AP-42 Section 11.26
Reference 4
Report Sect. 2
Reference 4

Date: 3-28-94

Reference: Ronald Myers

In response to your request the following is enclosed:

Here are my comments for the AP-42 section on talc. Most of the comments just update the data and processing sections. I am not aware of any emission data for talc.

If additional information is desired, feel free to contact the undersigned.

Bob Virta

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Date: February 14, 1994

Subject: Background Information for Proposed AP-42 Section 8.30,
Talc Processing
Review and Update Remaining Sections of Chapter 8
(Mineral Products Industry) of AP-42
EPA Contract 68-D2-0159, Work Assignment 012
MRI Project 3612

From: Richard Marinshaw

To: Ron Myers
EPA/EIB/EFMS (MD-14)
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## I. Introduction

This memorandum presents the background information that was used to develop the proposed AP-42 Section 8.30 on talc processing. A description of the industry is presented first. A process description followed by a discussion of emissions and controls is then presented. Finally, the reference list is provided. The draft AP-42 section is provided as the attachment.

## II. Industry Description[1-3]

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. The Standard Industrial Classification (SIC) code for talc mining is 1499 (miscellaneous nonmetallic minerals, except fuels), and the SIC code for talc processing is 3295 (minerals and earths, ground or otherwise treated). There is no Source Classification Code (SCC) for the source category.

The word talc refers to a wide variety of rocks and rock products. Soapstone ~~reportedly contains up to 50 percent talc~~. ← Soapstone is a massive impure talcose rock. Its talc content is variable and can exceed 50%. It has a slippery feeling and can be carved by hand. Steatite contains a high-purity talc suitable for making electrical insulators. These talc-containing minerals (soapstone and steatite) will be treated as talc in this section. The color of talc varies from snow-white to greenish-gray and various shades of green. The specific gravity of talc ranges from 2.6 to 2.8.

Talcose rocks may contain mineral impurities that are composed of

In theory, talc is composed of 63.4 percent silicon dioxide ($SiO_2$), 31.9 percent magnesium oxide (MgO), and 4.7 percent water ($H_2O$). The actual composition of commercial talc may vary widely from these levels. ~~Talc may also contain~~ one or more of the following oxides, ranging in concentration from a trace to several percent: iron, titanium, aluminum, calcium, chromium, cobalt, manganese, nickel, phosphorus, potassium, or sodium. For most end-uses, these impurities are undesirable and are removed to the extent feasible. ~~Asbestiform minerals~~, ~~including~~ tremolite, anthophylite, and actinolite, may be ~~are~~ found in talc deposits, but generally they are not ~~in~~ fibrous ~~form~~. Chrysotile ~~asbestiform minerals~~ can also be found in some talc deposits, but ~~they~~ is ~~are~~ found infrequently and at low levels.

Talc deposits can be found in many parts of the world. In 1992, talc minerals were mined and processed at 19 mines in 8 States, and domestic production amounted to 1,071,000 megagrams (Mg) 997,000 MT (~~1,178,000~~ tons). Talc mines in Montana, New York, Texas, and Vermont accounted for about ~~96~~ 98 percent of total domestic production in 1992.

The largest use of talc-group minerals is for manufacturing of ceramics (31 percent), which includes ~~kiln furniture~~, sanitary ware, floor and wall tile, dinnerware glazes, and electrical porcelains. For these end-products, adding talc to the usual clay-silica-feldspar body mixtures facilitates the firing of the ware and improves the quality. The third ~~second~~ major use of talc minerals is as a filler or a pigment for paints 18 (~~17~~ percent of total 1992 U.S. production). The paper industry is the ~~third~~ second major user 20 (~~16~~ percent) of talc, followed by roofing applications 9 (~~11~~ percent), plastics 5 (~~6~~ percent), and cosmetics (5 percent). Talc also is used in the production of synthetic rubber, insecticides, and pharmaceuticals.

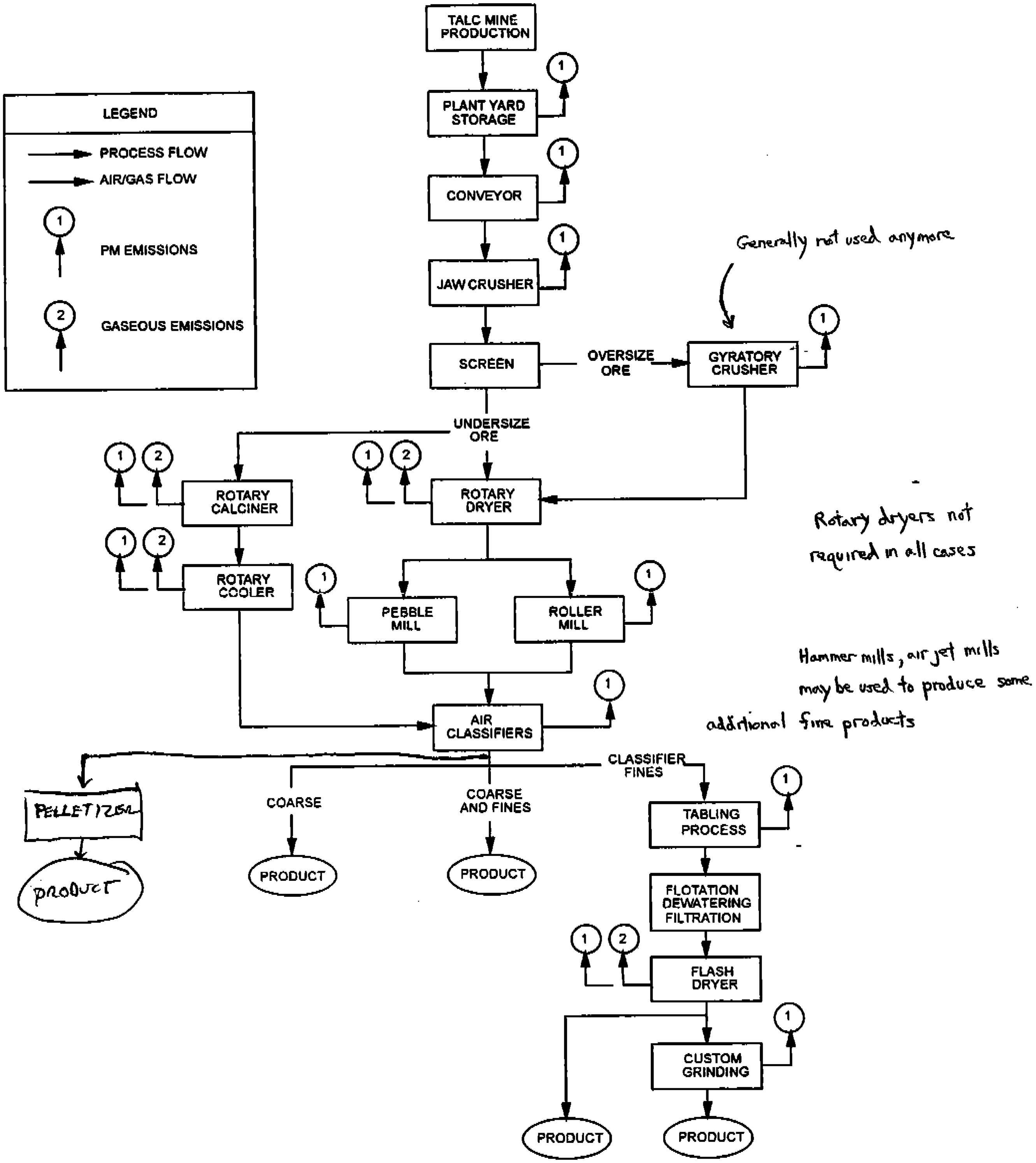
Updated statistics

Grades of talc are most frequently identified with the end use. Some of the important desirable properties are softness and smoothness, color, luster, high slip tendency, moisture content, oil and grease absorption, chemical inertness, fusion point, heat and electrical conductivity, and high dielectrical strength.

## III. Process Description[1,2,4]

Most domestic talc is mined from open-pit operations; ~~in 1985,~~ over 95 ~~93~~ percent of the talc ore produced in the United States came from open-pit mines. ~~Underground mines continue to be important sources of this mineral, however.~~ Mining operations usually consist of conventional drilling and blasting methods. The softness of talc makes it easier to mine and process than most other minerals.

Figure 1 is a process flow diagram for a typical U.S. talc plant. Talc ore generally is hauled to the plant by truck from a nearby mine. The ore is crushed and screened, and coarse



Generally not used anymore

Rotary dryers not required in all cases

Hammer mills, air jet mills may be used to produce some additional fine products

Figure 1. Process flow diagram for talc processing.[1]

generally not used anymore

(oversize) material is sent through a gyratory crusher. Rotary dryers may be ~~are~~ used to dry the two separate fractions. 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. 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 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, or it may be further ground to meet customer specifications.

Hammer mills or air jet mills may be used to produce additional fine products.

Talc deposits mined in the south western United States contain organic impurities and must be calcined prior to additional processing to yield a product with uniform chemical and physical properties. 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 stored for shipment, or it may be further processed. Calcined talc may be mixed with dried talc from other product lines and passed through a roller mill prior to bulk shipping.

## IV. Emissions and Controls[1,2,5-8]

The primary pollutant of concern in talc processing is particulate matter (PM) and PM less than 10 μm (PM-10). Particulate matter is emitted from drilling, blasting, crushing, screening, grinding, drying, calcining, classifying, and materials handling and transfer operations. Particulate matter emissions may include trace amounts of several inorganic compounds that are listed hazardous air pollutants (HAP's), including chromium, cobalt, manganese, nickel, and phosphorus.

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 (VOC's) also are emitted from the drying and calcining of south western United States talc deposits, which generally contain organic impurities.

Asbestos emissions from talc mining and processing have been the subject of concern, particularly for the talc deposits located in upper New York State. However, no emission data were located that provided an indication of asbestiform fiber emission rates from talc processing. Some studies of talc mining and processing plant worker exposure to asbestiform fibers have been conducted. A National Institute for Occupational Safety and Health (NIOSH) study of worker exposure to asbestiform fibers at a talc mining and processing plant in upper New York State found fibrous tremolite and anthophylite to be major contaminants in the talc processed by the plant. The study also found that worker exposure to these fibers far exceeded Occupational Safety and Health Administration (OSHA) standards. A later study sponsored by the talc processing plant that was the subject of the NIOSH study disputed the NIOSH report results. Other than worker exposure studies, the only information located that relates asbestiform fiber emissions to talc processing is from a study by the New York State Department of Health. In that study, asbestiform fibers in low concentrations (0.064 to 0.116 fibers per cubic centimeter) were detected in ambient air samples taken in the vicinity of a talc mining area.

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.

The only test data found on talc processing are from an emission test conducted in 1976. Uncontrolled and controlled filterable and condensible inorganic PM emissions and particle size distribution were measured. The PM emissions were measured using a modified Method 17. The particle size distribution was measured using an alundum thimble connected to the nozzle by a 12-in. steel probe, followed by a 47-millimeter-type SGA filter. The particle size distribution of the portion of the sample found to be less than 45 μm was determined using electronic particle counter methods. Table 1 summarizes the measured emission concentrations and rates, and Table 2 summarizes the particle size distribution. Because the test report did not include process operating rates, emission factors could not be developed from the emission data.

spelling?

TABLE 1. SUMMARY OF PM EMISSION DATA FROM A TALC CRUSHING AND GRINDING TEST[5]

| Sampling location[a] | Processes | Average concentration | | Average emission rate | |
|---|---|---|---|---|---|
| | | mg/dscm | gr/dscf | kg/hr | lb/hr |
| Fabric filter inlet No. 1 | Primary/secondary crushing | 20,100 | 8.8 | 387 | 852 |
| Fabric filter inlet No. 2 | Vertical mill | 2,880 | 1.26 | 14.4 | 31.7 |
| Fabric filter inlet No. 3 | Storage, bagging, air classification | 7,050 | 3.08 | 40.9 | 90.1 |
| Fabric filter inlet No. 1A | Storage | 148,000 | 64.6 | 98.7 | 218 |
| Fabric filter Inlet No. 1B | Storage | 20,700 | 9.06 | 21.2 | 46.8 |
| Fabric filter outlet | All of the above | 139 | 0.061 | 4.72 | 10.4 |

[a] Inlets 1, 2, 3, 1A, and 1B are deducted to a common fabric filter.

## TABLE 2. SUMMARY OF PARTICLE SIZE DISTRIBUTION DATA FROM A TALC CRUSHING AND GRINDING FACILITY[5]

| Process | Diameter, μm[a] | Cumulative weight, g | Cumulative percent less than diameter |
|---|---|---|---|
| Primary/secondary crushing | 55.4 | 1.564 | 91.3 |
| | 34.9 | 3.932 | 78.2 |
| | 22.0 | 7.822 | 56.7 |
| | 17.4 | 9.546 | 47.2 |
| | 11.0 | 11.063 | 38.8 |
| | 6.9 | 14.197 | 21.4 |
| | 3.0 | 17.521 | 3.0 |
| | 2.0 | 17.898 | 0.94 |
| | 1.0 | 18.049 | 0.11 |
| Vertical mill | 29.0 | 0.002 | 100.0 |
| | 18.8 | 0.017 | 99.7 |
| | 14.9 | 0.031 | 99.4 |
| | 11.9 | 0.144 | 97.1 |
| | 9.4 | 0.943 | 80.8 |
| | 7.5 | 2.792 | 43.3 |
| | 4.7 | 4.554 | 7.5 |
| | 3.0 | 4.821 | 2.1 |
| | 1.9 | 4.908 | 0.28 |
| | 1.0 | 4.920 | 0.04 |
| Storage, bagging, air classification | 43.9 | 0.014 | 99.9 |
| | 27.7 | 0.339 | 97.9 |
| | 17.4 | 2.141 | 86.6 |
| | 13.8 | 4.289 | 73.2 |
| | 11.0 | 6.922 | 56.8 |
| | 6.9 | 12.108 | 24.5 |
| | 4.4 | 14.847 | 7.4 |
| | 3.0 | 15.534 | 3.1 |
| | 2.0 | 15.885 | 0.92 |
| | 1 | 16.016 | 0.10 |

[a] Optical procedures rather than inertial separators used to determine particle size distribution; data may be suspect.

## IV. REFERENCES

1. Calciners and Dryers in Mineral Industries--Background Information for Proposed Standards, EPA-450/3-025a, U. S. Environmental Protection Agency, Research Triangle Park, NC, October 1985.
2. L. A. Roe and R. H. Olson, "Talc", Industrial Rocks and Minerals, Volume I, Society of Mining Engineers, New York, NY, 1983.
3. R. L. Virta, "Talc in 1992", Mineral Industry Surveys, Annual, Preliminary, Bureau of Mines, U.S. Department of the Interior, Washington, DC, January 1993.
4. R. L. Virta, The Talc Industry--An Overview, Information Circular 9220, Bureau of Mines, U.S. Department of the Interior, Washington, DC, 1989.
5. Emission Study at a Talc Crushing and Grinding Facility, Eastern Magnesia Talc Company, Johnson, Vermont, October 19-21, 1976, Report No. 76-NMM-4, U. S. Environmental Protection Agency, Research Triangle Park, NC, 1977.
6. Occupational Exposure to Talc Containing Asbestos, DHEW (NIOSH) Publication No. 80-115, National Institute for Occupational Safety and Health, U.S. Department Of Health, Education, and Welfare, Washington, DC, February 1980.
7. An Evaluation of Mineral Particles at Governeur Talc Company, 1975 and 1982: A Comparison of Mineralogical Results Between NIOSH and DGC, Dunn Geoscience Corporation, Latham, NY, January 4, 1985.
8. Investigation of Environmental Occurrence of Asbestiform Fibers in St. Lawrence County, New York State Department of Health, Bureau of Toxic Substance Assessment, February 1987.

ATTACHMENT

Use comments from previous section

# DRAFT AP-42 SECTION 8.30

## 8.30 TALC PROCESSING

### 8.30.1 Process Description[1-3]

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. The Standard Industrial Classification (SIC) code for talc mining is 1499 (miscellaneous nonmetallic minerals, except fuels), and the SIC code for talc processing is 3295 (minerals and earths, ground or otherwise treated). There is no Source Classification Code (SCC) for the source category.

Most domestic talc is mined from open-pit operations; in 1985, 93 percent of the talc ore produced in the United States came from open-pit mines. Underground mines continue to be important sources of this mineral, however. Mining operations usually consist of conventional drilling and blasting methods. The softness of talc makes it easier to mine and process than most other minerals.

Figure 8.30-1 is a process flow diagram for a typical U.S. talc plant. Talc ore generally is hauled to the plant by truck from a nearby mine. The ore is crushed and screened, and coarse (oversize) material is sent through a gyratory crusher. Rotary dryers are used to dry the two separate fractions. 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. 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 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, or it may be further ground to meet customer specifications.

Talc deposits mined in the western 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 stored for shipment, or it may be further processed. Calcined talc may be mixed with dried talc from other product lines and passed through a roller mill prior to bulk shipping.

### 8.30.2 Emissions and Controls[1,2,4,5]

The primary pollutant of concern in talc processing is particulate matter (PM) and PM less than 10 μm (PM-10). Particulate matter is emitted from drilling, blasting, crushing, screening, grinding, drying, calcining, classifying, and materials handling and transfer operations. Particulate matter emissions may include trace amounts of several inorganic compounds that are listed hazardous air pollutants (HAP's), including chromium, cobalt, manganese, nickel, and phosphorus.

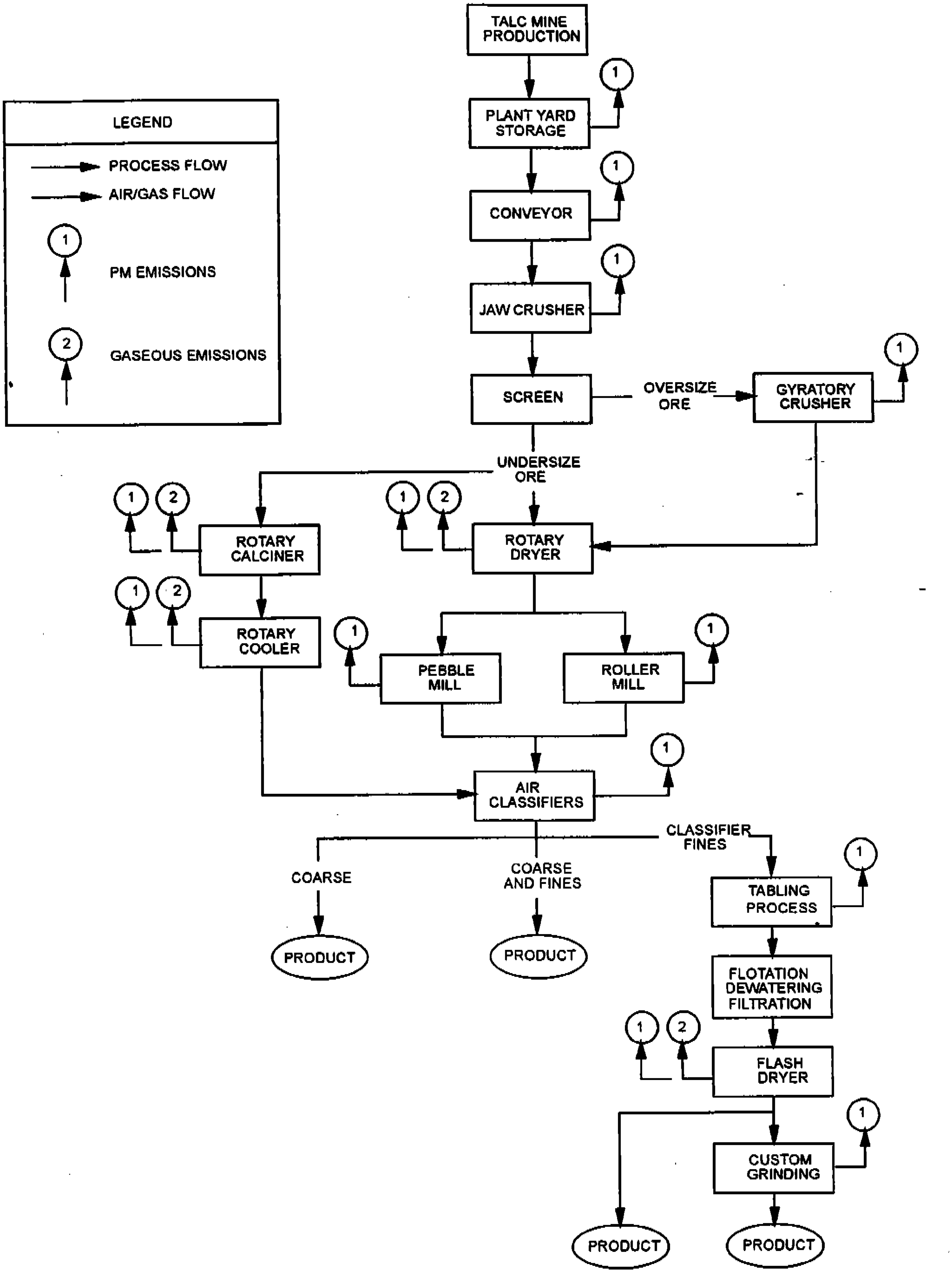


Figure 8.30-1. Process flow diagram for talc processing.[1]

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 western United States talc deposits, which generally contain organic impurities.

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.

Due to a lack of availability, no emission factors for talc processing are presented.

REFERENCES FOR SECTION 8.30

1. Calciners and Dryers in Mineral Industries--Background Information for Proposed Standards, EPA-450/3-025a, U. S. Environmental Protection Agency, Research Triangle Park, NC, October 1985.

2. L. A. Roe and R. H. Olson, "Talc", Industrial Rocks and Minerals, Volume I, Society of Mining Engineers, NY, 1983.

3. R. L. Virta, The Talc Industry-An Overview, Information Circular 9220, Bureau of Mines, U.S. Department of the Interior, Washington, DC, 1989.

4. Emission Study at a Talc Crushing and Grinding Facility, Eastern Magnesia Talc Company, Johnson, Vermont, October 19-21, 1976, Report No. 76-NMM-4, U. S. Environmental Protection Agency, Research Triangle Park, NC, 1977.

5. Investigation of Environmental Occurrence of Asbestiform Fibers in St. Lawrence County, New York State Department of Health, Bureau of Toxic Substance Assessment, February 1987.