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G. L. Allen, et al.,

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perlite and to reduce the dust load in the gases released to the air. Part of the hot gases may be returned to the furnace as preheat, or used for drying ore. Careful control of temperatures and operating conditions reduces the amount of very fine dusts produced in the operation, but the low density of the material, 12-15 pounds per cubic foot, probably adds to the difficulty of satisfactory dust separation. Specific tests had not been made on plants of this type at the time of this writing, but from inspections it appears that dust losses are high and recovery equipment suitable for micron sizes will be required.

ASPHALT PAVING-MIX PLANTS

It has been said that the Southern California area has more asphalt-mixing plants than any comparable area in the United States, and it is certain that an immense tonnage of paving mix is required annually. Plants range from 75- to 360-ton-per-hour capacity and may average about 100 tons. These plants are usually equipped with cyclone collectors for the coarse dust, and this is often followed by wet collectors, which may be horizontal or vertical spray-towers, multitube centrifugal, or other types of separators. If properly installed and carefully operated this equipment is capable of meeting Air-Pollution Control District requirements. However, table 10 shows that about half of the plants tested violated these requirements, even with some form of collecting equipment. Such was the case with the plant in figure 29. Its normal process rate of far over 60,000 pounds per hour entitles it to the maximum of 40 pounds allowed to any size plant under Air-Pollution Control District Rule 54. For a plant producing 100 tons per hour, this amounts to only 0.02 percent allowable loss or 2 pounds from every 5 tons of material processed. Some authorities believe that, for so complete a removal, high-efficiency spray towers or dynamic wet scrubbers may be required following the dry cyclone collectors and that they may have to be supplemented by air filters.

A conventional asphalt paving-mix plant consists of some suitable equipment to feed properly proportioned aggregate material, such as crushed rock and sand, onto a conveyor belt delivering usually to a bucket elevator. This in turn feeds a rotary kiln, most often oil-fired. Hot rock discharged from the kiln is elevated to the top of a batching machine, which accurately proportions the hot aggregate and steam-heated asphalt into a pugmill mixer. The asphalt-aggregate mixture is caught in a hopper beneath the pugmill and discharged into trucks. A 6,000-pound batch machine will produce 180 tons of asphalt mixture per hour operating on a 60-second cycle or 360 tons on a 30-second cycle.

Most of the dust to be collected will be from the ends of the drier and the hot-stone elevator. Dust is usually drawn into a conventional-type cyclone collector, which may recover 80-90 percent of dust coarser than about 40 microns. This dry dust may be fed back to the boot of the elevator feeding the batcher, or part of it may go to a silo to be discarded. Specifications usually make the return of at least a portion of the dust necessary. Fine dust andasphalt fumes or mist are collected from hoodings in the batch plant and from storage bins, screen housings, and several other points in the plant and materials-handling equipment. The dust and fumes may be combined with the hot gases at the dry collector or may be drawn directly to violent wet scrubbers, spray washers, or towers. The sludge from the wet machines is usually discarded.

TABLE 10. - Asphalt paving-mix plant data

Plant No.	Collection equipment	Gas volume, a.c.f.m.	Process wt/hr., lb.	Spray water, g.p.m. Added	Spray water, g.p.m. Recycled	Loss, lb./hr. Allowable	Loss, lb./hr. Actual	lb/ton
1	Reduster; Multiclone scrubber	27,900	200,000	240	Yes	40	26.2	.262
1-a	30-ft. cyclone; Multiclone scrubber (8 x 40 ft.)	18,700	250,000	240	Yes	40	58.6	.469
1-b	12-ft. cyclone; 25-tube Multiclone scrubber (8 x 40 ft.)	11,020	180,000	273	Yes	40	48.1	.534
1-c	10-ft. cyclone; horiz. scrubber (4 x 24-ft.); (5 x 40-ft.)	14,000	180,000	206 in horiz. No water in vertical scrubber	Yes	40	67.2	.747
2	Cyclone; unpacked spray tower	13,100	309,220	374	No	40	30.6	0.198
3	Scrubber	12,200	200,000	50	No	40	84	0.84
4	6-ft. cyclone; 8 x 10 x 30-ft. wood scrubbers	17,600	175,000	200	Yes	40	62.5	0.714
5	Cyclone; horiz. scrub. with baffle and spray, not tangential	ND	145,000	250	250	40	26.5	0.366
6	Cyclone; horiz. scrub.; 10-ft. vert. scrub.	18,676	192,000	250	50	40	13.61	0.142
7	Cyclone; vert. scrub., 15-g.p.m. before fan	19,200	160,000	115	100 plus 15 fan inlet	40	13.8	0.173
7-a	do.	12,200	32,000	40	Yes	40	33.6	2.1
8	Cyclone; horiz. scrubber, tang. in and out	17,600	190,000	ND	ND	40	256	2.69
8-a	do.	15,200	190,000	8.75	8.75	40	344	3.62
8-b	do.	6,000	190,000	16.6	16.6	40	273	2.87
9	Cyclone scrubber	7,200	180,000	ND	ND	40	74.0	0.822
10	Stack outlet of water vent line	7,090 stack 2,680 water flue	236,000	25	No	40	64.0	0.542
10-a	Outlet stack from scrubber	11,200	240,000	150	No	40	47.5	0.396
10-b	Outlet stack spray scrubber	8,300	236,000	65	No	40	32.6	0.276
10-c	Spray scrubber with plate spiral	10,500 Stack gas	ND probably same as above	75	No	40	34	0.288

Avg. .950

ND indicates no data given or available.

Asphalt plants in the area are [illegible]. Mechanically, they generally follow the pattern illustrated in Figure [illegible], which shows a well-designed plant under construction. They are usually in remote [illegible] areas, but business and even residential areas have encroached on these making dust-suppression even more necessary.

CERAMIC AND CLAYS

Some 450 establishments[20] in the Los Angeles area make ceramic and clay products, such as brick, tile, sewer pipe, pottery, and vitreous wares. Growth of petroleum-refining, chemical, dye, and cleaning industries has created demand for activated-clay products, catalysts, filter aids, and related materials. The preparation of essentially inert clay products for fillers also has become increasingly important. Only a few of the plants processing such materials have been checked for objectionable stack emissions. Almost all California ceramic and clay plants have some type of dust-suppressing equipment and some have quite elaborate recovery systems, but few plants have entirely satisfactory dust and fume controls.

Settling chambers, cyclones, and impact separators are in general use for the coarse particulate matter. For the collection of finer dusts, spray towers, dynamic centrifugal separators, wet scrubbers, sometimes supplemented by electrical precipitators and air filters, are used. The latter two are perhaps the most effective for dry dust, generally speaking, although some of the other types have been found satisfactory in some instances. Operations most often involve wet and dry fine grinding, processing at elevated temperatures in kilns or driers, and sometimes acid or other chemical treatment. Process weights are characteristically large and dust loadings heavy - up to 5 or 6 grains per cubic foot in untreated gases. Plants 2, 8, and 10 in table 11 are indicative of the dust losses in some types of clay-products operations. However, it is not feasible to generalize because of the great variety of raw materials and products and because only a few Los Angeles County plants have been investigated.

Examples of modern clay-processing operations are those for the manufacturing diatomaceous filter aids and for activating bentonitic clays. In the process of activating clays, the raw bentonite is crushed and ground in machinery especially developed for processing wet, sticky materials. The ground clay is pugged with water, pelletized, and partly dried. The pelletized clay is drawn continuously from storage into a tower where it is treated with sulfuric acid. The activated pellets are dried and calcined in large rotary kilns, cooled in rotary coolers, and sent to storage for packaging or for regrinding in Raymond mills. The latter are operated dry in a closed circuit with air-classifier cyclones. The air leaving the cyclones is satisfactorily cleared through bag-type filters.

Hot gases collected from the rotary driers and hoods at the feed and discharge-ends of the kilns and coolers are treated in multiple-tube centrifugal separators to collect the coarser dust, and then are put through a multiple washing tower receiving about 200 p.g.m. spray water, which is recirculated. Part of the sludge is bled off to settlers for clarification. Dirty gas entering the dust-recovery system may carry 4 to 6 grains per cubic foot or 720 to 1,000 pounds per hour, and the exit gas may carry about 60 pounds per hour. The legal limit for one source is 40 pounds per hour, so despite the high collection efficiency of over 90 percent, the plant described was in violation of County regulations.

20/ United States Department of Commerce, Census of Manufactures, 1947: Bull. Mc104, p. 9.