11.26 Talc Processing

11.26.1 Process Description[1-9]

Talc, which is a soft, hydrous magnesium silicate ($3MgO \cdot 4SiO_2 \cdot H_2O$), is used in a wide range of industries including the manufacture of ceramics, paints, paper, and asphalt roofing. The end-uses for talc are determined by variables such as chemical and mineralogical composition, particle size and shape, specific gravity, hardness, and color. There is no Source Classification Code (SCC) for the source category.

Over 95 percent of the talc ore produced in the United States comes from open-pit mines. Mining operations usually consist of conventional drilling and blasting methods.

Figure 11.26-1 is a process flow diagram for a typical domestic talc plant. Talc ore generally is hauled to the plant by truck from a nearby mine. The ore is crushed, typically in a jaw crusher, and screened. The coarse (oversize) material then is returned to the crusher. Rotary dryers may be used to dry the material. Secondary grinding is achieved with pebble mills or roller mills, producing a product that is 44 to 149 micrometers (μm) (325 to 100 mesh) in size. Some roller mills are designed to use heated air to dry the material as it is being ground. Hammer mills or steam- or compressed air-powered jet mills may be used to produce additional final products. Air classifiers (separators), generally in closed circuit with the mills, separate the material into coarse, coarse-plus-fine, and fine fractions. The coarse and coarse-plus-fine fractions then are stored as products. The fines may be concentrated using a shaking table (tabling process) to separate product containing small quantities of nickel, iron, cobalt, or other minerals and then may undergo a one-step flotation process. The resultant talc slurry is dewatered and filtered prior to passing through a flash dryer. The flash-dried product is then stored for shipment, unless it needs further grinding to meet customer specifications. The classified material also may be pelletized prior to packaging for specific applications. In the pelletizing step, processed talc is mixed with water to form a paste and then is extruded as pellets.

Talc deposits mined in the southwestern United States contain organic impurities and must be calcined prior to additional processing to yield a product with uniform chemical and physical properties. Generally, a separate product will be used to produce the calcined talc. Prior to calcining, the mined ore passes through a crusher and is ground to a specified screen size. After calcining in a rotary kiln, the material passes through a rotary cooler. The cooled calcine (0 percent free water) is then either stored for shipment or further processed. Calcined talc may be mixed with dried talc from other product lines and passed through a roller mill prior to bulk shipping.

11.26.2 Emissions And Controls[1-2,4-5,7-8,10-13]

The primary pollutants of concern in talc processing are particulate matter (PM) and PM less than 10 μm (PM-10). Particulate matter is emitted from drilling, blasting, crushing, screening, grinding, drying, calcining, classifying, materials handling and transfer operations, packaging, and storage. Although pelletizing is a wet process, PM may be emitted from the transfer and feeding of processed talc to the pelletizer. Depending on the purity of the talc ore body, PM emissions may include trace amounts of several inorganic compounds that are listed hazardous air pollutants (HAP), including arsenic, cadmium, chromium, cobalt, manganese, nickel, and phosphorus.

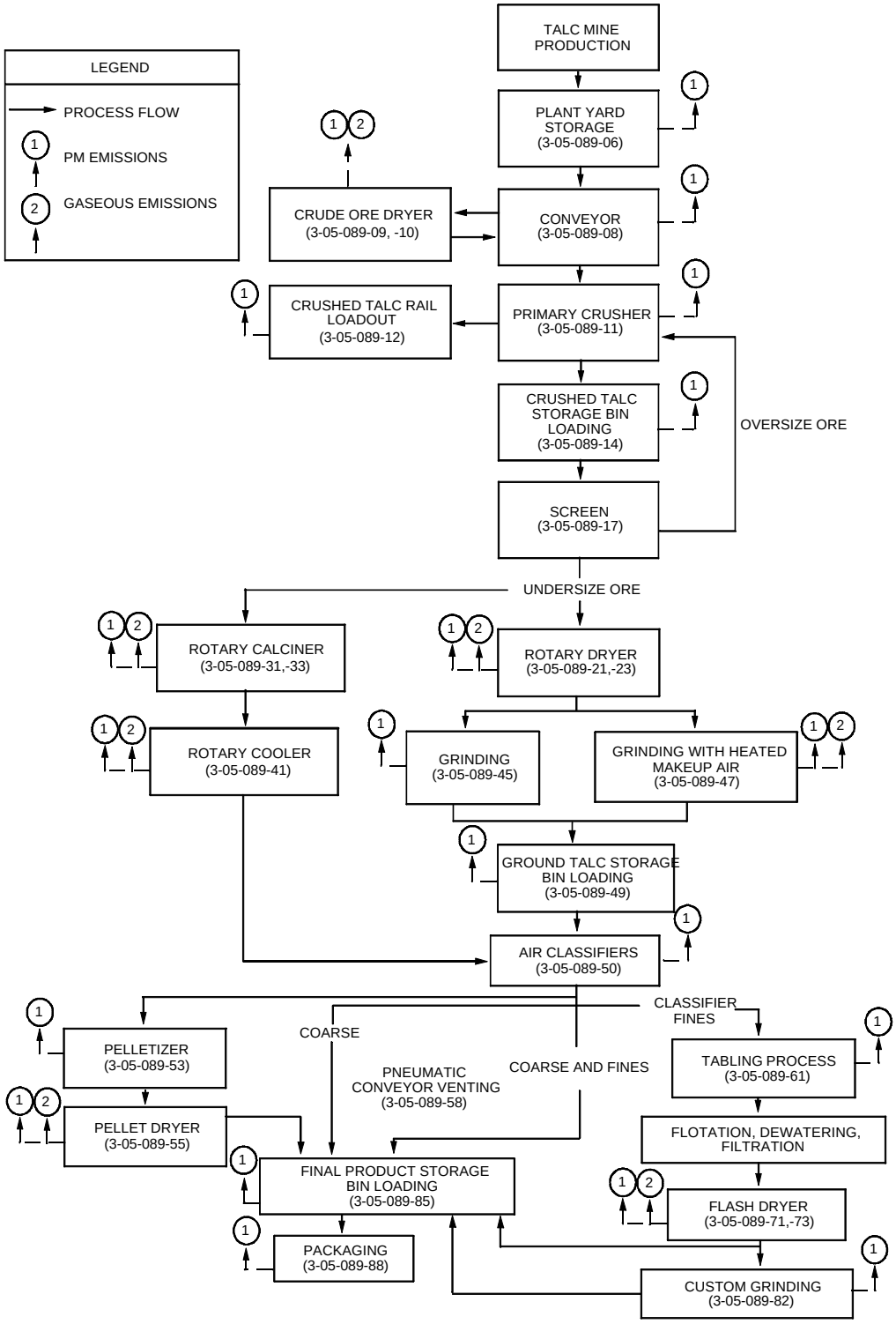

Figure 11.26-1. Process flow diagram for talc processing.[1,4,6]
(Source Classification Codes in parentheses.)

The emissions from dryers and calciners include products of combustion, such as carbon monoxide, carbon dioxide, nitrogen oxides, and sulfur oxides, in addition to filterable and condensible PM. Volatile organic compounds also are emitted from the drying and calcining of southwestern United States talc deposits, which generally contain organic impurities. Products of combustion and VOC may also be emitted from roller mills that use heated air and from the furnaces that provide the heated air to the mill.

Emissions from talc dryers and calciners are typically controlled with fabric filters. Fabric filters also are used at some facilities to control emissions from mechanical processes such as crushing and grinding. Emission factors for emissions from talc processing are presented in Table 11.26-1. Particle size distributions for talc processing are summarized in Table 11.26-2 and are depicted graphically in Figure 11.26-2.

Table 11.26-1. EMISSION FACTORS FOR TALC PROCESSING[a]

EMISSION FACTOR RATING: D

Process	Total PM[b] lb/1,000 lb	CO_2 lb/1,000 lb
Natural gas-fired crude ore drying with fabric filter[c] (SCC 3-05-089-09)	0.0020	ND
Primary crushing, with fabric filter[d] (SCC 3-05-089-11)	0.00074	NA
Crushed talc railcar loading[e] (SCC 3-05-089-12)	0.00049	NA
Screening, with fabric filter[f] (SCC 3-05-089-17)	0.0043	NA
Grinding, with fabric filter[g] (SCC 3-05-089-45)	0.022	NA
Grinding with heated makeup air, with fabric filter (SCC 3-05-089-47)	0.022[g]	9.3[h]
Classifying, with fabric filter[j] (SCC 3-05-089-50)	0.00077	NA
Pellet drying, with fabric filter[k] (SCC 3-05-089-55)	0.032	ND
Pneumatic conveyor venting, with fabric filter[m] (SCC 3-05-089-58)	0.0018	NA
Packaging, with fabric filter[n] (SCC 3-05-089-88)	0.0090	NA
Crushed talc storage bin loading, with fabric filter[p] (SCC 3-05-089-14)	0.0036	NA
Ground talc storage bin loading, with fabric filter[q] (SCC 3-05-089-49)	0.0016	NA
Final product storage bin loading, with fabric filter[p] (SCC 3-05-089-85)	0.0035	NA

[a] Units are lb/1,000 lb of production unless noted. One lb/1,000 lb is equal to 1 kg/Mg. SCC = Source Classification Code. NA = not applicable. ND = no data.

[b] Total PM includes the PM collected in the front half and the inorganic PM caught in the back half (impingers) of a Method 5 sampling train.

[c] Reference 15. Filterable PM fraction is 60%, and condensible inorganic fraction is 40%.

[d] References 10,13,15.

[e] Reference 14.

[f] References 10,13. For crushed talc ore.

[g] References 11,13.

[h] References 10-11. For roller mill using heated makeup air. EMISSION FACTOR RATING: E.

[j] Reference 13. For ground talc.

[k] Reference 13. Filterable PM fraction is 56%, and condensible inorganic fraction is 44%. EMISSION FACTOR RATING: E.

[m] Reference 13. For final product. Units are lb/1,000 lb of material conveyed.

[n] Reference 10,13.

[p] Reference 13. Units are lb/1,000 lb of material loaded into storage bin.

[q] Reference 12. Units are lb/1,000 lb of material loaded into storage bin.

Table 11.26-2. SUMMARY OF PARTICLE SIZE DISTRIBUTIONS FOR TALC PROCESSING[a]

Process	Diameter, μm	Cumulative Percent Less Than Diameter
Primary crushing (SCC 3-05-089-11)	55.4	91.3
	34.9	78.2
	22.0	56.7
	17.4	47.2
	11.0	38.8
	6.9	21.4
	3.0	3.0
	2.0	0.94
	1.0	0.11
Grinding (SCC 3-05-089-45)	29.0	100.0
	18.8	99.7
	14.9	99.4
	11.9	97.1
	9.4	80.8
	7.5	43.3
	4.7	7.5
	3.0	2.1
	1.9	0.28
	1.0	0.04
Storage, bagging, air classification (SCC 3-05-089-85,-88,-50)	43.9	99.9
	27.7	97.9
	17.4	86.6
	13.8	73.2
	11.0	56.8
	6.9	24.5
	4.4	7.4
	3.0	3.1
	2.0	0.92
	1.0	0.10

[a] Reference 5. Optical procedures used to determine particle size distribution, rather than inertial separators. Data are suspect. SCC = Source Classification Code.

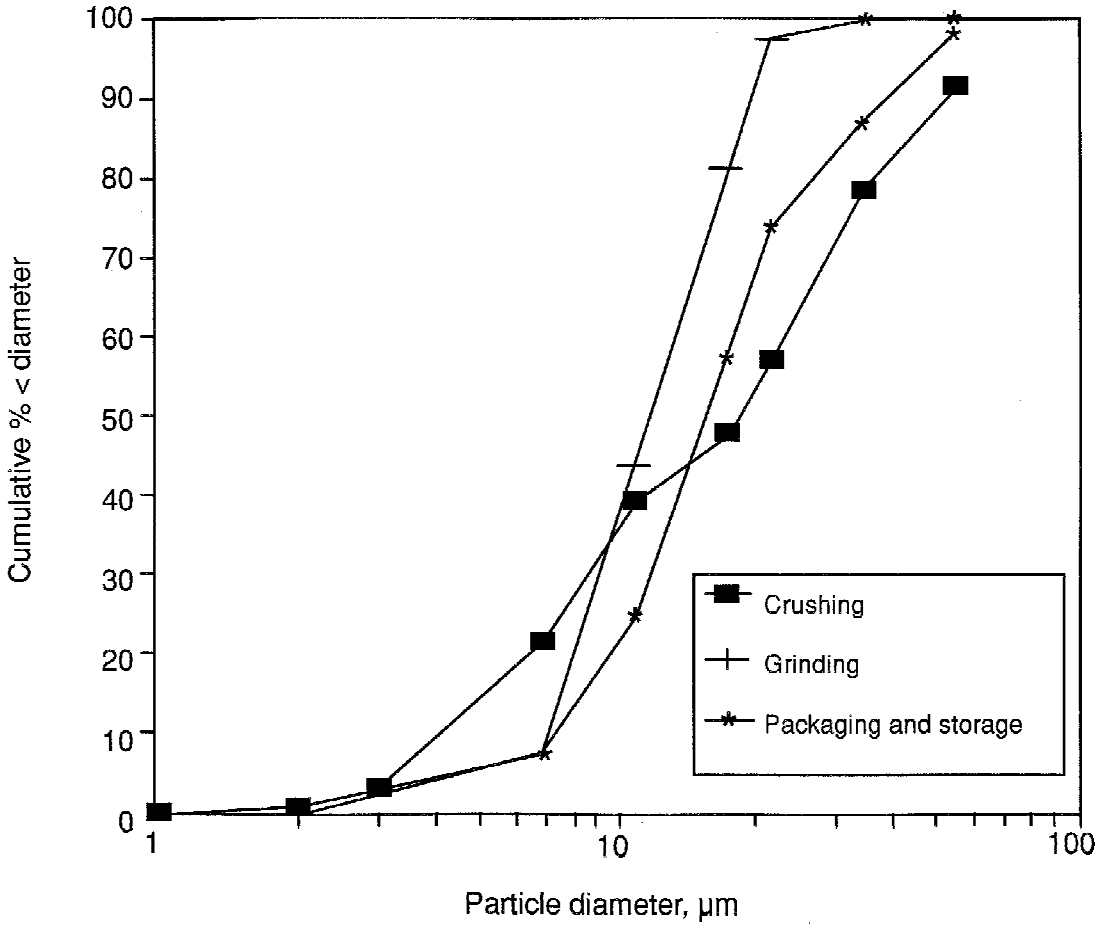

Figure 11.26-2. Particle size distribution for talc processing.[5]

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