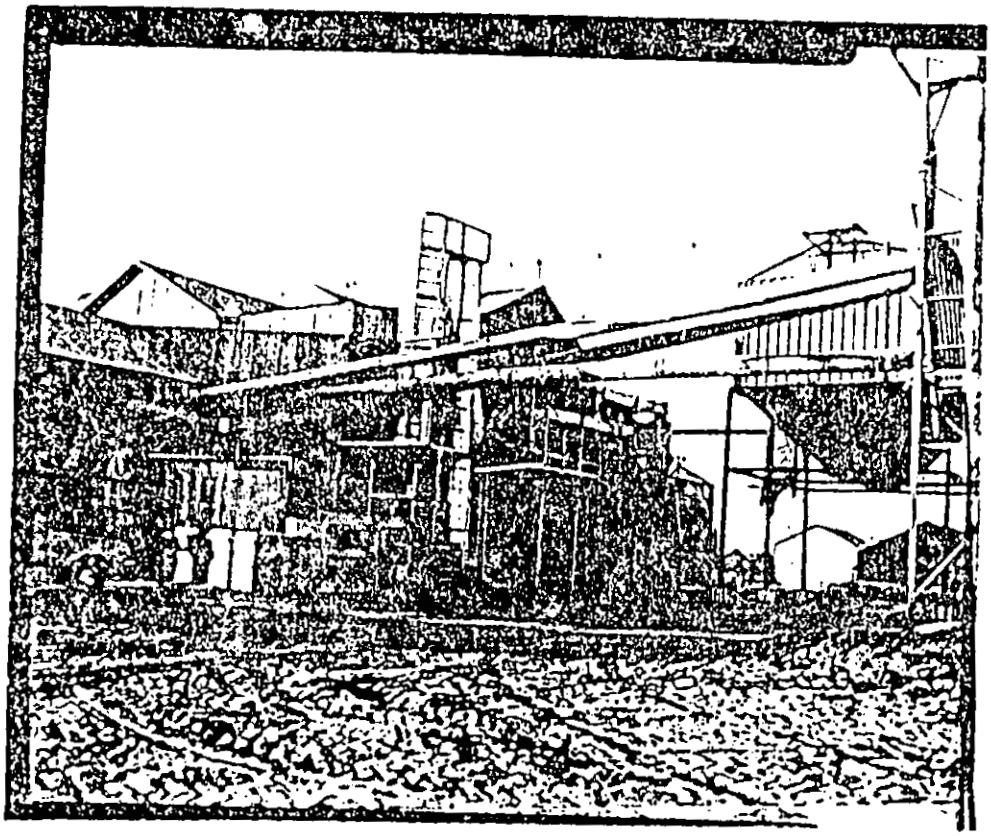


Figure 2.--Cyclone and wet scrubber installation--long-cone cyclones, right of center by seed hopper, cyclone wet scrubber, center, and sludge tanks, left side directly in front of car.

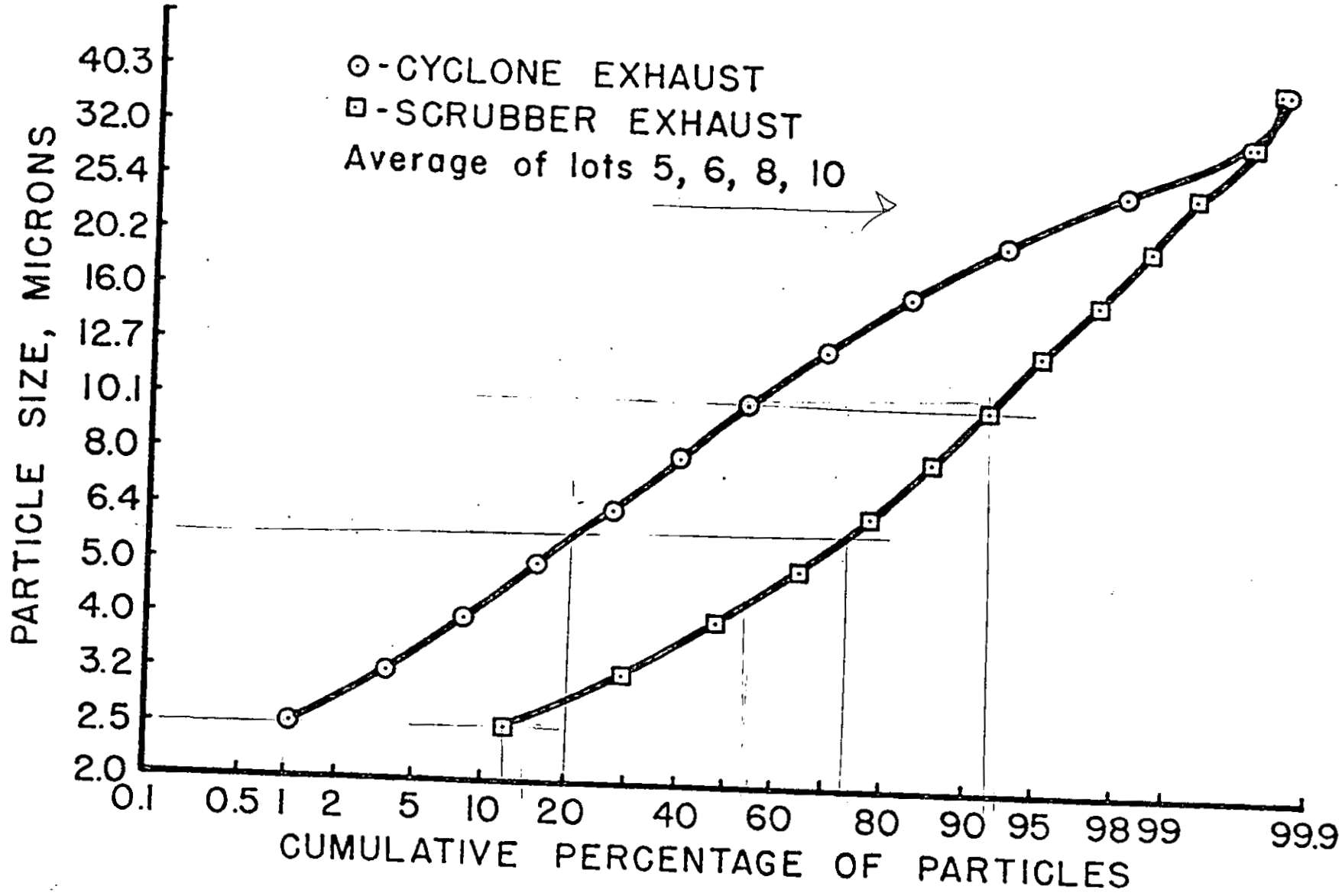


Figure 3.--Particle size versus cumulative weight percentage of particles in exhaust sample.

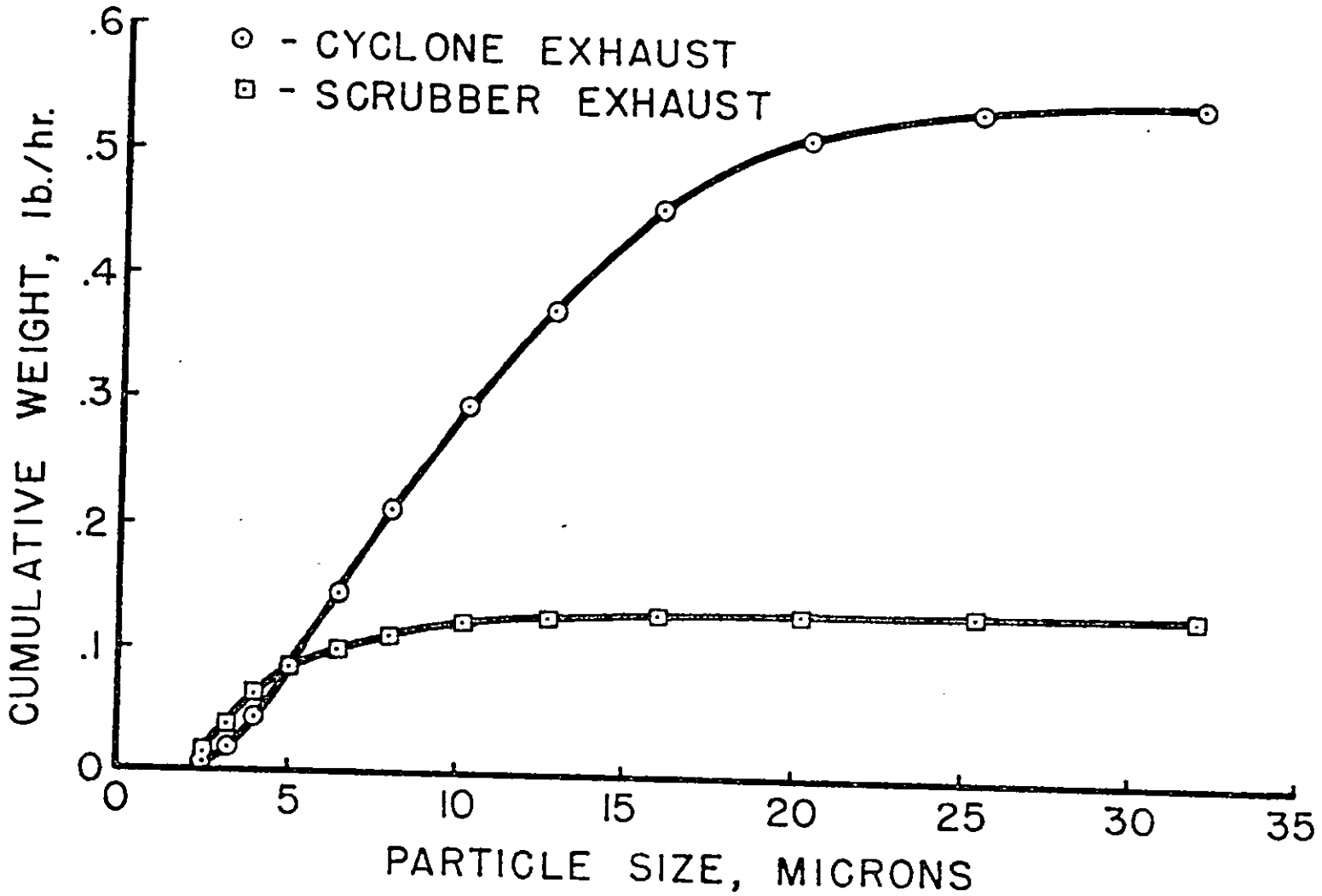


Figure 4.--Cumulative weight of particles emitted versus particle size.

Appendix C.1 Reference 20

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 PAGE 1 DATE 06/21/83

SERIES NO: 229 DESCRIBES SAMPLING AT SITE FROM 03/23/78 TO 03/23/78 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY: FOOD INDUSTRY
SOURCE TYPE: GRAIN MILL PRODUCTS
PRODUCT/DEVICE: CAROB KIBBLE
PROCESS TYPE: ROASTING
DESIGN PROCESS RATE: 300 KG/HR
FEED MATERIAL CATEGORY: AGRI FEED
PRIMARY CONTROL DEVICE:

SOURCE NAME: CONFIDENTIAL
SITE NAME:
ADDRESS:
LOS ANGELES ,CA 00000
SIC CODE: 2041

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00081 SDDS TSN:

REFERENCE REPORT----------

TITLE / AUTHOR / SPONSOR REPORT NUMBER	NTIS NUMBER	PUBLICATION DATE
FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN. TABACK H.J. KVB REPORT 5806-783	PB 293 923/AS	FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL. ROASTER HEAT INPUT IS 795M KJ/HR OF NATURAL GAS.

App. C1, Ref. 20

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE•10 CYC		
		STAGE/FILTER CUT SIZE:	8.30 UM
		STAGE WEIGHT:	5.65E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	385.000 MG
		CHEMICAL ANALYSIS LABORATORY NAME:	ARMAME
2	3 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	1.90 UM
		STAGE WEIGHT:	1.00E•00 MG
3	1 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	.60 UM
		STAGE WEIGHT:	8.10E+00 MG
4	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	2.10E+00 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	8.30	1.90	.60	.01
STAGE WEIGHTS(MILLIGRAMS)	5.65E+02	1.00E+00	8.10E+00	2.10E+00
MICROGRAMS/DNCM/STAGE	9.60E+04	1.70E+02	1.38E+03	3.57E+02
NUMBER/DNCM/STAGE	3.03E+10	5.18E+09	2.16E+12	1.47E+15
CUM. %MASS<D50	1.94	1.77	.36	
CUM. MICROGRAMS/ACM<D50	1.08E+03	9.84E+02	2.03E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.90E+03	1.73E+03	3.57E+02	0.00E+00
GEOM D50	1.82E+01	3.97E+00	1.07E+00	7.75E-02
DM/DLOGD-(UG/DNM3)	1.41E+05	2.65E+02	2.75E+03	2.01E+02
DN-LOGD/(NUMBER/DNM3)	4.44E+10	8.09E+09	4.31E+12	8.24E+14

COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE•10 CYC	ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NITRATE & TOTAL CARBON. PROBE WT IS 180 MG & CYCLONE WT IS 385 MG

5257 MJS [illegible]

Appendix
C.1
Reference 21

~~204~~

Source Data

Source Type: Cereal Dryers

Source Fuel Type:

Source Description (Size, Rating, Ect.):
Confidential

Particle Size Data

Cumulative mass, % less than indicated size	Uncontrolled			Controlled	
	Dryer #1	Dryer #2	Dryer #3		
1 μm, aerodynamic	~40	~8	~8	19	3
2.5	~47	~13	~21	27	34
5	~53	~17	~36	35	45
10	~58	~22	~54	45	56
20	~64	~28	~70	54	67

Emission ~~Factor~~ Rate:

Dryer #1	Dry #2	Dryer #3
0.06 lb/h	0.24 lb/h	0.09 lb/h

Nothing - Size of Dryer

Testing Data

Number of tests run: Controlled = _____ Uncontrolled = 6 - 2 each dryer

Test Method*: Impactors were run at a point of average velocity

Type of Impactor: Andersen Mark III

Impactor Flow Rate: Dryer #1 - .40, Dryer #2 - .45, Dryer #3 - .38 acfm, % Isokinetic 100 ± 10% for all sample ru.

Was Impactor Heated: No for all 3 sites, Was Sample Gas Saturated: No for all 3 sites

Did Sampling Site Meet Method 1 criteria: yes for all 3 sites

Comments

* Example Method 5 - implies Method 5 procedures were used

App C.1 p 5

(23) 1.501.5

74-GRN-7

(REPORT NUMBE

Appendix
C.1
Reference 23

AIR POLLUTION EMISSION TEST

BUNGE CORPORATION

(PLANT NAME)

Destrehan, Louisiana

(PLANT ADDRESS)

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Water Programs
Office of Air Quality Planning and Standards
Emission Standards and Engineering Division
Emission Measurement Branch
Research Triangle Park, N. C. 27711

Emission Testing Report
EMB Test No.: 74-GRN-7

BUNGE CORPORATION

Destrehan, Louisiana

Project Officer
Roger O. Pfaff

Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

January 1974

TABLE 5

Particle Size Results

Run 1

Stage	Characteristic Diameter, Dn μm	μg	Weight Percent	Cumulative Weight Percent, <Dn
Probe & cyclone		22,450		
1	3.14	1,480	71.5	28.5
2	1.63	190	9.2	19.3
3	1.10	210	10.1	9.2
4	0.57	120	5.8	3.4
5	0.33	70	3.4	
	TOTAL	2,070		

Run 2

Probe & cyclone		44,900		
1	3.14	1,260	87.5	12.6
2	1.63	90	6.3	6.3
3	1.10	30	2.1	4.2
4	0.57	40	2.8	1.4
5	0.33	20	1.4	
	TOTAL	1,440		

Appendix C.1 Reference 24

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 DATE 06/20/83

NO: 154 DESCRIBES SAMPLING AT SITE FROM 09/07/75 TO 09/07/75 BY WASH. DEPT. OF ECOLOG

SPONSOR ORGANIZATION: WASHINGTON DEPT. OF ECOLOGY
CONTRACT NUMBER: PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY:	FOOD INDUSTRY	SOURCE NAME:	
SOURCE TYPE:	GRAIN MILL PRODUCTS	SITE NAME:	UNIONTOWN
PRODUCT/DEVICE:	GRAIN	ADDRESS:	
PROCESS TYPE:	PROCESSING		, 00000
DESIGN PROCESS RATE:			
FEED MATERIAL CATEGORY:	AGRI FEED		
PRIMARY CONTROL DEVICE:		SIC CODE:	2041

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: SDDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

NELSON,P.A.

TEST SERIES COMMENTS----------

App. I C 1, Ref. 5

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
11	STAGE 11		
		STAGE/FILTER CUT SIZE:	.06 UM
		STAGE MASS:	1.00E+00 UG/DNM3
12	STAGE 12		
		STAGE/FILTER CUT SIZE:	.03 UM
		STAGE MASS:	1.15E+01 UG/DNM3
13	STAGE 13		
		STAGE/FILTER CUT SIZE:	.02 UM
		STAGE MASS:	2.04E+00 UG/DNM3
14	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE MASS:	3.28E+01 UG/DNM3

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9	10
D50(MICRONS)	10.73	4.98	2.64	1.26	.59	.25	.16	.12	.10	.08
MICROGRAMS/DNCM/STAGE	6.22E+03	5.22E+03	2.71E+03	8.31E+02	4.12E+02	1.02E+02	1.58E+02	5.70E+01	2.90E+01	2.95E+01
NUMBER/DNCM/STAGE	3.68E+08	9.82E+09	4.18E+10	1.01E+11	4.72E+11	1.32E+12	1.45E+13	1.57E+13	1.62E+13	3.03E+13
CUM. %MASS<D50										
CUM. MICROGRAMS/DNCM<D50	9.60E+03	4.38E+03	1.67E+03	8.35E+02	4.23E+02	3.21E+02	1.63E+02	1.06E+02	7.68E+01	4.73E+01
GEOM D50	2.32E+01	7.31E+00	3.63E+00	1.82E+00	8.62E-01	3.84E-01	2.00E-01	1.39E-01	1.10E-01	8.94E-02
DM/DLOGD-(UG/DNM3)	9.31E+03	1.57E+04	9.83E+03	2.59E+03	1.25E+03	2.74E+02	8.15E+02	4.56E+02	3.66E+02	3.04E+02
DN-LOGD/(NUMBER/DNM3)	5.50E+08	2.94E+10	1.52E+11	3.13E+11	1.43E+12	3.55E+12	7.49E+13	1.26E+14	2.05E+14	3.12E+14

STAGE #	11	12	13	14
D50(MICRONS)	.06	.03	.02	.01
STAGE WEIGHTS(MILLIGRAMS)	1.00E+00	1.15E+01	2.04E+00	3.28E+01
MICROGRAMS/DNCM/STAGE	1.00E+00	1.15E+01	2.04E+00	3.28E+01
NUMBER/DNCM/STAGE	2.21E+12	1.11E+14	1.02E+14	8.52E+15
CUM. %MASS<D50				
CUM. MICROGRAMS/ACM<D50	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CUM. MICROGRAMS/DNCM<D50	4.63E+01	3.48E+01	3.28E+01	0.00E+00
GEOM D50	6.93E-02	4.24E-02	2.45E-02	1.41E-02
DM/DLOGD-(UG/DNM3)	8.00E+00	3.82E+01	1.16E+01	1.09E+02
DN-LOGD/(NUMBER/DNM3)	1.77E+13	3.67E+14	5.79E+14	2.83E+16

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
11	STAGE 11	STAGE/FILTER CUT SIZE:	.06 UM
		STAGE MASS:	1.00E+00 UG/DNM3
12	STAGE 12	STAGE/FILTER CUT SIZE:	.03 UM
		STAGE MASS:	2.67E+01 UG/DNM3
13	STAGE 13	STAGE/FILTER CUT SIZE:	.02 UM
		STAGE MASS:	1.29E+01 UG/DNM3
14	FILTER	STAGE/FILTER CUT SIZE:	.01 UM
		STAGE MASS:	5.71E+02 UG/DNM3

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9	10
D50(MICRONS)	10.71	4.98	2.64	1.26	.99	.25	.16	.12	.10	.08
MICROGRAMS/DNCM/STAGE	6.49E+03	1.43E+03	1.87E+03	3.83E+02	5.64E+02	1.34E+02	2.00E+02	5.42E+01	2.67E+01	5.52E+01
NUMBER/DNCM/STAGE	3.85E+08	2.70E+09	2.88E+10	4.64E+10	2.97E+11	7.99E+11	1.84E+13	1.50E+13	1.49E+13	5.67E+13
CUM. %MASS<D50										
CUM. MICROGRAMS/DNCM<D50	5.33E+03	3.90E+03	2.03E+03	1.65E+03	1.08E+03	9.48E+02	7.48E+02	6.93E+02	6.67E+02	6.12E+02
GEOM D50	2.31E+01	7.30E+00	3.63E+00	1.82E+00	1.12E+00	4.97E-01	2.00E-01	1.39E-01	1.10E-01	8.94E-02
DM/DLOGD-(UG/DNM3)	9.70E+03	4.30E+03	6.78E+03	1.19E+03	5.39E+03	2.24E+02	1.03E+03	4.34E+02	3.37E+02	5.70E+02
DN-LOGD/(NUMBER/DNM3)	5.75E+08	8.11E+09	1.05E+11	1.44E+11	2.84E+12	1.34E+12	9.47E+13	1.20E+14	1.88E+14	5.85E+14

STAGE #	11	12	13	14
D50(MICRONS)	.06	.03	.02	.01
STAGE WEIGHTS(MILLIGRAMS)	1.00E+00	2.67E+01	1.29E+01	5.71E+02
MICROGRAMS/DNCM/STAGE	1.00E+00	2.67E+01	1.29E+01	5.71E+02
NUMBER/DNCM/STAGE	2.21E+12	2.57E+14	6.45E+14	1.48E+17
CUM. %MASS<D50				
CUM. MICROGRAMS/ACM<D50	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CUM. MICROGRAMS/DNCM<D50	6.11E+02	5.84E+02	5.71E+02	0.00E+00
GEOM D50	6.93E-02	4.24E-02	2.45E-02	1.41E-02
DM/DLOGD-(UG/DNM3)	8.00E+00	8.87E+01	7.33E+01	1.90E+03
DN-LOGD/(NUMBER/DNM3)	1.77E+13	8.53E+14	3.66E+15	4.93E+17

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
11	STAGE 11		
		STAGE/FILTER CUT SIZE:	.06 UM
		STAGE MASS:	0.00E+00 UG/DNM3
12	STAGE 12		
		STAGE/FILTER CUT SIZE:	.03 UM
		STAGE MASS:	1.57E+01 UG/DNM3
13	STAGE 13		
		STAGE/FILTER CUT SIZE:	.02 UM
		STAGE MASS:	8.03E+00 UG/DNM3
14	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE MASS:	4.06E+01 UG/DNM3

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9	10
D50(MICRONS)	10.71	4.98	2.64	1.26	.59	.25	.16	.12	.10	.08
MICROGRAMS/DNCM/STAGE	5.53E+03	3.89E+03	1.81E+03	4.29E+02	3.58E+02	1.88E+02	1.57E+02	6.50E+01	4.45E+01	4.42E+01
NUMBER/DNCM/STAGE	3.28E+08	7.34E+09	2.79E+10	5.19E+10	4.10E+11	2.44E+12	1.44E+13	1.79E+13	2.49E+13	4.54E+13
CUM. %MASS<D50										
CUM. MICROGRAMS/DNCM<D50	7.05E+03	3.16E+03	1.35E+03	9.21E+02	5.63E+02	3.75E+02	2.18E+02	1.53E+02	1.09E+02	6.43E+01
GEOM D50	2.31E+01	7.30E+00	3.63E+00	1.82E+00	8.62E-01	3.84E-01	2.00E-01	1.39E-01	1.10E-01	8.94E-02
DM/DLOGD-(UG/DNM3)	8.26E+03	1.17E+04	6.57E+03	1.34E+03	1.09E+03	5.04E+02	8.10E+02	5.20E+02	5.62E+02	4.56E+02
DN-LOGD/(NUMBER/DNM3)	4.90E+08	2.21E+10	1.01E+11	1.62E+11	1.25E+12	6.54E+12	7.44E+13	1.44E+14	3.14E+14	4.68E+14

STAGE #	11	12	13	14
D50(MICRONS)	.06	.03	.02	.01
STAGE WEIGHTS(MILLIGRAMS)	0.00E+00	1.57E+01	8.03E+00	4.06E+01
MICROGRAMS/DNCM/STAGE	0.00E-0	1.57E+01	8.03E+00	4.06E+01
NUMBER/DNCM/STAGE	0.00E-0	1.51E+14	4.01E+14	1.05E+16
CUM. %MASS<D50				
CUM. MICROGRAMS/ACM<D50	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CUM. MICROGRAMS/DNCM<D50	6.43E+01	4.86E+01	4.06E+01	0.00E+00
GEOM D50	6.93E-02	4.24E-02	2.45E-02	1.41E-02
DM/DLOGD-(UG/DNM3)	0.00E+00	5.22E+01	4.56E+01	1.35E+02
DN-LOGD/(NUMBER/DNM3)	0.00E-0	5.02E+14	2.28E+15	3.50E+16

Appendix C.1 Reference 25

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

NO: 228 DESCRIBES SAMPLING AT SITE FROM 10/11/77 TO 10/11/77 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY: FOOD INDUSTRY
SOURCE TYPE: GRAIN MILL PRODUCTS
PRODUCT/DEVICE: RICE
PROCESS TYPE: PROCESSING
DESIGN PROCESS RATE: 90800 KG/HR
FEED MATERIAL CATEGORY: AGRI FEED
PRIMARY CONTROL DEVICE:

SOURCE NAME: CONFIDENTIAL
SITE NAME:
ADDRESS:
LOS ANGELES ,CA 00000
SIC CODE: 2044

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00080 SDDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN.
TABACK H.J.
KVB REPORT 5806-783 PB 293 923/AS FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL. RICE DRYER IS A HOLLOW,DOUBLE-WALL CYLINDER ENCLOSED IN A BLDG. VENTED THRU 6-4.1M DIA. SCREENS & HEATED BY 4-9.54KJ/HR BURNERS

App. C1, Ref. 41

1.6 6.1 11.2
1.9 3.1 10.2
2.0 21.6 39.8

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE+10 CYC		
		STAGE/FILTER CUT SIZE:	9.20 UM
		STAGE WEIGHT:	3.65E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	327.800 MG
2	3 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	3.80 UM
		STAGE WEIGHT:	6.49E+01 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	64.900 MG
3	1 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	1.30 UM
		STAGE WEIGHT:	7.60E+00 MG
4	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	1.00E+00 MG

PARTICLE SIZE TABLE----------

STAGE #	1	2	3	4
D50(MICRONS)	9.20	3.80	1.30	.01
STAGE WEIGHTS(MILLIGRAMS)	3.65E+02	6.49E+01	7.60E+00	1.00E+00
MICROGRAMS/DNCM/STAGE	1.31E+04	2.33E+03	2.73E+02	3.59E+01
NUMBER/DNCM/STAGE	3.54E+09	2.15E+10	4.74E+10	4.62E+13
CUM. %MASS<D50	33.5 16.76	3.9 1.96	0.46 .23	
CUM. MICROGRAMS/ACM<D50	2.05E+03	2.40E+02	2.79E+01	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.64E+03	3.09E+02	3.59E+01	0.00E+00
GEOM D50	1.92E+01	5.91E+00	2.22E+00	1.14E-01
DM/DLOGD-(UG/DNM3)	2.05E+04	6.06E+03	5.85E+02	1.70E+01
DN-LOGD/(NUMBER/DNM3)	5.55E+09	5.60E+10	1.02E+11	2.19E+13

Sass - 4 L/min
10 6 2.5
37.5 12 1.8

4th-order poly to curve

COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE+10 CYC	ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NITRATE, AND TOT. CARBON. PROBE WT IS 37.5 MG.

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE+10 CYC	STAGE/FILTER CUT SIZE:	8.30 UM
		STAGE WEIGHT:	1.78E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	141.000 MG
2	3 UM CYCLONE	STAGE/FILTER CUT SIZE:	1.90 UM
		STAGE WEIGHT:	2.20E+00 MG
3	1 UM CYCLONE	STAGE/FILTER CUT SIZE:	.60 UM
		STAGE WEIGHT:	1.00E+00 MG
4	FILTER	STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	7.00E-01 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	8.30	1.90	.60	.01
STAGE WEIGHTS(MILLIGRAMS)	1.78E+02	2.20E+00	1.00E+00	7.00E-01
MICROGRAMS/DNCM/STAGE	3.26E+04	4.03E+02	1.83E+02	1.28E+02
NUMBER/DNCM/STAGE	2.83E+35	6.54E+35	1.06E+37	0.00E-0
CUM. %MASS<D50	4.28	2.14	1.86 .93	0.76 .38
CUM. MICROGRAMS/ACM<D50	7.14E+02	3.11E+02	1.28E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	7.14E+02	3.11E+02	1.28E+02	0.00E+00
GEOM D50	1.82E+01	3.97E+00	1.07E+00	7.75E-02
DM/DLOGD-(UG/DNM3)	4.77E+04	6.29E+02	3.66E+02	7.21E+01
DN-LOGD/(NUMBER/DNM3)	6.22E+35	1.15E+36	2.12E+37	0.00E-0

10 6 2.5

4.8 3.6 2.1

COMMENTS ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE+10 CYC	ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NITRATE & TOT.CARBON. PROBE WT. IS 36.6 MG & CYCLONE IS 141 MG.

Section 6.18 Reference 3 App C-1 Ref 3?? 26

United States Environmental Protection Agency

Office of Air Quality Planning and Standards Research Triangle Park NC 27711

EPA-450/3-79-034a December 1979

Air

Appendix C.1 Reference 26

EPA

Ammonium Sulfate Manufacture — Background Information for Proposed Emission Standards

NSPS

EPA-450/3-79-034a

Ammonium Sulfate Manufacture — Background Information for Proposed Emission Standards

Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise, and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

December 1979

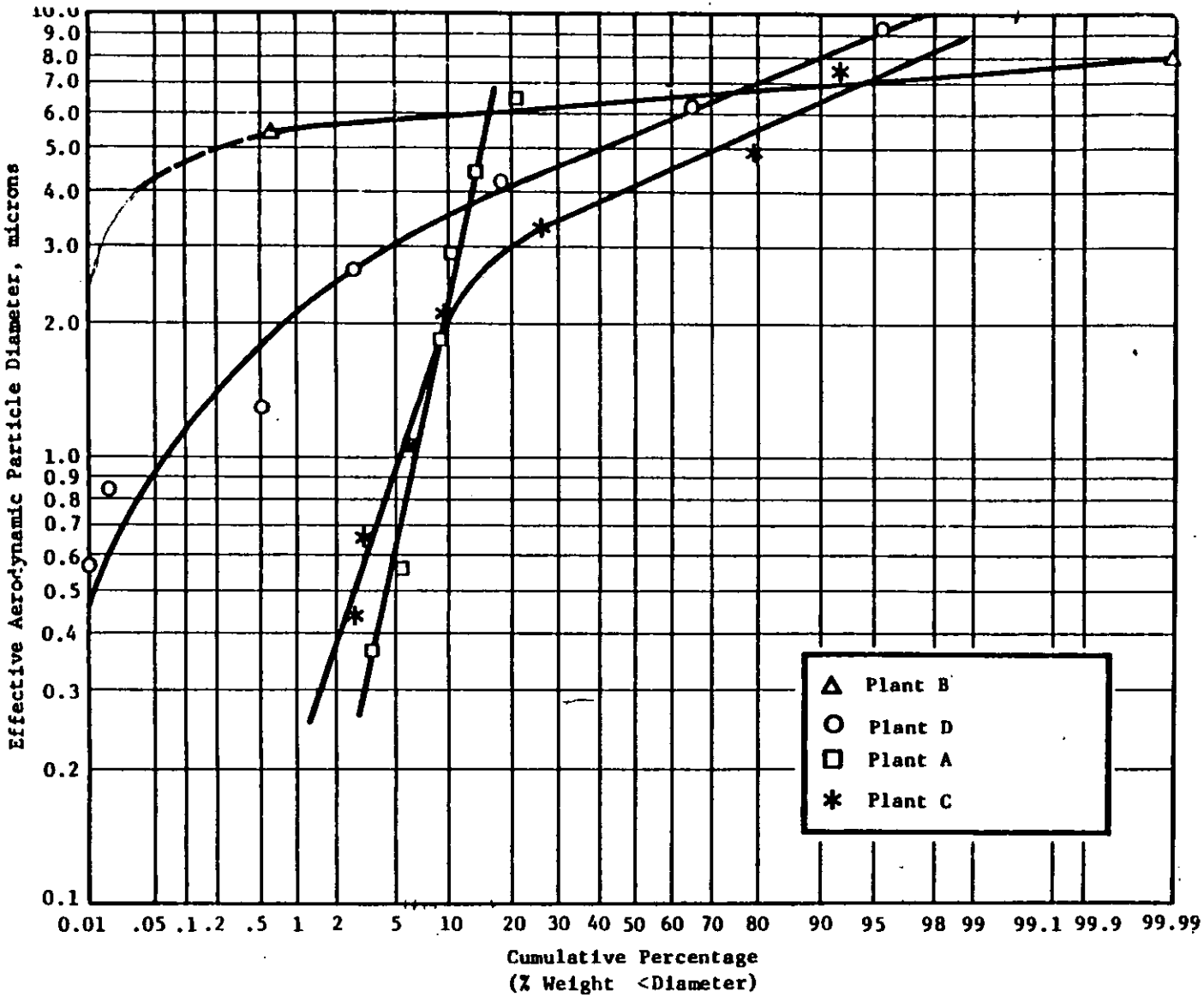


FIGURE 4-2
UNCONTROLLED AMMONIUM SULFATE DRYER EMISSIONS[2-5] PARTICLE SIZE DISTRIBUTION

Table C-14. AMMONIUM SULFATE PARTICLE SIZE DISTRIBUTION ANALYSIS

Facility: B
Date: 10/4/78
Sampling Method: Brinks Cascade Impactor

Impactor Fraction	Range of Effective Diameter Microns	Net Wt. (mg)	Size Distribution by Weight	
			Percent	Cumulative Percent
Cyclone	>8.04	289.2	99.3	100
Stage 1	2.74-8.04	2.0	0.7	0.7
Stage 2	1.62-2.74	<0.1	<0.1	<0.1
Stage 3	1.10-1.62	<0.1	<0.1	<0.1
Stage 4	0.58-1.10	<0.1	<0.1	<0.1
Stage 5	0.36-0.58	<0.1	<0.1	<0.1
Back-up Filter	<0.36	0.06	<0.1	<0.1
Total		291.4	100	

Table C-13. AMMONIUM SULFATE PARTICLE SIZE DISTRIBUTION ANALYSIS

Facility: A
Date: 9/13/78
Sampling Method: Anderson Cascade Impactor

Plate No.	Effective Diameter, Microns	Net Wt. mg.	Weight Percent	Cumulative Wt. Percent
1	9.5	45.7	79.6	100
2	6.0	3.7	6.4	20.3
3	4.0	1.8	3.2	13.9
4	2.72	1.0	1.7	10.8
5	1.72	1.5	2.6	9.1
6	0.87	0.8	1.4	6.5
7	0.83	0.8	1.4	5.1
8	0.35	1.3	2.3	3.7
Back-up Filter		0.8	1.4	1.4
Total		57.4	100	

Table 3-3. SUMMARY OF UNCONTROLLED AS EMISSION DATA - EPA EMISSION TESTS ON AS DRYERS*

Plant	Dryer type	Average uncontrolled AS emissions			
		gm/dscm [gr(dscf)]		kg/Mg	(lb/ton)
A	Rotary Dryer	4.38	(1.93)	0.41	(0.82)
B	Fluidized Bed Dryer	39.0	(17.2)	110	(221)
C	Rotary Dryer	8.87	(3.91)	3.46	(6.92)
D	Rotary Dryer	98.3	(43.3)	77	(153)

*Detailed uncontrolled emission data for the individual plants is given in Appendix C, Tables C-1, C-4, C-6, and C-8.

Table C-15. AMMONIUM SULFATE PARTICLE SIZE DISTRIBUTION ANALYSIS

Facility: C
Date: 12/6/78
Sampling Method: Anderson Cascade Impactor

Plate No.	Effective Diameter, Microns	Net Wt. mg.	Weight Percent	Cumulative Wt. Percent
1	≥11.8	450.4*	24.0	100.0
2	7.49	200.8	10.7	76.0
3	4.94	818.3	43.6	65.3
4	3.42	253.4	13.5	21.7
5	2.18	42.2	2.3	8.2
6	1.11	56.0	3.0	5.9
7	0.67	11.5	0.6	2.9
8	0.45	11.5	0.6	2.3
Back-up Filter	<0.45	31.3	1.7	1.7
Total		1875.4		

*Weight includes particulate collected in Plate No. 0 and in nozzle and head of sampler up stream of the collection plates.

Table C-16. AMMONIUM SULFATE PARTICLE SIZE DISTRIBUTION ANALYSIS

Facility: D
Date: 12/13/78
Sampling Method: Anderson Cascade Impactor

Plate No.	Effective Diameter, Microns	Net Wt. mg.	Weight Percent	Cumulative Wt. Percent
1	≥14.73	157.3	5.8	100.0
2	9.28	789.5	29.1	94.2
3	6.15	1271.6	46.8	65.1
4	4.26	413.8	15.2	18.3
5	2.11	71.2	2.6	3.1
6	1.40	13.2	0.5	0.5
7	0.85	0.5	0.0	0.0
8	0.58	0.0	0.0	0.0
Back-up Filter	<0.58	0.3	0.0	0.0
Total		2717.4		

Test reports need to get for Ammonium Sulfate Fertilizer

4.6 REFERENCES

1. Perry, J. H., Chemical Engineering Handbook, McGraw Hill Publishing Company, N.Y., N.Y., 3rd Ed., p. 196.

These only

~~2~~ 1. Jackson, B. L. and Marks, P. J., Source Emissions Test Report, Occidental Chemical Co., Houston, Texas, Ammonium Sulfate Dryer Baghouse, R. F. Weston, Inc., EPA Contract No. 68-02-2816, Draft Report, p. 24.

~~3~~ 2. Clayton Environmental Consultants, Inc., Draft Report, Emission Testing at an Ammonium Sulfate Manufacturing Plant, U.S. Environmental Protection Agency Report No. 78-NHF-1, Southfield, Michigan, November, 1978, p. 13.

~~4~~ 3. Scott, Environmental Technology, Inc., Particulate Emissions From An Ammonium Sulfate Plant Controlled by a Cyclonic Scrubber. U.S. EPA Contract No. 68-02-2813, Work Assignment No. 27, Draft Report, p. 2-4.

~~5~~ 4. Scott, Environmental Technology, Inc., Particulate Emissions From An Ammonium Sulfate Plant Controlled by a Venturi Scrubber. U.S. EPA Contract No. 68-02-2813, Work Assignment No. 28. Draft Report, p. 2-4.

6. Cheremisinoff, P. N. and Young, R. A., Wet Scrubbers - A Special Report, Pollution Engineering, Volume 6, No. 5, p. 34, May, 1974.

7. Cheremisinoff, P. M. and Young, R. A., Air Pollution Control and Design Handbook, Marcel Dekker, Inc., N.Y., N.Y., 1977, Part 2, p. 751.

8. Data provided by the Ducon Company, Mineola, N.Y., in a telephone conversation between H. Krockta and Craig Sherwood of U.S. EPA, OAQPS on December 20, 1978.

9. Data provided by American Air Filter, Inc., Louisville, Kentucky, in a telephone conversation between W. Klimczak and Craig Sherwood of U.S. EPA, OAQPS on December 11, 1978.

10. Op. Cit., Ref. 34, p. 35.

11. Response of Occidental Petroleum Corp., Plainview, Texas, to EPA 114 request.

12. Magill, P. C., et al., Air Pollution Handbook, McGraw-Hill Book Co., N.Y., N.Y., 1956, p. 13-48.

5. Ammonium Sulfate Manufacture - Background Information For Proposed Emission Standards (Draft), EPA-450/3-79-034a, U.S. Environmental Protection Agency, Research Triangle Park, NC, December 1979.

app. C1, Ref. 27

27

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB Report 80-MET-9
May 1980

Air

EPA

Metallic Minerals

Appendix
C.1
Reference 27

Emission Test Report Reynolds Metals Company Corpus Christi, Texas

SOURCE EMISSIONS TEST REPORT

Reynolds Metals Company
Sherwin Plant
Corpus Christi, Texas

Sources Tested:

- Ship Unloading Process
- Fine Ore Storage Area

Bauxite

August 1980

David A. Ralston
Assistant Project Scientist

Barry L. Jackson
Project Manager
Air Testing

RFW Report No. 0300-81-16
Contract No. 68-02-2816
Work Assignment No. 14

Prepared by

Roy F. Weston, Inc.
Designers - Consultants
Weston Way
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Table 10

PARTICLE SIZE DISTRIBUTION

Date: 6-24-80

Location: Reynolds Metals Company

Sampling Location: Ship Unloading Scb.Outl

Traverse Point No. Sampled: X-15

Run No. 1

P_{bar} (in. Hg.) 29.94

Stack Temp (^{o}F) 76

Sample Time (Min.) 95.0

Sample Volume (cf) 59.3

Moisture (% H_2O) 3.5

Meter Temp (^{o}F) 100

Flow Setting, ΔH (in. H_2O) 1.2

Nozzle Diameter (in.) 0.188

Sample Flow Rate (at stack conditions): 0.61 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	EAD (Microns)
1	18.9	32.7	100.0	12.5
2	0.5	0.8	67.3	7.8
3	0.9	1.6	66.5	5.2
4	1.8	3.1	64.9	3.6
5	4.5	7.8	61.8	2.7
6	15.4	26.6	54.0	1.2
7	8.7	15.1	27.4	0.71
8	4.8	8.3	12.3	0.48
Backup Filter	2.3	4.0	4.0	
TOTAL	57.8			

Figure 7

Ship Unloading Scrubber Outlet
Run No. 1 Particle Size Distribution

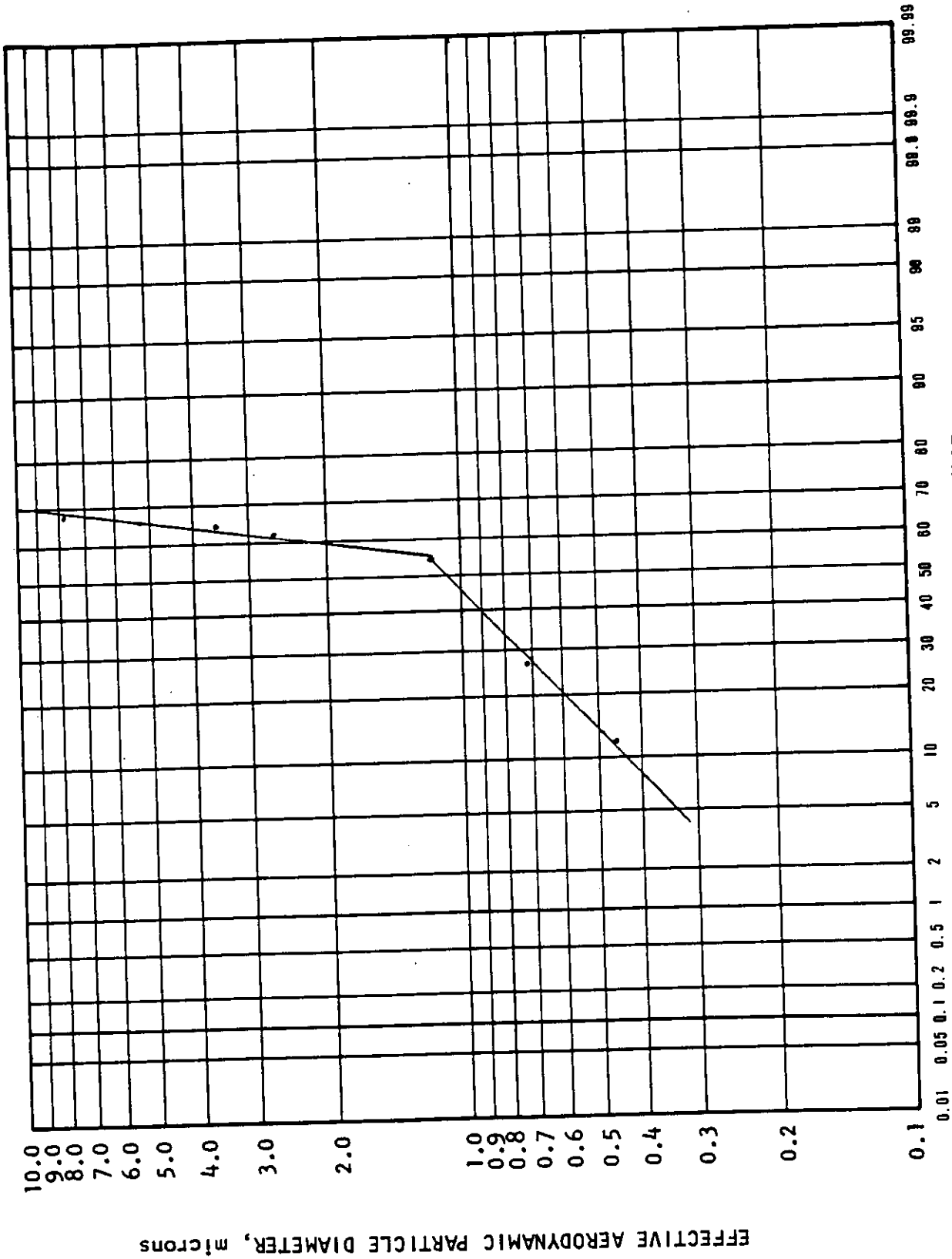


Table 11

PARTICLE SIZE DISTRIBUTION

Date: 6-25-80

Location: Reynolds Metals Company

Sampling Location: No. 1 & No. 2 Fine Ore Bins Exhaust Stack

Traverse Point No. Sampled: X-3

Run No. 1

P_{bar} (in. Hg.) 30.00

Stack Temp (^{o}F) 90

Sample Time (Min.) 90.0

Sample Volume (cf) 57.5

Moisture (% H_2O) 2.0

Meter Temp (^{o}F) 104

Flow Setting, ΔH (in. H_2O) 1.35

Nozzle Diameter (in.) 0.185

Sample Flow Rate (at stack conditions): 0.63 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	EAD (Microns)
1	2.4	17.8	100	12.2
2	1.0	7.4	82.2	7.6
3	1.1	8.2	74.8	5.2
4	0.8	5.9	66.6	3.6
5	1.5	11.1	60.7	2.4
6	1.6	11.9	49.6	1.2
7	1.3	9.6	37.7	0.71
8	1.5	11.1	28.1	0.47
Backup Filter	2.3	17.0	17.0	
TOTAL	13.5			

Figure 8

No. 1 and No. 2 Fine Ore Bins Exhaust Stack
Run No. 1 Particle Size Distribution

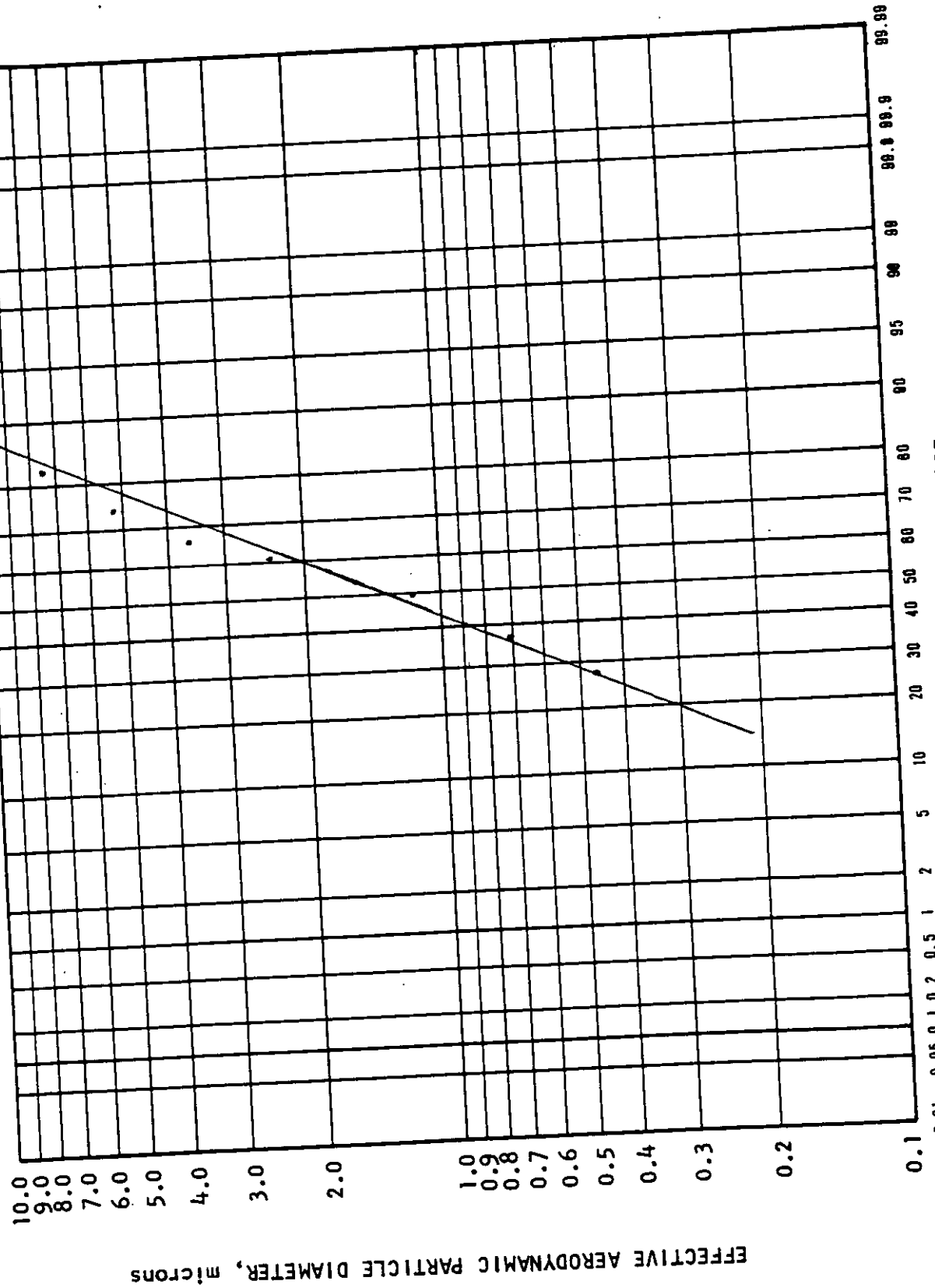


Table 12

PARTICLE SIZE DISTRIBUTION

Date: 6-25-80

Location: Reynolds Metals

Sampling Location: No. 1 & No. 2 Fine Ore Bins Exhaust Stack

Traverse Point No. Sampled: X-3

Run No. 2

P_{bar} (in. Hg.) 29.99

Stack Temp (^{o}F) 90

Sample Time (Min.) 180

Sample Volume (cf) 113.152

Moisture (% H_2O) 2.0

Meter Temp (^{o}F) 95

Flow Setting, ΔH (in. H_2O) 1.35

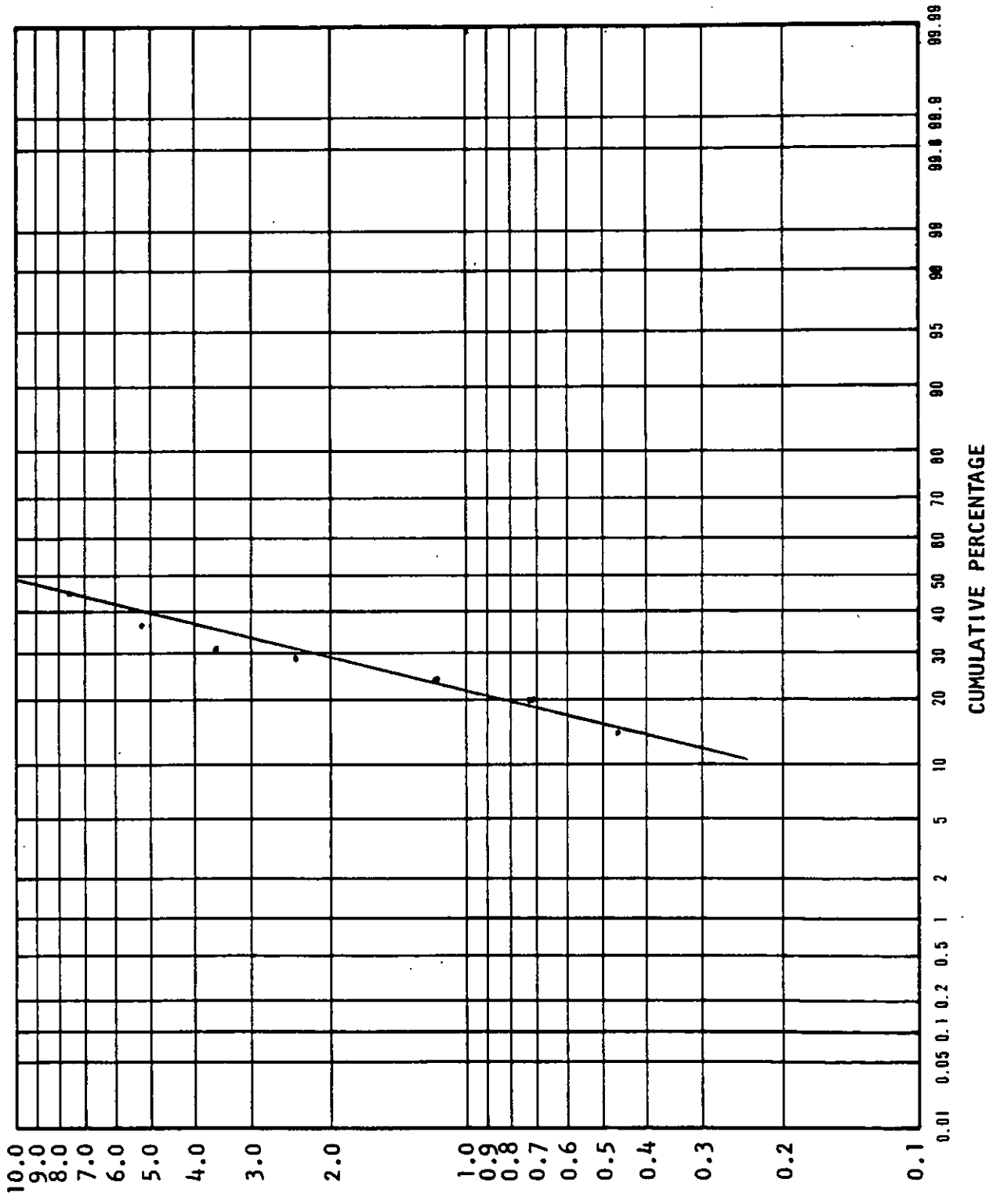
Nozzle Diameter (in.) 0.185

Sample Flow Rate (at stack conditions): 0.62 cfm

Plate No.	Net Wt. (mg)	%	Cumulative %	EAD (Microns)
1	12.2	55.5	100	12.2
2	1.5	6.8	44.5	7.6
3	1.3	5.9	37.7	5.2
4	0.5	2.3	31.8	3.6
5	1.2	5.5	29.5	2.4
6	0.8	3.6	24.0	1.2
7	1.1	5.0	20.4	0.71
8	1.0	4.5	15.4	0.47
Backup Filter	2.4	10.9	10.9	
TOTAL	22.0			

Figure 9

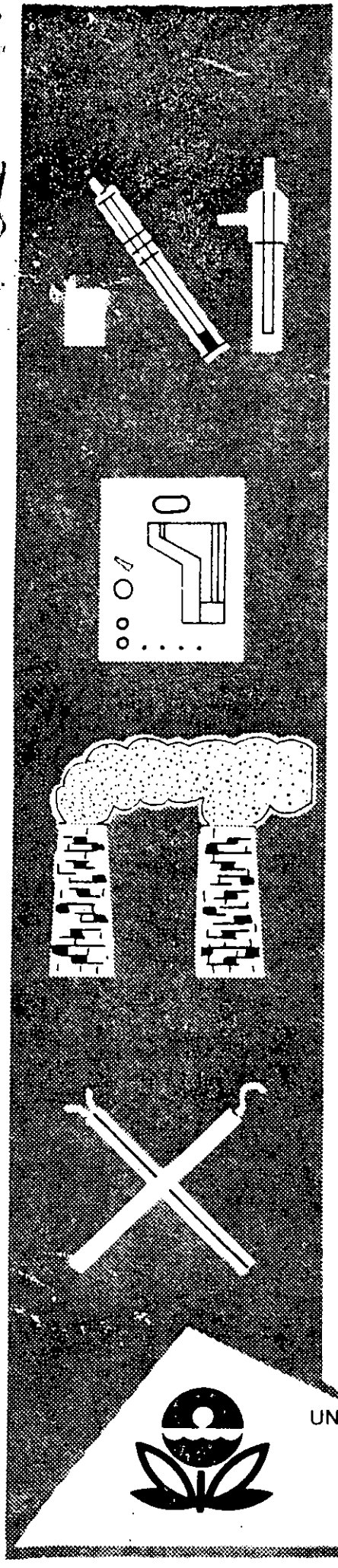
No. 1 and No. 2 Fine Ore Bins Exhaust Stack
Run No. 2 Particle Size Distribution



App. C1, Ref. 1, 4; 32

REPORT NO. 76-BAT-4

Appendix
C.1
Reference 32



AIR POLLUTION EMISSION TEST

GLOBE UNION, INC.
CANBY, OREGON

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

SOURCE TESTING OF A LEAD ACID BATTERY MANUFACTURING PLANT

Globe Union, Inc.
Canby, Oregon

Test No. 76-BAT-4

Test Conducted by

U.S. Environmental Protection Agency
Emission Measurement Branch
Research Triangle Park, North Carolina 27711

Report Prepared by

Robert M. Martin
Environmental Protection Specialist
Emission Measurement Branch
Research Triangle Park, North Carolina 27711

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 1X

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	10.0
PRESSURE DROP	IN HG	5.50
STATIC PRESSURE	IN H2O	-5.00
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.76
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	96.0
GAS VISCOSITY	POISE	0.00019
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	0.300		0.27	27.37	100.00
1	0.705	0.99	0.62	64.32	72.63
2	0.030	0.56	0.03	2.74	8.30
3	0.010	0.36	0.01	0.91	5.57
4	0.041	0.15	0.04	3.74	4.65
5	0.010	0.07	0.01	0.91	0.91
FILTER	0.000		0.00	0.00	0.00

Table 21.

Grid Casting + Small Parts Casting

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 2X

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	10.0
PRESSURE DROP	IN HG	5.50
STATIC PRESSURE	IN H2O	-6.00
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.92
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	93.0
GAS VISCOSITY	POISE	0.00019
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	1.200		1.07	59.29	100.00
1	0.701	1.00	0.62	34.63	40.71
2	0.016	0.56	0.01	0.79	6.08
3	0.028	0.36	0.02	1.38	5.29
4	0.019	0.15	0.02	0.94	3.90
5	0.010	0.07	0.01	0.49	2.96
FILTER	0.050		0.04	2.47	2.47

Table 23.

Grid Casting and Small Parts Casting

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 3X

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	10.0
PRESSURE DROP	IN HG	5.50
STATIC PRESSURE	IN H2O	-6.10
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.92
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	90.0
GAS VISCOSITY	POISE	0.00019
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	2.300		2.05	49.84	100.00
1	0.700	1.00	0.62	15.17	50.16
2	0.001	0.56	0.00	0.02	34.99
3	0.006	0.36	0.01	0.13	34.97
4	0.004	0.15	0.00	0.09	34.84
5	0.004	0.07	0.00	0.09	34.76
FILTER	1.600		1.43	34.67	34.67

Table 25.

Grid Casting and Small Parts Casting

Table 42. Andersen Particle Size Data - Continued

Element Assembly (3 Process Operation)

RUN 1B

Stage	DPC	Wt of Material (mg)	WT PCT	CUM WT PCT
nozzle	>4.13	1.1	35.48	100.00
0	4.13	0.1	3.23	64.52
1	2.58	0.4	12.90	61.29
2	1.74	0.2	6.45	48.39
3	1.22	0.2	6.45	41.94
4	.796	0	0	35.49
5	.393	0.1	3.23	35.49
6	.240	0.3	9.68	32.26
7	.161	0.2	6.45	22.58
F	<.161	0.5	16.13	16.13

RUN 2B

Stage	DPC	Wt of Material (mg)	WT PCT	CUM WT PCT
nozzle	>4.06	1.2	63.16	100.00
0	4.06	0.1	5.26	36.85
1	2.55	0	0	31.59
2	1.71	0	0	31.59
3	1.21	0	0	31.59
4	.822	0	0	31.59
5	.383	0	0	31.59
6	.235	0.2	10.53	31.59
7	.158	0.2	10.53	21.06
F	<.158	0.2	10.53	10.53

RUN 3B

Stage	DPC	Wt of Material (mg)	WT PCT	CUM WT PCT
nozzle	>4.00	0.9	37.50	100.00
0	4.00	0.1	4.17	62.50
1	2.51	0.2	8.333	58.33
2	1.68	0	0	49.99
3	1.18	0	0	49.99
4	.739	0	0	49.99
5	.377	0.2	8.333	50.00
6	.232	0.2	8.333	41.67
7	.155	0.2	8.333	33.33
F	<.155	0.6	25.00	25.00

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 2A

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	10.0
PRESSURE DROP	IN HG	3.80
STATIC PRESSURE	IN H2O	-5.60
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.92
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	70.0
GAS VISCOSITY	POISE	0.00019
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	2.600		2.78	58.94	100.00
1	0.403	1.10	0.43	9.14	41.06
2	0.001	0.63	0.00	0.02	31.92
3	0.000	0.41	0.00	0.00	31.90
4	0.005	0.18	0.01	0.11	31.90
5	0.002	0.09	0.00	0.05	31.78
FILTER	1.400		1.49	31.74	31.74

Table 29.

Paste Mixing

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 1A

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	10.0
PRESSURE DROP	IN HG	3.80
STATIC PRESSURE	IN H2O	-5.00
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.92
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	98.0
GAS VISCOSITY	POISE	0.00019
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	1.060		1.11	71.48	100.00
1	0.188	1.09	0.20	12.68	28.52
2	0.006	0.62	0.01	0.40	15.85
3	0.002	0.40	0.00	0.13	15.44
4	0.006	0.18	0.01	0.40	15.31
5	0.155	0.08	0.16	10.45	14.90
FILTER	0.066		0.07	4.45	4.45

Table 27.

Paste Mixing

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 3A

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	10.0
PRESSURE DROP	IN HG	3.80
STATIC PRESSURE	IN H2O	-5.60
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.92
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	77.0
GAS VISCOSITY	POISE	0.00019
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	0.200		0.21	11.07	100.00
1	1.005	1.10	1.07	55.65	88.93
2	0.001	0.62	0.00	0.06	33.28
3	0.000	0.41	0.00	0.00	33.22
4	0.000	0.18	0.00	0.00	33.22
5	0.000	0.09	0.00	0.00	33.22
FILTER	0.600		0.64	33.22	33.22

Table 31.

Paste Mixing

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

ES NO: 117 DESCRIBES SAMPLING AT SITE FROM 04/26/73 TO 04/26/73 BY SOUTHERN RESEARCH INST

SPONSOR ORGANIZATION: NOT SPECIFIED
CONTRACT NUMBER:
TASK/DIRECTIVE NUMBER: 000

PURPOSE OF TEST: SOURCE CHARACTERIZATION STUDY

SOURCE DESCRIPTION----------

SOURCE CATEGORY: METALS
SOURCE TYPE: SECONDARY FERROUS
PRODUCT/DEVICE: STEEL
PROCESS TYPE: FOUNDRY
DESIGN PROCESS RATE:
FEED MATERIAL CATEGORY: NOT SPECFD
PRIMARY CONTROL DEVICE:

SOURCE NAME: CONFIDENTIAL
SITE NAME: CONFIDENTIAL
ADDRESS:
00000
SIC CODE: 3320

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):

LEDS TSN: GEDS TSN: SDDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

BIRD, ALVIN N.
SORI-EAS-73-200

TEST SERIES COMMENTS----------

THE PURPOSE WAS TO CONDUCT PARTICLE SIZE MEASUREMENTS TO DETERMINE THE SIZE RANGE OF PARTICLES FROM HOOD DUCTS IN A STEEL FOUNDRY. WHEN PIPE MOLDS ARE BROKEN SMALL PARTICLES ARE RELEASED AND DRAWN THROUGH HOOD DUCTS.

PARTICLE DIAMETERS BASED ON CLASSIC AERODYNAMIC DEFINITION (TASK GROUP ON LUNG DYNAMICS)

PARTICLE SIZE SUMMARY----------

SAMPLE NO.	SAMPLE LOCATIONS DEVICE	SYSTEM	UG/DNM3	PARTICLE DIAMETER IN MICROMETERS 20.0	15.0	10.0	6.0	2.5	1.25	1.0	0.625
01	OUTLET		CUM MASS CONC	4.62E+04	4.11E+04	3.59E+04	3.21E+04	3.08E+04	3.07E+04	3.06E+04	3.02E+04
			DM/DLOG D	4.41E+04	3.73E+04	2.07E+04	1.24E+04	0.00E+00	9.14E+02	1.31E+03	3.25E+03
				EXTRAPOL	EXTRAPOL	EXTRAPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL
02	OUTLET		CUM MASS CONC	4.90E+04	4.56E+04	4.23E+04	4.07E+04	3.80E+04	3.68E+04	3.48E+04	2.38E+04
			DM/DLOG D	2.96E+04	2.44E+04	1.18E+04	4.84E+03	4.70E+03	4.75E+03	3.74E+04	6.92E+04
				EXTRAPOL	EXTRAPOL	EXTRAPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL	INTERPOL

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8
D50(MICRONS)	8.65	4.95	2.98	2.07	1.15	.77	.46	.23
MICROGRAMS/DNCM/STAGE	2.34E+04	1.40E+03	1.97E+03	7.33E+02	9.39E+02	7.33E+03	1.62E+04	1.32E+04
NUMBER/DNCM/STAGE	7.65E+08	4.15E+09	2.89E+10	3.97E+10	2.12E+11	7.30E+12	6.38E+13	3.19E+14
CUM. %MASS<D50								
CUM. MICROGRAMS/DNCM<D50	4.18E+04	4.04E+04	3.84E+04	3.77E+04	3.67E+04	2.94E+04	1.32E+04	0.00E+00
GEOM D50	2.94E+01	6.54E+00	3.84E+00	2.48E+00	1.54E+00	9.41E-01	5.95E-01	3.25E-01
DM/DLOGD-(UG/DNM3)	2.20E+04	5.78E+03	8.94E+03	4.63E+03	3.68E+03	4.21E+04	7.24E+04	4.38E+04
DN-LOGD/(NUMBER/DNM3)	7.20E+08	1.71E+10	1.31E+11	2.51E+11	8.32E+11	4.19E+13	2.85E+14	1.06E+15

Appendix C.1 Reference 31

ES NO: 233 DESCRIBES SAMPLING AT SITE FROM 03/21/78 TO 03/21/78 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY:	METALS	SOURCE NAME:	CONFIDENTIAL
SOURCE TYPE:	SECONDARY FERROUS	SITE NAME:	
PRODUCT/DEVICE:	STEEL	ADDRESS:	
PROCESS TYPE:	OPEN HEARTH		LOS ANGELES ,CA 00000
DESIGN PROCESS RATE:	8260 KG/HR		
FEED MATERIAL CATEGORY:	MTL SCRAP		
PRIMARY CONTROL DEVICE:		SIC CODE:	3320

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00085 SDDS TSN:

REFERENCE REPORT----------

TITLE / AUTHOR / SPONSOR REPORT NUMBER	NTIS NUMBER	PUBLICATION DATE
FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN. TABACK H.J. KVB REPORT 5806-783	PB 293 923/AS	FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL.

App.C.1, Ref. 31

STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE+10 CYC	STAGE/FILTER CUT SIZE:	8.30 UM
		STAGE WEIGHT:	4.97E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	269.000 MG
		CHEMICAL ANALYSIS LABORATORY NAME:	ARMAME
2	3 UM CYCLONE	STAGE/FILTER CUT SIZE:	1.90 UM
		STAGE WEIGHT:	9.91E+01 MG
3	1 UM CYCLONE	STAGE/FILTER CUT SIZE:	.60 UM
		STAGE WEIGHT:	5.85E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	585.000 MG
4	FILTER	STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	8.83E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	883.000 MG

SIZE TABLE---------

	1	2	3	4
RONS)	8.30	1.90	.60	.01
EIGHTS(MILLIGRAMS)	4.97E+02	9.91E+01	5.85E+02	8.83E+02
AMS/DNCM/STAGE	1.02E+05	2.03E+04	1.20E+05	1.81E+05
DNCM/STAGE	3.21E+10	6.19E+11	1.88E+14	7.43E+17
ASS<D50	75.92	71.12	42.78	
CROGRAMS/ACM<D50	1.77E+05	1.66E+05	9.96E+04	0.00E+00
CROGRAMS/DNCM<D50	3.21E+05	3.01E+05	1.81E+05	0.00E+00
0	1.82E+01	3.97E+00	1.07E+00	7.75E-02
D-(UG/DNM3)	1.49E+05	3.17E+04	2.39E+05	1.02E+05
/(NUMBER/DNM3)	4.71E+10	9.67E+11	3.76E+14	4.18E+17

'S ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE+10 CYC	ARMAMENT LAB DID ELEMENTAL ANALYSIS & ROCKWELL DID SULFATE, NITRATE & TOTAL CARBON. PROBE WT IS 228MG & CYCLONE WT IS 269 MG

STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE+10 CYC	STAGE/FILTER CUT SIZE:	9.20 UM
		STAGE WEIGHT:	4.43E+02 MG
2	3 UM CYCLONE	STAGE/FILTER CUT SIZE:	3.80 UM
		STAGE WEIGHT:	6.61E+01 MG
3	1 UM CYCLONE	STAGE/FILTER CUT SIZE:	1.30 UM
		STAGE WEIGHT:	1.61E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	161.000 MG
		CHEMICAL ANALYSIS LABORATORY NAME:	ARMAME
4	FILTER	STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	2.51E+02 MG
		COMPONENT (ALIQUOT) MASS/VOLUME:	251.000 MG

IZE TABLE---------

	1	2	3	4
ONS)	9.20	3.80	1.30	.01
IGHTS(MILLIGRAMS)	4.43E+02	6.61E+01	1.61E+02	2.51E+02
MS/DNCM/STAGE	2.22E+04	3.32E+03	8.08E+03	1.26E+04
NCM/STAGE	6.02E+09	3.07E+10	1.41E+12	1.62E+16
SS<D50	51.91	44.73	27.25	
ROGRAMS/ACM<D50	1.35E+04	1.17E+04	7.11E+03	0.00E+00
ROGRAMS/DNCM<D50	2.40E+04	2.07E+04	1.26E+04	0.00E+00
	1.92E+01	5.91E+00	2.22E+00	1.14E-01
-(UG/DNM3)	3.48E+04	8.64E+03	1.73E+04	5.96E+03
(NUMBER/DNM3)	9.43E+09	7.98E+10	3.02E+12	7.68E+15

ON THE EFFLUENT CHARACTERISTICS---------

COMPONENT NO.	NAME	REMARKS
1	PROBE+10 CYC	PROBE WT IS 373 MG & 10 UM CYCLONE IS 70.3 MG.

App. C. 1, Ref.

Report No. 76-BAT-3

(33)

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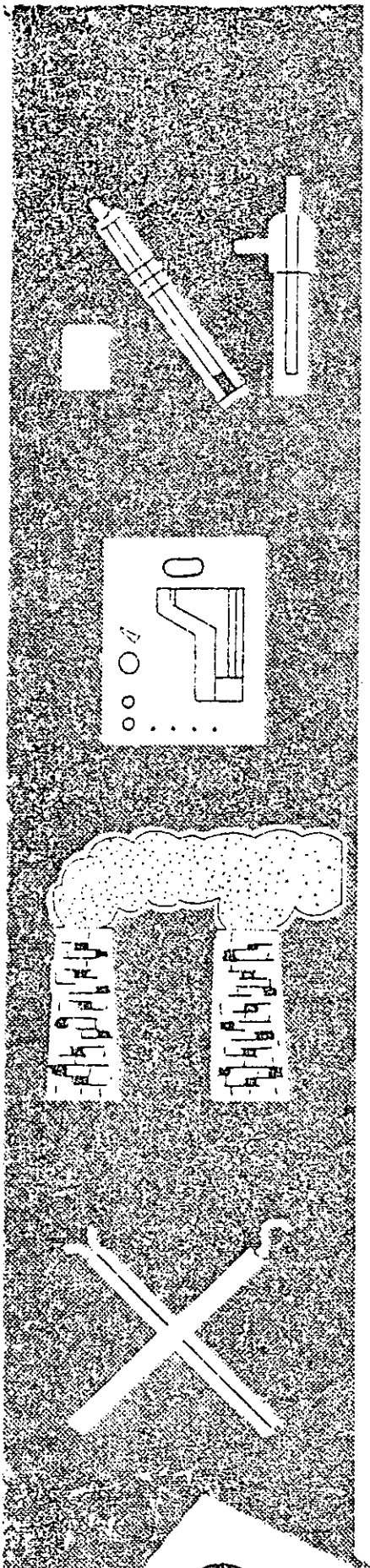
Appendix C.1
Reference 33



AIR POLLUTION EMISSION TEST

ESB CANADA LIMITED

MISSISSAUGA, ONTARIO

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

SOURCE TESTING
AT A
LEAD ACID BATTERY MANUFACTURING COMPANY

ESB Canada Limited
Mississauga, Ontario

Test Conducted By
Monsanto Research Corporation
Dayton, Ohio

August 16-20, 1976

Report Prepared by
Robert Martin
Environmental Protection Specialist
U.S. Environmental Protection Agency
Research Triangle Park, N. C.

ESB Canada Ltd.
Mississauga, Ontario

A= outlet for Lead Oxide product recovery bag house

Run 1A

Stage	DPC (microns)	Wt. of Material (mg)	Wt. %	Cum. Wt. %
nozzle	>5.42	4.04	54.30	100.00
0	5.42	0.1	1.34	45.70
1	3.38	0.3	4.03	44.36
2	2.26	0.1	1.34	40.33
3	1.58	0.5	6.72	38.99
4	0.98	0.7	9.41	32.27
5	0.51	0.9	12.10	22.86
6	0.31	0.5	6.72	10.76
7	0.20	0.1	1.34	4.04
F	<0.20	0.2	2.70	2.70

Run 2A

Stage	DPC (microns)	Wt. of Material (mg)	Wt. %	Cum. Wt. %
nozzle	>5.32	3.74	78.90	100.00
0	5.32	0	0	21.10
1	3.38	0.2	4.22	21.10
2	2.23	0.1	2.11	16.88
3	1.57	0.2	4.22	14.77
4	0.98	0.2	4.22	10.55
5	0.50	0.1	2.11	6.33
6	0.31	0.1	2.11	4.22
7	0.20	0	0	2.11
F	<0.20	0.1	2.11	2.11

Run 3A

Stage	DPC (microns)	Wt. of Material (mg)	Wt. %	Cum. Wt. %
nozzle	>5.32	1.84	49.19	100.00
0	5.32	0	0	50.81
1	3.32	0.1	2.67	50.81
2	2.25	0.4	10.70	48.14
3	1.55	0.4	10.70	37.44
4	0.96	0.4	10.70	26.74
5	0.50	0	0	16.04
6	0.31	0.5	13.37	16.04
7	0.20	0.1	2.67	2.67
F	<0.20	0	0	0

Andersen Particle Size Data
ESB Canada Ltd.
Mississauga, Ontario

D= outlet from baghouse controlling three process operation ventilation system (industrial hygiene baghouse)

Run 1D

Stage	DPC (microns)	Wt. of Material (mg)	Wt. %	Cum. Wt. %
nozzle	>4.26	2.34	85.40	100.00
0	4.26	0.1	3.65	14.60
1	2.67	0.1	3.65	10.95
2	1.75	0	0	7.30
3	1.25	0.1	3.65	7.30
4	0.78	0	0	3.65
5	0.40	0	0	3.65
6	0.24	0	0	3.65
7	0.16	0	0	3.65
F	<0.16	0.1	3.65	3.65

Run 2D

Stage	DPC (microns)	Wt. of Material (mg)	Wt. %	Cum. Wt. %
nozzle	>4.20	2.54	86.40	100.00
0	4.20	0	0	13.60
1	2.62	0.1	3.40	13.60
2	1.74	0	0	10.20
3	1.23	0	0	10.20
4	0.77	0.2	6.80	10.20
5	0.39	0.1	3.40	3.40
6	0.24	0	0	0
7	0.16	0	0	0
F	<0.16	0	0	0

Run 3D

Stage	DPC (microns)	Wt. of Material (mg)	Wt. %	Cum. Wt. %
nozzle	>4.33	2.14	78.10	100.00
0	4.33	0.2	7.30	21.90
1	2.73	0	0	14.60
2	1.80	0	0	14.60
3	1.26	0	0	14.60
4	0.79	0.3	10.95	14.60
5	0.41	0	0	3.65
6	0.25	0	0	3.65
7	0.17	0.1	3.65	3.65
F	<0.17	0	0	0

C = Inlet to Fan House Containing Lead Oxide Mill

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 1C

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	30.0
PRESSURE DROP	IN HG	1.66
STATIC PRESSURE	IN H2O	-4.15
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.99
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	156.0
GAS VISCOSITY	POISE	0.00016
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	20.600		9.84	47.95	100.00
1	3.787	1.25	1.81	8.82	52.05
2	5.383	0.72	2.57	12.53	43.23
3	5.137	0.47	2.45	11.96	30.70
4	4.048	0.22	1.93	9.42	18.74
5	3.802	0.12	1.82	8.85	9.32
FILTER	0.200		0.10	0.47	0.47

4 NOVEMBER 1976

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 1C

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	30.0
PRESSURE DROP	CM HG	4.27
STATIC PRESSURE	CM H2O	-10.54
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	CM HG	76.17
GAS MOL WT		28.8
GAS TEMPERATURE	DEG C	68.9
GAS VISCOSITY	POISE	0.00018
GAS DENSITY	G/CC	0.00100

STAGE	WT OF MATERIAL	DPC	MG/ACM	WT PCNT	CUM WT PCNT
CYCLONE	20.600		0.28	47.95	100.00
1	3.787	1.25	0.05	8.82	52.05
2	5.383	0.72	0.07	12.53	43.23
3	5.137	0.47	0.07	11.96	30.70
4	4.048	0.22	0.05	9.42	18.74
5	3.802	0.12	0.05	8.85	9.32
FILTER	0.200		0.00	0.47	0.47

4 NOVEMBER 1976

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 2C

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	20.0
PRESSURE DROP	IN HG	1.66
STATIC PRESSURE	IN H2O	-4.10
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.99
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	188.0
GAS VISCOSITY	POISE	0.00018
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	15.400		10.80	49.60	100.00
1	4.172	1.23	2.92	13.44	50.40
2	3.533	0.71	2.48	11.38	36.96
3	2.487	0.46	1.74	8.01	25.58
4	1.762	0.22	1.24	5.68	17.57
5	3.693	0.11	2.59	11.89	11.89
FILTER	0.000		0.00	0.00	0.00

4 NOVEMBER 1976

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 2C

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	20.0
PRESSURE DROP	CM HG	4.27
STATIC PRESSURE	CM H2O	-10.41
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	CM HG	76.17
GAS MOL WT		28.8
GAS TEMPERATURE	DEG C	86.7
GAS VISCOSITY	POISE	0.00018
GAS DENSITY	G/CC	0.00100

STAGE	WT OF MATERIAL	DPC	MG/ACM	WT PCNT	CUM WT PCNT
CYCLONE	15.400		0.31	49.60	100.00
1	4.172	1.23	0.08	13.44	50.40
2	3.533	0.71	0.07	11.38	36.96
3	2.487	0.46	0.05	8.01	25.58
4	1.762	0.22	0.03	5.68	17.57
5	3.693	0.11	0.07	11.89	11.89
FILTER	0.000		0.00	0.00	0.00

4 NOVEMBER 1976

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 3C

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	30.0
PRESSURE DROP	IN HG	1.68
STATIC PRESSURE	IN H2O	-3.70
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	IN HG	29.99
GAS MOL WT		28.8
GAS TEMPERATURE	DEG F	160.0
GAS VISCOSITY	POISE	0.00018
GAS DENSITY	G/CC	0.00100

STATE	WT OF MATERIAL	DPC	MG/ACF	WT PCNT	CUM WT PCNT
CYCLONE	23.500		11.20	55.23	100.00
1	7.775	1.25	3.71	18.27	44.77
2	2.106	0.72	1.00	4.95	26.49
3	3.104	0.47	1.48	7.30	21.54
4	3.342	0.22	1.59	7.85	14.25
5	2.720	0.12	1.30	6.39	6.39
FILTER	0.000		0.00	0.00	0.00

CASCADE IMPACTOR PARTICLE SIZE DISTRIBUTION FOR RUN 3C

INPUT VARIABLE	UNITS	INPUT DATA
SAMPLING TIME	MIN	30.0
PRESSURE DROP	CM HG	4.27
STATIC PRESSURE	CM H2O	-9.40
PARTICLE DENSITY	G/CC	9.53
BAROMETRIC PRESSURE	CM HG	76.17
GAS MOL WT		28.8
GAS TEMPERATURE	DEG C	71.1
GAS VISCOSITY	POISE	0.00018
GAS DENSITY	G/CC	0.00100

STAGE	WT OF MATERIAL	DPC	MG/ACM	WT PCNT	CUM WT PCNT
CYCLONE	23.500		0.32	55.23	100.00
1	7.775	1.25	0.10	18.27	44.77
2	2.106	0.72	0.03	4.95	26.49
3	3.104	0.47	0.04	7.30	21.54
4	3.342	0.22	0.05	7.85	14.25
5	2.720	0.12	0.04	6.39	6.39
FILTER	0.000		0.00	0.00	0.00

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Appendix
C.1
Reference 34

Source Data

Source Type: Batch Tinner (Tubing Plant)

Source Fuel Type:

Source Description (Size, Rating, Ect.):
See Attachment

Particle Size Data

Cumulative mass, % less than indicated size	Uncontrolled	Controlled
1 μm, aerodynamic	~30	
2.5	~39	
5	~47	
10	~54	

Emission Factor: Rate
Uncontrolled
1.5 lb/h

Nothing on process rate / hr

BATCH TINNER

Pre-formed tubes are fed into the batch tinner, a maximum of six at a time. These tubes pass through a flux bath to remove oxides from the tubing before the lead-tin coating is applied in the tinner. The batch tinner has an exhaust system which collects any vapors produced in the tinner. Under operating conditions utilizing the scrubber, it is reported that the gases are exhausted at 70 acfm. During this test series, all vapors were exhausted through the bypass system.

App. C.1, Ref.

11503

Appendix
C.1
Reference 39

72-C1-4

MAC DONALD CORPORATION
ONE MACDONALD DRIVE
STRATFORD, CONN. 06497

REPORT

by

YORK RESEARCH CORPORATION

on

EMISSIONS FROM THE FLORENCE MINING COMPANY COAL PROCESSING PLANT

at

SEWARD, PENNSYLVANIA

By

Richard W. Kling
Project Engineer

February 18, 1972 REPORT NO. Y-7730-G

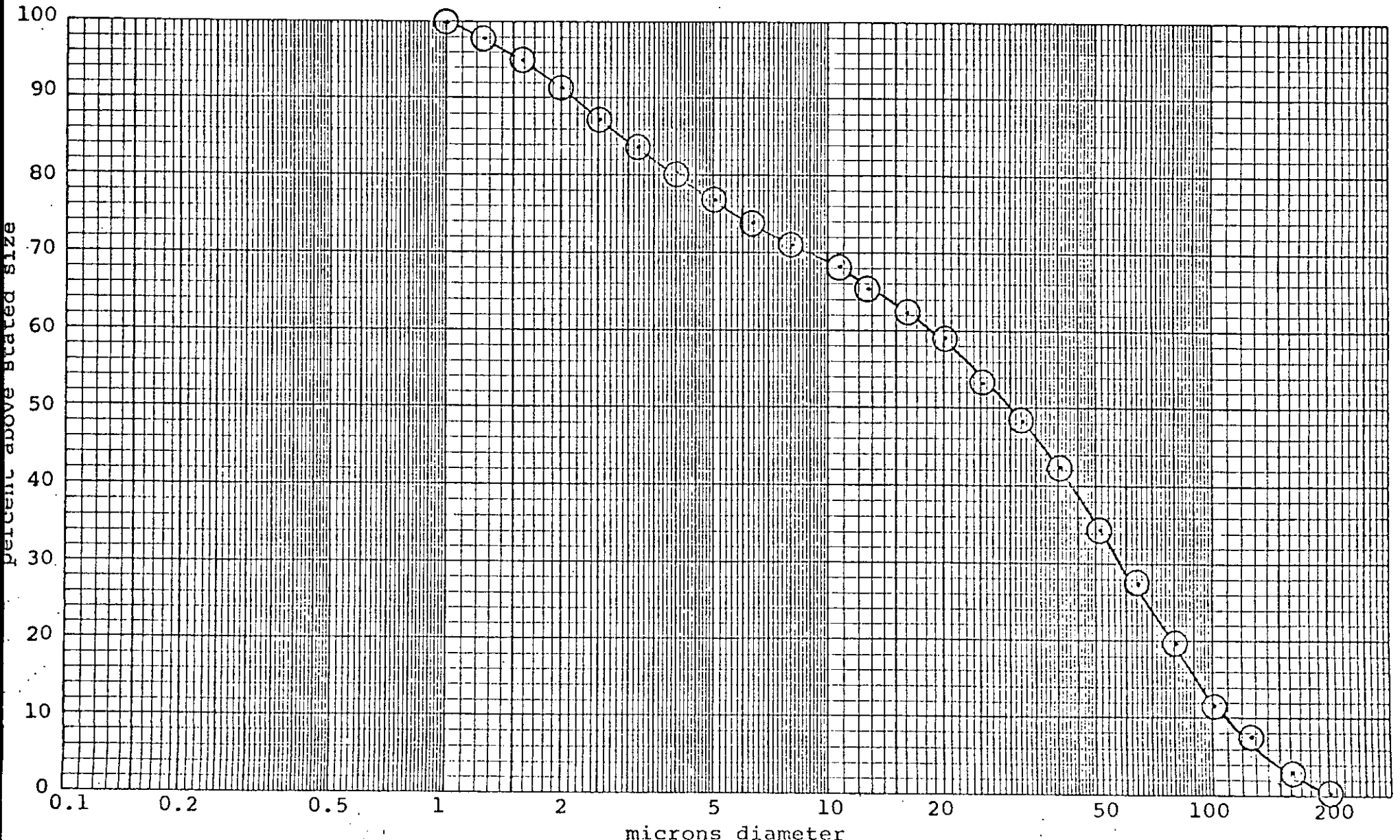
COULTER COUNTER®

PARTICLE SIZE ANALYSIS

COMMERCIAL TESTING & ENGINEERING CO.
CHICAGO, ILLINOIS 60601
228 NORTH LA SALLE STREET
312/726-8434

Source YORK RESEARCH CORPORATION Operator LSB Date 2-16-72

	material and sample no.	electrolyte & dispersant		aperture	
⊙	Y-7730-G (out)	Isoton	Aerosol OT	400 μ	
⊡			Ultrasonic	280 μ	
△			bath	100 μ	
◈				30 μ	



App. C.1, Ref. 40 72-CI-6 (40)

Appendix
C.1
Reference 40

REPORT

by

YORK RESEARCH CORPORATION

on

EMISSIONS FROM THE

ISLAND CREEK COAL COMPANY
COAL PROCESSING PLANT

at

VANSANT, VIRGINIA 24656

By

Richard W. Kling
Project Engineer

February 14, 1972

TABLE I

SUMMARY OF RESULTS - TEST #1

	Inlet	Outlet
Date:	1/25/72	1/25/72
Stack Flow Rate - SCFM	156,000	162,000
% Water Vapor - Vol. %	15.0	13.3
% CO_2 - Vol. % Dry	1.1	1.1
% O_2 - Vol. % Dry	17.4	17.4
% N_2 - Vol. % Dry	81.5	81.5
SO_2 Emission - ppm	37.1	6.71
NO_2 Emission - ppm		
#1	-	73.9
#2	-	69.6
#3	-	53.9
Hydrocarbons - ppm		
#1	-	44.91
#2	-	64.53
#3	-	62.78
Particulate Emission - Filter, Cyclone and Probe		
Gr./CF @ Stack Conditions	1.2719	0.0177
Gr./SCFD	1.8360	0.0236
Lb./hr.	2450.	32.8
Particulate Emission - Total		
Gr./CF @ Stack Conditions	1.2763	.0229
Gr./SCFD	1.8423	0.0305
Lb/hr.	2460.	42.3

TABLE II

SUMMARY OF RESULTS - TEST #2

	Inlet	Outlet
Date:	1/26/72	1/26/72
Stack Flow Rate - SCFM	157,000	157,000
% Water Vapor - Vol. %	8.4	13.4
% CO_2 - Vol. % Dry	1.6	1.6
% O_2 - Vol. % Dry	17.3	17.7
% N_2 - Vol. % Dry	81.1	80.7
SO_2 Emission - ppm	41.0	2.68
NO_2 Emission - ppm		
#1	-	17.2
#2	-	71.7
#3	-	88.3
Hydrocarbons - ppm		
#1	-	53.64
#2	-	65.40
#3	-	44.14
Particulate Emission - Filter, Cyclone and Probe		
Gr./CF @ Stack Conditions	.5518	0.0088
Gr./SCFD	.7356	0.0118
Lb./hr.	990.	15.9
Particulate Emission - Total		
Gr/CF @ Stack Conditions	.5627	0.0117
Gr/SCFD	.7502	0.0157
Lb./hr	1010.	21.1

TABLE III

SUMMARY OF RESULTS - TEST #3

	Inlet	Outlet
Date:	1/27/72	1/27/72
Stack Flow Rate - SCFM	170,000	157,000
% Water Vapor - Vol. %	9.6	12.7
% CO_2 - Vol. % Dry	1.6	1.5
% O_2 - Vol. % Dry	17.8	17.7
% N_2 - Vol. % Dry	80.6	80.8
SO_2 Emissions - ppm	44.5	25.7
NO_2 Emissions - ppm		
#1	-	43.1
#2	-	72.5
#3	-	71.8
Hydrocarbons - ppm		
#1	-	175.5
#2	-	160.5
#3	-	-
Particulate Emission - Filter, Cyclone and Probe		
Gr/CF @ Stack Conditions	1.6255	0.0120
Gr/SCFD	2.1644	0.0159
Lb./hr	3150.	21.4
Particulate Emission - Total		
Gr/CF @ Stack Conditions	1.6285	0.0157
Gr/SCFD	2.1684	0.0208
Lb./Hr	3160.	28.0

PARTICLE SIZE ANALYSIS

The following two graphs show the particle size distribution of the inlet and the outlet samples on the first test.

This report was submitted to York Research by Commercial Testing and Engineering Company of Chicago, Illinois.

All analyses were done on the Coulter Counter. Each sample was dispersed with Aerosol OT, and further dispersed using an ultrasonic bath. Isoton was the electrolyte used.

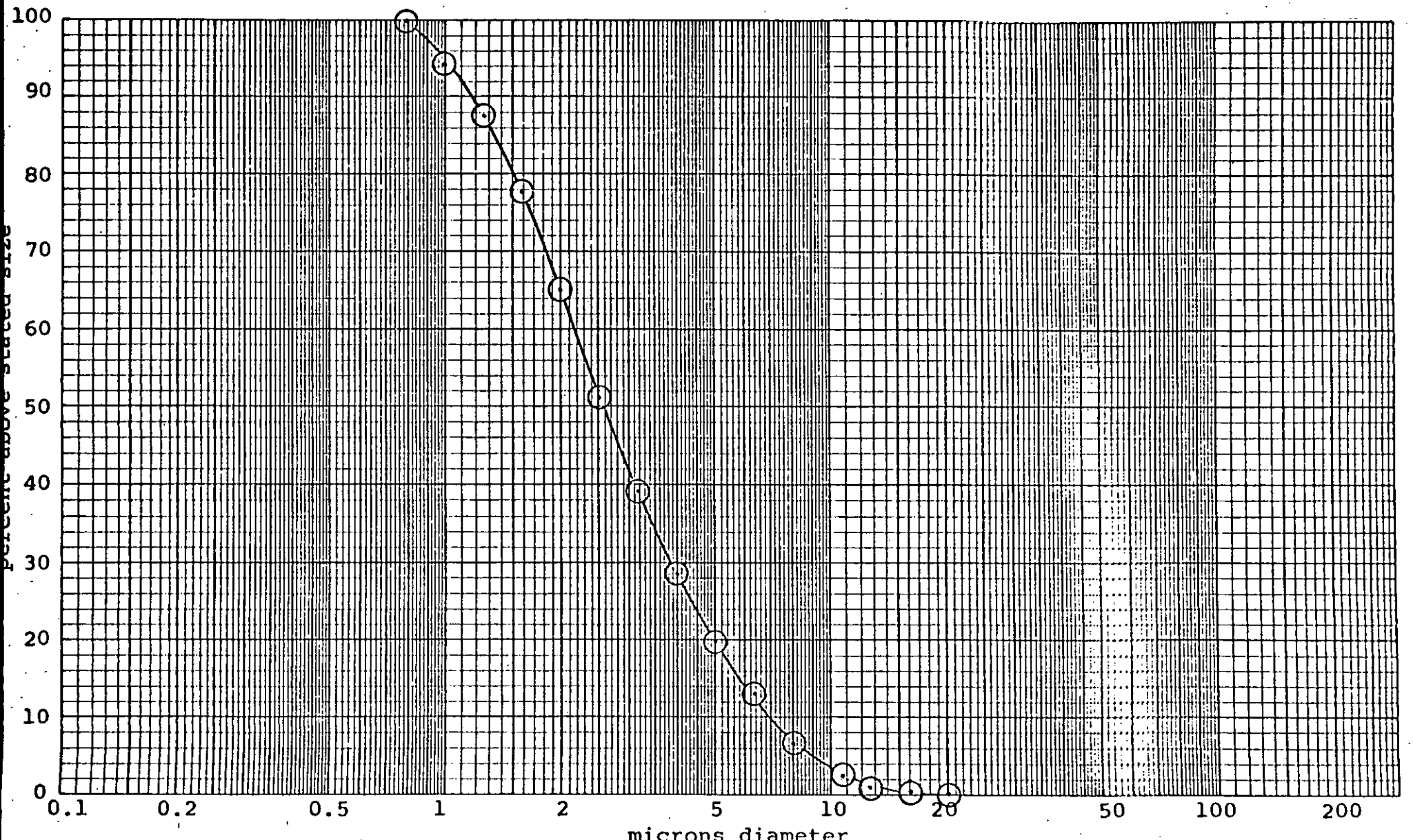
COULTER COUNTER®

PARTICLE SIZE ANALYSIS

COMMERCIAL TESTING & ENGINEERING CO.
CHICAGO, ILLINOIS 60601
228 NORTH LA SALLE STREET
312/726-8434

Source YORK RESEARCH CORPORATION Operator LSB Date 2-16-72

	material and sample no.	electrolyte & dispersant		aperture
⊙	Y-7730-H (in)	Isoton	Aerosol OT	100 μ
⊡			Ultrasonic	30 μ
△			bath	
◈				



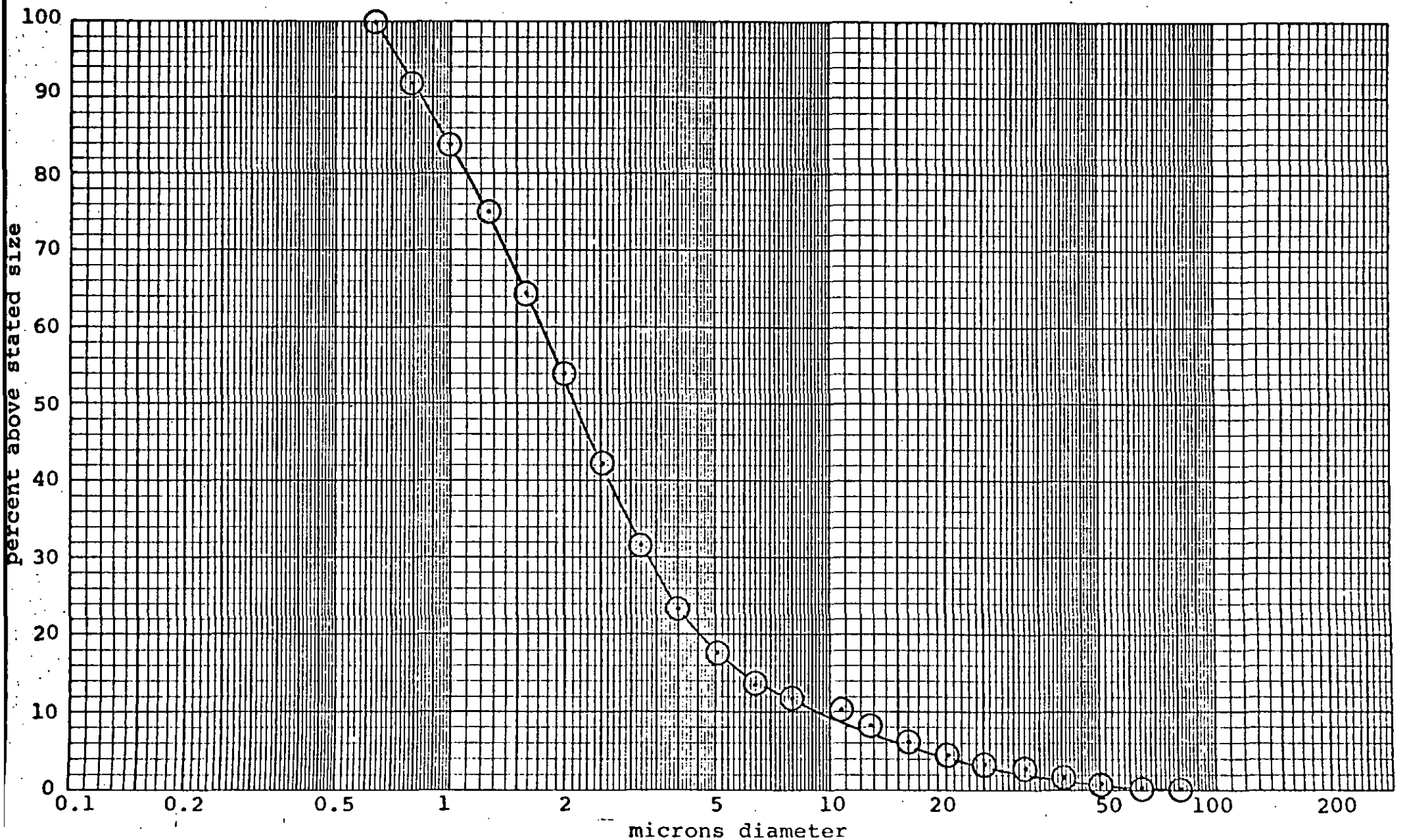
COULTER COUNTER®

PARTICLE SIZE ANALYSIS

COMMERCIAL TESTING & ENGINEERING CO.
CHICAGO, ILLINOIS 60601
228 NORTH LA SALLE STREET
312/726-8434

Source YORK RESEARCH CORPORATION Operator LSB Date 2-18-72

	material and sample no.	electrolyte & dispersant		aperture	
⊙	Y-7730-H (out)	Isoton	Aerosol OT	280 μ	
⊡			Ultrasonic	100 μ	
◬			bath	30 μ	
◈					



Appendix
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Reference 41

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Source Data

Source Type: Thermal Incinerator

Source Fuel Type:

Source Descripion (Size, Rating, Ect.):

The incinerator's primary function is to control gaseous emissions from a rotory kiln used to dry coal. The emissions from the incinerator are controlled by a high efficiency multiclone

Particle Size Data

Cumulative mass, % less than indicated size	Uncontrolled	Controlled
1 µm, aerodynamic	~1.6	~11.5
2.5	~7.5	~26
5.0	~18	~40.5
10.0	~35	~57
20.0	~44.5	~67

Emission ~~Factor~~ Rate: Controlled 31 lb/h * Uncontrolled 31 lb/h *

Nothing on size of incinerator

* indicates no collection efficiency

Testing Data

Number of tests run: Controlled = 2 Uncontrolled = 2

Test Method*: Impactor run at a point of average velocity

Type of Impactor: Andersen Mark III

Impactor Flow Rate: _____ acfm, % Isokinetic _____

Was Impactor Heated: No for both test sites, Was Sample Gas Saturated: No for both test sites

Did Sampling Site Meet Method 1 criteria: yes for both test site

Comments

Method 5 tests were also conducted during the test series. The emission rates presented are an average of the test results for the Method 5 runs.

* Example Method 5 - implies Method 5 procedures were used

App. C1, Reference.

Appendix
C.1
Reference 46

STATIONARY SOURCE TESTING OF A PHOSPHATE ROCK PLANT

At

The Beker Industries Corporation
Conda, Idaho

By

Emile Baladi
Midwest Research Institute

EPA Project Report No. 75-PRP-4

FINAL REPORT

EPA Contract No. 68-02-1403
MRI Project No. 3927-C(13)

For

Environmental Protection Agency
Research Triangle Park
North Carolina 27711

Attn: Mr. R. Terry Harrison

EMB REPORT NUMBER 75-PRP-4

76152

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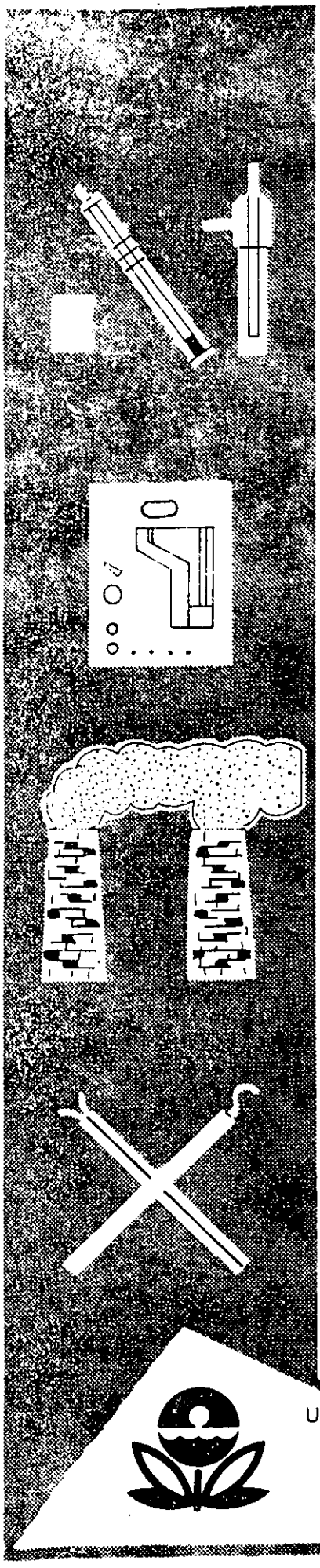

AIR POLLUTION EMISSION TEST

BEKER INDUSTRIES, INC.

Conda, Idaho

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

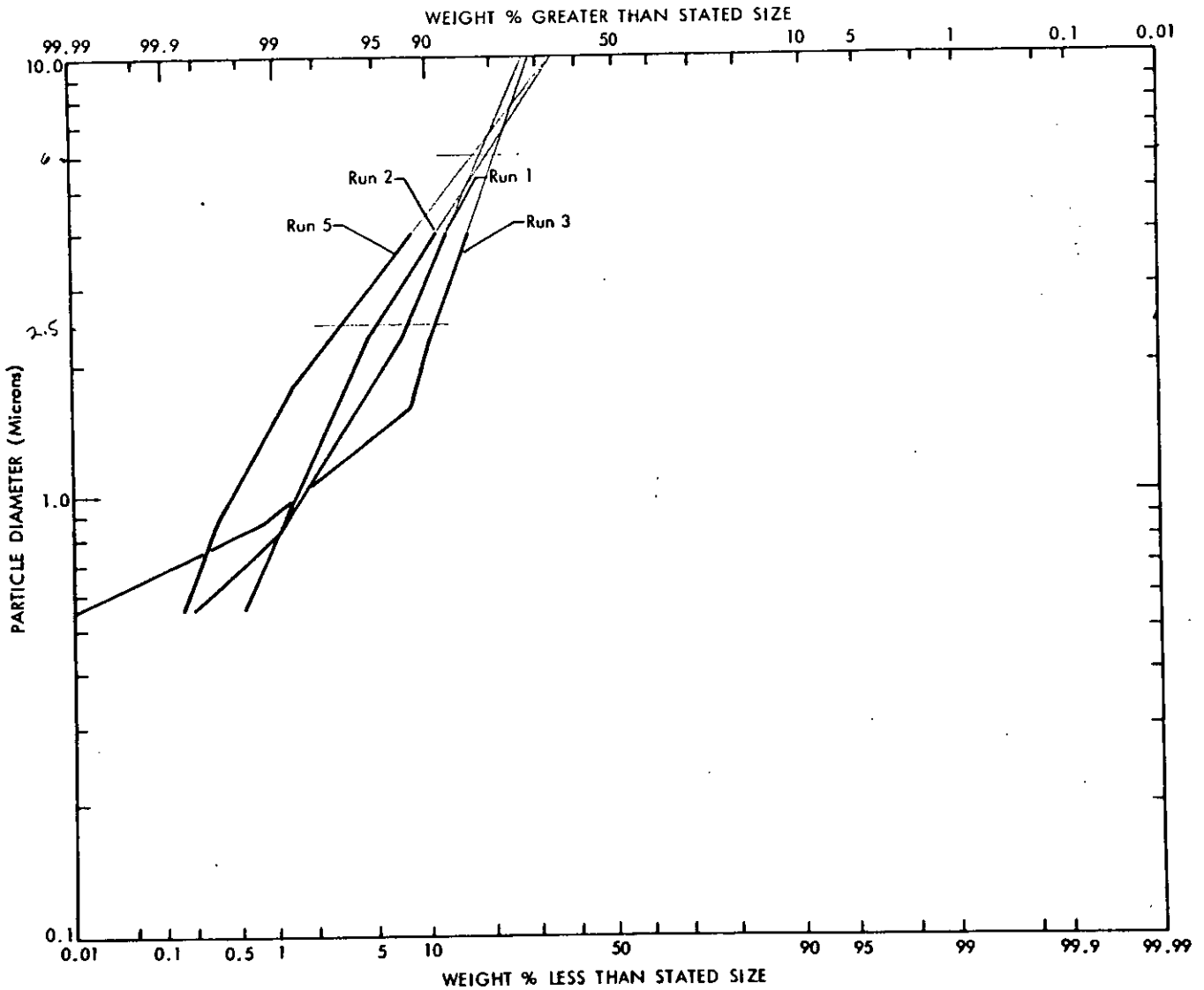

Figure 2 - Particle Diameter Versus Weight Percent Less/Greater Than Stated Size for Brink Tests (Baghouse Inlet)

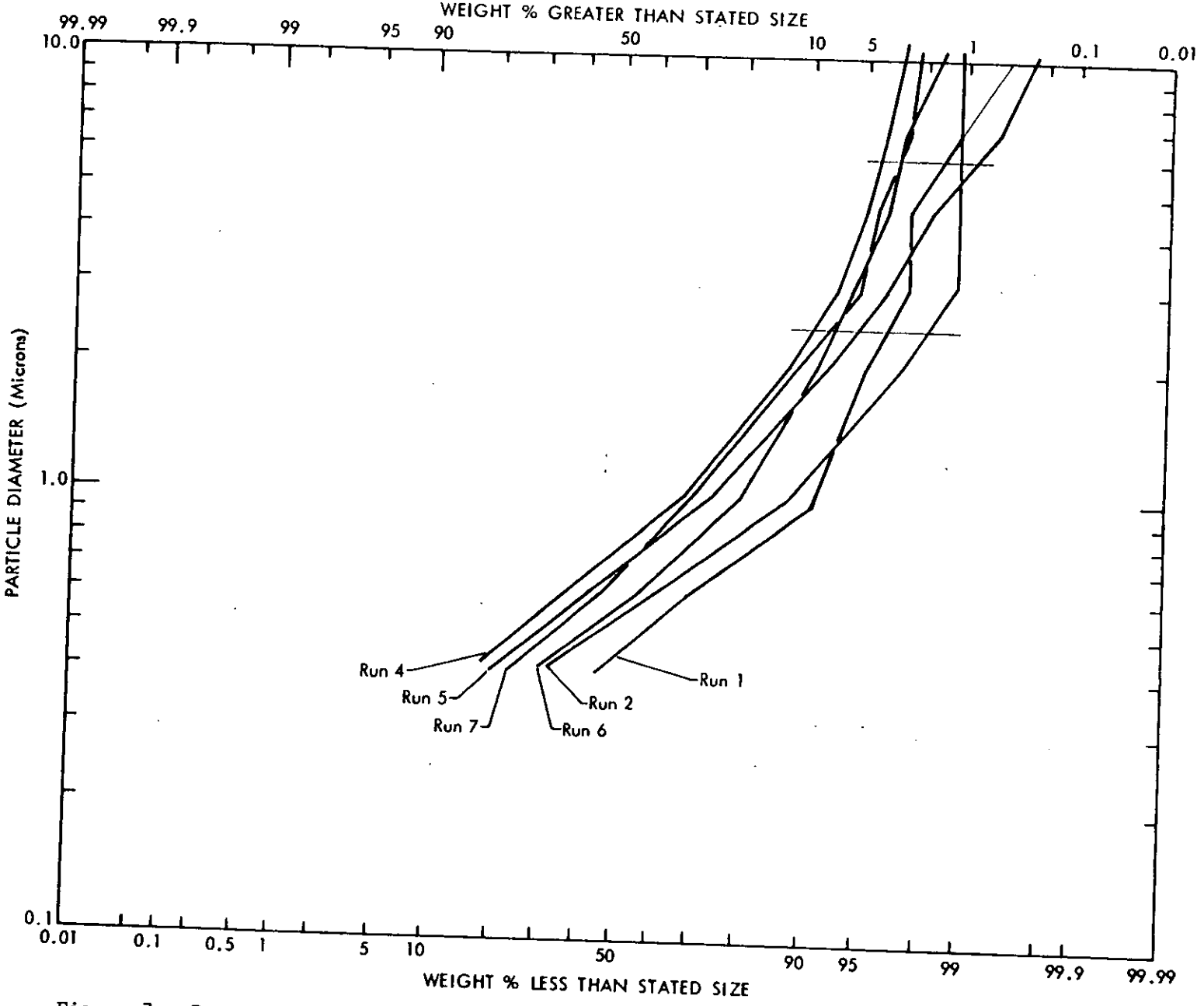

Figure 7 - Particle Diameter Versus Weight Percent Less/Greater Than Stated Size for Andersen Tests (Scrubber Outlet Runs)

Calciner

TABLE 20

SUMMARY OF ANDERSEN SAMPLING PARAMETERS

Run	Date	Start Time	Duration (min)	Sampling Location	Stack Gas Composition(%) CO_2	O_2	CO	N_2	H_2O	Molecular Wt. Dry	Wet
1	4-8-75	13:26	45	Scrubber outlet	9.3	11.7	0.0	79.0	20.1	29.95	27.55
2	4-8-75	15:06	40	Scrubber outlet	9.5	11.4	0.0	79.0	18.5	29.95	27.73
4	4-9-75	16:10	35	Scrubber outlet	9.7	10.4	0.0	79.9	18.4	29.97	27.77
5	4-9-75	17:33	35	Scrubber outlet	9.7	10.4	0.0	79.9	18.4	29.97	27.77
6	4-9-75	18:36	35	Scrubber outlet	9.7	10.4	0.0	79.9	21.2	29.97	27.43
7	4-9-75	19:53	35	Scrubber outlet	9.7	10.4	0.0	79.9	21.1	29.97	27.44

Run	Stack Temperature (°F)[a/]	Barometric Pressure (in. Hg)[a/]	Static Pressure (in. H_2O)[a/]	Sample Volume (cf)[a/]	Sample Rate (acfm)	Sample Volume (dscf)[a/]	Nozzle Diameter (in.)[a/]	Grain Loading gr/scf[a/]	mg/m^3[a/]
1	150	24.32	0.0	25.90	0.791	20.08	0.25	0.016	36.57
2	148	24.32	0.0	23.10	0.758	17.51	0.25	0.018	41.14
4	148	24.37	0.0	19.83	0.722	14.64	0.25	0.030	68.57
5	154	24.32	0.0	20.50	0.762	15.27	0.25	0.026	59.43
6	156	24.32	0.0	20.10	0.777	15.00	0.25	0.030	68.57
7	154	24.37	0.0	20.50	0.794	15.42	0.25	0.026	59.43

a/ °F = degrees Fahrenheit
in. Hg = inches of mercury
in. H_2O = inches of water
cf = cubic feet (meter condition)
dscf = dry standard cubic feet
in. = inches
gr/scf = grains per standard cubic foot
mg/m^3 = milligrams per cubic meter.

TABLE 21

ANDERSEN ANALYSIS SUMMARY (RUN NUMBER 1-S)

DATE 04087 DENSITY= 1.000 IMP.EFF.C= .140 SAMPLING RATE = .79063 CFM FILTER WT= .00951 GM TOTAL WT= .0213- GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	--WITHOUT FILTER-- WEIGHT PERCENT	--WITHOUT FILTER-- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	AERODIC. DIAM. (MICR)
/0	.49935	0.00000	.49935	0.00000	.49935	0.00000	0.00	0.00	0.00	0.00		
0/1	.70688	0.00000	.70660	0.00000	.70660	.00028	2.36	2.36	1.31	1.31	60.88	10.92
1/2	.68799	0.00000	.68799	0.00000	.68799	0.00000	0.00	2.36	0.00	1.31	113.52	6.81
2/3	.70244	0.00000	.70213	0.00000	.70213	.00031	2.62	4.98	1.45	2.76	189.40	4.62
3/4	.68303	0.00000	.68303	0.00000	.68303	0.00000	0.00	4.98	0.00	2.76	313.09	3.14
4/5	.70568	0.00000	.70517	0.00000	.70517	.00051	4.31	9.29	2.39	5.15	556.61	2.01
5/6	.68721	0.00000	.68614	0.00000	.68614	.00107	9.04	18.33	5.01	10.16	1346.86	1.00
6/7	.70137	0.00000	.69655	0.00000	.69655	.00482	40.71	59.04	22.58	32.74	2454.66	.61
7/8	.68987	0.00000	.68502	0.00000	.68502	.00485	40.96	100.00	22.72	55.46	4909.31	.41

TABLE 22

ANDERSEN ANALYSIS SUMMARY (RUN NUMBER 2-S)

DATE 040875 DENSITY= 1.000 IMP.EFF.C= .140 SAMPLING RATE = .75767 CFM FILTER WT= .00638 GM TOTAL WT= .02061 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.53297	0.00000	.53297	0.00000	.53297	0.00000	0.00	0.00	0.00	0.00		
0/1	.70814	0.00000	.70787	0.00000	.70787	.00027	1.90	1.90	1.31	1.31	58.34	11.16
1/2	.69299	0.00000	.69299	0.00000	.69299	0.00000	0.00	1.90	0.00	1.31	108.79	6.96
2/3	.69572	0.00000	.69572	0.00000	.69572	0.00000	0.00	1.90	0.00	1.31	181.51	4.72
3/4	.69327	0.00000	.69327	0.00000	.69327	0.00000	0.00	1.90	0.00	1.31	300.04	3.21
4/5	.71189	0.00000	.71145	0.00000	.71145	.00044	3.09	4.99	2.13	3.44	533.41	2.06
5/6	.68882	0.00000	.68688	0.00000	.68688	.00194	13.63	18.62	9.41	12.86	1290.71	1.02
6/7	.72139	0.00000	.71566	0.00000	.71566	.00573	40.27	58.89	27.80	40.66	2352.33	.63
7/8	.69411	0.00000	.68826	0.00000	.68826	.00585	41.11	100.00	28.38	69.04	4704.65	.42

TABLE 23

ANDERSEN ANALYSIS SUMMARY (RUN NUMBER 4-S)

DATE 040975 DENSITY= 1.000 IMP.EFF.C= .140 SAMPLING RATE = .72152 CFM FILTER WT= .00484 GM TOTAL WT= .02828 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.61517	0.00000	.61517	0.00000	.61517	0.00000	0.00	0.00	0.00	0.00		
0/1	.84601	0.00000	.84521	0.00000	.84521	.00080	3.41	3.41	2.83	2.83	55.55	11.44
1/2	.83433	0.00000	.83405	0.00000	.83405	.00028	1.19	4.61	.99	3.82	103.60	7.14
2/3	.81663	0.00000	.81617	0.00000	.81617	.00046	1.96	6.57	1.63	5.45	172.65	4.84
3/4	.81115	0.00000	.81052	0.00000	.81052	.00063	2.69	9.26	2.23	7.67	285.73	3.29
4/5	.80362	0.00000	.80201	0.00000	.80201	.00161	6.87	16.13	5.69	13.37	567.96	2.11
5/6	.80806	0.00000	.80239	0.00000	.80239	.00567	24.19	40.32	20.05	33.42	1229.13	1.05
6/7	.83588	0.00000	.82732	0.00000	.82732	.00856	36.52	76.83	30.27	63.68	2240.09	.64
7/8	.83753	0.00000	.83210	0.00000	.83210	.00543	23.17	100.00	19.20	82.89	4480.18	.44

TABLE 24

ANDERSEN ANALYSIS SUMMARY (RUN NUMBER 5-S)

DATE 040975 DENSITY= 1.000 IMP.EFF.C= .140 SAMPLING RATE = .76257 CFM FILTER WT= .00513 GM TOTAL WT= .02570 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.61902	0.00000	.61902	0.00000	.61902	0.00000	0.00	0.00	0.00	0.00		
0/1	.83151	0.00000	.83143	0.00000	.83143	.00008	.39	.39	.31	.31	58.72	11.12
1/2	.82199	0.00000	.82191	0.00000	.82191	.00008	.39	.78	.31	.62	109.49	6.94
2/3	.83351	0.00000	.83318	0.00000	.83318	.00033	1.60	2.38	1.28	1.91	182.48	4.70
3/4	.80700	0.00000	.80652	0.00000	.80652	.00048	2.33	4.72	1.87	3.77	301.98	3.20
4/5	.84024	0.00000	.83895	0.00000	.83895	.00129	6.27	10.99	5.02	8.79	536.86	2.05
5/6	.84146	0.00000	.83641	0.00000	.83641	.00505	24.55	35.54	19.65	28.44	1299.06	1.02
6/7	.84805	0.00000	.84045	0.00000	.84045	.00760	36.95	72.48	29.57	58.02	2367.54	.62
7/8	.83962	0.00000	.83396	0.00000	.83396	.00566	27.52	100.00	22.02	80.04	4735.08	.42

TABLE 25

ANDERSEN ANALYSIS SUMMARY(RUN NUMBER 6-S)

DATE 040975 DENSITY= 1.000 IMP.EFF.C= .140 SAMPLING RATE = .77667 CFM FILTER WT= .00835 GM TOTAL WT= .02945 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	CUM. WEIGHT PERCENT	---WITH FILTER--- WEIGHT PERCENT	CUM. WEIGHT PERCENT	JET VEL. (CM/S)	AERODYNAMIC DIAM. (MICM)
/0	.62100	0.00000	.62100	0.00000	.62100	0.00000	0.00	0.00	0.00	0.00		
0/1	.82865	0.00000	.82818	0.00000	.82818	.00047	2.23	2.23	1.60	1.60	59.30	11.02
1/2	.82428	0.00000	.82383	0.00000	.82383	.00045	2.13	4.36	1.53	3.12	111.52	6.88
2/3	.84281	0.00000	.84251	0.00000	.84251	.00030	1.42	5.79	1.02	4.14	186.06	4.66
3/4	.82711	0.00000	.82656	0.00000	.82656	.00055	2.61	8.40	1.87	6.01	307.57	3.17
4/5	.83132	0.00000	.83039	0.00000	.83039	.00093	4.41	12.81	3.16	9.16	546.78	2.03
5/6	.82425	0.00000	.82077	0.00000	.82077	.00348	16.51	29.32	11.81	20.98	1323.08	1.01
6/7	.87961	0.00000	.87275	0.00000	.87275	.00686	32.54	61.86	23.29	44.26	2411.32	.62
7/8	.87225	0.00000	.86421	0.00000	.86421	.00804	38.14	100.00	27.29	71.55	4122.03	.42

TABLE 26

ANDERSEN ANALYSIS SUMMARY (RUN NUMBER 7-S)

DATE 040975 DENSITY= 1.000 IMP.EFF.C= .140 SAMPLING RATE = .79441 CFM FILTER WT= .00547 GM TOTAL WT= .02559 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.66998	0.00000	.66998	0.00000	.66998	0.00000	0.00	0.00	0.00	0.00		
0/1	.86555	0.00000	.86489	0.00000	.86489	.00066	3.28	3.28	2.58	2.58	61.17	10.90
1/2	.85830	0.00000	.85818	0.00000	.85818	.00012	.60	3.88	.47	3.05	114.07	6.80
2/3	.87362	0.00000	.87329	0.00000	.87329	.00033	1.64	5.52	1.29	4.34	190.31	4.61
3/4	.86899	0.00000	.86859	0.00000	.86859	.00040	1.99	7.50	1.56	5.90	314.59	3.13
4/5	.87743	0.00000	.87585	0.00000	.87585	.00158	7.85	15.36	6.17	12.08	559.27	2.01
5/6	.82517	0.00000	.82006	0.00000	.82006	.00511	25.40	40.76	19.97	32.04	1353.30	1.00
6/7	.84425	0.00000	.83802	0.00000	.83802	.00623	30.96	71.72	24.35	56.39	2466.39	.61
7/8	.84519	0.00000	.83950	0.00000	.83950	.00569	28.28	100.00	22.24	78.62	4932.78	.41

App. C.1, Ref.

REPORT NO. 75-PRP-2

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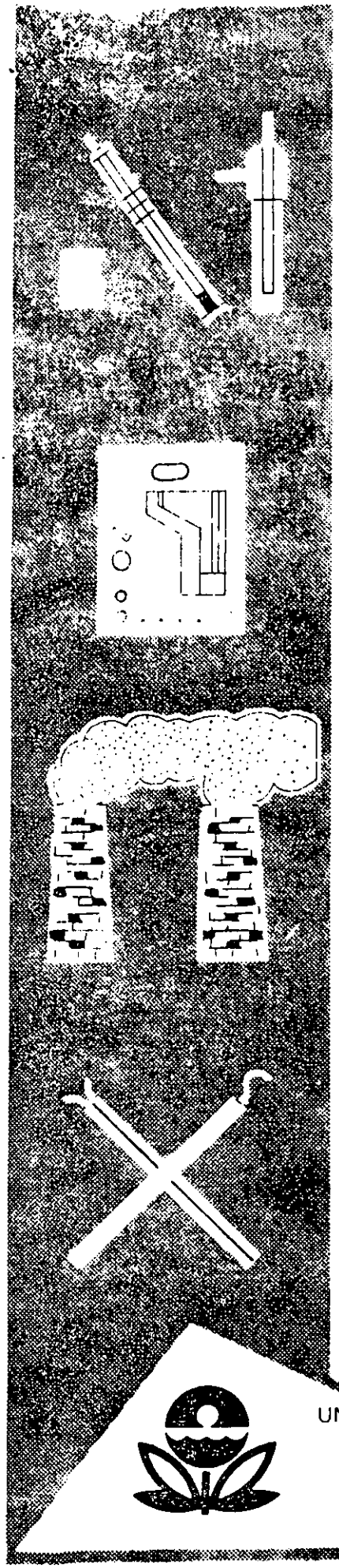
Appendix
C.1
Reference 49



AIR POLLUTION EMISSION TEST

THE ROYSTER COMPANY

MULBERRY, FLORIDA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

EPA REPORT FOR

THE ROYSTER COMPANY

PHOSPHATE ROCK FACILITY

MULBERRY, FLORIDA

EPA REPORT NO. 75-PRP-2

TASK NO. 14

CONTRACT NO. 68-02-1406

Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Measurements Branch
Research Triangle Park, North Carolina 27711

Submitted by

Engineering-Science, Inc.
7903 Westpark Drive
McLean, Virginia 22101

January 1976

TABLE II-12

PARTICULATE MASS COLLECTED IN THE BRINK PARTICLE SIZING TRAIN
(Royster Chemical)

Stage	Run 4		Run 5	
	Grams	gr/scf[a/]	Grams	gr/scf[a/]
Cyclone	0.04117	1.241	0.04427	1.335
1	0.00583	0.176	0.00491	0.148
2	0.00727	0.219	0.00982	0.296
3	0.00457	0.138	0.00612	0.185
4	0.00331	0.100	0.00144	0.043
5	0.00092	0.028	0.00111	0.033
Filter	0.00016	0.005	0.00004	0.001
Total	0.06323	1.907	0.06771	2.041

a/ gr/scf = grains per standard cubic foot.

TABLE II-13

CUMULATIVE WEIGHT PERCENT[a/] VERSUS PARTICLE SIZE FOR THE BRINK SAMPLING TRAIN
(Royster Chemical)

Stage	Run 4		Run 5	
	Cum. Wt%[a/]	Dp[a/]	Cum. Wt%[a/]	Dp
Cyclone	65.11	7	65.38	7
1	74.33	2.93	72.63	2.93
2	85.83	1.73	87.14	1.73
3	93.06	1.18	96.17	1.18
4	98.29	0.63	98.30	0.63
5	99.75	0.40	99.94	0.40
Filter[b/]	100.00	0.30	100.00	0.30

a/ Dp = Effective cutoff diameter (microns) based on unit density particles.
Cum. wt% = Cumulative weight percent includes particulate collected on the back-up filter, all stages, and the cyclone.

b/ Dp for the filter was assumed to be 0.3 μm (over 99% of particulate ≥ 0.3 μm are collected on the filter according to manufacturer data).

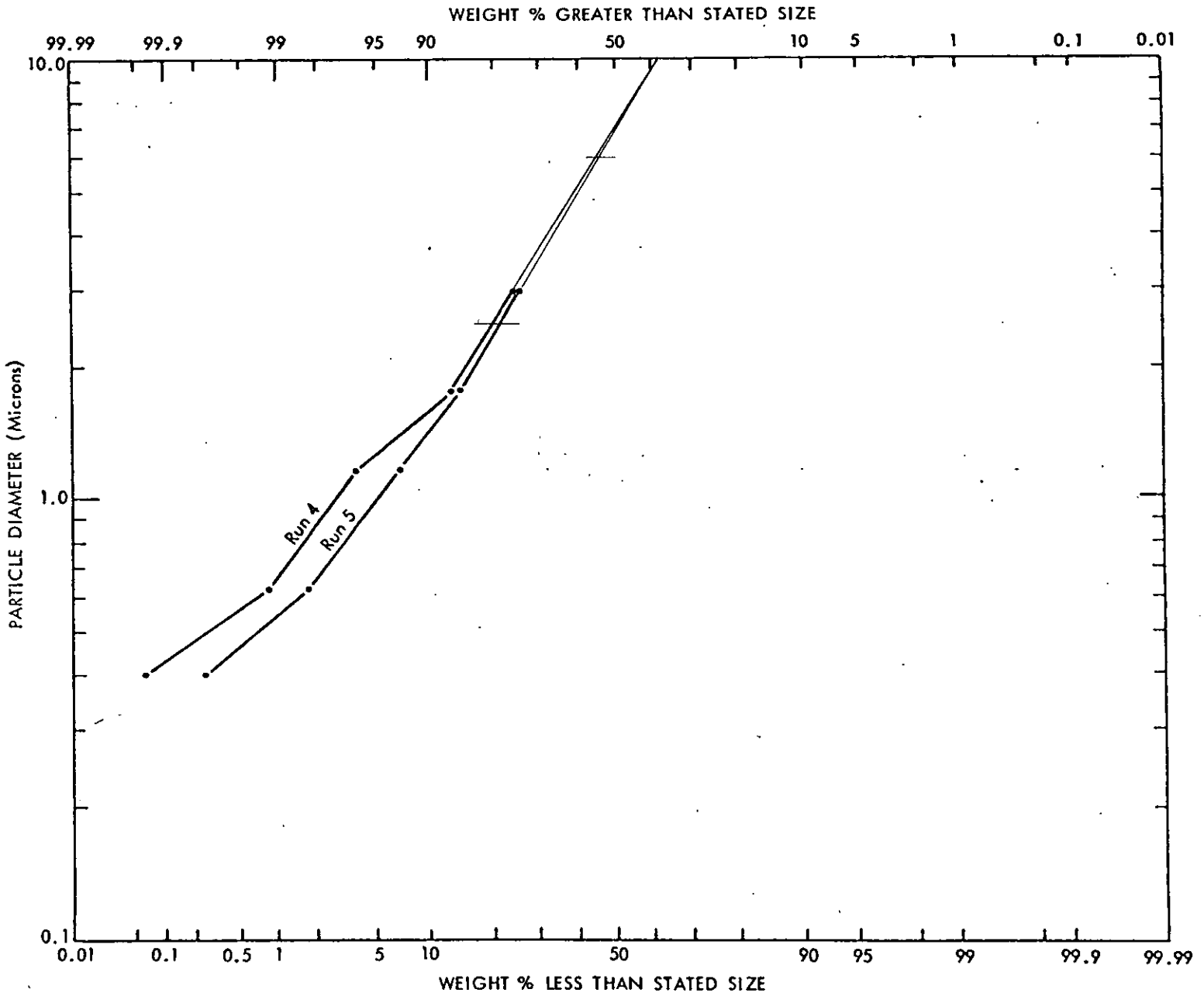


FIGURE II-1 - Particle Diameter Versus Weight Percent Less/Greater Than Stated Size (Inlet)

TABLE II-16

ANDERSEN ANALYSIS SUMMARY

RUN NUMBER 5 DENSITY= 1.000 SAMPLIN- FILTER WT= 0.00000 GM
DATE 032575 IMP.EFF.C= .140 RATE = .87900 CF TOTAL WT= .00243 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.48640	0.00000	.48640	0.00000	.48640	0.00000	0.00	0.00	0.00	0.00		
0/1	.61887	0.00000	.61867	0.00000	.61867	.00020	8.23	8.23	8.23	8.23	67.68	10.35
1/2	.59707	0.00000	.59662	0.00000	.59662	.00045	18.52	26.75	18.52	26.75	126.21	6.46
2/3	.60096	0.00000	.60042	0.00000	.60042	.00054	22.22	48.97	22.22	48.97	210.57	4.37
3/4	.59786	0.00000	.59740	0.00000	.59740	.00046	18.93	67.90	18.93	67.90	348.09	2.98
4/5	.61652	0.00000	.61611	0.00000	.61611	.00041	16.87	84.77	16.87	84.77	618.82	1.91
5/6	.69679	0.00000	.69645	0.00000	.69645	.00034	13.99	98.77	13.99	98.77	1497.40	.95
6/7	.71924	0.00000	.71921	0.00000	.71921	.00003	1.23	100.00	1.23	100.00	2729.02	.58
7/8	.69125	0.00000	.69125	0.00000	.69125	0.00000	0.00	100.00	0.00	100.00	5456.03	.39

TABLE II-17

ANDERSEN ANALYSIS SUMMARY

RUN NUMBER 7 DENSITY= 1.000 SAMPLING FILTER WT= .00225 GM
DATE 032575 IMP.EFF.C= .140 RATE = .90400 CFM TOTAL WT= .00231 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.46884	0.00000	.46884	0.00000	.46884	0.00000	0.00	0.00	0.00	0.00		
0/1	.65152	0.00000	.65152	0.00000	.65152	0.00000	0.00	0.00	0.00	0.00	69.60	10.21
1/2	.65298	0.00000	.65298	0.00000	.65298	0.00000	0.00	0.00	0.00	0.00	129.80	6.37
2/3	.67685	0.00000	.67685	0.00000	.67685	0.00000	0.00	0.00	0.00	0.00	216.56	4.31
3/4	.64572	0.00000	.64569	0.00000	.64569	.00003	50.00	50.00	1.30	1.30	357.99	2.93
4/5	.66194	0.00000	.66194	0.00000	.66194	0.00000	0.00	50.00	0.00	1.30	636.43	1.88
5/6	.65351	0.00000	.65346	0.00000	.65343	.00003	50.00	100.00	1.30	2.60	1539.99	.93
6/7	.66355	0.00000	.66355	0.00000	.66355	0.00000	0.00	100.00	0.00	2.60	2806.63	.57
7/8	.67085	0.00000	.67085	0.00000	.67085	0.00000	0.00	100.00	0.00	2.60	5613.27	.38

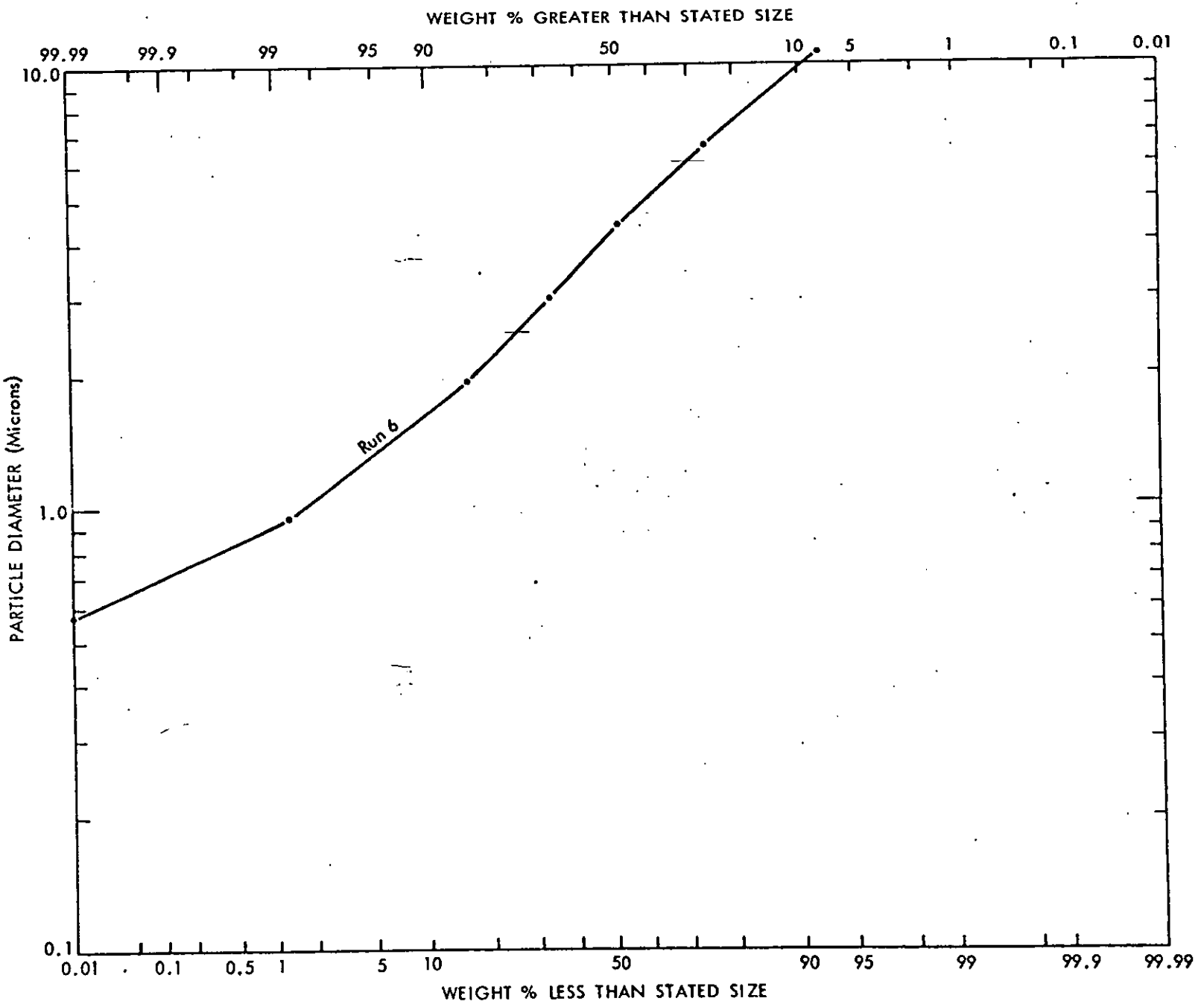


FIGURE II-6 - Particulate Diameter Versus Weight Percent Less/Greater Than Stated Size (Outlet)

App. C.1, Ref. 47

EMB REPORT NUMBER 75-PRP-3

7509

Appendix
C.1
Reference 47

DU

AIR POLLUTION EMISSION TEST

MOBIL CHEMICAL

Nichols, Florida

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

EPA REPORT FOR
MOBIL CHEMICAL
NICHOLS, FLORIDA
NO. 75-PRP-3

Task No. 15

Contract No. 68-02-1406

Submitted to

Environmental Protection Agency
Office of Air Quality Programs and Standards
Emission Measurement Branch

Submitted by

Engineering-Science, Inc.
7903 Westpark Drive
McLean, Virginia 22101

January 1976

TABLE II-6

PARTICULATE MASS COLLECTED IN THE BRINK PARTICLE SIZING TRAIN

	Run 1		Run 2		Run 3	
Stage	Grams	g/scf	Grams	g/scf	Grams	g/scf
Cyclone	0.06835	1.340	0.05120	1.434	0.02811	0.966
1	0.03600	0.710	0.01029	0.288	0.00179	0.061
2	0.01100	0.216	0.01062	0.297	0.00509	0.175
3	0.00452	0.089	0.00387	0.108	0.00242	0.083
4	0.00300	0.059	0.00166	0.046	0.00197	0.068
5	0.00141	0.028	0.00050	0.014	0.00074	0.025
Filter	0.00205	0.040	0.00040	0.011	0.00109	0.037
Total	0.12633	2.4772	0.07854	2.198	0.04121	1.415

TABLE II-7

CUMULATIVE WEIGHT PERCENT[a] VERSUS PARTICLE SIZE FOR THE BRINK SAMPLING TRAIN

	Run 1		Run 2		Run 3	
Stage	Cum. Wt %[a]	D_p (μm)[a]	Cum. Wt %	D_p (μm)	Cum. Wt %	D_p (μm)
Cyclone	54.10	7	65.19	7	68.21	7
1	82.60	3.55	78.29	3.35	72.56	3.19
2	91.31	1.99	91.81	1.99	84.91	1.89
3	94.89	1.37	96.74	1.37	90.78	1.29
4	97.26	0.72	98.85	0.72	95.56	0.69
5	98.38	0.47	99.49	0.47	97.36	0.44
Filter[b]	100.00	0.30	100.00	0.30	100.00	0.30

a/ D_p = Effective cutoff diameter (microns) based on unit density particles. Cum. wt. % = Cumulative weight percent includes particulate collected on the back-up filter, all stages, and the cyclone.

b/ D_p for the filter was assumed to be 0.3 μm. (Over 99% of particulate ≥ 0.3 μm are collected on the filter according to manufacturer data.)

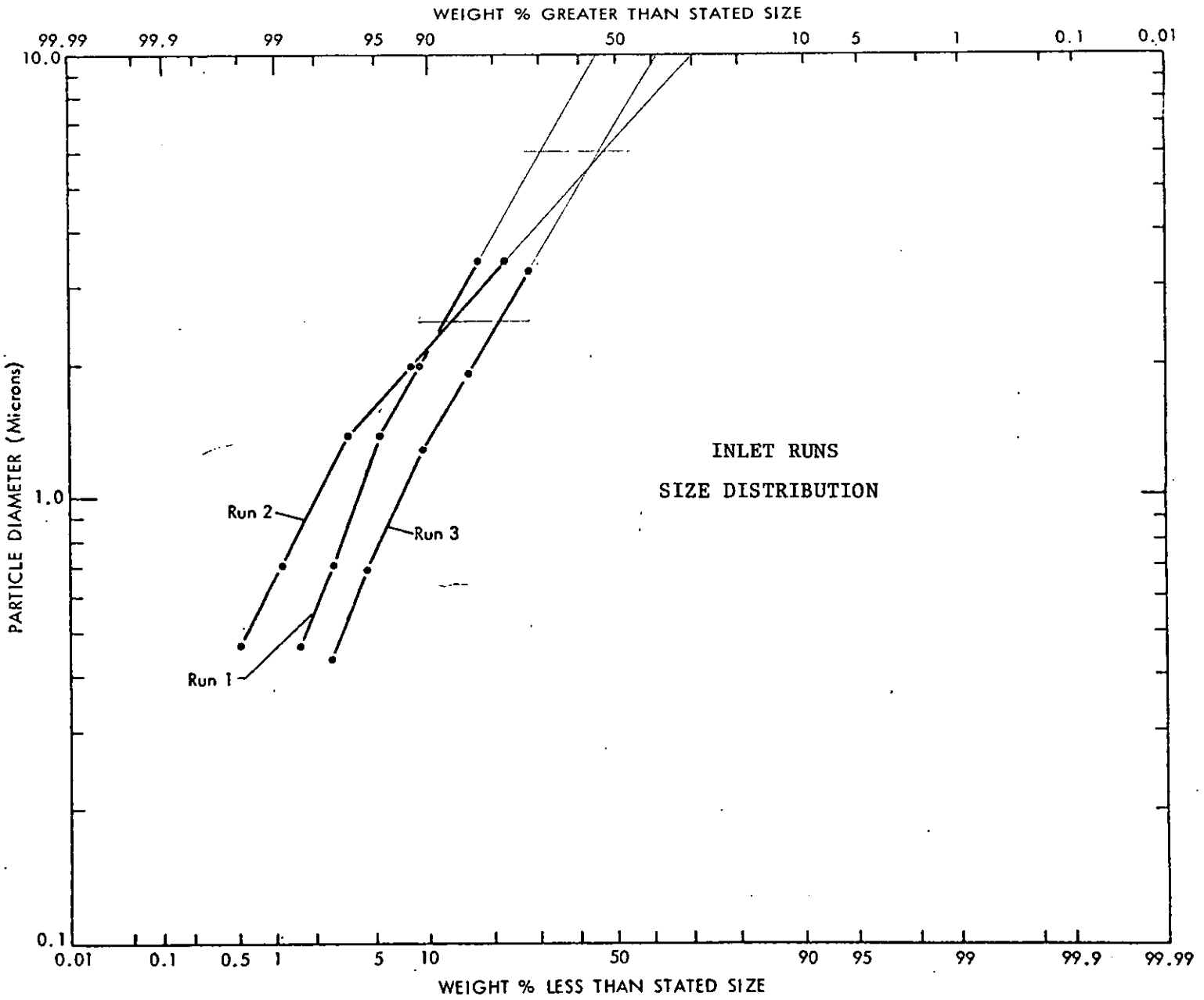


FIGURE II-1 - Particle Diameter Versus Weight % Less/Greater Than Stated Size - Scrubber Inlet

TABLE II-11

ANDERSEN ANALYSIS SUMMARY

RUN NUMBER 1 DENSITY= 1.000 SAMPLING FILTER WT= .00239 GM
DATE 031875 IMP.EFF.C= .140 RATE = .86000 LPM TOTAL WT= .00939 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.48875	0.00000	.48851	0.00000	.48851	.00024	3.42	3.42	2.56	2.56		
0/1	.63358	0.00000	.63326	0.00000	.63326	.00032	4.56	7.99	3.41	5.96	66.22	10.47
1/2	.62649	0.00000	.62606	0.00000	.62606	.00043	6.13	14.12	4.58	10.54	123.48	6.53
2/3	.63361	0.00000	.63350	0.00000	.63350	.00011	1.57	15.69	1.17	11.71	206.02	4.42
3/4	.63497	0.00000	.63487	0.00000	.63487	.00010	1.43	17.12	1.06	12.78	340.56	3.01
4/5	.64396	0.00000	.64360	0.00000	.64360	.00036	5.14	22.25	3.83	16.61	605.45	1.93
5/6	.65172	0.00000	.64974	0.00000	.64974	.00198	28.25	50.50	21.09	37.70	1465.04	.96
6/7	.68601	0.00000	.68360	0.00000	.68360	.00241	34.38	84.88	25.67	63.37	2670.03	.58
7/8	.65580	0.00000	.65474	0.00000	.65474	.00106	15.12	100.00	11.29	74.65	5340.06	.39

TABLE II-12

ANDERSEN ANALYSIS SUMMARY

RUN NUMBER 3 DENSITY= 1.000 SAMPLING FILTER WT= .00119 GM
DATE 3/1975 IMP.EFF.C= .140 RATE = .86800 CFM TOTAL WT= .00960 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.45700	0.00000	.45700	0.00000	.45700	0.00000	0.00	0.00	0.00	0.00		
0/1	.67120	0.00000	.67112	0.00000	.67112	.00008	.95	.95	.83	.83	66.83	10.42
1/2	.65482	0.00000	.65472	0.00000	.65472	.00010	1.19	2.14	1.04	1.88	124.63	6.50
2/3	.68488	0.00000	.68475	0.00000	.68475	.00013	1.55	3.69	1.35	3.23	207.94	4.40
3/4	.66921	0.00000	.66910	0.00000	.66910	.00011	1.31	4.99	1.15	4.37	343.73	3.00
4/5	.64536	0.00000	.64484	0.00000	.64484	.00052	6.18	11.18	5.42	9.79	511.08	1.92
5/6	.64676	0.00000	.64419	0.00000	.64419	.00257	30.56	41.74	26.77	36.56	1478.66	.95
6/7	.66023	0.00000	.65704	0.00000	.65704	.00319	37.93	79.67	33.23	69.79	2694.87	.58
7/8	.62228	0.00000	.62057	0.00000	.62057	.00171	20.33	100.00	17.81	87.60	5389.73	.39

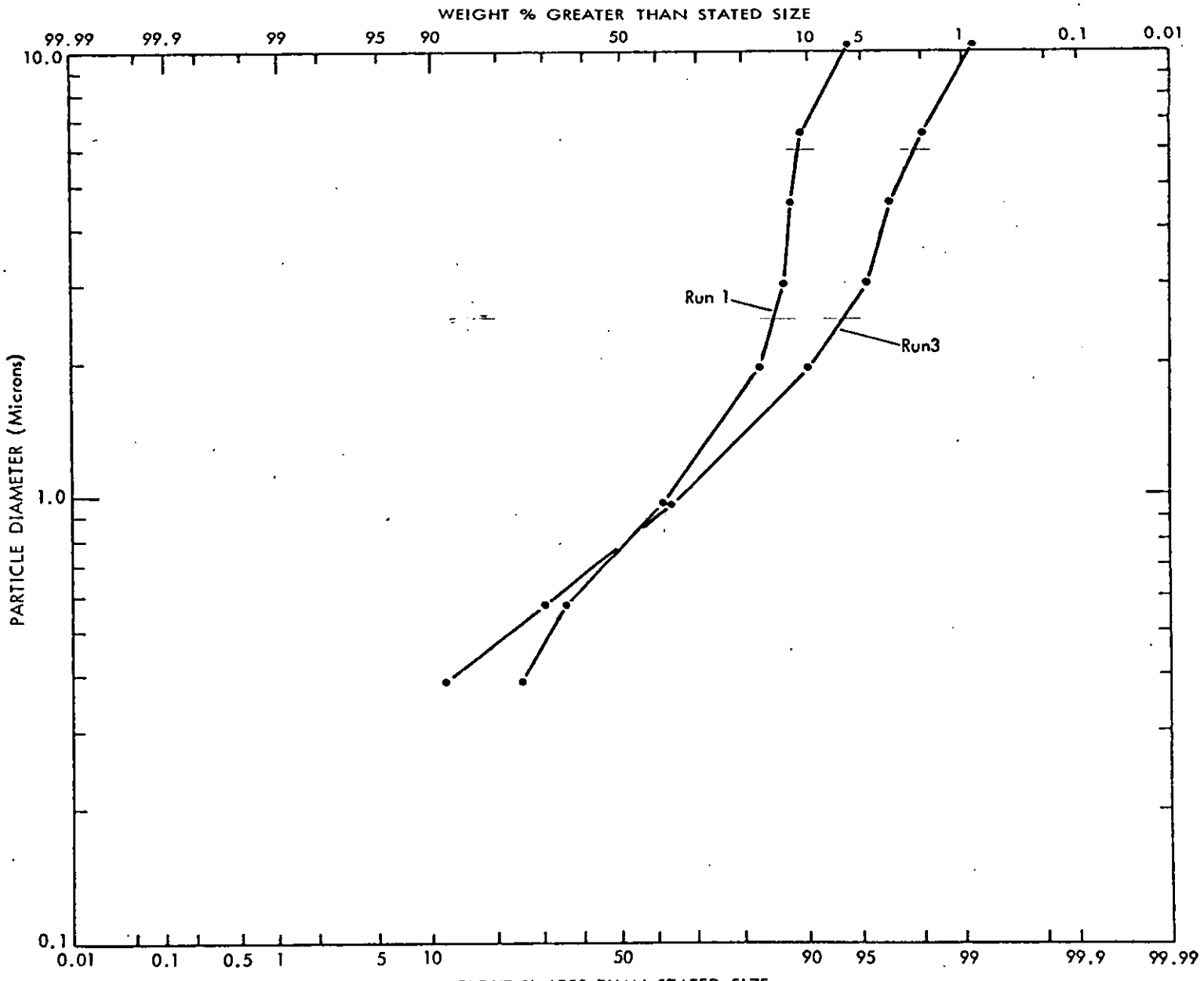


FIGURE II-6 - Particle Diameter Versus Weight % Less/Greater Than Stated Size - Scrubber Outlet

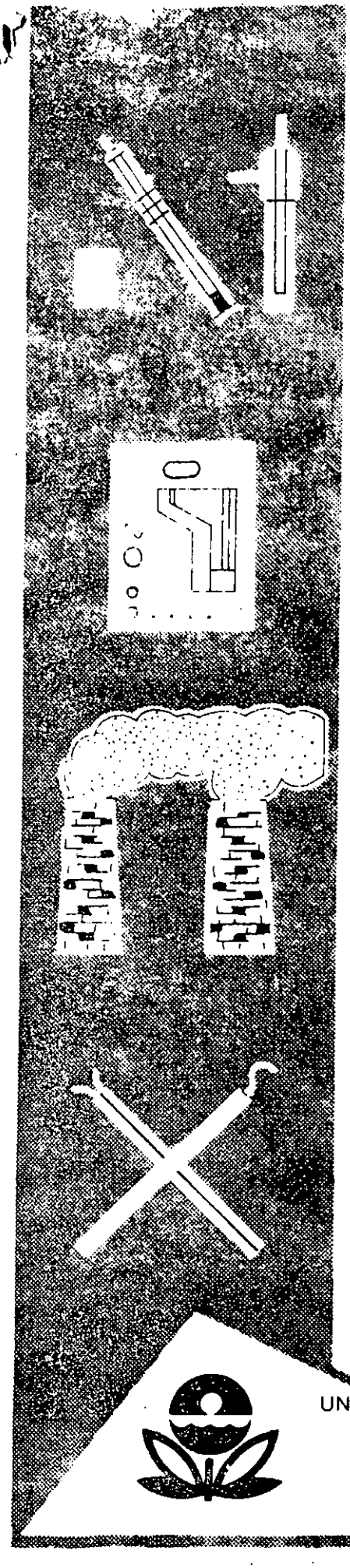
App. C.1, Ref. 11

REPORT NO. 75-PRP-1

Appendix
C.1
Reference 48

75066
DUPE

AIR POLLUTION EMISSION TEST



W. R. GRACE CHEMICAL CO.

BARTOW, FLORIDA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

EPA REPORT FOR

W.R. GRACE CHEMICAL COMPANY

BARTOW, FLORIDA

EPA REPORT NO. 75-PRP-1

TASK NO. 14

CONTRACT NO. 68-02-1406

Submitted to

Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Measurements Branch
Research Triangle Park, North Carolina 27711

Submitted by

Engineering-Science, Inc.
7903 Westpark Drive
McLean, Virginia 22101

January 1976

TABLE II-8

ANDERSEN ANALYSIS SUMMARY

RUN NUMBER [illegible] DENSITY= 1.000 SAMPLING FILTER WT= .00020 GM
DATE 032475 IMP.EFF.C= .140 RATE = [illegible] CFM TOTAL WT= .00464 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	AMOUNT WEIGHT (GM)	--WITHOUT FILTER-- WEIGHT PERCENT	CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC DIAM. (MICR)
/0	.46951	0.00000	.46939	0.00000	.46939	.00014	3.15	3.15	3.02	3.02		
0/1	.67971	0.00000	.67965	0.00000	.67965	.00006	1.35	4.50	1.29	4.31	4M.43	12.26
1/2	.67035	0.00000	.67035	0.00000	.67035	0.00000	0.00	4.50	0.00	4.31	90.32	7.65
2/3	.68123	0.00000	.68121	0.00000	.68121	.00002	.45	4.95	.43	4.74	150.68	5.19
3/4	.65450	0.00000	.65447	0.00000	.65447	.00003	.68	5.63	.65	5.39	249.09	3.53
4/5	.66322	0.00000	.66318	0.00000	.66318	.00004	.90	6.53	.86	6.25	442.82	2.27
5/6	.64590	0.00000	.64455	0.00000	.64455	.00135	30.41	36.94	29.09	35.34	1071.52	1.13
6/7	.65885	0.00000	.65712	0.00000	.65712	.00173	38.96	75.90	37.28	72.63	1952.85	.70
7/8	.65692	0.00000	.65785	0.00000	.65785	.00107	24.10	100.00	23.06	95.69	3905.69	.47

TABLE II-9

ANDERSEN ANALYSIS SUMMARY

RUN NUMBER
DATE 032475

DENSITY= 1.000
IMP.EFF.C= .140.

SAMPLING RATE = .01500 CFM

FILTER WT= .00096 GM
TOTAL WT= .00664 GM

STAGE/ PLATE	SAMPLE PLATE + PAN	PAN FOR SAMPLE	TARE PLATE + PAN	PAN FOR TARE	TARE OF PLATE	SAMPLE WEIGHT (GM)	-WITHOUT FILTER- WEIGHT PERCENT	-WITHOUT FILTER- CUM. WEIGHT PERCENT	--WITH FILTER-- WEIGHT PERCENT	--WITH FILTER-- CUM. WEIGHT PERCENT	JET VEL. (CM/S)	PARTIC. DIAM. (MICR)
/0	.47089	0.00000	.47089	0.00000	.47089	0.00000	0.00	0.00	0.00	0.00		
0/1	.61770	0.00000	.61734	0.00000	.61734	.00036	5.49	5.49	5.42	5.42	47.66	12.35
1/2	.63295	0.00000	.63247	0.00000	.63247	.00048	7.32	12.80	7.23	12.65	88.88	7.71
2/3	.62252	0.00000	.62192	0.00000	.62192	.00060	9.15	21.95	9.04	21.69	148.29	5.23
3/4	.57386	0.00000	.57349	0.00000	.57349	.00037	5.64	27.59	5.57	27.26	245.13	3.56
4/5	.59652	0.00000	.59564	0.00000	.59564	.00088	13.41	41.01	13.25	40.51	435.78	2.29
5/6	.65292	0.00000	.65108	0.00000	.65108	.00184	28.05	69.05	27.71	68.22	1054.49	1.14
6/7	.66451	0.00000	.66301	0.00000	.66301	.00150	22.87	91.92	22.59	90.81	1921.80	.70
7/8	.65092	0.00000	.65039	0.00000	.65039	.00053	8.08	100.00	7.98	98.80	3843.60	.48

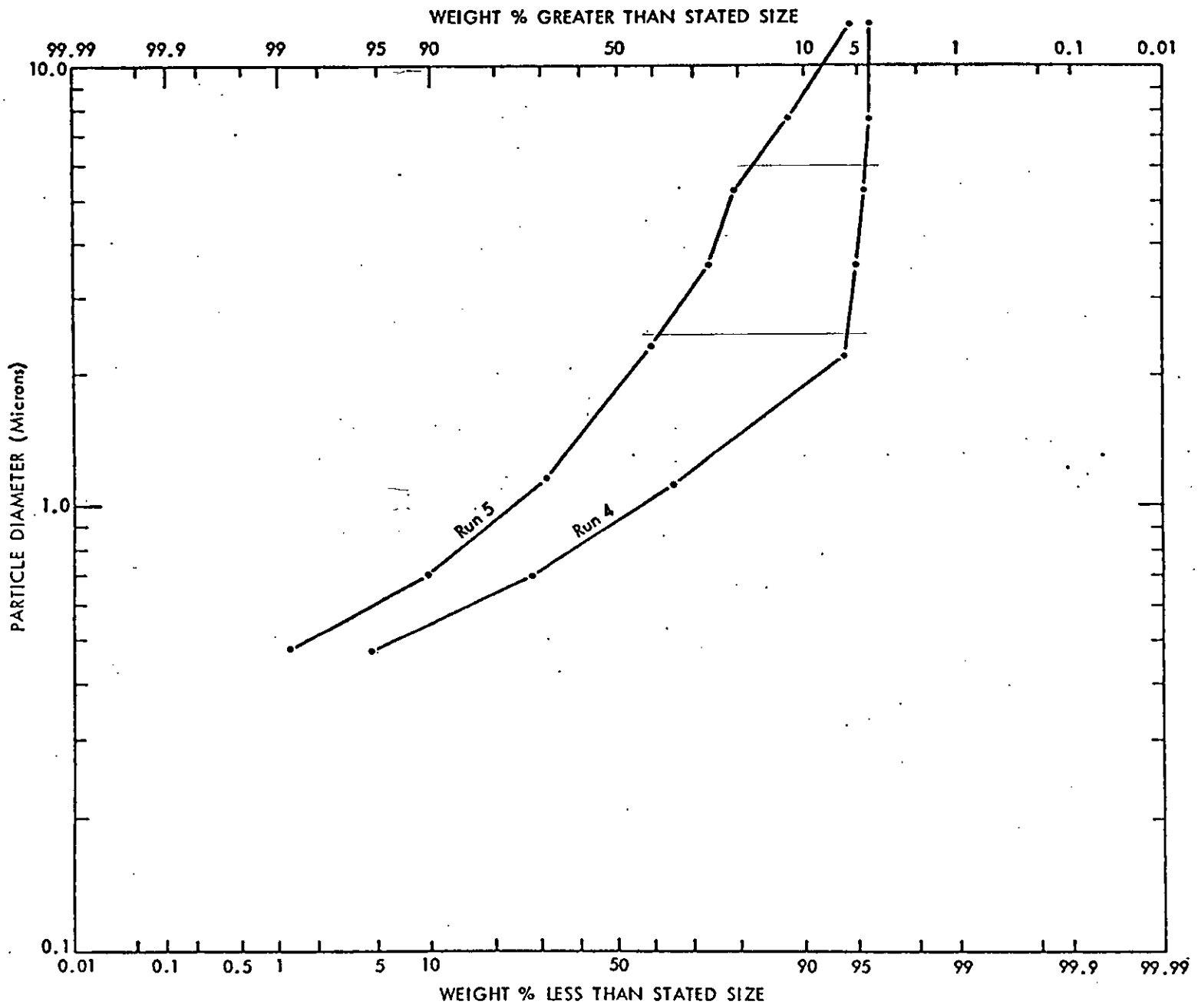


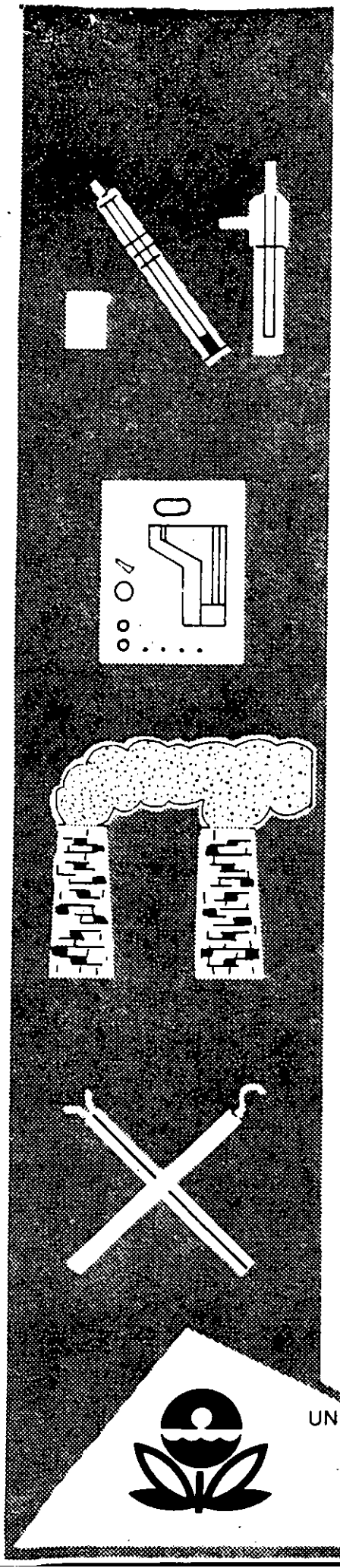
Figure II-1 - Particle Diameter Versus Weight Percent Less/Greater Than Stated Size (Outlet)

App. C1, Ref. 5

Copy - do not sen

Project No. 76-NMM-1

Appendix
C.1
Reference 51



AIR POLLUTION EMISSION TEST

INTERNATIONAL MINERALS AND
CHEMICAL COMPANY
SPRUCE PINE, N. C.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

EMISSION STUDY

at a

FELDSPAR CRUSHING AND GRINDING FACILITY

International Minerals and Chemicals Corporation
Spruce Pine, North Carolina
September 27-29, 1976

Prepared for the

U.S. Environmental Protection Agency

by

Clayton Environmental Consultants, Inc.
25711 Southfield Road
Southfield, Michigan 48075

Project NMM-1

Task 25

Contract No. 68-02-1408

TABLE IV-1

PARTICLE SIZE DISTRIBUTION
NO. 2 MILL BAGHOUSE NORTH INLET

International Minerals and Chemicals Corporation
Spruce Pine, North Carolina
September 27-29, 1976

Characteristic Diameter of Particles (microns)	Weight (gm)	Size Distribution by Weight	
		Percent	Cumulative Percent
>45	11.400	34.2	100.0
30 - 45	4.175	12.5	65.8
20 - 30	3.345	10.0	53.3
10 - 20	7.834	23.5	43.3
8.0 - 10	0.147	0.4	19.8
6.3 - 8.0	0.405	1.2	19.4
5.0 - 6.3	0.710	2.1	18.2
4.0 - 5.0	0.666	2.0	16.1
3.2 - 4.0	0.841	2.5	14.1
2.5 - 3.2	1.028	3.1	11.6
2.0 - 2.5	0.902	2.7	8.5
1.6 - 2.0	0.621	1.9	5.8
1.3 - 1.6	0.349	1.1	3.9
1.0 - 1.3	0.401	1.2	2.8
0.5 - 1.0	0.396	1.2	1.6
<0.5	0.119	0.4	0.4
TOTAL	33.339	100.0	—

TABLE IV-2

PARTICLE SIZE DISTRIBUTION
NO. 2 MILL BAGHOUSE SOUTH INLET

International Minerals and Chemicals Corporation
Spruce Pine, North Carolina
September 27-29, 1976

Characteristic Diameter of Particles (microns)	Weight (gm)	Size Distribution by Weight	
		Percent	Cumulative Percent
>45	0.366	25.7	100.0
30 - 45	0.271	19.1	74.3
20 - 30	0.233	16.4	55.2
10 - 20	0.141	9.9	38.8
5.0 - 10	0.094	6.6	28.9
4.0 - 5.0	0.006	0.4	22.3
3.2 - 4.0	0.016	1.1	21.9
2.5 - 3.2	0.030	2.1	20.8
2.0 - 2.5	0.040	2.8	18.7
1.6 - 2.0	0.044	3.1	15.9
1.3 - 1.6	0.036	2.5	12.8
1.0 - 1.3	0.034	2.4	10.3
0.5 - 1.0	0.073	5.1	7.9
<0.5	0.039	2.8	2.8
TOTAL	1.423	100.0	—

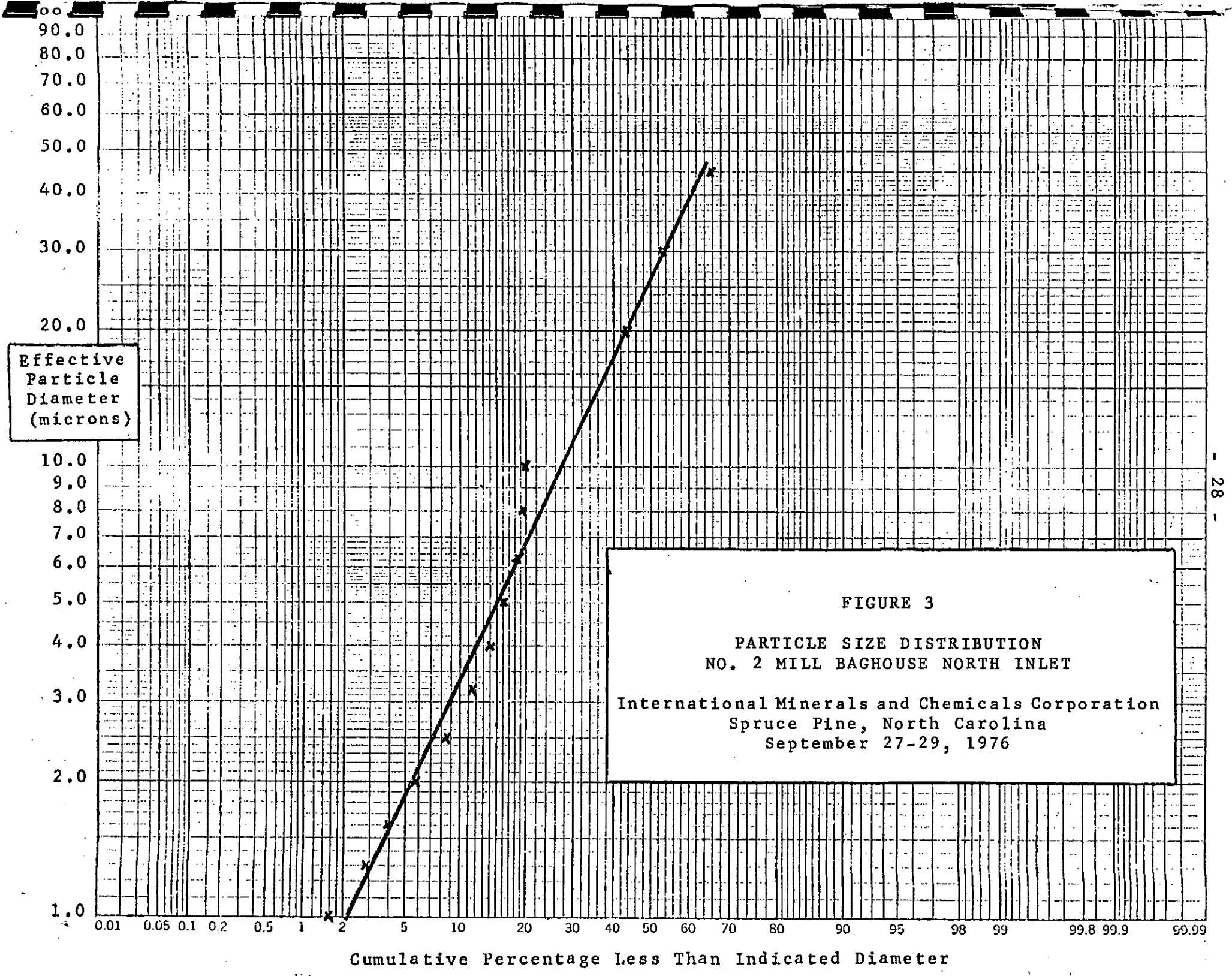


FIGURE 3

PARTICLE SIZE DISTRIBUTION
NO. 2 MILL BAGHOUSE NORTH INLET

International Minerals and Chemicals Corporation
Spruce Pine, North Carolina
September 27-29, 1976

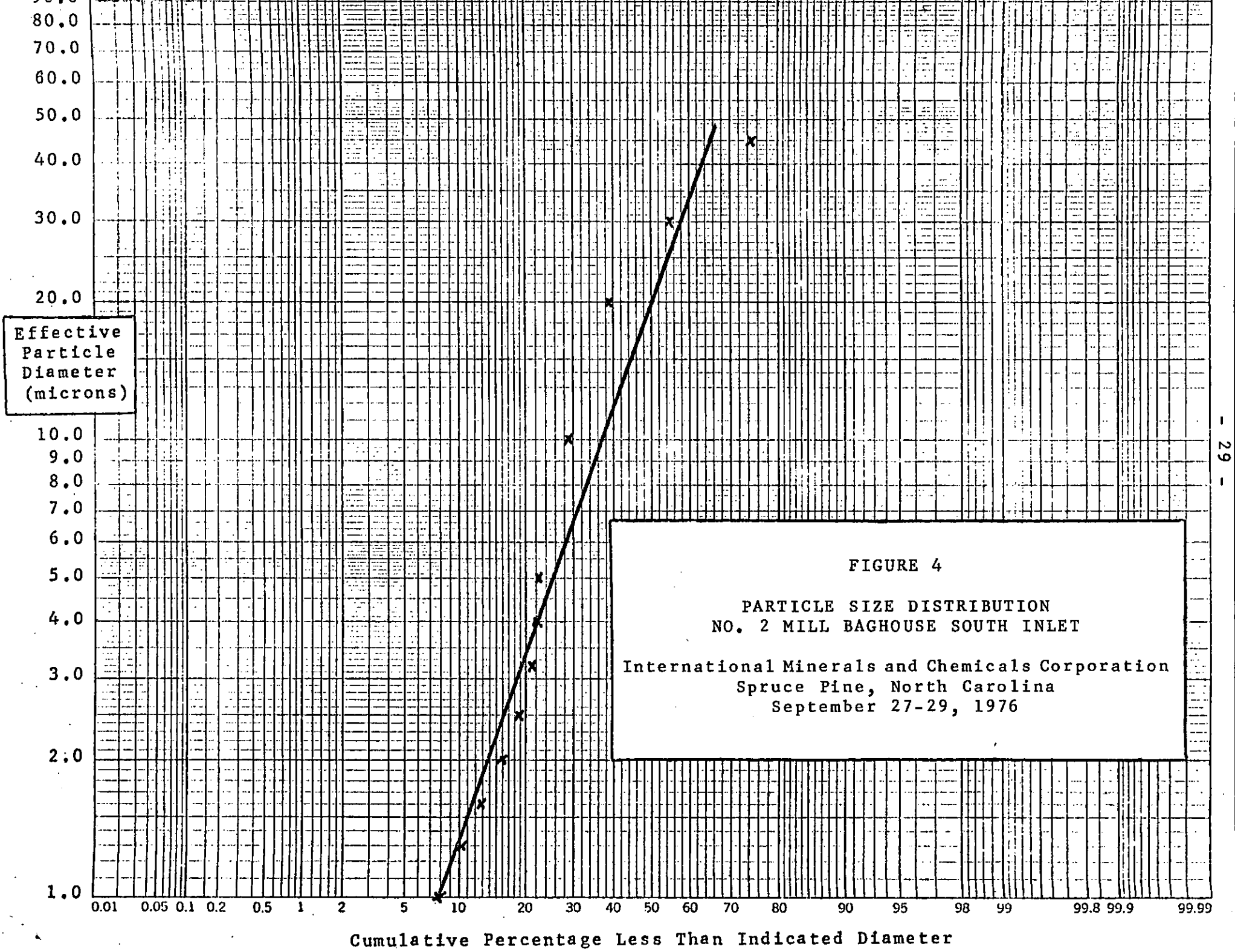


FIGURE 4

PARTICLE SIZE DISTRIBUTION
NO. 2 MILL BAGHOUSE SOUTH INLET

International Minerals and Chemicals Corporation
Spruce Pine, North Carolina
September 27-29, 1976

Appendix
C.1
Reference 52

Source Data

Source Type: Rotary Drum-Dryer

Source Fuel Type:

Source Description (Size, Rating, Ect.):
Mining operation for fluorspar ore (processing)
Emissions from the Rotary Drum Dryer is controlled by a baghouse.

Particle Size Data

Cumulative mass, % less than indicated size	Uncontrolled	Controlled
1 μm, aerodynamic		-2
2.5		~10
5		-25
10		~48

Emission Factor: Rate Controlled

1.5 lb/h

.75 lb part/ton throughput

or

Testing Data

Number of tests run: Controlled = 1 Uncontrolled = ____

Test Method: * Impactor run at a single point of average velocity

Type of Impactor: Andersen Mark III

Impactor Flow Rate: .75 acfm, % Isokinetic 117

Was Impactor Heated: No, Was Sample Gas Saturated: No

Did Sampling Site Meet Method 1 criteria: yes

Comments

Throughput for Dryer No. 1 - 2 tons/h (during testing period)
Method 5 tests were also run during the testing period.
The average Method 5 emission rate is presented

* Example Method 5 - implies Method 5 procedures were used

Appendix C.1 Reference 53

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 DATE 06/20/83

ID: 88 DESCRIBES SAMPLING AT SITE FROM 02/14/73 TO 02/15/73 BY SOUTHERN RESEARCH INST

SPONSOR ORGANIZATION: TOMBIGBEE LTWT AG. CO.
CONTRACT NUMBER: PURPOSE OF TEST: CONTROL TECHNOLOGY EVALUATION
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY:	MINERALS	SOURCE NAME:	CLAY DRYER
SOURCE TYPE:	BUILDING MATERIALS	SITE NAME:	TOMBIGBEE LTWT AGGRT CO.
PRODUCT/DEVICE:	CERAMIC/CLAY	ADDRESS:	
PROCESS TYPE:	PRODUCTION		LIVINGSTON ,AL 35470 USA
DESIGN PROCESS RATE:			
FEED MATERIAL CATEGORY:	NOT SPECFD		
PRIMARY CONTROL DEVICE:		SIC CODE:	3259

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: SDDS TSN:

REFERENCE REPORT----------

TITLE		
AUTHOR		
SPONSOR REPORT NUMBER	NTIS NUMBER	PUBLICATION DATE
MCCAIN,J.D.		
SORI-EAS-73-052		FEBRUARY 1973

TEST SERIES COMMENTS----------

App. C 1, Ref. 53

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7
D50(MICRONS)	4.99	3.08	1.79	1.20	.59	.29	.15
MICROGRAMS/DNCM/STAGE	9.90E+05	3.98E+05	3.41E+05	1.65E+05	1.56E+05	1.10E+05	7.39E+04
NUMBER/DNCM/STAGE	1.70E+11	1.26E+13	5.03E+13	1.00E+14	5.00E+14	2.97E+15	1.56E+16
CUM. %MASS<D50	55.68	37.87	22.60	15.22	8.23	3.31	
CUM. MICROGRAMS/ACM<D50	5.93E+05	4.03E+05	2.41E+05	1.62E+05	8.76E+04	3.52E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.24E+06	8.46E+05	5.05E+05	3.40E+05	1.84E+05	7.39E+04	0.00E+00
GEOM D50	2.23E+01	3.92E+00	2.35E+00	1.47E+00	8.41E-01	4.14E-01	2.09E-01
DM/DLOGD-(UG/DNM3)	7.61E+05	1.90E+06	1.45E+06	9.50E+05	5.06E+05	3.57E+05	2.58E+05
DN-LOGD/(NUMBER/DNM3)	1.31E+11	6.02E+13	2.13E+14	5.76E+14	1.62E+15	9.62E+15	5.43E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8
D50(MICRONS)	30.02	7.50	4.23	2.49	1.69	.88	.54	.27
MICROGRAMS/DNCM/STAGE	8.23E+05	2.30E+05	5.50E+05	3.13E+05	1.65E+05	1.43E+05	1.07E+05	2.66E+05
NUMBER/DNCM/STAGE	9.57E+09	1.30E+11	5.88E+12	1.75E+13	3.65E+13	1.51E+14	6.24E+14	9.13E+15
CUM. %MASS<D50	68.31	59.45	38.27	26.22	19.87	14.36	10.24	
CUM. MICROGRAMS/ACM<D50	8.45E+05	7.36E+05	4.74E+05	3.25E+05	2.46E+05	1.78E+05	1.27E+05	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.77E+06	1.54E+06	9.94E+05	6.81E+05	5.16E+05	3.73E+05	2.66E+05	0.00E+00
GEOM D50	5.48E+01	1.50E+01	5.63E+00	3.25E+00	2.05E+00	1.22E+00	6.89E-01	3.82E-01
DM/DLOGD-(UG/DNM3)	1.58E+06	3.82E+05	2.21E+06	1.36E+06	9.80E+05	5.05E+05	5.05E+05	8.84E+05
DN-LOGD/(NUMBER/DNM3)	1.83E+10	2.16E+11	2.36E+13	7.60E+13	2.17E+14	5.31E+14	2.94E+15	3.03E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8
D50(MICRONS)	4.82	3.02	1.76	1.18	.57	.27	.25	.10
MICROGRAMS/DNCM/STAGE	9.08E+05	3.90E+05	2.19E+05	1.30E+05	1.39E+05	0.00E-0	8.65E+04	1.22E+05
NUMBER/DNCM/STAGE	1.64E+11	1.34E+13	3.41E+13	8.30E+13	4.81E+14	0.00E-0	9.42E+15	5.89E+16
CUM. %MASS<D50	54.47	34.92	23.94	17.42	10.45	10.45	6.12	
CUM. MICROGRAMS/ACM<D50	5.18E+05	3.32E+05	2.28E+05	1.66E+05	9.94E+04	9.94E+04	5.81E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.09E+06	6.96E+05	4.77E+05	3.47E+05	2.08E+05	2.08E+05	1.22E+05	0.00E+00
GEOM D50	2.19E+01	3.82E+00	2.31E+00	1.44E+00	8.20E-01	3.92E-01	2.60E-01	1.58E-01
DM/DLOGD-(UG/DNM3)	6.90E+05	1.92E+06	9.34E+05	7.49E+05	4.40E+05	0.00E+00	2.59E+06	3.07E+05
DN-LOGD/(NUMBER/DNM3)	1.25E+11	6.61E+13	1.46E+14	4.78E+14	1.52E+15	0.00E-0	2.82E+17	1.48E+17

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8
D50(MICRONS)	28.56	7.34	4.14	2.43	1.65	.85	.51	.26
MICROGRAMS/DNCM/STAGE	1.05E+06	3.14E+05	5.54E+05	2.51E+05	1.22E+05	1.32E+05	1.23E+05	2.38E+05
NUMBER/DNCM/STAGE	1.32E+10	1.98E+11	6.32E+12	1.50E+13	2.90E+13	1.52E+14	8.23E+14	9.41E+15
CUM. %MASS<D50	62.28	51.01	31.11	22.09	17.71	12.97	8.55	
CUM. MICROGRAMS/ACM<D50	8.26E+05	6.77E+05	4.13E+05	2.93E+05	2.35E+05	1.72E+05	1.13E+05	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.73E+06	1.42E+06	8.66E+05	6.15E+05	4.93E+05	3.61E+05	2.38E+05	0.00E+00
GEOM D50	5.34E+01	1.45E+01	5.51E+00	3.17E+00	2.00E+00	1.18E+00	6.58E-01	3.64E-01
DM/DLOGD-(UG/DNM3)	1.93E+06	5.32E+05	2.23E+06	1.08E+06	7.26E+05	4.58E+05	5.54E+05	8.13E+05
DN-LOGD/(NUMBER/DNM3)	2.42E+10	3.35E+11	2.54E+13	6.49E+13	1.73E+14	5.27E+14	3.71E+15	3.22E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8
D50(MICRONS)	27.39	7.23	4.07	2.39	1.62	.83	.50	.25
MICROGRAMS/DNCM/STAGE	1.12E+06	2.72E+05	5.81E+05	3.72E+05	1.37E+05	1.85E+05	1.91E+05	2.54E+05
NUMBER/DNCM/STAGE	1.49E+10	1.86E+11	6.95E+12	2.34E+13	3.43E+13	2.27E+14	1.36E+15	1.10E+16
CUM. %MASS<D50	64.01	55.27	36.60	24.65	20.24	14.30	8.16	
CUM. MICROGRAMS/ACM<D50	9.49E+05	8.20E+05	5.43E+05	3.66E+05	3.00E+05	2.12E+05	1.21E+05	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.99E+06	1.72E+06	1.14E+06	7.67E+05	6.30E+05	4.45E+05	2.54E+05	0.00E+00
GEOM D50	5.23E+01	1.41E+01	5.42E+00	3.12E+00	1.97E+00	1.16E+00	6.44E-01	3.54E-01
DM/DLOGD-(UG/DNM3)	1.99E+06	4.70E+05	2.33E+06	1.61E+06	8.11E+05	6.37E+05	8.68E+05	8.44E+05
DN-LOGD/(NUMBER/DNM3)	2.66E+10	3.22E+11	2.79E+13	1.01E+14	2.03E+14	7.80E+14	6.20E+15	3.65E+16

Appendix C.1 Reference 54

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 DATE 06/21/83

O: 342 DESCRIBES SAMPLING AT SITE FROM 10/21/80 TO 10/22/80 BY PEDCO ENVIRONMENTAL

SPONSOR ORGANIZATION: EPA/OAQPS/EMB
CONTRACT NUMBER: 68-02-3546 PURPOSE OF TEST: STANDARDS DEVELOPMENT
TASK/DIRECTIVE NUMBER: 001

SOURCE DESCRIPTION----------

SOURCE CATEGORY: MINERALS
SOURCE TYPE: BUILDING MATERIALS
PRODUCT/DEVICE: CERAMIC/CLAY
PROCESS TYPE: PRODUCTION
DESIGN PROCESS RATE:
FEED MATERIAL CATEGORY: COAL
PRIMARY CONTROL DEVICE:

SOURCE NAME: CLINKER COOLER
SITE NAME: ARKANSAS LGTWGT AGGREGATE
ADDRESS:
WEST MEMPHIS ,AR 00000 USA

SIC CODE: 3259

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: SDDS TSN:

REFERENCE REPORT----------

TITLE
AUTHOR
SPONSOR REPORT NUMBER NTIS NUMBER PUBLICATION DATE

EMISSION TEST REPORT-METHOD DEVELOPMENT AND TESTING FOR CLAY, SHALE,AND SLATE AGGREGATE INDUSTRY

EMB RPT 80-LWA-2 MAY 1981

TEST SERIES COMMENTS----------
CLINKER COOLER IS RECIPROCATING GRATE TYPE

App. C.1, Ref. 68

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	9.73	9.01	5.84	3.76	2.20	1.09	.71	.42	.10
MICROGRAMS/DNCM/STAGE	4.31E+04	7.95E+03	3.07E+03	1.23E+04	9.76E+02	6.28E+03	0.00E-0	4.18E+02	4.18E+03
NUMBER/DNCM/STAGE	2.71E+09	1.85E+10	1.54E+10	2.28E+11	7.83E+10	3.23E+12	0.00E-0	4.90E+12	9.27E+14
CUM. %MASS<D50	44.94	34.78	30.86	15.14	13.90	5.87	5.87	5.34	
CUM. MICROGRAMS/ACM<D50	3.11E+04	2.41E+04	2.14E+04	1.05E+04	9.63E+03	4.07E+03	4.07E+03	3.70E+03	0.00E+00
CUM. MICROGRAMS/DNCM<D50	3.52E+04	2.72E+04	2.42E+04	1.19E+04	1.09E+04	4.60E+03	4.60E+03	4.18E+03	0.00E+00
GEOM D50	3.12E+01	9.36E+00	7.25E+00	4.69E+00	2.88E+00	1.55E+00	8.80E-01	5.46E-01	2.05E-01
DM/DLOGD-(UG/DNM3)	4.26E+04	2.38E+05	1.63E+04	6.43E+04	4.19E+03	2.06E+04	0.00E+00	1.83E+03	6.71E+03
DN-LOGD/(NUMBER/DNM3)	2.68E+09	5.54E+11	8.16E+10	1.19E+12	3.37E+11	1.06E+13	0.00E-0	2.15E+13	1.49E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.29	9.53	6.18	3.98	2.33	1.15	.75	.45	.10
MICROGRAMS/DNCM/STAGE	2.37E+05	3.05E+03	9.63E+03	8.46E+03	1.06E+04	9.16E+03	2.82E+03	9.40E+02	4.23E+03
NUMBER/DNCM/STAGE	1.37E+10	6.00E+09	4.07E+10	1.32E+11	7.17E+11	3.99E+12	6.72E+12	9.16E+12	8.46E+14
CUM. %MASS<D50	17.10	16.03	12.67	9.71	6.00	2.79	1.81	1.48	
CUM. MICROGRAMS/ACM<D50	4.33E+04	4.06E+04	3.21E+04	2.46E+04	1.52E+04	7.07E+03	4.58E+03	3.75E+03	0.00E+00
CUM. MICROGRAMS/DNCM<D50	4.89E+04	4.58E+04	3.62E+04	2.77E+04	1.71E+04	7.99E+03	5.17E+03	4.23E+03	0.00E+00
GEOM D50	3.21E+01	9.90E+00	7.67E+00	4.96E+00	3.05E+00	1.64E+00	9.29E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	2.40E+05	9.15E+04	5.12E+04	4.43E+04	4.56E+04	2.99E+04	1.52E+04	4.24E+03	6.48E+03
DN-LOGD/(NUMBER/DNM3)	1.39E+10	1.80E+11	2.16E+11	6.93E+11	3.08E+12	1.30E+13	3.62E+13	4.13E+13	1.30E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.30	9.54	6.19	3.99	2.33	1.15	.75	.45	.10
MICROGRAMS/DNCM/STAGE	5.49E+04	8.21E+03	2.13E+04	1.99E+04	1.76E+04	1.01E+04	4.46E+03	9.38E+02	4.92E+03
NUMBER/DNCM/STAGE	3.17E+09	1.61E+10	8.96E+10	3.10E+11	1.19E+12	4.40E+12	1.06E+13	9.14E+12	9.84E+14
CUM. %MASS<D50	61.43	55.66	40.69	26.71	14.35	7.25	4.12	3.46	
CUM. MICROGRAMS/ACM<D50	7.74E+04	7.01E+04	5.13E+04	3.37E+04	1.81E+04	9.14E+03	5.19E+03	4.36E+03	0.00E+00
CUM. MICROGRAMS/DNCM<D50	8.74E+04	7.92E+04	5.79E+04	3.80E+04	2.04E+04	1.03E+04	5.86E+03	4.92E+03	0.00E+00
GEOM D50	3.21E+01	9.91E+00	7.68E+00	4.97E+00	3.05E+00	1.64E+00	9.29E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	5.56E+04	2.47E+05	1.13E+05	1.04E+05	7.53E+04	3.29E+04	2.40E+04	4.23E+03	7.53E+03
DN-LOGD/(NUMBER/DNM3)	3.21E+09	4.84E+11	4.77E+11	1.62E+12	5.08E+12	1.43E+13	5.73E+13	4.12E+13	1.51E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.29	9.52	6.18	3.98	2.33	1.15	.75	.45	.10
MICROGRAMS/DNCM/STAGE	6.94E+04	2.82E+03	1.02E+04	1.10E+04	1.78E+04	1.24E+04	5.36E+03	5.64E+02	1.19E+04
NUMBER/DNCM/STAGE	4.02E+09	5.55E+09	4.32E+10	1.72E+11	1.20E+12	5.40E+12	1.28E+13	5.49E+12	2.38E+15
CUM. %MASS<D50	50.93	48.94	41.73	33.95	21.37	12.60	8.81	8.41	
CUM. MICROGRAMS/ACM<D50	6.38E+04	6.13E+04	5.23E+04	4.25E+04	2.68E+04	1.58E+04	1.10E+04	1.05E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	7.20E+04	6.92E+04	5.90E+04	4.80E+04	3.02E+04	1.78E+04	1.25E+04	1.19E+04	0.00E+00
GEOM D50	3.21E+01	9.90E+00	7.67E+00	4.96E+00	3.05E+00	1.64E+00	9.29E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	7.03E+04	8.35E+04	5.44E+04	5.76E+04	7.66E+04	4.04E+04	2.89E+04	2.54E+03	1.82E+04
DN-LOGD/(NUMBER/DNM3)	4.07E+09	1.64E+11	2.30E+11	9.01E+11	5.18E+12	1.76E+13	6.88E+13	2.48E+13	3.64E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.26	9.50	6.17	3.97	2.32	1.15	.75	.45	.10
MICROGRAMS/DNCM/STAGE	7.58E+04	4.91E+03	1.30E+04	1.61E+04	2.18E+04	1.51E+04	7.37E+03	2.46E+03	9.12E+03
NUMBER/DNCM/STAGE	4.41E+09	9.74E+09	5.53E+10	2.54E+11	1.49E+12	6.62E+12	1.76E+13	2.40E+13	1.82E+15
CUM. %MASS<D50	54.24	51.28	43.43	33.71	20.55	11.44	6.99	5.51	
CUM. MICROGRAMS/ACM<D50	7.96E+04	7.52E+04	6.37E+04	4.94E+04	3.01E+04	1.68E+04	1.03E+04	8.07E+03	0.00E+00
CUM. MICROGRAMS/DNCM<D50	8.99E+04	8.49E+04	7.19E+04	5.58E+04	3.40E+04	1.89E+04	1.16E+04	9.12E+03	0.00E+00
GEOM D50	3.20E+01	9.87E+00	7.66E+00	4.95E+00	3.03E+00	1.63E+00	9.29E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	7.67E+04	1.47E+05	6.94E+04	8.41E+04	9.34E+04	4.95E+04	3.97E+04	1.11E+04	1.40E+04
DN-LOGD/(NUMBER/DNM3)	4.45E+09	2.92E+11	2.95E+11	1.32E+12	6.38E+12	2.17E+13	9.47E+13	1.08E+14	2.79E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	9.78	9.06	5.88	3.79	2.21	1.09	.71	.43	.10
MICROGRAMS/DNCM/STAGE	7.85E+04	1.36E+04	3.80E+04	8.23E+03	4.43E+03	3.80E+03	0.00E-0	3.48E+03	1.20E+04
NUMBER/DNCM/STAGE	4.90E+09	3.11E+10	1.87E+11	1.49E+11	3.49E+11	1.94E+12	0.00E-0	3.94E+13	2.57E+15
CUM. %MASS<D50	51.56	43.16	19.71	14.63	11.90	9.55	9.55	7.41	
CUM. MICROGRAMS/ACM<D50	7.40E+04	6.19E+04	2.83E+04	2.10E+04	1.71E+04	1.37E+04	1.37E+04	1.06E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	8.35E+04	6.99E+04	3.19E+04	2.37E+04	1.93E+04	1.55E+04	1.55E+04	1.20E+04	0.00E+00
GEOM D50	3.13E+01	9.41E+00	7.30E+00	4.72E+00	2.89E+00	1.55E+00	8.80E-01	5.53E-01	2.07E-01
DM/DLOGD-(UG/DNM3)	7.77E+04	4.10E+05	2.02E+05	4.31E+04	1.89E+04	1.24E+04	0.00E+00	1.60E+04	1.89E+04
DN-LOGD/(NUMBER/DNM3)	4.85E+09	9.38E+11	9.94E+11	7.83E+11	1.49E+12	6.32E+12	0.00E-0	1.81E+14	4.06E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.28	9.52	6.18	3.98	2.32	1.15	.75	.45	.10
MICROGRAMS/DNCM/STAGE	8.62E+04	7.62E+03	1.42E+04	1.18E+04	1.14E+04	7.27E+03	3.46E+03	3.46E+03	7.62E+03
NUMBER/DNCM/STAGE	4.99E+09	1.50E+10	6.01E+10	1.85E+11	7.76E+11	3.19E+12	8.25E+12	3.37E+13	1.52E+15
CUM. %MASS<D50	43.67	38.69	29.41	21.70	14.25	9.50	7.24	4.98	
CUM. MICROGRAMS/ACM<D50	5.92E+04	5.24E+04	3.99E+04	2.94E+04	1.93E+04	1.29E+04	9.81E+03	6.75E+03	0.00E+00
CUM. MICROGRAMS/DNCM<D50	6.68E+04	5.92E+04	4.50E+04	3.32E+04	2.18E+04	1.45E+04	1.11E+04	7.62E+03	0.00E+00
GEOM D50	3.21E+01	9.89E+00	7.67E+00	4.96E+00	3.04E+00	1.63E+00	9.29E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	8.72E+04	2.28E+05	7.57E+04	6.17E+04	4.86E+04	2.39E+04	1.86E+04	1.56E+04	1.17E+04
DN-LOGD/(NUMBER/DNM3)	5.06E+09	4.51E+11	3.20E+11	9.67E+11	3.31E+12	1.05E+13	4.44E+13	1.52E+14	2.33E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	9.57	8.86	5.75	3.70	2.16	1.07	.70	.42	.10
MICROGRAMS/DNCM/STAGE	5.31E+04	9.65E+03	3.30E+04	1.41E+04	3.09E+04	1.09E+04	0.00E-0	2.41E+03	1.61E+04
NUMBER/DNCM/STAGE	3.43E+09	2.36E+10	1.73E+11	2.74E+11	2.61E+12	5.92E+12	0.00E-0	2.89E+13	3.57E+15
CUM. %MASS<D50	68.79	63.12	43.73	35.44	17.28	10.88	10.88	9.46	
CUM. MICROGRAMS/ACM<D50	1.04E+05	9.51E+04	6.59E+04	5.34E+04	2.60E+04	1.64E+04	1.64E+04	1.43E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.17E+05	1.07E+05	7.44E+04	6.03E+04	2.94E+04	1.85E+04	1.85E+04	1.61E+04	0.00E+00
GEOM D50	3.09E+01	9.21E+00	7.14E+00	4.61E+00	2.83E+00	1.52E+00	8.65E-01	5.42E-01	2.05E-01
DM/DLOGD-(UG/DNM3)	5.21E+04	2.88E+05	1.76E+05	7.36E+04	1.32E+05	3.57E+04	0.00E+00	1.09E+04	2.58E+04
DN-LOGD/(NUMBER/DNM3)	3.36E+09	7.05E+11	9.23E+11	1.43E+12	1.12E+13	1.94E+13	0.00E-0	1.30E+14	5.73E+15

15 - App. C.1, Ref. 1

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB Report 80-LWA-3

Air

EPA

Lightweight Aggregate Industry (Clay, Shale, and Slate)

Appendix
C.1
Reference 55

Emission Test Report
Texas Industries, Inc.
Clodine, Texas

° EMISSION TEST REPORT °

METHOD DEVELOPMENT AND TESTING FOR CLAY, SHALE, AND SLATE AGGREGATE INDUSTRY: Texas Industries, Inc. Clodine, Texas ESED 80/12

By

PEDCo Environmental, Inc.
11499 Chester Road
Cincinnati, Ohio 45246

Contract No. 68-02-3546
Work Assignment No. 1
PN 3530-1

EPA Task Manager

Frank Clay

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EMISSION MEASUREMENT BRANCH
EMISSION STANDARDS AND ENGINEERING DIVISION
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

May 1981

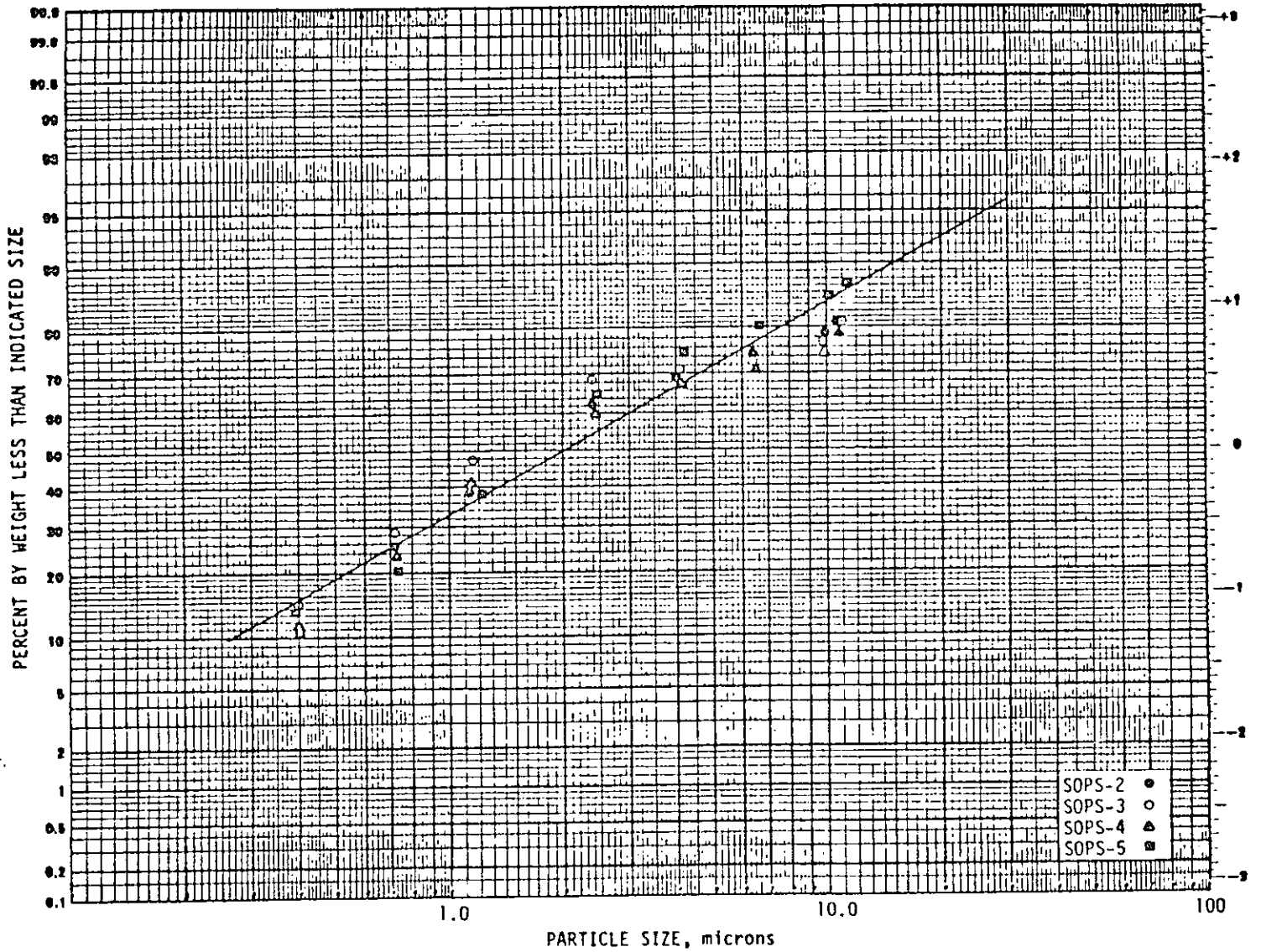


Figure 3.1-1. Particle size distribution, kiln exhaust scrubber outlet.

3530-1 R

Source Data

186/187

Source Type: Rotary Kiln (shale lightweight aggregate plant)

Source Fuel Type: Coal (Low sulfur 1%)

Source Description (Size, Rating, Ect.):

Kiln dimensions - 190 ft long, 12 ft in diameter
designed to process 40 tons raw material/h

Exhaust gases from the Kiln are controlled by a settling chamber - followed by a medium energy wet scrubber

Particle Size Data

Cumulative mass, % less than indicated size			Uncontrolled	Controlled
Uncontrolled	(physical)	Controlled	(aerodynamic)	
1	μm,	1	~4	~24
2.5		2.5	~14	~33
5		5	~25	~34
10		10	~42	~39
20		20	~60	~52

Emission Rate Factor: Uncontrolled 3,695 lb/h, 106 lb part/ton produced

Controlled 119.4 lb/h, 3.4 lb part/ton produced

Testing Data

Number of tests run: Controlled = 6 Uncontrolled = 3

Test Method: Controlled - IP protocol * Uncontrolled Method 5
Uncontrolled - Bacho analysis of Method 5 samples

Type of Impactor: Controlled - Andersen Mark III

Impactor Flow Rate: Controlled - .5-.7 acfm, % Isokinetic 100 ± 10% for both sites

Was Impactor Heated: No, Was Sample Gas Saturated: yes

Did Sampling Site Meet Method 1 criteria: yes for both test site

Comments

Avg production rate during testing ~ 35 tons/h
specific gravity of part. ~ 2.64 at Uncontrolled Test site
Method 5 tests were conducted simultaneously with the particle size runs.
The average Method 5 emission rates are presented

* Example Method 5 - implies Method 5 procedures were used

Appendix C.1 Reference 56

ENVIRONMENTAL ASSESSMENT DATA SYSTEMS
FPEIS SERIES REPORT

SERIES FORM 1 DATE 06/21/83

ID: 341 DESCRIBES SAMPLING AT SITE FROM 10/21/80 TO 10/22/80 BY PEDCO ENVIRONMENTAL

SPONSOR ORGANIZATION: EPA/OAQPS/EMB
CONTRACT NUMBER: 68-02-3546 PURPOSE OF TEST: STANDARDS DEVELOPMENT
TASK/DIRECTIVE NUMBER: 001

SOURCE DESCRIPTION----------

SOURCE CATEGORY:	MINERALS	SOURCE NAME:	ROTARY KILN
SOURCE TYPE:	BUILDING MATERIALS	SITE NAME:	ARKANSAS LGTWGT AGGREGATE
PRODUCT/DEVICE:	CERAMIC/CLAY	ADDRESS:	
PROCESS TYPE:	PRODUCTION		WEST MEMPHIS ,AR 00000 USA
DESIGN PROCESS RATE:			
FEED MATERIAL CATEGORY:	COAL		
PRIMARY CONTROL DEVICE:		SIC CODE:	3259

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):

LEDS TSN: GEDS TSN: SODS TSN:

REFERENCE REPORT----------

TITLE	AUTHOR	SPONSOR REPORT NUMBER	NTIS NUMBER	PUBLICATION DATE
EMISSION TEST REPORT-METHOD DEVELOPMENT AND TESTING FOR CLAY, SHALE,AND SLATE AGGREGATE INDUSTRY		80-LWA-4		NOVEMBER 1980

TEST SERIES COMMENTS----------

Opp. CZ, Ref. 69

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.21	9.45	6.13	3.95	2.31	1.14	.75	.45	.10
MICROGRAMS/DNCM/STAGE	1.12E+05	1.27E+04	2.44E+04	1.96E+04	3.13E+04	4.30E+04	3.42E+04	1.17E+04	4.60E+04
NUMBER/DNCM/STAGE	6.56E+09	2.56E+10	1.06E+11	3.14E+11	2.17E+12	1.92E+13	8.26E+13	1.14E+14	9.20E+15
CUM. %MASS<D50	66.56	62.77	55.48	49.63	40.28	27.44	17.23	13.74	
CUM. MICROGRAMS/ACM<D50	1.97E+05	1.86E+05	1.65E+05	1.47E+05	1.19E+05	8.14E+04	5.11E+04	4.07E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.23E+05	2.10E+05	1.86E+05	1.66E+05	1.35E+05	9.19E+04	5.77E+04	4.60E+04	0.00E+00
GEOM D50	3.20E+01	9.82E+00	7.61E+00	4.92E+00	3.02E+00	1.62E+00	9.25E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	1.13E+05	3.78E+05	1.30E+05	1.03E+05	1.34E+05	1.40E+05	1.88E+05	5.27E+04	7.04E+04
DN-LOGD/(NUMBER/DNM3)	6.62E+09	7.62E+11	5.62E+11	1.65E+12	9.31E+12	6.27E+13	4.54E+14	5.14E+14	1.41E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	9.70	8.98	5.83	3.75	2.19	1.08	.71	.42	.10
MICROGRAMS/DNCM/STAGE	1.24E+05	1.77E+04	1.22E+04	5.53E+03	1.44E+04	1.77E+04	2.65E+04	1.99E+04	1.06E+05
NUMBER/DNCM/STAGE	7.84E+09	4.16E+10	6.15E+10	1.03E+11	1.17E+12	9.29E+12	7.54E+13	2.33E+14	2.35E+16
CUM. %MASS<D50	63.95	58.80	55.25	53.64	49.46	44.31	36.61	30.82	
CUM. MICROGRAMS/ACM<D50	1.95E+05	1.79E+05	1.68E+05	1.63E+05	1.51E+05	1.35E+05	1.11E+05	9.38E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.20E+05	2.02E+05	1.90E+05	1.84E+05	1.70E+05	1.52E+05	1.26E+05	1.06E+05	0.00E+00
GEOM D50	3.11E+01	9.33E+00	7.24E+00	4.68E+00	2.87E+00	1.54E+00	8.76E-01	5.46E-01	2.05E-01
DM/DLOGD-(UG/DNM3)	1.22E+05	5.28E+05	6.50E+04	2.89E+04	6.16E+04	5.77E+04	1.45E+05	8.73E+04	1.70E+05
DN-LOGD/(NUMBER/DNM3)	7.74E+09	1.24E+12	3.28E+11	5.39E+11	5.00E+12	3.03E+13	4.14E+14	1.02E+15	3.77E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.14	9.39	6.09	3.92	2.29	1.13	.74	.44	.10
MICROGRAMS/DNCM/STAGE	1.64E+05	5.44E+04	4.83E+04	1.57E+04	3.14E+04	4.23E+04	5.20E+04	7.61E+04	5.44E+04
NUMBER/DNCM/STAGE	9.70E+09	1.12E+11	2.13E+11	2.57E+11	2.23E+12	1.94E+13	1.30E+14	7.82E+14	1.13E+16
CUM. %MASS<D50	69.55	59.45	50.48	47.57	41.74	33.88	24.23	10.10	
CUM. MICROGRAMS/ACM<D50	3.32E+05	2.83E+05	2.41E+05	2.27E+05	1.99E+05	1.62E+05	1.16E+05	4.82E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	3.75E+05	3.20E+05	2.72E+05	2.56E+05	2.25E+05	1.82E+05	1.30E+05	5.44E+04	0.00E+00
GEOM D50	3.18E+01	9.76E+00	7.56E+00	4.89E+00	3.00E+00	1.61E+00	9.14E-01	5.71E-01	2.10E-01
DM/DLOGD-(UG/DNM3)	1.65E+05	1.63E+06	2.57E+05	8.21E+04	1.35E+05	1.38E+05	2.83E+05	3.37E+05	8.45E+04
DN-LOGD/(NUMBER/DNM3)	9.76E+09	3.35E+12	1.13E+12	1.34E+12	9.55E+12	6.33E+13	7.06E+14	3.46E+15	1.75E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	9.35	8.65	5.62	3.62	2.11	1.04	.68	.41	.10
MICROGRAMS/DNCM/STAGE	6.43E+04	2.04E+04	1.63E+04	1.53E+04	2.04E+04	3.78E+04	3.27E+04	1.63E+04	4.80E+04
NUMBER/DNCM/STAGE	4.30E+09	5.36E+10	9.18E+10	3.18E+11	1.85E+12	2.22E+13	1.05E+14	2.11E+14	1.10E+16
CUM. %MASS<D50	76.32	68.80	62.80	57.16	49.65	35.73	23.68	17.68	
CUM. MICROGRAMS/ACM<D50	1.83E+05	1.65E+05	1.51E+05	1.37E+05	1.19E+05	8.59E+04	5.69E+04	4.25E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.07E+05	1.87E+05	1.70E+05	1.55E+05	1.35E+05	9.70E+04	6.43E+04	4.80E+04	0.00E+00
GEOM D50	3.06E+01	8.99E+00	6.97E+00	4.51E+00	2.76E+00	1.48E+00	8.41E-01	5.28E-01	2.02E-01
DM/DLOGD-(UG/DNM3)	6.25E+04	6.04E+05	8.70E+04	8.01E+04	8.70E+04	1.23E+05	1.77E+05	7.42E+04	7.83E+04
DN-LOGD/(NUMBER/DNM3)	4.17E+09	1.59E+12	4.90E+11	1.67E+12	7.87E+12	7.23E+13	5.69E+14	9.62E+14	1.80E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	9.38	8.69	5.64	3.63	2.12	1.05	.69	.41	.10
MICROGRAMS/DNCM/STAGE	1.81E+05	3.40E+04	4.22E+04	0.00E-0	4.84E+04	9.67E+04	7.92E+04	1.44E+04	2.54E+05
NUMBER/DNCM/STAGE	1.20E+10	8.82E+10	2.35E+11	0.00E-0	4.33E+12	5.56E+13	2.45E+14	1.83E+14	5.84E+16
CUM. %MASS<D50	75.86	71.33	65.70	65.70	59.25	46.35	35.79	33.87	
CUM. MICROGRAMS/ACM<D50	5.04E+05	4.74E+05	4.36E+05	4.36E+05	3.93E+05	3.08E+05	2.38E+05	2.25E+05	0.00E+00
CUM. MICROGRAMS/DNCM<D50	5.69E+05	5.35E+05	4.93E+05	4.93E+05	4.44E+05	3.48E+05	2.68E+05	2.54E+05	0.00E+00
GEOM D50	3.06E+01	9.03E+00	7.00E+00	4.52E+00	2.77E+00	1.49E+00	8.51E-01	5.32E-01	2.02E-01
DM/DLOGD-(UG/DNM3)	1.76E+05	1.02E+06	2.25E+05	0.00E+00	2.07E+05	3.17E+05	4.34E+05	6.37E+04	4.15E+05
DN-LOGD/(NUMBER/DNM3)	1.17E+10	2.66E+12	1.25E+12	0.00E-0	1.85E+13	1.82E+14	1.35E+15	8.08E+14	9.54E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.28	9.52	6.18	3.98	2.32	1.15	.75	.45	.10
MICROGRAMS/DNCM/STAGE	1.83E+05	4.11E+04	3.74E+04	3.49E+04	3.99E+04	5.85E+04	4.86E+04	3.86E+04	1.07E+05
NUMBER/DNCM/STAGE	1.06E+10	8.11E+10	1.58E+11	5.46E+11	2.72E+12	2.56E+13	1.16E+14	3.76E+14	2.14E+16
CUM. %MASS<D50	68.93	61.95	55.60	49.68	42.90	32.97	24.72	18.17	
CUM. MICROGRAMS/ACM<D50	3.59E+05	3.23E+05	2.90E+05	2.59E+05	2.24E+05	1.72E+05	1.29E+05	9.47E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	4.06E+05	3.65E+05	3.27E+05	2.93E+05	2.53E+05	1.94E+05	1.46E+05	1.07E+05	0.00E+00
GEOM D50	3.21E+01	9.89E+00	7.67E+00	4.96E+00	3.04E+00	1.63E+00	9.29E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	1.85E+05	1.23E+06	1.99E+05	1.83E+05	1.70E+05	1.92E+05	2.62E+05	1.74E+05	1.64E+05
DN-LOGD/(NUMBER/DNM3)	1.07E+10	2.43E+12	8.44E+11	2.86E+12	1.16E+13	8.41E+13	6.24E+14	1.69E+15	3.28E+16

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.20	9.44	6.13	3.95	2.31	1.14	.75	.45	.10
MICROGRAMS/DNCM/STAGE	3.59E+05	3.04E+04	3.53E+04	2.68E+04	3.17E+04	4.26E+04	4.38E+04	3.29E+04	2.80E+04
NUMBER/DNCM/STAGE	2.10E+10	6.14E+10	1.53E+11	4.30E+11	2.20E+12	1.90E+13	1.06E+14	3.20E+14	5.60E+15
CUM. %MASS<D50	43.06	38.24	32.64	28.39	23.36	16.61	9.66	4.44	
CUM. MICROGRAMS/ACM<D50	2.40E+05	2.13E+05	1.82E+05	1.58E+05	1.30E+05	9.27E+04	5.39E+04	2.48E+04	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.71E+05	2.41E+05	2.06E+05	1.79E+05	1.47E+05	1.05E+05	6.09E+04	2.80E+04	0.00E+00
GEOM D50	3.19E+01	9.81E+00	7.61E+00	4.92E+00	3.02E+00	1.62E+00	9.25E-01	5.81E-01	2.12E-01
DM/DLOGD-(UG/DNM3)	3.62E+05	9.04E+05	1.88E+05	1.40E+05	1.36E+05	1.39E+05	2.41E+05	1.48E+05	4.29E+04
DN-LOGD/(NUMBER/DNM3)	2.12E+10	1.83E+12	8.17E+11	2.25E+12	9.43E+12	6.21E+13	5.82E+14	1.44E+15	8.58E+15

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4	5	6	7	8	9
D50(MICRONS)	10.45	9.67	6.28	4.04	2.36	1.17	.76	.46	.10
MICROGRAMS/DNCM/STAGE	5.53E+04	4.50E+04	3.98E+04	1.41E+04	0.00E-0	1.16E+04	5.14E+03	2.57E+03	1.92E+05
NUMBER/DNCM/STAGE	3.13E+09	8.46E+10	1.61E+11	2.11E+11	0.00E-0	4.83E+12	1.17E+13	2.37E+13	3.72E+16
CUM. %MASS<D50	84.87	72.56	61.67	57.81	57.81	54.64	53.23	52.53	
CUM. MICROGRAMS/ACM<D50	2.75E+05	2.35E+05	2.00E+05	1.87E+05	1.87E+05	1.77E+05	1.72E+05	1.70E+05	0.00E+00
CUM. MICROGRAMS/DNCM<D50	3.10E+05	2.65E+05	2.25E+05	2.11E+05	2.11E+05	2.00E+05	1.95E+05	1.92E+05	0.00E+00
GEOM D50	3.23E+01	1.01E+01	7.79E+00	5.04E+00	3.09E+00	1.66E+00	9.43E-01	5.91E-01	2.14E-01
DM/DLOGD-(UG/DNM3)	5.64E+04	1.34E+06	2.12E+05	7.36E+04	0.00E+00	3.81E+04	2.74E+04	1.18E+04	2.90E+05
DN-LOGD/(NUMBER/DNM3)	3.19E+09	2.51E+12	8.57E+11	1.10E+12	0.00E-0	1.58E+13	6.25E+13	1.09E+14	5.61E+16

App.C.1, Ref.

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB Report 80-LWA-4

Air

Appendix
C.1
Reference 57

EPA

Lightweight Aggregate Industry (Clay, Shale, and Slate)

Emission Test Report Vulcan Materials Company Bessemer, Alabama

° EMISSION TEST REPORT °

METHOD DEVELOPMENT AND TESTING FOR CLAY, SHALE, AND SLATE AGGREGATE INDUSTRY

Vulcan Materials Company
Bessemer, Alabama
ESED 80/12

by

PEDCo Environmental, Inc.
11499 Chester Road
Cincinnati, Ohio 45246

Contract No. 68-02-3546
Work Assignment No. 1
PN: 3530-1

EPA Task Manager
Frank Clay

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EMISSION MEASUREMENT BRANCH
EMISSION STANDARDS AND ENGINEERING DIVISION
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

March 1982

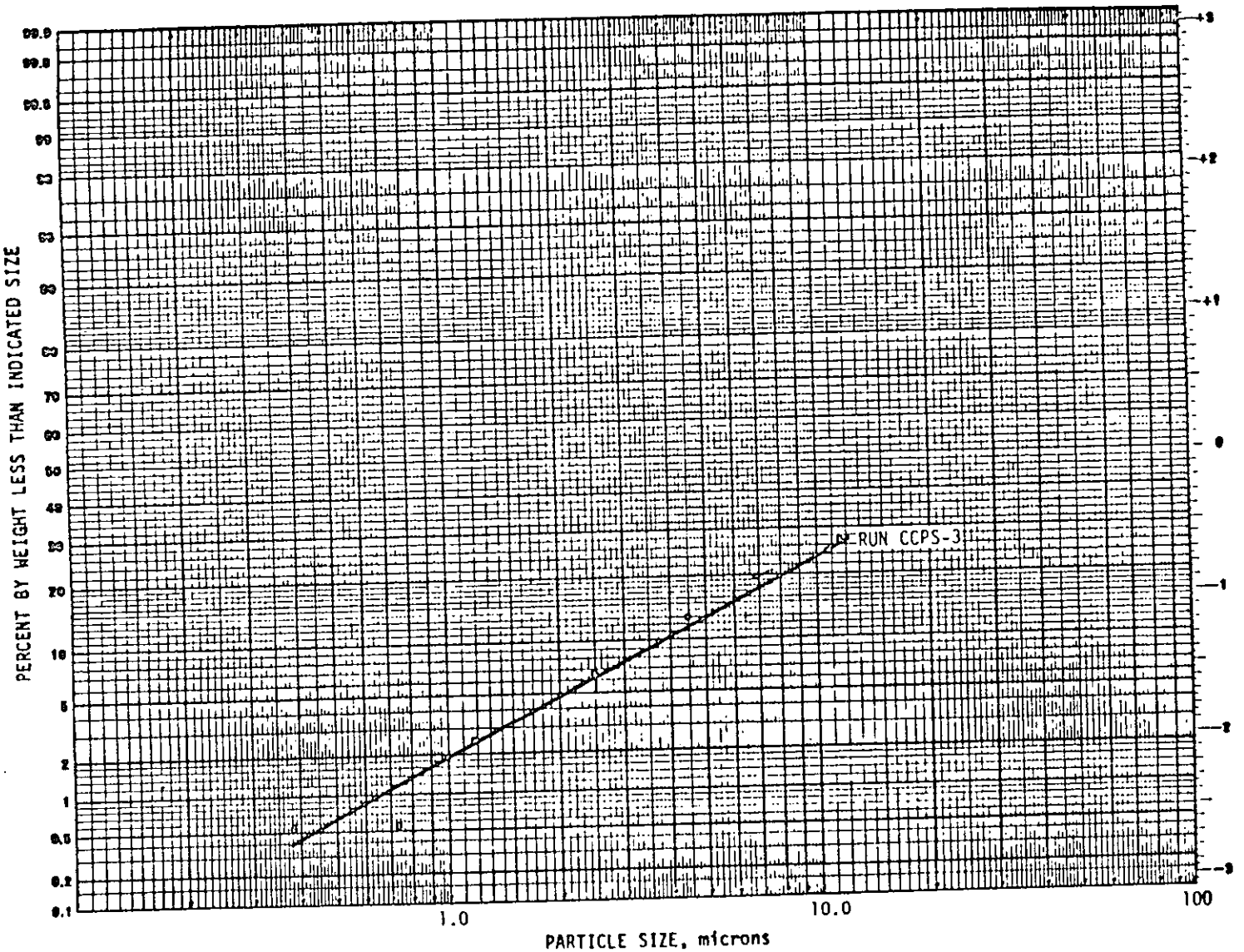


Figure 3-3. Particle size distribution - clinker cooler exhaust.

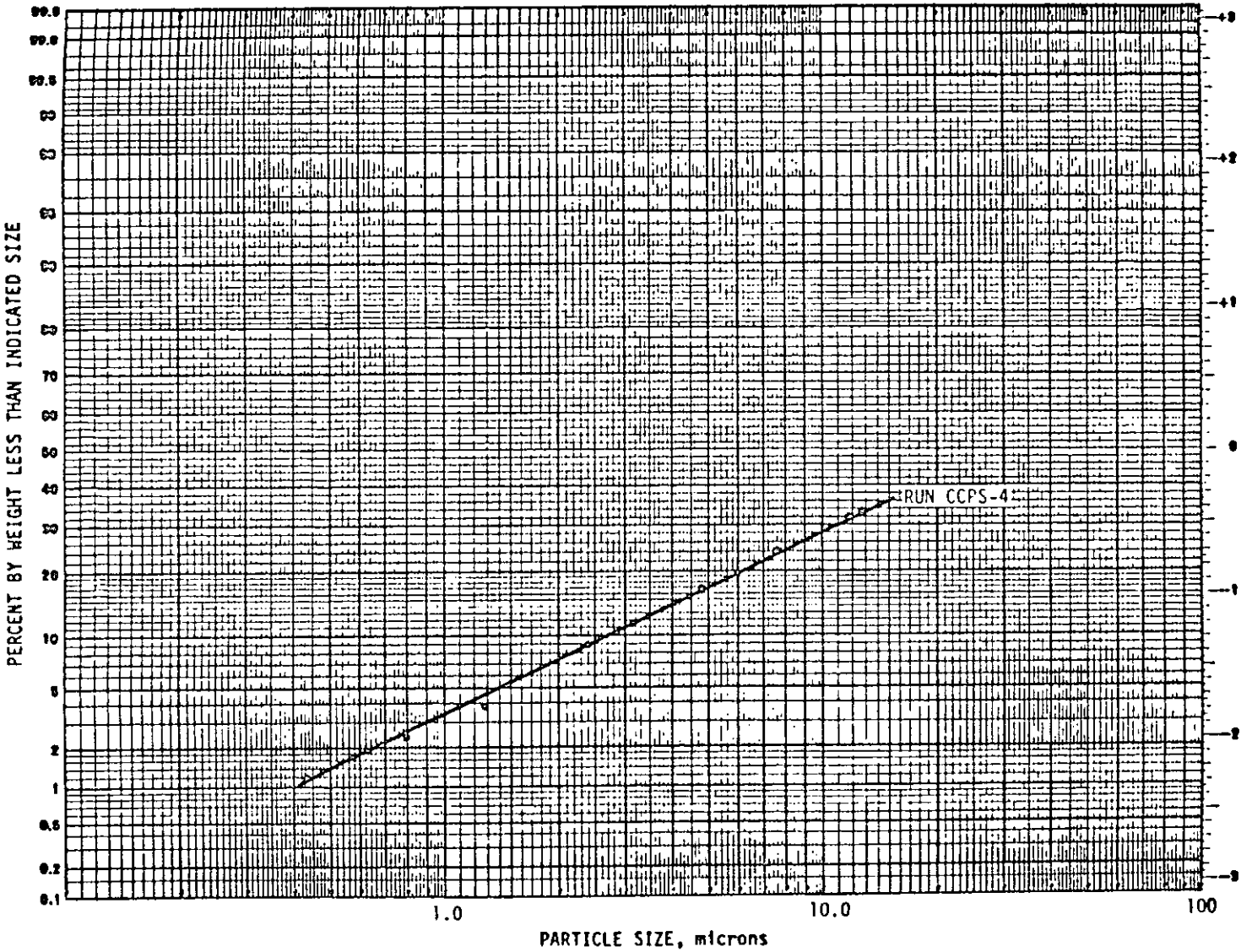


Figure 3-3 (continued)

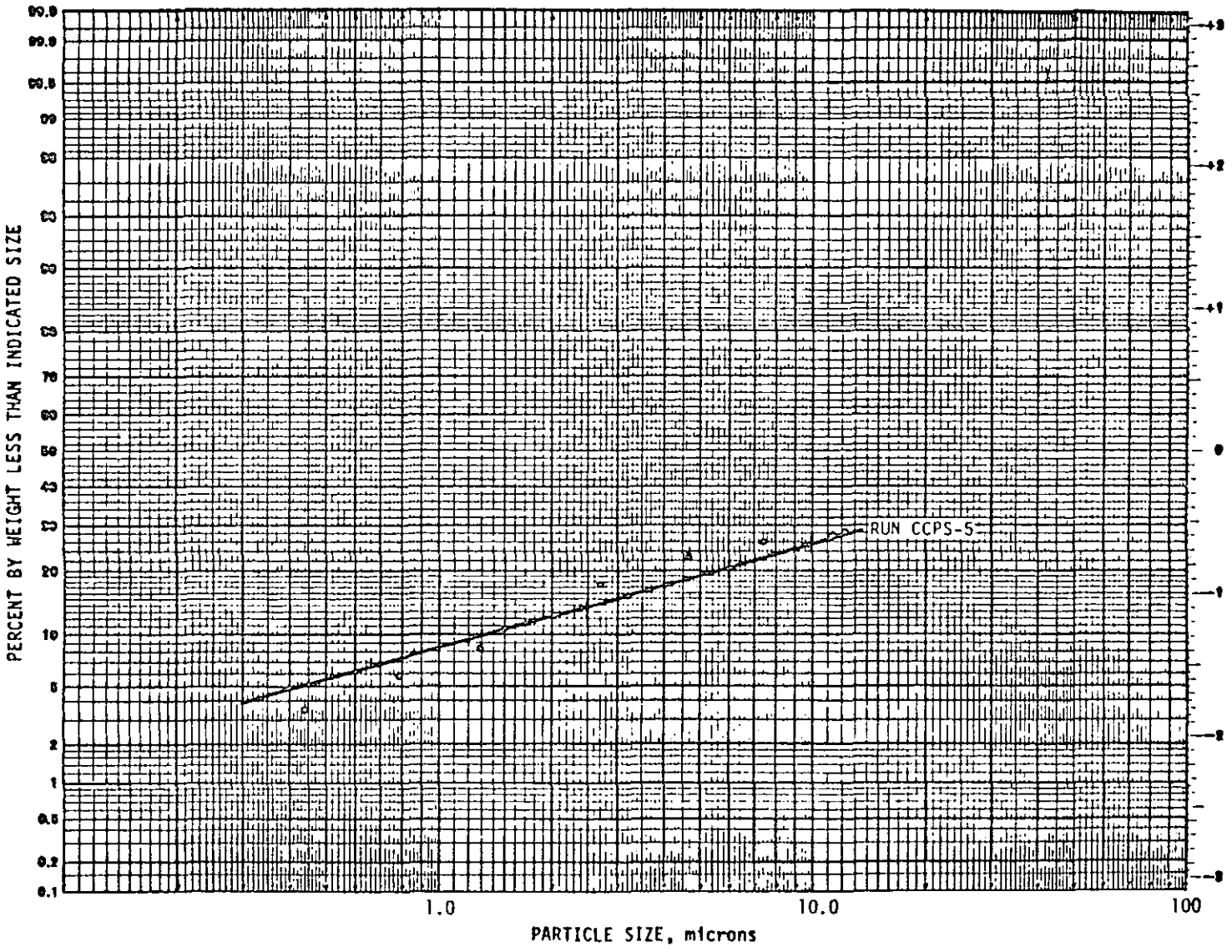


Figure 3-3 (continued)

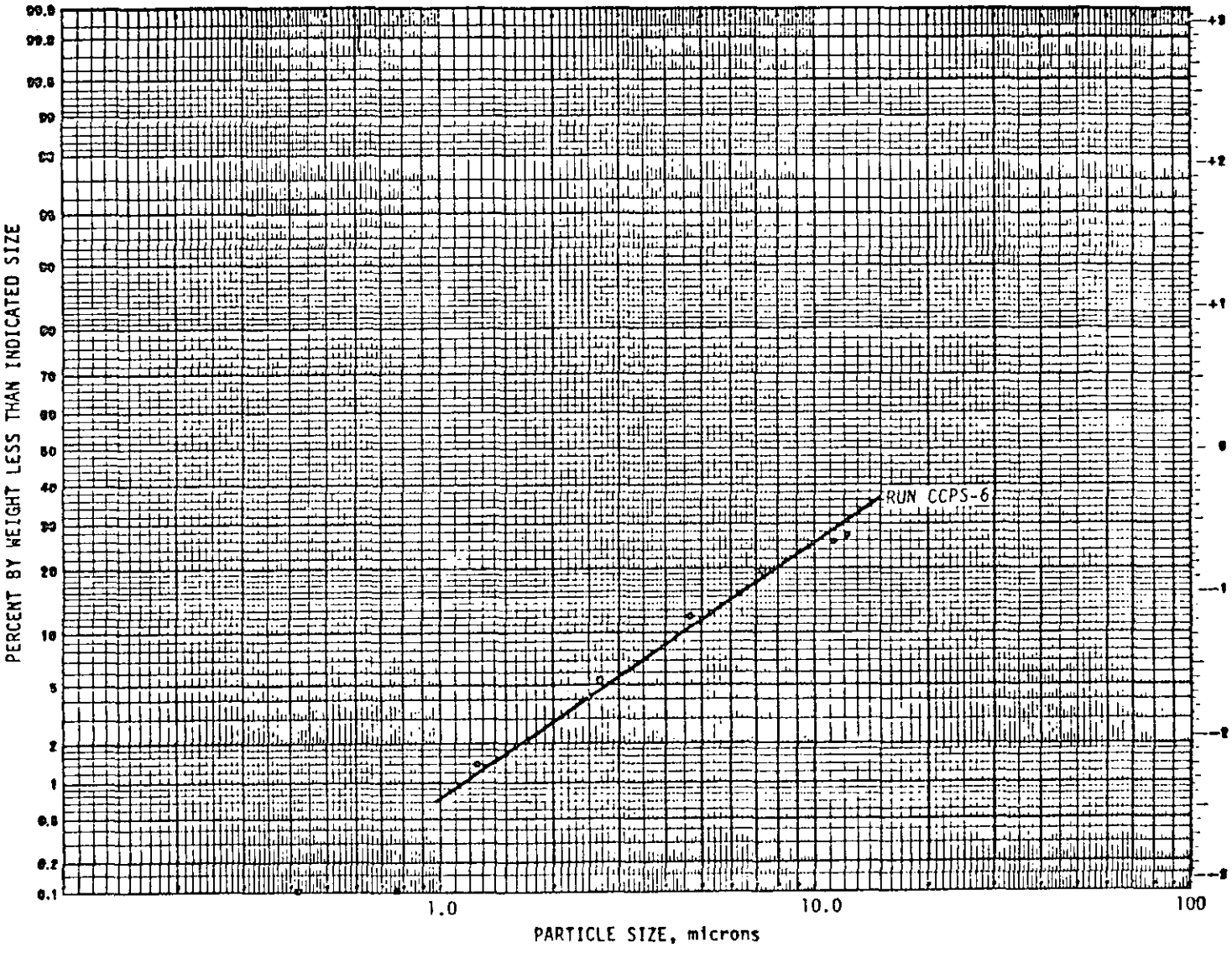


Figure 3-3 (continued)

3.3.30-1 B

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Source Data

Source Type: Reciprocating grate clinker cooler (shale lightweight aggregate plant)

Source Fuel Type:

Source Description (Size, Rating, Ect.):
Exhaust gases from the clinker cooler are controlled by a settling chamber.

Particle Size Data

Cumulative mass, % less than indicated size	Uncontrolled	Controlled
1 μm, aerodynamic		~3.5
2.5		~8.5
5		~15
10		~26

Emission Rate Factor: Controlled
3.8 lb/h
0.17 lb part/ton produced

Testing Data

Number of tests run: Controlled = 4 Uncontrolled = _____

Test Method*: IP protocol

Type of Impactor: Andersen Mark III

Impactor Flow Rate: .4-.6 acfm, % Isokinetic/00 ± 10%

Was Impactor Heated: No, Was Sample Gas Saturated: No

Did Sampling Site Meet Method 1 criteria: Yes

Comments

Avg. final production rate 23 tons/h (during the test series)
Method 5 tests were conducted simultaneously with the particle size runs
The average Method 5 emission rate is reported

* Example Method 5 - implies Method 5 procedures were used

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Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

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February 1982

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Lightweight Aggregate Industry (Clay, Shale, and Slate)

Appendix
C.1
Reference 58

Emission Test Report Galite Corporation Rockmart, Georgia

EMISSION TEST REPORT

METHOD DEVELOPMENT AND TESTING FOR CLAY, SHALE, AND SLATE AGGREGATE INDUSTRY

Galite Corporation
Rockmart, Georgia

ESED 80/12

by

PEDCo Environmental, Inc.
11499 Chester Road
Cincinnati, Ohio 45246

Contract No. 68-02-3546
Work Assignment No. 1
PN: 3530-1

EPA Task Manager
Frank Clay

U.S. ENVIRONMENTAL PROTECTION AGENCY
EMISSION MEASUREMENT BRANCH
EMISSION STANDARDS AND ENGINEERING DIVISION
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

April 1982

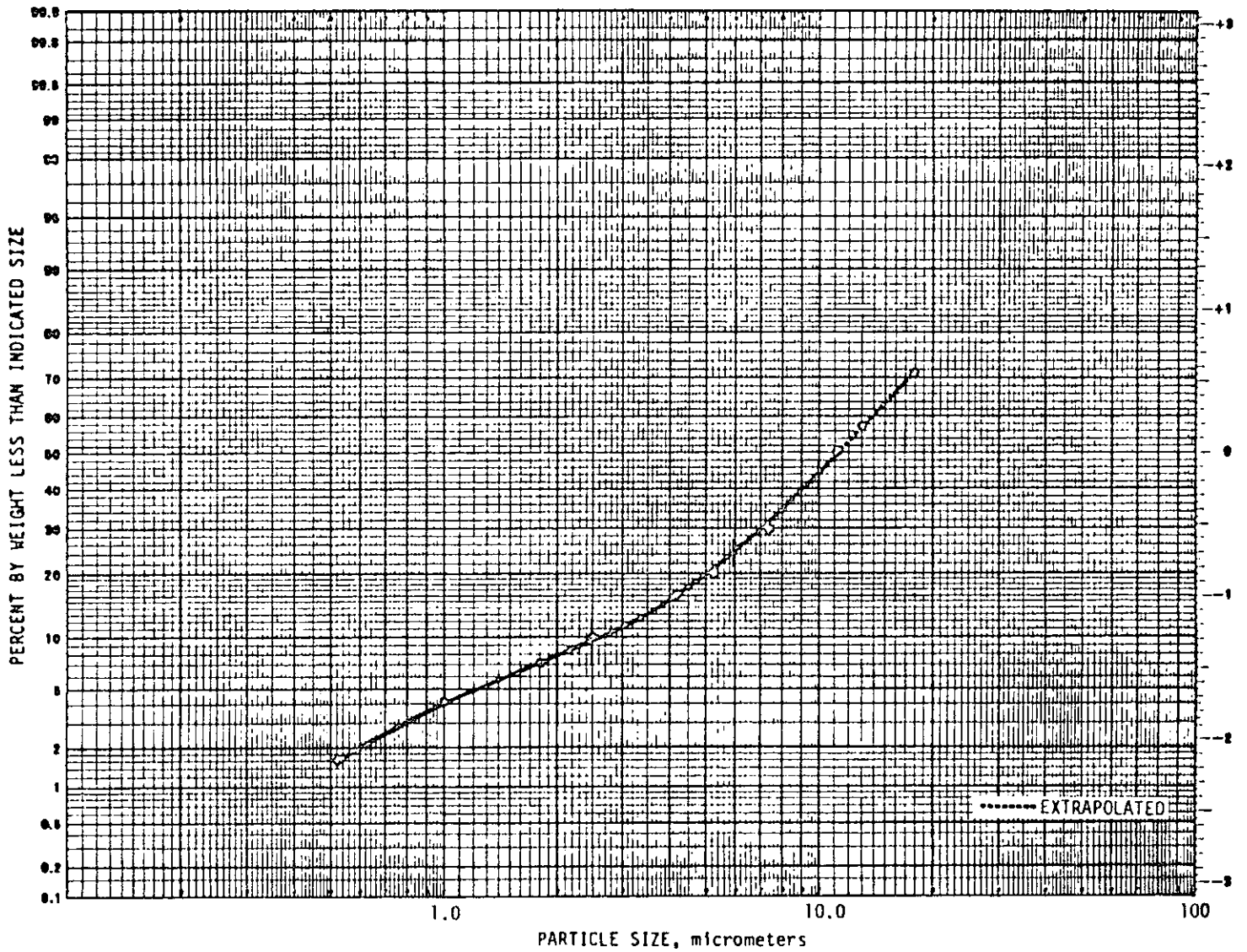

Figure 3-10. Average particle size distribution for the clinker cooler.

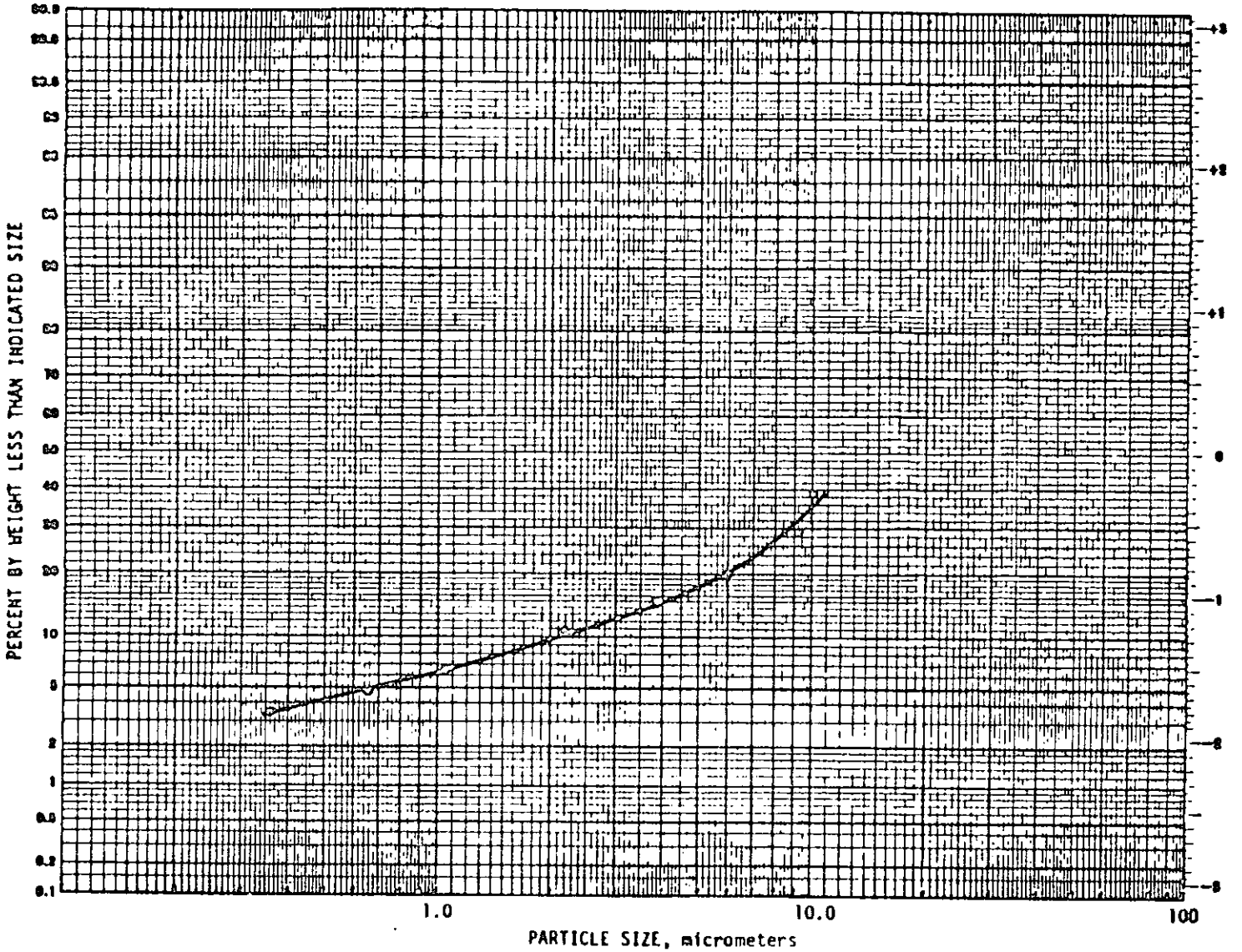

Figure 3-11. Particle size distribution for Run No. CCPS-1.

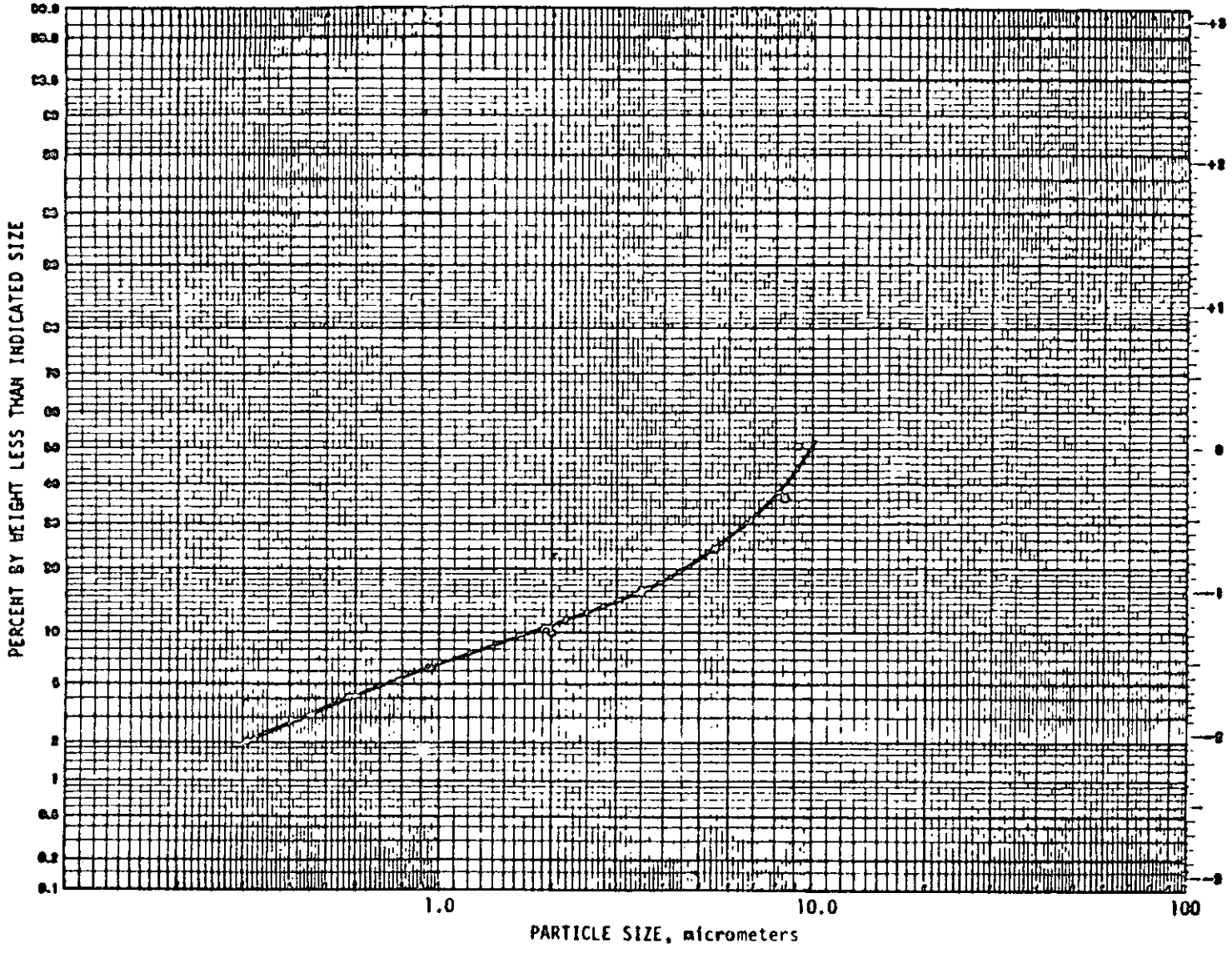

Figure 3-12. Particle size distribution for Run No. CCPS-4.

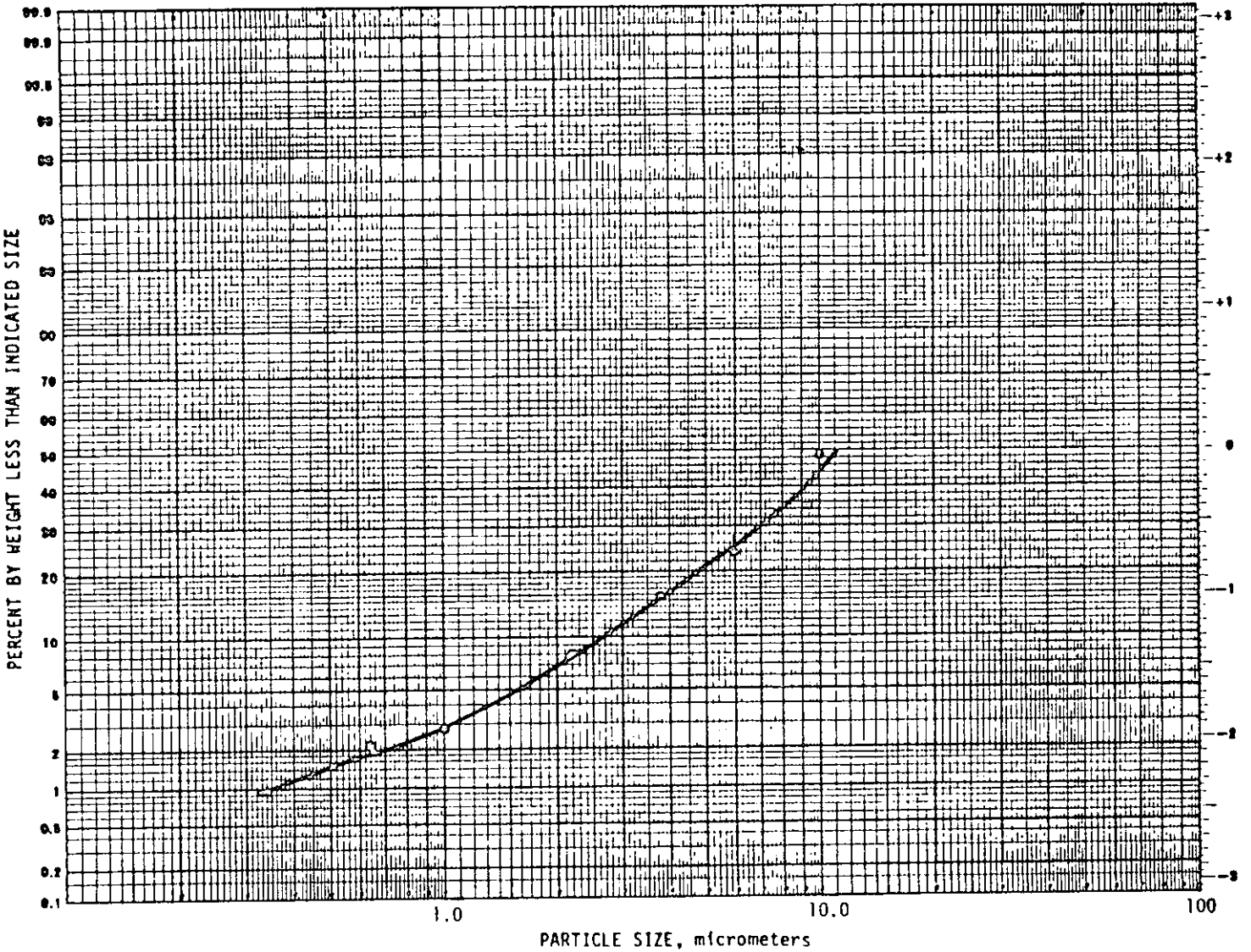

Figure 3-13. Particle size distribution for Run No. CCPS-5.

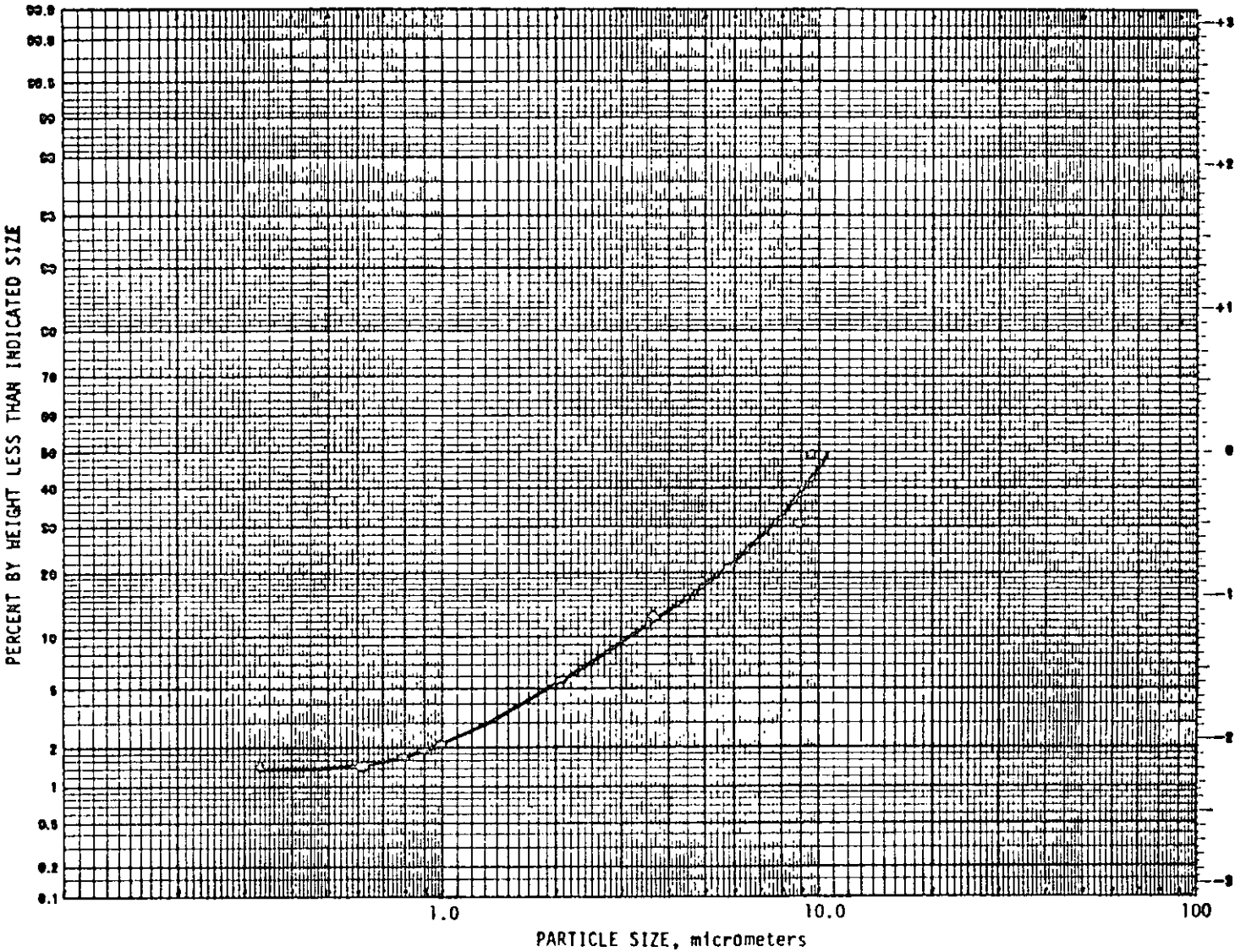

Figure 3-14. Particle size distribution for Run No. CCPS-7.

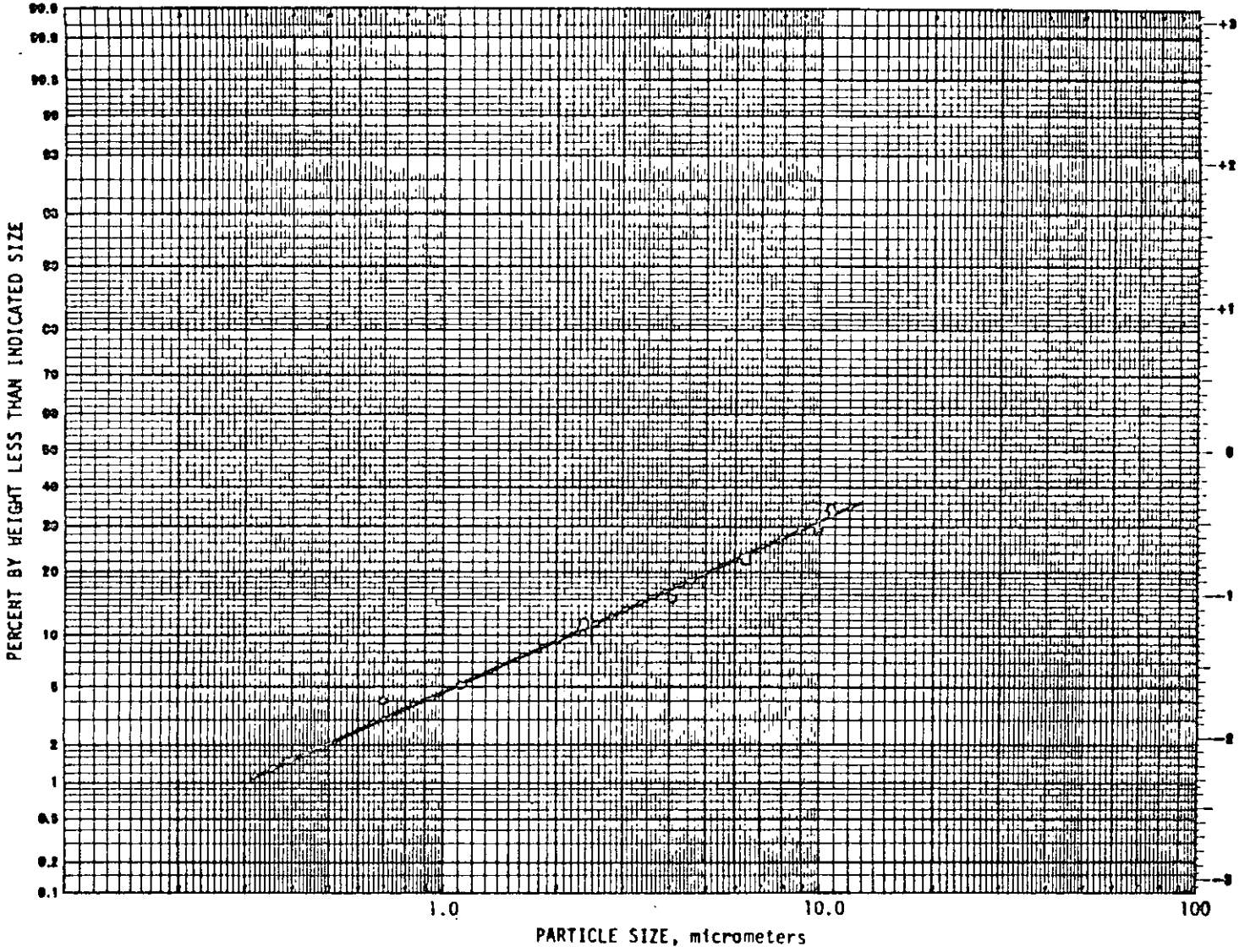

Figure 3-15. Particle size distribution for Run No. CCPS-8.

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Research Triangle Park NC 27711

EMB Report 80-LWA-2
May 1981

Air

EPA

Lightweight Aggregate

Appendix
C.1
Reference 59

Emission Test Report Arkansas Lightweight Aggregate Corporation W. Memphis, Arkansas

TABLE 2-1. PROCESS DATA FOR EMISSION TEST AT ARKANSAS LIGHTWEIGHT AGGREGATE PLANT, WEST MEMPHIS, ARKANSAS: OCTOBER 20-23, 1980; ESED PROJECT 80/12; MRI PROJECT 4659-L

Production report, Monday, October 20

	First shift	Second shift	Third shift	24-h Total
Coal input, tons	0	11.65	16.90	28.55
Gas input, MCF*	509	205	55	769
Clay input, tons	278.7	298.8	317.0	894.5
Product output, yd^3	317.7	340.6	361.4	1019.7

Product density (average composite): 33 lb/ft^3

Production report, Tuesday, October 21

	First shift	Second shift	Third shift	24-h Total
Coal input, tons	18.81	17.99	17.56	54.36
Gas input, MCF	36	29	45	110
Clay input, tons	317.7	317.2	317.4	952.3
Product output, yd^3	362.2	361.6	361.8	1085.6

Product density (average composite): 33 lb/ft^3

*Million cubic feet.

(continued)

both of which were heated to approximately 121°C (250°F). The condensible organic and inorganic fractions represent material that condensed out or was trapped in the impinger section of the sample train at a temperature of approximately 20°C (68°F).

The volumetric flow rate averaged 31,283 dscmh (1,104,749 dscfh) at an average temperature of 89°C (191°F). The moisture content averaged 1.9 percent; and oxygen, carbon dioxide, and carbon monoxide contents averaged 18.8, 1.6, and 0.0 percent, respectively.

Filterable particulate concentrations averaged 175.6 mg/dscm (0.076 gr/dscf) with a corresponding mass emission rate of 5.5 kg/h (12.1 lb/h). The condensible organic and inorganic concentrations averaged 1.5 mg/dscm (0.0007 gr/dscf) each with a corresponding mass emission rate of 0.05 kg/h (0.105 lb/h).

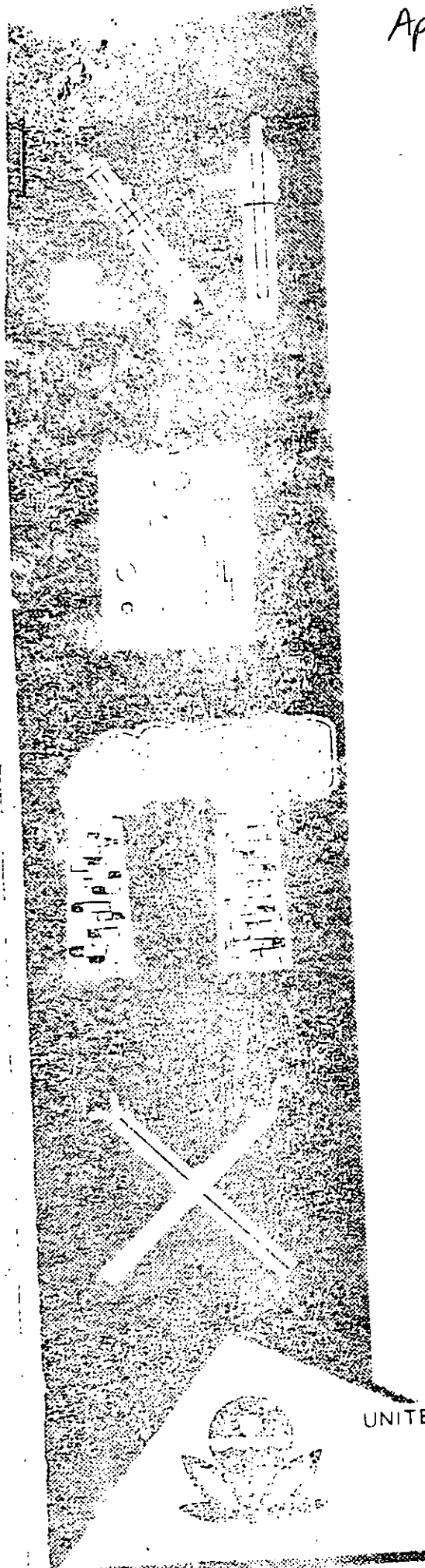
3.2.2 Particle Size Distribution

A total of nine samples were collected from the clinker cooler cyclone exhaust. The first test was a preliminary run and is not considered representative; therefore, it is not included in the overall data averages. The sampling and analytical procedures as well as the data reduction technique are the same as those described in Section 3.1.2 and Appendix A of this report.

Figures 3.2-1 and 3.2-2 present the distribution curves for each set of four samples collected. Individual data points for each test were plotted manually. The distribution curve was plotted manually and represents the best-fit average curve for the specified number of test runs. All particle size results are based on aerodynamic diameters and unit density (1 g/cc).

App. C1, Ref.

Appendix
C.1
Reference 60



AIR POLLUTION EMISSION TEST

PFIZER, INC.

VICTORVILLE, CALIFORNIA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

EMISSION SOURCE TEST FROM A BAGHOUSE SERVING A TALC GRINDING MILL

AT

PFIZER, INC.
Victorville, California

Task Order #12
Contract No. 68-02-1405

July, 1977

Robert J. Bryan, Director of Field Services
Robert L. Norton, Project Manager

Pacific Environmental Services, INC.

CORPORATE AND ENGINEERING 1930 14th Street Santa Monica, California 90404 Telephone (213) 393-9449
MIDWEST OPERATIONS Suite 228N 2625 Butterfield Road Oak Brook, Illinois 60521 Telephone (312) 325-5586

Table III-3. PARTICLE SIZE DATA

Particle Size Range	Sample #1 Particle Count	Sample #1 % of Total	Sample #2 Particle Count	Sample #2 % of Total	Average Particle Count	Average % of Total
1-5	2925	36.8	3181	37.3	3053	37.1
5-10	1855	23.3	1898	22.3	1876	22.8
10-15	1024	12.9	998	11.7	1011	12.3
15-20	759	9.5	895	10.5	827	10.0
20-25	476	6.0	497	5.8	486	5.9
25-30	334	4.2	366	4.3	350	4.2
30-35	210	2.6	229	2.7	220	2.7
35-40	139	1.7	142	1.7	140	1.7
40-45	87	1.1	104	1.2	96	1.2
45-50	67	0.8	94	1.1	80	1.0
50-55	34	0.4	45	0.5	40	0.5
55-60	21	0.3	36	0.4	28	0.3
60-65	12	0.2	15	0.2	14	0.2
65-70	9	0.1	9	0.1	9	0.1
70-75	7	0.1	11	0.1	9	0.1
Total Count	7959	100	8520	100	8239	100

Appendix C.1 Reference 61

IES NO: 238 DESCRIBES SAMPLING AT SITE FROM 02/24/78 TO 02/24/78 BY KVB, INC.

SPONSOR ORGANIZATION: CALIFORNIA AIR RESOURCES BOARD
CONTRACT NUMBER: A6-191-30 PURPOSE OF TEST: ENVIRONMENTAL ASSESSMENTS (MULTIMEDIA)
TASK/DIRECTIVE NUMBER: 000

SOURCE DESCRIPTION----------

SOURCE CATEGORY:	LUMBER & WOOD PROD	SOURCE NAME:	CONFIDENTIAL
SOURCE TYPE:	MILLWORK	SITE NAME:	
PRODUCT/DEVICE:	HOUSING PRODUCTS	ADDRESS:	
PROCESS TYPE:	FINISHING		LOS ANGELES ,CA 00000
DESIGN PROCESS RATE:	1110 M2/HR		
FEED MATERIAL CATEGORY:	WOOD		
PRIMARY CONTROL DEVICE:		SIC CODE:	2431

EADS WASTE STREAM DATA BASES----------

WASTE STREAM DATA FROM OTHER MEDIA WHICH WERE COLLECTED CONCURRENTLY WITH THIS TEST SERIES ARE AS FOLLOWS(TEST SERIES NUMBER-TSN):
LEDS TSN: GEDS TSN: 00090 SDDS TSN:

REFERENCE REPORT----------

TITLE / AUTHOR / SPONSOR REPORT NUMBER	NTIS NUMBER	PUBLICATION DATE
FINE PARTICLE EMISSIONS FROM STATIONARY AND MISCELLANEOUS SOURCES IN THE SOUTH COAST AIR BASIN. TABACK H.J. KVB REPORT 5806-783	PB 293 923/AS	FEBRUARY 1979

TEST SERIES COMMENTS----------

PROGRAM OBJECTIVES TO INVENTORY TSP EMISSIONS,TO PREPARE A COMPREHENSIVE INVENTORY OF EMISSIONS(I.E. BY SIZE DISTRIBUTION AND CHEMICAL COMPOSITION),AND TO DESCRIBE ALT. METHODS OF CONTROL.

App. C.1, Ref. 1

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE•10 CYC		
		STAGE/FILTER CUT SIZE:	8.30 UM
		STAGE WEIGHT:	8.19E•01 MG
2	3 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	1.90 UM
		STAGE WEIGHT:	2.13E+01 MG
3	1 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	.60 UM
		STAGE WEIGHT:	2.38E+01 MG
4	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	7.00E-01 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	8.30	1.90	.60	.01
STAGE WEIGHTS(MILLIGRAMS)	8.19E+01	2.13E+01	2.38E+01	7.00E-01
MICROGRAMS/DNCM/STAGE	2.49E+04	6.48E+03	7.24E+03	2.13E+02
NUMBER/DNCM/STAGE	7.86E+09	1.97E+11	1.14E+13	8.75E+14
CUM. %MASS<D50	35.87	19.19	.55	
CUM. MICROGRAMS/ACM<D50	1.25E+04	6.67E+03	1.91E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	1.39E+04	7.45E+03	2.13E+02	0.00E+00
GEOM D50	1.82E+01	3.97E+00	1.07E+00	7.75E-02
DM/DLOGD-(UG/DNM3)	3.65E+04	1.01E+04	1.45E+04	1.20E+02
DN-LOGD/(NUMBER/DNM3)	1.15E+10	3.08E+11	2.27E+13	4.92E+14

EFFLUENT STREAM DESIGN CHARACTERISTICS----------

COMPONENT NO	NAME	DESCRIPTION	VALUE
1	PROBE•10 CYC		
		STAGE/FILTER CUT SIZE:	9.20 UM
		STAGE WEIGHT:	2.35E•01 MG
2	3 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	3.80 UM
		STAGE WEIGHT:	2.60E+00 MG
3	1 UM CYCLONE		
		STAGE/FILTER CUT SIZE:	1.30 UM
		STAGE WEIGHT:	8.00E-01 MG
4	FILTER		
		STAGE/FILTER CUT SIZE:	.01 UM
		STAGE WEIGHT:	2.20E+00 MG

PARTICLE SIZE TABLE---------

STAGE #	1	2	3	4
D50(MICRONS)	9.20	3.80	1.30	.01
STAGE WEIGHTS(MILLIGRAMS)	2.35E+01	2.60E+00	8.00E-01	2.20E+00
MICROGRAMS/DNCM/STAGE	1.07E+03	1.19E+02	3.65E+01	1.00E+02
NUMBER/DNCM/STAGE	2.90E+08	1.10E+09	6.35E+09	1.29E+14
CUM. %MASS<D50	19.24	10.31	7.56	
CUM. MICROGRAMS/ACM<D50	2.56E+02	1.37E+02	1.00E+02	0.00E+00
CUM. MICROGRAMS/DNCM<D50	2.56E+02	1.37E+02	1.00E+02	0.00E+00
GEOM D50	1.92E+01	5.91E+00	2.22E+00	1.14E-01
DM/DLOGD-(UG/DNM3)	1.68E+03	3.09E+02	7.84E+01	4.75E+01
DN-LOGD/(NUMBER/DNM3)	4.55E+08	2.86E+09	1.36E+10	6.12E+13