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.

AP42 Section:	11.25
Background Chapter	4
Reference:	7
Title:	*Calciners and Dryers in Mineral Industries-Background Information for Proposed Standards*, EPA-450/3-85-025a U.S. Environmental Protection Agency, Research Triangle Park, NC, October, 1985. Excerpts

outlet of an impinjet wet scrubber controlling emissions from a fluid bed dryer at Plant I2. The dryer operated at 91 percent of capacity during the tests and was fired by propane gas. The scrubber operated with a water flow rate of approximately 5.68 ℓ/min (150 gpm). The pressure drop for the scrubber measured 0.8 kPa (3 in.w.c.). No operating or process difficulties were indicated in the test report.

C.1.9.3 Plant I3--Industry Test. Particulate emission tests were conducted at the outlet of a venturi scrubber controlling emissions from a fluid bed dryer at Plant I3. The dryer operated at maximum capacity during the tests and was fired by No. 2 fuel oil. Actual operating parameters for the scrubber were not reported. Design parameters of the wet scrubber include a gas flow rate of 9.12 m^3/s (19,300 acfm), liquid flow rate of 341 ℓ/min (90 gpm), and a gas pressure drop across the throat of 4.38 kPa (1.75 in. w.c.). No operating or process upsets were noted in the test report.

C.1.9.4 Plant I4--Industry Test. Figure C-15 is a schematic of the plant tested. Particulate emissions were conducted at the outlet of a wet scrubber controlling emissions from a fluid bed dryer/cooler unit at Plant I4. The scrubber was preceded by twin cyclones. The dryer operated at 103 percent of design capacity during the tests and was fired by natural gas. A summary of visible emission observations in the test report indicated that the 6-minute average opacity ranged from 5 to 10 percent. No equipment operating problems were noted.

C.1.10 Kaolin

C.1.10.1 Plant J1--EPA Tests. Figures C-16 and C-17 are schematics of the systems tested. The inlet and outlet of the venturi scrubber controlling a multiple hearth furnace and the inlet and outlet to the fabric filter controlling a flash calciner were tested at Plant J1. Particle size distribution samples were collected at all test sites except the outlet of the scrubber. Particle size determinations were not possible at this location because of the large quantity of water droplets in the exhaust gases. Visible emission observations were made at the exhaust stacks of the scrubber and fabric filter, and fugitive emission observations were made at the product discharge point of the flash calciner. The product feed and discharge points of the multiple

(140) Kaolin → (36) Ball → Fire → (144) Bent. → (37) Fullers Earth C-11
(2)4 1 3 2 1

hearth furnace were totally enclosed; therefore, process fugitive emissions were not monitored at these locations.

The multiple hearth furnace and flash calciner operated at 115 percent and 82 percent of design capacity, respectively, during the tests and were fired by natural gas. All process conditions were normal during the testing except that the multiple hearth furnace was shut down for a period of 8 minutes during Run No. 2 due to problems with the product screw conveyor. Testing was discontinued for this period.

Excessive visible emissions were noted from the exhaust stack of the fabric filter during Run No. 1 for the flash calciner. Two bags were found to be loose. This problem was corrected for Run Nos. 2 and 3. Six-minute average opacities for Run No. 1 were 0 to 0.6 percent. The opacity during all other runs was 0 percent.

Visible emission observations for the multiple hearth furnace scrubber were all 0 percent. Process fugitive emission observations of the flash calciner inlet resulted in 6-minute average opacities of 0.8 to 8.9 percent.

C.1.10.2 Plant J2--Industry Tests. Figures C-18 and C-19 are schematics of the two systems tested. Particulate emission tests were conducted at the outlet of a shaker-type fabric filter controlling emissions from a spray dryer and at the outlet of a wet scrubber controlling emissions from a multiple hearth furnace at Plant J2. The spray dryer operated at 81 percent of capacity, and the multiple hearth furnace operated at 110 percent of capacity during the tests. Each unit was fired by natural gas.

Actual operating parameters for the two control devices were not reported. Design parameters for the fabric filter include gas flow rate of 1,699 m^3/min (60,000 acfm), pressure drop of 0.25 kPa (1 in. w.c.), total cloth area of 2,997 m^2 (32,256 ft^2), and air-to-cloth ratio of 2.7:1. Design parameters for the wet scrubber include gas flow rate of 5.71 m^3/s (12,100 acfm), pressure drop across the entire system of 4.5 to 5.3 kPa (18 to 21 in. w.c.), and liquid flow rate of 511 ℓ/min (135 gpm). No process upsets were noted in the test report.

C.1.10.3 Plant J3--Industry Test. Figure C-18 is a schematic of the system tested. Particulate emission tests were conducted at the

outlet of the fabric filter controlling emissions from a spray dryer. The dryer operated at 83 percent of design capacity during the tests. The design air-to-cloth ratio for the fabric filter is 3.8:1, and the design pressure drop across the unit is 1.5 kPa (6 in. w.c.). The report noted that isokinetic sampling ratios were 100 percent ±10 percent. Individual isokinetic ratios were not reported for each run. No process upsets were noted in the report.

C.1.10.4 Plant J4--Industry Test. Figure C-18 is a schematic of the system tested. Particulate emission tests were conducted on a shaker-type fabric filter controlling emissions from a spray dryer. The dryer operated at 104 percent of maximum capacity during the tests and was fired by natural gas. Actual baghouse operating parameters were not reported. Design parameters for the fabric filter include an inlet gas flow rate of 39.18 m^3/s (83,000 acfm), a total cloth area of 4,459 m^2 (48,000 ft^2), and an air-to-cloth ratio of 1.7:1. No process upsets were noted in the test report.

C.1.11 Lightweight Aggregate

C.1.11.1 Plant K1--EPA Test. Figure C-20 is a schematic of the system tested. Particulate emission tests were conducted on the inlet and outlet of a medium-energy wet scrubber controlling emissions from a rotary calciner at Plant K1. Other tests included sulfur dioxide, nitrogen oxide, and hydrocarbon emissions (outlet only) and particle size distribution (inlet and outlet). Visible emission observations were made at the scrubber stack, and fugitive emission observations were made at the calciner seals.

The rotary calciner operated at 83 percent of design capacity during the tests and was fired by pulverized coal. No instrumentation was present at the test site to indicate water flow rate to the wet scrubber or the inlet and outlet gas flow rates, temperatures, or pressure drop. The design pressure drop is 1.5 kPa (6 in. w.c.). The 6-minute average opacities at the scrubber stack ranged from 0 to 3.8 percent. All process fugitive emission observations were zero percent opacity. No process upsets were reported.

C.1.11.2 Plant K2--EPA Test. Figure C-20 is a schematic of the system tested. Emission tests were conducted on a rotary calciner at

TABLE C-69. SUMMARY OF EMISSION TEST RESULTS--PLANT J1

Industry: Kaolin
Process unit: Multiple hearth furnace
Emission source: Scrubber inlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	9/26/83	9/27/83	9/27/83	--
Sampling time, minutes	72	72	72	--
Isokinetic ratio, percent	112	103	101	--
Production rate, Mg/h[a]	b	b	b	b
(tons/h)				
Capacity utilization, percent	106	129	109	115
Gas stream data				
Temperature, °C	301	294	290	295
(°F)	(573)	(560)	(554)	(562)
Moisture, percent	17.1	17.2	15.5	17
Flow rate, m^3/s	5.0	5.2	5.3	5.1
(acfm)	(10,600)	(11,000)	(11,100)	(10,900)
Flow rate, dsm^3/s	2.1	2.2	2.3	2.2
(dscfm)	(4,410)	(4,650)	(4,830)	(4,630)
Particulate emissions				
g/dsm^3	8.44	8.15	9.14	8.58
(gr/dscf)	(3.69)	(3.56)	(4.00)	(3.75)
kg/h	63	64	75	68
(lb/h)	(140)	(140)	(160)	(150)
kg/Mg[c]	b	b	b	b
(lb/ton)				

[a]Estimated using feed rate and material moisture content.
[b]Confidential data.
[c]Calculated from estimate of production rate.

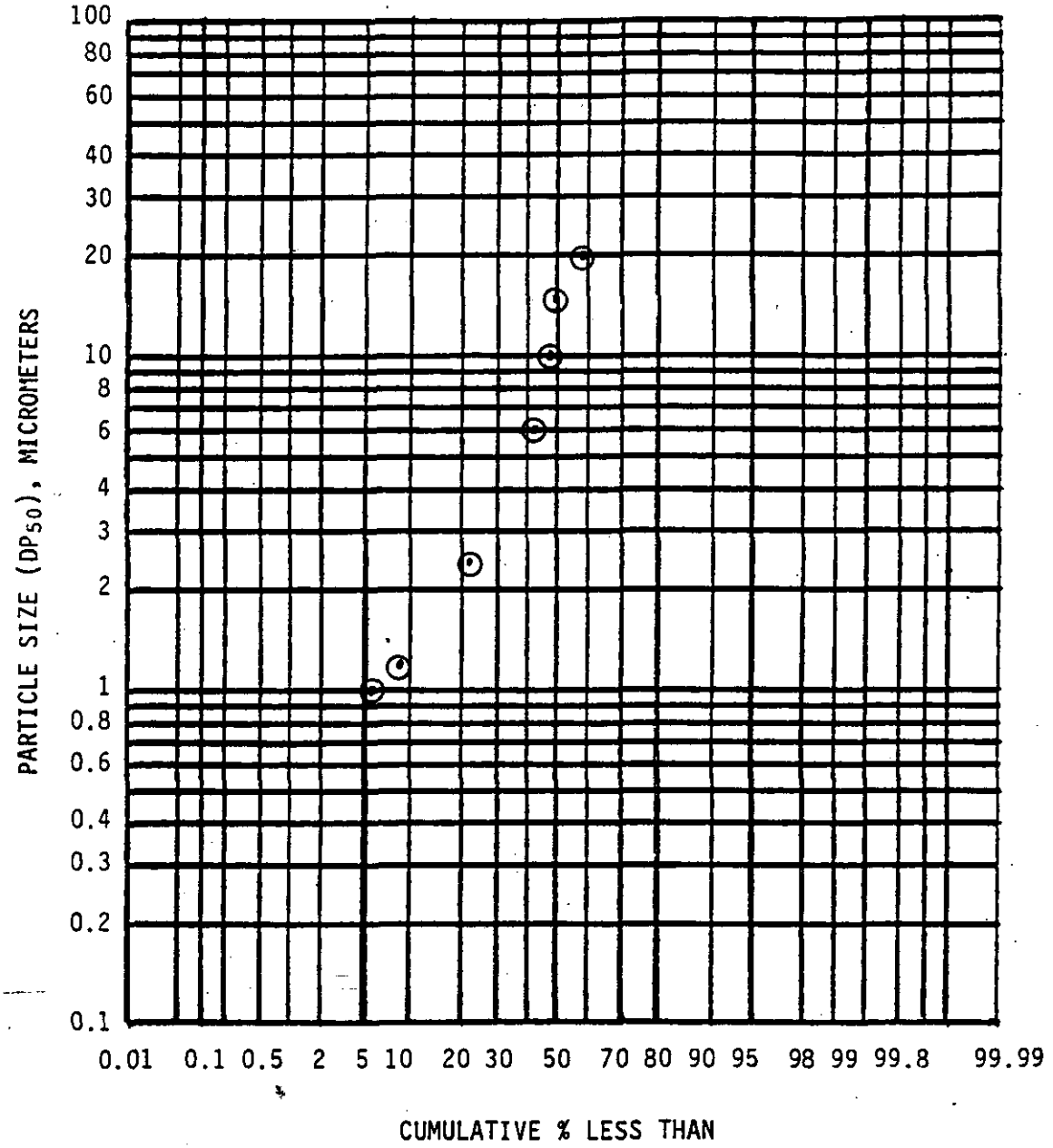

Figure C-51. Particle size distribution data: multiple hearth furnace scrubber inlet--Plant J1.

TABLE C-70. SUMMARY OF EMISSION TEST RESULTS--PLANT J1
Industry: Kaolin
Process unit: Multiple hearth furnace
Emission source: Scrubber outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	9/26/83	9/27/83	9/27/83	--
Sampling time, minutes	64	64	72	--
Isokinetic ratio, percent	101	107	105	--
Production rate, Mg/h[a] (tons/h)	b	b	b	b
Capacity utilization, percent	106	129	109	115
Gas stream data				
Temperature, °C	56	55	56	56
(°F)	(133)	(132)	(132)	(132)
Moisture, percent	18.9	17.6	15.7	17.4
Flow rate, m^3/s	3.6	3.9	3.7	3.7
(acfm)	(7,640)	(8,160)	(7,790)	(7,860)
Flow rate, dsm^3/s	2.6	2.8	2.7	2.7
(dscfm)	(5,460)	(5,940)	(5,790)	(5,730)
Particulate emissions				
g/dsm^3	0.056	0.039	0.047	0.047
(gr/dscf)	(0.025)	(0.017)	(0.021)	(0.021)
kg/h	0.52	0.39	0.46	0.46
(lb/h)	(1.1)	(0.86)	(1.0)	(1.0)
kg/Mg[c]	b	b	b	b
(lb/ton)				

[a]Estimated using feed rate and material moisture content.
[b]Confidential data.
[c]Calculated from estimates of production rates.

TABLE C-71. SUMMARY OF EMISSION TEST RESULTS--PLANT J1
Industry: Kaolin
Process unit: Flash calciner
Emission source: Baghouse inlet

Data	Run No. 1[a]	Run No. 2	Run No. 3	Average for test series
General				
Date	9/28/83	9/29/83	9/29/83	--
Sampling time, minutes	72	36	36	--
Isokinetic ratio, percent	102	102	100	--
Production rate, Mg/h	b	b	b	b
(tons/h)				
Capacity utilization, percent[c]	72	90	82	86
Gas stream data				
Temperature, °C	130	123	128	126
(°F)	(265)	(254)	(263)	(258)
Moisture, percent	7.1	8.9	5.5	7.2
Flow rate, m^3/s	14	14	13	14
(acfm)	(29,700)	(29,800)	(28,400)	(29,100)
Flow rate, dsm^3/s	9.3	9.3	9.0	9.2
(dscfm)	(19,600)	(19,600)	(19,100)	(19,400)
Particulate emissions				
g/dsm^3	49.5	49.1	48.9	49.0
(gr/dscf)	(21.6)	(21.5)	(21.4)	(21.5)
kg/h	1,600	1,600	1,600	1,600
(lb/h)	(3,400)	(3,600)	(3,500)	(3,500)
kg/Mg[c]	b	b	b	b
(lb/ton)				

[a]Data from Run 1 not included in average for test series because of low capacity utilization.
[b]Confidential data.
[c]Estimated using feed rate and material moisture content.

PARTICLE SIZE (DP_{50}), MICROMETERS

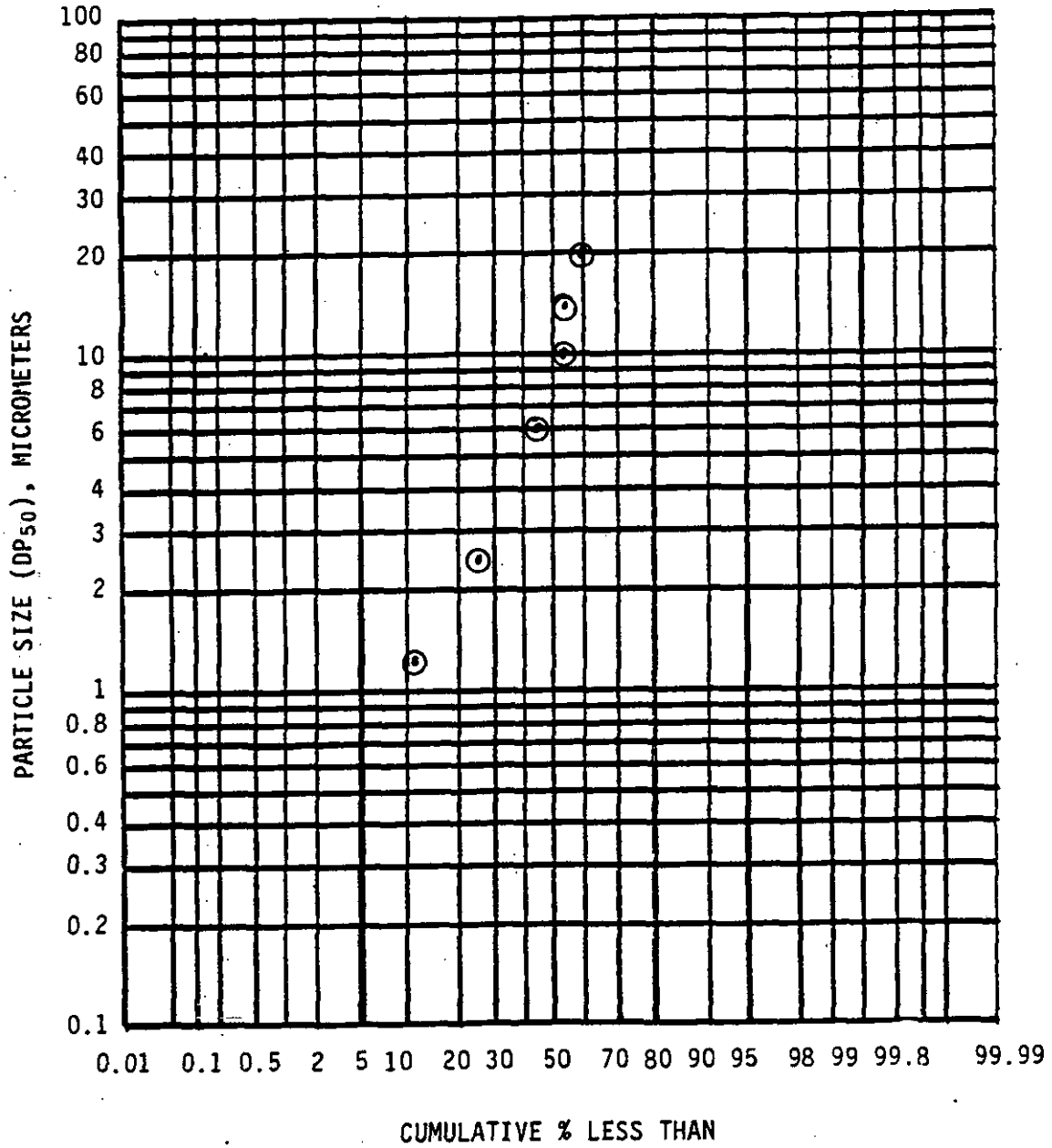

Figure C-52. Particle size distribution data: flash calciner baghouse inlet--Plant J1.

TABLE C-72. SUMMARY OF EMISSION TEST RESULTS--PLANT J1
Industry: Kaolin
Process unit: Flash calciner
Emission source: Baghouse outlet

Data	Run No. 1[a]	Run No. 2	Run No. 3	Average for test series
General				
Date	9/28/83	9/29/83	9/29/83	--
Sampling time, minutes	128	176	176	--
Isokinetic ratio, percent	102	103	101	--
Production rate, Mg/h (tons/h)	b	b	b	b
Capacity utilization, percent[c]	72	90	82	86
Gas stream data				
Temperature, °C	91	77	83	80
(°F)	(195)	(171)	*181)	(176)
Moisture, percent	5.9	5.7	5.1	5.4
Flow rate, m^3/s	12	12	13	12
(acfm)	(26,300)	(26,400)	(27,100)	(26,800)
Flow rate, dsm^3/s	9.2	9.7	9.9	9.8
(dscfm)	(19,500)	(20,600)	(20,900)	(20,800)
Particulate emissions				
g/dsm^3	0.036	0.003	0.002	0.002
(gr/dscf)	(0.016)	(0.001)	(0.001)	(0.001)
kg/h	1.2	0.094	0.076	0.085
(lb/h)	(2.6)	(0.21)	(0.17)	(0.19)
kg/Mg[c]	b	b	b	b
(lb/ton)				

[a]Data for Run No. 1 not included in average for test series because a bag had slipped off its mounting.
[b]Confidential data.
[c]Estimated using feed rate and material moisture content.

PARTICLE SIZE (DP50), MICROMETERS

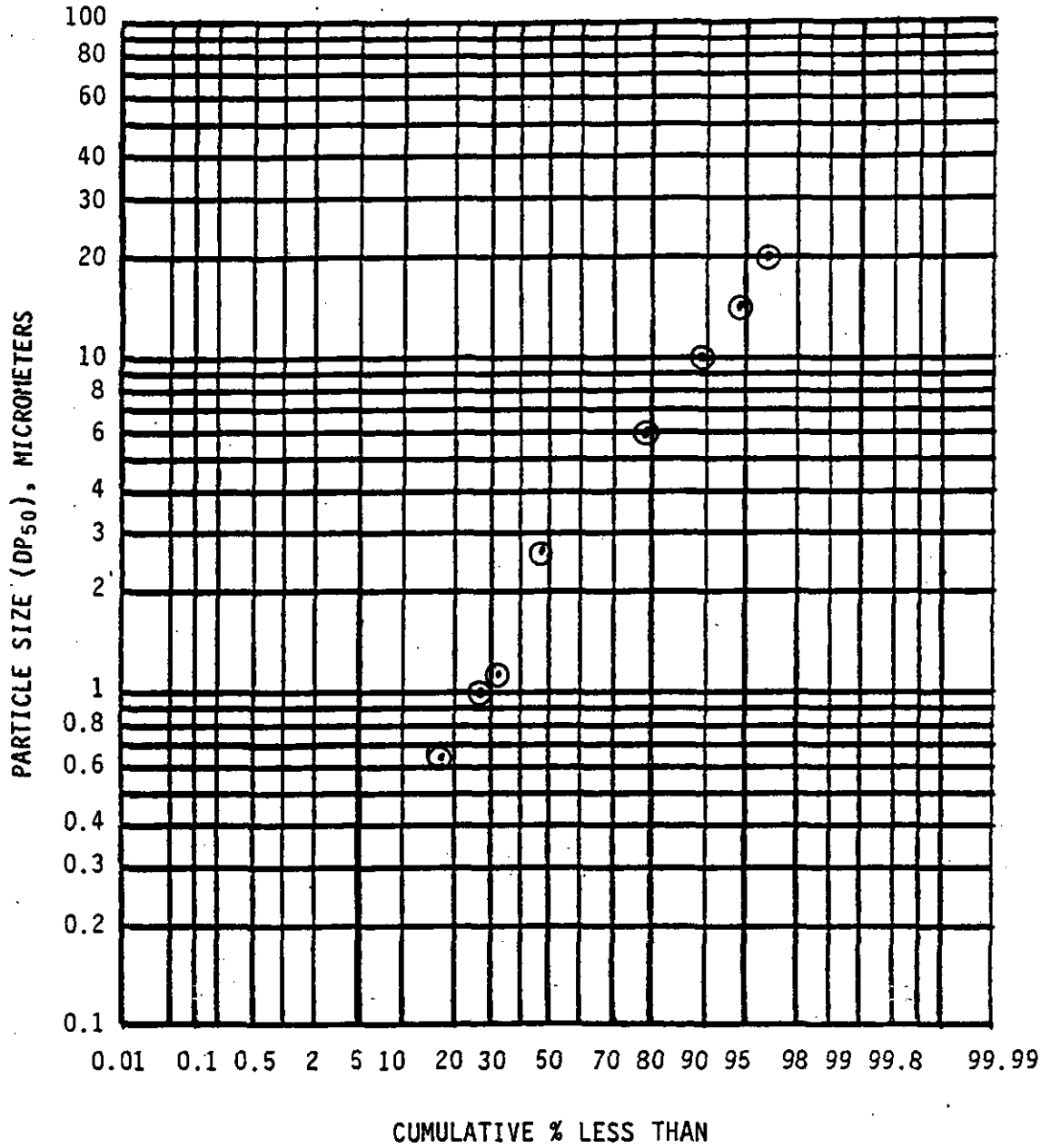

Figure C-53. Particle size distribution data: flash calciner baghouse outlet--Plant J1.

TABLE C-75. SUMMARY OF EMISSION TEST RESULTS--PLANT J2
Industry: Kaolin
Process unit: Multiple hearth furnace
Emission source: Scrubber outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	9/22/81	9/22/81	9/22/81	--
Sampling time, minutes	60	60	60	--
Isokinetic ratio, percent	93	91	92	--
Production rate, Mg/h	a	a	a	a
(tons/h)				
Capacity utilization, percent[b]	110	110	110	110
Gas stream data				
Temperature, °C	63	68	71	67
(°F)	(146)	(154)	(159)	(153)
Moisture, percent	24.2	22.4	24.0	23.5
Flow rate, m^3/s	3.3	3.3	3.3	3.3
(acfm)	(6,900)	(6,900)	(6,900)	(6,900)
Flow rate, dsm^3/s	2.5	2.2	2.1	2.1
(dscfm)	(4,500)	(4,600)	(4,500)	(4,500)
Particulate emissions				
g/dsm^3	0.058	0.076	0.057	0.097
(gr/dscf)	(0.025)	(0.033)	(0.025)	(0.028)
kg/h	0.44	0.58	0.44	0.49
(lb/h)	(0.98)	(1.3)	(0.96)	(1.1)
kg/Mg	a	a	a	a
(lb/ton)				

[a]Confidential data.
[b]Estimated using feed rate and material moisture content.

TABLE C-76. SUMMARY OF EMISSION TEST RESULTS--PLANT J2
Industry: Kaolin
Process unit: Spray dryer
Emission source: Baghouse outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	7/29/82	7/29/82	7/29/82	--
Sampling time, minutes	60	60	60	--
Isokinetic ratio, percent	108	108	109	--
Production rate, Mg/h (tons/h)	a	a	a	a
Capacity utilization, percent[b]	81	81	81	81
Gas stream data				
Temperature, °C	82	79	78	80
(°F)	(179)	(175)	(172)	(175)
Moisture, percent	26.1	27.0	26.6	26.6
Flow rate, m^3/s	35	35	35	35
(acfm)	(75,200)	(73,600)	(73,900)	(74,200)
Flow rate, dsm^3/s	21	21	21	21
(dscfm)	(45,400)	(44,300)	(44,800)	(44,800)
Particulate emissions				
g/dsm^3	0.007	0.008	0.008	0.007
(gr/dscf)	(0.003)	(0.004)	(0.003)	(0.003)
kg/h	0.51	0.60	0.58	0.56
(lb/h)	(1.1)	(1.3)	(1.3)	(1.2)
kg/Mg (lb/ton)	a	a	a	a

[a]Confidential data.
[b]Estimated using feed rate and material moisture content.

TABLE C-77. SUMMARY OF EMISSION TEST RESULTS--PLANT J3
Industry: Kaolin
Process unit: Spray dryer
Emission source: Baghouse outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	9/27/74	9/28/74	9/30/74	--
Sampling time, minutes	60	60	60	--
Isokinetic ratio, percent[a]	100 ±10	100 ±10	100 ±10	--
Production rate, Mg/h[b]	10.7	12.2	11.1	11.3
(tons/h)	(11.8)	(13.5)	(12.2)	(12.5)
Capacity utilization, percent	79	90	81	83
Gas stream data				
Temperature, °C	94	91	93	93
(°F)	(201)	(195)	(199)	(198)
Moisture, percent	30.7	31.7	29.7	30.7
Flow rate, m^3/s	28	28	26	28
(acfm)	(59,700)	(59,900)	(55,400)	(58,300)
Flow rate, dsm^3/s	16	16	15	15
(dscfm)	(33,100)	(33,000)	(31,200)	(32,400)
Particulate emissions				
g/dsm^3	0.071	0.078	0.030	0.060
(gr/dscf)	(0.031)	(0.034)	(0.013)	(0.026)
kg/h	4.0	4.4	1.6	3.3
(lb/h)	(8.8)	(9.7)	(3.5)	(7.3)
kg/Mg[c]	0.38	0.36	0.14	0.29
(lb/ton)	(0.75)	(0.71)	(0.29)	(0.58)

[a]Individual isokinetic ratios were not reported.
[b]Estimated using feed rate and material moisture content.
[c]Calculated from estimates of production rate.

TABLE C-78. SUMMARY OF EMISSION TEST RESULTS--PLANT J4
Industry: Kaolin
Process unit: Spray dryer
Emission source: Baghouse outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	4/29/81	4/29/81	4/29/81	--
Sampling time, minutes	72	72	72	--
Isokinetic ratio, percent	101	98	100	--
Production rate, Mg/h[a]	27.7	27.3	29.9	28.3
(tons/h)	(30.5)	(30.1)	(33.0)	(31.2)
Capacity utilization, percent	101	100	110	104
Gas stream data				
Temperature, °C	113	113	118	115
(°F)	(235)	(236)	(245)	(239)
Moisture, percent	22.4	21.6	22.9	22.3
Flow rate, m^3/s	40	40	42	41
(acfm)	(85,300)	(84,900)	(88,500)	(86,200)
Flow rate, dsm^3/s	24	23	24	24
(dscfm)	(49,600)	(49,700)	(50,400)	(49,900)
Particulate emissions				
g/dsm^3	0.008	0.006	0.005	0.006
(gr/dscf)	(0.003)	(0.003)	(0.002)	(0.003)
kg/h	0.65	0.50	0.39	0.52
(lb/h)	(1.4)	(1.1)	(0.86)	(1.1)
kg/Mg[b]	0.024	0.018	0.013	0.018
(lb/ton)	(0.047)	(0.037)	(0.026)	(0.037)

[a]Process weight rate.
[b]Calculated from process weight rate.

operations; no plant upsets were encountered during the test runs. The calciners, which were fired with No. 6 fuel oil, operated at 105 to 117 percent of design process rates. Two of the ESP's had specific collection areas (SCA) of 0.5 m^2 per m^3/min (147 ft^2 per 1,000 acfm), and the other two had SCA's of 1.1 m^2 per m^3/min (344 ft^2 per 1,000 acfm). Additional operating parameters and the schematic of the system tested are given in the Confidential Addendum to this document.

C.1.2 Ball Clay

C.1.2.1 Plant B1--Industry Test. Figure C-1 is a schematic of the system tested. The vibrating-grate dryer was controlled by a pulse-jet fabric filter. The dryer operated at 81 percent of design capacity during the test and was fired by natural gas. Two types of ball clay were blended during the test. Actual operating parameters for the fabric filter include an air-to-cloth ratio of 4.5:1 and a pressure drop of 1.0 kPa (4.0 in. w.c.). No plant upsets were noted in the test report.

C.1.3 Bentonite

C.1.3.1 Plant C1--EPA Test. Figure C-2 is a schematic of the system tested. The direct-fired rotary dryer at Plant C1 was controlled by a fabric filter preceded by a product recovery cyclone. Testing was performed at the cyclone inlet and the baghouse outlet. Particulate mass and particle size distribution data were collected at both locations simultaneously. The dryer operated at 96 percent of capacity during the tests and was fired with pulverized coal. The normal blend of four grades of bentonite was processed during the emission tests.

Some fluctuation in the dryer fire box temperature was observed throughout testing of the dryer. The fluctuations are normal and are caused by variations in the feed moisture content and amount of fines in the coal. The coal feed rate was adjusted when the fire box temperature dropped below 820°C (1500°F).

Additional air was added to the baghouse by a baghouse heating system. The actual operating air-to-cloth ratio for the reverse-air fabric filter was 0.9:1. No abnormalities in fabric filter operation were noted during the testing. The 6-minute average opacity data taken

at the baghouse exhaust stack during the tests ranged from 0 to 8.3 percent.

C.1.3.2 Plant C3--Industry Test. The rotary dryer at Plant C3 was controlled by an ESP and operated at 96 percent of capacity during the particulate emission tests conducted at the ESP outlet. The specific collection area for the ESP was 2.97 m^2 per m^3/min (904 ft^2 per 1,000 acfm). Because the isokinetic sampling rate for Run No. 1 did not conform to EPA requirements, a fourth run was performed. Data from Run No. 1 were not included in the test report. No equipment operating problems were noted.

C.1.4 Diatomite

C.1.4.1 Plant D1--Industry Test. Particulate emission tests were conducted at the outlet of a wet scrubber controlling emissions from a rotary calciner at Plant D1. Feed material, which was preheated by kiln exhaust gases, was pneumatically conveyed through cyclones and air separators to the kiln. Product cooling air was used to preheat primary and secondary combustion air. The calciner operated between 89 and 104 percent of design capacity during the tests. No equipment operating problems were noted in the test report. A schematic of the system tested is presented in the Confidential Addendum to this document.

C.1.5 Feldspar

C.1.5.1 Plant E1--Industry Test. Particulate emission tests were conducted at the outlet of a wet scrubber controlling a rotary dryer at Plant E1. The dryer operated at 90 percent of capacity during the tests and was fired by No. 2 fuel oil. The operating pressure drop for the wet scrubber was 2.5 kPa (10 in. w.c.). No equipment operating problems were indicated in the test report.

C.1.5.2 Plant E2--Industry Test. Figure C-3 is a schematic of the system tested. The rotary dryer at Plant E2 was controlled by a wet scrubber. A multiple cyclone collector preceding the wet scrubber was used for product recovery. Particulate emission testing was conducted at the scrubber outlet. The dryer, fired by No. 2 fuel oil, operated at 100 percent of capacity during the test. The operating pressure drop for the scrubber during the test is given in the Confidential Addendum to this document. No unusual conditions were noted during sampling.

TABLE C-6. SUMMARY OF EMISSION TEST RESULTS--PLANT B1
Industry: Ball clay
Process unit: Vibrating-grate dryer
Emission source: Baghouse outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	4/3/79	4/3/79	4/4/79	--
Sampling time, minutes	72	60	60	--
Isokinetic ratio, percent	105	110	109	--
Production rate, Mg/h	7.3	7.3	7.3	7.3
(tons/h)	(8.1)	(8.1)	(8.1)	(8.1)
Capacity utilization, percent	81	81	81	81
Gas stream data				
Temperature, °C	71	71	71	71
(°F)	(160)	(160)	(160)	(160)
Moisture, percent	4.17	4.81	4.55	4.51
Flow rate, m^3/s	11	11	11	11
(acfm)	(23,300)	(23,800)	(22,900)	(23,300)
Flow rate, dsm^3/s	8.9	8.9	8.6	8.8
(dscfm)	(18,800)	(18,900)	(18,200)	(18,700)
Particulate emissions				
g/dsm^3	0.026	0.017	0.006	0.016
(gr/dscf)	(0.011)	(0.008)	(0.003)	(0.007)
kg/h	0.82	0.56	0.19	0.52
(lb/h)	(1.80)	(1.23)	(0.41)	(1.15)
kg/Mg	0.11	0.076	0.026	0.071
(lb/ton)	(0.22)	(0.15)	(0.051)	(0.14)

TABLE C-7. SUMMARY OF EMISSION TEST RESULTS--PLANT C1
Industry: Bentonite
Process unit: Rotary dryer
Emission source: Cyclone inlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	9/20/83	9/21/83	9/22/83	--
Sampling time, minutes	60	60	60	--
Isokinetic ratio, percent	104	102	103	--
Production rate, Mg/h	24.5	24.5	24.5	24.5
(tons/h)	(27)	(27)	(27)	(27)
Capacity utilization, percent	87	87	87	87
Gas stream data				
Temperature, °C	80	77	76	78
(°F)	176	(171)	(168)	(172)
Moisture, percent	22.5	23.9	27.1	24.5
Flow rate, m^3/s	7.4	6.7	6.8	7.0
(acfm)	(15,700)	(14,300)	(14,400)	(14,800)
Flow rate, dsm^3/s	4.1	3.7	3.6	3.8
(dscfm)	(8,620)	(7,780)	(7,542)	(7,980)
Particulate emissions				
g/dsm^3	254	269	254	259
(gr/dscf)	(111)	(117)	(111)	(113)
kg/h	3,719	3,551	3,261	3,510
(lb/h)	(8,192)	(7,821)	(7,183)	(7,732)
kg/Mg	150	140	130	140
(lb/ton)	(300)	(290)	(270)	(290)

TABLE C-8. SUMMARY OF EMISSION TEST RESULTS--PLANT C1
Industry: Bentonite
Process unit: Rotary dryer
Emission source: Baghouse outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	9/20/83	9/21/83	9/22/83	--
Sampling time, minutes	108	180	180	--
Isokinetic ratio, percent	103	105	105	--
Production rate, Mg/h	24.5	24.5	24.5	24.5
(tons/h)	(27)	(27)	(27)	(27)
Capacity utilization, percent	87	87	87	87
Gas stream data				
Temperature, °C	64	67	68	67
(°F)	(148)	(153)	(154)	(152)
Moisture, percent	13.2	13.8	14.9	14.0
Flow rate, m^3/s	11	12	11	11
(acfm)	(23,400)	(24,900)	(24,300)	(24,200)
Flow rate, dsm^3/s	7.1	7.5	7.2	7.2
(dscfm)	(15,100)	(15,800)	(15,200)	(15,400)
Particulate emissions				
g/dsm^3	0.031	0.045	0.064	0.047
(gr/dscf)	(0.013)	(0.020)	(0.028)	(0.020)
kg/h	0.79	1.22	1.66	1.22
(lb/h)	(1.74)	(2.68)	(3.65)	(2.69)
kg/Mg	0.032	0.050	0.068	0.050
(lb/ton)	(0.06)	(0.10)	(0.14)	(0.10)

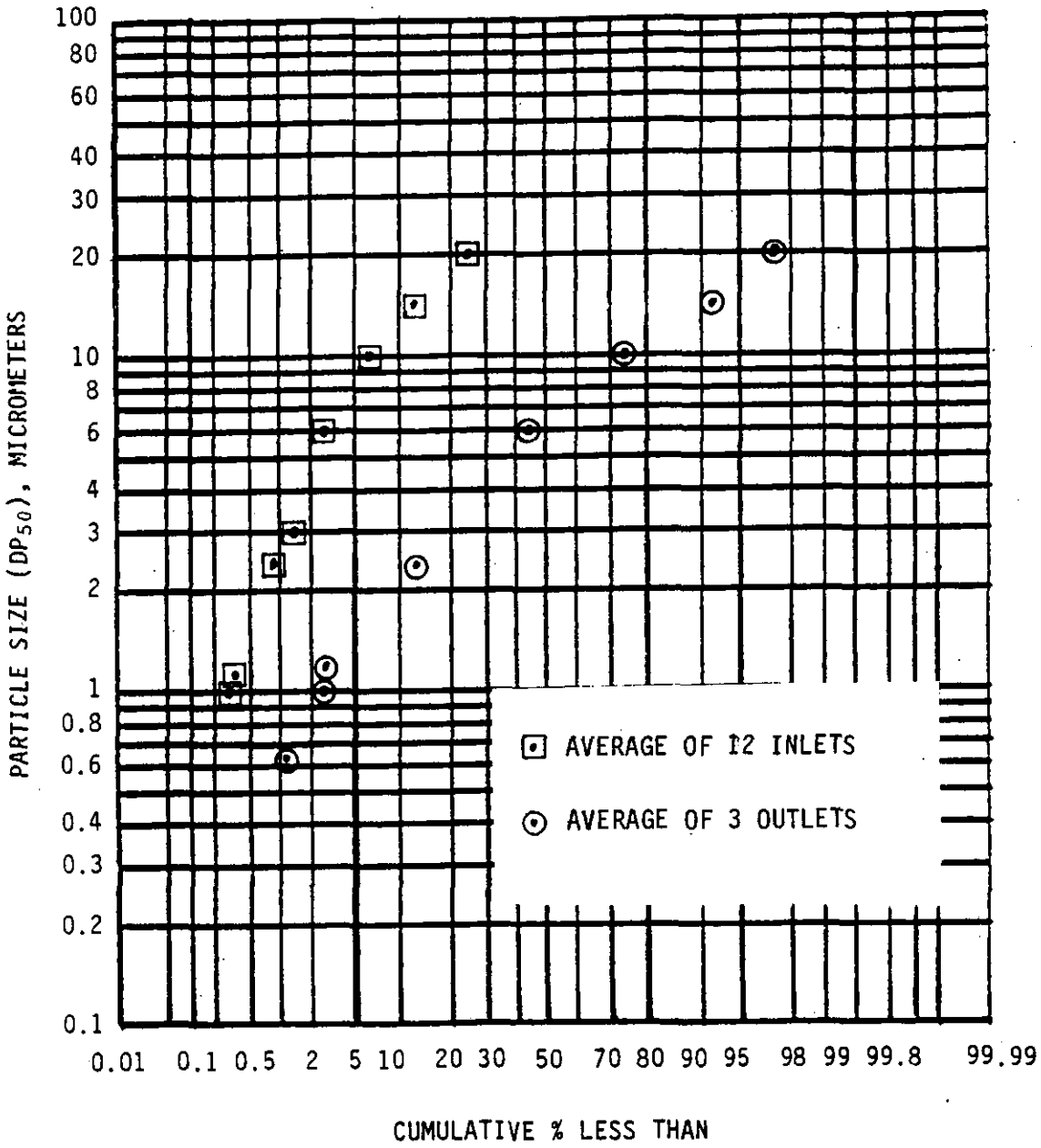

Figure C-31. Particle size distribution data: rotary dryer--Plant C1.

TABLE C-12. SUMMARY OF EMISSION TEST RESULTS--PLANT C3
Industry: Bentonite
Process unit: Rotary dryer
Emission source: ESP outlet

Data	Run No. 2[a]	Run No. 3	Run No. 4	Average for test series
General				
Date	11/4/81	11/4/81	11/5/81	--
Sampling time, minutes	60	60	60	--
Isokinetic ratio, percent	92	97	101	--
Production rate, Mg/h	40.0	40.0	50.8	43.6
(tons/h)	(44)	(44)	(56)	(48)
Capacity utilization, percent	88	88	112	96
Gas stream data				
Temperature, °C	75	72	68	72
(°F)	(165)	(160)	(153)	(159)
Moisture, percent	14.8	12.9	15.3	14.4
Flow rate, m^3/s	22	21	23	22
(acfm)	(47,500)	(44,400)	(48,200)	(46,700)
Flow rate, dsm^3/s	14	14	15	14
(dscfm)	(29,700)	(28,600)	(30,800)	(29,700)
Particulate emissions				
g/dsm^3	0.025	0.006	0.010	0.014
(gr/dscf)	(0.011)	(0.003)	(0.004)	(0.006)
kg/h	1.25	0.31	0.52	0.69
(lb/h)	(2.75)	(0.69)	(1.14)	(1.53)
kg/Mg	0.031	0.078	0.010	0.016
(lb/ton)	(0.062)	(0.016)	(0.020)	(0.033)

[a]Isokinetic ratio for Run No. 1 not within allowable limits; data were not included in average. Test data for Run No. 1 were not given in the test report.

visible emissions, particle size distributions, sulfur dioxide and nitrogen oxide emissions, and trace metal content. All VE observations were 0 percent opacity from the scrubber stack. Process fugitive emission observations were not made because both the calciner feed inlet and product outlet were totally enclosed with no visible leaks.

The rotary calciner operated at 98 percent of capacity during all tests and was fired by pulverized coal. The scrubber flow rate measured during testing was 1,514 ℓ/min (400 gpm), and the pressure drop was approximately 4.5 kPa (18 in. w.c.). Other operating parameters of the scrubber during the test series are presented in the Confidential Addendum to this document.

Particle size distribution tests were not conducted at the scrubber outlet because of moisture in the flue gas. At the West induced draft (I.D.) fan inlet location (scrubber inlet), particle sizing Run Nos. 7B and 9B were not tabulated in the results due to an extremely low catch (underloaded) and extremely large catch (overloaded), respectively. No process upsets were reported.

C.1.7 Fuller's Earth

C.1.7.1 Plant G1--Industry Test. Figure C-7 is a schematic of the system tested. Particulate emission tests were performed at the outlet of the wet scrubber controlling emissions from the rotary dryer at Plant G1. During the test, the dryer operated at 102 percent of capacity and was fired with natural gas. The pressure drop of the scrubber was 2.5 kPa (10 in. w.c.) During the initial 14 minutes of Run No. 1, the make-up water to the scrubber was shut off. High stack temperature readings and particulate emission rates resulted from this malfunction. For this reason, data from Run No. 1 are not included in the test summary averages. No process operating problems were recorded in the test report.

C.1.8 Gypsum

C.1.8.1 Plant H1--EPA Tests. Figures C-8 and C-9 are schematics of the systems tested. Particulate emission tests were performed on fabric filters controlling emissions from a continuous kettle calciner and from a rotary dryer at Plant H1. The calciner operated at full

TABLE C-40. SUMMARY OF EMISSION TEST RESULTS--PLANT G1
Industry: Fuller's earth
Process unit: Rotary dryer
Emission source: Scrubber outlet

Data	Run No. 1[a]	Run No. 2	Run No. 3	Average for test series
General				
Date	9/9/76	9/9/76	9/9/76	--
Sampling time, minutes	64	80	80	--
Isokinetic ratio, percent	106	97	106	--
Production rate, Mg/h	b	b	b	b
(tons/h)				
Capacity utilization, percent[c]	106	99	103	102
Gas stream data				
Temperature, °C	94	76	77	76.5
(°F)	(202)	(169)	(170)	(169.5)
Moisture, percent	36.2	34.1	38.7	36.4
Flow rate, m^3/s	13	12	12	12
(acfm)	(26,900)	(25,100)	(25,800)	(25,500)
Flow rate, dsm^3/s	6.4	6.5	6.2	6.4
(dscfm)	(13,600)	(13,800)	(13,200)	(13,500)
Particulate emissions				
g/dsm^3	0.134	0.050	0.069	0.059
(gr/dscf)	(0.059)	(0.022)	(0.030)	(0.026)
kg/h	3.1	1.2	1.6	1.4
(lb/h)	(6.8)	(2.5)	(3.4)	(3.0)
kg/Mg	b	b	b	b
(lb/ton)				

[a]Scrubber malfunction; data not included in average.
[b]Confidential data.
[c]Estimated using feed rate and material moisture content.