AP42 Section:	11.20
Reference:	5
Title:	Emission Test Report: Plant K6, from Calciners And Dryers In Mineral Industries - Background Information Standards, EPA-450/3-85-025a, U. S. Environmental Protection Agency, Research Triangle Park, NC, October 1985. excerpts

C.1.11.4 Plant K4--Industry Test. Figure C-22 is a schematic o the system tested. Particulate emission tests were conducted at the outlet of a wet scrubber (gravity spray chamber) controlling emissions from a rotary calciner. The calciner operated at 92 percent of capacity during the tests and was fired by No. 2 fuel oil. Visible emission observations were made at the scrubber outlet after completion of the third particulate run and have not been tabulated. The design pressure drop for the wet scrubber is 0.5 kPa (2 in. w.c.). The pressure drop during the test was not reported. During the period of testing, the plant and all associated air pollution control equipment were operating normally.

C.1.11.5 Plant K5--Industry Test. Figure C-23 is a schematic of the system tested. Particulate emission tests were conducted at the inlet and outlet of a reverse-air fabric filter controlling emissions from a rotary calciner. The calciner operated at maximum capacity during the tests and was fueled by pulverized coal. Actual operating parameters for the fabric filter were not reported. Design parameters for the fabric filter include a total cloth area of 520 m^2 (5,600 ft^2), a pressure drop of 1.2 to 1.9 kPa (5 to 8 in. w.c.), and an air-to-cloth ratio of 5:1.

During Run No. 2, a malfunction of the coal mill caused a temporary shutdown of the system. Testing was resumed in about 2 minutes. No other process upsets were noted in the test report.

C.1.11.6 Plant K6--EPA Test. Emission tests were conducted on a medium-energy impinjet wet scrubber controlling emissions from a rotary calciner. The rotary calciner operated at 100 percent of design capacity and was fired with pulverized coal. Tests included particulate emissions, sulfur dioxide, nitrogen oxide, and hydrocarbon emissions, and trace metal content.

Some problems occurred during hydrocarbon sampling due to the high moisture content of the scrubber exhaust gas. Subsequently, only 1 hour of continuous hydrocarbon monitoring data was obtained. The hydrocarbon concentrations varied from 140 to 220 ppm with an average concentration of 175 ppm as methane. This average concentration corresponds to an emission rate of 4.2 kg/h (9.3 lb/h).

Visible emission observations were made at the scrubber exhaust stack, and fugitive emission observations were made at the calciner seals. The 6-minute average opacity measurements at the scrubber outlet ranged from 0 to 15 percent. All fugitive emission observations were 0 percent opacity.

No instrumentation was present at the test site to indicate the water flow rate, the inlet and outlet gas flow rates, or pressure drop for the wet scrubber. The design pressure drop across the wet scrubber is 2.5 kPa (10 in. w.c.). Process operations were normal.

C.1.12 Magnesium Compounds

C.1.12.1 Plant L1--Industry Test. Figure C-24 is a schematic of the system tested. Particulate emission tests were conducted at the outlet of a reverse-air fabric filter controlling emissions from a multiple hearth furnace. The furnace operated at 85 percent of capacity (based on process feed rates) during the test and was fired by No. 6 fuel oil. The report notes that opacity was observed by State testing personnel and that all opacity readings were 0 percent. The air-to-cloth ratio of the fabric filter during the tests was 1.4:1. Process operations were normal.

C.1.12.2 Plant L2--Industry Test. Figure C-25 is a schematic of the system tested. Particulate emission tests were conducted at the outlet of two ESP's in series controlling emissions from a rotary calciner. The calciner operated at 92 percent of capacity during the tests and was fired by natural gas. The combined specific collection area of the two ESP's was 1.8 m^2 per m^3/min (550 ft^3/1,000 acfm) during the tests. No process upsets were noted in the report.

C.1.12.3 Plant L3--Industry Test. Emission tests were conducted at the outlet of the wet scrubber controlling emissions from a rotary calciner. The scrubber was preceded by a product recovery cyclone. During the tests, pressure drop across the scrubber was 2.5 kPa (10 in. w.c.). The calciner operated at 95 percent of capacity during the tests and was fired by No. 6 fuel oil. No process upsets were noted in the test report.

C.1.12.4 Plant L4--Industry Test. Particulate emission tests were conducted at the outlet of an ESP controlling emissions from a rotary

TABLE C-98. SUMMARY OF EMISSION TEST RESULTS--PLANT K6
Industry: Lightweight aggregate
Process unit: Rotary calciner
Emission source: Scrubber outlet

Data	Run No. 1	Run No. 2	Run No. 3	Average for test series
General				
Date	2/23/81	2/23/81	2/24/81	--
Sampling time, minutes	136	134	124	--
Isokinetic ratio, percent	99	99	101	--
Production rate, Mg/h[a]	12.0	12.0	12.0	12.0
(tons/h)	(13.3)	(13.3)	(13.3)	(13.3)
Capacity utilization, percent	100	100	100	100
Gas stream data				
Temperature, °C	78	78	81	79
(°F)	(172)	(173)	(178)	(174)
Moisture, percent	17.5	15.2	19.3	17.3
Flow rate, m^3/s	14	15	15	14
(acfm)	(30,300)	(30,700)	(30,800)	(30,600)
Flow rate, dsm^3/s	10	10	10	10
(dscfm)	(21,100)	(22,000)	(20,700)	(21,300)
Particulate emissions				
g/dsm^3	0.090	0.090	0.108	0.096
(gr/dscf)	(0.040)	(0.040)	(0.047)	(0.042)
kg/h	3.2	3.4	3.8	3.5
(lb/h)	(7.1)	(7.4)	(8.4)	(7.6)
kg/Mg[a]	0.27	0.28	0.32	0.29
(lb/ton)	(0.54)	(0.57)	(0.64)	(0.58)

[a]Based on "average operating rate" of the rotary calciner at Plant K6. Actual production rate data were not monitored during tests.

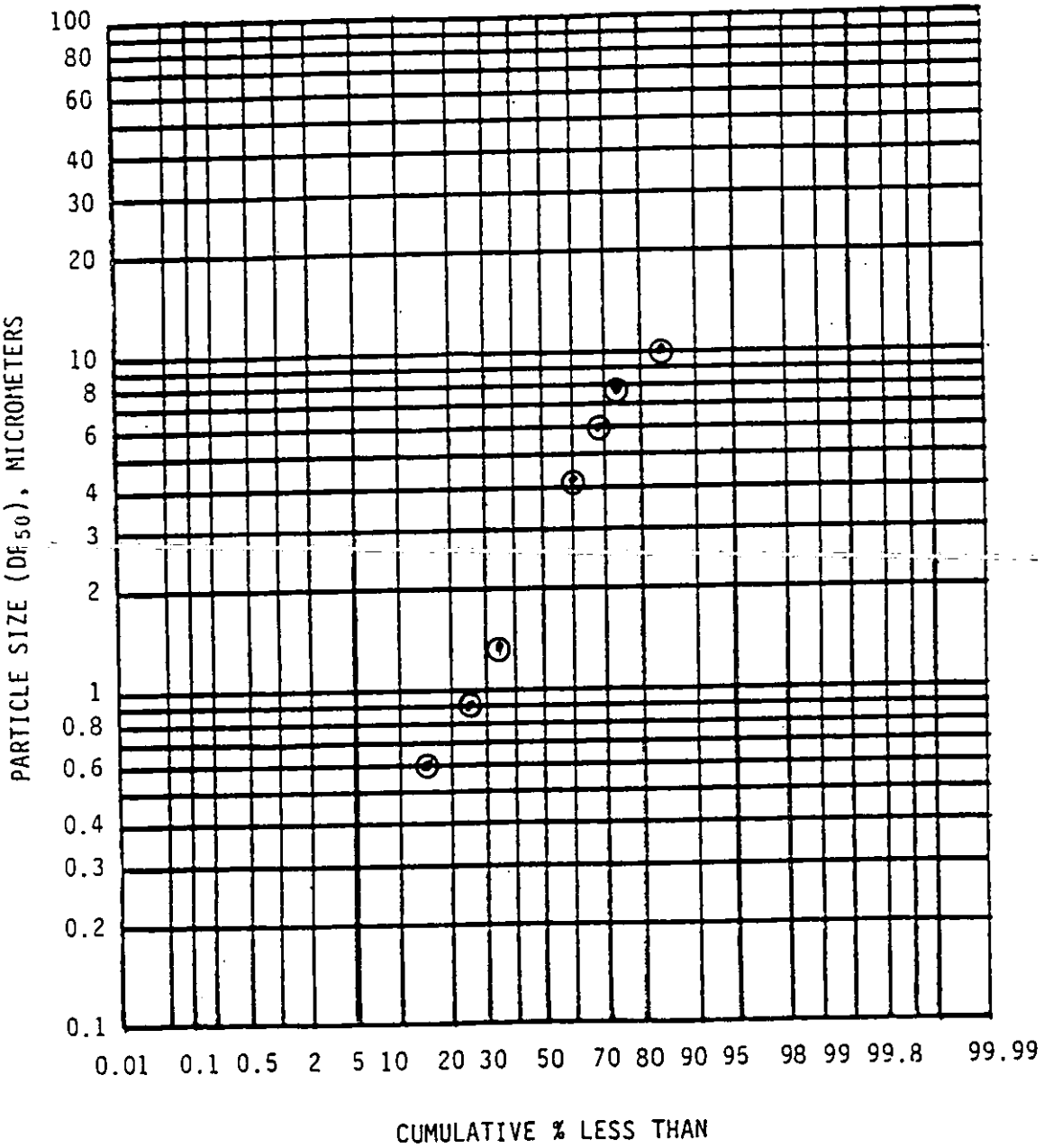
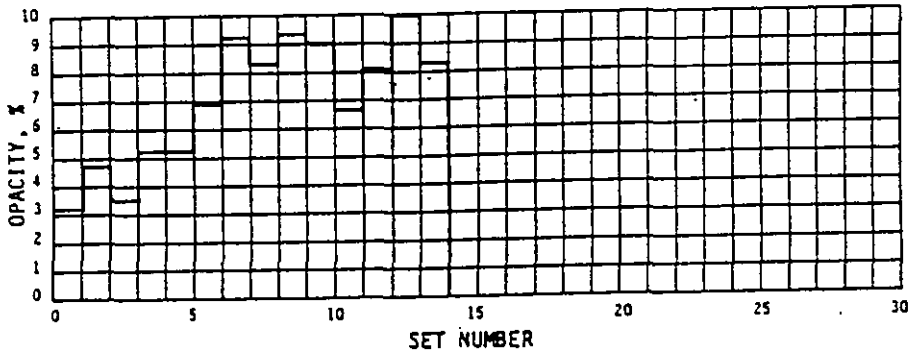


Figure C-58. Particle size distribution data: rotary calciner scrubber outlet--Plant K6.

TABLE C-99. SUMMARY OF VISIBLE EMISSIONS--PLANT K6

Date	2/23/81
Industry	Lightweight aggregate
Process unit	Rotary calciner
Location of discharge	Scrubber outlet
Height of observation point, ft	Ground
Height of point of discharge, ft	100
Distance from observer to discharge point, ft	200, 100
Direction of observer from discharge point	E, SW
Description of background	Clear sky
Description of sky	Clear
Wind direction	SW
Wind velocity, mph	10-15
Color of plume	White
Duration of observation, min	84
Period of observation	1030-1709[a]
Highest single reading, percent	15
Highest 6-minute average, percent	10.0

[a]14 sets of 6-minute observations were made during this period.



TA3LE C-100. SUMMARY OF VISIBLE EMISSIONS--PLANT K6

Date	2/24/81
Industry	Lightweight aggregate
Process unit	Rotary calciner
Location of discharge	Scrubber outlet
Height of observation point, ft	Ground
Height of point of discharge, ft	100
Distance from observer to discharge point, ft	200, 100
Direction of observer from discharge point	E, SW
Description of background	Clear sky
Description of sky	Scattered, broken
Wind direction	SW, S
Wind velocity, mph	5
Color of plume	White
Duration of observation, min	78
Period of observation	0912-1526[a]
Highest single reading, percent	15
Highest 6-minute average, percent	9.8

[a]13 sets of 6-minute observations were made during this period.

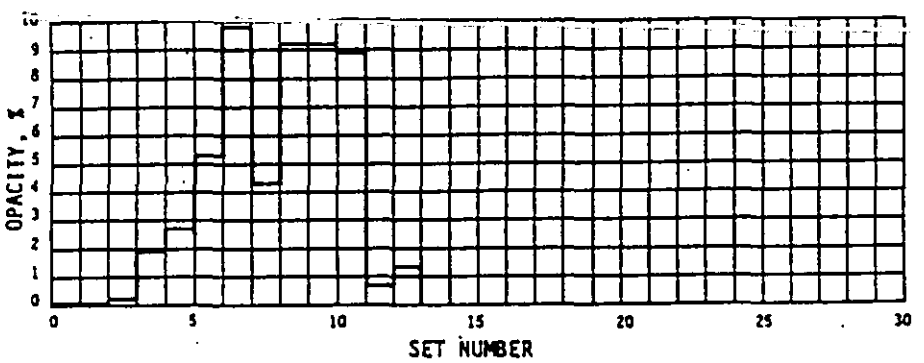


TABLE C-101. SUMMARY OF SULFUR DIOXIDE EMISSIONS DATA--PLANT K6
Industry: Lightweight aggregate
Process unit: Rotary calciner
Location of discharge: Scrubber inlet and outlet

Test location	Date, 1981	Concentration, g/dsm³ (ppm)	Mass emission rate, kg/h (lb/h)	Temp., °C (°F)
Scrubber inlet				
Run No. 1	2/26	0.718 (273)	19.9 (43.9)	338 (640)
Run No. 2	2/26	0.753 (286)	19.8 (43.7)	338 (640)
Average	--	0.736 (280)	19.9 (43.8)	338 (640)
Run No. 3	2/26	0.785 (299)	24.3 (53.6)	338 (640)
Run No. 4	2/26	0.702 (267)	21.7 (48.0)	338 (640)
Average	--	0.744 (283)	23.0 (50.8)	338 (640)
Run No. 5	2/26	0.660 (251)	19.2 (42.2)	338 (640)
Run No. 6	2/26	0.231[a] (88)[a]	6.7[a] (14.7)[a]	338 (640)
Average	--	0.660 (251)	19.2 (42.2)	338 (640)
Scrubber outlet				
Run No. 1	2/26	0.481 (183)	17.4 (38.3)	77 (170)
Run No. 2	2/26	0.509 (194)	18.4 (40.5)	77 (170)
Average	--	0.495 (189)	17.9 (39.4)	77 (170)
Run No. 3	2/26	0.562 (214)	20.3 (44.8)	77 (170)
Run No. 4	2/26	0.485 (185)	17.5 (38.7)	77 (170)
Average	--	0.524 (200)	18.9 (41.8)	77 (170)
Run No. 5	2/26	0.489 (186)	17.7 (38.9)	77 (170)
Run No. 6	2/26	0.537 (204)	19.4 (42.8)	77 (170)
Average	--	0.513 (195)	18.6 (40.9)	77 (170)

[a]Outlier--not included in averages.

TABLE C-102. SUMMARY OF NITROGEN OXIDE EMISSIONS DATA--PLANT K6

Industry: Lightweight aggregate
Process unit: Rotary calciner
Location of discharge: Scrubber outlet

Test location	Date, 1981	Concentration, g/dsm³ (ppm)	Mass emission rate,[a] kg/h (lb/h)
Scrubber outlet			
Sample No. 1A	2/26	0.282 (147)	10.2 (22.4)
Sample No. 1B	2/26	0.330 (172)	11.9 (26.3)
Sample No. 1C	2/26	0.325 (170)	11.8 (25.9)
Sample No. 1D	2/26	0.266 (139)	9.6 (21.2)
Average	--	0.301 (157)	10.9 (24.0)
Sample No. 2A	2/26	0.268 (140)	9.7 (21.4)
Sample No. 2B	2/26	0.270 (141)	9.7 (21.5)
Sample No. 2C	2/26	0.289 (151)	10.4 (23.0)
Sample No. 2D	2/26	0.300 (157)	10.8 (23.9)
Average	--	0.282 (147)	10.2 (22.5)
Sample No. 3A	2/26	0.302 (158)	10.9 (24.1)
Sample No. 3B	2/26	0.231 (121)	8.3 (18.4)
Sample No. 3C	2/26	0.294 (153)	10.6 (23.4)
Sample No. 3D	2/26	0.287 (150)	10.4 (22.9)
Average	--	0.279 (146)	10.1 (22.2)

[a]Mass emission rate in kilograms per hour (kg/h) and pounds per hour (lb/h) calculated using average measured flow obtained from the particulate tests.

TABLE C-103. SUMMARY OF TRACE METAL ANALYSIS--PLANT K6[a]
(Composite samples per category, ppm of impinger solution [unless noted])
Industry: Lightweight aggregate
Process unit: Rotary calciner
Sample source: Method 5 particulate catch

Element	Coal	Clay	Final product	Scrubber effluent
Calcium	3.1%	0.65%	0.82%	320
Magnesium	0.384%	0.71%	0.79%	33
Potassium	0.568%	0.53%	0.58%	10
Sodium	0.480%	0.40%	0.46%	62
Silicon	9.6%	28%	34%	12
Barium	630	370	360	0.080
Manganese	470	700	430	2.2
Aluminum	4.2%	6.6%	7.4%	<0.05
Chrominum	46	62	70	<0.001
Copper	100	19	24	<0.001
Zinc	540	77	94	0.058
Titanium	0.244%	0.38%	0.490%	<0.005
Strontium	250	66	80	1.1
Vanadium	73	92	110	0.008
Lithium	7.5	40	52	0.18
Yttrium	19	23	25	<0.002
Iron	4.0%	3.2%	3.9%	0.040

[a]Elements not detected in samples: Phosphorus, Tungsten, Platinum, Boron, Mercury, Thallium, Molybdenum, Antimony, Gold, Tellurium, Nickel, Bismuth, Beryllium, Arsenic, Indium, Selenium, Silver, Lead, Cadmium, Cobalt, Tin, and Uranium.