SODIUM SULFATE

A. Commodity Summary

The domestic natural sodium sulfate industry consists of three producers in California, Texas, and Utah. In addition, the recovery of sodium sulfate as a byproduct from facilities that manufacture rayon and various chemicals accounts for nearly 50% of total domestic production. The total value of sodium sulfate sold was estimated at $50 million in 1994. End uses of sodium sulfate are soap and detergents (40%), pulp and paper (25%), textiles (19%), glass (5%), and other uses (11%).[1]

In its natural form, sodium sulfate is found in two minerals, mirabilite (Glauber's salt) and thenardite. Its occurrence is widespread and it is commonly found in mineral waters such as sea water, atmospheric precipitation, and saline lakes. Essentially all commercial deposits of sodium sulfate resulted from the accumulation and evaporation of surface and ground water in basins with interior drainage. These basins, or playas, are found in arid to semiarid regions.[2]

At the present time, sodium sulfate production is chiefly from brine deposits in Searles Lake, California; Great Salt Lake, Utah; and in Western Texas. North American Chemical Company processes sodium sulfate from Searles Lake at Trona, California. Great Salt Lake Minerals and Chemicals Corp., an affiliate of North America Chemical Co., operates a plant at the north end of the Great Salt Lake, which produces sodium sulfate as a byproduct. This facility has a sodium sulfate capacity of 22.7 to 32.9 kilotons per year. Ozark-Mahoning Company operates one plant in Western Texas near Seagraves. Exhibit 1 presents the names and locations of the facilities involved in the production of sodium sulfate.[3]

EXHIBIT 1

SUMMARY OF SODIUM SULFATE PROCESSING FACILITIES

Facility Name	Location
Great Salt Lake Minerals and Chemicals Corp.	Great Salt Lake, UT
North American Chemical, Inc.	Searles Lake, CA
Ozark-Mahoning Co.	Western Texas

B. Generalized Process Description

1. Discussion of Typical Production Processes

There are three principle methods used to produce sodium sulfate from brines: (1) the Ozark-Mahoning process used in Western Texas, (2) the North American Chemical Company process at Searles Lake, and (3) the process used by the Great Salt Lake Minerals and Chemical Corp. in Utah. Because these three processes are all slightly different, each is described in more detail below. Exhibits 2 and 3 present process flow diagrams for sodium sulfate production.

2. Generalized Process Flow Diagram

Ozark-Mahoning Co. Process

The Ozark-Mahoning Company, the nation's second largest natural producer, operates a facility in Western Texas. As shown in Exhibit 2, brines are refrigerated to selectively precipitate Glauber's salt which is subsequently filtered and washed. Washing produces a saturated solution of Glauber's salt which is converted to the anhydrous form in mechanical vapor recompression crystallizers. Hydroclones and centrifuges separate the anhydrous crystals from the

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[1] Dennis Kostick, "Sodium Sulfate," from Mineral Commodity Summaries, U.S. Bureau of Mines, January 1995, pp. 158-159.

[2] Sid McIlveen and Robert L. Cheek, Jr., "Sodium Sulfate Resources," from Industrial Minerals and Rocks, 6th edition, Society for Mining, Metallurgy, and Exploration, 1994, pp. 959-970.

[3] Ibid.

saturated solution, which is returned to evaporators. Anhydrous sodium sulfate is then dried in a rotary kiln and the resultant material is a product of 99.7% purity.[4]

North American Chemicals, Inc. Process (Searles Lake)

North American Chemicals, Inc. operates two facilities near Searles Lake, CA--the West End plant and the Argus plant. The West End plant is North American's only source of sodium sulfate. Here, sodium sulfate is recovered along with soda ash and borax. As shown in Exhibit 3, mixed brines are carbonated with carbon dioxide to precipitate sodium bicarbonate, which is removed by filtration. The decarbonated brine is cooled three times to produce two successive batches of borax and one of Glauber's salt. By heating, the sodium bicarbonate is converted to soda ash and the borax is either crystallized as a hydrate or dehydrated to anhydrous form. The Glauber's salt is washed, melted, and recrystallized as anhydrous sodium sulfate; 99.3% purity can be obtained.[5]

Great Salt Lake Minerals and Chemical Corp. Process

Great Salt Lake Minerals and Chemicals Corp. operates a facility on the Great Salt Lake for the production of potassium sulfate and magnesium chloride, of which sodium sulfate is a byproduct. Brine is pumped from the Great Salt Lake into solar evaporation ponds where sodium chloride precipitates. Sodium sulfate crystals precipitate in a fairly pure state when winter weather cools the brine to -1 to 4°C. The crystals are picked up by large earthmoving machinery and stored outdoors until further processing can take place. The harvested Glauber's salt is melted and anhydrous sodium sulfate precipitated by the addition of sodium chloride to reduce its solubility through the common ion effect. The final product is 99.5% pure.[6]

3. Identification/Discussion of Novel (or otherwise distinct) Process(es)

None identified.

4. Beneficiation/Processing Boundaries

Based on a review of the process, there are no mineral processing operations involved in the production of sodium sulfate.

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[4] Sid McIlveen and Robert L. Cheek, Jr., 1994, Op. Cit., pp. 959-970.

[5] Ibid.

[6] Ibid.

EXHIBIT 2

OZARK-MAHONING PROCESS

Graphic Not Available.

Source: 1988 Final Draft Summary Report of Mineral Industry Processing Waste, 1988, pp. 2-47 - 2-51.

EXHIBIT 3

SEARLES LAKE PROCESS

Graphic Not Available.

Source: 1988 Final Draft Summary Report of Mineral Industry Processing Waste, 1988, pp. 2-47 - 2-51.

C. Process Waste Streams

Existing data and engineering judgement suggest that the wastes listed below from sodium sulfate production do not exhibit any characteristics of hazardous waste. Therefore, the Agency did not evaluate these materials further.

1. Extraction/Beneficiation Wastes

Ozark-Mahoning Process

Waste brine and **wastewater** are wastes from filtrating and washing Glauber's salt. Literature reports that these wastes are reinjected into the salt formation.

Searles Lake Process

Clarifier overflow.

Filtrate.

2. Mineral Processing Wastes

None identified.

D. Ancillary Hazardous Wastes

Ancillary hazardous wastes may be generated at on-site laboratories, and may include used chemicals and liquid samples. Other hazardous wastes may include spent solvents (e.g., petroleum naptha), acidic tank cleaning wastes, and polychlorinated biphenyls from electrical transformers and capacitors. Non-hazardous wastes may include sanitary sewage, waste oil (which may or may not be hazardous), and other lubricants.

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