Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP-42 Section 11.5
Reference
Report Sect. 4
Reference

NSPS DEVELOPMENT
PARTICULATE, SULFUR DIOXIDE, AND NITOGEN OXIDES EMISSIONS AND PARTICLE SIZING TESTING
#4 ROTARY CALCINER

[redacted]

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Post Office Box 12291
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68-02-3852
[redacted]
EMB Project No. 81/08
[redacted]

Task Manager

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OFFICE OF AIR QUALITY PLANNING AND STANDARDS
OFFICE OF AIR, NOISE, AND RADIATION
U. S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, N. C., 27711

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1. INTRODUCTION

1.1 Background. The Emission Measurement Branch (EMB) of the United States Environmental Protection Agency (EPA) is directing a project designed to generate support data for New Source Performance Standards (NSPS) for calciners and dryers in the mineral industries. Emission standards for the various industries may be developed based upon process-related emission factors determined from the testing of controlled sources.

1.2 Scope of the Project. The EMB is responsible for coordinating the efforts of Entropy and Midwest Research Institute (MRI) to achieve the goals of the testing program. Entropy has been retained under the EMB Contract No. 68-02-3852, Work Assignment [redacted] to conduct testing programs at designated industrial facilities. Entropy is to perform emission measurements at the recommended sampling locations, obtain process feed and product samples, and, in conjunction with Research Triangle Institute (RTI), conduct sample analyses. MRI will monitor process and operating conditions in order to designate suitable testing conditions for the respective processes and to provide a record of process and operational data during the testing.

1.3 [redacted] Testing Program. The present report covers stationary source sampling performed at the [redacted] Plant in [redacted] on [redacted] to characterize emissions from the #4 rotary calciner and associated air pollution control equipment. [redacted] and [redacted] of [redacted] and Dennis Holzschuh of EPA EMB were present to coordinate the testing. Amy J. Kowalski of MRI monitored the plant process and recorded operational data during the testing.

1.3.1 Source Applicability. The [redacted] plant uses rotary calciners for the drying of pulverized or extruded clay. The plant's use of coal-fired rotary calciners represents the most difficult emissions control situation in the clay refining industry. The plant is considered to be well operated and well maintained, as well as providing feasible opportunities for inlet testing.

1.3.2 Outline of Testing Program. Emission measurements were performed at the multiclone inlet, at the I.D. fan inlets (east & west) and at the scrubber exhaust stack. Table 1-1 outlines the testing program, giving test dates, sampling locations, test methods, and run numbers.

TABLE 1-1

TESTING PROTOCOL AND

RUN/SAMPLE NUMBERING CROSS-REFERENCE

Sampling			Test Set		
Objective	Method	Location*	4/17	4/17	4/18
Particulate	EPA 5	MI	1	2tm	3
		IE	4	5tm	6
		IW	7	8tm	9
Particulate/ Sulfur Dioxide	EPA 5 & 8	SE	10	11tm	12
Particle Sizing	Cascade Impactor	MI	S1A&B	S2A&B	S3A&B
		IE	S4A&B	S5A&B	S6A&B
		IW	S7A&B**	S8A&B	S9A&B**
Nitrogen Oxides	EPA 7	SE	10	11	12
Sieving/ Moisture	Grab Sample	CI	1	2	3
		VP	1	2	3
		VM	1	2	3
Opacity	EPA 9	SE	1	2	3

tm Method 5 particulate catch and distilled water from impingers analyzed for trace metals

* Sampling Location Legend:
- MI - Multiclone Inlet
- IE - I.D. Fan Inlet East
- IW - I.D. Fan Inlet West
- SE - Scrubber Exhaust Stack
- CI - Calciner Inlet
- VM - Vibrating Grate Cooler Multiclone Outlet
- VP - Vibrating Grate Cooler Product Outlet

** The results of runs S7B and S9B are not tabulated in this report. Run S7B was underloaded; run S9B was overloaded.

1.4 Report Organization. Immediately following is the "Summary of Results" section. Appendix 7.1 presents the complete results of each run; field data can be found in Appendix 7.2. The source and the process are described in the "Process Description and Operation" section. The next section, "Sampling Locations" provides a comprehensive description and illustration for each location; "Sampling and Analytical Procedures" follows, describing the sampling strategy used. Descriptions of the equipment and procedures can be found in Appendix 7.3, while Appendix 7.4 presents analytical documentation. The final section, "Quality Assurance," notes the procedures used to ensure the integrity of the sampling program; Appendix 7.6 provides pertinent calibration data. Appendix 7.5 contains a listing of the Entropy test participants and their roles in the testing program.

2. SUMMARY AND DISCUSSION OF RESULTS

2.1 Summary. Table 2-1 presents a summary of the particulate and sulfur dioxide emissions and concentrations at the sampled locations, as well as particulate collection efficiencies for the multiclone. Run-by-run summaries of the particulate testing are provided for the multiclone inlet and for the I.D. fans east and west in Tables 2-2 through 2-4, respectively. Table 2-5 summarizes the results of particulate and sulfur dioxide testing performed at the scrubber exhaust stack. Detailed results of all particulate and sulfur dioxide testing appear in Appendix 7.1.1.

Tables 2-6 through 2-8 present the particle sizing test results for each of the sampled locations; particle sizing was not performed at the scrubber exhaust stack due to moisture in the flue gas. Appendix 7.1.2 presents the detailed results of particle size testing.

Nitrogen oxides (as NO_2) results are summarized in Table 2-9; complete results are given in Appendix 7.1.3.

Opacity observations (runs 1-3) are reported in Tables 2-10, 2-11, and 2-12. No visible emissions were observed throughout the testing; field data is presented in Appendix 7.2.3.

The results of trace metals analyses are reported in Appendix 7.2.5.

2.2 Discussion of Results. At the I.D. fan inlet west location, particle sizing runs 7B and 9B were not tabulated in the results due to an extremely low catch (underloaded), and extremely large catch (overloaded), respectively.

In order to calculate particulate removal efficiencies of the multiclone and scrubbers, a particulate concentration representing a combined inlets value is necessary. A technique for eliminating any bias due to uneven air flow distribution through the two fans was used in calculating the equivalent, weighted average concentrations as follows:

$$C_{eq} = \frac{\text{Sum of A-Side \& B-Side Emissions, lb/hr}}{\text{Sum of A-Side \& B-Side Flow Rates, SCFM}} * \frac{7{,}000 \text{ gr/lb}}{60 \text{ min/hr}} = \text{gr/DSCF for combined inlets}$$

$$C_{eq_{Runs\ 4\&7}} = \frac{554.15 + 463.07}{14{,}717 + 14{,}747} * \frac{7{,}000}{60} = 4.0278 \text{ gr/DSCF}$$

TABLE 2-1

PARTICULATE EMISSIONS & CONCENTRATIONS SUMMARY

AND CONTROL EQUIPMENT EFFICIENCIES

	Test Set 1	Test Set 2	Test Set 3	Average
Emission Rates, lb/Hr:				
Multiclone Inlet	2,192.95	2,361.38	1,947.90	2,167.41
I.D. Fan Inlet, East	554.15	564.37	553.04	557.18
I.D. Fan Inlet, West	463.07	471.38	458.11	464.18
Scrubber Stack	8.37	8.08	8.98	8.48
Concentration, Gr/DSCF:				
Multiclone Inlet	7.5227	8.2405	7.1672	7.6434
I.D. Fan Inlet, East	4.3930	4.3858	4.1514	4.31
I.D. Fan Inlet, West	3.6634	3.7308	3.7454	3.7132
Equivalent I.D. Fan Inlet	4.0278	4.0614	3.9570	4.0154
Scrubber Stack	0.0336	0.0315	0.0344	0.0331
Collection Efficiency, %:				
Multiclone	46.46	50.72	44.79	47.32
Scrubber	99.16	99.21	99.14	99.17
Emission Rates, Kg/Hr:				
Multiclone Inlet	994.7	1,071.1	883.5	983.1
I.D. Fan Inlet, East	251.4	256.0	250.9	252.7
I.D. Fan Inlet, West	210.0	213.8	207.0	210.0
Scrubber Stack	3.80	3.67	4.07	3.85
Concentration, mg/DSCM:				
Multiclone Inlet	17,212	18,855	16,399	17,489
I.D. Fan Inlet, East	10,051	10,035	9,499	9,862
I.D. Fan Inlet, West	8,382	8,537	8,570	8,496
Scrubber Stack	76.89	72.12	78.77	75.93

TABLE 2-2

PARTICULATE TESTS SUMMARY OF RESULTS

Multiclone Inlet

	1	2	3
Run Date	04/17/84	04/17/84	04/18/84
Test Train Parameters:			
Volume of Dry Gas Sampled, SCF*	31.526	29.831	30.040
Percent Isokinetic	107.5	103.5	109.9
Stack Parameters:			
Temperature, Deg. F	593	601	602
Air Flow Rates SCFM*, Dry	34,010	33,432	31,708
ACFM, Wet	78,921	78,066	73,375
Method 5 Results (English):			
Catch, milligrams	15,367.5	15,929.3	13,951.5
Concen., grains/DSCF*	7.5227	8.2405	7.1672
Emissions, pounds/hour	2,192.95	2,361.38	1,947.90
Method 5 Results (Metric):			
Concen., milligrams/DSCM*	17,212.4	18,855.4	16,399.4
Emissions, kilograms/hour	994.7	1071.1	883.5

* 68 Deg. F. - 29.92 in. Hg.

TABLE 2-3

PARTICULATE TESTS SUMMARY OF RESULTS

I.D. Fan Inlet, East Side

	4	5	6
Run Date	[redacted]/84	[redacted]/84	[redacted]/84
Test Train Parameters:			
Volume of Dry Gas Sampled, SCF*	25.334	26.926	27.172
Percent Isokinetic	102.4	106.7	104.0
Stack Parameters:			
Temperature, Deg. F	549	545	555
Air Flow Rates SCFM*, Dry	14,717	15,013	15,542
ACFM, Wet	33,312	33,970	34,752
Method 5 Results (English):			
Catch, milligrams	7,211.5	7,652.4	7,309.4
Concen., grains/DSCF*	4.3930	4.3858	4.1514
Emissions, pounds/hour	554.15	564.37	553.04
Method 5 Results (Metric):			
Concen., milligrams/DSCM*	10,051.4	10,035.4	9,498.8
Emissions, kilograms/hour	251.4	256.0	250.9

* 68 Deg. F. - 29.92 in. Hg.

TABLE 2-4

PARTICULATE TESTS SUMMARY OF RESULTS

I.D. Fan Inlet, West Side

	7	8	9
Run Date	[redacted]/84	[redacted]/84	[redacted]/84
Test Train Parameters:			
Volume of Dry Gas Sampled, SCF*	27.582	26.633	25.955
Percent Isokinetic	105.6	102.0	102.7
Stack Parameters:			
Temperature, Deg. F	543	539	545
Air Flow Rates SCFM*, Dry	14,747	14,740	14,270
ACFM, Wet	33,246	33,331	32,223
Method 5 Results (English):			
Catch, milligrams	6,547.5	6,438.7	6,299.2
Concen., grains/DSCF*	3.6634	3.7308	3.7454
Emissions, pounds/hour	463.07	471.38	458.11
Method 5 Results (Metric):			
Concen., milligrams/DSCM*	8,382.2	8,536.6	8,569.8
Emissions, kilograms/hour	210.0	213.8	207.0

* 68 Deg. F. - 29.92 in. Hg.

TABLE 2-5

PARTICULATE AND SULFUR DIOXIDE TESTS SUMMARY OF RESULTS

Scrubber Stack

	10	11	12
Run Date	[redacted]/84	[redacted]/84	[redacted]/84
Test Train Parameters:			
Volume of Dry Gas Sampled, SCF*	88.220	91.896	91.630
Percent Isokinetic	99.0	100.2	98.2
Stack Parameters:			
Temperature, Deg. F	140	140	141
Air Flow Rates SCFM*, Dry	29,064	29,915	30,432
ACFM, Wet	41,994	43,217	43,558
Method 5 Results (English):			
Catch, milligrams	192.1	187.7	204.4
Concen., grains/DSCF*	0.0336	0.0315	0.0344
Emissions, pounds/hour	8.37	8.08	8.98
Method 5 Results (Metric):			
Concen., milligrams/DSCM*	76.8895	72.1231	78.768
Emissions, kilograms/hour	3.80	3.66	4.07
Method 8 Sulfur Dioxide (English):			
Catch, Milligrams	2,871.8	3,006.8	2,772.0
Concen., ppm by vol., dry	432.06	434.27	401.52
Emission, pounds/hour	125.15	129.48	121.78

(continued on next page)

TABLE 2-5

PARTICULATE AND SULFUR DIOXIDE TESTS SUMMARY OF RESULTS

Scrubber Stack

(continued)

	10	11	12
Run Date	[redacted]/84	[redacted]/84	[redacted]/84
Method 8 Sulfur Dioxide (Metric):			
Concen., milligrams/DSCM*	1,149.46	1,155.35	1,068.22
Emissions, kilograms/hour	56.77	58.73	55.24

* 68 Deg. F. - 29.92 in. Hg.

TABLE 2-6

SUMMARY OF PARTICLE SIZING TEST RESULTS

Multiclone Inlet

SAMPLING DATA	PS Run 1	PS Run 2	PS Run 3	Average
Date	[redacted]/84	[redacted]/84	[redacted]/84	---
Start Time	1323,1412	1751,1846	1401,1434	---
Finish Time	1325,1413	1753,1847	1403,1436	---
Impactor Flow Rate (l/min)	21.90	21.90	15.30	---
Isokinetic Ratio (%)	108.5	105.3	103.9	---
STACK DATA				
Temperature (degrees C)	309	322	320	317
Moisture (%)	12.3	12.2	11.6	12.0
Velocity (m/min)	643.4	650.1	471.1	588.2
EMISSION DATA				
Concentration (mg/dscm)	13,297	6,655	8,019	9,324
Percent Recovery (PS conc./ M-5 conc.)	62.0	32.0	44.0	46.0
Cumulative % Mass less than 10 microns	42.0	58.0	34.0	45.0
Concentration < 10 microns: From PS runs, mg/dscm	5,670	3,850	2,600	4,040
From M-5 runs, mg/dscm	8,996	12,116	6,164	9,091
Emission Rate < 10 microns (kg/hr, from M-5 runs)	418	621	300	446

PS: Particle Size Run
M-5: Method 5 Particulate Run

PARTICLE SIZE DISTRIBUTION

COMPANY NAME [redacted] Plant

ADDRESS [redacted]

SAMPLING LOCATION Multiclone Inlet

DATE(S) [redacted]84 , [redacted]84

AVERAGE OF RUNS 1a,1b,2a,2b, / 3a,3b

DENSITY = 1 GM/CM^3

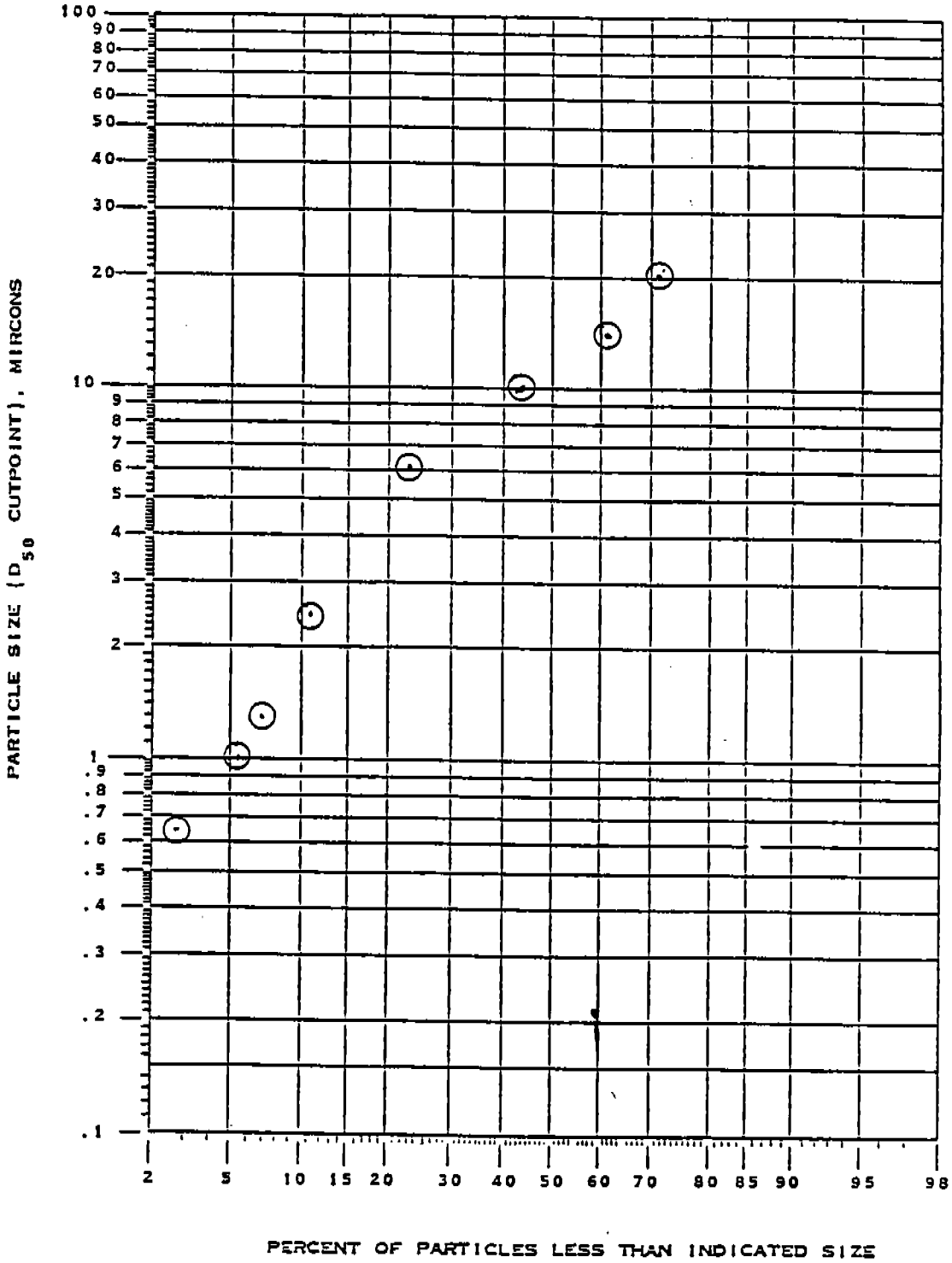


TABLE 2-7

SUMMARY OF PARTICLE SIZING TEST RESULTS

I.D. Fan Inlet, East Side

SAMPLING DATA	PS Run 4	PS Run 5	PS Run 6	Average
Date	[redacted]84	[redacted]84	[redacted]/84	---
Start Time	1243,1258	1745,1755	1414,1424	---
Finish Time	1247,1302	1747,1757	1416,1426	---
Impactor Flow Rate (l/min)	17.70	17.10	17.60	---
Isokinetic Ratio (%)	103.8	105.9	110.7	---
STACK DATA				
Temperature (degrees C)	289	281	294	288
Moisture (%)	13.1	13.4	11.8	12.8
Velocity (m/min)	538.4	528.5	661.5	576.1
EMISSION DATA				
Concentration (mg/dscm)	8,777	9,406	8,884	9,022
Percent Recovery (PS conc./ M-5 conc.)	87.0	94.0	93.0	91.0
Cumulative % Mass less than 10 microns	47.0	47.0	32.0	42.0
Concentration < 10 microns: From PS runs, mg/dscm	4,120	4,400	2,770	3,763
From M-5 runs, mg/dscm	4,724	4,716	2,944	4,121
Emission Rate < 10 microns (kg/hr, from M-5 runs)	118	120	78	105

PS: Particle Size Run
M-5: Method 5 Particulate Run

PARTICLE SIZE DISTRIBUTION

COMPANY NAME [redacted] a Plant

ADDRESS [redacted] a

SAMPLING LOCATION I.D. Fan Inlet East-side

DATE(S) [redacted] 84, [redacted] 84

AVERAGE OF RUNS 4a,4b,5a,5b, 6a,6b

DENSITY = 1 GM/CM^3

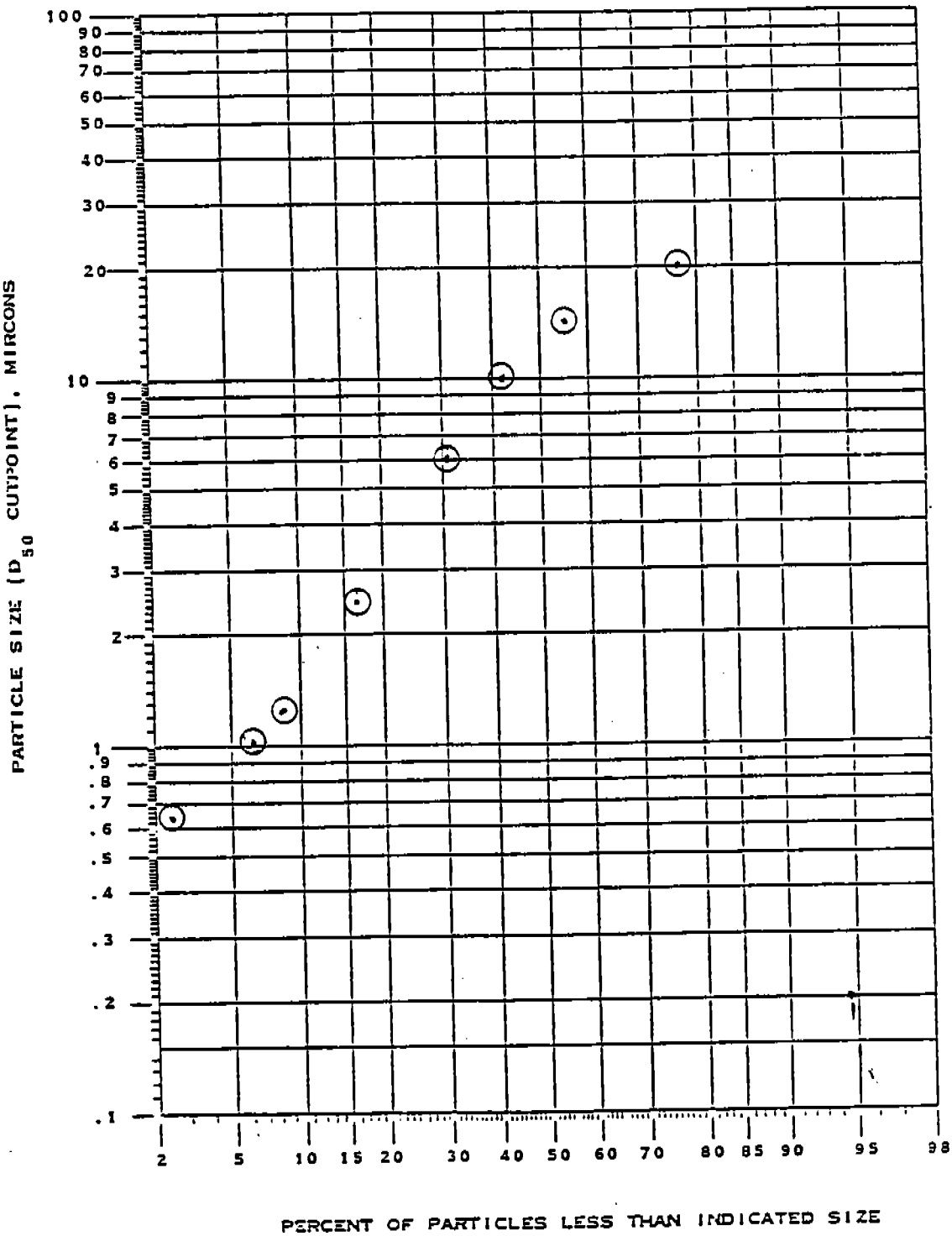


TABLE 2-8

SUMMARY OF PARTICLE SIZING TEST RESULTS

I.D. Fan Inlet, West Side

SAMPLING DATA	PS Run 7	PS Run 8	PS Run 9	Average
Date	[redacted]/84	[redacted]/84	[redacted]/84	---
Start Time	1350	1833,1857	1454	---
Finish Time	1352	1835,1859	1456	---
Impactor Flow Rate (l/min)	30.00	23.80	14.80	---
Isokinetic Ratio (%)	109.3	109.9	108.4	---
STACK DATA				
Temperature (degrees C)	293	286	279	286
Moisture (%)	13.3	13.9	13.6	13.6
Velocity (m/min)	852.4	682.9	423.2	652.8
EMISSION DATA				
Concentration (mg/dscm)	6,191	6,241	5,273	5,902
Percent Recovery (PS conc./ M-5 conc.)	74.0	73.0	62.0	70.0
Cumulative % Mass less than 10 microns	72.0	55.0	46.0	57.0
Concentration < 10 microns: From PS runs, mg/dscm	4,429	3,430	2,425	3,428
From M-5 runs, mg/dscm	5,951	4,695	3,942	4,862
Emission Rate < 10 microns (kg/hr, from M-5 runs)	149	118	96	121

PS: Particle Size Run
M-5: Method 5 Particulate Run

PARTICLE SIZE DISTRIBUTION

COMPANY NAME [redacted]nt

ADDRESS [redacted]gia

SAMPLING LOCATION I.D. Fan Inlet West-side

DATE(S) [redacted]84, [redacted]84

AVERAGE OF RUNS 7a,8a,8b,9a

DENSITY = 1 GM/CM^3

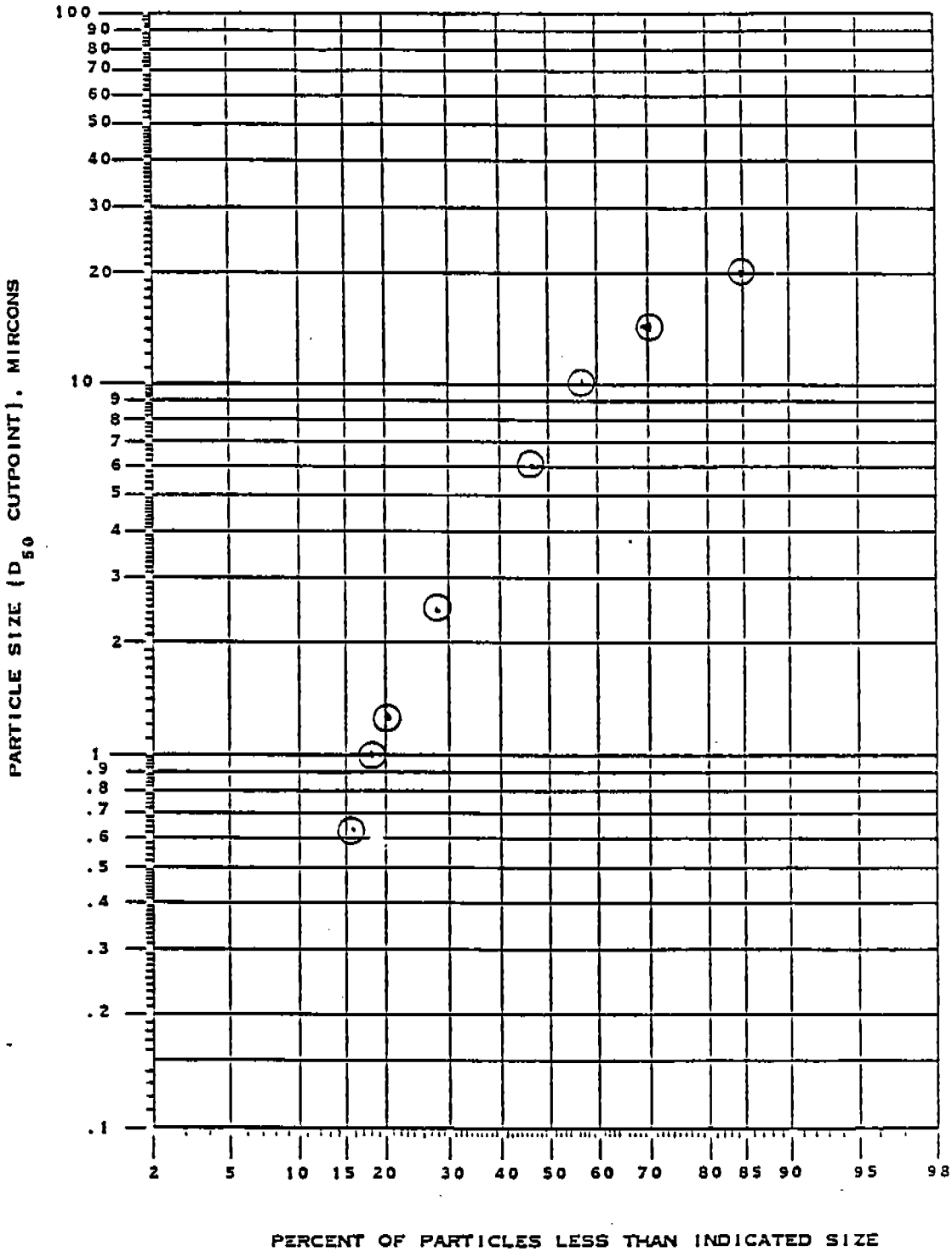


TABLE 2-9

NITROGEN OXIDES (AS NO_2) EMISSION RATES & CONCENTRATIONS

SUMMARY OF RESULTS

Scrubber Stack

	Run Numbers		
	10	11	12
Run Date	[redacted]/84	[redacted]/84	[redacted]84
Sample Number	10A-10D	11A-11D	12A-12D
Parameters per Run:			
Air Flow Rate, dry SCFM	29,060	29,920	30,430
Nitrogen Oxides (as NO2) Results:			
Concentration, ppm, dry	265.5	311.4	321.0
Emissions, Lb/Hr	55.2	66.7	69.9

TABLE 2-10

SUMMARY OF VISIBLE EMISSIONS

Run 1

Date: [redacted]/84
Type of Discharge: Stack
Height of Point of Discharge: 120'
Wind Direction: West-North-West
Color of Plume: White
Observer No.:
Type of Plant: Clay
Location of Discharge: Multiclone
Description of Sky: Partly Cloudy
Wind Velocity: 8-12
Detached Plume: No
Duration of Observation: 197 min.
Distance from Observer to Discharge Point: 950'
Direction of Observer from Point: South
Height of Observation Point: Ground level
Description of Background: Partly Cloudy

SUMMARY OF AVERAGE OPACITY

Set	Time		Opacity		Set	Time		Opacity	
Number	Start	End	Sum	Average	Number	Start	End	Sum	Average
1	0958	1004	0	0	13	1210	1216	0	0
2	1004	1010	0	0	14	1216	1222	0	0
3	1010	1016	0	0	15	1222	1228	0	0
4	1016	1022	0	0	16	1228	1234	0	0
5	1022	1028	0	0	17	1234	1240	0	0
6	1028	1034	0	0	18	1240	1246	0	0
7	1034	1040	0	0	19	1246	1252	0	0
8	1040	1046	0	0	20	1252	1258	0	0
9	1046	1152	0	0	21	1258	1304	0	0
10	1152	1158	0	0	22	1304	1310	0	0
11	1158	1204	0	0	23	1310	1315	0	0
12	1204	1210	0	0					

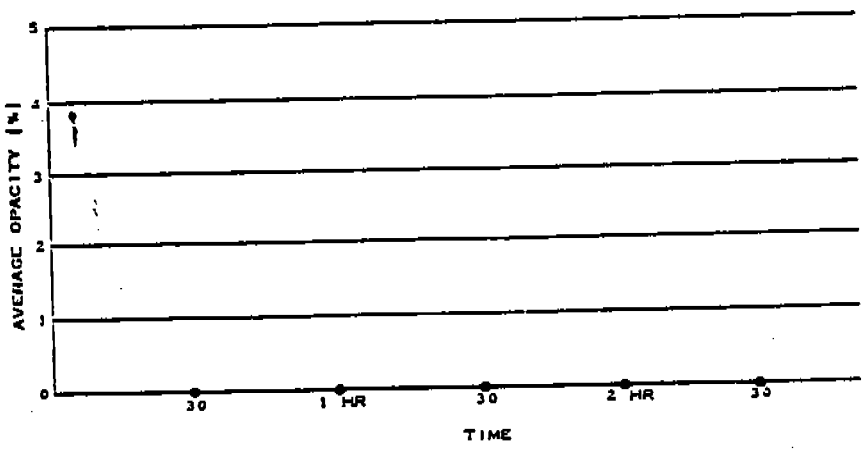


TABLE 2-11

SUMMARY OF VISIBLE EMISSIONS

Run 2

Date: [redacted]/84
Type of Plant: Clay
Type of Discharge: Stack
Location of Discharge: Multiclone
Height of Point of Discharge: 120'
Description of Sky: Partly Cloudy
Wind Direction: West-North-West
Wind Velocity: 12-15
Color of Plume: White
Detached Plume: No
Observer No.:
Duration of Observation: 150 min.
Distance from Observer to Discharge Point: 800'
Direction of Observer from Point: South
Height of Observation Point: Ground level
Description of Background: Partly Cloudy

SUMMARY OF AVERAGE OPACITY

Set	Time		Opacity		Set	Time		Opacity	
Number	Start	End	Sum	Average	Number	Start	End	Sum	Average
1	1500	1506	0	0	15	1624	1630	0	0
2	1506	1512	0	0	16	1630	1636	0	0
3	1512	1518	0	0	17	1636	1642	0	0
4	1518	1524	0	0	18	1642	1646	0	0
5	1524	1530	0	0	19	1646	1652	0	0
6	1530	1536	0	0	20	1652	1658	0	0
7	1536	1542	0	0	21	1658	1704	0	0
8	1542	1548	0	0	22	1704	1710	0	0
9	1548	1554	0	0	23	1710	1716	0	0
10	1554	1600	0	0	24	1716	1722	0	0
11	1600	1606	0	0	25	1722	1728	0	0
12	1606	1612	0	0	26	1728	1730	0	0
13	1612	1618	0	0					
14	1618	1624	0	0					

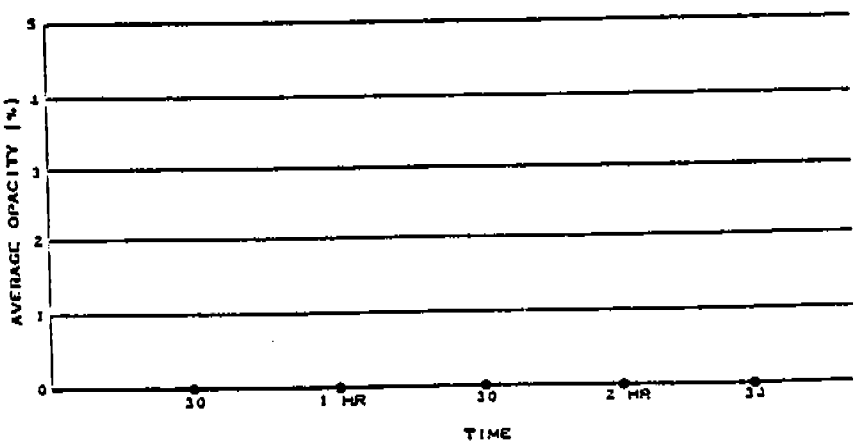


TABLE 2-12

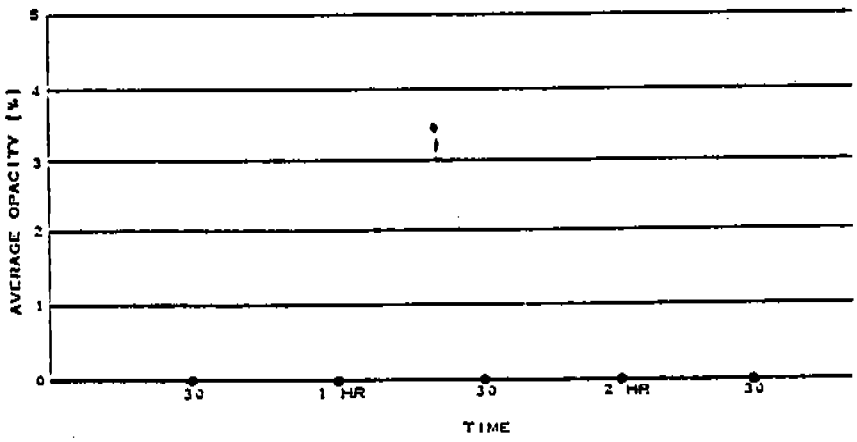
SUMMARY OF VISIBLE EMISSIONS

Run 3

Date: [redacted]/84
Type of Discharge: Stack
Height of Point of Discharge: 120'
Wind Direction: West-North-West
Color of Plume: White
Observer No.:
Type of Plant: Clay
Location of Discharge: Multiclone
Description of Sky: Clear
Wind Velocity: 8-10
Detached Plume: No
Duration of Observation: 150 min.
Distance from Observer to Discharge Point: 800'
Direction of Observer from Point: South
Height of Observation Point: Ground level
Description of Background: Clear

SUMMARY OF AVERAGE OPACITY

Set	Time		Opacity		Set	Time		Opacity	
Number	Start	End	Sum	Average	Number	Start	End	Sum	Average
1	1203	1209	0	0	13	1315	1321	0	0
2	1209	1215	0	0	14	1321	1327	0	0
3	1215	1221	0	0	15	1327	1333	0	0
4	1221	1227	0	0	16	1333	1339	0	0
5	1227	1233	0	0	17	1339	1345	0	0
6	1233	1239	0	0	18	1345	1351	0	0
7	1239	1245	0	0	19	1357	1403	0	0
8	1245	1251	0	0	20	1403	1409	0	0
9	1251	1257	0	0	21	1409	1415	0	0
10	1257	1303	0	0	22	1415	1421	0	0
11	1303	1309	0	0	23	1421	1427	0	0
12	1309	1315	0	0	24	1427	1433	0	0



STATEMENT OF CONFIDENTIALITY

All information referenced in the Process Description as (Confidential Addendum No. 1 through No. 7) have been deemed confidential by the [redacted] Plant officials. Due to this fact, this information has been deleted from the final report and put under separate cover. Pending determination by the Environmental Protection Agency of the confidentiality of this information, they have been submitted as described to us for official entry into our confidential files.

3. PROCESS DESCRIPTION AND OPERATION

3.1 Production of Calciner Feed.

3.1.1 Raw Material. A simplified process flow diagram representative of plant operations is shown in Figure 3-1. Kaolinitic clays are obtained from nearby mining operations, transported to the plant by truck, and deposited in outside storage piles. Various clays are withdrawn from storage piles and mixed in predetermined proportions to obtain the desired product composition and properties. (See Confidential Addendum, No. 1, for a description of processing methods).

3.1.2 Fuel. The fuel used in this operation is natural gas. No. 2 fuel oil is a standby fuel.

3.1.3 Pellet Formation. The clay is pulverized (see Confidential Addendum, No. 2, for particle size information) in a roller mill swept with heated air. The pulverized clay produced by the roller mill is mixed with water in a pug mill, and the mixture is extruded to form 1.3 to 2.5 cm (0.5 to 1 in.) diameter pellets (referred to as "noodles") of varying lengths up to about 0.6 m (2 ft.).

Some of the raw material bypasses the mills and is only processed through the pug mill and extruder before being calcined. [redacted] (and [redacted], a product very similar to [redacted] in composition) are produced using the bypass method. [redacted] personnel believe these bypass materials generate the most difficult to control emissions. [redacted] was being processed during the testing).

3.1.4 Pellet Drying. Pellets produced by the extruder are dried on a moving pan dryer (natural gas is used as fuel). This pellet dryer dries only the surface of the pellets so that they do not stick together and their handling properties are improved. The moisture content of the dried pellets is 20 to 22 percent, and they have a loose fill density of 1,600 to 1,760 kg/m^3 (100 to 110 lb/ft^3). The average water evaporation rate for the pellet dryer is about 1,810 kg/h (4,000 lb/h).

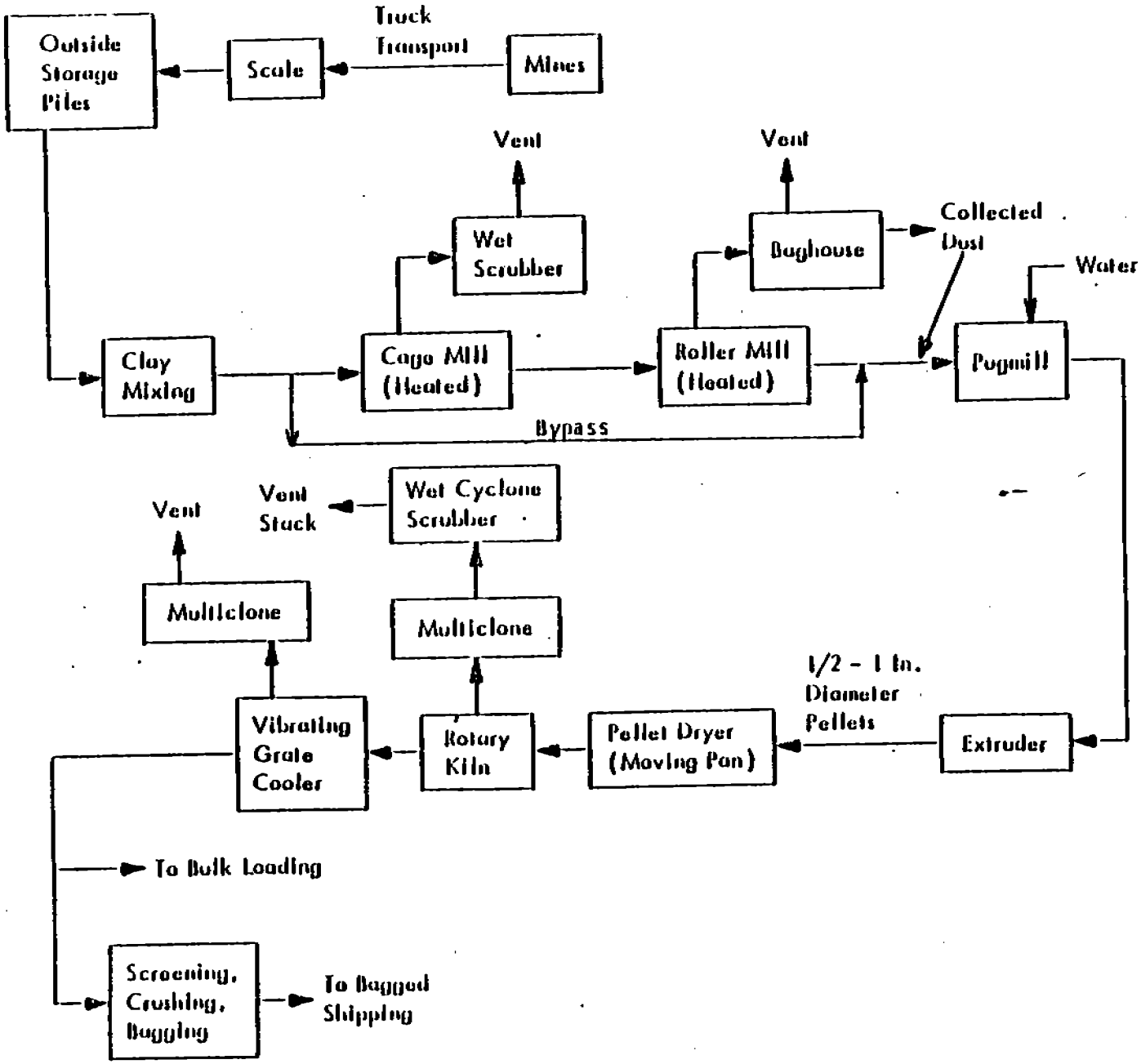


Figure 3-1. Simplified process flow diagram for [redacted] plant at [redacted]

3.1.5 Pellets as Feed. As shown in Figure 3-1, dried pellets are used as feed material for the rotary calciner (kiln) and vibrating-grate cooler system. The operations described above for mixing, fine grinding, and extruding the clay are all designed to effect intimate contact of the clay particles and to promote a chemical reaction that produces mullite during calcining. All moisture and other volatile matter are removed during calcining. The chemical reactions are as follows:

$$Al_2O_3 - 2SiO_2 - 2H_2O \xrightarrow{\text{Heat}} Al_2O_3 - 2SiO_2 + 2H_2O$$

$$3\,(Al_2O_3 - 2SiO_2) \xrightarrow{\text{Heat}} \underbrace{3Al_2O_3 - 2SiO_2}_{\text{Mullite}} + 4SiO_2$$

Pellets produced using the bypass method contain particles that are less uniform in size than those produced with the additional milling. This causes them to break apart more during calcining, thus making emissions from bypass materials more difficult to control than the emissions from other mullite products.

3.2 Calcining Process.

3.2.1 Kilns. [redacted] operates seven identical rotary kilns in [redacted] and each kiln is operated at its design capacity. Data for the rotary kiln equipment is shown in Table 3-1. The kilns are operated continously throughout the year except for occasions when a shutdown is necessary to repair equipment. The maximum kiln temperature is 1540° to 1760°C (2800° to 3200°F) and the heat application method is counterflow. The pulverized coal used as fuel has a heating value of about 30,260 kJ/kg (13,000 Btu/lb) and contains 5 to 6 percent ash and less than 1 percent sulfur.

3.2.2 Calcine. The hot calcine discharged from the rotary kiln is fed to a vibrating-grate cooler (see Confidential Addendum, No. 3, for cooler

TABLE 3-1. DATA FOR ROTARY KILNS USED AT [redacted] PLANTS AT [redacted]

Equipment dimensions	8 ft dia. by 150 ft long
Design production capacity	(See Confidential Addendum, No. 5)
Method of determining actual production rate	Electronic scale on conveyor feed belt
Hours of operation	
Hours/day	24
Hours/week	168
Hours/year	8,760
Retention time (min)	120
Maximum kiln temperature (°F)	2,800 to 3,200
Heat application method	Counterflow
Fuel used	Coal (pulverized)
Fuel to product ratio (ton/ton)	(See Confidential Addendum, No. 6)
Feed moisture content (%)	20-22
Feed particle size	½ to 1 in. dia. pellets
Feed density, loose fill (lb/ft³)	100-110
Product moisture content (%)	0
Effect of over-calcining	Reduces quality
Heat recovery system	~ 80% of exhaust air from cooler used as secondary air for kiln
Normal life of rotary kiln (yr)	50
Maintenance and repair practices	Good preventive maintenance; scheduled shutdowns for repairs as necessary. Patching of refractory lining is infrequently required.

dimensions). The clay pellets are moved through the cooler by the horizontal vibration of the bed along the longitudinal axis. (See Confidential Addendum, No. 4, for a description of cooler operation).

3.2.3 Exhaust Emissions. Air passes upward through the grate and the vibrating bed of calcine. About 80 percent of the air leaving the cooler is sent to the discharge end of the rotary kiln as secondary air for that unit. The remainder of the air from the cooler is ducted through a multiclone collector, an induced draft fan, and a vent stack. Exhaust gases from the rotary kiln are ducted through a multiclone collector (manufactured by Zurn Industries), an exhaust fan, a venturi scrubber, and a vent stack to the atmosphere. (See Confidential Addendum, No. 7, for vent stack dimensions).

3.2.4 Control Equipment. At the inlet to the scrubber the gas temperature is about 316°C (600°F). This scrubber is constructed of 316 low-carbon stainless steel. Sulfur in the clay and coal results in acid buildup in the scrubber water and causes corrosion problems. A system for adding calcium oxide (CaO) to the scrubber water has recently been installed. The water flow rate to the scrubber is 1,363 l/min (360 gpm). The pressure drop across the scrubber is 4.5 kPa (18 in. w.c.). The design efficiency of the wet scrubber is greater than 90 percent.

4. SAMPLING LOCATIONS

4.1 Suitability of Sampling Sites. The primary goal of the testing program was to characterize emissions from the #4 rotary calciner dryer. Additionally, physical properties of the process feed stock and the product were investigated. Sampling sites appropriate to these objectives were approved prior to testing. Each sampling location is discussed individually, and the position of each site within the system is illustrated in Figure 4-1.

4.2 Rotary Calciner Feed Inlet (Sampling Location A). Grab samples of the feed to the rotary calciner were collected for sieve analysis and moisture content determination. Samples were taken during each set of simultaneous Method 5 runs.

4.3 Vibrating Grate Cooler Product Outlet (Sample Location B). Grab samples of the product were collected for sieve analysis and moisture content determination. Samples were taken during each set of simultaneous Method 5 runs.

4.4 Vibrating Grate Cooler Multiclone Outlet (Sample Location G). Grab samples of the product were collected for sieve analysis and moisture content determination. Samples were taken during each set of simultaneous Method 5 runs.

4.5 Multiclone Inlet (Sampling Location C). Particulate emissions and particle size distribution testing was conducted in the 55-inch by 95-inch expansion flume. Four sampling ports were positioned 40 feet from the ground, 7.6 feet from the nearest upstream disturbance and 4.7 feet from the nearest downstream disturbance. A schematic of the sampling location is shown in Figure 4-2.

Particulate sampling was done using 24 points (i.e. six points located on four traverse axes); each point was sampled for 2.5 minutes, resulting in a total test time of 60 minutes.

Particle size runs were performed for either 1.5 or 2 minutes. During each run, two points were sampled for equal lengths of time.

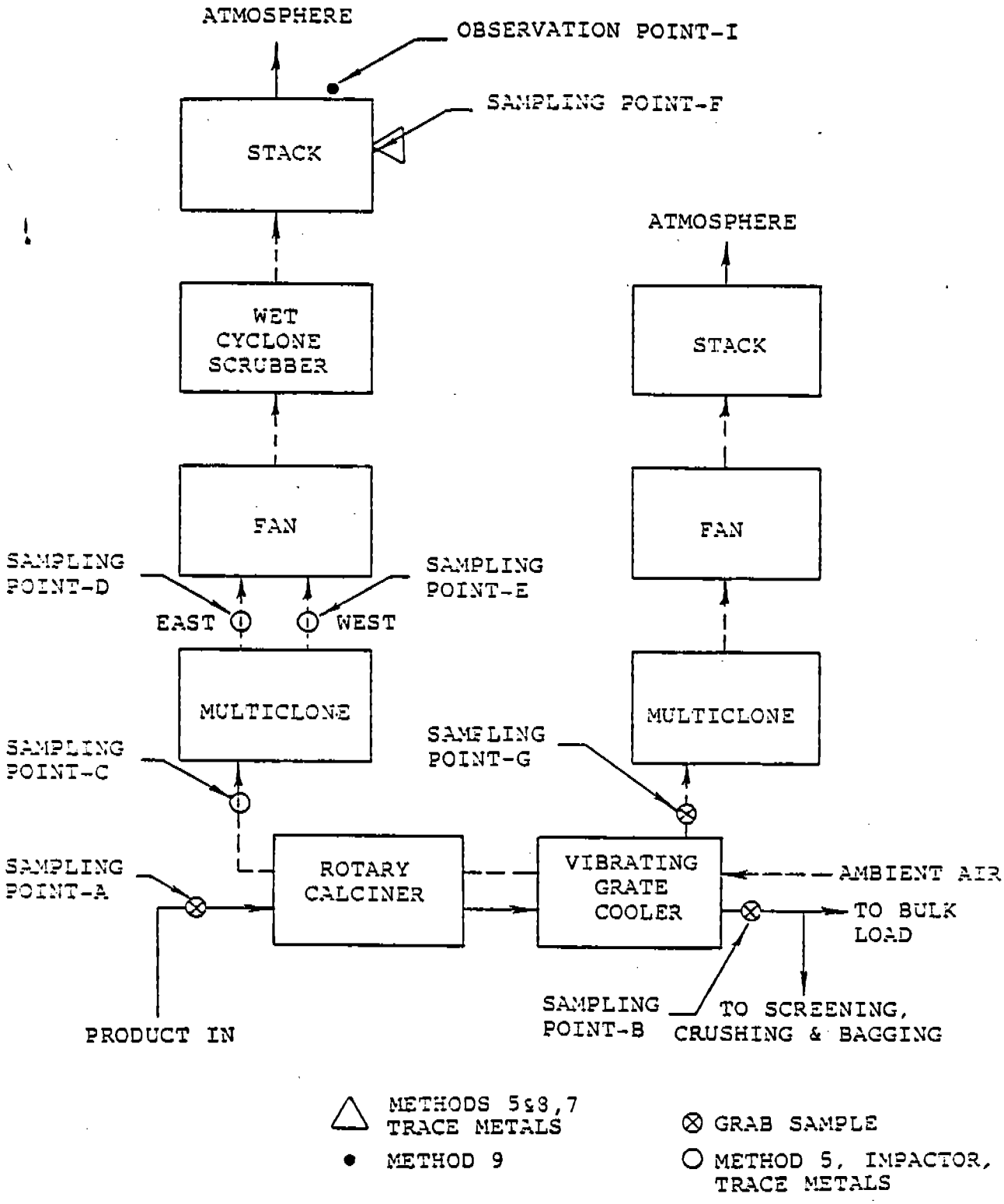


FIGURE 4-1. ROTARY CALCINER PROCESS SCHEMATIC SHOWING SAMPLING LOCATIONS

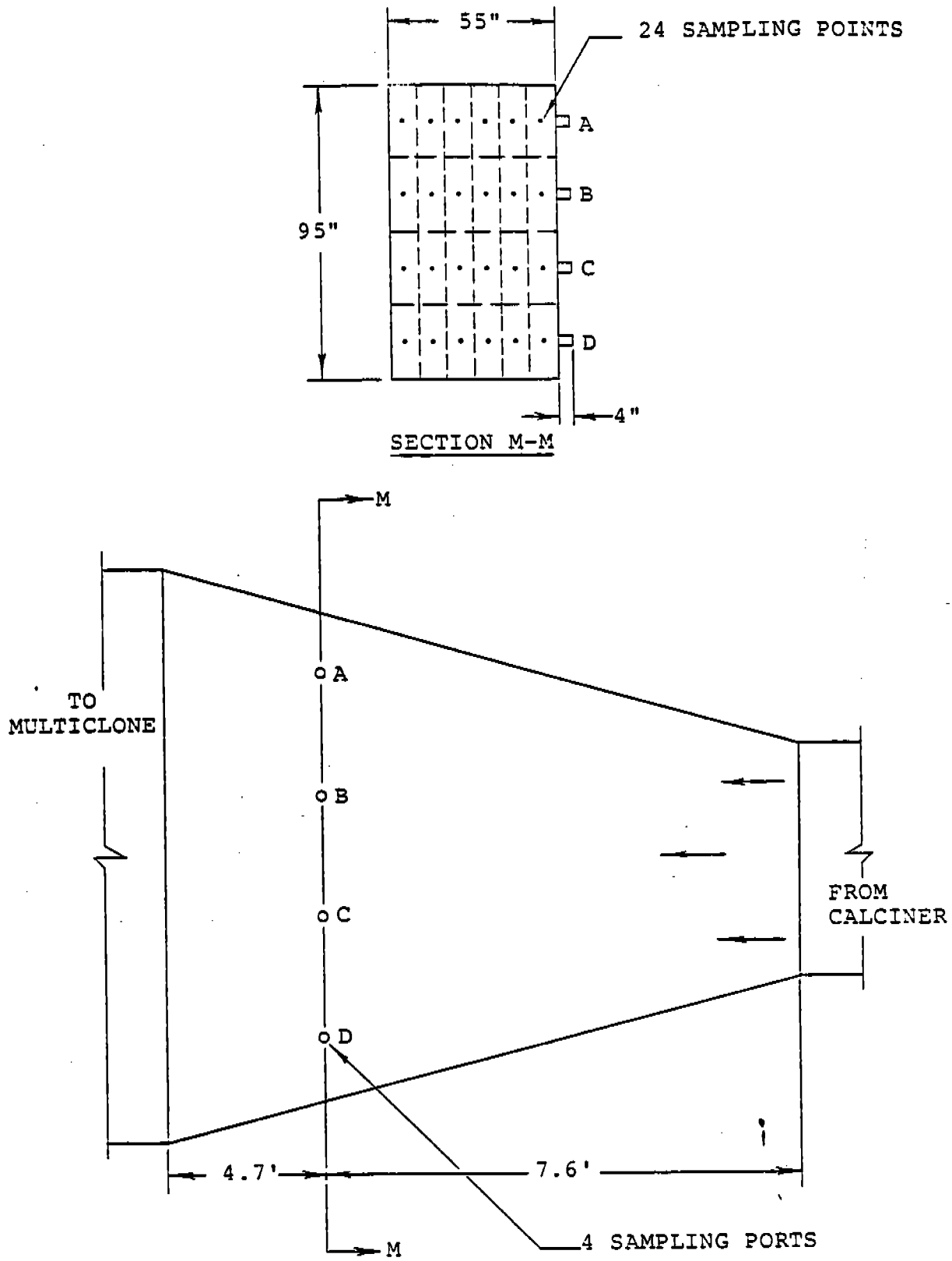


FIGURE 4-2. MULTICLONE INLET DIMENSIONS WITH SAMPLING PORT AND POINT LOCATIONS

4.6 I.D. Fan Inlet East & West (Sampling Locations D & E). Particulate emissions and particle size tests were performed in a 104.5-inch by 24.5-inch rectangular duct. Five sampling ports were located 164 inches upstream and 120 inches downstream from the nearest flow disturbance, as shown in Figure 4-3.

For particulate tests, each of the I.D. fan inlet cross sections (east and west) was divided into 25 equal areas (i.e. five sampling points along each of five traverse axes). Of the 25 possible points, only 20 points were sampled; the first point along each traverse axis was not sampled due to the disruption of air flow along the air duct wall caused by high negative pressure. Each of the 20 points was sampled for three minutes, resulting in a total run time of 60 minutes.

Particle size runs ranged in length from 1.5 to 4 minutes. During each run, two points were sampled for equal lengths of time.

4.7 Scrubber Exhaust Stack (Sample Location F, Observation Point I). The particulate and particle size tests were performed in a 60-inch diameter round duct. Two sampling ports spaced 90° apart are located approximately 26 feet downstream from the nearest flow disturbance (straightening vanes) and 48 feet upstream from the stack gas exit point. A schematic of the sampling location is provided in Figure 4-4.

The stack cross section was divided into 24 equal areas (i.e., two traverse axes with 12 points each) for particulate and sulfur dioxide emissions sampling. Each point was sampled for five minutes, resulting in a total run time of 120 minutes.

Visible emissions observations and nitrogen oxides testing were also performed at the scrubber exhaust stack.

Particle size testing was not performed at this location due to the presence of moisture in the flue gas.

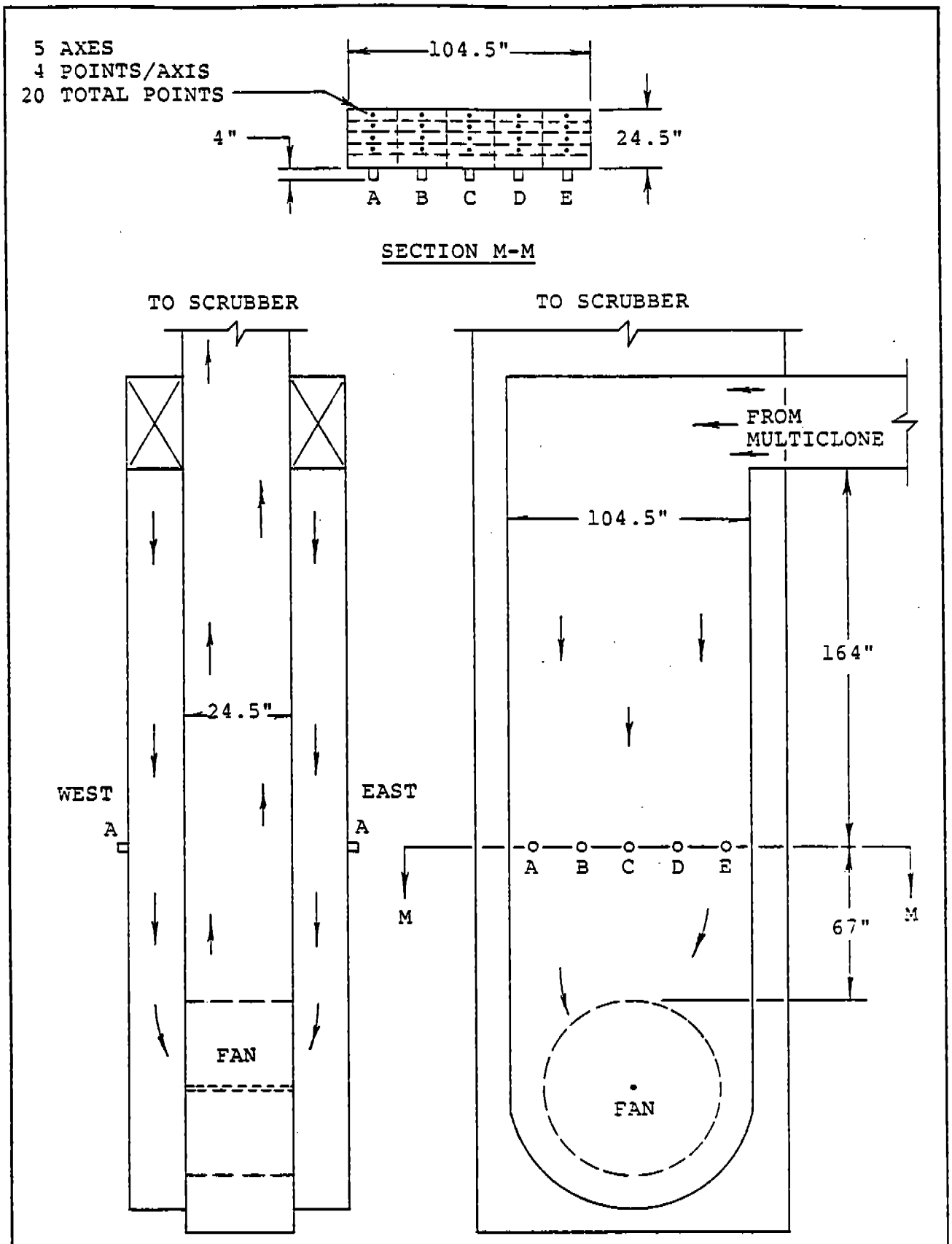


FIGURE 4-3. I.D. FAN INLET DUCT DIMENSIONS WITH SAMPLING PORT AND POINT LOCATIONS (TYPICAL FOR EAST AND WEST INLETS)

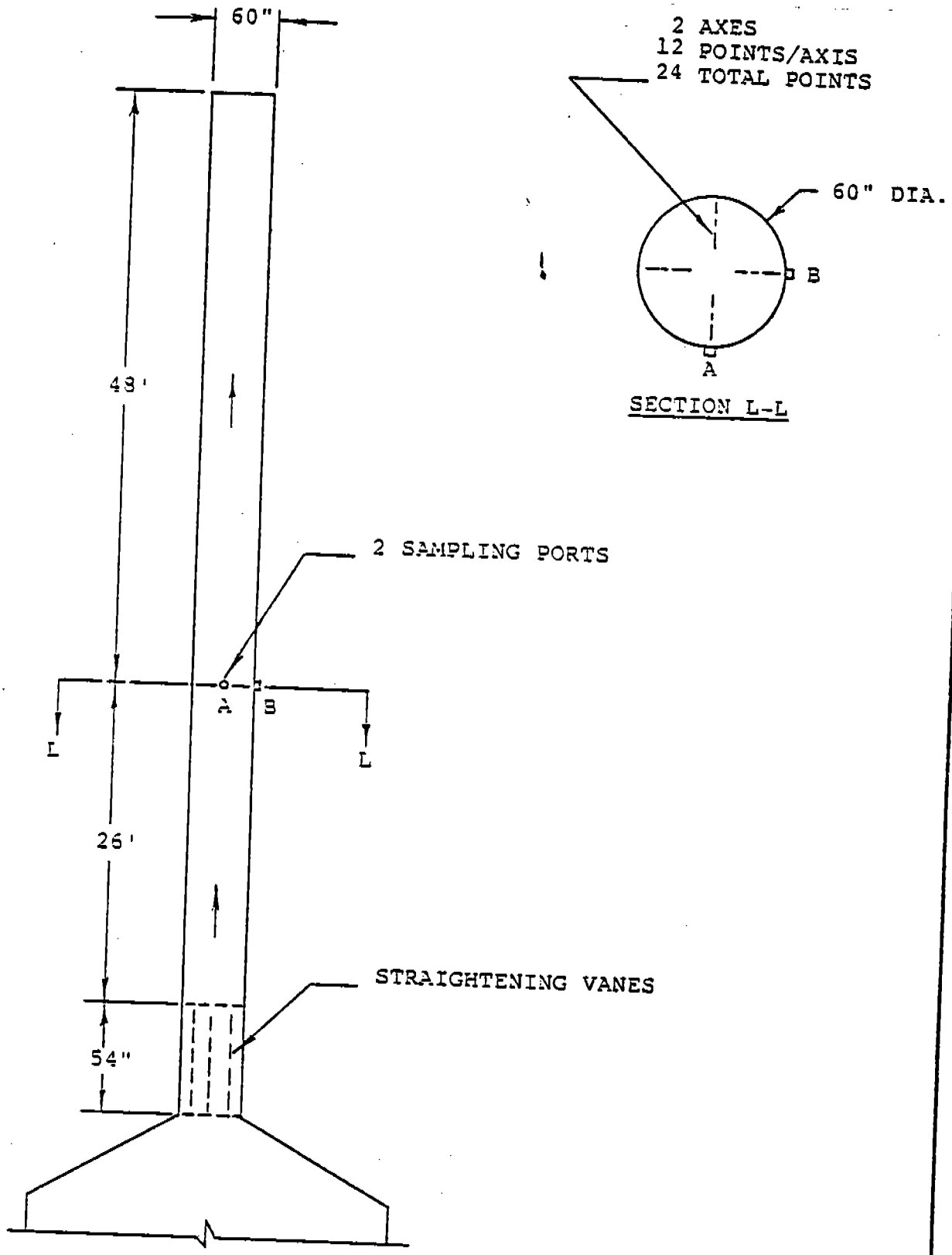


FIGURE 4-4. SCRUBBER EXHAUST STACK DIMENSIONS WITH SAMPLING PORT AND POINT LOCATIONS

5. SAMPLING AND ANALYTICAL METHODS

5.1 Sampling Objectives. This section describes the sampling and analytical procedures which were employed at the [redacted] plant in order to gather data concerning emissions from the #4 rotary calciner and associated air pollution control equipment and to investigate physical properties of the process feed stock and the product. The sampling program included tests for particulate and sulfur dioxide, trace metals, and nitrogen oxides emissions, sieve and moisture analysis on feed and product samples, plume opacity, and particle size distribution. The sampling methods used are fully described in Appendix 7.3, portions of which are extracted from 40 CFR Part 60.

5.2 Particulate and Sufur Dioxide Emissions Testing. Where appropriate, particulate emissions sampling conformed to the standards and procedures set forth by EPA Reference Method 5. Method 8 was combined with Method 5 testing at the scrubber exhaust stack for the determination of sulfur dioxide. It was necessary at some locations to modify the test procedures in order to cope with heavy particulate loading and/or high negative pressure.

5.3 Trace Metals Analysis. The Method 5 particulate catch and the distilled water reagent from one run at each location were analyzed for trace metals by using atomic absorption or inductively coupled argon plasma spectrometry. These metals are zinc, nickel, iron, manganese, vanadium, calcium, silicon, aluminum, magnesium, fluorine, beryllium, uranium, lead, and mercury.

5.4 Sieve Analysis and Moisture Content. Sieve analysis and moisture content determinations were performed on all feed and product samples. ASTM Method D 2216 was used to analyze the samples for moisture content, while ASTM Method D 422 was used for sieve analysis.

5.5 Plume Opacity. Plume opacity observations were performed in accordance with EPA Reference Method 9 as described in 40 CFR Part 60.

5.6 Particle Size Testing. Particle size determinations were made using a right angle inlet preseparator, followed by an Andersen Mark III cascade impactor. The test procedures were based upon the publication, "Procedures for Cascade Impactor Calibration and Operation in Process Streams - Revised 1979," developed by the Industrial Environmental Research Laboratory (IERL) and Southern Research Institute.

5.7 Nitrogen Oxides Testing. Nitrogen oxides emissions were determined by utilizing the sampling and analytical procedures outlined in EPA Method 7. Each Method 7 run consisted of four samples taken concurrently with the Method 5 sampling.

6. QUALITY ASSURANCE

6.1 Introduction. The goal of quality assurance for the project was to ensure the accuracy of all data collected. The procedures used are contained in Entropy's "Quality Assurance Program Plan," which was approved by the U.S. EPA EMB in the contract agreement governing the project.

In order to ensure continuity among field testing personnel, daily meetings were held before each day of the field testing. At the meetings, results from the testing conducted on the previous day were reviewed. Responsibilities were clearly delineated for each member of the testing team, and questions were addressed and resolved immediately. In situations where more than one person was performing similar activities, consistency was ensured through communication at the meetings.

In addition to the general quality assurance measures, specific quality assurance activities were conducted for several of the individual test methods performed.

6.2 Sampling Train Components. Entropy's sampling equipment, including nozzles, pitot tubes, dry gas meters, orifices, and thermocouples, was uniquely identified and calibrated in accordance with documented procedures and acceptance criteria prior to and at the completion of the field testing program. All sampling equipment was manufactured by Nutech Corporation, Andersen 2000 or by Entropy. Calibration data for the sampling equipment are contained in Appendix 7.9.

6.3 Preseparator and Cascade Impactors. All internal components and surfaces of the impactors were cleaned in an ultrasonic bath to ensure that all surface impurities were removed, and visual inspections for cleanliness were made prior to shipment to the field. After each sample recovery, the preseparator, the impactor body, and the plates were rinsed with acetone to ensure that all organic residuals and/or particulate matter were removed.

6.4 Sample Collection Substrates. Schleicker & Schuell #30 glass fiber sample collection substrates were used for particle size testing. To prevent contamination of the substrate surface, all filters were handled with laboratory tweezers. This procedure was used during impactor assembly, sample recovery, and weighing of the substrates.

6.5 Substrate Weighing. An analytical balance capable of weighing to the nearest 0.01 milligram (mg) was used. To ensure that no weight bias was produced from the preparation, transportation, recovery, or weighing procedures, two control samples were obtained during the test program: a reactivity run and a blank run.

The reactivity run was performed to ensure that the flue gases did not interact with the substrate to produce extraneous results. For the reactivity run, a solid filter was placed in the front section of the impactor, and the impactor was introduced into the stack, and a sample was pulled through the head using the parameters outlined for a normal particle sizing run. The average difference between the pre- and post-test weights, as shown in Section 7.6, was 0.01 milligrams, based upon weight differences ranging from 0.00 to 0.02 milligrams. A blank run was also performed to demonstrate that the impactor could be assembled and disassembled without affecting the weight of the substrate. The average difference between the pre- and post-assembly weights was 0.05 milligrams, based upon a difference ranging from 0.01 to 0.10 milligrams.

6.6 Sample Analysis. In order to reduce the probability of errors or inconsistent results, one member of the field crew had sole responsibility for the sample analysis procedure. Sample analysis was performed in a room dedicated exclusively to filter weighing.

6.7 EPA Method 3. All Method 3 analyses were performed in triplicate. Each analyzer was checked for leaks prior to any analysis as specified in the method. Samples were analyzed within four hours of collection.

6.8 EPA Method 9. The visible emissions observers held current certifications issued within the last 6 months. Documentation verifying the observer's certifications are provided in Appendix 7.2.3.

7. APPENDICES

APPENDIX 7.1.1.1

7.1 TEST RESULTS AND EXAMPLE CALCULATIONS

7.1.1 PARTICULATE AND SULFUR DIOXIDE

7.1.1.1 MULTICLONE INLET

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: [redacted] Plant, [redacted]

RUN	SAMPLING LOCATION	TEST TEAM LEADER
1	Calciner #4, Multi-Clone Inlet	B. Dwain Ritchie
2	Calciner #4, Multi-Clone Inlet	B. Dwain Ritchie
3	Calciner #4, Multi-Clone Inlet	B. Dwain Ritchie

		1	2	3
	RUN DATE	[redacted]/84	[redacted]/84	[redacted]/84
	RUN START TIME	1131	1500	1205
	RUN FINISH TIME	1233	1718	1301
	NET SAMPLING POINTS	24	24	24
Theta	NET RUN TIME, MINUTES	60.00	60.00	60.00
Dia	NOZZLE DIAMETER, INCHES	0.309	0.309	0.309
Cp	PITOT TUBE COEFFICIENT	0.840	0.840	0.840
Y	DRY GAS METER CAL. FACTOR	0.997	0.997	0.997
Pbar	BAROMETRIC PRESSURE, IN. HG.	29.50	29.50	29.60
Delta H	AVG. PRESS. DIFFERENTIAL OF ORIFICE METER, IN. H2O	1.185	1.090	1.250
Vm	VOLUME OF METERED GAS SAMPLE DRY ACTUAL CUBIC FEET	33.322	31.424	31.755
tm	DRY GAS METER TEMP., DEG. F	90	88	92
Vm(std)	VOLUME OF METERED GAS SAMPLE @ DRY STD. COND., DSCF*	31.526	29.831	30.040
Vlc	VOLUME OF WATER CATCH IN IMPINGERS & SIL. GEL.,ML	94.0	88.0	84.0
Vw(std)	VOLUME OF WATER VAPOR, SCF*	4.425	4.142	3.954
%H2O	MOISTURE, PERCENT BY VOLUME	12.3	12.2	11.6
Mfd	DRY MOLE FRACTION	0.877	0.878	0.884

(continued next page)

		1	2	3
%CO2	PERCENT CO2 BY VOLUME, DRY	5.3	5.7	5.3
%O2	PERCENT O2 BY VOLUME, DRY	14.4	14.3	14.6
%CO+N2	PERCENT CO + N2 BY VOLUME, DRY	80.3	80.0	80.1
Md	DRY MOLECULAR WT, LB/LB-MOLE	29.42	29.48	29.43
Ms	WET MOLECULAR WT, LB/LB-MOLE	28.02	28.08	28.10
Pg	STACK STATIC PRESS., IN H2O	-2.3	-2.3	-2.2
Ps	ABSOLUTE STACK PRESS., IN HG	29.33	29.33	29.44
ts	STACK TEMPERATURE, DEG. F	593	601	602
Delta P	AVG VELOCITY HEAD. IN. H2O	0.1989	0.1936	0.1716
vs	STACK GAS VELOCITY, FT/SEC	36.3	35.9	33.7
A	STACK AREA, SQUARE INCHES	5,225.0	5,225.0	5,225.0
Qsd	STACK FLOW RATE, DRY SCFM*	34,010	33,432	31,708
Qaw	STACK FLOW RATE, WET ACFM	78,921	78,066	73,375
%I	PERCENT ISOKINETIC	107.5	103.5	109.9
	METHOD 5 PARTICULATE (ENGLISH):			
mg	CATCH, MILLIGRAMS	15,367.5	15,929.3	13,951.5
gr/DSCF	CONCEN., GRAINS/DSCF*	7.5227	8.2405	7.1672
lb/hr	EMISSIONS, POUNDS/HOUR	2,192.95	2,361.38	1,947.90
	METHOD 5 PARTICULATE (METRIC):			
mg/DSCM	CONCEN., MILLIGRAMS/DSCM*	17,212.39	18,855.39	16,399.39
kg/hr	EMISSIONS, KILOGRAMS/HOUR	994.70	1,071.10	883.55

* 68 Deg. F - 29.92 in. Hg.

I.D. FAN INLET EAST & WEST

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: [redacted]

RUN	SAMPLING LOCATION	TEST TEAM LEADER
4	Calciner #4, I.D. Fan Inlet, East Side	Willis S. Nesbit
5	Calciner #4, I.D. Fan Inlet, East Side	Willis S. Nesbit
6	Calciner #4, I.D. Fan Inlet, East Side	Willis S. Nesbit

		4	5	6
	RUN DATE	[redacted]84	[redacted]84	[redacted]84
	RUN START TIME	954	1500	1205
	RUN FINISH TIME	1149	1702	1316
	NET SAMPLING POINTS	20	20	20
Theta	NET RUN TIME, MINUTES	60.00	60.00	60.00
Dia	NOZZLE DIAMETER, INCHES	0.302	0.302	0.302
Cp	PITOT TUBE COEFFICIENT	0.840	0.840	0.840
Y	DRY GAS METER CAL. FACTOR	1.004	1.004	1.004
Pbar	BAROMETRIC PRESSURE, IN. HG.	29.50	29.50	29.60
Delta H	AVG. PRESS. DIFFERENTIAL OF ORIFICE METER, IN. H2O	0.681	0.699	0.736
Vm	VOLUME OF METERED GAS SAMPLE DRY ACTUAL CUBIC FEET	26.769	28.605	29.128
tm	DRY GAS METER TEMP., DEG. F	93	96	103
Vm(std)	VOLUME OF METERED GAS SAMPLE @ DRY STD. COND., DSCF*	25.334	26.926	27.172
Vlc	VOLUME OF WATER CATCH IN IMPINGERS & SIL. GEL.,ML	81.0	88.5	77.5
Vw(std)	VOLUME OF WATER VAPOR, SCF*	3.813	4.166	3.648
%H2O	MOISTURE, PERCENT BY VOLUME	13.1	13.4	11.8
Mfd	DRY MOLE FRACTION	0.869	0.866	0.882

(continued next page)

		4	5	6
%CO2	PERCENT CO2 BY VOLUME, DRY	5.3	5.7	5.3
%O2	PERCENT O2 BY VOLUME, DRY	14.4	14.3	14.6
%CO+N2	PERCENT CO + N2 BY VOLUME, DRY	80.3	80.0	80.1
Md	DRY MOLECULAR WT, LB/LB-MOLE	29.42	29.48	29.43
Ms	WET MOLECULAR WT, LB/LB-MOLE	27.93	27.95	28.08
Pg	STACK STATIC PRESS., IN H2O	-5.8	-5.8	-5.6
Ps	ABSOLUTE STACK PRESS., IN HG	29.07	29.07	29.19
ts	STACK TEMPERATURE, DEG. F	549	545	555
Delta P	AVG VELOCITY HEAD. IN. H2O	0.1522	0.1590	0.1662
vs	STACK GAS VELOCITY, FT/SEC	31.2	31.8	32.6
A	STACK AREA, SQUARE INCHES	2,560.0	2,560.0	2,560.0
Qsd	STACK FLOW RATE, DRY SCFM*	14,717	15,013	15,542
Qaw	STACK FLOW RATE, WET ACFM	33,312	33,970	34,752
%I	PERCENT ISOKINETIC	102.4	106.7	104.0
	METHOD 5 PARTICULATE (ENGLISH):			
mg	CATCH, MILLIGRAMS	7,211.5	7,652.4	7,309.4
gr/DSCF	CONCEN., GRAINS/DSCF*	4.3930	4.3856	4.1514
lb/hr	EMISSIONS, POUNDS/HOUR	554.15	564.37	553.04
	METHOD 5 PARTICULATE (METRIC):			
mg/DSCM	CONCEN., MILLIGRAMS/DSCM*	10,051.45	10,035.35	9,498.76
kg/hr	EMISSIONS, KILOGRAMS/HOUR	251.35	255.99	250.85

* 68 Deg. F - 29.92 in. Hg.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: [redacted] Plant, [redacted]

RUN	SAMPLING LOCATION	TEST TEAM LEADER
7	Calciner #4, I.D. Fan Inlet, West Side	Steve Terll
8	Calciner #4, I.D. Fan Inlet, West Side	Steve Terll
9	Calciner #4, I.D. Fan Inlet, West Side	Steve Terll

		7	8	9
	RUN DATE	[redacted]84	[redacted]84	[redacted]84
	RUN START TIME	956	1500	1205
	RUN FINISH TIME	1150	1700	1317
	NET SAMPLING POINTS	20	20	20
Theta	NET RUN TIME, MINUTES	60.00	60.00	60.00
Dia	NOZZLE DIAMETER, INCHES	0.310	0.310	0.310
Cp	PITOT TUBE COEFFICIENT	0.840	0.840	0.840
Y	DRY GAS METER CAL. FACTOR	0.998	0.998	0.998
Pbar	BAROMETRIC PRESSURE, IN. HG.	29.50	29.50	29.60
Delta H	AVG. PRESS. DIFFERENTIAL OF ORIFICE METER, IN. H2O	0.769	0.774	0.681
Vm	VOLUME OF METERED GAS SAMPLE DRY ACTUAL CUBIC FEET	29.207	28.356	27.796
tm	DRY GAS METER TEMP., DEG. F	91	94	99
Vm(std)	VOLUME OF METERED GAS SAMPLE @ DRY STD. COND., DSCF*	27.582	26.633	25.955
Vlc	VOLUME OF WATER CATCH IN IMPINGERS & SIL. GEL.,ML	89.5	91.0	86.5
Vw(std)	VOLUME OF WATER VAPOR, SCF*	4.213	4.283	4.072
%H2O	MOISTURE, PERCENT BY VOLUME	13.3	13.9	13.6
Mfd	DRY MOLE FRACTION	0.867	0.861	0.864

(continued next page)

		7	8	9
%CO2	PERCENT CO2 BY VOLUME, DRY	5.3	5.7	5.3
%O2	PERCENT O2 BY VOLUME, DRY	14.4	14.3	14.6
%CO+N2	PERCENT CO + N2 BY VOLUME, DRY	80.3	80.0	80.1
Md	DRY MOLECULAR WT, LB/LB-MOLE	29.42	29.48	29.43
Ms	WET MOLECULAR WT, LB/LB-MOLE	27.91	27.89	27.88
Ps	STACK STATIC PRESS., IN H2O	-5.8	-5.8	-5.6
Ps	ABSOLUTE STACK PRESS., IN HG	29.07	29.07	29.19
ts	STACK TEMPERATURE, DEG. F	543	539	545
Delta P	AVG VELOCITY HEAD. IN. H2O	0.1524	0.1537	0.1433
vs	STACK GAS VELOCITY, FT/SEC	31.2	31.2	30.2
A	STACK AREA, SQUARE INCHES	2,560.0	2,560.0	2,560.0
Qsd	STACK FLOW RATE, DRY SCFM*	14,747	14,740	14,270
Qaw	STACK FLOW RATE, WET ACFM	33,246	33,331	32,223
%I	PERCENT ISOKINETIC	105.6	102.0	102.7
	METHOD 5 PARTICULATE (ENGLISH):			
mg	CATCH, MILLIGRAMS	6,547.5	6,438.7	6,299.2
gr/DSCF	CONCEN., GRAINS/DSCF*	3.6634	3.7308	3.7454
lb/hr	EMISSIONS, POUNDS/HOUR	463.07	471.38	458.11
	METHOD 5 PARTICULATE (METRIC):			
mg/DSCM	CONCEN., MILLIGRAMS/DSCM*	8,382.17	8,536.60	8,569.81
kg/hr	EMISSIONS, KILOGRAMS/HOUR	210.04	213.81	207.79

* 68 Deg. F - 29.92 in. Hg.

SCRUBBER EXHAUST STACK AND EXAMPLE CALCULATIONS

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: [redacted]

RUN	SAMPLING LOCATION	TEST TEAM LEADER
10	Calciner #4, Scrubber Stack	Gerard M. Carty
11	Calciner #4, Scrubber Stack	Gerard M. Carty
12	Calciner #4, Scrubber Stack	Gerard M. Carty

		10	11	12
	RUN DATE	[redacted]/84	[redacted]84	[redacted]84
	RUN START TIME	1000	1509	1210
	RUN FINISH TIME	1305	1725	1429
	NET SAMPLING POINTS	24	24	24
Theta	NET RUN TIME, MINUTES	120.00	120.00	120.00
Dia	NOZZLE DIAMETER, INCHES	0.303	0.303	0.303
Cp	PITOT TUBE COEFFICIENT	0.840	0.840	0.840
Y	DRY GAS METER CAL. FACTOR	1.002	1.002	1.002
Pbar	BAROMETRIC PRESSURE, IN. HG.	29.40	29.40	29.40
Delta H	AVG. PRESS. DIFFERENTIAL OF ORIFICE METER, IN. H2O	1.908	2.005	2.044
Vm	VOLUME OF METERED GAS SAMPLE DRY ACTUAL CUBIC FEET	89.380	93.786	93.681
tm	DRY GAS METER TEMP., DEG. F	69	73	74
Vm(std)	VOLUME OF METERED GAS SAMPLE @ DRY STD. COND., DSCF*	88.220	91.896	91.630
Vlc	VOLUME OF WATER CATCH IN IMPINGERS & SIL. GEL.,ML	465.5	484.5	456.5
Vw(std)	VOLUME OF WATER VAPOR, SCF*	21.911	22.805	21.487
%H2O	MOISTURE, PERCENT BY VOLUME	19.9	19.9	19.0
Mfd	DRY MOLE FRACTION	0.801	0.801	0.810

(continued next page)

EXAMPLE PARTICULATE TEST CALCULATIONS NO. 10

Calciner #4, Scrubber Stack

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$Vm(std) = 17.64 * Y * Vm * \frac{(Pbar + Delta\ H/13.6)}{(460 + tm)}$$

$$Vm(std) = 17.64 * 1.002 * 89.380 * \frac{(29.40 + 1.908/13.6)}{(460 + 69)} = 88.220 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$$Vw(std) = 0.04707 * Vlc$$

$$Vw(std) = 0.04707 * 465.5 = 21.911 \text{ SCF}$$

PERCENT MOISTURE, BY VOLUME, AS MEASURED IN STACK GAS

$$\%H2O = 100 * Vw(std) / (Vw(std) + Vm(std))$$

$$\%H2O = \frac{21.911}{21.911 + 88.220} * 100 = 19.9\ \%$$

DRY MOLE FRACTION OF STACK GAS

$$Mfd = 1 - \%H2O/100$$

$$Mfd = 1 - 19.9/100 = 0.801$$

DRY MOLECULAR WEIGHT OF STACK GAS

$$Md = \%CO2 * 0.44 + \%O2 * 0.32 + \%CO+N2 * 0.28$$

$$Md = 4.6*0.44 + 14.7*0.32 + 80.7*0.28 = 29.32 \text{ LB/LB-MOLE}$$

WET MOLECULAR WEIGHT OF STACK GAS

$$Ms = (Md * Mfd) + (0.18 * \%H2O)$$

$$Ms = 29.32 * 0.801 + (0.18 * 19.9) = 27.07 \text{ LB/LB-MOLE}$$

GRAINS PER DRY STANDARD CUBIC FOOT

$$gr/DSCF = \frac{7,000}{453,592} * \frac{mgs}{Vm(std)}$$

$$gr/DSCF = \frac{7,000}{453,592} * \frac{192.1}{88.220} = 0.0336 \text{ gr/DSCF}$$

MILLIGRAMS PER DRY STANDARD CUBIC METER

mg/DSCM = mg / (Vm(std) * 0.02832)

mg/DSCM = 192.1 / (88.220 * 0.02832) = 215.16 mg/DSCM

POUNDS PER HOUR

Lb/Hr = (60/7000) * Gn/DSCF * Qsd

Lb/Hr = (60/7000) * 0.0336 * 29,064 = 8.37 Lb/Hr

KILOGRAMS PER HOUR

Kg/Hr = .453592 * Lb/Hr

Kg/Hr = .453592 * 8.37 = 3.80 kg/Hr

SULFUR DIOXIDE PARTS PER MILLION DRY BY VOLUME

$$ppmd = \frac{385.3 * 10E6 * mg}{453,592 * Mol.\ Wt. * Vm(std)}$$

$$ppmd = \frac{385.3 * 10E6 * 2,871.8}{453,592 * 64 * 88.220} = 432.06 \text{ ppmd}$$

ABSOLUTE STACK GAS PRESSURE

$$Ps = Pbar + Pg / 13.6$$

$$Ps = 29.40 + (-0.1 / 13.6) = 29.39 \text{ IN. HG.}$$

AVERAGE STACK GAS VELOCITY [Note: (Delta p)avg is square of avg sq. root]

$$vs = 85.49 * Cp * SQRT\left[\frac{(Delta\ p)avg * (460 + ts)}{Ps * Ms}\right]$$

$$vs = 85.49 * 0.840 * SQRT\left[\frac{0.3268 * (460 + 140)}{29.39 * 27.07}\right] = 35.7 \text{ FT/SEC}$$

DRY VOLUMETRIC STACK GAS FLOW RATE @ STANDARD CONDITIONS

$$Qsd = \frac{60}{144} * Mfd * vs * A * \frac{Tstd}{ts + 460} * \frac{Ps}{Pstd}$$

$$Qsd = \frac{60}{144} * 0.801 * 35.7 * 2,827.0 * \frac{528}{140 + 460} * \frac{29.39}{29.92}$$

$$Qsd = 29,064 \text{ SCFM}$$

WET VOLUMETRIC STACK GAS FLOW RATE @ STACK CONDITIONS

$$Qaw = 60 / 144 * vs * A$$

$$Qaw = 60 / 144 * 35.7 * 2,827.0 = 41,994 \text{ ACFM}$$

PERCENT ISOKINETIC OF SAMPLING RATE

$$\%I = \frac{Pstd}{Tstd} * \frac{100}{60} * \frac{(ts + 460) * Vm(std)}{Ps * vs * Mfd * Theta * Area\text{-}nozzle,\ sq.ft.}$$

$$\%I = \frac{29.92}{528} * \frac{100}{60} * \frac{(140 + 460) * 88.220}{29.39 * 35.7 * 0.801 * 120.00 * 0.0005007}$$

$$\%I = 99.0 \ \%$$

		10	11	12
%CO2	PERCENT CO2 BY VOLUME, DRY	4.6	4.4	4.1
%O2	PERCENT O2 BY VOLUME, DRY	14.7	14.7	15.5
%CO+N2	PERCENT CO + N2 BY VOLUME, DRY	80.7	80.9	80.4
Md	DRY MOLECULAR WT, LB/LB-MOLE	29.32	29.29	29.28
Ms	WET MOLECULAR WT, LB/LB-MOLE	27.07	27.05	27.13
Pg	STACK STATIC PRESS., IN H2O	-0.2	-0.2	-0.2
Ps	ABSOLUTE STACK PRESS., IN HG	29.39	29.39	29.39
ts	STACK TEMPERATURE, DEG. F	140	140	141
Delta p	AVG VELOCITY HEAD. IN. H2O	0.3268	0.3458	0.3518
vs	STACK GAS VELOCITY, FT/SEC	35.7	36.7	37.0
A	STACK AREA, SQUARE INCHES	2,827.0	2,827.0	2,827.0
Qsd	STACK FLOW RATE, DRY SCFM*	29,064	29,915	30,432
Qaw	STACK FLOW RATE, WET ACFM	41,994	43,217	43,558
%I	PERCENT ISOKINETIC	99.0	100.2	98.2
	METHOD 5 PARTICULATE (ENGLISH):			
mg	CATCH, MILLIGRAMS	192.1	187.7	204.4
gr/DSCF	CONCEN., GRAINS/DSCF*	0.0336	0.0315	0.0344
lb/hr	EMISSIONS, POUNDS/HOUR	8.37	8.08	8.98
	METHOD 5 PARTICULATE (METRIC):			
mg/DSCM	CONCEN., MILLIGRAMS/DSCM*	76.89	72.12	78.77
kg/hr	EMISSIONS, KILOGRAMS/HOUR	3.80	3.66	4.07
	METHOD 8 SULFUR DIOXIDE (ENGLISH):			
	CATCH, MILLIGRAMS	2,871.3	3,006.3	2,772.0
ppmd	CONCEN., PPM BY VOL., DRY	432.06	434.27	401.52
	EMISSION RATE, LBS/HOUR	125.15	129.48	121.78
	METHOD 8 SULFUR DIOXIDE (METRIC):			
	CONCEN., MILLIGRAMS/DSCM*	1,149.46	1,155.35	1,068.22
	EMISSIONS, KILOGRAMS/HOUR	56.77	58.73	55.24

* 68 Deg. F - 29.92 in. Hg.

APPENDIX 7.1.2

PARTICLE SIZING

MULTICLONE INLET

RUNS S1A, S1B, S2A, S2B, S3A, S3B


```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
>041784

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=DM/DLOGD, 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>IN

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   621.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            1
SAMPLING AT  108.1 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .30520490      .64016353
   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              8  IS LOW
   *** SAMPLING DURATION   1.5000000      IS SHORT
   *** STACK TEMPERATURE   554.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            2
SAMPLING AT  109.2 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .41566358      .75964125
   *** LINEAR INTERPOLATION USED BETWEEN   1.1498113      2.0944961
   *** JET VELOCITY > 5000 CM/SEC
STAGE        8
VALUE  5765.01
   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   633.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            3
SAMPLING AT  102.8 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .31584842      .66024540
   *** MASS ON STAGE              1  IS HIGH
   *** SAMPLING DURATION   1.5000000      IS SHORT
   *** STACK TEMPERATURE   589.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            4
SAMPLING AT  106.9 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   1.1364915      2.07[illegible]
   *** LINEAR INTERPOLATION USED BETWEEN   4.0726979      [illegible]
   *** JET VELOCITY > 5000 CM/SEC
STAGE        8
VALUE  5973.74
```

```
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   599.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            5
SAMPLING AT  102.4 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .37933963      .76817653
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   613.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            6
SAMPLING AT  105.7 % OF ISOKINETIC RATE
```

	S1A	S1B	S2A	S2B	S3A	S3B
TEST SITE	CE	CE	CE	CE	CE	CE
TEST DATE	41734	41734	41734	41734	41734	41734
RUN NUMBER	1	2	3	4	5	6
RUN DATE	41734	41734	41734	41734	41734	41734
START TIME	1323	1412	1751	1346	1401	1434
TOTAL MASS	6.394E+03	2.020E+04	6.034E+03	7.276E+03	9.505E+03	6.531E+03

STD. DIAM.	CUM. % MASS < DSO					
.63	1.40	.59	3.44	6.31	1.23	4.74
1.00	3.61	.68	7.12	7.64	2.92	9.44
1.25	4.68	.90	9.06	8.37	4.25	14.17
2.50	10.25	2.93	16.34	12.48	8.41	20.03
6.00	21.34	13.51	23.74	21.50	13.02	31.53
10.00	42.06	42.30	63.16	53.42	26.53	41.03
15.00	57.76	60.95	87.68	76.76	35.99	50.66
20.00	68.43	72.13	97.13	88.13	44.71	58.25

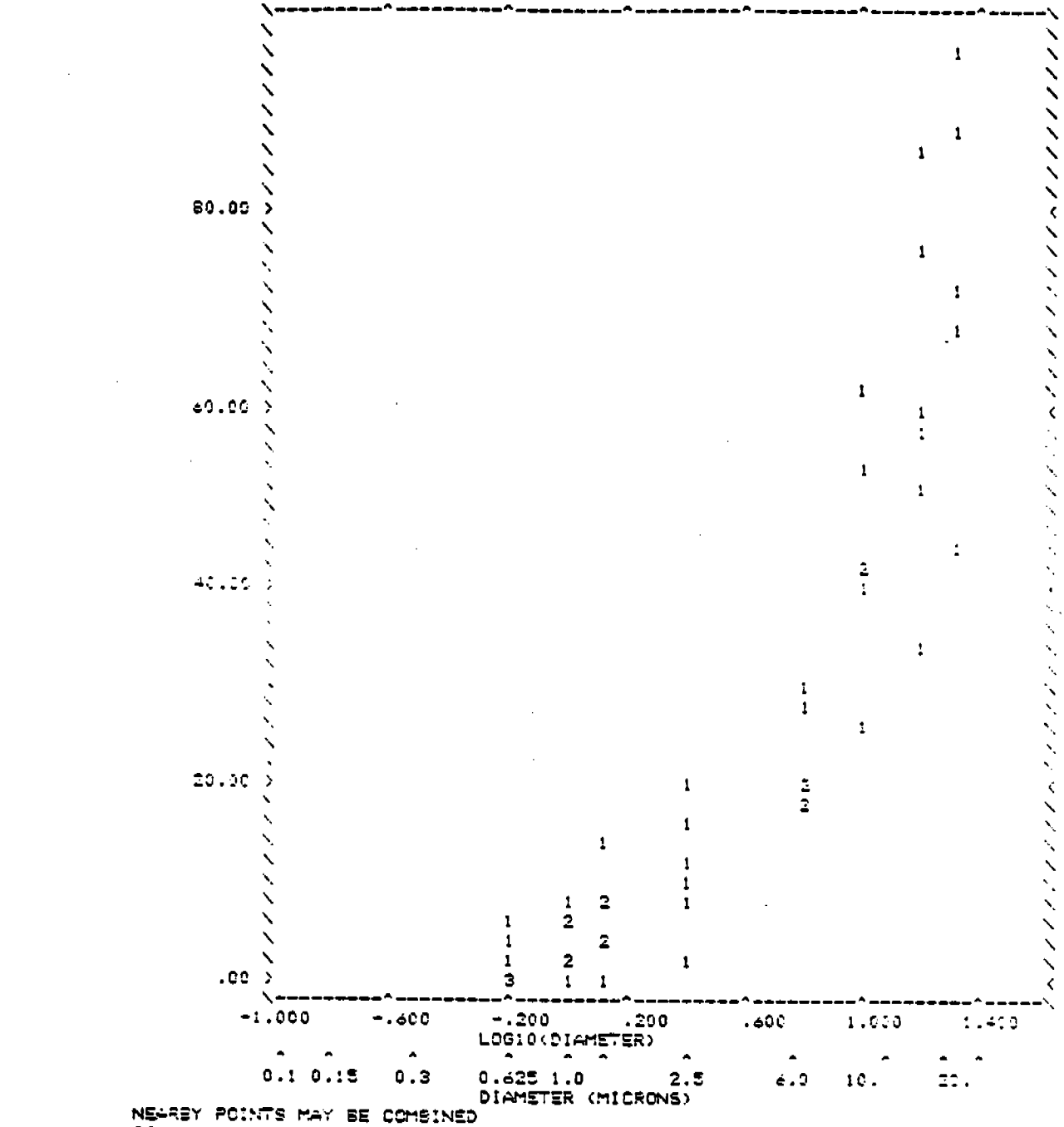
DATA COMPARISON FOR 6 INLET RUNS BY ENT

STD. DIAM. (MICRONS)	NO. RUNS	DM/DLOGD (MG/CNCM)	CUMULATIVE MASS < DSO	CUM. % MASS < DSO AVG.	STD. DEV.	MIN.	MAX.
.63	6	3.20E+02	2.17E+02	2.95	2.27	.59	6.31
1.00	6	1.13E+03	3.75E+02	5.24	3.34	.68	9.44
1.25	6	1.20E+03	4.97E+02	6.94	4.62	.90	14.17
2.50	6	2.11E+03	8.75E+02	11.75	6.04	2.93	20.03
6.00	6	5.24E+03	2.04E+03	23.37	5.56	13.02	31.53
10.00	6	9.13E+03	4.04E+03	44.84	12.41	26.53	63.16
15.00	6	8.27E+03	5.60E+03	61.63	13.45	35.99	87.68
20.00	6	7.03E+03	6.55E+03	71.51	17.12	44.71	97.13

```
DO YOU WANT TO PLOT CUM % MASS?  ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM  6 RUNS AT STD. DIAM.
```

COMPARISON OF CUM. % MASS FROM 6 RUNS AT STD. DIAM.

48 INPUT POINTS, 0 WERE OUTSIDE LIMITS



NEARBY POINTS MAY BE COMBINED

DO YOU WISH TO REPEAT THE COMPARISON EXCLUDING SOME RUNS? ENTER Y OR N

>

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S1A

PLANT: [redacted] Plant, [redacted]

SAMPLING LOCATION: Calciner #4, Multiclone Inlet DATE: [redacted]/84

	START-FINISH TIME:	1323-1325		VOLUME METERED, ACF:	0.648
SR)	SAMPLING RATE, ACFM	0.734		NOZZLE DIA., INCHES:	0.251
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	0.997
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	86
PSI)	STATIC PRESS., IN. H2O:	-2.25	DH)	DELTA H AVG., IN. H2O:	0.29
TS)	STACK GAS TEMP., DEG F:	621	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	12.3	VCF)	VISCOSITY CORR. FACTOR:	1.291
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.42
	ISOKINETICS, %	107.9		CONCENT., GR/DSCF:	2.8035

STAGE NO.	PARTICLE DIAMETER (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	9.86	12.73	54.60	48.8	51.1
0	11.23	14.50	11.44	10.2	40.9
1	7.05	9.10	10.29	9.2	31.7
2	4.70	6.07	9.10	8.1	23.6
3	3.26	4.21	7.96	7.1	16.5
4	2.06	2.66	7.66	6.8	9.7
5	1.05	1.36	6.25	5.6	4.1
6	0.64	0.83	3.06	2.7	1.4
7	0.43	0.56	0.52	0.5	0.9
FILTER	< 0.43	< 0.56	1.06	0.9	

TOTAL CATCH 111.94

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S1B

PLANT: [redacted]lant, [redacted]

SAMPLING LOCATION: Calciner #4, Multiclone Inlet DATE: [redacted]84

	START-FINISH TIME:	1412-1413		VOLUME METERED, ACF:	0.569
SR)	SAMPLING RATE, ACFM	0.809		NOZZLE DIA., INCHES:	0.246
ST)	SAMPLING TIME, MINUTES:	1.50	Y)	METER CAL. FACTOR:	0.997
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	84
PSI)	STATIC PRESS., IN. H2O:	-2.25	DH)	DELTA H AVG., IN. H2O:	0.39
TS)	STACK GAS TEMP., DEG F:	554	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	12.3	VCF)	VISCOSITY CORR. FACTOR:	1.263
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.42
	ISOKINETICS, %	109.0		CONCENT., GR/DSCF:	8.8539

STAGE NO.	- PARTICLE DIAMETER (microns) - FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	9.37	11.83	155.20	49.8	50.2
PreImp	8.16	10.31	61.48	19.7	30.5
1	5.35	6.76	30.92	9.9	20.6
2	3.44	4.34	33.11	10.6	10.0
3	2.21	2.79	19.35	6.2	3.8
4	1.31	1.65	6.46	2.1	1.7
5	0.87	1.10	2.67	0.9	0.8
6	0.54	0.68	0.59	0.2	0.6
7	0.31	0.39	0.10	0.0	0.6
FILTER	< 0.31	< 0.39	1.76	0.6	

TOTAL CATCH 311.64

RUNS S1A, S1B


```
CE
ENTER TEST DATE. IDATE. (MMDDYY)
[redacted]

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=CM/DLOGD, 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>1 2

*FTN ERROR   SUBPROGRAM BSORT            ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   621.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN              1
SAMPLING AT  103.1 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .30520490       .64016293

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              8  IS LOW
   *** SAMPLING DURATION   1.5000000      IS SHORT
   *** STACK TEMPERATURE   554.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN              2
SAMPLING AT  109.2 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .41566358       .75954125
   *** LINEAR INTERPOLATION USED BETWEEN   1.1498113       2.0944761
   *** JET VELOCITY > 5000 CM/SEC
STAGE        8
VALUE  5765.01
```

	S1A	S1B
TEST SITE	CE	CE
TEST DATE	41794	41794
RUN NUMBER	1	2
RUN DATE	41794	41794
START TIME	1323	1412
TOTAL MASS	6.3942E+03	2.020E+04

STD. DIAM.		CUM. % MASS	< D50
4	.63	1.40	.59
5	1.00	3.61	.68
6	1.25	4.33	.90
7	2.50	10.25	2.93
8	5.00	21.34	13.51

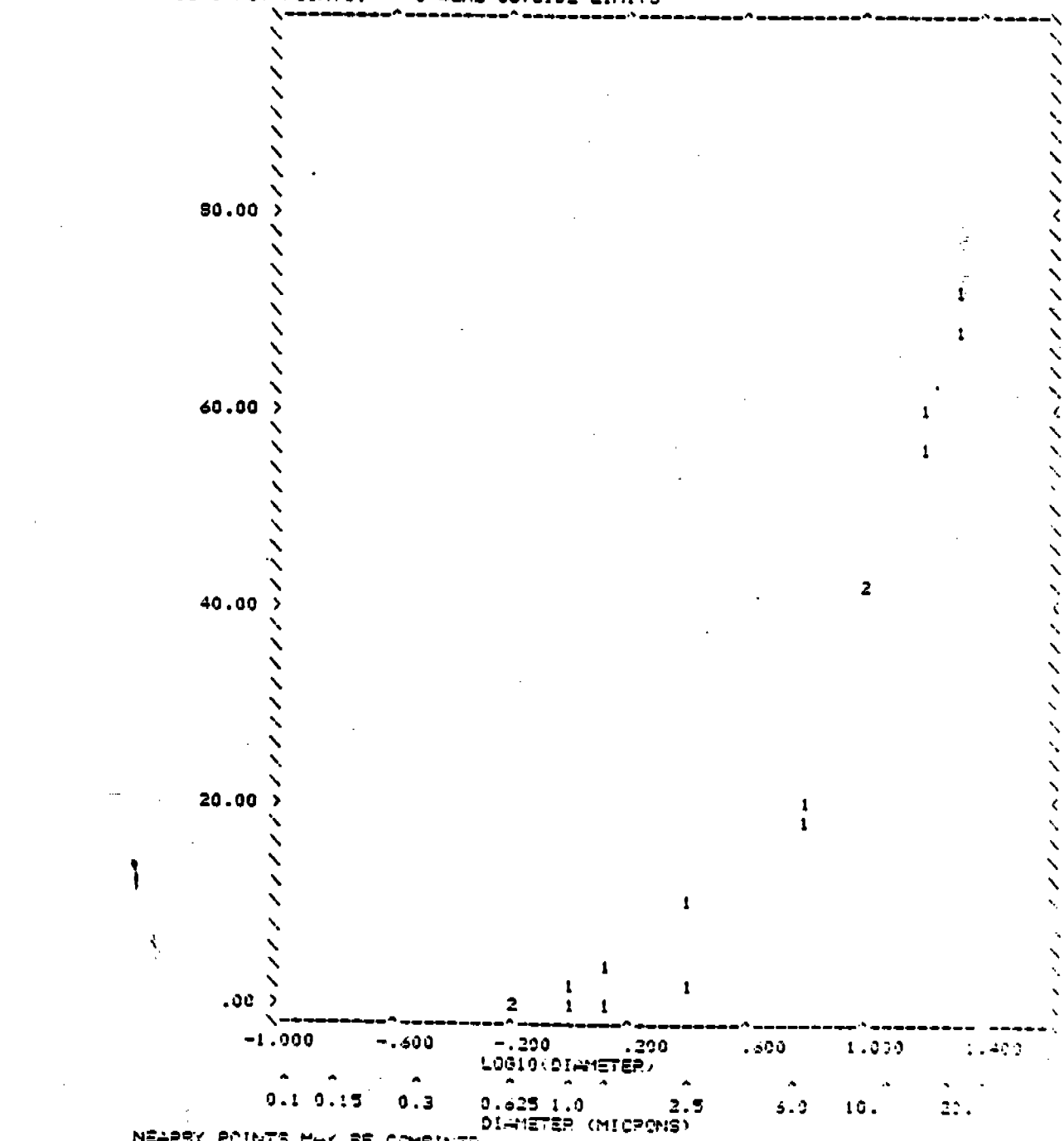
9	10.00	42.06	42.80
10	15.00	57.76	60.95
11	20.00	68.43	72.13

DATA COMPARISON FOR 2 INLET RUNS BY ENT

STD. DIAM. (MICRONS)	NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4 .63	2	1.59E+02	1.04E+02	.99	.57	.59	1.40
5 1.00	2	5.53E+02	1.84E+02	2.15	2.07	.68	3.61
6 1.25	2	7.69E+02	2.47E+02	2.69	2.81	.90	4.38
7 2.50	2	2.74E+03	6.24E+02	6.59	5.18	2.93	10.28
8 6.00	2	9.82E+03	2.57E+03	20.18	2.35	18.51	21.84
9 10.00	2	1.35E+04	5.67E+03	42.43	.52	42.06	42.80
10 15.00	2	1.27E+04	8.00E+03	59.35	2.26	57.76	60.95
11 20.00	2	1.08E+04	9.47E+03	70.28	2.62	68.43	72.13

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 2 RUNS AT STD. DIAM.

16 INPUT POINTS. 0 WERE OUTSIDE LIMITS



NEARBY POINTS MAY BE COMBINED
DO YOU WISH TO REPEAT THE COMPARISON EXCLUDING SOME RUNS? ENTER Y OR N
>

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S2A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, Multiclone Inlet DATE: [redacted]

	START-FINISH TIME:	1751-1753		VOLUME METERED, ACF:	0.630
SR)	SAMPLING RATE, ACFM	0.710		NOZZLE DIA., INCHES:	0.251
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	0.997
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	94
PSI)	STATIC PRESS., IN. H2O:	-2.25	DH)	DELTA H AVG., IN. H2O:	0.29
TS)	STACK GAS TEMP., DEG F:	633	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	12.2	VCF)	VISCOSITY CORR. FACTOR:	1.296
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.48
	ISOKINETICS, %	103.9		CONCENT., GR/DSCF:	2.6112

STAGE NO.	PARTICLE DIAMETER (microns) FROM GRAPH	PARTICLE DIAMETER (microns) AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	10.03	13.00	20.80	20.8	79.2
0	11.42	14.80	23.61	23.6	55.6
1	7.17	9.29	12.05	12.1	43.5
2	4.78	6.19	11.30	11.3	32.2
3	3.31	4.29	7.76	7.8	24.4
4	2.09	2.71	8.47	8.5	15.9
5	1.07	1.39	7.69	7.7	8.2
6	0.65	0.84	4.69	4.7	3.5
7	0.44	0.57	1.22	1.2	2.3
FILTER	< 0.44	< 0.57	2.31	2.3	

TOTAL CATCH 99.90

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S2B

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, Multiclone Inlet DATE: [redacted]

	START-FINISH TIME:	1846-1847		VOLUME METERED, ACF:	0.588
SR)	SAMPLING RATE, ACFM	0.838		NOZZLE DIA., INCHES:	0.251
ST)	SAMPLING TIME, MINUTES:	1.50	Y)	METER CAL. FACTOR:	0.997
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	101
PSI)	STATIC PRESS., IN. H2O:	-2.25	DH)	DELTA H AVG., IN. H2O:	0.42
TS)	STACK GAS TEMP., DEG F:	589	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	12.2	VCF)	VISCOSITY CORR. FACTOR:	1.278
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.48
	ISOKINETICS, %	106.7		CONCENT., GR/DSCF:	3.1902

STAGE NO.	PARTICLE DIAMETER (microns) FROM GRAPH	PARTICLE DIAMETER (microns) AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	9.20	11.76	41.80	37.1	62.8
PreImp	8.01	10.24	41.70	37.1	25.7
1	5.25	6.71	4.26	3.8	21.9
2	3.38	4.32	4.50	4.0	17.9
3	2.17	2.77	5.42	4.8	13.1
4	1.29	1.65	3.52	3.1	10.0
5	0.86	1.10	2.27	2.0	8.0
6	0.53	0.68	1.48	1.3	6.7
7	0.30	0.38	1.27	1.1	5.6
FILTER	< 0.30	< 0.38	6.31	5.6	

TOTAL CATCH 112.53

RUNS S2A, S2B

```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
[redacted]

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=DM/DLOGD, 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>3 4

*FTN ERROR   SUBPROGRAM BSORT            ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   633.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN              3
SAMPLING AT  102.3 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .31534842      .46024540

   *** MASS ON STAGE              1  IS HIGH
   *** SAMPLING DURATION   1.5000000      IS SHORT
   *** STACK TEMPERATURE   589.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN              4
SAMPLING AT  106.9 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   1.1364915      2.0751559
   *** LINEAR INTERPOLATION USED BETWEEN   4.0726978      6.3483291
   *** JET VELOCITY > 5000 CM/SEC
STAGE        9
VALUE  5972.74
```

	S2A	S2B
TEST SITE	CE	CE
TEST DATE	41784	41784
RUN NUMBER	3	4
RUN DATE	41784	41784
START TIME	1751	1346
TOTAL MASS	6.034E+03	7.276E+03

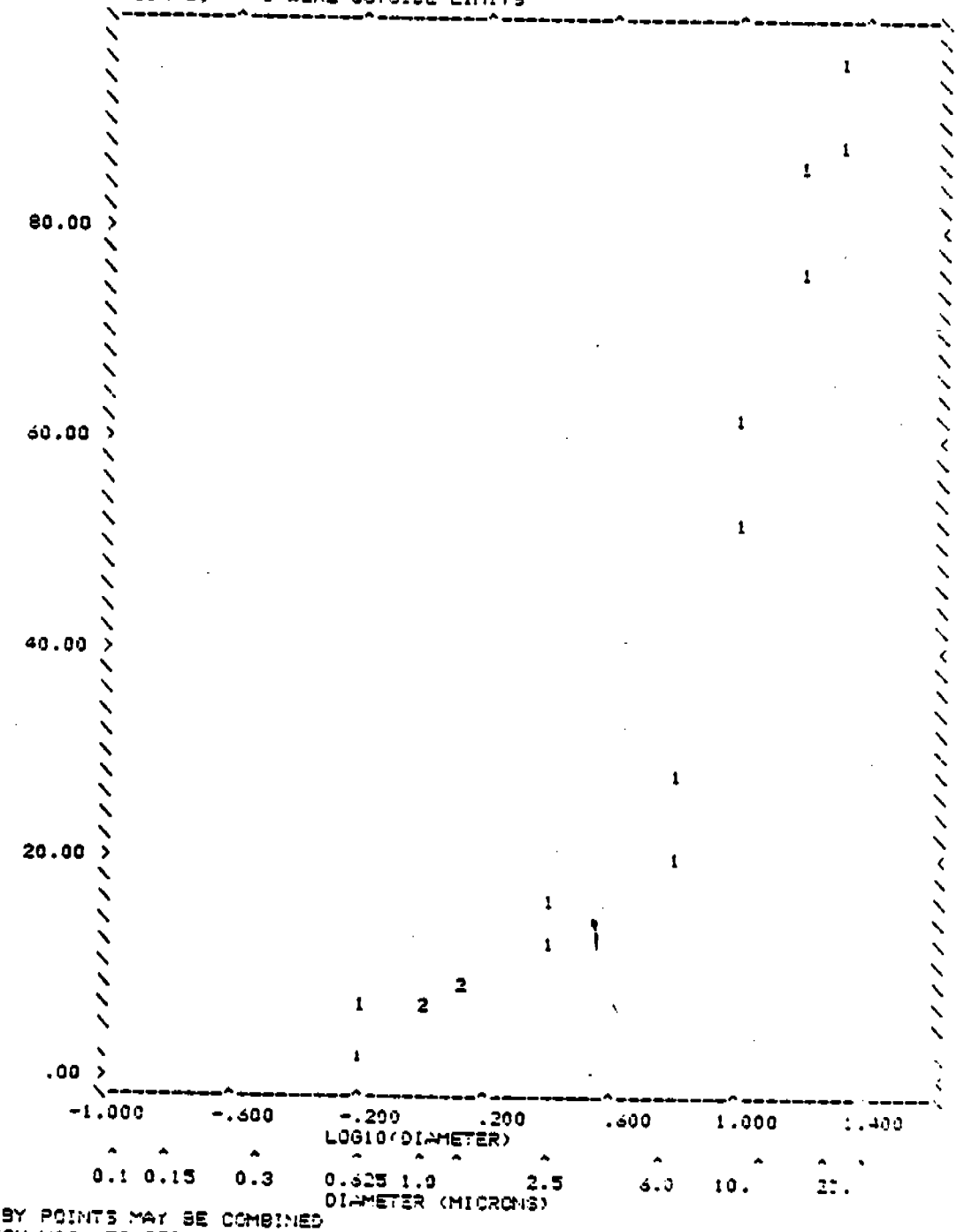
STD.	DIAM.	CUM. % MASS	< D50
4	.63	3.44	6.31
5	1.00	7.12	7.64
6	1.25	9.08	8.37
7	2.50	16.34	12.48
8	6.00	28.74	21.50
9	10.00	63.16	53.42
10	15.00	87.68	76.76
11	20.00	97.13	98.10

DATA COMPARISON FOR 2 INLET RUNS BY ENT

STD. DIAM. (MICRONS)	NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4 .63	2	3.94E+02	3.33E+02	4.87	2.02	3.44	6.31
5 1.00	2	8.97E+02	4.93E+02	7.38	.37	7.12	7.64
6 1.25	2	9.75E+02	5.72E+02	8.73	.50	8.37	9.09
7 2.50	2	1.87E+03	9.47E+02	14.41	2.73	12.48	16.34
8 6.00	2	3.90E+03	1.65E+03	25.12	5.12	21.50	28.74
9 10.00	2	9.76E+03	3.85E+03	58.29	6.39	53.42	63.16
10 15.00	2	7.52E+03	5.44E+03	82.22	7.73	76.76	87.68
11 20.00	2	3.92E+03	6.14E+03	92.61	6.38	88.10	97.13

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 2 RUNS AT STD. DIAM.

16 INPUT POINTS, 0 WERE OUTSIDE LIMITS



NEARBY POINTS MAY BE COMBINED
DO YOU WISH TO REPEAT THE COMPARISON EXCLUDING SOME RUNS? ENTER Y OR N
>

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S3A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, Multiclone Inlet DATE: [redacted]

	START-FINISH TIME:	1401-1403		VOLUME METERED, ACF:	0.503
SR)	SAMPLING RATE, ACFM	0.546		NOZZLE DIA., INCHES:	0.246
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	0.997
PB)	BARO. PRESS., IN.HG.:	29.60	TM)	METER TEMP., DEG F:	93
PSI)	STATIC PRESS., IN. H2O:	-2.20	DH)	DELTA H AVG., IN. H2O:	0.19
TS)	STACK GAS TEMP., DEG F:	598	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	11.6	VCF)	VISCOSITY CORR. FACTOR:	1.282
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.43
	ISOKINETICS, %	102.2		CONCENT., GR/DSCF:	4.1691

STAGE NO.	- PARTICLE DIAMETER - (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	11.51	14.76	82.40	64.4	35.7
0	13.07	16.76	6.74	5.3	30.4
1	8.13	10.49	5.05	3.9	26.5
2	5.47	7.01	7.37	5.8	20.7
3	3.79	4.86	5.11	4.0	16.7
4	2.39	3.06	9.50	7.4	9.3
5	1.23	1.58	6.11	4.8	4.5
6	0.75	0.96	3.93	3.1	1.4
7	0.51	0.65	0.67	0.5	0.9
FILTER	< 0.51	< 0.65	1.10	0.9	

TOTAL CATCH 127.98

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S3B

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, Multiclone Inlet DATE: [redacted]

	START-FINISH TIME:	1434-1436		VOLUME METERED, ACF:	0.484
SR)	SAMPLING RATE, ACFM	0.536		NOZZLE DIA., INCHES:	0.251
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	0.997
PB)	BARO. PRESS., IN.HG.:	29.60	TM)	METER TEMP., DEG F:	92
PSI)	STATIC PRESS., IN. H2O:	-2.20	DH)	DELTA H AVG., IN. H2O:	0.17
TS)	STACK GAS TEMP., DEG F:	618	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	11.6	VCF)	VISCOSITY CORR. FACTOR:	1.290
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.43
	ISOKINETICS, %	105.6		CONCENT., GR/DSCF:	2.8625

STAGE NO.	- PARTICLE DIAMETER - (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	11.62	14.99	41.80	49.4	50.6
PreImp	10.12	13.05	7.00	8.3	42.3
1	6.64	8.57	5.29	6.2	36.1
2	4.23	5.46	5.28	6.2	29.9
3	2.72	3.51	4.43	5.2	24.7
4	1.61	2.08	3.38	4.0	20.7
5	1.07	1.38	3.24	3.8	16.9
6	0.67	0.86	6.60	7.8	9.1
7	0.39	0.50	3.97	4.7	4.4
FILTER	< 0.39	< 0.50	3.71	4.4	
		TOTAL CATCH	84.70		

RUNS S3A, S3B


```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
[redacted]

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>N
 DO YOU WISH TO CALCULATE PENETRATION AND EFFICIENCY?  ENTER Y OR N
Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=DM/DLOGD, 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>5 6

*FTN ERROR   SUBPROGRAM BSORT          ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   599.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            5
SAMPLING AT  102.4 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .37933968      .76817653

   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   618.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            6
SAMPLING AT  105.7 % OF ISOKINETIC RATE
```

	S3A	S3B
TEST SITE	CE	CE
TEST DATE	41734	41734
RUN NUMBER	5	6
RUN DATE	41384	41384
START TIME	1401	1434
TOTAL MASS	9.508E+03	6.531E+03

STD. DIAM.	CUM. % MASS < D50		
4	.63	1.23	4.74
5	1.00	2.92	9.44
6	1.25	4.25	14.17
7	2.50	8.41	20.08
8	6.00	18.02	31.58
9	10.00	26.53	41.08
10	15.00	35.99	50.66
11	20.00	44.71	58.58

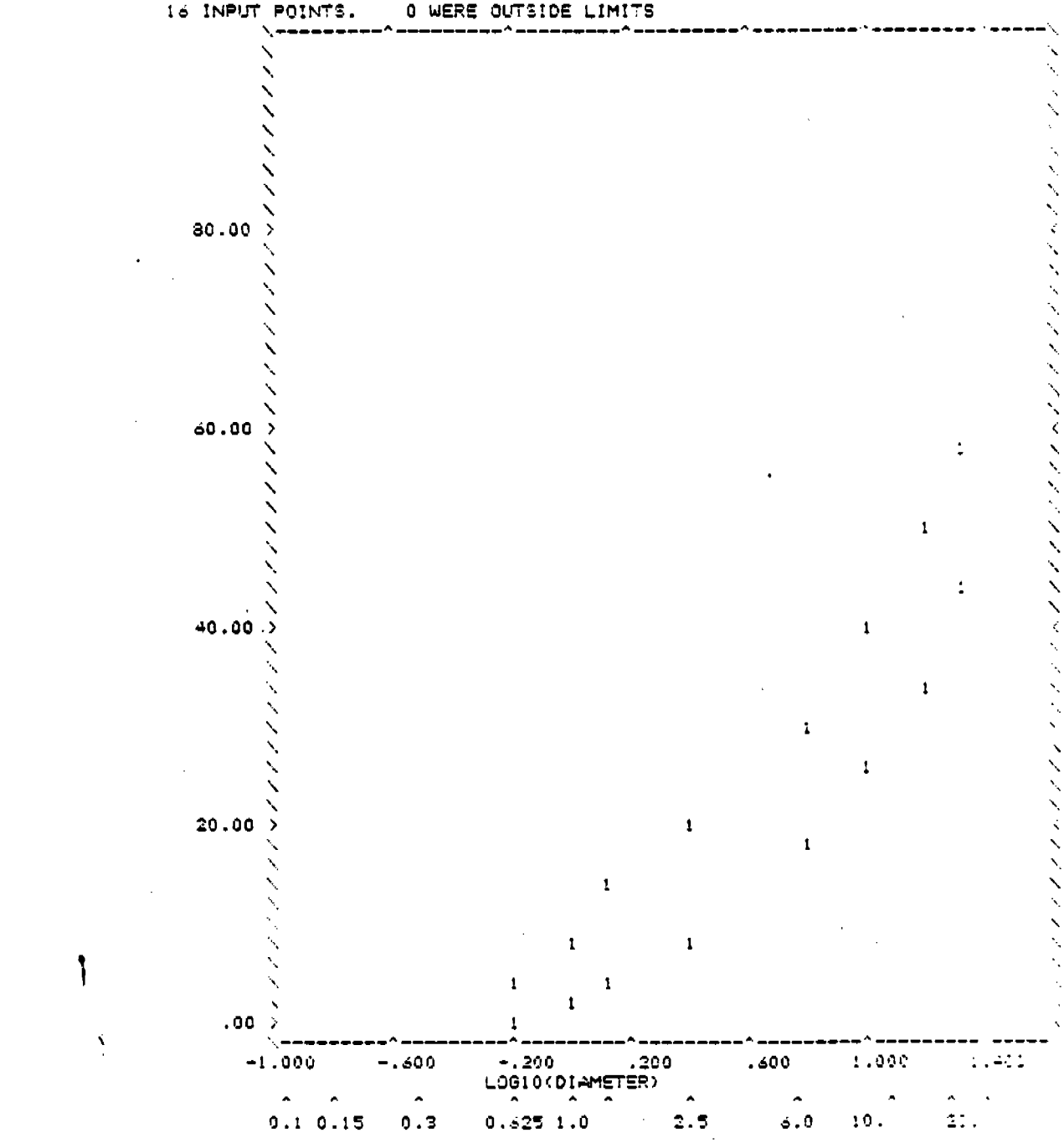
DATA COMPARISON FOR 2 INLET RUNS BY ENT

STD. DIAM. (MICRONS)		NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4	.63	2	4.07E+02	2.13E+02	2.99	2.48	1.23	4.74
5	1.00	2	2.09E+03	4.47E+02	6.18	4.61	2.92	9.44
6	1.25	2	1.94E+03	6.65E+02	9.21	7.02	4.25	14.17

7	2.50	2	1.73E+03	1.06E+03	14.24	8.25	8.41	[illegible]
8	6.00	2	1.99E+03	1.89E+03	24.80	9.59	18.02	[illegible]
9	10.00	2	4.11E+03	2.60E+03	33.81	10.29	28.53	[illegible]
10	15.00	2	4.57E+03	3.36E+03	43.32	10.39	25.98	[illegible]
11	20.00	2	6.32E+03	4.04E+03	51.64	9.81	44.71	[illegible]

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 2 RUNS AT STD. DIAM.

16 INPUT POINTS. 0 WERE OUTSIDE LIMITS



APPENDIX 7.1.2.2

I.D. FAN INLET EAST AND WEST

RUNS S4A, S4B, S5A, S5B, S6A, S6B


```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
>041884

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC INSPECTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
                                                        R 3=CUM. % MASS?
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>1 2 3 4 5 6

*FTN ERROR   SUBPROGRAM BSORT          ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              5  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** MASS ON STAGE              7  IS HIGH
   *** RUN DATE,         41784 BEFORE TEST DATE,        41884
   *** STACK TEMPERATURE   561.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
 REDUCE DATA FOR RUN            1
 SAMPLING AT   98.9 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .29354557      .61393420

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              5  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** MASS ON STAGE              7  IS HIGH
   *** RUN DATE,         41784 BEFORE TEST DATE,        41884
   *** STACK TEMPERATURE   542.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
 REDUCE DATA FOR RUN            2
 SAMPLING AT  109.2 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .41150601      .91351337
   *** LINEAR INTERPOLATION USED BETWEEN   7.8299651      15.500000

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              5  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** RUN DATE,         41784 BEFORE TEST DATE,        41884
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   558.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
 REDUCE DATA FOR RUN            3
 SAMPLING AT  100.8 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .29495430      .61599231
```

```
    *** MASS ON STAGE                  5  IS HIGH
    *** MASS ON STAGE                  6  IS HIGH
    *** RUN DATE,          41784 BEFORE TEST DATE.          41884
    *** SAMPLING DURATION    2.0000000        IS SHORT
    *** STACK TEMPERATURE    517.00000        IS HIGH
    *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN                  4
SAMPLING AT  111.4 % OF ISOKINETIC RATE
    *** LINEAR INTERPOLATION USED BETWEEN    .43306478        .85239580

    *** SAMPLING DURATION    2.0000000        IS SHORT
    *** STACK TEMPERATURE    562.00000        IS HIGH
    *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN                  5
SAMPLING AT  110.6 % OF ISOKINETIC RATE
    *** LINEAR INTERPOLATION USED BETWEEN    .38656504        .77733654
    *** LINEAR INTERPOLATION USED BETWEEN    7.5166231        14.820000

    *** MASS ON STAGE                  1  IS HIGH
    *** MASS ON STAGE                  6  IS HIGH
    *** SAMPLING DURATION    2.0000000        IS SHORT
    *** STACK TEMPERATURE    562.00000        IS HIGH
    *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN                  6
SAMPLING AT  111.3 % OF ISOKINETIC RATE
    *** LINEAR INTERPOLATION USED BETWEEN    .31036350        .64359665
    *** LINEAR INTERPOLATION USED BETWEEN    4.2638686        6.4213685
```

	S4A	S4B	S5A	S5B	S6A	S6B
TEST SITE	CE	CE	CE	CE	CE	CE
TEST DATE	41884	41884	41884	41884	41884	41884
RUN NUMBER	1	2	3	4	5	6
RUN DATE	41784	41784	41784	41784	41884	41884
START TIME	1243	1258	1745	1755	1414	1424
TOTAL MASS	8.656E+03	8.898E+03	9.203E+03	9.609E+03	8.014E+03	9.755E+03

STD.	DIAM.	CUM. % MASS < D50					
4	.63	1.13	4.52	2.37	3.19	3.38	2.45
5	1.00	4.25	8.63	5.68	6.55	7.03	5.87
6	1.25	5.87	11.88	7.24	9.44	9.53	7.78
7	2.50	13.01	21.21	14.95	19.71	17.21	13.78
8	6.00	28.25	38.60	30.52	36.05	27.49	20.03
9	10.00	47.59	46.31	50.39	43.38	35.57	27.52
10	15.00	66.81	53.17	69.22	55.56	44.03	45.52
11	20.00	85.26	70.71	86.47	72.79	67.65	73.55

DATA COMPARISON FOR 6 OUTLET RUNS BY ENT

STD. DIAM. (MICRONS)		NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4	.63	6	8.51E+02	2.56E+02	2.35	1.13	1.13	4.52
5	1.00	6	2.11E+03	5.70E+02	6.33	1.47	4.25	8.63
6	1.25	6	2.18E+03	7.77E+02	8.62	2.11	5.87	11.88
7	2.50	6	2.86E+03	1.50E+03	16.65	3.31	13.01	21.21
8	6.00	6	3.38E+03	2.72E+03	30.16	6.62	20.03	38.60
9	10.00	6	5.83E+03	3.76E+03	41.79	8.63	27.52	50.39
10	15.00	6	1.03E+04	5.03E+03	55.72	10.51	44.03	69.22
11	20.00	6	1.77E+04	6.87E+03	76.07	7.87	67.65	86.47

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 6 RUNS AT STD. DIAM.

```
48 INPUT POINTS,    0 WERE OUTSIDE LIMITS
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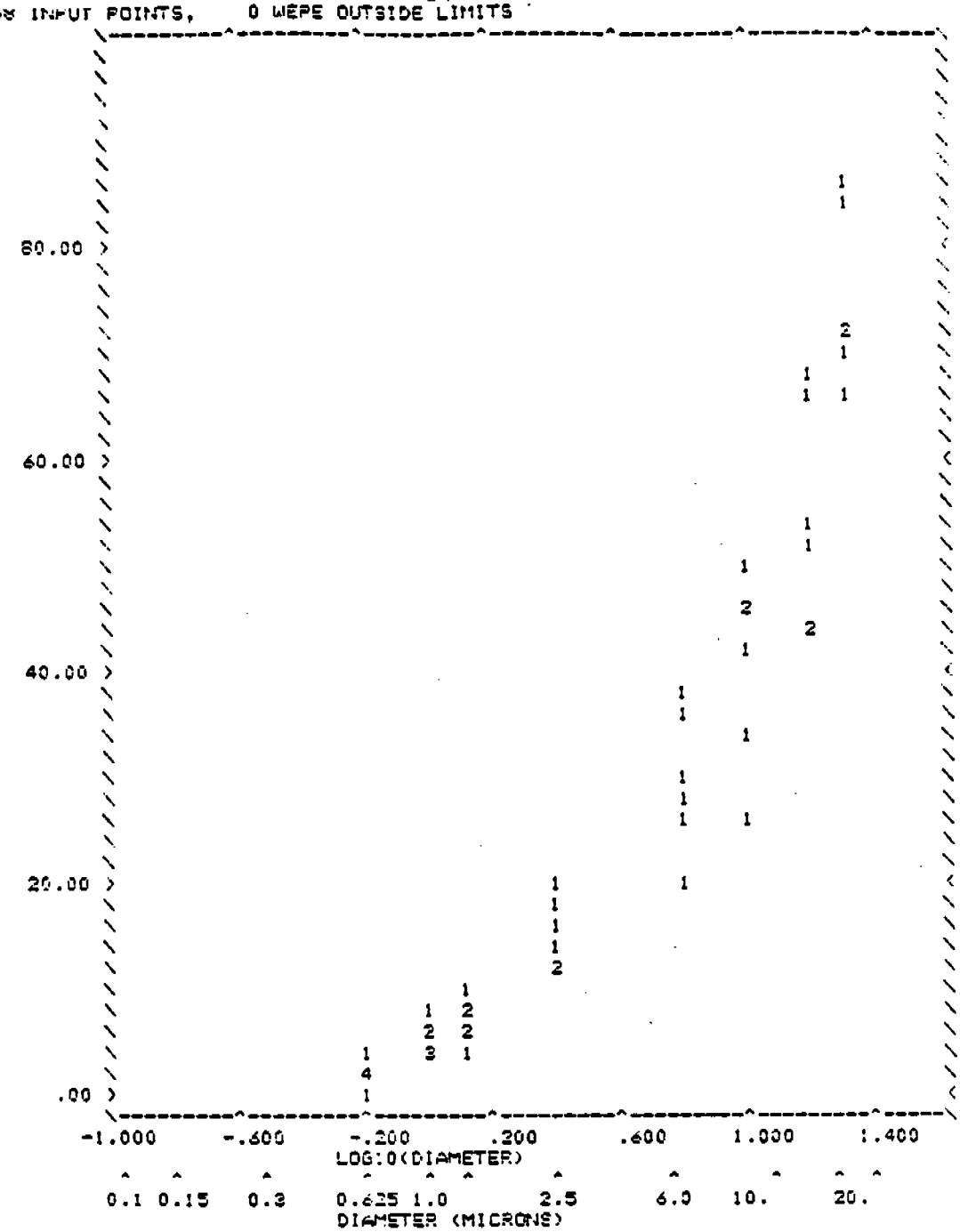



```
NEARBY POINTS MAY BE COMBINED
DO YOU WISH TO REPEAT THE COMPARISON EXCLUDING SOME RUNS?  ENTER Y OR N
>
```

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S4A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, East Side DATE: [redacted]

	START-FINISH TIME:	1243-1247		VOLUME METERED, ACF:	1.431
SR)	SAMPLING RATE, ACFM	0.770		NOZZLE DIA., INCHES:	0.251
ST)	SAMPLING TIME, MINUTES:	4.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	97
PSI)	STATIC PRESS., IN. H2O:	-5.80	DH)	DELTA H AVG., IN. H2O:	0.45
TS)	STACK GAS TEMP., DEG F:	561	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	13.1	VCF)	VISCOSITY CORR. FACTOR:	1.266
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.42
	ISOKINETICS, %	98.6		CONCENT., GR/DSCF:	3.7968

STAGE NO.	- PARTICLE DIAMETER - (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	9.62	12.18	145.60	44.0	56.0
0	10.95	13.86	32.39	9.8	46.2
1	6.88	8.71	20.24	6.1	40.1
2	4.59	5.81	36.30	11.0	29.1
3	3.18	4.03	28.03	8.5	20.6
4	2.01	2.54	29.26	8.9	11.7
5	1.03	1.30	23.54	7.1	4.6
6	0.62	0.78	11.68	3.5	1.1
7	0.42	0.53	2.39	0.7	0.4
FILTER	< 0.42	< 0.53	1.18	0.4	
		TOTAL CATCH	330.61		

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S4B

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, East Side DATE: [redacted]

	START-FINISH TIME:	1258-1302		VOLUME METERED, ACF:	0.908
SR)	SAMPLING RATE, ACFM	0.479		NOZZLE DIA., INCHES:	0.252
ST)	SAMPLING TIME, MINUTES:	4.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	97
PSI)	STATIC PRESS., IN. H2O:	-5.80	DH)	DELTA H AVG., IN. H2O:	0.14
TS)	STACK GAS TEMP., DEG F:	542	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	13.1	VCF)	VISCOSITY CORR. FACTOR:	1.257
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.42
	ISOKINETICS, %	109.0		CONCENT., GR/DSCF:	3.9023

STAGE NO.	- PARTICLE DIAMETER - (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	12.33	15.50	99.70	46.3	53.9
0	13.97	17.56	13.29	6.2	47.7
1	8.73	10.97	3.08	1.4	46.3
2	5.85	7.35	8.51	4.0	42.3
3	4.05	5.09	11.33	5.3	37.0
4	2.55	3.21	28.57	13.3	23.7
5	1.31	1.65	22.63	10.5	13.2
6	0.81	1.02	16.08	7.5	5.7
7	0.55	0.69	6.39	3.0	2.7
FILTER	< 0.55	< 0.69	5.86	2.7	

TOTAL CATCH 215.44

RUNS S4A, S4B


```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
>041384

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
TER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=CM/DLOGD. 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>1 2

*FTN ERROR   SUBPROGRAM BSORT          ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              5  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** MASS ON STAGE              7  IS HIGH
   *** RUN DATE,          41784 BEFORE TEST DATE,        41384
   *** STACK TEMPERATURE   561.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            1
SAMPLING AT   98.9 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .29354557      .61393420

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              5  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** MASS ON STAGE              7  IS HIGH
   *** RUN DATE,          41784 BEFORE TEST DATE,        41384
   *** STACK TEMPERATURE   542.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            2
SAMPLING AT  109.2 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .41150601      .81851337
   *** LINEAR INTERPOLATION USED BETWEEN   7.8298651      15.500000
```

	S4A	S4B
TEST SITE	CE	CE
TEST DATE	41384	41384
RUN NUMBER	1	2
RUN DATE	41784	41784
START TIME	1243	1259
TOTAL MASS	8.656E+03	8.898E+03

STD.	DIAM.	CUM. % MASS < D50	
4	.63	1.13	4.52
5	1.00	4.25	8.63
6	1.25	5.87	11.88

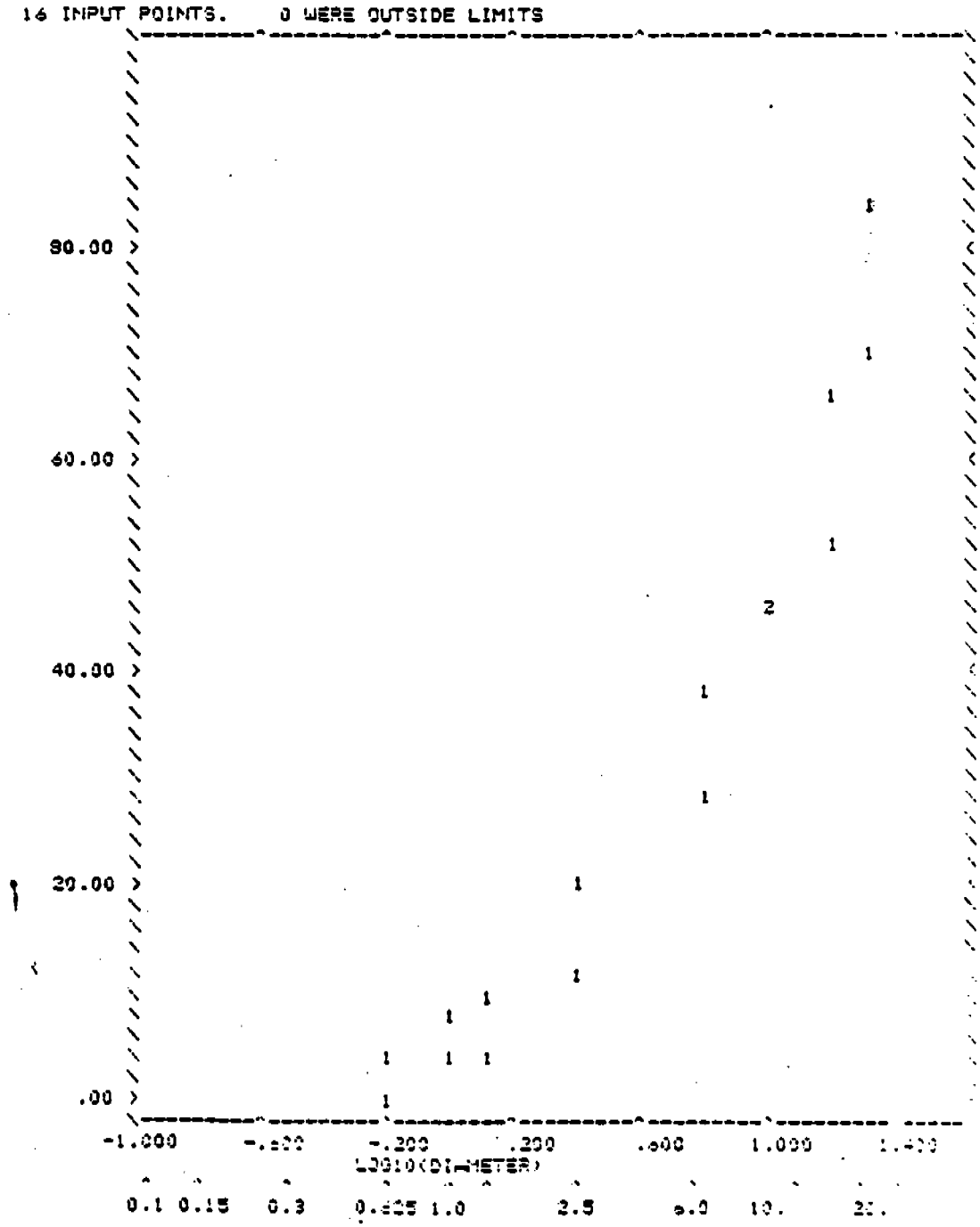
7	2.50	13.01	21.21
8	6.00	29.25	39.60
9	10.00	47.59	46.31
10	15.00	66.81	53.17
11	20.00	85.26	70.71

DATA COMPARISON FOR 2 OUTLET RUNS BY ENT

STD. DIAM. (MICRONS)	NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4 .63	2	8.19E+02	2.52E+02	2.85	2.37	1.18	4.52
5 1.00	2	2.22E+03	5.68E+02	6.44	3.10	4.25	8.63
6 1.25	2	2.24E+03	7.82E+02	8.87	4.25	5.87	11.86
7 2.50	2	2.97E+03	1.51E+03	17.11	5.80	13.01	21.21
8 6.00	2	4.19E+03	2.94E+03	33.43	7.31	29.25	39.60
9 10.00	2	5.85E+03	4.12E+03	46.95	.90	46.31	47.59
10 15.00	2	8.31E+03	5.26E+03	59.99	9.65	53.17	66.81
11 20.00	2	1.58E+04	6.84E+03	77.99	10.29	70.71	85.26

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 2 RUNS AT STD. DIAM.

16 INPUT POINTS. 0 WERE OUTSIDE LIMITS



PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN 55A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, East Side DATE: [redacted]

	START-FINISH TIME:	1745-1747		VOLUME METERED, ACF:	0.707
SR)	SAMPLING RATE, ACFM	0.765		NOZZLE DIA., INCHES:	0.248
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	94
PSI)	STATIC PRESS., IN. H2O:	-5.80	DH)	DELTA H AVG., IN. H2O:	0.42
TS)	STACK GAS TEMP., DEG F:	558	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	13.4	VCF)	VISCOSITY CORR. FACTOR:	1.264
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.48
	ISOKINETICS, %	100.6		CONCENT., GR/DSCF:	4.0354

STAGE NO.	- PARTICLE DIAMETER - (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	9.65	12.20	72.00	41.3	58.3
0	10.99	13.89	20.92	12.0	46.8
1	6.91	8.73	9.97	5.7	41.1
2	4.60	5.81	16.90	9.7	31.4
3	3.19	4.03	14.12	8.1	23.3
4	2.02	2.55	17.29	9.9	13.4
5	1.03	1.30	12.72	7.3	6.1
6	0.63	0.80	6.63	3.8	2.3
7	0.42	0.53	2.05	1.2	1.1
FILTER	< 0.42	< 0.53	1.93	1.1	
		TOTAL CATCH	174.53		

SSA, SSB


```
CE
ENTER TEST DATE, IDATE. (MMDDYY)

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=DM/DLOGD. 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>3 4

*FTN ERROR   SUBPROGRAM BSORT           ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              5  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** RUN DATE,          41784 BEFORE TEST DATE,        41884
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   558.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN             3
SAMPLING AT  100.3 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .29495430      .61599291

   *** MASS ON STAGE              5  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** RUN DATE,          41784 BEFORE TEST DATE,        41884
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   517.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN             4
SAMPLING AT  111.4 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .43306478      .85229560
```

	SSA	SSB
TEST SITE	CE	CE
TEST DATE	41884	41884
RUN NUMBER	3	4
RUN DATE	41784	41784
START TIME	1745	1755
TOTAL MASS	9.203E+03	9.609E+03

STD.	DIAM.	CUM. % MASS	< D50
4	.63	2.37	3.19
5	1.00	5.48	6.55
6	1.25	7.24	9.44
7	2.50	14.95	19.71
8	6.00	30.52	36.05
9	10.00	50.39	43.33
10	15.00	69.22	55.56

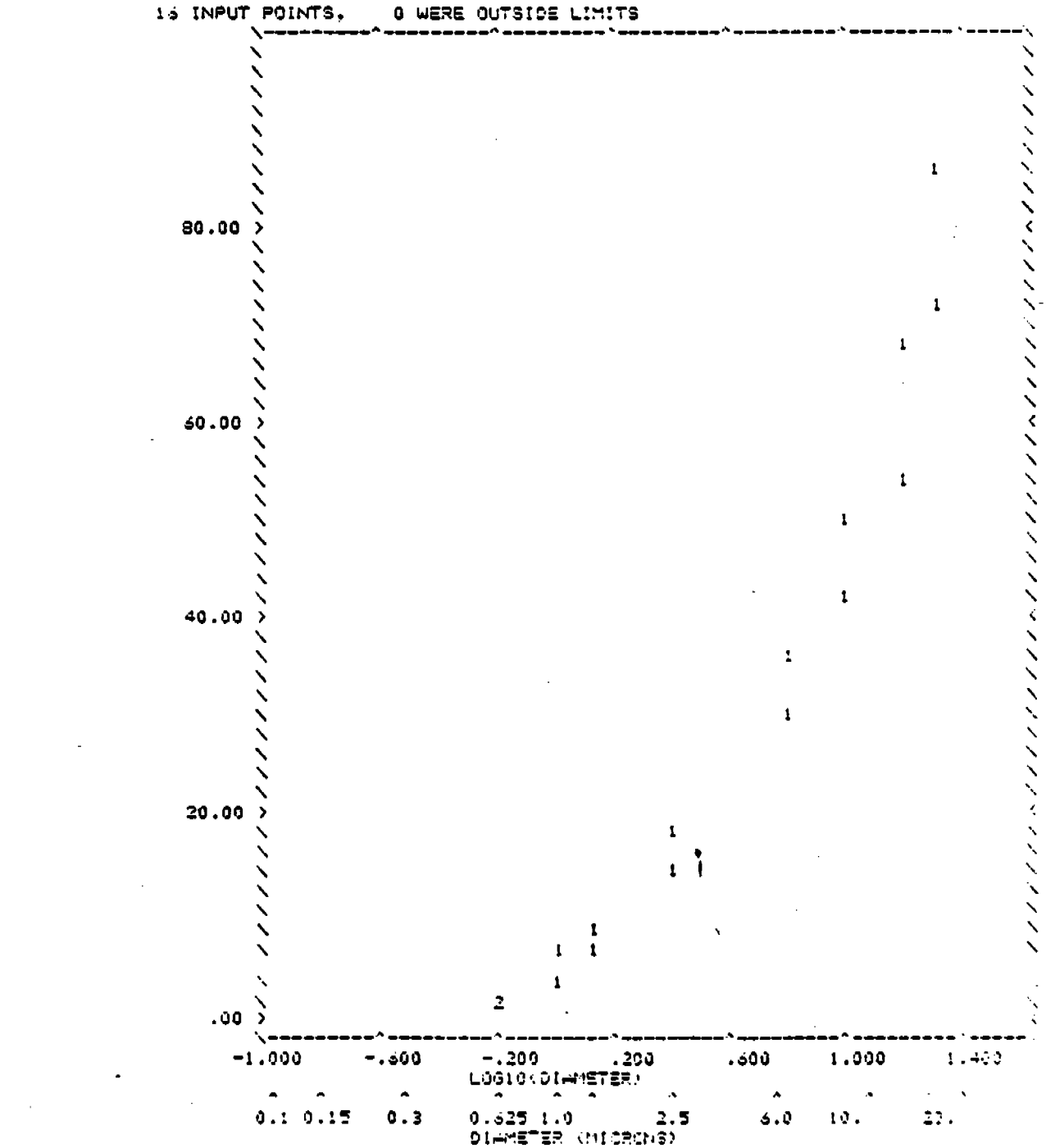
11 20.00 86.47 72.79

DATA COMPARISON FOR 2 OUTLET RUNS BY ENT

STD. DIAM. (MICRONS)	NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4 .63	2	9.62E+02	2.62E+02	2.78	.58	2.37	3.19
5 1.00	2	2.17E+03	5.76E+02	6.11	.61	5.68	6.55
6 1.25	2	2.29E+03	7.86E+02	8.34	1.55	7.24	9.44
7 2.50	2	3.47E+03	1.63E+03	17.33	3.36	14.95	19.71
8 6.00	2	4.72E+03	3.14E+03	33.29	3.91	30.52	36.05
9 10.00	2	6.31E+03	4.40E+03	46.89	4.95	43.38	50.39
10 15.00	2	1.06E+04	5.85E+03	62.39	9.66	55.56	69.22
11 20.00	2	1.56E+04	7.48E+03	79.63	9.68	72.79	86.47

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 2 RUNS AT STD. DIAM.

16 INPUT POINTS, 0 WERE OUTSIDE LIMITS



NEARBY POINTS MAY BE COMBINED

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S6A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, East Side DATE: [redacted]

	START-FINISH TIME:	1414-1416		VOLUME METERED, ACF:	0.506
SR)	SAMPLING RATE, ACFM	0.528		NOZZLE DIA., INCHES:	0.188
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.60	TM)	METER TEMP., DEG F:	106
PSI)	STATIC PRESS., IN. H2O:	-5.60	DH)	DELTA H AVG., IN. H2O:	0.18
TS)	STACK GAS TEMP., DEG F:	562	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	11.8	VCF)	VISCOSITY CORR. FACTOR:	1.266
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.43
	ISOKINETICS, %	110.3		CONCENT., GR/DSCF:	3.5162

STAGE NO.	- PARTICLE DIAMETER (microns) - FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	11.71	14.82	60.10	56.3	43.7
0	13.29	16.83	9.65	9.0	34.7
1	8.31	10.52	2.64	2.5	32.2
2	5.57	7.05	2.78	2.6	29.6
3	3.85	4.87	3.15	2.9	26.7
4	2.43	3.08	8.86	8.3	18.4
5	1.25	1.58	8.97	8.4	10.0
6	0.76	0.96	6.19	5.8	4.2
7	0.52	0.66	2.82	2.6	1.6
FILTER	< 0.52	< 0.66	1.67	1.6	

TOTAL CATCH 106.83

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S6B

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, East Side DATE: [redacted]

	START-FINISH TIME:	1424-1426		VOLUME METERED, ACF:	0.690
SR)	SAMPLING RATE, ACFM	0.718		NOZZLE DIA., INCHES:	0.252
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.60	TM)	METER TEMP., DEG F:	107
PSI)	STATIC PRESS., IN. H2O:	-5.60	DH)	DELTA H AVG., IN. H2O:	0.31
TS)	STACK GAS TEMP., DEG F:	562	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	11.8	VCF)	VISCOSITY CORR. FACTOR:	1.266
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.43
	ISOKINETICS, %	111.1		CONCENT., GR/DSCF:	4.2743

STAGE NO.	- PARTICLE DIAMETER - (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	9.98	12.63	112.50	63.6	36.5
0	11.35	14.37	14.45	8.2	28.3
1	7.13	9.03	5.78	3.3	25.0
2	4.76	6.03	7.96	4.5	20.5
3	3.29	4.17	4.30	2.4	18.1
4	2.08	2.63	8.59	4.9	13.2
5	1.06	1.34	11.59	6.6	6.6
6	0.65	0.82	7.23	4.1	2.5
7	0.44	0.56	2.42	1.4	1.1
FILTER	< 0.44	< 0.56	2.01	1.1	
		TOTAL CATCH	176.83		

RUNS S6A, S6B

```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
>041384

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=DM/DLOGD, 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>5 6

*FTN ERROR   SUBPROGRAM BSORT            ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01. CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   562.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            5
SAMPLING AT  110.6 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .38656504      .77733654
   *** LINEAR INTERPOLATION USED BETWEEN   7.3166231      14.820000

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              6  IS HIGH
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   562.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            6
SAMPLING AT  111.3 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .31036350      .64359665
   *** LINEAR INTERPOLATION USED BETWEEN   4.2638686      6.4213685
```

	S6A	S6B
TEST SITE	CE	CE
TEST DATE	41384	41384
RUN NUMBER	5	6
RUN DATE	41384	41384
START TIME	1414	1424
TOTAL MASS	9.014E+03	9.755E+03

STD.	DIAM.	CUM. % MASS < D50	
4	.63	3.38	2.45
5	1.00	7.03	5.37
6	1.25	9.53	7.78
7	2.50	17.21	13.78
8	6.00	27.49	20.03
9	10.00	35.57	27.52
10	15.00	44.03	45.52
11	20.00	67.65	73.55

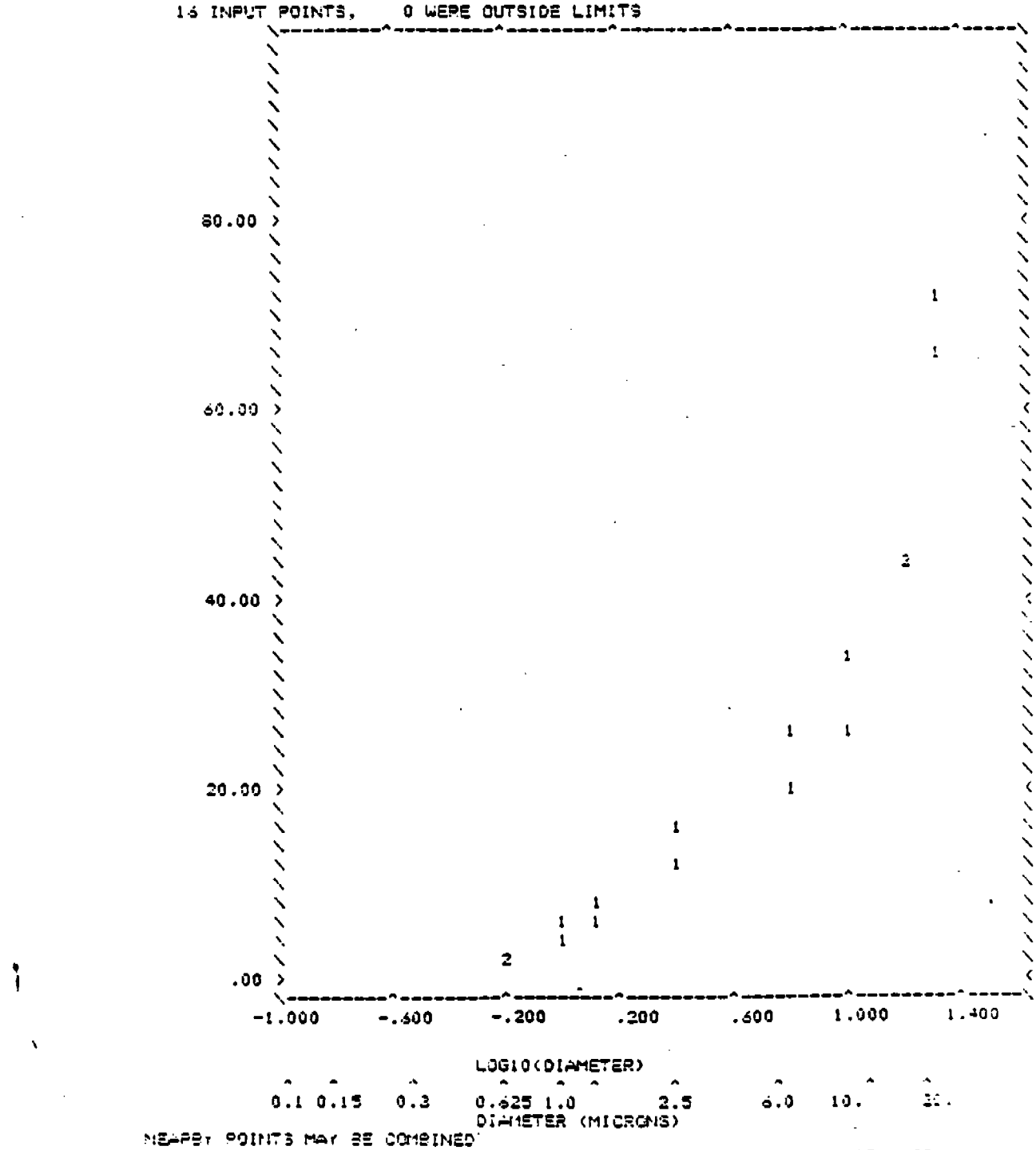
DATA COMPARISON FOR 2 OUTLET RUNS BY ENT

STD. DIAM. (MICRONS)	NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.

4	.63	2	7.72E+02	2.55E+02	2.91	.66	2.45	3.38
5	1.00	2	1.93E+03	5.68E+02	6.45	.92	5.87	7.03
6	1.25	2	2.00E+03	7.61E+02	8.66	1.24	7.78	9.53
7	2.50	2	2.14E+03	1.36E+03	15.50	2.43	13.78	17.21
8	6.00	2	1.23E+03	2.08E+03	23.76	5.27	20.03	27.49
9	10.00	2	5.33E+03	2.77E+03	31.55	5.69	27.52	35.57
10	15.00	2	1.19E+04	3.98E+03	44.78	1.05	44.03	45.52
11	20.00	2	2.17E+04	6.30E+03	70.60	4.17	67.65	73.55

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 2 RUNS AT STD. DIAM.

16 INPUT POINTS, 0 WERE OUTSIDE LIMITS



NEARBY POINTS MAY BE COMBINED
DO YOU WISH TO REPEAT THE COMPARISON EXCLUDING SOME RUNS? ENTER Y OR N

 RUNS S7A, S8A, S8B, S9A

```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
>041894

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODYNAMIC IMPACTION)
>2
THE TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=CM/DLOGD, 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>7 8 9 10

*FTN ERROR   SUBPROGRAM BSORT           ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              9  IS HIGH
   *** RUN DATE,          41794 BEFORE TEST DATE,        41894
   *** SAMPLING DURATION   1.5000000       IS SHORT
   *** STACK TEMPERATURE   560.00000       IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            7
SAMPLING AT  109.5 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .64130916      .98277948
   *** LINEAR INTERPOLATION USED BETWEEN   .98277948      1.3084393
   *** JET VELOCITY > 5000 CM/SEC
STAGE        8
VALUE  7577.32

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** RUN DATE,          41794 BEFORE TEST DATE,        41894
   *** SAMPLING DURATION   2.0000000       IS SHORT
   *** STACK TEMPERATURE   553.00000       IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            8
SAMPLING AT  109.4 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .97930951      1.3013088
   *** JET VELOCITY > 5000 CM/SEC
STAGE        8
VALUE  7592.71

   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              9  IS HIGH
   *** RUN DATE,          41794 BEFORE TEST DATE,        41894
   *** SAMPLING DURATION   2.0000000       IS SHORT
   *** STACK TEMPERATURE   539.00000       IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            9
SAMPLING AT  110.7 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   1.3340006      2.4108529
```

```
   *** SAMPLING DURATION    2.0000000       IS SHORT
   *** STACK TEMPERATURE    534.00000       IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN            10
SAMPLING AT  108.5 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   5.1032025      7.9265638
```

	S7A	S8A	S8B	S9A
TEST SITE	CE	CE	CE	CE
TEST DATE	41884	41884	41884	41884
RUN NUMBER	7	8	9	10
RUN DATE	41784	41784	41784	41884
START TIME	1350	1833	1857	1454
TOTAL MASS	6.191E+03	5.116E+03	7.367E+03	5.273E+03

STD. DIAM.		CUM. % MASS < D50			
4	.63	32.12	6.01	15.44	8.44
5	1.00	32.69	8.93	18.01	12.54
6	1.25	34.17	10.29	19.54	16.10
7	2.50	45.55	21.32	25.09	23.63
8	6.00	59.10	39.32	46.02	40.48
9	10.00	71.54	58.33	52.59	45.99
10	15.00	83.99	76.70	63.45	58.85
11	20.00	93.38	90.40	81.33	77.30

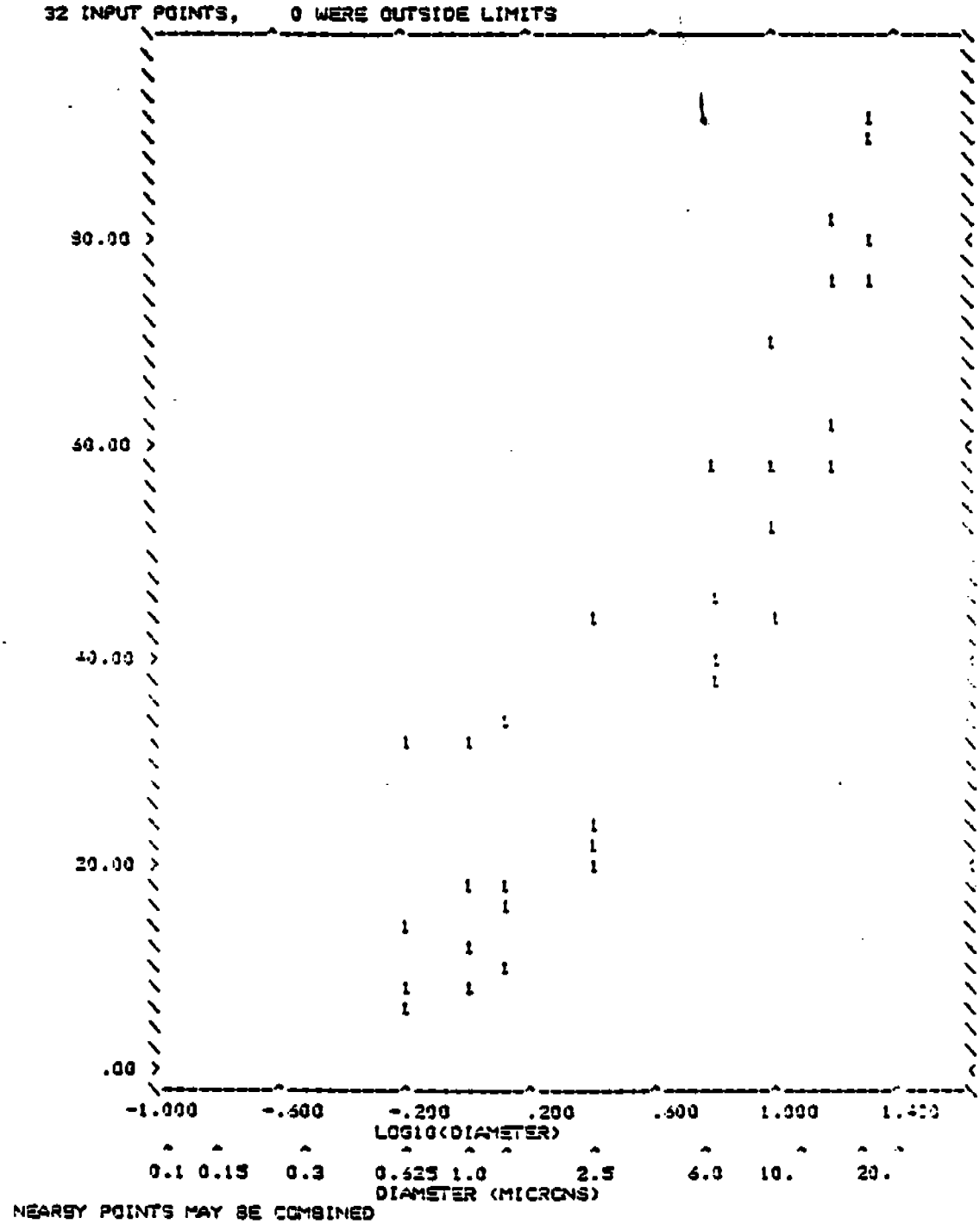
DATA COMPARISON FOR 4 OUTLET RUNS BY ENT

STD. DIAM. (MICRONS)		NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4	.63	4	6.09E+02	9.70E+02	15.50	11.73	6.01	32.12
5	1.00	4	1.07E+03	1.12E+03	18.04	10.45	8.93	32.69
6	1.25	4	1.15E+03	1.23E+03	20.03	10.17	10.29	34.17
7	2.50	4	3.27E+03	1.75E+03	29.90	11.21	21.32	45.55
8	6.00	4	2.65E+03	2.81E+03	46.35	8.94	39.32	59.10
9	10.00	4	3.46E+03	3.43E+03	57.11	10.86	45.99	71.54
10	15.00	4	5.74E+03	4.23E+03	70.75	11.63	58.85	83.99
11	20.00	4	7.62E+03	5.12E+03	85.60	7.54	77.30	93.38

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N

```
DO YOU WANT TO PLOT CUM % MASS?  ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM  4 RUNS AT STD. DIAM.
```

32 INPUT POINTS, 0 WERE OUTSIDE LIMITS




```
NEARBY POINTS MAY BE COMBINED
DO YOU WISH TO REPEAT THE COMPARISON EXCLUDING SOME RUNS?  ENTER Y OR N
>
```

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S7A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, West Side DATE: [redacted]

	START-FINISH TIME:	1350-1352		VOLUME METERED, ACF:	0.742
SR)	SAMPLING RATE, ACFM	1.060		NOZZLE DIA., INCHES:	0.252
ST)	SAMPLING TIME, MINUTES:	1.50	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	100
PSI)	STATIC PRESS., IN. H2O:	-5.80	DH)	DELTA H AVG., IN. H2O:	0.67
TS)	STACK GAS TEMP., DEG F:	560	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	13.3	VCF)	VISCOSITY CORR. FACTOR:	1.265
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.42
	ISOKINETICS, %	109.3		CONCENT., GR/DSCF:	2.7132

STAGE NO.	PARTICLE DIAMETER (microns) FROM GRAPH	PARTICLE DIAMETER (microns) AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	8.14	10.30	33.80	27.7	72.1
PreImp	7.09	8.97	7.61	6.2	65.9
1	4.65	5.88	10.65	8.7	57.2
2	3.00	3.80	5.78	4.7	52.5
3	1.93	2.44	9.43	7.7	44.8
4	1.15	1.45	9.99	8.2	36.6
5	0.76	0.96	4.94	4.1	32.5
6	0.47	0.59	0.40	0.3	32.2
7	0.27	0.34	7.61	6.2	26.0
FILTER	< 0.27	< 0.34	31.70	26.0	

TOTAL CATCH 121.91

RUN S7A


```
CE
ENTER TEST DATE, IDATE (MMDDYY), OR RETURN TO USE CURRENT VALUE
[redacted]
ENTER THE RUN NUMBER, IRUN
>7
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              9  IS HIGH
   *** RUN DATE,        41784 BEFORE TEST DATE,        41884
   *** SAMPLING DURATION   1.5000000      IS SHORT
   *** STACK TEMPERATURE   560.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500

DO YOU WISH TO LIST THE DATA FOR RUN? ENTER Y OR N
>N

DO YOU WISH TO MODIFY ANY RUN CONDITIONS?  ENTER Y OR N
>N
WANT TO RETRIEVE ANOTHER RUN?  ENTER Y OR N
>N

DO YOU WISH TO TO REDUCE THE DATA? ENTER Y OR N
>Y



 PARTICULATE DATA REDUCTION AND ENTRY SYSTEM     05/17/84          14:12:53
DATA FOR TEST BY CONTRACTOR ENT , AT SITE CE  , ON DATE  41884, RUN NO.  7
SAMPLING AT  109.5 % OF ISOKINETIC RATE
WANT TO SEE RESULTS USING CLASSICAL (STOKES) DEF. OF DIAM.?  ENTER Y OR N
>N
   *** LINEAR INTERPOLATION USED BETWEEN   .64130916      .98277948
   *** LINEAR INTERPOLATION USED BETWEEN   .98277948      1.8084393
   *** JET VELOCITY > 5000 CM/SEC
STAGE        8
VALUE  7577.82
WANT TO SEE RESULTS USING THE TGLD DEF. OF AERO. DIAM.?  ENTER Y OR N
>Y

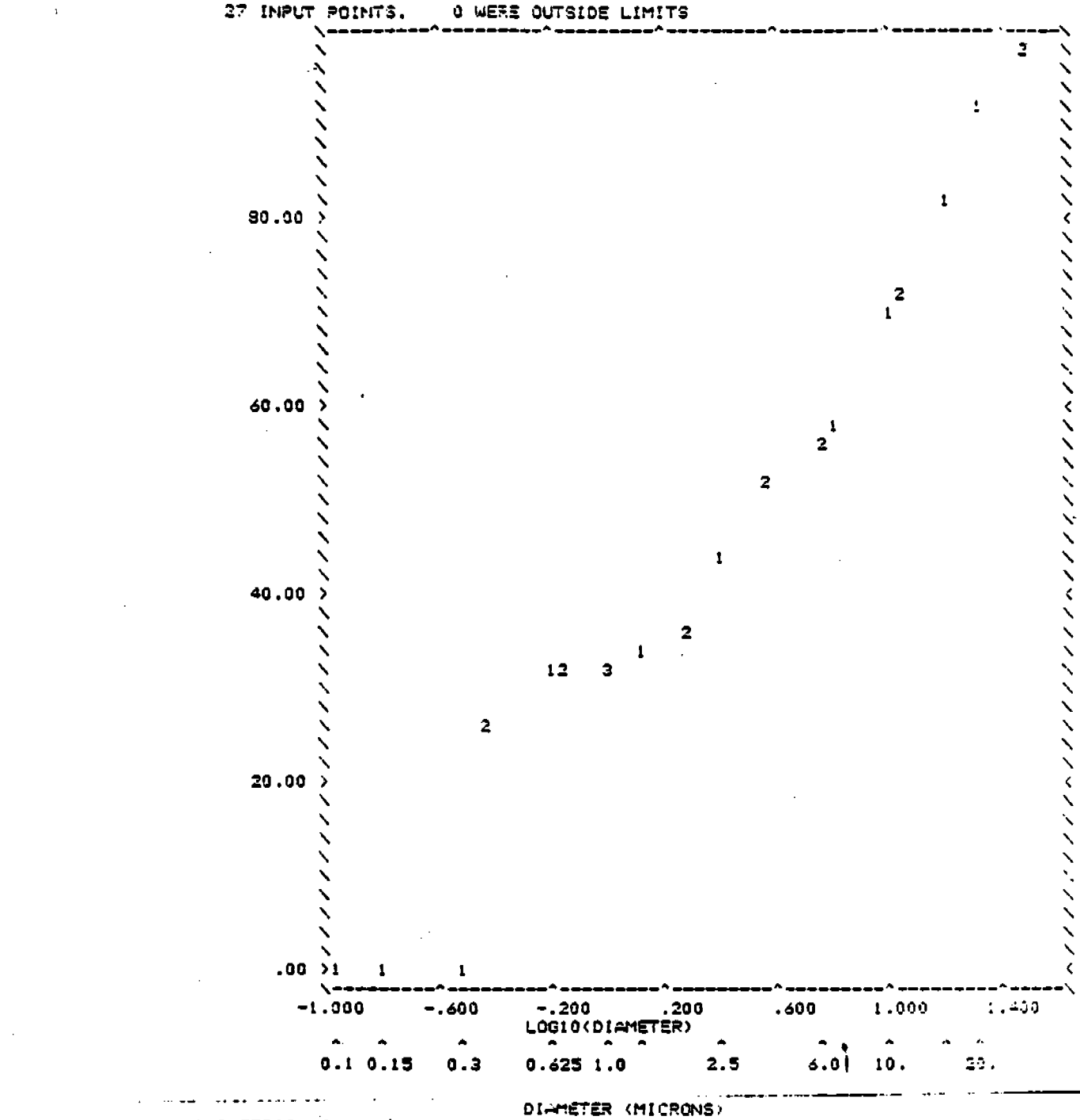
Run S7A, I.D. Fan Inlet, West Side
TOTAL MASS  1.1832+000  2.7055+000  2.7077+003  6.1911+003      DMAX=  30.0
              GR/ACF      GR/DNCF     MG/ACM      MG/DNCM            MICRONS

 STAGE       MASS       MASS    CUM. MASS      D50     GEO. MEAN DM/DLOGD  DN/DLOGD
             (MG)    (MG/DNCM)  (MG/DNCM)   (MICRONS)  (MICRONS) (MG/DNCM) (NO/DNCM)
CYCLONE     33.80    1716.49    4474.56      10.30      17.58   3.70+003  1.30+009
    1        7.61     386.46    4088.10      11.03      10.66  -1.31+004 -2.06+010
    2       10.65     540.95    3547.25       5.56       7.83   1.82+003  7.24+009
    3        5.78     293.53    3253.72       3.56       4.45   1.52+003  3.28+010
    4        9.43     478.89    2774.83       2.64       3.07   3.67+003  2.43+011
    5        9.99     507.33    2267.50       1.31       2.13   3.09+003  5.67+011
    6        4.94     250.87    2016.62        .98       1.33   9.47+002  7.64+011
    7         .40      20.31    1996.31        .64        .79   1.10+002  4.13+011
    8        7.61     386.46    1609.85        .34        .47   1.41+003  2.63+013
FILTER      31.70    1609.85                              .24   5.35+003  7.25+014
   *** CUT POINTS FOR STAGES  0  1 ARE SIMILAR OR INVERTED
       MEASURED DATA FOR STAGE,  1 WITH D50=   11.03 OMITTED FROM INTERPOLATION
   *** CUT POINTS FOR STAGES  3  4 ARE SIMILAR OR INVERTED
       MEASURED DATA FOR STAGE,  4 WITH D50=    2.64 OMITTED FROM INTERPOLATION
   *** LINEAR INTERPOLATION USED BETWEEN   .64130916      .98277948
   *** LINEAR INTERPOLATION USED BETWEEN   .98277948      1.8084393
INTERPOLATED TO STD. INTERVALS: (VALUES AT DIAM. MARKED WITH * ARE EXTRAPOLATED)
                                1988.34        .63              5.39+002
                                2023.77       1.00              6.05+002
```

2115.57	1.25	9.47+002
2819.76	2.50	3.40+003
3658.70	6.00	3.29+003
4429.03	10.00	3.59+003
5199.88	15.00*	4.90+003
5781.30	20.00*	4.06+003

WANT TO PLOT CUM. % MASS? ENTER Y OR N
>Y

27 INPUT POINTS. 0 WERE OUTSIDE LIMITS



1 INTERPOLATED POINTS 2 MEASURED POINTS 3 NEARBY POINTS
*** JET VELOCITY > 5000 CM/SEC
STAGE 8
VALUE 7577.82
WANT TO SEE RESULTS USING MERCERS DEF. OF AERO. DIAM.? ENTER Y OR N
>

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S8A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, West Side DATE: [redacted]

	START-FINISH TIME:	1833-1835		VOLUME METERED, ACF:	0.978
SR)	SAMPLING RATE, ACFM	1.062		NOZZLE DIA., INCHES:	0.251
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	93
PSI)	STATIC PRESS., IN. H2O:	-5.80	DH)	DELTA H AVG., IN. H2O:	0.70
TS)	STACK GAS TEMP., DEG F:	553	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	13.9	VCF)	VISCOSITY CORR. FACTOR:	1.262
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.48
	ISOKINETICS, %	109.2		CONCENT., GR/DSCF:	2.2435

STAGE NO.	PARTICLE DIAMETER (microns) FROM GRAPH	PARTICLE DIAMETER (microns) AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	8.13	10.26	54.80	40.7	59.3
PreImp	7.08	8.93	14.08	10.5	48.8
1	4.64	5.86	15.92	11.8	37.0
2	3.00	3.79	10.47	7.8	29.2
3	1.93	2.44	15.03	11.2	18.0
4	1.15	1.45	7.39	5.5	12.5
5	0.76	0.96	5.03	3.7	8.8
6	0.47	0.59	3.59	2.7	6.1
7	0.27	0.34	3.28	2.4	3.7
FILTER	< 0.27	< 0.34	4.97	3.7	

TOTAL CATCH 134.56

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S3B

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, West Side DATE: [redacted]

	START-FINISH TIME:	1857-1859		VOLUME METERED, ACF:	0.572
SR)	SAMPLING RATE, ACFM	0.615		NOZZLE DIA., INCHES:	0.248
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.50	TM)	METER TEMP., DEG F:	90
PSI)	STATIC PRESS., IN. H2O:	-5.80	DH)	DELTA H AVG., IN. H2O:	0.23
TS)	STACK GAS TEMP., DEG F:	539	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	13.9	VCF)	VISCOSITY CORR. FACTOR:	1.256
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.48
	ISOKINETICS, %	110.5		CONCENT., GR/DSCF:	3.2638

STAGE NO.	PARTICLE DIAMETER (microns) FROM GRAPH	PARTICLE DIAMETER (microns) AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	10.82	13.59	45.60	39.7	60.2
PreImp	9.42	11.83	5.20	4.5	55.7
1	6.18	7.76	7.81	6.8	48.9
2	3.94	4.95	7.29	6.3	42.6
3	2.54	3.19	14.92	13.0	29.6
4	1.51	1.90	6.83	5.9	23.7
5	1.00	1.26	4.36	3.8	19.9
6	0.62	0.78	3.21	2.8	17.1
7	0.36	0.45	2.92	2.5	14.6
FILTER	< 0.36	< 0.45	16.84	14.6	

TOTAL CATCH 114.98

RUNS S8A, S8B


```
CE
ENTER TEST DATE, IDATE, (MMDDYY)
>041884

DO YOU WISH TO REVIEW ALL RUNS IN A TEST?  ENTER Y OR N?
>N

 DO YOU WISH TO COMPARE SEVERAL RUNS? ENTER Y OR N
>Y
ENTER DIAMETER DEFINITION (1=PHYSICAL, 2=AERODYNAMIC, 3=AERODINAMIC IMPACTION)
>2
E TGLD AERODYNAMIC DIAM. WILL BE USED
 DO YOU WANT STATISTICS FOR 1=DM/DLOGD, 2=CUM. MASS, OR 3=CUM. % MASS?
>3
THE STD.DEV., MINIMUM, AND MAXIMUM OF THE CUM. % MASS WILL BE PRINTED
ENTER THE NO. OF STD. DEV. TO BE USED TO IDENTIFY POTENTIAL OUTLIERS.
>3
ENTER INDICES OF RUNS TO BE COMPARED SEPARATED BY BLANKS OR
   ENTER IN TO COMPARE ALL INLET RUNS IN THE TEST OR
   ENTER OUT TO COMPARE ALL OUTLET RUNS IN THE TEST
>8 9

*FTN ERROR   SUBPROGRAM BSORT          ARGUMENT LIST DOESN'T MATCH CALLER
BSORT  REFERENCED AT LN.   143  OF  COMPAR
FOLLOWING ARGUMENT TYPES DO NOT MATCH:
ARGUMENT NO. 01, CALLERS TYPE: INTEGER     SUBPROGRAMS TYPE: REAL*4

   *** MASS ON STAGE              1  IS HIGH
   *** MASS ON STAGE              2  IS HIGH
   *** MASS ON STAGE              3  IS HIGH
   *** MASS ON STAGE              4  IS HIGH
   *** RUN DATE,          41784 BEFORE TEST DATE,        41884
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   553.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN              8
SAMPLING AT  109.4 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   .97930951      1.3013088
   *** JET VELOCITY > 5000 CM/SEC
STAGE        8
VALUE  7592.71

   *** MASS ON STAGE              4  IS HIGH
   *** MASS ON STAGE              9  IS HIGH
   *** RUN DATE,          41784 BEFORE TEST DATE,        41884
   *** SAMPLING DURATION   2.0000000      IS SHORT
   *** STACK TEMPERATURE   539.00000      IS HIGH
   *** IMPACTOR TEMP., TIMP, SHOULD BE < 500
REDUCE DATA FOR RUN              9
SAMPLING AT  110.7 % OF ISOKINETIC RATE
   *** LINEAR INTERPOLATION USED BETWEEN   1.3340006      2.4106529
```

	S8A	S8B
TEST SITE	CE	CE
TEST DATE	41884	41884
RUN NUMBER	8	9
RUN DATE	41784	41784
START TIME	1833	1957
TOTAL MASS	5.116E+03	7.367E+03

STD.	DIAM.	CUM. % MASS	< D50
4	.63	6.01	15.44
5	1.00	8.93	18.01
6	1.25	10.29	19.54
7	2.50	21.32	25.09
8	6.00	39.92	46.02

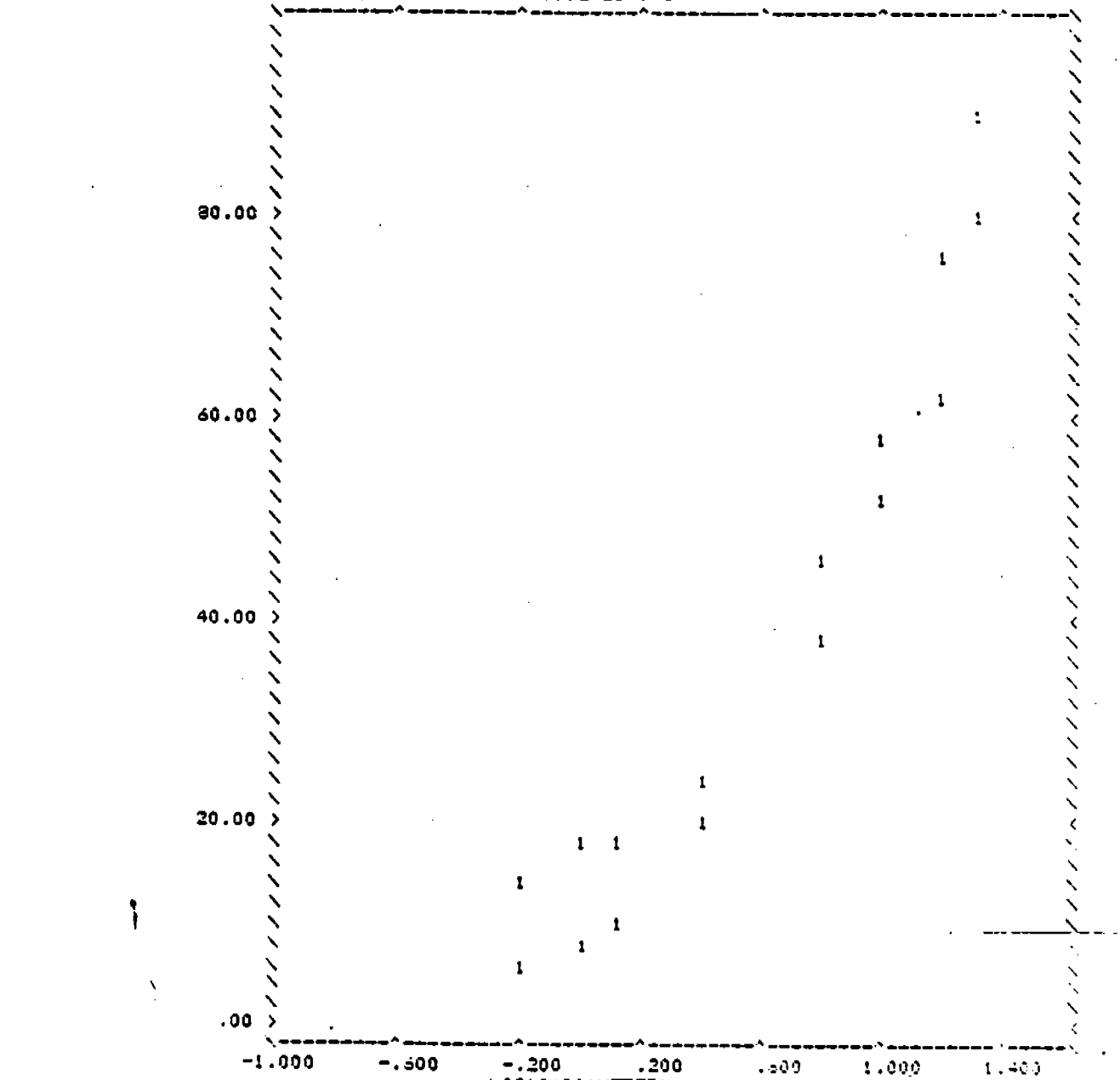
9	10.00	58.33	52.59
10	15.00	76.70	63.45
11	20.00	90.40	81.33

DATA COMPARISON FOR 2 OUTLET RUNS BY ENT

STD. DIAM. (MICRONS)	NO. RUNS	DM/DLOGD (MG/DNCM)	CUMULATIVE MASS < D50	CUM. % MASS < D50 AVG.	STD. DEV.	MIN.	MAX.
4 .63	2	6.68E+02	7.22E+02	10.72	6.66	6.01	15.44
5 1.00	2	9.55E+02	8.92E+02	13.47	6.42	8.93	18.01
6 1.25	2	9.31E+02	9.83E+02	14.92	6.54	10.35	19.54
7 2.50	2	3.68E+03	1.47E+03	23.20	2.66	21.32	25.09
8 6.00	2	3.29E+03	2.71E+03	42.92	4.38	39.82	46.02
9 10.00	2	3.77E+03	3.43E+03	55.46	4.06	52.59	58.33
10 15.00	2	6.50E+03	4.30E+03	70.07	9.37	63.45	76.70
11 20.00	2	8.33E+03	5.31E+03	85.86	6.41	81.33	90.40

DO YOU WANT TO PLOT CUM % MASS? ENTER Y OR N
>Y
COMPARISON OF CUM. % MASS FROM 2 RUNS AT STD. DIAM.

16 INPUT POINTS, 0 WERE OUTSIDE LIMITS



NEARBY POINTS MAY BE COMBINED
DO YOU WISH TO REPEAT THE COMPARISON EXCLUDING SOME RUNS? ENTER Y OR N
>

PARTICLE SIZING FIELD DATA & RESULTS TABULATION

RUN S9A

PLANT: [redacted]

SAMPLING LOCATION: Calciner #4, I.D. Fan Inlet, West Side DATE: [redacted]

	START-FINISH TIME:	1454-1456		VOLUME METERED, ACF:	0.507
SR)	SAMPLING RATE, ACFM	0.522		NOZZLE DIA., INCHES:	0.252
ST)	SAMPLING TIME, MINUTES:	2.00	Y)	METER CAL. FACTOR:	1.004
PB)	BARO. PRESS., IN.HG.:	29.60	TM)	METER TEMP., DEG F:	109
PSI)	STATIC PRESS., IN. H2O:	-5.60	DH)	DELTA H AVG., IN. H2O:	0.16
TS)	STACK GAS TEMP., DEG F:	534	DEN)	PARTICLE DENSITY, GM/CC:	1.00
PMV)	MOISTURE % BY VOLUME:	13.6	VCF)	VISCOSITY CORR. FACTOR:	1.254
DCF)	DENSITY CORR. FACTOR:	1.000	MD)	MOL WT, DRY LB/LB-MOLE:	29.43
	ISOKINETICS, %	108.4		CONCENT., GR/DSCF:	2.3114

STAGE NO.	- PARTICLE DIAMETER - (microns) FROM GRAPH	AERODYNAMIC	CATCH WEIGHT (mgms)	PERCENT OF TOTAL (%)	CUM. % LESS THAN GIVEN DIA
PreSep	11.79	14.78	29.10	41.6	58.4
PreImp	10.26	12.87	9.92	14.2	44.2
1	6.73	8.44	1.47	2.1	42.1
2	4.28	5.37	1.85	2.6	39.5
3	2.75	3.45	6.24	8.9	30.6
4	1.64	2.06	4.33	6.2	24.4
5	1.09	1.37	4.29	6.1	18.3
6	0.68	0.85	4.28	6.1	12.2
7	0.39	0.49	2.91	4.2	8.0
FILTER	< 0.39	< 0.49	5.60	8.0	
		TOTAL CATCH	69.99		

```
CE
ENTER TEST DATE. IDATE (MMDDYY), OR RETURN TO USE CURRENT VALUE
>041884
ENTER THE RUN NO., IRUN, OR RETURN TO USE CURRENT VALUE
>10
   *** SAMPLING DURATION    2.0000000       IS SHORT
   *** STACK TEMPERATURE    534.00000       IS HIGH
   *** IMPACTOR TEMP., TIMP. SHOULD BE < 500

DO YOU WISH TO LIST THE DATA FOR RUN? ENTER Y OR N
>N

DO YOU WISH TO MODIFY ANY RUN CONDITIONS?  ENTER Y OR N
>N
WANT TO RETRIEVE ANOTHER RUN?  ENTER Y OR N
>N

DO YOU WISH TO TO REDUCE THE DATA? ENTER Y OR N
>Y

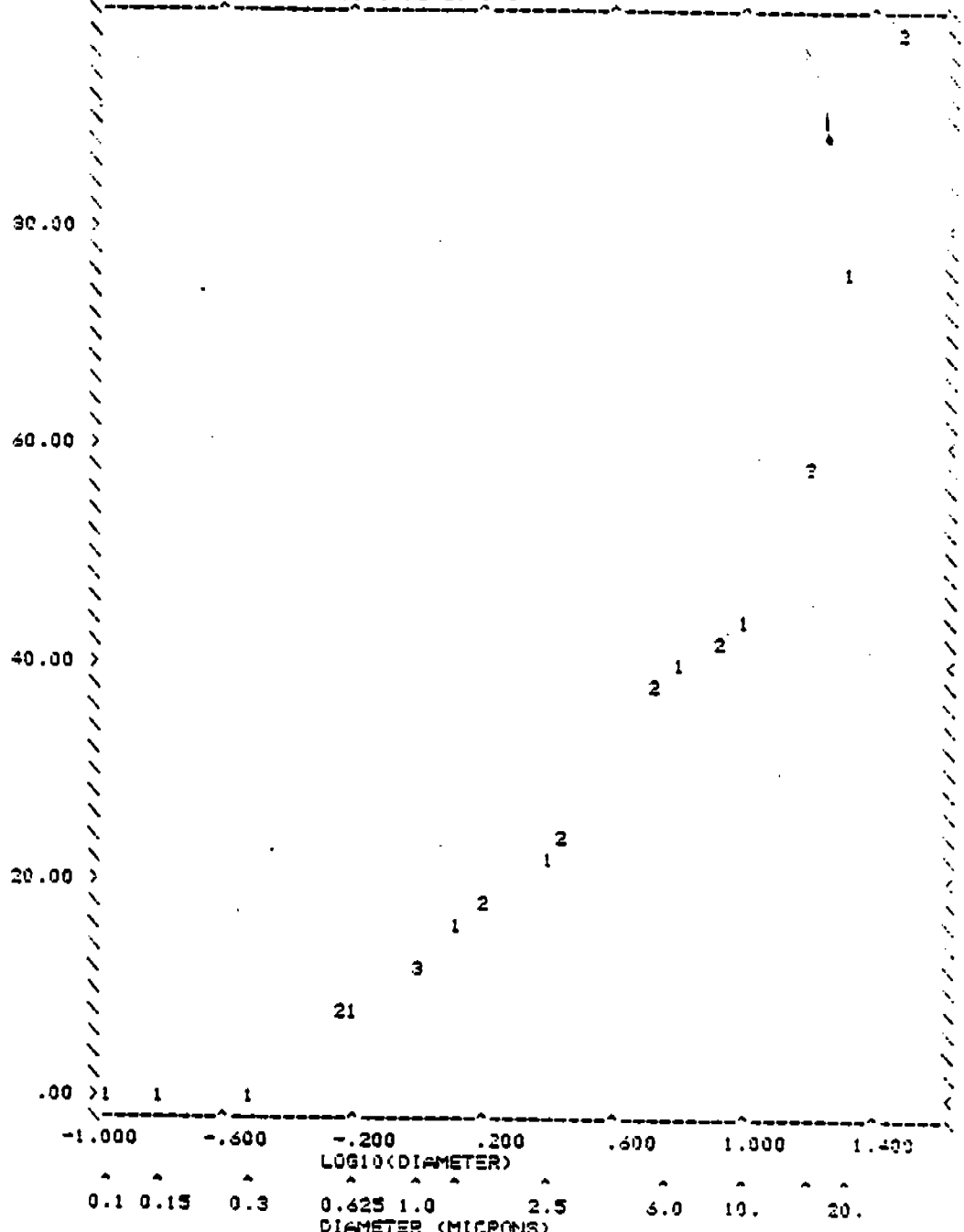


 PARTICULATE DATA REDUCTION AND ENTRY SYSTEM     05/17/84          14:12:58
DATA FOR TEST BY CONTRACTOR ENT , AT SITE CE  , ON DATE  41884, RUN NO. 10
SAMPLING AT  108.5 % OF ISOKINETIC RATE
WANT TO SEE RESULTS USING CLASSICAL (STOKES) DEF. OF DIAM.?  ENTER Y OR N
>N
   *** LINEAR INTERPOLATION USED BETWEEN   5.1032025       7.9265938
WANT TO SEE RESULTS USING THE TGLD DEF. OF AERO. DIAM.?  ENTER Y OR N
>Y

Run S9A, I.D. Fan Inlet, West Side
TOTAL MASS  1.0346+000  2.3041+000  2.3675+003  5.2727+003       DMAX=  30.0
              GR/ACF      GR/DNCF     MG/ACM      MG/DNCM              MICRONS

 STAGE       MASS       MASS    CUM. MASS      D50     GEO. MEAN DM/DLOGD  DN/DLOGD
             (MG)    (MG/DNCM) (MG/DNCM)   (MICRONS) (MICRONS) (MG/DNCM) (NO/DNCM)
CYCLONE     29.10    2192.25   3080.45      14.78     21.06   7.13+003  1.46+009
    1        9.92     747.32   2333.12      15.64     15.20  -3.05+004 -1.66+010
    2        1.47     110.74   2222.38       7.93     11.13   3.75+002  5.19+008
    3        1.85     139.37   2083.01       5.10      6.36   7.29+002  5.41+009
    4        6.24     470.09   1612.92       3.80      4.40   3.66+003  3.20+010
    5        4.33     326.20   1286.72       2.63      3.16   2.03+002  1.23+011
    6        4.29     323.19    963.53       1.46      1.96   1.27+003  3.23+011
    7        4.28     322.43    641.10        .98      1.19   1.85+003  2.09+012
    8        2.91     219.22    421.88        .55       .74   8.86+002  4.25+012
FILTER       5.60     421.88                            .39   1.40+003  4.48+013
   *** CUT POINTS FOR STAGES  0  1 ARE SIMILAR OR INVERTED
       MEASURED DATA FOR STAGE,  1 WITH D50=   15.64 OMITTED FROM INTERPOLATION
   *** CUT POINTS FOR STAGES  3  4 ARE SIMILAR OR INVERTED
       MEASURED DATA FOR STAGE,  4 WITH D50=    3.80 OMITTED FROM INTERPOLATION
   *** LINEAR INTERPOLATION USED BETWEEN   5.1032025       7.9265938
INTERPOLATED TO STD. INTERVALS: (VALUES AT DIAM. MARKED WITH * ARE EXTRAPOLATED)
                                445.18        .63              5.61+002
                                661.40       1.00              1.79+003
                                848.77       1.25              1.80+003
                               1246.16       2.50              2.31+003
                               2134.25       6.00              7.29+002
                               2425.11      10.00              2.70+003
                               3102.78      15.00*             5.05+003
                               4075.67      20.00*             9.76+003
 WANT TO PLOT CUM. % MASS?  ENTER Y OR N
>Y
```

27 INPUT POINTS. 0 WERE OUTSIDE LIMITS



1 INTERPOLATED POINTS 2 MEASURED POINTS 3 NEARBY POINTS

WANT TO SEE RESULTS USING MERCERS DEF. OF AERO. DIAM.? ENTER Y OR N

>

APPENDIX 7.1.3

NITROGEN OXIDES

NITROGEN OXIDES FIELD DATA AND RESULTS TABULATION

Plant: [redacted]

Testing Personnel: Gerard M. Carty

Date of Sampling: [redacted]

PARAMETERS PER RUN (OR SET OF SAMPLES)			SAMPLE ID	SAMPLE LOCATION OR CONDITIONS
Qsd	Air Flow Rate, Dry SCFM*:	29,060	10A	#4 Scrubber Stack
			10B	#4 Scrubber Stack
			10C	#4 Scrubber Stack
			10D	#4 Scrubber Stack

PARAMETERS PER SAMPLE:		10A	10B	10C	10D
	Time of Sample	1005	1035	1210	1240
Va	Volume of Absorbing Sol., ml	25.0	25.0	25.0	25.0
Vf	Volume of Flask, ml	2,080	2,027	2,092	2,066
Vsc	Volume Sampled, Dry Std.* ml	1,977.4	1,926.2	1,989.0	2,012.2
	INITIAL FLASK PARAMETERS:				
Pbar(i)	Barometric Pressure, in. Hg.	29.40	29.40	29.40	29.40
Pg(i)	Evacuated Pressure, in. Hg.	-28.3	-28.1	-28.3	-28.8
Pa(i)	Absolute Pressure, in. Hg.	1.10	1.30	1.10	0.60
ts(i)	Temperature, Degrees F	60	60	60	60
	FINAL FLASK PARAMETERS:				
Pbar(f)	Barometric Pressure, in. Hg.	29.92	29.92	29.92	29.92
Pg(f)	Gauge Pressure, in. Hg.	0.00	0.20	0.00	0.20
Pa(f)	Absolute Pressure, in. Hg.	29.92	30.12	29.92	30.12
ts(f)	Temperature, Degrees F	68	68	68	68
	METHOD 7 NOx RESULTS AS NO2:				
m	Mass Absorbed, micrograms	1,027.0	1,013.1	999.2	971.5
ppmd*	Concent., PPM Dry by Volume	271.6	275.0	262.7	252.5
Lb/Hr	Emissions Rate, Lbs/Hour	56.5	57.2	54.6	52.5

* 68 Degrees F -- 29.92 inches Hg.

NITROGEN OXIDES FIELD DATA AND RESULTS TABULATION

Plant: [redacted]

Testing Personnel: Gerard M. Carty

Date of Sampling: [redacted]

PARAMETERS PER RUN (OR SET OF SAMPLES)			SAMPLE ID	SAMPLE LOCATION OR CONDITIONS
Qsd	Air Flow Rate, Dry SCFM*:	29,920	11A	#4 Scrubber Stack
			11B	#4 Scrubber Stack
			11C	#4 Scrubber Stack
			11D	#4 Scrubber Stack

PARAMETERS PER SAMPLE:		11A	11B	11C	11D
	Time of Sample	1515	1545	1615	1640
Va	Volume of Absorbing Sol., ml	25.0	25.0	25.0	25.0
Vf	Volume of Flask, ml	2,075	2,046	1,953	2,033
Vsc	Volume Sampled, Dry Std.* ml	1,993.1	1,964.9	1,861.8	1,973.1
	INITIAL FLASK PARAMETERS:				
Pbar(i)	Barometric Pressure, in. Hg.	29.40	29.40	29.40	29.40
Pg(i)	Evacuated Pressure, in. Hg.	-28.2	-28.2	-28.4	-28.9
Pa(i)	Absolute Pressure, in. Hg.	1.20	1.20	1.00	0.50
ts(i)	Temperature, Degrees F	60	60	60	60
	FINAL FLASK PARAMETERS:				
Pbar(f)	Barometric Pressure, in. Hg.	29.92	29.92	29.92	29.92
Pg(f)	Gauge Pressure, in. Hg.	0.40	0.40	0.00	0.00
Pa(f)	Absolute Pressure, in. Hg.	30.32	30.32	29.92	29.92
ts(f)	Temperature, Degrees F	68	68	68	68
	METHOD 7 NOx RESULTS AS NO2:				
m	Mass Absorbed, micrograms	1,138.0	1,110.2	1,138.0	1,251.8
ppmd	Concent., PPM Dry by Volume	298.6	295.5	319.6	331.8
Lb/Hr	Emissions Rate, Lbs/Hour	64.0	63.3	68.5	71.1

* 68 Degrees F — 29.92 inches Hg.

NITROGEN OXIDES FIELD DATA AND RESULTS TABULATION

Plant: [redacted]

Testing Personnel: Gerard M. Carty

Date of Sampling: [redacted]

PARAMETERS PER RUN (OR SET OF SAMPLES)			SAMPLE ID	SAMPLE LOCATION OR CONDITIONS
Qsd	Air Flow Rate, Dry SCFM*:	30,430	12A	#4 Scrubber Stack
			12B	#4 Scrubber Stack
			12C	#4 Scrubber Stack
			12D	#4 Scrubber Stack

PARAMETERS PER SAMPLE:		12A	12B	12C	12D
	Time of Sample	1215	1245	1315	1345
Va	Volume of Absorbing Sol., ml	25.0	25.0	25.0	25.0
Vf	Volume of Flask, ml	2,032	1,948	2,047	2,007
Vsc	Volume Sampled, Dry Std.* ml	1,925.7	1,883.6	1,845.5	1,914.9
	INITIAL FLASK PARAMETERS:				
Pbar(i)	Barometric Pressure, in. Hg.	29.40	29.40	29.40	29.40
Pg(i)	Evacuated Pressure, in. Hg.	-28.2	-28.5	-27.6	-28.6
Pa(i)	Absolute Pressure, in. Hg.	1.20	0.90	1.80	0.80
ts(i)	Temperature, Degrees F	68	68	68	68
	FINAL FLASK PARAMETERS:				
Pbar(f)	Barometric Pressure, in. Hg.	29.92	29.92	29.92	29.92
Pg(f)	Gauge Pressure, in. Hg.	0.00	0.30	-0.80	-0.20
Pa(f)	Absolute Pressure, in. Hg.	29.92	30.22	29.12	29.72
ts(f)	Temperature, Degrees F	68	68	68	68
	METHOD 7 NOx RESULTS AS NO2:				
m	Mass Absorbed, micrograms	1,110.2	1,057.5	1,332.3	1,140.8
ppmd	Concent., PPM Dry by Volume	301.5	293.6	377.5	311.5
Lb/Hr	Emissions Rate, Lbs/Hour	65.7	63.9	82.2	67.9

* 68 Degrees F -- 29.92 inches Hg.

TRACE METALS CONCENTRATIONS & ANALYTICAL RESULTS

Method 5 Filters and Impinger Reagents

Element	I.D. Fan Inlet East ---- Run 5 ----		I.D. Fan Inlet West ---- Run 8 ----	
	mg.	ppm	mg.	ppm
Aluminum (Al)	511	597.504	26.98	527.238
Beryllium (Be)	0.020	0.0700	0.016	0.0566
Calcium (Ca)	12.6	9.918	12.5	9.947
Chromium (Cr)	0.440	0.267	0.392	0.240
Fluorine (F)	0.0	0.0	0.0	0.0
Iron (Fe)	44.8	25.306	39.7	22.672
Lead (Pb)	0.292	0.0445	0.270	0.0416
Magnesium (Mg)	5.00	6.489	4.34	5.694
Manganese (Mn)	0.088	0.0505	0.056	0.0325
Mercury (Hg)	0.0098	0.001541	0.0132	0.00210
Nickel (Ni)	0.376	0.202	0.428	0.233
Silicon (Si)	0.0	0.0	0.0	0.0
Titanium (Ti)	6.90	4.544	4.50	2.996
Uranium (U)	0.0	0.0	0.0	0.0
Vanadium (V)	0.760	0.471	0.700	0.438
Zinc (Zn)	0.332	0.160	0.430	0.210

TRACE METALS CONCENTRATIONS & ANALYTICAL RESULTS

Method 5 Filters and Impinger Reagents

Element	Multiclone Inlet ---- Run 2 ---- mg.	ppm	Scrubber Exhaust Stack ---- Run 11 ---- mg.	ppm
Aluminum (Al)	774	816.9	8.3	2.843
Beryllium (Be)	0.018	0.0569	BDL	BDL
Calcium (Ca)	18.0	12.788	2.07	0.477
Chromium (Cr)	1.580	0.865	0.020	0.00356
Fluorine (F)	0.0	0.0	0.0	0.0
Iron (Fe)	69.8	35.588	0.88	0.146
Lead (Pb)	0.431	0.0592	0.0276	0.00123
Magnesium (Mg)	5.49	6.431	0.22	0.0837
Manganese (Mn)	0.162	0.0840	BDL	BDL
Mercury (Hg)	0.0318	0.00451	0.0030	0.000138
Nickel (Ni)	1.170	0.567	0.028	0.00441
Silicon (Si)	0.0	0.0	0.0	0.0
Titanium (Ti)	9.13	5.428	0.27	0.0521
Uranium (U)	0.0	0.0	0.0	0.0
Vanadium (V)	1.110	0.620	0.056	0.0102
Zinc (Zn)	4.430	1.929	0.067	0.00947