

# SODIUM SULFATE

By Dennis S. Kostick

Sodium sulfate is produced from naturally occurring brines or crystalline mineral sources and as a byproduct from various chemical processes. It is used to make many consumer products used by virtually everyone, such as powdered laundry detergents, brown paper bags, textiles, and glass. Based on an annual survey of the nation's top 50 organic and inorganic chemicals produced, sodium sulfate had traditionally ranked about 47th in terms of production volume; however, in 1994 for the first time sodium sulfate failed to appear on this top 50 chemical list.<sup>1</sup>

## Production

U.S. production and inventory data for natural sodium sulfate are obtained by the U.S. Bureau of Mines from monthly and annual surveys of domestic operations. All producers of natural sodium sulfate responded to the canvass, representing 100% of the natural sodium sulfate data used in this report.

Synthetic sodium sulfate data were collected by the U.S. Department of Commerce, Bureau of the Census, from quarterly and annual surveys of companies engaged in recovering and selling byproduct sodium sulfate. The information was published in the Current Industrial Reports, Inorganic Chemicals, MQ28A (quarterly) and MA28A (annual). Any revised Census Bureau data have been included in this report using the most recent Census Bureau statistics. These data are aggregated with U.S. Bureau of Mines natural sodium sulfate data and included in several tables. [(See table 1.)]

Production of natural and synthetic sodium sulfate declined 14% in 1994. The total sodium sulfate industry operated at 63% of combined nameplate capacity, which was 738,000 metric tons. Producers of natural sodium sulfate, which usually is a high-purity product, will encounter competition from battery recycling companies that plan to upgrade their recovered sodium sulfate material by removing heavy metals and other contaminants that would have prevented them from selling into the high purity markets. These battery recyclers were forced to improve the quality of their byproduct sodium sulfate because environmental regulations became more strict, thereby preventing them from disposing of the material to landfills or

underground injection disposal. The Doe Run Co. of Boss, MO, is one company already in business recovering sodium sulfate from battery recycling. [(See table 2).]

Two new battery recycling plants, RSR Corp. of Scotchtown, NY, and GNB Inc., of Columbus, GA, will have high-purity sodium sulfate production capacities reported to be between 20,000 tons and 30,000 tons each. This material is suitable for the detergent industry, which requires a very white, high specification sodium sulfate product. GNB planned to be in operation in 1995, and RSR planned to be onstream in 1996. Another company, Schuilkil Metals, reportedly also intends to recover sodium sulfate at its plant in Baton Rouge, LA.<sup>2</sup> Because this plant will be located near Elf Atochem's natural sodium sulfate operation at Seagraves, TX, Schuilkil will be competing in Atochem's southern and southeast markets.

Concern about the environment has prompted other companies, such as Occidental Chemical Corp., to investigate ways to also upgrade their sodium sulfate. Occidental's chemical plant at Castle Hayne, NC, recovers sodium sulfate but the final product contains some residual chrome compounds that make it unsuitable for sale to markets that demand high-purity product. For this reason, Occidental reportedly planned install a new filtration system to upgrade one-half of its sodium sulfate output to produce a new high-purity material. Presently, the plant has an annual production capacity of 120,000 tons.<sup>3</sup> The extra availability of high-purity sodium sulfate from byproduct operations will have an adverse affect on the natural sodium sulfate industry, which has always had to price its material based on that of the byproduct. This was part of the reason why Great Salt Lake Minerals Corp. of Ogden, UT, closed its natural sodium sulfate facility in 1993, leaving only two other companies to produce from natural sources.

## Consumption and Uses

Apparent consumption of total sodium sulfate declined 3% in 1994 from that of the previous year, based on revised 1993 Census Bureau production data that affected apparent consumption calculations. The estimated distribution of sodium sulfate by end use in

1994 was detergents, 40%; pulp and paper, 20%; textiles, 19%; carpet fresheners and glass, 5% each; and miscellaneous, 11%.<sup>4</sup>

Reduced consumption of saltcake by the pulp and paper industry contributed to part of this decline. Of the 120 kraft pulp and paper mills in the United States, only about 12 continue to use sodium sulfate in the Kraft pulping process. These mills have switched to using chlorine dioxide for the bleaching process that generates its own byproduct sodium sulfate. Pulp mills have converted to oxygen-based chlorine dioxide because of environmental problems associated with chlorine-based bleaching agents, which have been the traditional bleaching compounds used.

The major use of sodium sulfate is as an inert filler with a brilliant whiteness that provides bulk in powdered laundry detergents. The growth of superconcentrated liquid detergents and compact detergents has adversely affected the demand for powdered products. Detergent manufacturers have switched some of their products to powdered formulations, primarily for the export market to certain developing nations that have growing demand for powdered detergents that are less expensive than the liquid alternatives.

The textile industry is another domestic markets that consumes sodium sulfate. In the dyeing process, sodium sulfate is blended with dyes to standardize the concentration of the dyes. Consumption of sodium sulfate by the textile industry reportedly declined but market observers were optimistic that demand should improve because the fashion industry was emphasizing more dark cotton apparel, which uses more sodium sulfate than lighter colored ware. Foreign textile manufacturers, particularly those in China and Mexico, are importing sodium sulfate to meet demand requirements.

Although natural sodium sulfate had been the preferred choice by the glass industry, consumption of byproduct material by glass manufacturers reportedly has increased. The miscellaneous uses of sodium sulfate include ceramics, chemicals (potassium sulfate, sodium hyposulfite, sodium sulfide, sodium silicate, and sodium aluminum sulfate), feed supplements, printing inks, sulfonated oils, veterinary medicines, and viscose sponges.

## Foreign Trade

Imports of crude and anhydrous sodium sulfate decreased 14% in 1994, primarily from Canada and Mexico. The average c.i.f. value remained virtually the same--\$82.63 per ton in 1994 and \$83.44 per ton in 1993. Imports of crude saltcake, which is a low-purity product generally preferred by the pulp and paper industry, represented about 57% of total imports.

Exports declined 27% in 1994. In terms of volume of exports in decreasing order, Canada, Australia, Guatemala, Colombia, the Republic of Korea, and Mexico were the major buyers of U.S. sodium sulfate. (See tables 4 and 5.)

## World Review

Total world sodium sulfate production declined for the fourth consecutive year. Approximately 59% of world sodium sulfate output in 1994 was from natural sources. The United States ranked fourth in 1994 in production of natural sodium sulfate and third in synthetic output. (See table 6.)

**Canada.**—In July 1994, Ormiston Mining and Smelting Co., Ltd., of Ormiston, Saskatchewan announced plans to close because of declining sales to North American markets. However, the plant which had an annual production capacity of 50,000 tons, was still in operation by yearend. Decreased demand also caused other Canadian sodium sulfate producers to operate at reduced capacities. Saskatchewan Minerals, which exports about 70% of its product to the United States, reportedly operated at 70% of capacity while others were at 50%.<sup>5</sup>

**Turkey.**—Plans to construct a potassium nitrate and sodium sulfate facility were announced. Dead Sea Works and a Turkish chemical company will share the ownership and will each provide the engineering and construction capital. Israel Chemicals will provide the technology for the potassium nitrate plant.<sup>6</sup>

## Outlook

Domestic consumption of total sodium sulfate is forecast to remain flat or decline. There will be occasional small surges in demand in certain categories but not enough to make significant changes in growth trends. One positive area for increased sodium sulfate consumption is in the carpet cleaning sector. Carpet freshener products, which have a sodium sulfate content of up to 85%, appears to be a growing market that will benefit the sodium sulfate industry.

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<sup>1</sup>Chemical and Engineering News. Production of Top 50 Chemicals Increased Substantially in 1994. Apr. 10, 1995, V. 73, No. 15, p. 17.

<sup>2</sup>Chemical Marketing Reporter. Natural Sodium Sulfate Squeeze Gets Tighter. Dec. 26, 1994, V. 246, No. 26, p. 5.

<sup>3</sup>\_\_\_\_\_. Sodium Sulfate Pressure Rises. Aug. 15, 1994, V. 246, No. 7, p. 7.

<sup>4</sup>Sodium Sulfate. Chemical Products Synopsis, Mar. 1995, Mannsville Chemical Products Corp.

<sup>5</sup>Work cited in footnote 2.

<sup>6</sup>European Chemical News. In Brief. Apr. 25, 1994, V. 61, No. 1615, p.

## OTHER SOURCES OF INFORMATION

### U.S. Bureau of Mines Publications

Sodium Sulfate. Ch. in Minerals Yearbook, annual.

Sodium Sulfate in Mineral Industry Surveys, monthly.

Sodium Sulfate in Mineral Commodity Summaries, annual.

Soda Ash and Sodium Sulfate, Ch. in 1985 Mineral Facts and Problems.

### Other Sources

Sodium Sulfate in Ceramic Bulletin, annual commodity review.

Sodium Sulfate Deposits, Industrial Minerals and Rocks, Society of Mining Engineers, 6th ed., 1994.

Sodium Sulfate in Mining Engineering, annual commodity review.

TABLE 1  
SALIENT SODIUM SULFATE STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1990	1991	1992	1993	1994
United States:					
Production, natural	349	354	337	327 r/	298
Production, synthetic	364	366	216 r/	210 r/	165
Synthetic and natural:					
Low purity (99% or less)	345	367	345 r/	320	W
High purity	368	353	207 r/	217	W
Total 2/	713	720	552 r/	537 r/	463
Value 3/	\$64,200	\$62,900	\$50,800 r/	\$41,100 r/	\$37,600
Per ton	\$90.10	\$87.34	\$91.79	\$76.53	\$81.25
Exports	62	103	155	89	65
Value	\$6,700	\$11,500	\$11,900	\$8,540	\$7,020
Imports for consumption	162	157	158	163	190
Value	\$13,200	\$13,800	\$13,400	\$13,600	\$15,700
Stocks, Dec. 31: Producers	39	35	47	42	34
Apparent consumption	798	778	544 r/	616 r/	596
World: Production	5,040 r/	4,720 r/	4,100 r/	4,000 r/	3,860 e/

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Previously published and 1994 data are rounded by the U. S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Includes natural and synthetic. Total production data for synthetic sodium sulfate, obtained from the Bureau of the Census, were revised in Feb. 1995 MQ28A Inorganic Chemicals, Current Industrial Report.

3/ The value for synthetic sodium sulfate is based upon the average value for natural sodium sulfate.

TABLE 2  
U.S. PRODUCERS OF NATURAL AND SYNTHETIC SODIUM SULFATE IN 1994

Product and company	Plant nameplate capacity (Thousand metric tons)	Plant location	Source
Sodium sulfate, natural:			
North American Chemical Co., Westend plant	218	Trona, CA	Dry lake brine.
Ozark-Mahoning Co. 1/	141	Seagraves, TX	Do.
Total	359		
Sodium sulfate, synthetic:			
Courtaulds North American Inc.	45	La Moyne, AL	Rayon manufacture.
Flour Corp., Doe Run Co.	9	Boss, MO	Battery recycling.
4M Paper Corp.	6	Ft. Madison, IA	Pulping process.
FMC Corp.	41	Bessemer City, NC	Lithium carbonate.
W. R. Grace & Co. Organic Chemicals Div.	8	Nashua, NH	Chelating agents.
Hoffman- La Roche Inc.	14	Belvidere, NJ	Ascorbic acid.
J. M. Huber	32	Etowah, TN	Silica pigment.
Do.	14	Havre de Grace, MD	Do.
Indspec Chemical Corp.	35	Petrolia, PA	Resorcinol manufacture.
Lenzing A.G.	34	Lowland, TN	Rayon manufacture.
North American Rayon Corp.	14	Elizabethton, TN	Do.
Occidental Chemical Corp.	109	Castle Hayne, NC	Sodium dichromate manufacture.
Pineville Kraft	3	Deer Park, TX	Pulping process.
Public Service of New Mexico	6	Waterflow, NM	Fluegas desulfurization.
Star Enterprise 2/	3	Delaware City, DE	Do.
Teepak, Inc.	6	Danville, IL	Cellulose manufacture.
Total	169		
Grand total	528		

1/ Ozark's Brownfield plant, owned by Atochem North America (formerly Pennwalt), was placed on standby in Sept. 1987; 64,000 tons of capacity is not included in total industry capacity.

2/ Owned by Saudi Refining Inc. (50%) and Texaco Inc. (50%).

TABLE 3  
SODIUM SULFATE YEAREND PRICES

		1993	1994
Sodium sulfate (100% Na <sub>2</sub> SO <sub>4</sub> ):			
East, bulk, carlot, works, freight equalized	per ton	\$113.00 - \$114.00	\$113.00 - \$114.00
Gulf, bulk, carlot, same basis	do.	110.00	110.00
West, bulk, carlot, same basis	do.	127.00	127.00
Salt cake (100% Na <sub>2</sub> SO <sub>4</sub> ):			
East, bulk, f.o.b. works	do.	72.00	72.00

Sources: Chemical Marketing Reporter. Current Prices of Chemicals and Related Materials. V. 245, No. 1, Jan. 3, 1994, p. 31, and V. 247, No. 1, Dec. 30, 1994, p. 32.

TABLE 4  
U.S. EXPORTS OF SODIUM SULFATE, BY COUNTRY 1/

Country	Disodium sulfate, salt cake		Disodium sulfate, other		Total	
	Quantity (Metric tons)	Value 2/	Quantity (Metric tons)	Value 2/	Quantity (Metric tons)	Value 2/
1993:						
Argentina	9,570	\$957,000	1	\$5,280	9,570	\$962,000
Australia	17,900	1,790,000	2,550	564,000	20,500	2,350,000
Bermuda	--	--	16	5,430	16	5,430
Brazil	--	--	19	26,400	19	26,400
Canada	1,620	161,000	--	--	1,620	161,000
China	--	--	16	18,800	16	18,800
Colombia	22,900	1,120,000	445	155,000	23,400	1,270,000
El Salvador	--	--	968	115,000	968	115,000
Germany	--	--	18	50,400	18	50,400
Guatemala	--	--	4,000	460,000	4,000	460,000
Honduras	--	--	18	3550	18	3550
Hong Kong	--	--	1	3,900	1	3,900
Italy	798	86900	--	--	798	86900
Japan	--	--	172	83,200	172	83,200
Korea, Republic of	14,100	800,000	--	--	14,100	800,000
Mexico	472	57,600	2,650	802,000	3,120	859,000
Netherlands	--	--	1	3800	1	3800
New Zealand	6,660	618,000	--	--	6,660	618,000
Panama	--	--	44	180,000	44	180,000
Taiwan	--	--	115	53,800	115	53,800
Thailand	--	--	1	5,750	1	5,750
Venezuela	--	--	3,990	419,000	3,990	419,000
Total	74,000	5,590,000	15,000	2,950,000	89,000	8,540,000
1994:						
Australia	11,800	1,110,000	1	5,950	11,800	1,120,000
Belgium	4,610	410,000	--	--	4,610	410,000
Brazil	--	--	269	103,000	269	103,000
Canada	14,400	1,440,000	--	--	14,400	1,440,000
China	--	--	32	39,800	32	39,800
Colombia	7,510	300,000	--	--	7,510	300,000
Costa Rica	2,630	292,000	--	--	2,630	292,000
Dominican Republic	--	--	11	3,060	11	3,060
Ecuador	--	--	3	2,780	3	2,780
El Salvador	2,500	250,000	--	--	2,500	250,000
Guatemala	7,800	780,000	--	--	7,800	780,000
Honduras	--	--	20	5,100	20	5,100
Hong Kong	--	--	15	14,800	15	14,800
Japan	--	--	8	10,800	8	10,800
Korea, Republic of	7,030	415,000	(3/)	3,000	7,030	418,000
Mexico	750	85,200	5,190	1,700,000	5,940	1,780,000
Netherlands	--	--	3	12,700	3	12,700
Philippines	88	28,600	--	--	88	28,600
Spain	80	8,290	--	--	80	8,290
Total	59,200	5,120,000	5,550	1,900,000	64,800	7,020,000

1/ Previously published and 1994 data are rounded by the U. S. Bureau of Mines to three significant digits;

may not add to totals shown.

2/ F.a.s. value at U.S. ports.

3/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 5  
U.S. IMPORTS OF SODIUM SULFATE, BY COUNTRY 1/

Country	Disodium sulfate, salt cake 2/ 3/		Disodium sulfate, other		Total	
	Quantity (Metric tons)	Value 4/	Quantity (Metric tons)	Value 4/	Quantity (Metric tons)	Value 4/
1993:						
Canada	88,300	\$8,480,000	73,000	\$4,960,000	161,000	\$13,400,000
Germany	33	71,500	6	3,080	39	74,600
Japan	1,150	52,500	--	--	1,150	52,500
Mexico	51	38,300	--	--	51	38,300
United Kingdom	41	31,200	--	--	41	31,200
Total	89,500	8,670,000	73,000	4,960,000	163,000	13,600,000
1994:						
Canada	107,000	10,100,000	68,700	5,270,000	176,000	15,400,000
Germany	252	28,500	51	69,500	303	98,000
India	--	--	21	23,000	21	23,000
Japan	795	156,000	--	--	795	156,000
Mexico	10	2,940	12,300	90,800	12,300	93,800
Total	108,000	10,300,000	81,100	5,460,000	190,000	15,700,000

1/ Previously published and 1994 data are rounded by the U. S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Salt cake is HTS No. 2833.11.1000.

3/ Includes Glauber's salt, HTS No. 2833.11.5050.

4/ C.i.f. value at U.S. ports.

Source: Bureau of the Census.

TABLE 6  
SODIUM SULFATE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1990	1991	1992	1993	1994 e/
<b>Natural:</b>					
Argentina (mirabilite)	14,700 r/	16,100 r/	24,800 r/	6,550 r/	10,000
Canada 4/	345,000	332,000	282,000	320,000 r/	312,000 5/
Chile e/ 6/	13,500 5/	13,000	13,200	13,200	13,200
China e/ 7/	27,000	28,000	28,000	29,000	29,000
Egypt	41,400	41,100	41,000 e/	25,600 r/	25,000
Iran	177,000	144,000	237,000	280,000 r/	280,000
Mexico 8/ (bloedite)	545,000	518,000	534,000	500,000 e/	500,000
Netherlands e/	22,000	22,000	22,000	20,000	20,000
South Africa, Republic of	20 e/	--	37,200	36,400 r/	44,500 5/
Spain e/ 9/	716,000 5/	700,000	675,000	650,000	600,000
Turkey (concentrates)	110,000	115,000 e/	75,100	76,500 r/	80,000
Turkmenistan	XX	XX	100,000 e/	67,500 r/	50,000
U.S.S.R. e/ 10/	340,000	320,000	XX r/	XX r/	XX
United States	349,000	354,000	337,000	327,000	298,000 5/
Total	2,700,000	2,600,000	2,410,000 r/	2,350,000 r/	2,260,000
<b>Synthetic:</b>					
Austria e/	120,000	120,000	120,000	120,000	120,000
Belgium e/	250,000	260,000	250,000	250,000	250,000
Bosnia and Herzegovina e/	XX	XX	5,000	1,000	500
Brazil e/	9,000	9,000	9,000	9,000	9,000
Chile 11/	39,400 r/	33,800 r/	46,400 r/	45,000 r/ e/	46,000
Finland e/	33,000	33,000	30,000	30,000	30,000
France	120,000 e/	93,000	77,000	62,000 r/ e/	65,000
<b>Germany:</b>					
Eastern states	170,000 e/	XX	XX	XX	XX
Western states	167,000	XX	XX	XX	XX
Total	337,000 e/	146,000	114,000	107,000 r/	110,000
Greece e/	6,000	6,000	6,000	6,000	6,000
Hungary e/	8,000	6,000	6,000	6,000	6,000
Italy e/	125,000	125,000	125,000	125,000	125,000
Japan	253,000	250,000	243,000	229,000 r/	220,000
Macedonia e/	XX	XX	3,000	1,000	1,000
Netherlands e/	15,000	15,000	15,000	15,000	15,000
Pakistan e/	1,000	1,000	1,000	1,000	1,000
Portugal e/	50,000	50,000	50,000	50,000	50,000
Serbia and Montenegro	XX	XX	10,900 r/	10,000 r/ e/	8,000
Spain e/	150,000	150,000	150,000	150,000	150,000
Sweden e/	100,000	100,000	100,000	100,000	100,000
Turkey e/	27,000	30,000	30,000	30,000	30,000
U.S.S.R. e/ 10/	250,000	220,000	XX r/	XX r/	XX
United Kingdom e/	90,000	90,000	90,000	90,000	90,000
United States 12/	316,000	343,000	216,000 r/	210,000 r/	165,000 5/
Yugoslavia 13/	38,000	35,000 e/	XX	XX	XX
Total	2,340,000 r/	2,120,000 r/	1,700,000 r/	1,650,000 r/	1,600,000
Grand total	5,040,000 r/	4,720,000 r/	4,100,000 r/	4,000,000 r/	3,860,000

e/ Estimated. r/ Revised. XX Not applicable.

1/ Previously published and 1994 data have been rounded by the U.S. Bureau of Mines to three significant digits; data may not add to totals shown.

2/ Table includes data available through May 19, 1995.

3/ In addition to the countries listed, Norway, Poland, Romania, and Switzerland are known or are assumed to have produced synthetic sodium sulfate, and other unlisted countries may have produced this commodity, but production figures are not reported, and general information is inadequate for the formulation of reliable estimates of output levels.

4/ Excludes byproduct production from chemical plants.

5/ Reported figure.

6/ Natural mine output, excluding byproduct output from the nitrate industry, which is reported separately under "Synthetic" in this table.

7/ Byproduct sodium sulfate is known to be recovered but reliable data are not available; not included under "Synthetic."

8/ Series reflects output reported by Industrias Penoles plus an additional 22,000 tons estimated production by Sulfato de Viesca.

9/ Na<sub>2</sub>SO<sub>4</sub> content of glauberite and thenardite.

10/ Dissolved in Dec. 1991. Information is inadequate to formulate reliable estimates for individual countries other than Turkmenistan.

11/ Byproduct of nitrate industry.

12/ Derived approximate figures; data presented are the difference between reported total sodium sulfate production (natural and synthetic not differentiated) and reported natural sodium sulfate sold by producers (reported under "Natural" in this table).

13/ Dissolved in Apr. 1992.