



P.O. Box 078768, West Palm Beach, FL 33407-0768  
5500 Village Blvd.

May 8, 1991

Mr. A. Alexander, Deputy Assistant Secretary  
State of Florida Department of Environmental Regulation  
Central Florida District  
3319 Maguire Blvd., Suite 232  
Orlando, Florida 32803

RE: **Sanford Plant, Unit No. 4**  
**Orimulsion Test Burn**  
**Fuel Analysis - As Received**

Dear Mr. Alexander:

As required in specific condition No. 7e of the Department permit authorizing the Orimulsion Test Burn at FPL's Sanford Unit No. 4, enclosed please find a copy of the analysis of Orimulsion fuel received at the Jacksonville terminal on April 25, 1991.

Please call me at (407) 697-6926 if you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "Elsa A. Bishop".

Elsa A. Bishop  
Senior Environmental Coordinator  
Florida Power & Light Company

EAB:jm

Enclosure

cc: **Cindy Phillips - DER/Tall**



May 8, 1991

Mr. A. Alexander, Deputy Assistant Secretary  
State of Florida  
Department of Environmental Regulation  
Central Florida District  
3319 Maguire Blvd., Suite 232  
Orlando, Florida 32803

RE: **SO<sub>2</sub> Emissions**  
**Analyses of Fuel Oil Fired**  
**April, 1991 - Sanford Power Plant**

Dear Mr. Alexander:

As required by the DER Air Operating Permits for the units at the above facilities, enclosed are the analyses of Fuel Oil Fired at Sanford Units 3 and 5 for the April, 1991 sampling period.

As you are aware, the Orimulsion Test Burn at Sanford Unit No. 4 was temporarily suspended from April 24, to May 8, 1991 due to system generation demands which required the operation of both Units 4 and 5 on oil. Please note that, as agreed to by FPL and as reflected in the Modified Order dated February 28, 1991 authorizing the Test Burn in Unit No. 4, Sanford Unit No. 5 was not operated at all during the April, 1991 sampling period whenever Orimulsion was being burned in Sanford Unit No. 4.

If you have any questions, please call me at (407) 697-6926.

Sincerely,

A handwritten signature in cursive script that reads "Elsa A. Bishop".

Elsa A. Bishop  
Senior Environmental Coordinator  
Florida Power & Light Company

EAB:jm

Enclosure

cc: Cindy Phillips - DER/Tall

RECEIVED

APR 29 1991

FLORIDA POWER & LIGHT COMPANY  
 POWER RESOURCES CENTRAL LABORATORY ENV. PERMITTING  
 STATE OF FLORIDA LABORATORY CERTIFICATION NUMBERS  
 DRINKING WATER CERTIFICATION NUMBER: 56275  
 ENVIRONMENTAL CHEMISTRY CERTIFICATION NUMBER: E56078

SANFORD #3 PLANT  
 ANALYSES OF FUEL OIL FIRED APRIL 1991

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DATE SAMPLE RECEIV	04-18-91
API GRAVITY	11.2
DENSITY, LB/GAL	8.258
DENSITY, LB/BBL	346.836
HEAT OF COMBUSTION, BTU/LB	18243
HEAT OF COMBUSTION, BTU/GAL	150651
HEAT OF COMBUSTION, MBTU/BBL	6327
WATER, % BY VOLUME	0.50
SEDIMENT, % BY WEIGHT	0.07
SULFUR, % BY WEIGHT	0.96
SULFUR DIOXIDE EQUIVALENT, LB/MBTU	1.05
ASH, % BY WEIGHT	0.01
PARTICULATE EQUIVALENT, LB/MBTU	0.01
VANADIUM IN ASH AS V2O5, % BY WEIGHT	39
VANADIUM IN OIL AS V2O5, PPM	43
VANADIUM IN OIL AS V, PPM	24
VISCOSITY, SSF @ 122F	69
ASPHALTENES, % BY WEIGHT	1.9

---

COPIES TO: PSN PLANT MGR.  
 R N ALLEN - JEN/EDO  
 PLANT RESULTS DEPT  
 K WASHINGTON - PRS/EDO

ANALYZED BY: Y. Harrison / J. Uzice  
 CERTIFIED BY: M. M. Donnell

RECEIVED

MAY 08 1991

ENV. PERMITTING

FLORIDA POWER & LIGHT COMPANY  
 POWER RESOURCES CENTRAL LABORATORY  
 STATE OF FLORIDA LABORATORY CERTIFICATION NUMBERS  
 DRINKING WATER CERTIFICATION NUMBER: 56275  
 ENVIRONMENTAL CHEMISTRY CERTIFICATION NUMBER: E56078

SANFORD #4 & #5 PLANT  
 ANALYSES OF FUEL OIL FIRED APRIL 1991

DATE SAMPLE RECEIV	04-18-91
API GRAVITY	11.3
DENSITY, LB/GAL	8.252
DENSITY, LB/BBL	346.584
HEAT OF COMBUSTION, BTU/LB	18295
HEAT OF COMBUSTION, BTU/GAL	150970
HEAT OF COMBUSTION, MBTU/BBL	6341
WATER, % BY VOLUME	1.0
SEDIMENT, % BY WEIGHT	0.09
SULFUR, % BY WEIGHT	0.94
SULFUR DIOXIDE EQUIVALENT, LB/MBTU	1.03
ASH, % BY WEIGHT	0.03
PARTICULATE EQUIVALENT, LB/MBTU	0.02
VANADIUM IN ASH AS V2O5, % BY WEIGHT	10
VANADIUM IN OIL AS V2O5, PPM	34
VANADIUM IN OIL AS V, PPM	19
VISCOSITY, SSF @ 122F	66
ASPHALTENES, % BY WEIGHT	3.2

COPIES TO: PSN PLANT MGR.  
 R N ALLEN - JEN/EDO  
 PLANT RESULTS DEPT

ANALYZED BY: *L. Harrison / S. U. Rice*  
 CERTIFIED BY: *[Signature]*

*for K O'Connell*

K WASHINGTON - PRS/EDO



FEDERAL EXPRESS

May 7, 1991

Mr. A. Alexander, Deputy Assistant Secretary  
State of Florida Department of Environmental Regulation  
Central Florida District  
3319 Maguire Blvd., Suite 232  
Orlando, Florida 32802

RE: **Sanford Plant, Unit No. 4**  
**Orimulsion Test Burn**  
**Weekly Compliance Reports - April 29 - May 5, 1991**

Dear Mr. Alexander:

As I informed you during our meeting on May 1st, due to the current unseasonably and unusually warm weather, FPL has been experiencing extremely high generation demands. In order to meet that demand, it has been necessary to operate Sanford Unit No. 5. Since the Department's permit authorizing the Orimulsion Test Burn prohibits the operation of Unit No. 5 when Unit No. 4 is firing Orimulsion, the Orimulsion Test Burn has been temporarily suspended in order to allow both units to operate on oil. Unit No. 4 stopped burning Orimulsion at 12:32 a.m. on April 24, 1991 and is still off Orimulsion as of this date.

Based on the above, there is no Orimulsion data to report for the week of April 29 - May 5, 1991. Attached, however, is a copy of the Weekly Summary sheet listing the fuel burn schedule and the fuel (oil) usage for the week. We hope that we will soon be able to resume Orimulsion firing in Sanford Unit No. 4. At such time, reporting will be also resumed in the usual format.

Please call me at (407) 697-6926 if you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "Elsa A. Bishop".

Elsa A. Bishop  
Senior Environmental Coordinator  
Florida Power & Light Company

EAB:jm

Enclosure

cc: Charles M. Collins - DER/Orlando (w/o encl.)  
Cindy Phillips - DER/Tall (w/o encl.)  
John Gray - Orlando/Florida (w/o encl.)  
Saundra Gray - DeBary/Florida (w/o encl.)



P.O. Box 078768, West Palm Beach, FL 33407-0768  
5500 Village Blvd.

FEDERAL EXPRESS

May 7, 1991

Ms. Cindy Phillips  
State of Florida Department of Environmental Regulation  
2600 Blair Stone Road  
Tallahassee, Florida 32301

RE: **Sanford Plant, Unit No. 4**  
**Orimulsion Test Burn**  
**Weekly Compliance Reports - April 29 - May 5, 1991**

Dear Ms. Phillips:

As I informed you during our meeting on May 1st, due to the current unseasonably and unusually warm weather, FPL has been experiencing extremely high generation demands. In order to meet that demand, it has been necessary to operate Sanford Unit No. 5. Since the Department's permit authorizing the Orimulsion Test Burn prohibits the operation of Unit No. 5 when Unit No. 4 is firing Orimulsion, the Orimulsion Test Burn has been temporarily suspended in order to allow both units to operate on oil. Unit No. 4 stopped burning Orimulsion at 12:32 a.m. on April 24, 1991 and is still off Orimulsion as of this date.

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Please call me at (407) 697-6926 if you have any questions.

Sincerely,

Elsa A. Bishop  
Senior Environmental Coordinator  
Florida Power & Light Company

EAB:jm

Enclosure

cc: A. Alexander - DER/Orlando (w/o encl.)  
Charles M. Collins - DER/Orlando (w/o encl.)  
John Gray - Orlando/Florida (w/o encl.)  
Saundra Gray - DeBary/Florida (w/o encl.)

RECEIVED WEED

MAY 9 1991

Division of Air  
Resource Management  
Department of Environmental Regulation





P.O. Box 078768, West Palm Beach, FL 33407-0768  
5500 Village Blvd.

May 6, 1991

RECEIVED

MAY 9 1991

Ms. Cindy Phillips  
State of Florida Department of Environmental Regulation  
2600 Blair Stone Road  
Tallahassee, Florida 32301

Division of Air  
Resources Management

RE: **Sanford Plant, Unit No. 4**  
**Orimulsion Test Burn**  
**Flyash Particle size Testing**

Dear Ms. Phillips:

As required by Specific Condition No. 7.f of the Department's permit authorizing the Orimulsion Test Burn at Sanford Unit No. 4, enclosed please find a copy of the report of the flyash particle size testing conducted on March 29, 1991 by Southern Research Institute. This test was conducted using University of Washington Cascade Impactors.

Please call me at (407) 697-6926 if you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "Elsa A. Bishop".

Elsa A. Bishop  
Senior Environmental Coordinator  
Florida Power & Light Company

EAB:jm

Enclosure

cc: A. Alexander - DER/Orlando







P.O. Box 078768, West Palm Beach, FL 33407-0768  
5500 Village Blvd.

May 6, 1991

Mr. A. Alexander, Deputy Assistant Secretary  
State of Florida Department of Environmental Regulation  
Central Florida District  
3319 Maguire Blvd., Suite 232  
Orlando, Florida 32803

RE: **Sanford Plant, Unit No. 4**  
**Orimulsion Test Burn**  
**Flyash Particle size Testing**

Dear Mr. Alexander:

As required by Specific Condition No. 7.f of the Department's permit authorizing the Orimulsion Test Burn at Sanford Unit No. 4, enclosed please find a copy of the report of the flyash particle size testing conducted on March 29, 1991 by Southern Research Institute. This test was conducted using University of Washington Cascade Impactors.

Please call me at (407) 697-6926 if you have any questions.

Sincerely,

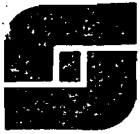
A handwritten signature in cursive script that reads "Elsa A. Bishop".

Elsa A. Bishop  
Senior Environmental Coordinator  
Florida Power & Light Company

EAB:jm

Enclosure

cc: Cindy Phillips - DER/Tall



Southern Research Institute

RECEIVED

April 12, 1991

APR 22 1991

Dr. K. R. Olen  
Florida Power & Light Company  
P.O. Box 078768  
West Palm Beach, FL 33407-0768

ENV. PERMITTING

**Subject: Orimulsion Fly Ash Particle Size Measurements**  
**FPL Purchase Order No. B91822 90012**  
**SRI Project Number 7322**  
**SRI Report No.: SRI-ENV-91-319-7322**

Dear Ken:

On March 29, 1991 Mr. Joe McCain of Southern Research Institute, in conjunction with Mr. Bob Allen, Mr. Bob Ridder, and other members of FPL's environmental testing crew, measured Orimulsion fly ash particle size distributions at the air preheater outlet of Sanford Unit 4. The measurements were made with FPL-owned University of Washington Mark III/V (Pilat) Source Test Cascade Impactors.

On March 28, 1991 a preliminary test took place to determine proper values for flowrate and sampling time and to determine and correct any unexpected problems. (Soot blowing was occurring during this test.) On March 29 four tests were conducted, two each at the outlet of air preheater A and B. Sampling was performed in the center port on each side (A and B) with the impactor located approximately half-way between the port and the opposite duct wall (no traversing of the duct occurred). There was no soot blowing during these tests. The precollector, cascade impactor stages, and back-up filter distributed the fly ash into eight sized fractions between 10 and 0.2  $\mu\text{m}$  (all particle diameters are reported on a classical aerodynamic basis). Quartz fiber substrates and back-up filters were used for all tests.

The results from the four tests conducted on March 29, 1991 have been averaged and are presented in Table 1 and Figures 1, 2, 3, and 4. Results from each of the five individual tests can be found in an attachment to this report. Table 1 presents seven columns of data. These are described below.

## Southern Research Institute

Dr. K. R. Olen  
Florida Power & Light Company

April 12, 1991  
Page 2

DIA. MICRON: Particle diameter in  $\mu\text{m}$  (classical aerodynamic basis)

DM/DLOGD MG/DNM<sup>3</sup>: Differential mass size distribution, milligrams per dry normal cubic meter/log size interval

STD DEV: Geometric standard deviation for the DM/DLOGD data

90% CON INT: 90 per cent confidence interval for the DM/DLOGD data

CUM LOAD. MG/DNM<sup>3</sup>: Cumulative mass concentration, milligrams per dry normal cubic meter

90% CON INT: 90 per cent confidence interval for the CUM LOAD. data

CUM%: Cumulative per cent distribution

Figure 1 presents the average differential mass size distribution versus particle diameter. The figure shows that the distribution is bimodal with 65% of the mass in the mode centered at about  $0.4 \mu\text{m}$  and 35% of the mass in the mode centered at  $4 \mu\text{m}$ . This particle size distribution indicates that the particle sizes are such that size stratification within the duct should not have caused bias in the measured size distribution. Due to the limited number of tests, no attempt was made to discern differences between the data from air preheater A and B.

Figure 2 shows the average cumulative mass concentration versus particle diameter. The average measured mass concentration from the four cascade impactor tests was  $262 \text{ mg/dnm}^3$ . The individual results were

<u>Run</u>	<u>Duct</u>	<u>gr/acf</u>	<u>mg/dnm<sup>3</sup></u>
2	B	0.050	237
3	A	0.057	266
4	B	0.053	252
5	A	0.062	292

These mass concentration values are somewhat smaller than those measured by Entropy Environmentalists. This is probably because the cascade impactor tests were conducted at a single sampling location (no traversing of the duct was performed). These data suggest that there may be a higher percentage of the total mass exiting the air preheaters in the region of high duct velocity (100 ft/sec) near the far wall of the air preheater outlet duct.

## Southern Research Institute

Dr. K. R. Olen  
Florida Power & Light Company

April 12, 1991  
Page 3

Figures 3 and 4 present the average cumulative per cent size distribution in two ways. Figure 3 uses log probability scales, while the cumulative size distribution in figure 4 is presented with a linearized cumulative per cent scale. If the size distribution was log normal, the data in figure 3 would form a straight line. These two figures show that the mass median diameter of the fly ash is approximately  $0.55 \mu\text{m}$  and that about 5% of the mass is composed of particles with diameters of  $0.1 \mu\text{m}$  or less.

If you have any questions related to this report, please contact Mr. Joe McCain or me.

Sincerely,



Kenneth M. Cushing, Head  
Fabric Filter Research Section

KMC/lcr  
Attachments

TABLE 1

AVERAGE ORIMULSION FLY ASH PARTICLE SIZE DISTRIBUTION DATA  
 FPL SANFORD UNIT 4 AIR PREHEATER OUTLET

March 29, 1991

DIA. MICRON	DM/DLOGD MG/DNM3	STD DEV	90% CON INT	CUM LOAD. MG/DNM3	90% CON INT	CUM%
0.10	1.07E+02	2.95E+01	4.95E+01	1.23E+01	1.09E+01	4.70
0.13	1.16E+02	1.80E+01	3.02E+01	2.36E+01	1.23E+01	9.01
0.16	1.26E+02	1.43E+01	2.40E+01	3.55E+01	1.29E+01	13.56
0.20	1.49E+02	8.79E+00	1.47E+01	4.97E+01	1.32E+01	18.97
0.25	1.75E+02	6.94E+00	1.16E+01	6.55E+01	1.33E+01	25.00
0.32	1.94E+02	1.44E+01	2.41E+01	8.42E+01	1.36E+01	32.16
0.40	2.03E+02	2.47E+01	4.15E+01	1.04E+02	1.44E+01	39.69
0.50	1.98E+02	3.21E+01	5.39E+01	1.24E+02	1.60E+01	47.32
0.63	1.76E+02	3.25E+01	5.45E+01	1.43E+02	1.77E+01	54.61
0.79	1.45E+02	2.48E+01	4.16E+01	1.59E+02	1.90E+01	60.54
1.00	1.19E+02	1.52E+01	2.55E+01	1.72E+02	1.96E+01	65.74
1.26	1.07E+02	1.12E+01	1.88E+01	1.83E+02	1.99E+01	69.98
1.58	1.05E+02	1.06E+01	1.78E+01	1.94E+02	2.00E+01	74.05
2.00	1.01E+02	1.24E+01	2.08E+01	2.04E+02	2.02E+01	77.98
2.51	9.18E+01	2.06E+01	3.45E+01	2.14E+02	2.06E+01	81.73
3.16	8.63E+01	3.00E+01	5.03E+01	2.23E+02	2.15E+01	85.10
3.98	9.67E+01	1.63E+01	2.74E+01	2.32E+02	2.22E+01	88.53
5.01	9.19E+01	2.21E+01	3.71E+01	2.41E+02	2.27E+01	92.10
6.31	5.49E+01	2.51E+01	4.20E+01	2.49E+02	2.34E+01	95.13
7.94	3.00E+01	2.91E+01	4.88E+01	2.53E+02	2.43E+01	96.60
10.00	2.06E+01	2.36E+01	3.95E+01	2.56E+02	2.51E+01	97.62
12.59	1.40E+01	1.68E+01	2.82E+01	2.57E+02	2.55E+01	98.24
15.85	9.73E+00	1.34E+01	2.24E+01	2.58E+02	2.58E+01	98.72
19.95	7.05E+00	1.13E+01	1.89E+01	2.59E+02	2.59E+01	99.02
25.12	5.32E+00	9.48E+00	1.59E+01	2.60E+02	2.61E+01	99.27
31.62	4.14E+00	7.86E+00	1.32E+01	2.60E+02	2.61E+01	99.44
39.81	3.27E+00	6.40E+00	1.07E+01	2.61E+02	2.62E+01	99.59
50.12	2.58E+00	5.12E+00	8.59E+00	2.61E+02	2.62E+01	99.70
63.10	2.02E+00	4.03E+00	6.75E+00	2.61E+02	2.63E+01	99.79
79.43	1.55E+00	3.09E+00	5.18E+00	2.61E+02	2.63E+01	99.85
100.00	1.15E+00	2.29E+00	3.85E+00	2.62E+02	2.63E+01	99.91
125.89	8.12E-01	1.62E+00	2.72E+00	2.62E+02	2.63E+01	99.94
158.49	5.34E-01	1.07E+00	1.79E+00	2.62E+02	2.63E+01	99.97
199.53	3.12E-01	6.23E-01	1.04E+00	2.62E+02	2.63E+01	99.99
251.19	1.48E-01	2.96E-01	4.96E-01	2.62E+02	2.63E+01	100.00
316.23	4.80E-02	9.60E-02	1.61E-01	2.62E+02	2.63E+01	100.00
398.11	7.14E-03	1.43E-02	2.39E-02	2.62E+02	2.63E+01	100.00
501.19	1.61E-04	3.22E-04	5.39E-04	2.62E+02	2.63E+01	100.00
630.96	8.33E-09	1.67E-08	2.79E-08	2.62E+02	2.63E+01	100.00
794.33	3.00E-29	3.46E-29	5.81E-29	2.62E+02	2.63E+01	100.00
1000.00	0.00E+00	0.00E+00	0.00E+00	2.62E+02	2.63E+01	100.00

S

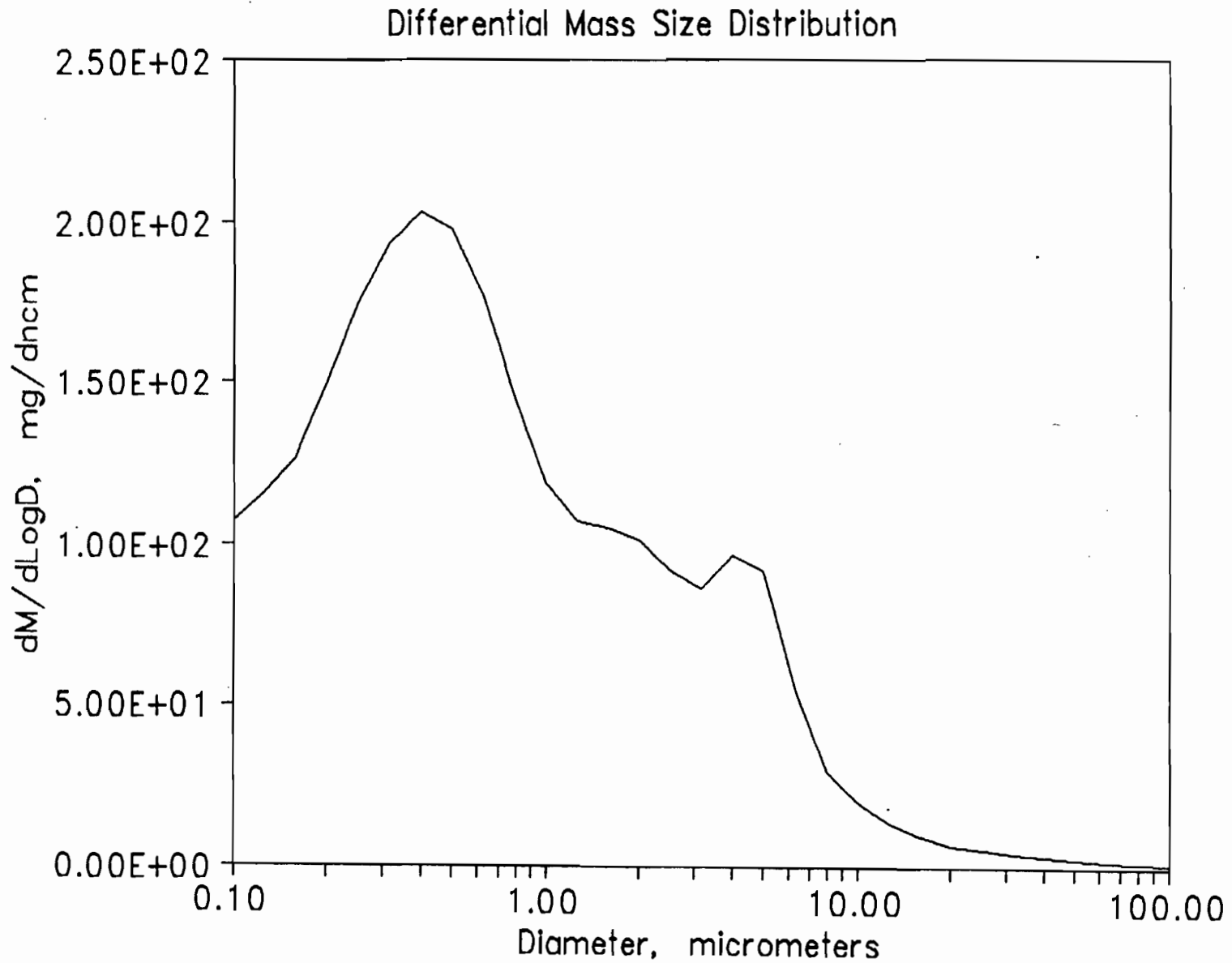


Figure 1. Average differential mass size distribution of Orimulsion fly ash measured on March 29, 1991 at FPL Sanford Unit 4.

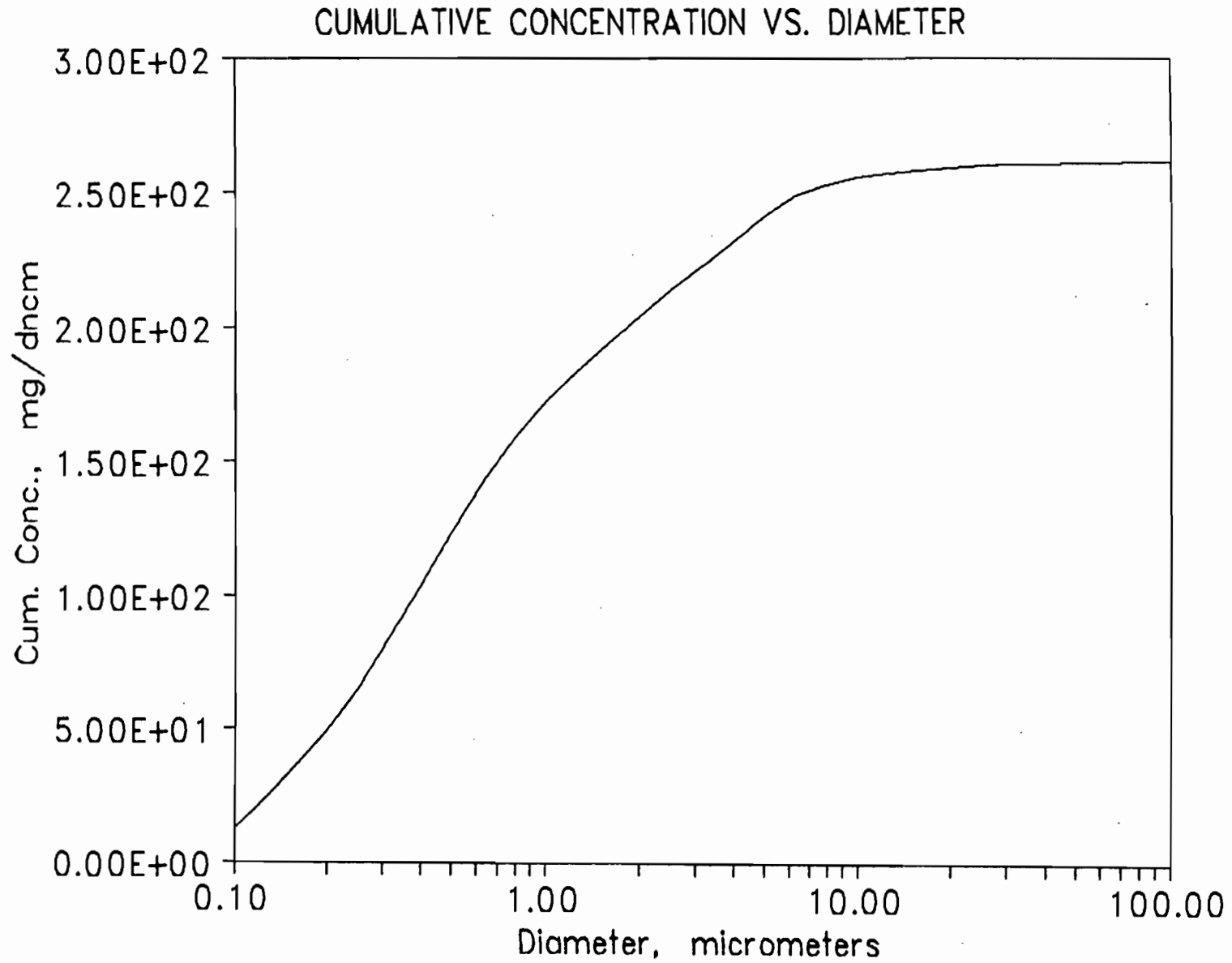


Figure 2. Average cumulative mass size distribution of Orimulsion fly ash measured on March 29, 1991 at FPL Sanford Unit 4.



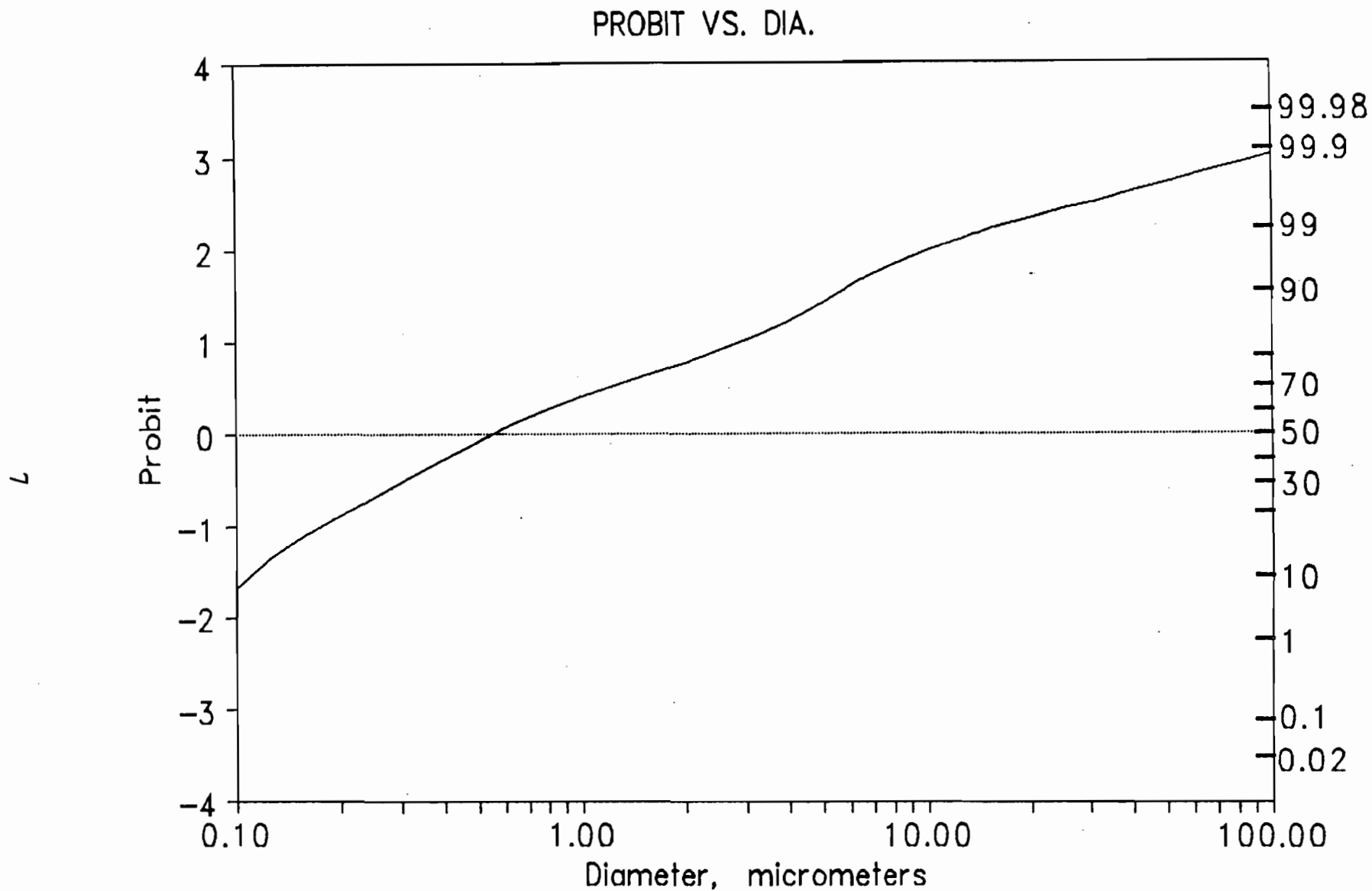


Figure 3. Average cumulative per cent size distribution (log probability scale) of Orimulsion fly ash measured on March 29, 1991 at FPL Sanford Unit 4.

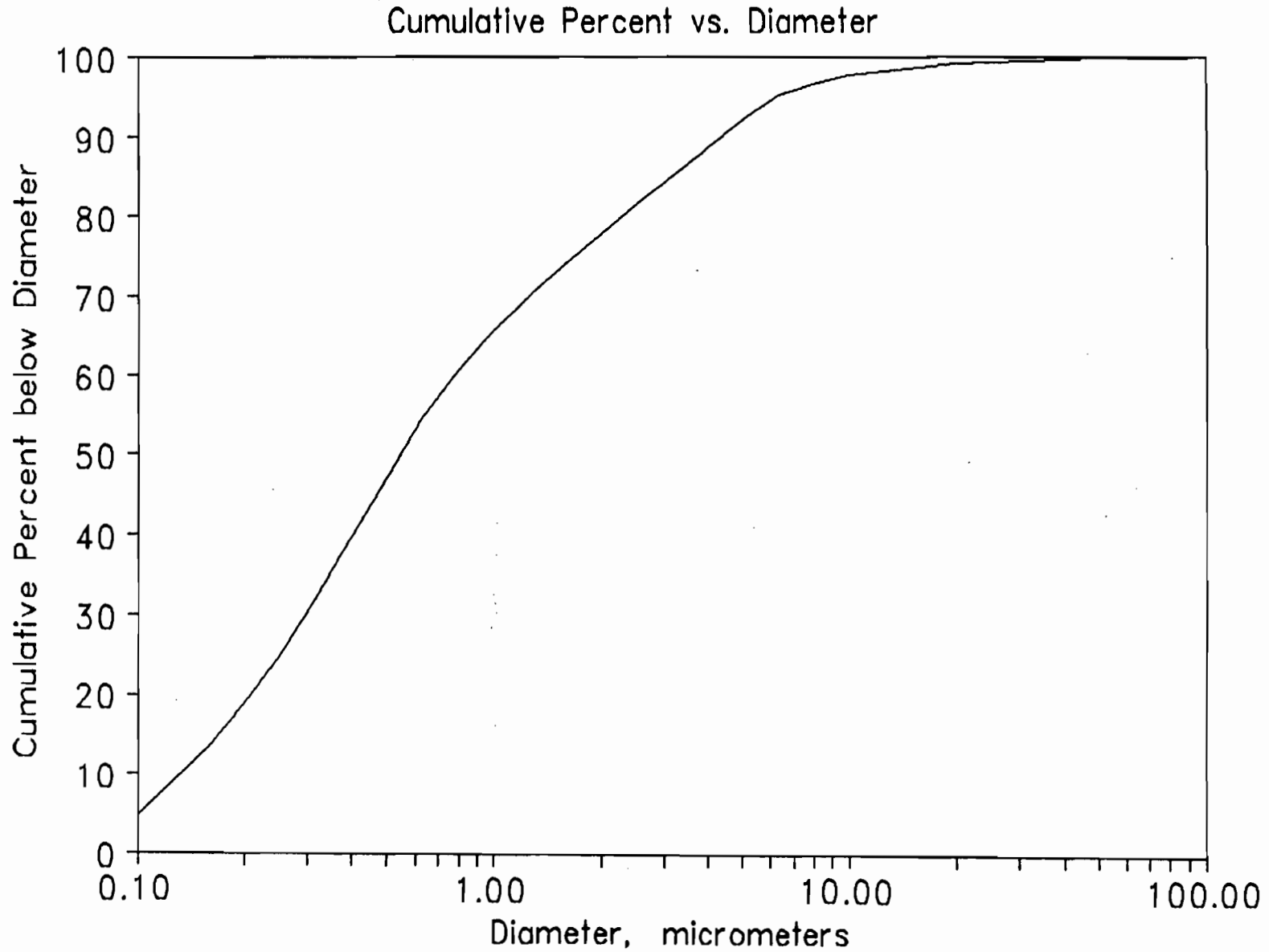
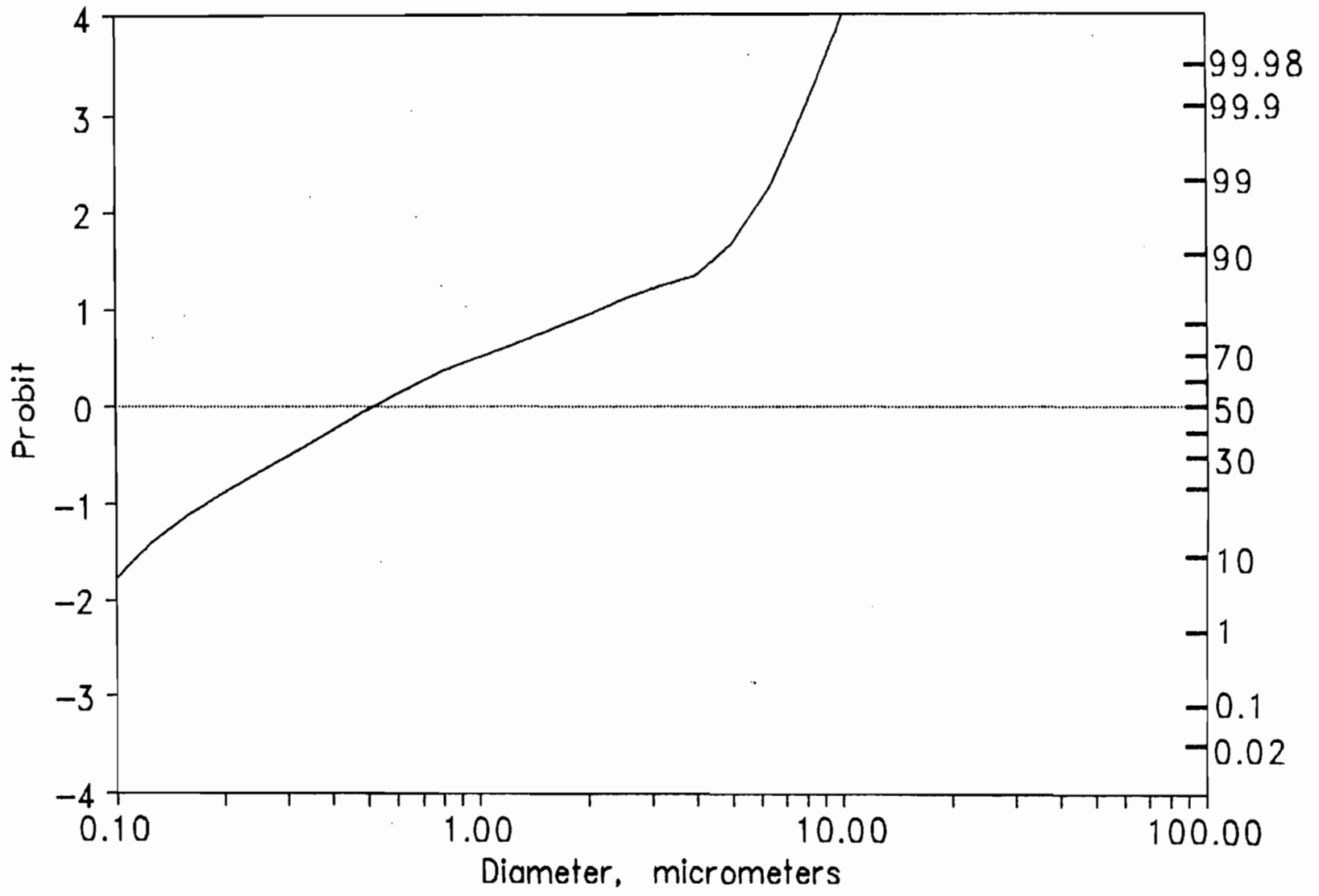
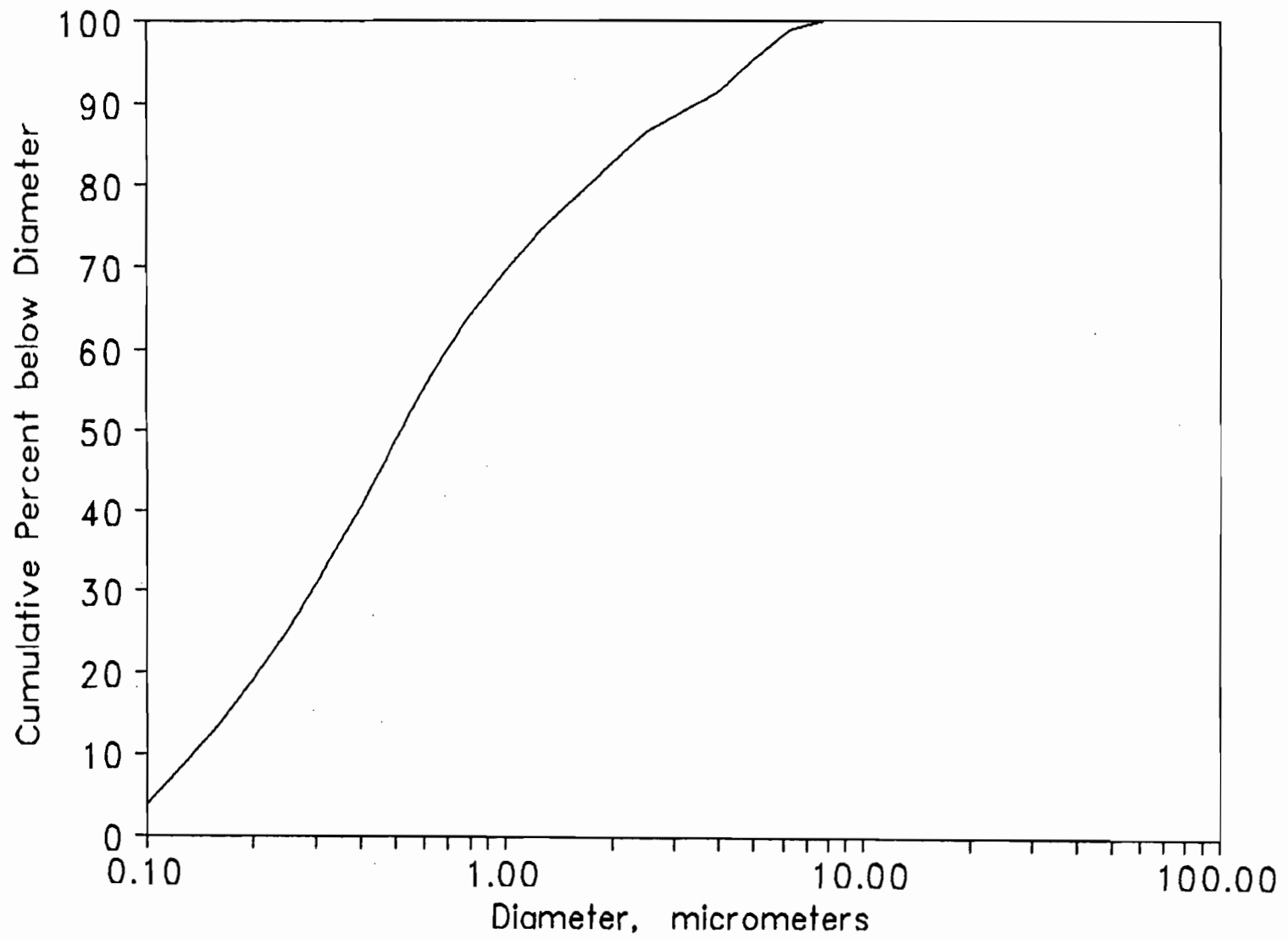


Figure 4. Average cumulative per cent size distribution (linear scale) of Orimulsion fly ash measured on March 29, 1991 at FPL Sanford Unit 4.

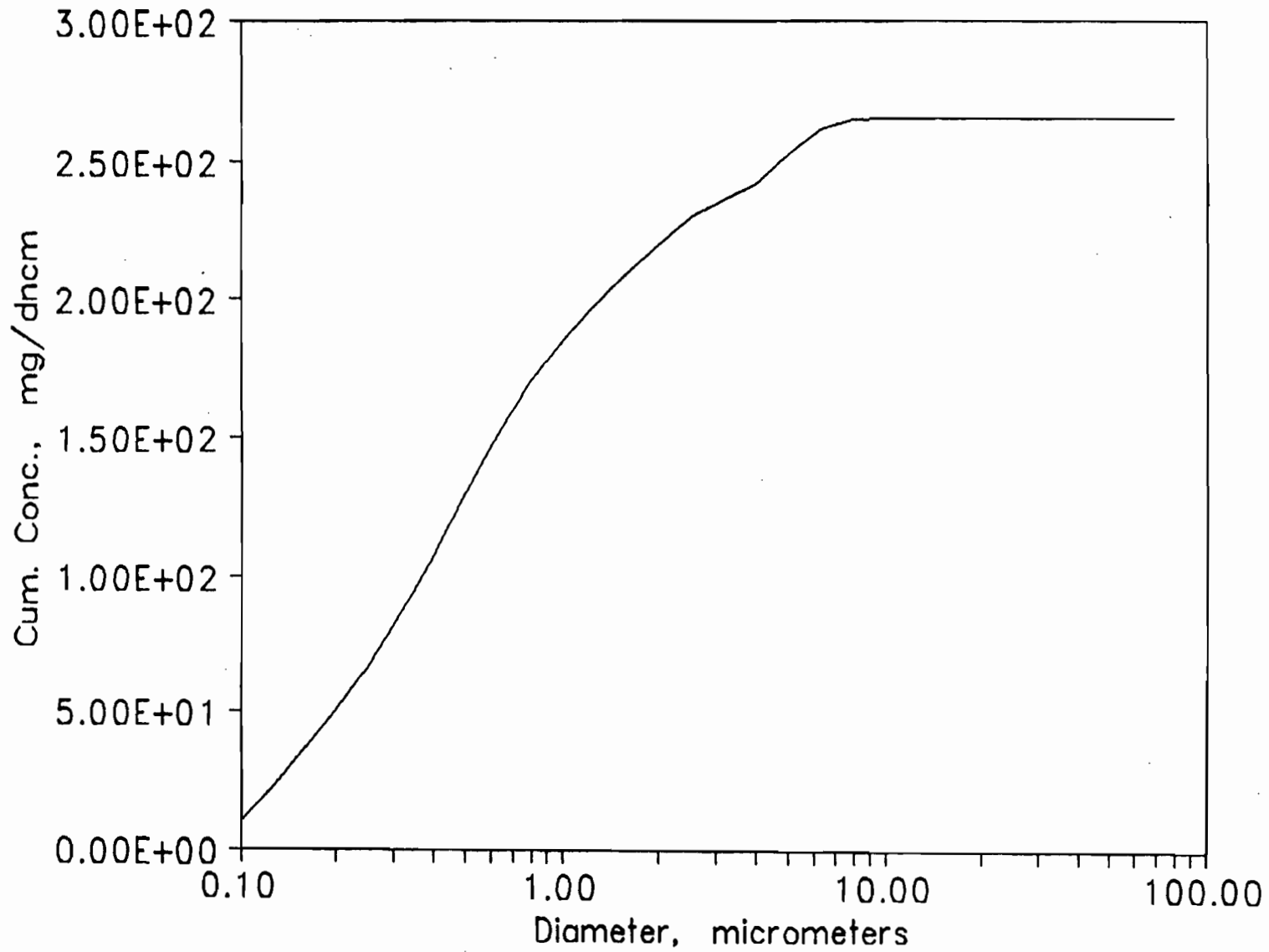
Probit vs. Diameter



Cumulative Percent vs. Diameter



Cumulative Concentration vs. Diameter



INPUT DATA

1)PART. DIAMETER CLASSICAL AERODYNAMIC  
 2)DATE OF TEST: 3/29/91  
 3)TIME OF TEST: 1640  
 4)LOCATION OF TEST: PSN 4 North  
 5)TEST DESIG.: SAN  
 6)TEST TYPE INLET  
 7)RUN NUMBER: 4-FILE NAME:TSANR4.IT  
 8)RUN REMARKS: substrate set 5  
 10)IMPACTOR TYPE: FPUW4-13  
 SRI RAPC UWV 4 5 7 9 11 13

9)WATER VAPOR 14.50%  
 CO2 13.00% CO 0.00%  
 O2 4.00% N2 83.00%

12)ORIFICE ID (OPTIONAL):  
 13)SUBSTRATE MATERIAL: QUARTZ FIBER

1)GAS METER VOL 4.758 CUBIC FEET  
 2)IMPACTOR DELTA P 0.00 IN. HG.  
 3)ORIFICE DELTA P 0.08 INCHES H2O  
 4)STACK PRESSURE -19.0 INCHES H2O  
 5)BAROMETRIC PRES 29.90 INCHES HG  
 6)STACK TEMP 430 DEGREES F  
 7)METER TEMP 82 DEGREES F  
 8)IMPACTOR TEMP 430 DEGREES F  
 9)SAMPLE TIME 25.00 MINUTES  
 10)AVG GAS VEL 64.00 FEET/SEC  
 11)ORI P WRT PBAR -0.01 INCHES HG  
 12)NOZZLE DIA 0.125 INCHES  
 13)MAX PART DIA 1000.0 MICRONS  
 14)WATER VOLUME 0.0 CC  
 15)METER FACTOR 0.9618

MASS GAIN OF STAGE 1 0.10 MG  
 MASS GAIN OF STAGE 2 2.15 MG  
 MASS GAIN OF STAGE 3 1.53 MG  
 MASS GAIN OF STAGE 4 3.03 MG  
 MASS GAIN OF STAGE 5 4.08 MG  
 MASS GAIN OF STAGE 6 6.39 MG  
 MASS GAIN OF STAGE 7 4.70 MG  
 MASS GAIN OF FILTER 3.52 MG

MASS GAIN OF BLANK SUBSTRATE -0.79  
 MASS GAIN OF BLANK FILTER -0.79

RESULTS

TEST DESIG.: SAN RUN NUMBER: 4

ACTUAL FLOW RATE 0.369 CFM  
 FLOW RATE AT STANDARD CONDITIONS 0.178 CFM  
 PERCENT ISOKINETIC 112.629 %  
 VISCOSITY 244.6E-06 GM/CM-SEC  
 CALCULATED IMPACTOR DELTA P = 2.10 IN. HG

STAGE	CUNN. CORR.	D50 (CLAS AERO)	D50 (IMP AERO)	CUM FREQ.	RE. NO.	V*D50 UM-M/S
1	1.033	9.430	9.583	97.2030	439	12.9
2	1.075	4.124	4.276	87.9636	78	16.3
3	1.119	2.601	2.751	80.6725	100	20.3
4	1.229	1.356	1.503	68.6675	148	23.2
5	1.464	0.687	0.832	53.3627	203	21.2
6	2.050	0.328	0.470	30.7982	380	19.0
7	3.159	0.174	0.309	13.5449	591	16.0

STAGE CUT DIAMETERS BASED ON THEORETICAL VALUES OF STAGE CONSTANTS

TOTAL MASS CONCENTRATION = 2.52E+02 MG/DRY NORMAL CUBIC METER  
 = 1.22E+02 MG/ACTUAL CUBIC METER  
 = 1.10E-01 GRAINS/DRY STD CUBIC FOOT  
 = 5.33E-02 GRAINS/ACTUAL CUBIC FOOT

TEST DESIG.: SAN RUN NUMBER: 4

SPLINE FIT ON CLASSICAL AERODYNAMIC DIAMETER BASIS

PARTICLE DIA. (MICRONS)	CUMFR (STDDEV)	CUMFR (PERCENT)	CUM.MASS (MG/DRY N.CU.METER)	DM/DLOGD
0.100	-1.7568	3.95	9.96E+00	8.94E+01
0.126	-1.4279	7.67	1.93E+01	9.70E+01
0.158	-1.1895	11.71	2.95E+01	1.10E+02
0.200	-0.9681	16.65	4.20E+01	1.40E+02
0.251	-0.7475	22.74	5.74E+01	1.66E+02
0.316	-0.5342	29.66	7.48E+01	1.82E+02
0.398	-0.3325	36.98	9.33E+01	1.86E+02
0.501	-0.1452	44.23	1.12E+02	1.79E+02
0.631	0.0254	51.01	1.29E+02	1.63E+02
0.794	0.1775	57.05	1.44E+02	1.42E+02
1.000	0.3147	62.35	1.57E+02	1.27E+02
1.259	0.4446	67.17	1.69E+02	1.17E+02
1.585	0.5742	71.71	1.81E+02	1.12E+02
1.995	0.7072	76.03	1.92E+02	1.06E+02
2.512	0.8446	80.08	2.02E+02	9.86E+01
3.162	0.9884	83.85	2.12E+02	9.23E+01
3.981	1.1469	87.43	2.21E+02	8.83E+01
5.012	1.3289	90.81	2.29E+02	8.06E+01
6.310	1.5315	93.72	2.36E+02	6.55E+01
7.943	1.7472	95.97	2.42E+02	4.81E+01
10.000	1.9891	97.66	2.46E+02	4.21E+01
12.589	2.2917	98.90	2.50E+02	2.21E+01
15.849	2.5948	99.53	2.51E+02	1.05E+01
19.953	2.8989	99.81	2.52E+02	4.59E+00
25.119	3.2047	99.93	2.52E+02	1.82E+00
31.623	3.5130	99.98	2.52E+02	6.52E-01
39.811	3.8249	99.99	2.52E+02	2.10E-01
50.119	4.1417	100.00	2.52E+02	6.07E-02
63.096	4.4652	100.00	2.52E+02	1.54E-02
79.433	4.7980	100.00	2.52E+02	3.42E-03
100.000	5.1435	100.00	2.52E+02	6.40E-04
125.893	5.5068	100.00	2.52E+02	9.80E-05
158.489	5.8955	100.00	2.52E+02	1.16E-05
199.526	6.3214	100.00	2.52E+02	9.53E-07
251.189	6.8045	100.00	2.52E+02	4.63E-08
316.228	7.3804	100.00	2.52E+02	9.59E-10
398.107	8.1206	100.00	2.52E+02	4.17E-12
501.187	9.1917	100.00	2.52E+02	6.11E-16
630.957	11.0937	100.00	2.52E+02	5.19E-24
794.328	16.3266	100.00	2.52E+02	0.00E+00
1000.000		100.00	2.52E+02	0.00E+00

INHALABLE PARTICULATE MATTER

CUM MASS LESS THAN 1.000 MICRON: 157.32 62.3520 %  
CUM MASS LESS THAN 2.512 MICRON: 202.06 80.0828 %  
CUM MASS LESS THAN 10.000 MICRON: 246.42 97.6646 %  
CUM MASS LESS THAN 15.849 MICRON: 251.12 99.5258 %  
NOTE: DIAMETERS FOR INHALABLE PARTICULATE MATTER ARE



LOG-NORMAL APPROXIMATION

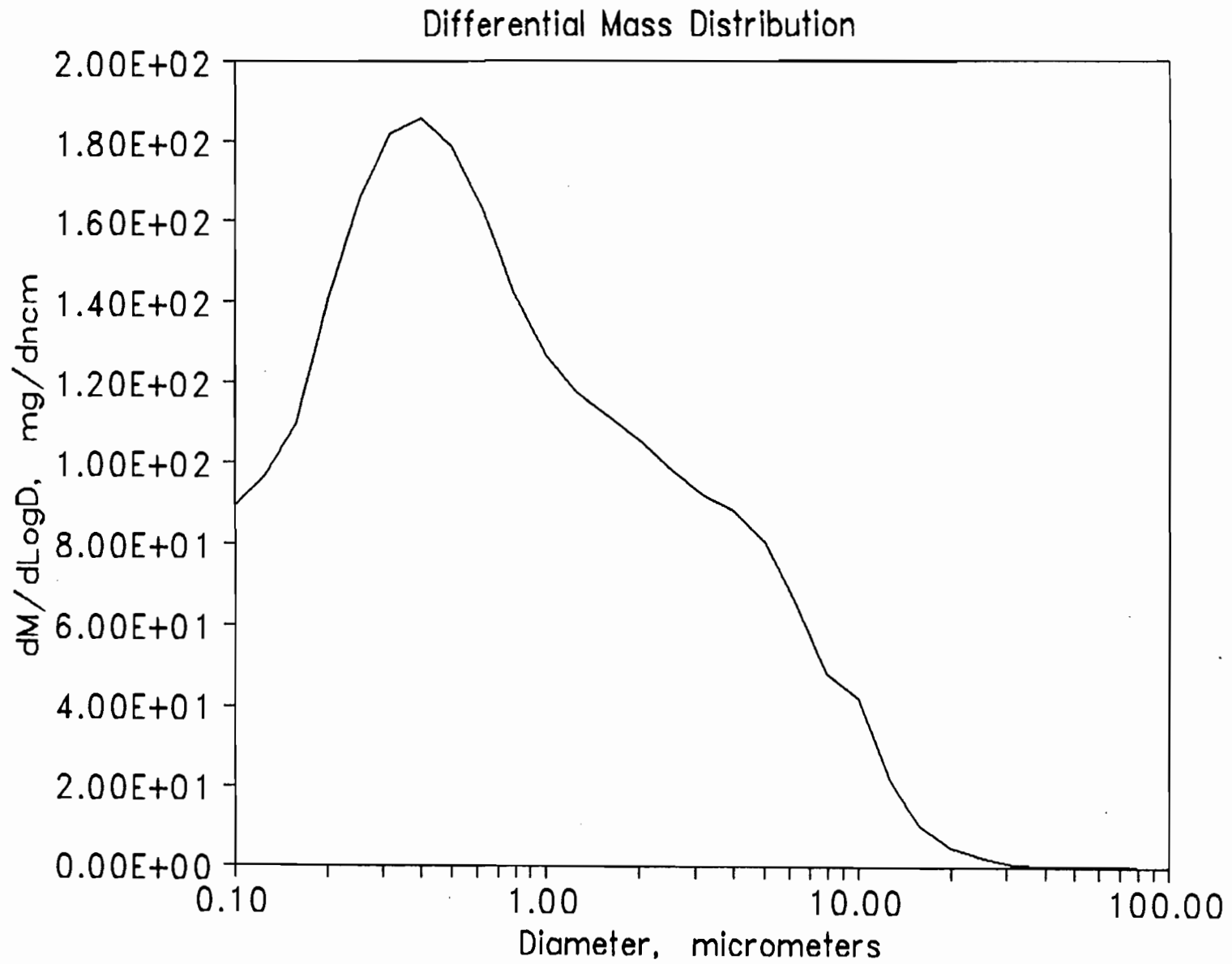
LOG-NORMAL SIZE DISTRIBUTION PARAMETERS

LEAST SQUARES LINE:  $Y = 0.24 + 1.65X$

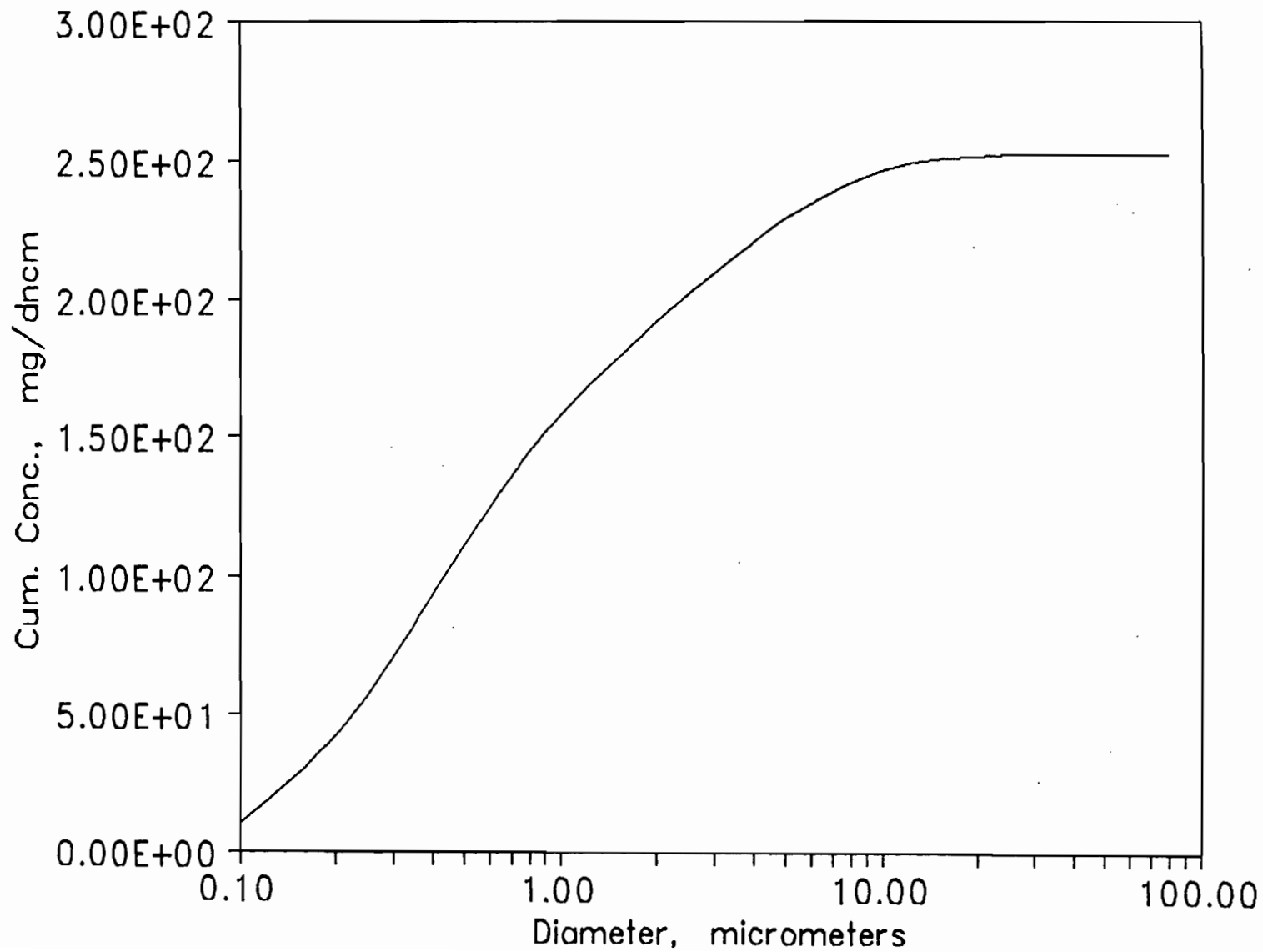
MASS MEDIAN DIAMETER: 0.712

GEOMETRIC STANDARD DEVIATION: 4.025

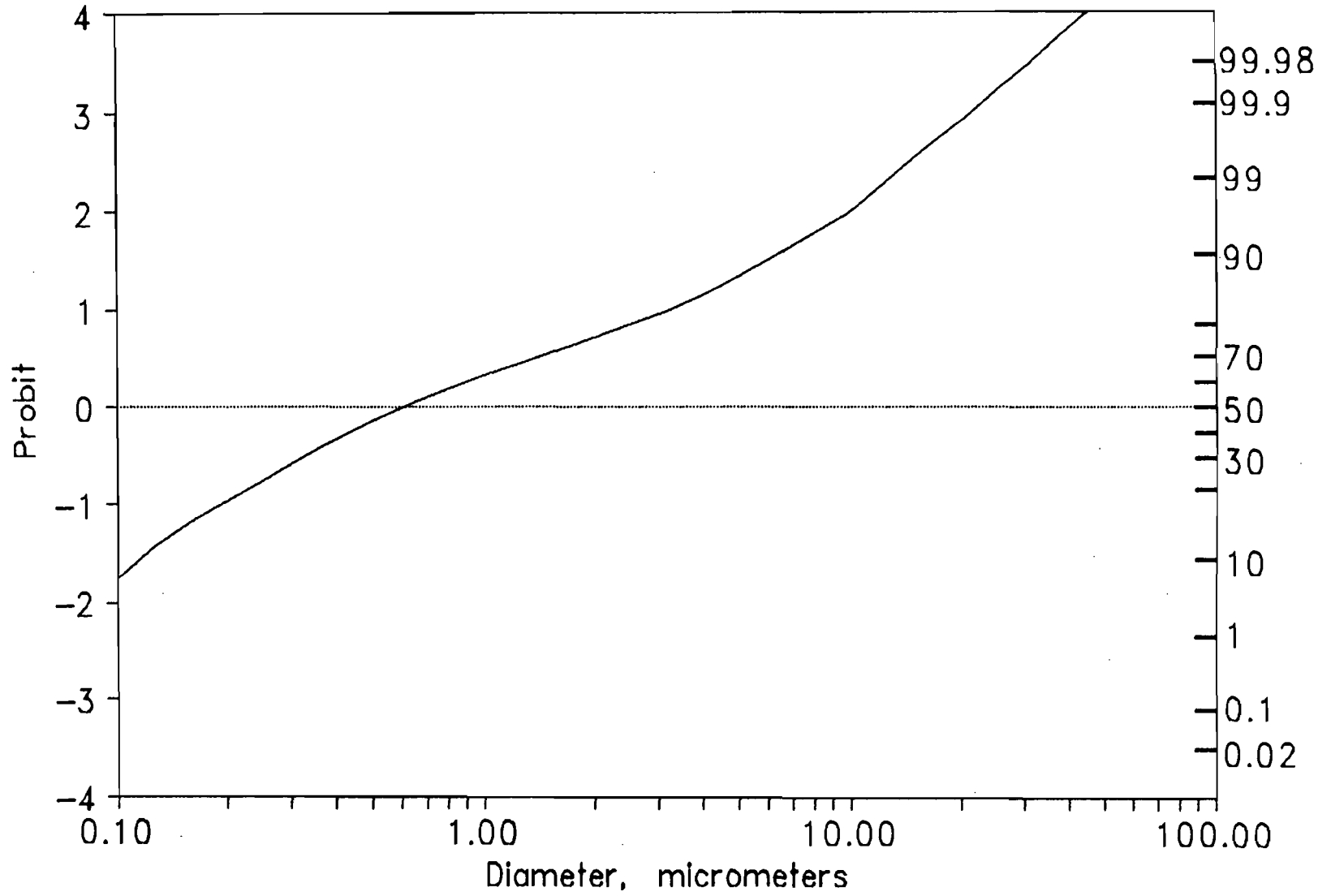
CORRELATION COEFFICIENT: 0.994



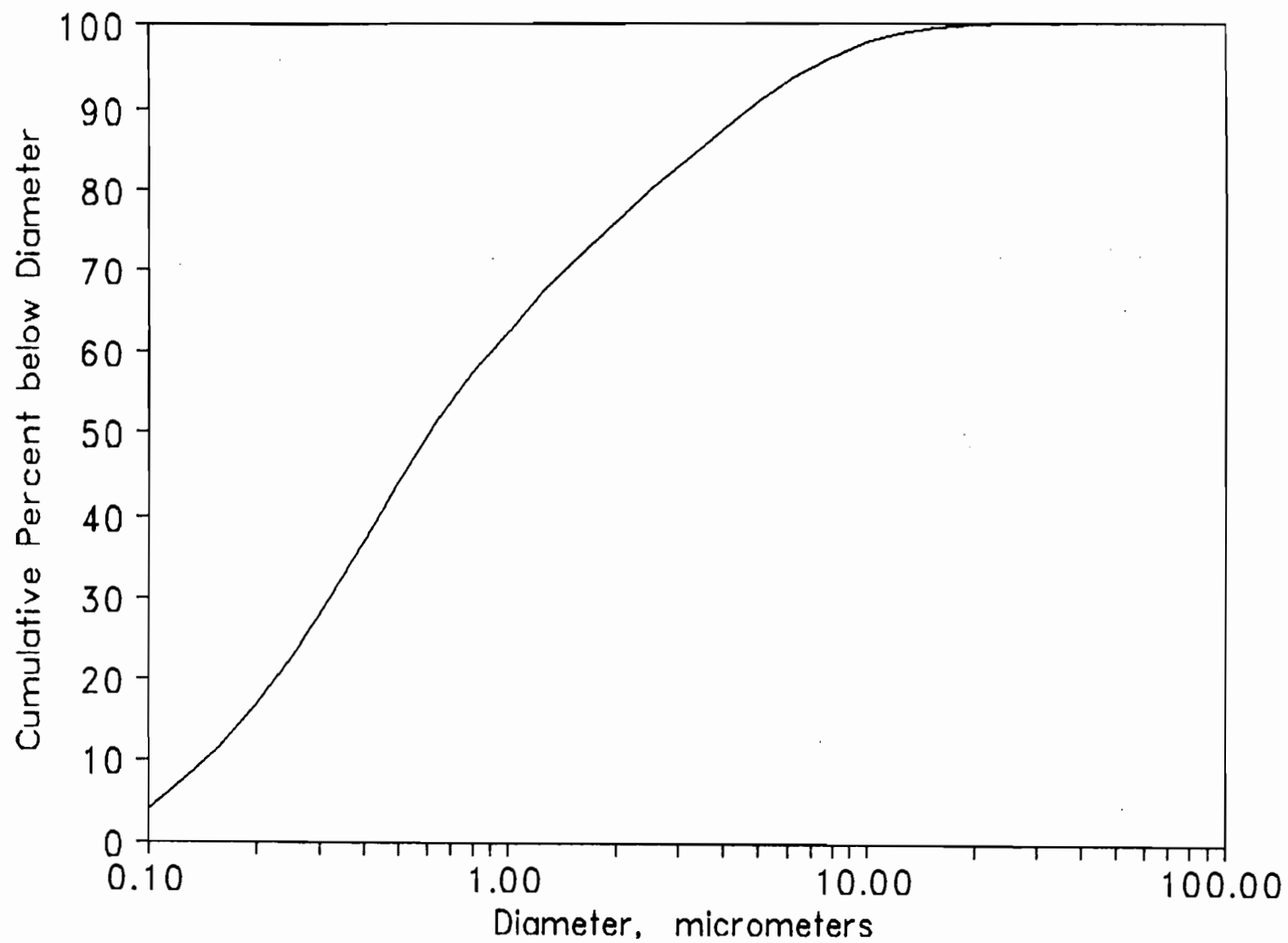
Cumulative Concentration vs. Diameter



Probit vs. Diameter



Cumulative Percent vs. Diameter



INPUT DATA

1)PART. DIAMETER CLASSICAL AERODYNAMIC  
 2)DATE OF TEST: 3/29/91  
 3)TIME OF TEST: 1643  
 4)LOCATION OF TEST: PSN 4 South  
 5)TEST DESIG.: SAN  
 6)TEST TYPE INLET  
 7)RUN NUMBER: 5-FILE NAME:TSANR5.IT  
 8)RUN REMARKS: substrate set 4  
 10)IMPACTOR TYPE: FPUW4-13  
 SRI RAPC UWV 4 5 7 9 11 13

9)WATER VAPOR 14.50%  
 CO2 13.00% CO 0.00%  
 O2 4.00% N2 83.00%

12)ORIFICE ID (OPTIONAL):  
 13)SUBSTRATE MATERIAL: QUARTZ FIBER

1)GAS METER VOL 3.816 CUBIC FEET  
 2)IMPACTOR DELTA P 0.00 IN. HG.  
 3)ORIFICE DELTA P 0.08 INCHES H2O  
 4)STACK PRESSURE -19.0 INCHES H2O  
 5)BAROMETRIC PRES 29.90 INCHES HG  
 6)STACK TEMP 422 DEGREES F  
 7)METER TEMP 82 DEGREES F  
 8)IMPACTOR TEMP 422 DEGREES F  
 9)SAMPLE TIME 25.00 MINUTES  
 10)AVG GAS VEL 64.00 FEET/SEC  
 11)ORI P WRT PBAR -0.01 INCHES HG  
 12)NOZZLE DIA 0.125 INCHES  
 13)MAX PART DIA 1000.0 MICRONS  
 14)WATER VOLUME 0.0 CC  
 15)METER FACTOR 1.0807

MASS GAIN OF STAGE 1 1.88 MG  
 MASS GAIN OF STAGE 2 2.56 MG  
 MASS GAIN OF STAGE 3 2.33 MG  
 MASS GAIN OF STAGE 4 3.20 MG  
 MASS GAIN OF STAGE 5 3.67 MG  
 MASS GAIN OF STAGE 6 7.31 MG  
 MASS GAIN OF STAGE 7 5.32 MG  
 MASS GAIN OF FILTER 4.63 MG

MASS GAIN OF BLANK SUBSTRATE -0.29  
 MASS GAIN OF BLANK FILTER -0.29

RESULTS

TEST DESIG.: SAN RUN NUMBER: 5

ACTUAL FLOW RATE 0.329 CFM  
 FLOW RATE AT STANDARD CONDITIONS 0.161 CFM  
 PERCENT ISOKINETIC 100.585 %  
 VISCOSITY 242.9E-06 GM/CM-SEC  
 CALCULATED IMPACTOR DELTA P = 1.67 IN. HG

STAGE	CUNN. CORR.	D50 (CLAS AERO)	D50 (IMP AERO)	CUM FREQ.	RE. NO.	V*D50 UM-M/S
1	1.031	9.955	10.106	93.4678	398	12.2
2	1.068	4.514	4.664	84.8886	71	15.9
3	1.106	2.871	3.020	77.0018	90	20.0
4	1.203	1.509	1.655	66.4961	134	23.1
5	1.405	0.773	0.916	54.5756	184	21.2
6	1.891	0.376	0.516	31.6978	344	19.4
7	2.753	0.207	0.343	14.8104	536	16.9

STAGE CUT DIAMETERS BASED ON THEORETICAL VALUES OF STAGE CONSTANTS

TOTAL MASS CONCENTRATION = 2.92E+02 MG/DRY NORMAL CUBIC METER  
 = 1.43E+02 MG/ACTUAL CUBIC METER  
 = 1.28E-01 GRAINS/DRY STD CUBIC FOOT  
 = 6.23E-02 GRAINS/ACTUAL CUBIC FOOT

## SPLINE FIT ON CLASSICAL AERODYNAMIC DIAMETER BASIS

PARTICLE DIA. (MICRONS)	CUMFR (STDDEV)	CUMFR (PERCENT)	CUM.MASS (MG/DRY N.CU.METER)	DM/DLOGD
0.100	-1.9535	2.54	7.42E+00	8.26E+01
0.126	-1.5738	5.78	1.69E+01	1.04E+02
0.158	-1.3063	9.57	2.80E+01	1.19E+02
0.200	-1.0795	14.02	4.10E+01	1.43E+02
0.251	-0.8580	19.54	5.71E+01	1.79E+02
0.316	-0.6379	26.18	7.65E+01	2.08E+02
0.398	-0.4215	33.67	9.84E+01	2.28E+02
0.501	-0.2139	41.53	1.21E+02	2.28E+02
0.631	-0.0257	48.97	1.43E+02	2.04E+02
0.794	0.1315	55.23	1.61E+02	1.60E+02
1.000	0.2531	59.99	1.75E+02	1.22E+02
1.259	0.3523	63.77	1.86E+02	1.03E+02
1.585	0.4460	67.22	1.96E+02	1.01E+02
1.995	0.5473	70.79	2.07E+02	1.08E+02
2.512	0.6629	74.63	2.18E+02	1.17E+02
3.162	0.7981	78.76	2.30E+02	1.23E+02
3.981	0.9486	82.86	2.42E+02	1.14E+02
5.012	1.0991	86.42	2.53E+02	9.34E+01
6.310	1.2421	89.29	2.61E+02	7.54E+01
7.943	1.3796	91.62	2.68E+02	6.11E+01
10.000	1.5140	93.50	2.73E+02	4.00E+01
12.589	1.6219	94.76	2.77E+02	3.38E+01
15.849	1.7302	95.82	2.80E+02	2.84E+01
19.953	1.8394	96.71	2.83E+02	2.36E+01
25.119	1.9503	97.44	2.85E+02	1.95E+01
31.623	2.0635	98.05	2.87E+02	1.59E+01
39.811	2.1802	98.54	2.88E+02	1.29E+01
50.119	2.3018	98.93	2.89E+02	1.03E+01
63.096	2.4300	99.24	2.90E+02	8.06E+00
79.433	2.5674	99.49	2.91E+02	6.18E+00
100.000	2.7174	99.67	2.91E+02	4.59E+00
125.893	2.8851	99.80	2.92E+02	3.25E+00
158.489	3.0782	99.90	2.92E+02	2.14E+00
199.526	3.3084	99.95	2.92E+02	1.25E+00
251.189	3.5956	99.98	2.92E+02	5.92E-01
316.228	3.9756	100.00	2.92E+02	1.92E-01
398.107	4.5198	100.00	2.92E+02	2.85E-02
501.187	5.3948	100.00	2.92E+02	6.43E-04
630.957	7.1006	100.00	2.92E+02	3.33E-08
794.328	12.1373	100.00	2.92E+02	1.20E-28
1000.000		100.00	2.92E+02	0.00E+00

## INHALABLE PARTICULATE MATTER

CUM MASS LESS THAN 1.000 MICRON: 175.35 59.9892 %  
 CUM MASS LESS THAN 2.512 MICRON: 218.15 74.6308 %  
 CUM MASS LESS THAN 10.000 MICRON: 273.30 93.4993 %  
 CUM MASS LESS THAN 15.849 MICRON: 280.08 95.8199 %  
 NOTE: DIAMETERS FOR INHALABLE PARTICULATE MATTER ARE

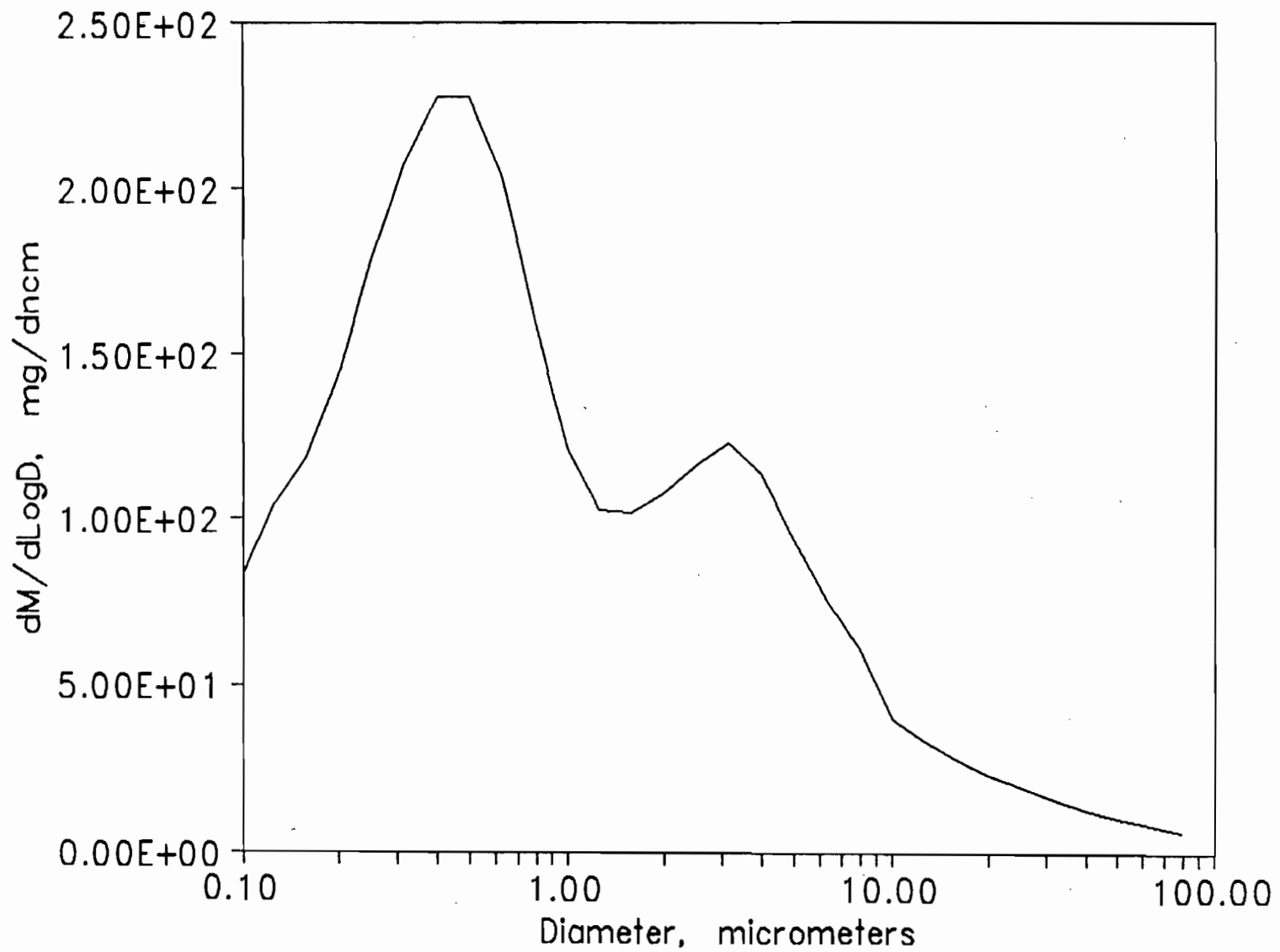


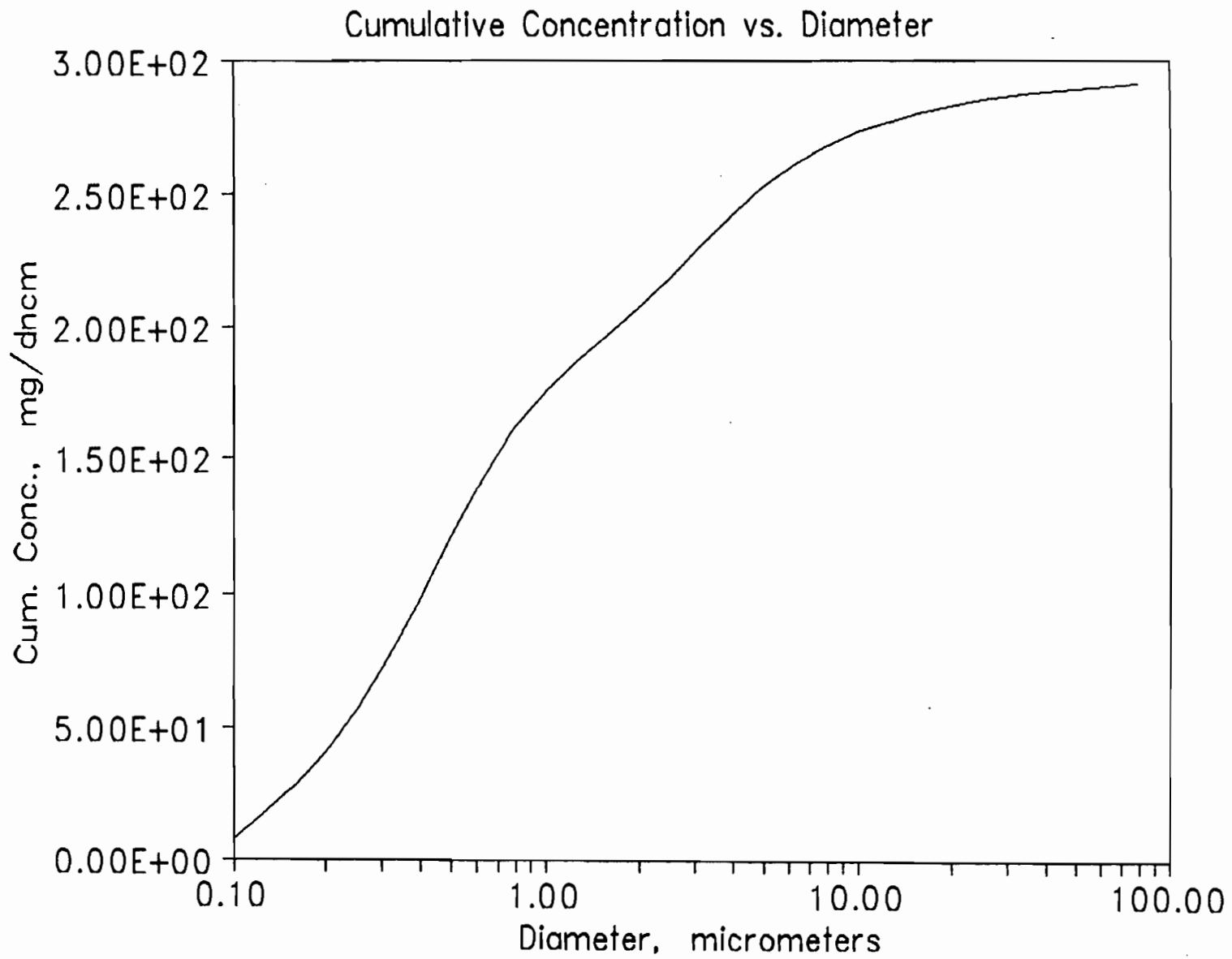
LOG-NORMAL APPROXIMATION

LOG-NORMAL SIZE DISTRIBUTION PARAMETERS

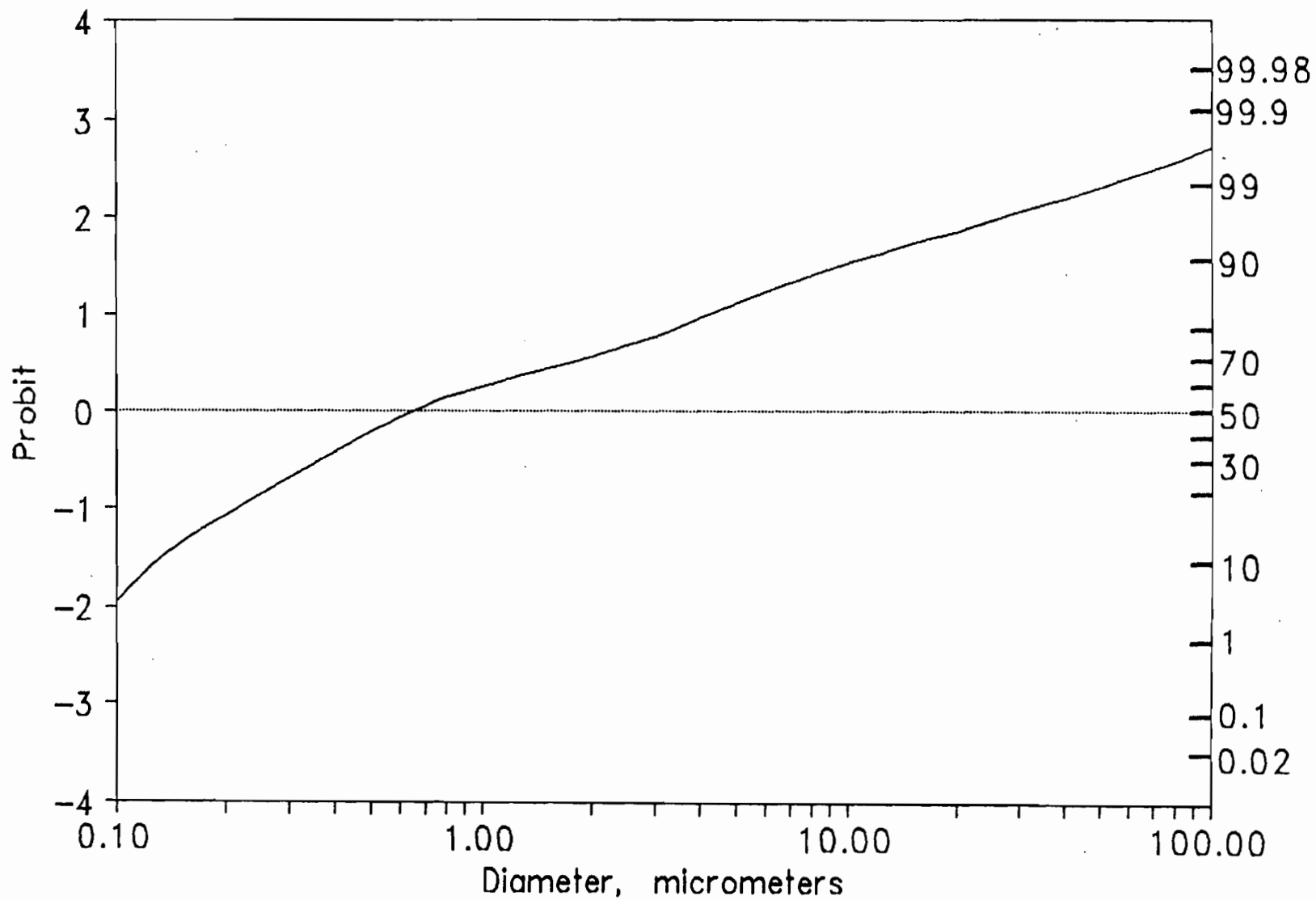
LEAST SQUARES LINE:  $Y = 0.11 + 1.46X$   
MASS MEDIAN DIAMETER: 0.845  
GEOMETRIC STANDARD DEVIATION: 4.863  
CORRELATION COEFFICIENT: 0.987

Differential Mass Distribution

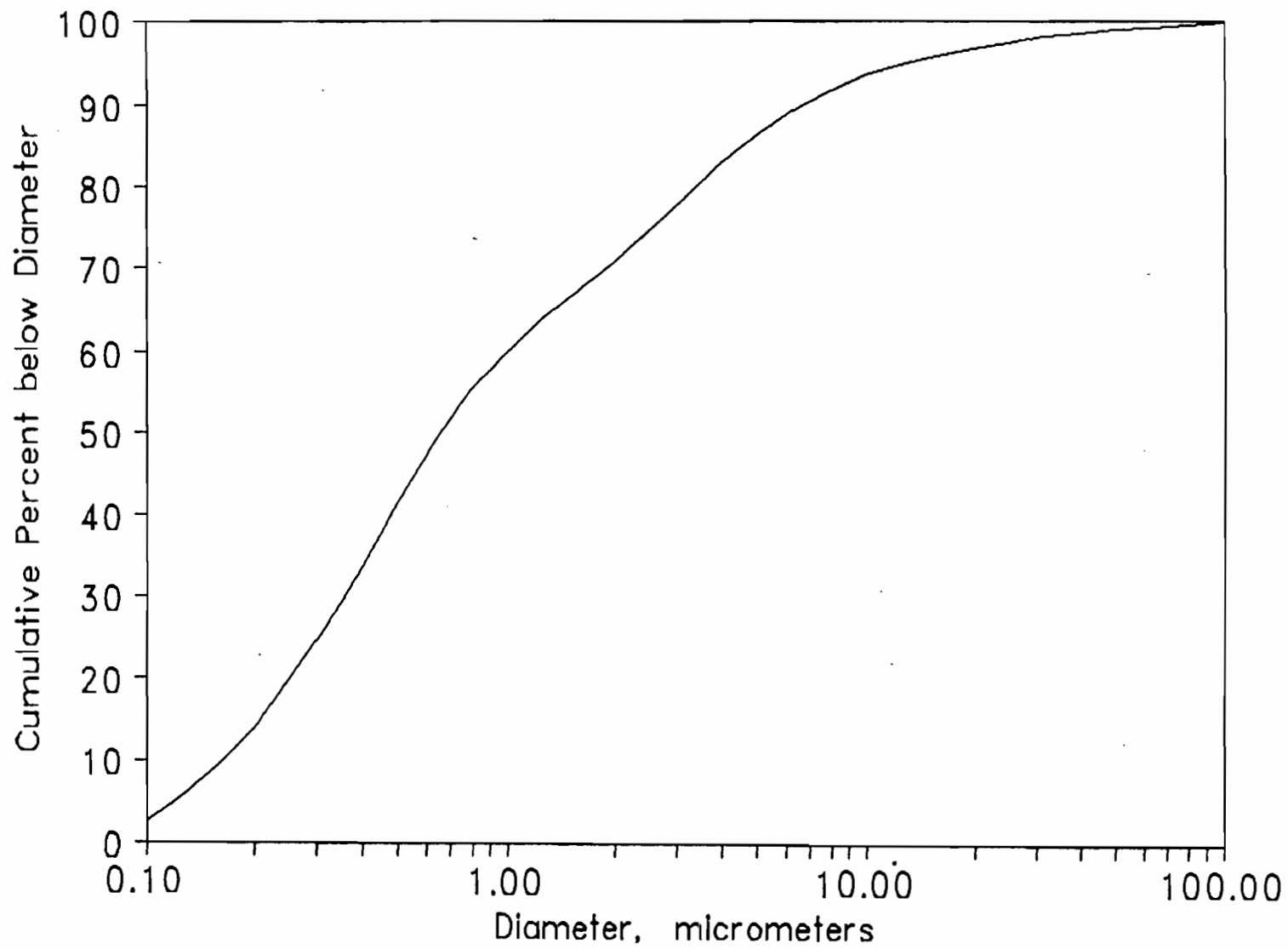




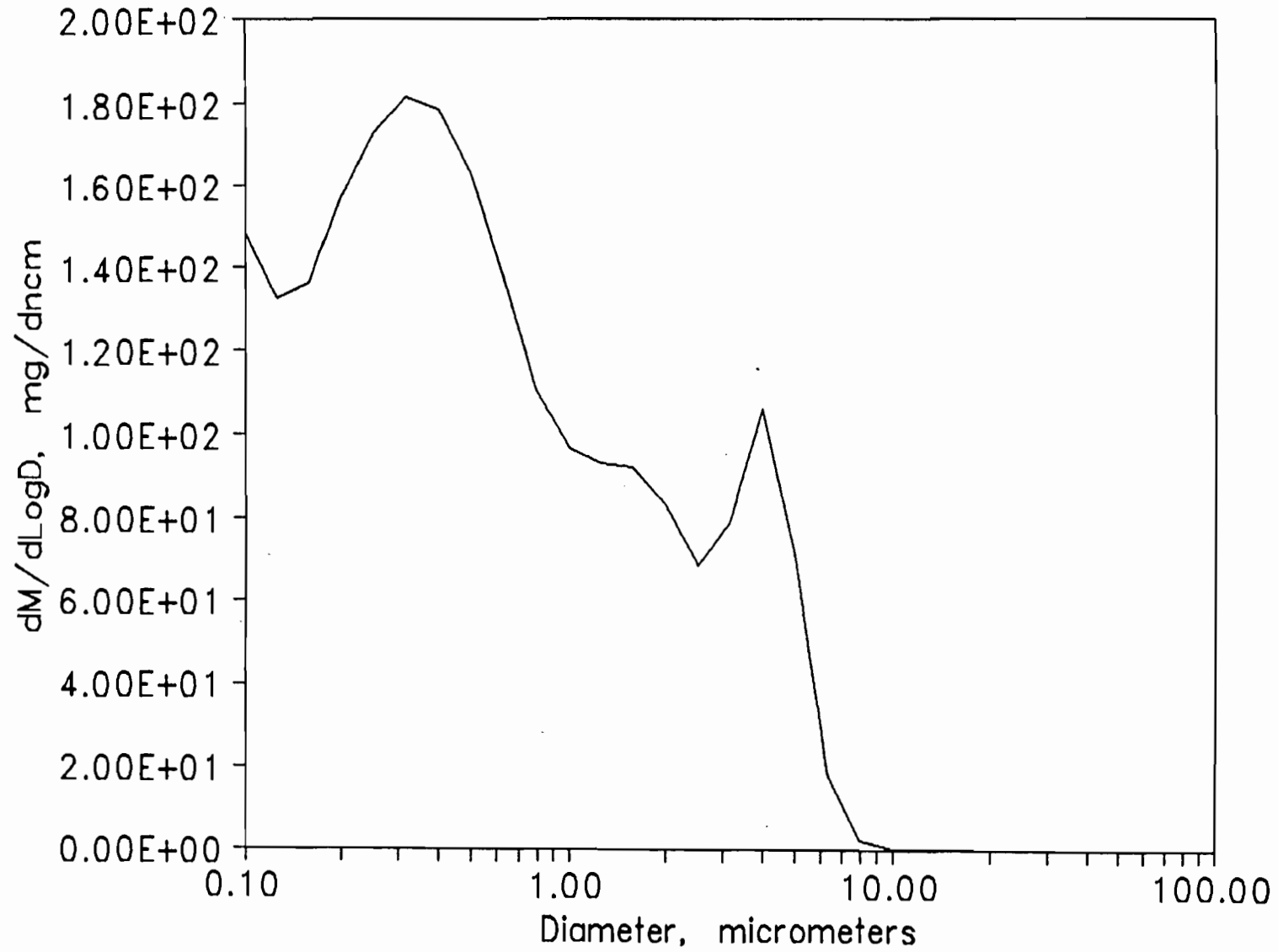
Probit vs. Diameter



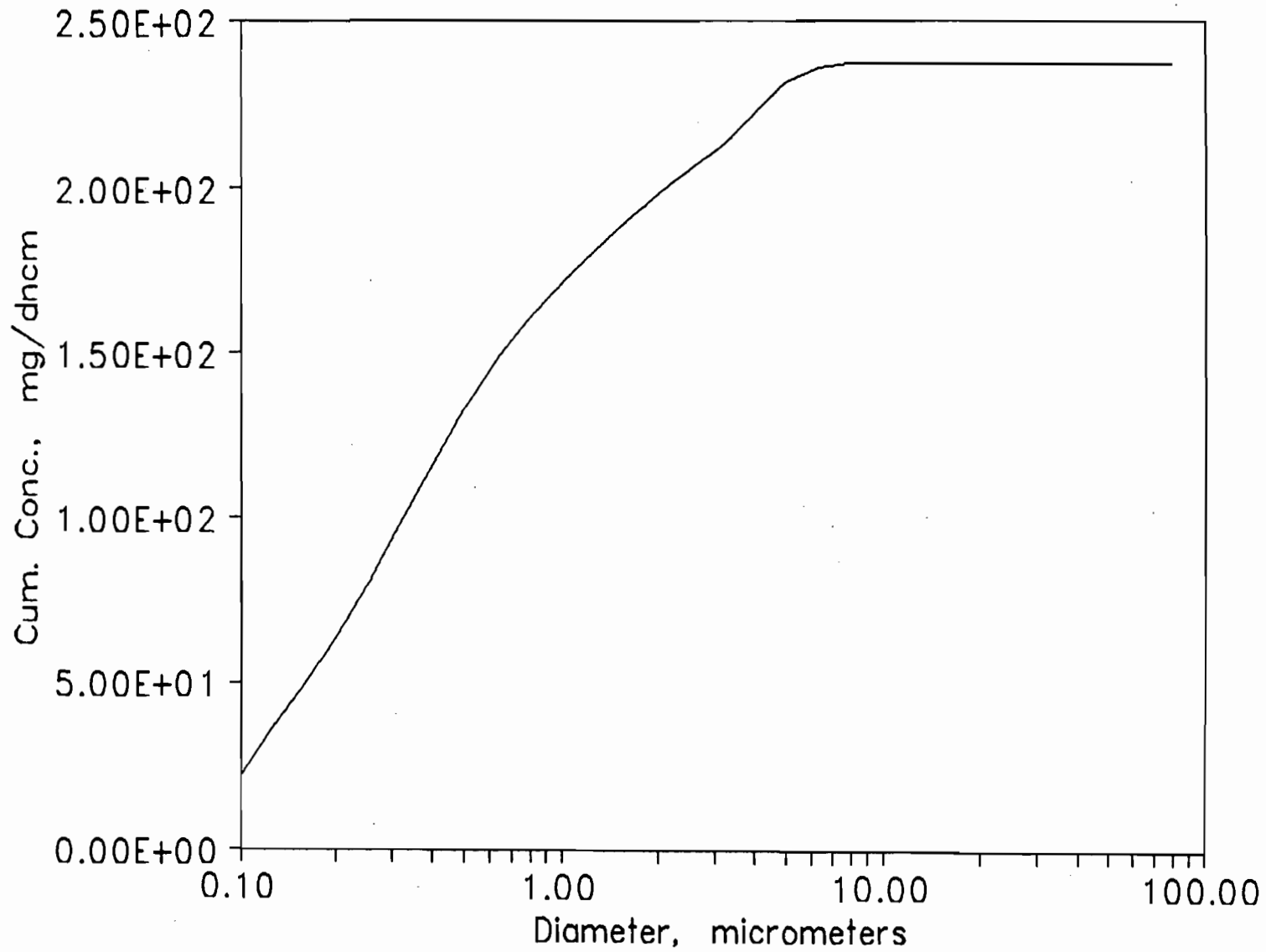
Cumulative Percent vs. Diameter



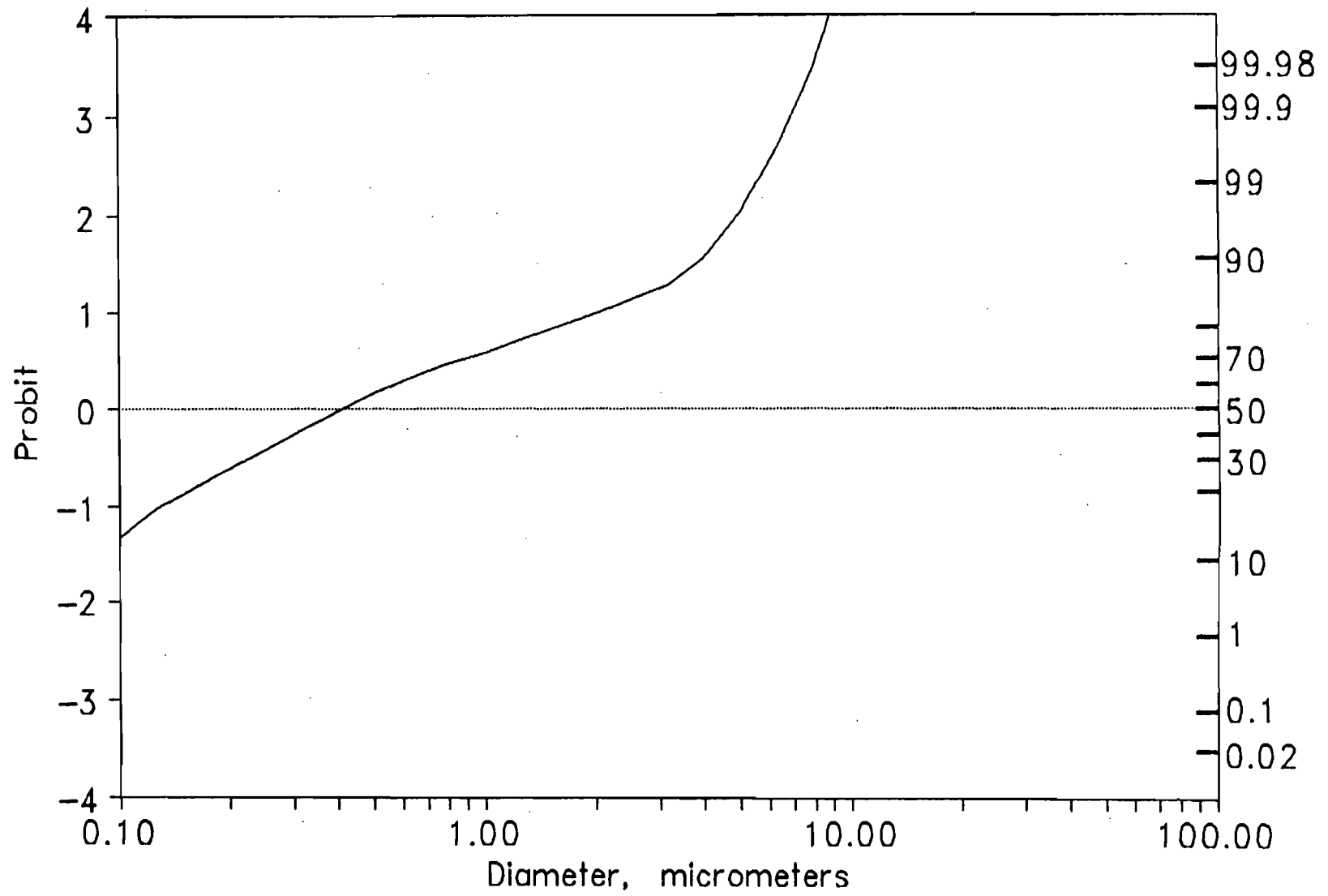
Differential Mass Distribution



Cumulative Concentration vs. Diameter

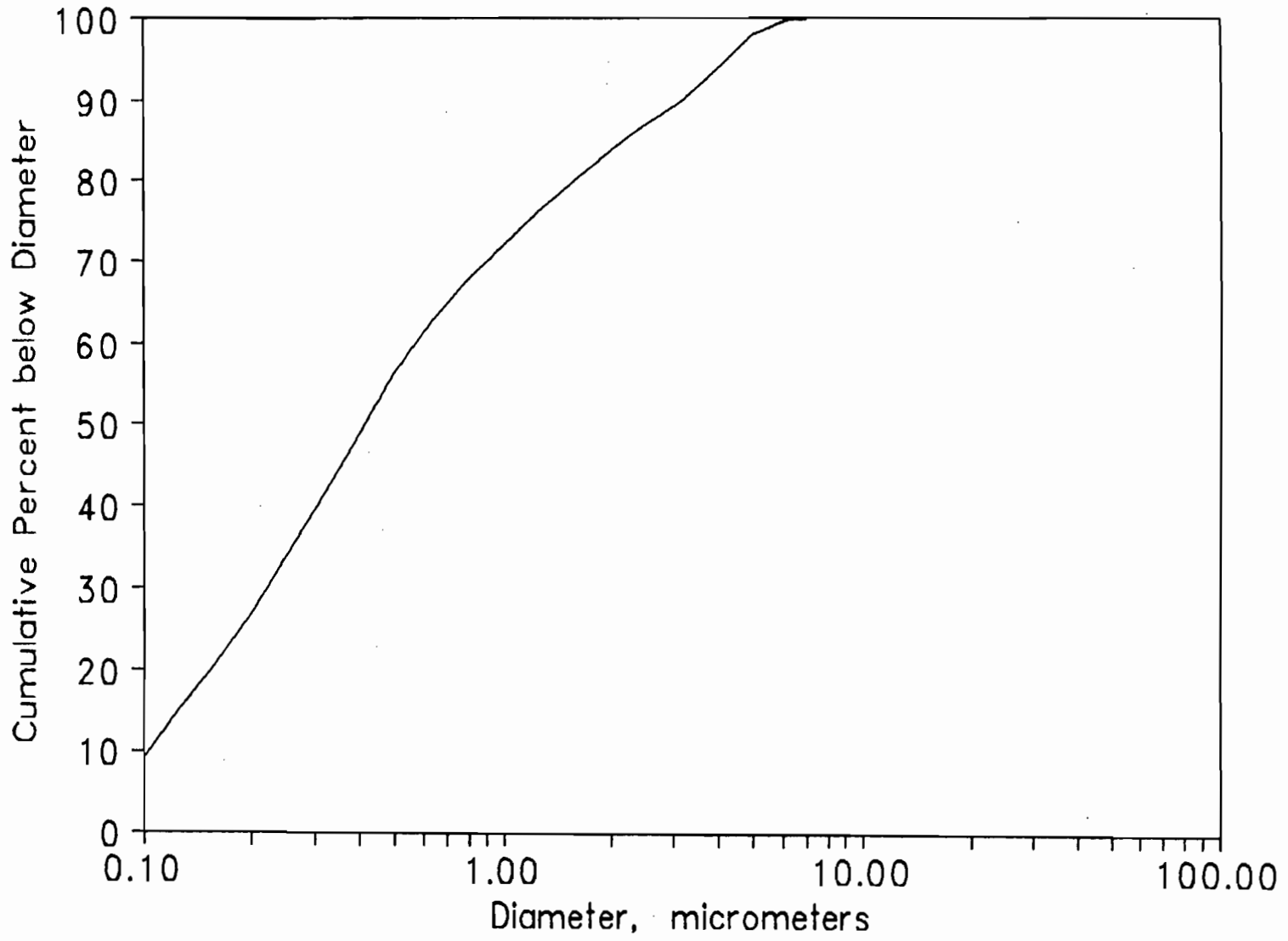


Probit vs. Diameter





Cumulative Percent vs. Diameter



## INPUT DATA

1)PART. DIAMETER CLASSICAL AERODYNAMIC  
 2)DATE OF TEST: 3/29/91  
 3)TIME OF TEST: 1254  
 4)LOCATION OF TEST: PSN 4 South  
 5)TEST DESIG.: SAN  
 6)TEST TYPE INLET  
 7)RUN NUMBER: 3-FILE NAME:TSANR3.IT  
 8)RUN REMARKS: substrate set 2  
 10)IMPACTOR TYPE: FPUW4-13  
 SRI RAPC UWV 4 5 7 9 11 13

9)WATER VAPOR 14.50%  
 CO2 13.00% CO 0.00%  
 O2 4.00% N2 83.00%

12)ORIFICE ID (OPTIONAL):  
 13)SUBSTRATE MATERIAL: QUARTZ FIBER

1)GAS METER VOL 5.057 CUBIC FEET  
 2)IMPACTOR DELTA P 0.00 IN. HG.  
 3)ORIFICE DELTA P 0.09 INCHES H2O  
 4)STACK PRESSURE -19.0 INCHES H2O  
 5)BAROMETRIC PRES 29.90 INCHES HG  
 6)STACK TEMP 417 DEGREES F  
 7)METER TEMP 82 DEGREES F  
 8)IMPACTOR TEMP 417 DEGREES F  
 9)SAMPLE TIME 35.00 MINUTES  
 10)AVG GAS VEL 64.00 FEET/SEC  
 11)ORI P WRT PBAR -0.01 INCHES HG  
 12)NOZZLE DIA 0.125 INCHES  
 13)MAX PART DIA 1000.0 MICRONS  
 14)WATER VOLUME 0.0 CC  
 15)METER FACTOR 1.0807

MASS GAIN OF STAGE 1 0.17 MG  
 MASS GAIN OF STAGE 2 2.57 MG  
 MASS GAIN OF STAGE 3 2.34 MG  
 MASS GAIN OF STAGE 4 4.15 MG  
 MASS GAIN OF STAGE 5 5.62 MG  
 MASS GAIN OF STAGE 6 9.77 MG  
 MASS GAIN OF STAGE 7 7.69 MG  
 MASS GAIN OF FILTER 9.06 MG

MASS GAIN OF BLANK SUBSTRATE 0.17  
 MASS GAIN OF BLANK FILTER 0.17

RESULTS

TEST DESIG.: SAN RUN NUMBER: 3

ACTUAL FLOW RATE 0.310 CFM  
 FLOW RATE AT STANDARD CONDITIONS 0.152 CFM  
 PERCENT ISOKINETIC 94.668 %  
 VISCOSITY 241.9E-06 GM/CM-SEC  
 CALCULATED IMPACTOR DELTA P = 1.47 IN. HG

STAGE	CUNN. CORR.	D50 (CLAS AERO)	D50 (IMP AERO)	CUM FREQ.	RE. NO.	V*D50 UM-M/S
1	1.030	10.245	10.395	99.9975	378	11.8
2	1.064	4.736	4.886	93.9991	68	15.7
3	1.100	3.024	3.172	88.5756	86	19.8
4	1.190	1.596	1.741	78.6284	127	23.0
5	1.377	0.821	0.964	65.0071	175	21.2
6	1.818	0.403	0.543	41.0137	327	19.6
7	2.576	0.226	0.362	22.2189	509	17.3

STAGE CUT DIAMETERS BASED ON THEORETICAL VALUES OF STAGE CONSTANTS

TOTAL MASS CONCENTRATION = 2.66E+02 MG/DRY NORMAL CUBIC METER  
 = 1.30E+02 MG/ACTUAL CUBIC METER  
 = 1.16E-01 GRAINS/DRY STD CUBIC FOOT  
 = 5.69E-02 GRAINS/ACTUAL CUBIC FOOT

TEST DESIG.: SAN RUN NUMBER: 3

SPLINE FIT ON CLASSICAL AERODYNAMIC DIAMETER BASIS

PARTICLE DIA. (MICRONS)	CUMFR (STDDEV)	CUMFR (PERCENT)	CUM.MASS (MG/DRY	DM/DLOGD N.CU.METER)
0.100	-1.7796	3.76	9.98E+00	1.08E+02
0.126	-1.3836	8.32	2.21E+01	1.30E+02
0.158	-1.1075	13.40	3.56E+01	1.40E+02
0.200	-0.8799	18.95	5.03E+01	1.56E+02
0.251	-0.6655	25.29	6.72E+01	1.82E+02
0.316	-0.4516	32.58	8.65E+01	2.05E+02
0.398	-0.2374	40.62	1.08E+02	2.21E+02
0.501	-0.0240	49.04	1.30E+02	2.23E+02
0.631	0.1793	57.12	1.52E+02	2.03E+02
0.794	0.3611	64.10	1.70E+02	1.66E+02
1.000	0.5134	69.62	1.85E+02	1.30E+02
1.259	0.6490	74.18	1.97E+02	1.15E+02
1.585	0.7889	78.49	2.09E+02	1.16E+02
1.995	0.9464	82.80	2.20E+02	1.09E+02
2.512	1.1014	86.46	2.30E+02	8.31E+01
3.162	1.2247	88.97	2.36E+02	5.09E+01
3.981	1.3507	91.16	2.42E+02	7.82E+01
5.012	1.6574	95.13	2.53E+02	1.22E+02
6.310	2.2494	98.77	2.62E+02	6.02E+01
7.943	3.0492	99.88	2.65E+02	8.84E+00
10.000	3.9582	100.00	2.66E+02	3.91E-01
12.589	5.7163	100.00	2.66E+02	1.58E-04
15.849	7.5717	100.00	2.66E+02	6.99E-10
19.953	9.4281	100.00	2.66E+02	9.82E-17
25.119	11.2860	100.00	2.66E+02	4.32E-25
31.623	13.1463	100.00	2.66E+02	5.84E-35
39.811	15.0100	100.00	2.66E+02	0.00E+00
50.119	16.8785	100.00	2.66E+02	0.00E+00
63.096	18.7536	100.00	2.66E+02	0.00E+00
79.433	20.6378	100.00	2.66E+02	0.00E+00
100.000	22.5346	100.00	2.66E+02	0.00E+00
125.893	24.4491	100.00	2.66E+02	0.00E+00
158.489	26.3888	100.00	2.66E+02	0.00E+00
199.526	28.3657	100.00	2.66E+02	0.00E+00
251.189	30.3995	100.00	2.66E+02	0.00E+00
316.228	32.5261	100.00	2.66E+02	0.00E+00
398.107	34.8167	100.00	2.66E+02	0.00E+00
501.187	37.4382	100.00	2.66E+02	0.00E+00
630.957	40.8905	100.00	2.66E+02	0.00E+00
794.328	47.6735	100.00	2.66E+02	0.00E+00
1000.000		100.00	2.66E+02	0.00E+00

INHALABLE PARTICULATE MATTER

CUM MASS LESS THAN 1.000 MICRON: 184.95 69.6153 %  
CUM MASS LESS THAN 2.512 MICRON: 229.71 86.4643 %  
CUM MASS LESS THAN 10.000 MICRON: 265.66 99.9962 %  
CUM MASS LESS THAN 15.849 MICRON: 265.67 100.0000 %  
NOTE: DIAMETERS FOR INHALABLE PARTICULATE MATTER ARE

LOG-NORMAL APPROXIMATION

LOG-NORMAL SIZE DISTRIBUTION PARAMETERS

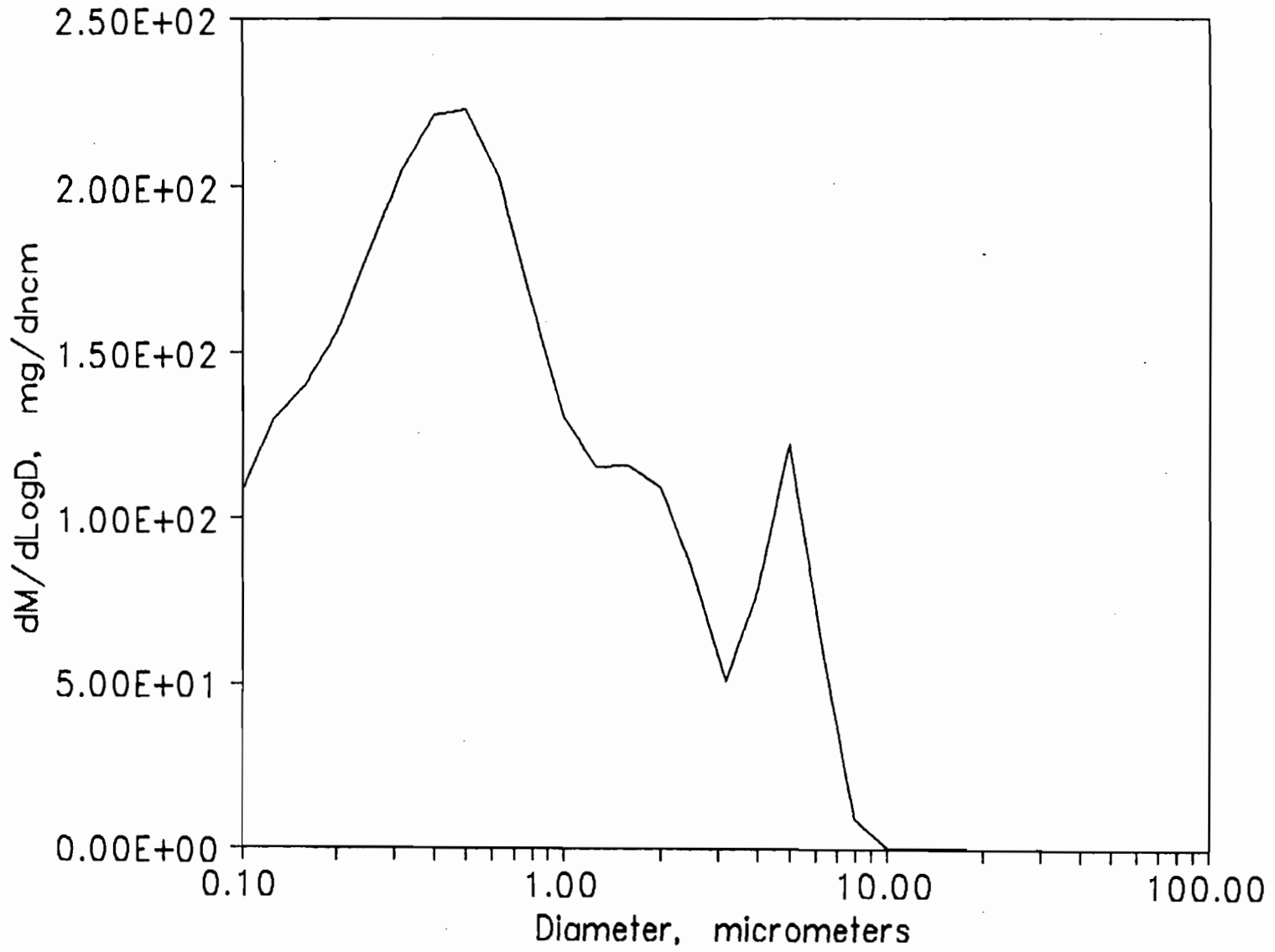
LEAST SQUARES LINE:  $Y = 0.56 + 2.46X$

MASS MEDIAN DIAMETER: 0.591

GEOMETRIC STANDARD DEVIATION: 2.547

CORRELATION COEFFICIENT: 0.869

Differential Mass Distribution



RESULTS

TEST DESIG.: SAN RUN NUMBER: 1

ACTUAL FLOW RATE 0.340 CFM  
 FLOW RATE AT STANDARD CONDITIONS 0.170 CFM  
 PERCENT ISOKINETIC 103.832 %  
 VISCOSITY 238.4E-06 GM/CM-SEC  
 CALCULATED IMPACTOR DELTA P = 1.83 IN. HG

STAGE	CUNN. CORR.	D50 (CLAS AERO)	D50 (IMP AERO)	CUM FREQ.	RE. NO.	V*D50 UM-M/S
1	1.031	9.706	9.853	92.5394	429	12.3
2	1.069	4.286	4.431	76.7737	77	15.6
3	1.109	2.712	2.857	66.3851	98	19.5
4	1.209	1.423	1.564	55.9685	145	22.5
5	1.416	0.729	0.868	44.7072	198	20.7
6	1.914	0.356	0.492	25.8446	372	19.0
7	2.805	0.196	0.328	12.8660	578	16.5

STAGE CUT DIAMETERS BASED ON THEORETICAL VALUES OF STAGE CONSTANTS

TOTAL MASS CONCENTRATION = 2.46E+02 MG/DRY NORMAL CUBIC METER  
 = 1.23E+02 MG/ACTUAL CUBIC METER  
 = 1.08E-01 GRAINS/DRY STD CUBIC FOOT  
 = 5.38E-02 GRAINS/ACTUAL CUBIC FOOT

TEST DESIG.: SAN RUN NUMBER: 1

SPLINE FIT ON CLASSICAL AERODYNAMIC DIAMETER BASIS

PARTICLE DIA. (MICRONS)	CUMFR (STDDEV)	CUMFR (PERCENT)	CUM.MASS (MG/DRY N.CU.METER)	DM/DLOGD
0.100	-1.8645	3.11	7.66E+00	7.36E+01
0.126	-1.5329	6.26	1.54E+01	7.93E+01
0.158	-1.3076	9.55	2.35E+01	8.35E+01
0.200	-1.1170	13.20	3.25E+01	9.87E+01
0.251	-0.9296	17.63	4.34E+01	1.19E+02
0.316	-0.7430	22.87	5.63E+01	1.38E+02
0.398	-0.5582	28.83	7.09E+01	1.53E+02
0.501	-0.3807	35.17	8.65E+01	1.56E+02
0.631	-0.2202	41.29	1.02E+02	1.42E+02
0.794	-0.0867	46.54	1.15E+02	1.15E+02
1.000	0.0185	50.74	1.25E+02	9.28E+01
1.259	0.1063	54.23	1.33E+02	8.10E+01
1.585	0.1884	57.47	1.41E+02	8.02E+01
1.995	0.2765	60.89	1.50E+02	8.95E+01
2.512	0.3817	64.87	1.60E+02	1.07E+02
3.162	0.5146	69.66	1.71E+02	1.27E+02
3.981	0.6750	75.02	1.85E+02	1.34E+02
5.012	0.8564	80.41	1.98E+02	1.29E+02
6.310	1.0528	85.38	2.10E+02	1.14E+02
7.943	1.2591	89.60	2.20E+02	9.30E+01
10.000	1.4771	93.02	2.29E+02	8.79E+01
12.589	1.7437	95.94	2.36E+02	5.73E+01
15.849	2.0109	97.78	2.41E+02	3.48E+01
19.953	2.2790	98.87	2.43E+02	1.97E+01
25.119	2.5487	99.46	2.45E+02	1.03E+01
31.623	2.8209	99.76	2.45E+02	5.03E+00
39.811	3.0966	99.90	2.46E+02	2.26E+00
50.119	3.3772	99.96	2.46E+02	9.29E-01
63.096	3.6644	99.99	2.46E+02	3.47E-01
79.433	3.9609	100.00	2.46E+02	1.16E-01
100.000	4.2701	100.00	2.46E+02	3.42E-02
125.893	4.5970	100.00	2.46E+02	8.55E-03
158.489	4.9492	100.00	2.46E+02	1.73E-03
199.526	5.3387	100.00	2.46E+02	2.63E-04
251.189	5.7853	100.00	2.46E+02	2.57E-05
316.228	6.3246	100.00	2.46E+02	1.22E-06
398.107	7.0282	100.00	2.46E+02	1.53E-08
501.187	8.0626	100.00	2.46E+02	9.86E-12
630.957	9.9279	100.00	2.46E+02	1.05E-18
794.328	15.1241	100.00	2.46E+02	0.00E+00
1000.000		100.00	2.46E+02	0.00E+00

INHALABLE PARTICULATE MATTER

CUM MASS LESS THAN 1.000 MICRON: 124.82 50.7388 %  
CUM MASS LESS THAN 2.512 MICRON: 159.58 64.8652 %  
CUM MASS LESS THAN 10.000 MICRON: 228.83 93.0180 %  
CUM MASS LESS THAN 15.849 MICRON: 240.55 97.7821 %  
NOTE: DIAMETERS FOR INHALABLE PARTICULATE MATTER ARE

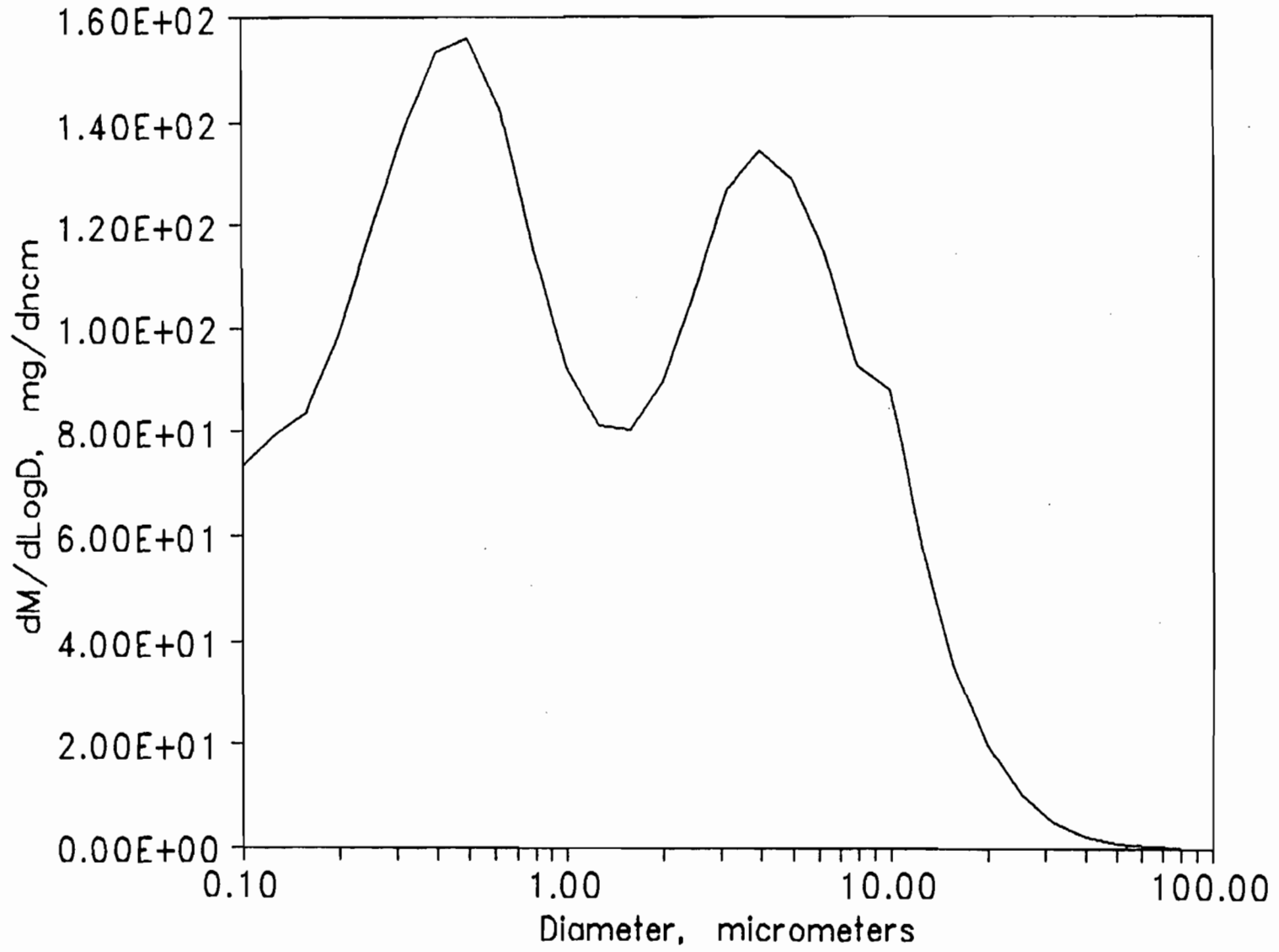


LOG-NORMAL APPROXIMATION

LOG-NORMAL SIZE DISTRIBUTION PARAMETERS

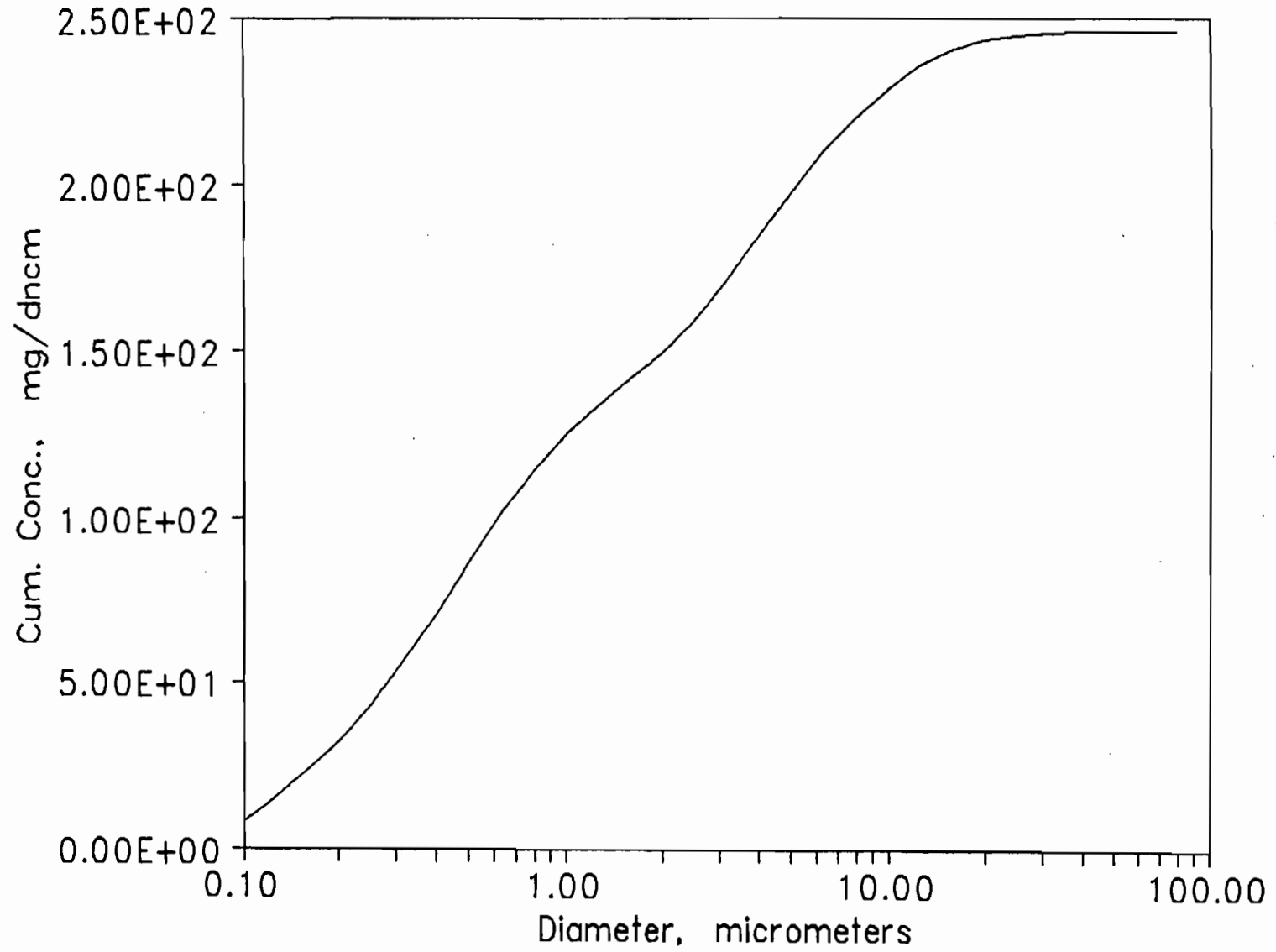
LEAST SQUARES LINE:  $Y = -0.07 + 1.41X$   
MASS MEDIAN DIAMETER: 1.112  
GEOMETRIC STANDARD DEVIATION: 5.094  
CORRELATION COEFFICIENT: 0.986

Differential Mass Distribution

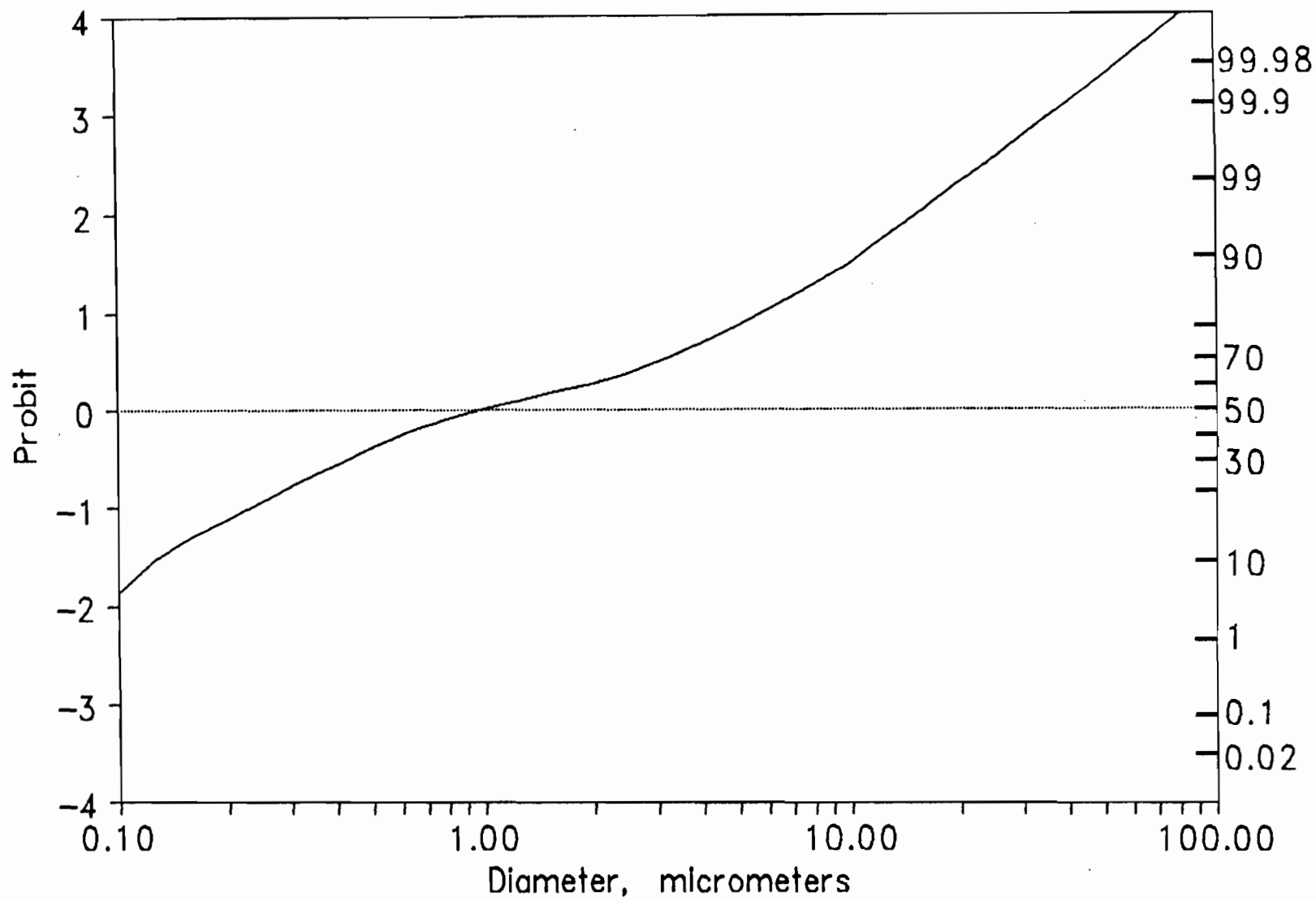


5

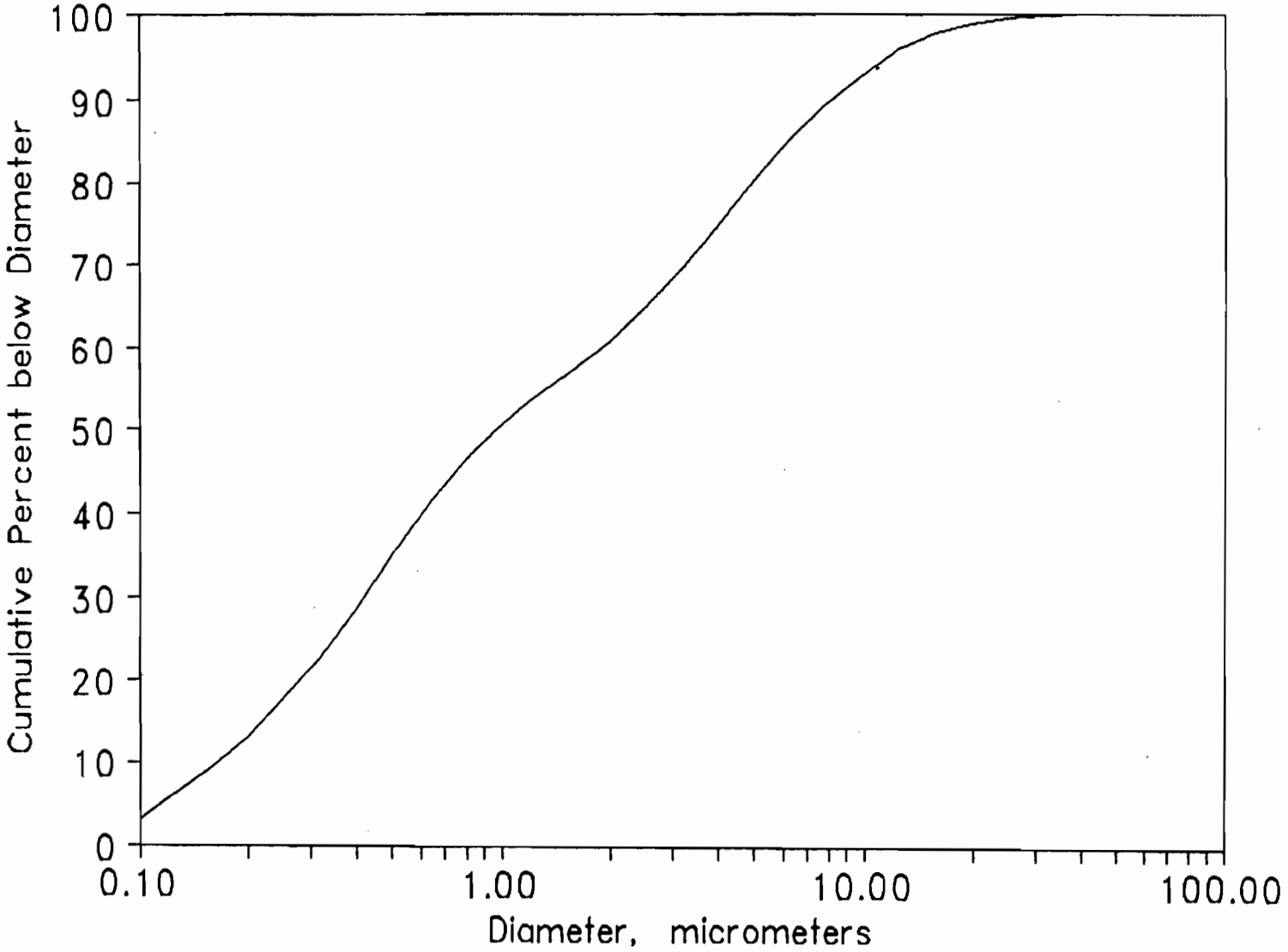
Cumulative Concentration vs. Diameter



Probit vs. Diameter



Cumulative Percent vs. Diameter



INPUT DATA

1)PART. DIAMETER CLASSICAL AERODYNAMIC  
 2)DATE OF TEST: 3/29/91  
 3)TIME OF TEST: 1253  
 4)LOCATION OF TEST: PSN 4 North  
 5)TEST DESIG.: SAN  
 6)TEST TYPE INLET  
 7)RUN NUMBER: 2-FILE NAME:TSANR2.IT  
 8)RUN REMARKS: substrate set 3  
 10)IMPACTOR TYPE: FPUW4-13  
 SRI RAPC UWV 4 5 7 9 11 13

9)WATER VAPOR 14.50%  
 CO2 13.00% CO 0.00%  
 O2 4.00% N2 83.00%

12)ORIFICE ID (OPTIONAL):  
 13)SUBSTRATE MATERIAL: QUARTZ FIBER

1)GAS METER VOL 5.892 CUBIC FEET  
 2)IMPACTOR DELTA P 0.00 IN. HG.  
 3)ORIFICE DELTA P 0.08 INCHES H2O  
 4)STACK PRESSURE -19.0 INCHES H2O  
 5)BAROMETRIC PRES 29.90 INCHES HG  
 6)STACK TEMP 430 DEGREES F  
 7)METER TEMP 82 DEGREES F  
 8)IMPACTOR TEMP 430 DEGREES F  
 9)SAMPLE TIME 30.00 MINUTES  
 10)AVG GAS VEL 64.00 FEET/SEC  
 11)ORI P WRT PBAR -0.01 INCHES HG  
 12)NOZZLE DIA 0.125 INCHES  
 13)MAX PART DIA 1000.0 MICRONS  
 14)WATER VOLUME 0.0 CC  
 15)METER FACTOR 0.9618

MASS GAIN OF STAGE 1 -0.31 MG  
 MASS GAIN OF STAGE 2 1.91 MG  
 MASS GAIN OF STAGE 3 2.29 MG  
 MASS GAIN OF STAGE 4 3.47 MG  
 MASS GAIN OF STAGE 5 4.49 MG  
 MASS GAIN OF STAGE 6 8.07 MG  
 MASS GAIN OF STAGE 7 6.93 MG  
 MASS GAIN OF FILTER 7.73 MG

MASS GAIN OF BLANK SUBSTRATE -0.31  
 MASS GAIN OF BLANK FILTER -0.31

RESULTS

TEST DESIG.: SAN RUN NUMBER: 2

ACTUAL FLOW RATE 0.380 CFM  
 FLOW RATE AT STANDARD CONDITIONS 0.184 CFM  
 PERCENT ISOKINETIC 116.227 %  
 VISCOSITY 244.6E-06 GM/CM-SEC  
 CALCULATED IMPACTOR DELTA P = 2.24 IN. HG

STAGE	CUNN. CORR.	D50 (CLAS AERO)	D50 (IMP AERO)	CUM FREQ.	RE. NO.	V*D50 UM-M/S
1	1.033	9.280	9.433	99.9973	453	13.2
2	1.077	4.014	4.165	94.0072	81	16.3
3	1.122	2.524	2.674	86.9917	103	20.3
4	1.236	1.313	1.459	76.7923	152	23.2
5	1.482	0.664	0.808	63.8407	209	21.1
6	2.098	0.315	0.457	41.2293	392	18.9
7	3.289	0.165	0.300	21.6940	610	15.7

STAGE CUT DIAMETERS BASED ON THEORETICAL VALUES OF STAGE CONSTANTS

TOTAL MASS CONCENTRATION = 2.37E+02 MG/DRY NORMAL CUBIC METER  
 = 1.15E+02 MG/ACTUAL CUBIC METER  
 = 1.04E-01 GRAINS/DRY STD CUBIC FOOT  
 = 5.01E-02 GRAINS/ACTUAL CUBIC FOOT

TEST DESIG.: SAN RUN NUMBER: 2

SPLINE FIT ON CLASSICAL AERODYNAMIC DIAMETER BASIS

PARTICLE DIA. (MICRONS)	CUMFR (STDDEV)	CUMFR (PERCENT)	CUM.MASS (MG/DRY	DM/DLOGD N.CU.METER)
0.100	-1.3279	9.21	2.19E+01	1.48E+02
0.126	-1.0321	15.10	3.58E+01	1.32E+02
0.158	-0.8183	20.66	4.90E+01	1.36E+02
0.200	-0.6170	26.86	6.38E+01	1.58E+02
0.251	-0.4164	33.85	8.03E+01	1.73E+02
0.316	-0.2184	41.36	9.81E+01	1.82E+02
0.398	-0.0252	49.00	1.16E+02	1.79E+02
0.501	0.1570	56.24	1.33E+02	1.63E+02
0.631	0.3210	62.59	1.49E+02	1.37E+02
0.794	0.4612	67.77	1.61E+02	1.11E+02
1.000	0.5857	72.09	1.71E+02	9.67E+01
1.259	0.7086	76.07	1.81E+02	9.34E+01
1.585	0.8420	80.01	1.90E+02	9.22E+01
1.995	0.9832	83.73	1.99E+02	8.30E+01
2.512	1.1232	86.93	2.06E+02	6.87E+01
3.162	1.2746	89.88	2.13E+02	7.90E+01
3.981	1.5424	93.85	2.23E+02	1.06E+02
5.012	2.0265	97.86	2.32E+02	7.14E+01
6.310	2.6947	99.65	2.36E+02	1.85E+01
7.943	3.4783	99.97	2.37E+02	1.83E+00
10.000	4.5554	100.00	2.37E+02	4.71E-02
12.589	6.1495	100.00	2.37E+02	9.27E-06
15.849	7.7442	100.00	2.37E+02	1.43E-10
19.953	9.3400	100.00	2.37E+02	1.72E-16
25.119	10.9375	100.00	2.37E+02	1.60E-23
31.623	12.5374	100.00	2.37E+02	1.12E-31
39.811	14.1410	100.00	2.37E+02	5.75E-41
50.119	15.7495	100.00	2.37E+02	0.00E+00
63.096	17.3648	100.00	2.37E+02	0.00E+00
79.433	18.9893	100.00	2.37E+02	0.00E+00
100.000	20.6266	100.00	2.37E+02	0.00E+00
125.893	22.2818	100.00	2.37E+02	0.00E+00
158.489	23.9623	100.00	2.37E+02	0.00E+00
199.526	25.6801	100.00	2.37E+02	0.00E+00
251.189	27.4551	100.00	2.37E+02	0.00E+00
316.228	29.3229	100.00	2.37E+02	0.00E+00
398.107	31.3550	100.00	2.37E+02	0.00E+00
501.187	33.7181	100.00	2.37E+02	0.00E+00
630.957	36.9121	100.00	2.37E+02	0.00E+00
794.328	43.4371	100.00	2.37E+02	0.00E+00
1000.000		100.00	2.37E+02	0.00E+00

INHALABLE PARTICULATE MATTER

CUM MASS LESS THAN 1.000 MICRON: 171.09 72.0942 %  
CUM MASS LESS THAN 2.512 MICRON: 206.30 86.9345 %  
CUM MASS LESS THAN 10.000 MICRON: 237.31 99.9997 %  
CUM MASS LESS THAN 15.849 MICRON: 237.31 100.0000 %  
NOTE: DIAMETERS FOR INHALABLE PARTICULATE MATTER ARE



LOG-NORMAL APPROXIMATION

LOG-NORMAL SIZE DISTRIBUTION PARAMETERS

LEAST SQUARES LINE:  $Y = 0.76 + 2.35X$   
MASS MEDIAN DIAMETER: 0.474  
GEOMETRIC STANDARD DEVIATION: 2.666  
CORRELATION COEFFICIENT: 0.867

ATTACHMENT TO REPORT NO. SRI-ENV-91-319-7322

ORIMULSION FLY ASH PARTICLE SIZE DISTRIBUTION DATA  
FPL SANFORD UNIT 4 AIR PREHEATER OUTLET  
March 28-29, 1991

Test no. SAN-1, pages 1 - 8  
Test no. SAN-2, pages 9 -16  
Test no. SAN-3, pages 17-24  
Test no. SAN-4, pages 25-32  
Test no. SAN-5, pages 33-40

INPUT DATA

1)PART. DIAMETER CLASSICAL AERODYNAMIC  
 2)DATE OF TEST: 3/28/91  
 3)TIME OF TEST: 1700  
 4)LOCATION OF TEST: PSN 4 North  
 5)TEST DESIG.: SAN  
 6)TEST TYPE INLET  
 7)RUN NUMBER: 1-FILE NAME:TSANR1.IT  
 8)RUN REMARKS: SUBSTRATE 1  
 10)IMPACTOR TYPE: FPUW4-13  
 SRI RAPC UWV 4 5 7 9 11 13

9)WATER VAPOR 14.50%  
 CO2 13.00% CO 0.00%  
 O2 4.00% N2 83.00%  
 12)ORIFICE ID (OPTIONAL):  
 13)SUBSTRATE MATERIAL: QUARTZ FIBER

1)GAS METER VOL 4.898 CUBIC FEET  
 2)IMPACTOR DELTA P 0.00 IN. HG.  
 3)ORIFICE DELTA P 0.09 INCHES H2O  
 4)STACK PRESSURE -19.0 INCHES H2O  
 5)BAROMETRIC PRES 29.90 INCHES HG  
 6)STACK TEMP 400 DEGREES F  
 7)METER TEMP 82 DEGREES F  
 8)IMPACTOR TEMP 400 DEGREES F  
 9)SAMPLE TIME 30.00 MINUTES  
 10)AVG GAS VEL 64.00 FEET/SEC  
 11)ORI P WRT PBAR -0.01 INCHES HG  
 12)NOZZLE DIA 0.125 INCHES  
 13)MAX PART DIA 1000.0 MICRONS  
 14)WATER VOLUME 0.0 CC  
 15)METER FACTOR 1.0697

MASS GAIN OF STAGE 1 2.08 MG  
 MASS GAIN OF STAGE 2 5.03 MG  
 MASS GAIN OF STAGE 3 3.12 MG  
 MASS GAIN OF STAGE 4 3.13 MG  
 MASS GAIN OF STAGE 5 3.43 MG  
 MASS GAIN OF STAGE 6 6.13 MG  
 MASS GAIN OF STAGE 7 4.04 MG  
 MASS GAIN OF FILTER 4.57 MG

MASS GAIN OF BLANK SUBSTRATE -0.57  
 MASS GAIN OF BLANK FILTER 0.00