SODIUM SULFATE

By Dennis S. Kostick

Sodium sulfate, also known as disodium sulfate (Na_2SO_4), is an inorganic chemical that has several important industrial uses. It is produced from naturally occurring sodium sulfate-bearing brines or crystalline evaporite deposits, and as a byproduct of a varity of chemical manufacturing processes, such as ascorbic acid, battery acid recycling, boric acid, cellulose, chromium chemicals, lithium carbonate, rayon, resorcinol, and silica pigments. The byproduct sodium sulfate is considered a waste product but has marketability; both types of sodium sulfate, however, have several important and useful applications in various consumer products.

Production

Domestic production and inventory data for natural sodium sulfate are developed by the U.S. Geological Survey (USGS) from monthly and annual surveys of U.S. operations. Of the two natural sodium sulfate operations to which a survey request was sent, both responded, 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 (aggregate data published in Current Industrial Reports, Inorganic Chemicals, MQ28A and MA28A) of companies engaged in recovering and selling byproduct sodium sulfate. Any revised Bureau of the Census data have been included using the most recent statistics. These data are aggregated with USGS natural sodium sulfate data and included in several tables.

Two companies produced natural sodium sulfate from a total of two plants in California and Texas. The domestic natural sodium sulfate industry supplied 56% of the total output of U.S. sodium sulfate. Because of the location of these plants, most natural sodium sulfate is marketed in the West and Southern Gulf areas. Based on final 1995 data from the Bureau of the Census, byproduct material was supplied by 14 establishments located primarily in the Midwest and Mid-Atlantic regions. The number of plants, by process, was natural, two; viscose rayon, three; sodium dichromate, one; and phenol, boric acid, formic acid, and other, eight. Total rated production capacity in 1996 was 762,000 tons, and the industry operated at 72% of this capacity.

Domestic natural sodium sulfate production decreased about 6% in 1996. Final 1996 statistics on synthetic sodium sulfate are unavailable because these data are usually subject to major revisions in updated reports issued by the Bureau of the Census. However, based on preliminary Bureau of the Census data for total sodium sulfate, 551,000 tons were produced in 1996, of which 327,000 tons were from natural sources and 245,000 tons were from byproduct sources. The quantity of byproduct material reported by the Bureau of the Census was less than expected, based on the strength of certain domestic and export sales and the opinions of industry analysts. Ending inventories of natural sodium sulfate were 19,000 tons.

Although GNB Technologies of Columbus, GA, came on-stream in 1995 with a battery acid recycling plant that recovers byproduct sodium sulfate, the operation had some technical difficulties in achieving its annual capacity of 27,000 tons (30,000 short tons). East Penn Manufacturing in Lyons Station, PA commissioned its new battery recycling facility in 1996. Its planned annual capacity was 4,000 tons of byproduct sodium sulfate (Chemical Marketing Reporter, 1996a). Occidental Chemical Corp.'s sodium dichromate plant in Castle Hayne, NC, contracted with Wheelabrator Water Technologies to develop technology in refining the chrome cake to detergent-grade sodium sulfate. Completion of the project was scheduled for mid-1997 (Chemical Marketing Reporter, 1996a).

Schuylkill Metals Corp., a battery recycling company that was scheduled to begin recovery of sodium sulfate in early 1997, retained Prior Chemical Corp. as its exclusive sales agent for its anhydrous sodium sulfate business at its Baton Rouge, LA facility (North American News, 1996).

DLD Resources acquired the hydrochloric acid facility at Hobbs, NM that was owned by Climax Chemical Co. Because of the growing demand for sodium sulfate, the plant was to be restarted to recover sodium sulfate that would be marketed to the regional oil well drilling industry. When in full operation in 1997, the plant is scheduled to have an annual capacity of 35,000 to 40,000 tons of byproduct sodium sulfate (Chemical Marketing Reporter, 1996b). Hellier & Moyle Resources, Inc., was formed to market the sodium sulfate from DLD (Chemical Marketing Reporter, 1996c).

Consumption

The estimated distribution of sodium sulfate by end use was soap and detergents, 42%; textiles, 15%; pulp and paper, 12%; glass 11%; and other, 20%. Miscellaneous uses included sodium sulfate for carpet fresheners and starch manufacture. Based on preliminary byproduct sodium sulfate production data, apparent consumption decreased 25% to 552,000 tons. However, industry analysts indicate that this amount was less than expected based on strong export and domestic sales.

The U.S. sodium sulfate industry continued to benefit from the strong demand for detergents and general supply shortages of sodium. The demand for less expensive consumer products

led detergent manufacturers to reformulate powdered home laundry products using more sodium sulfate as filler. The Mexican natural sodium sulfate producer, Quimica del Rey, continued to divert a majority of its supply normally dedicated for export to furnish the Mexican demand requirements. This allowed U.S. producers and others to fill the void in various world markets. Production of byproduct sodium sulfate in Japan also declined because of the downturn in Japanese rayon market.

An estimated 44% of the total sodium sulfate consumed in the United States is for use as a filler in powdered laundry detergents. Many areas in the country have adopted phosphate bans or limitations because it is believed that phosphatic detergents contribute to the environmental problems of eutrophication. The affected areas represent about 33% of the U.S. population. In response to this environmental issue, detergent manufacturers have reformulated many of their detergents by switching from sodium tripolyphosphate (STPP) to tetrasodium pyrophosphate, which has the same building power as STPP but requires less to be used, thereby reducing the amount of phosphate released into the environment. These reformulations used more sodium sulfate as filler, which was beneficial to the sodium sulfate industry.

Some domestic detergent manufacturers began adding additional quantities of sodium sulfate to powdered laundry products, reportedly to substitute for higher priced zeolites and surfactants.

The use of sodium sulfate in textiles apparently is increasing, according to industry sources. Salt traditionally has been used in the dyeing process to separate organic contaminants, promote "salting out" of dyestuff precipitates, and blending with dyes to standardize concentrated dyes. The equipment used in this process used stainless steel, which was susceptible to corrosion because of the salt. The textile industry began substituting sodium sulfate for the salt, which is not corrosive to the manufacturing equipment.

Stocks

Yearend 1996 inventories of natural sodium sulfate stored by the two producers were 19,000 tons, which was a 19% increase compared with 1995. The material stockpiled was anhydrous sodium sulfate. Synthetic sodium sulfate was marketed mainly through major chemical distributors, which have separate storage facilities from the producers.

Prices

Producers of natural sodium sulfate tend to market and sell most of their own product, but most synthetic producers use major chemical distributors or chemical supply companies as sales agents. The principal product made and sold by the synthetic sodium sulfate producer is the primary economic factor. Because sodium sulfate is considered a waste product, it will be sold at a price that ensures prompt sales. This practice tends to set the rates at which the natural product can be sold.

The list prices quoted in trade journals or by producers of all grades of sodium sulfate differ from the annual average values reported by the USGS. The value represents the combined amount of total revenue of domestic natural sodium sulfate sold at list prices, spot prices, long-term contracts, discounts, and export divided by the aggregated quantity of sodium sulfate sold. The published value does not necessarily correspond to the posted list price.

The average value increased from $84.55 per metric ton ($76.70 per short ton) in 1995 to $88.90 per metric ton ($80.64 per short ton) in 1996 for bulk sodium sulfate, f.o.b. mine or plant. Price increase announcements were made in late 1996 by Saskatchewan Minerals and Millar Western Industries, both of Canada, that raised the off-list price by $10 per ton. U.S. natural producers Elf Atochem North America Inc. and North American Chemical Co. followed the price initiative also by $10 per ton (Chemical Market Reporter, 1996d).

Foreign Trade

Sodium sulfate exports amounted to 86,000 tons, according to Bureau of the Census data. Of the 86,000 tons, crude sodium sulfate exports of 76,000 tons was exported to 14 nations. Canada received the largest share; about 34% of the total, followed by Colombia, 31%, and Brazil, 20%. Anhydrous sodium sulfate exports to 16 countries were nearly 10,000 tons. New Zealand imported the most; nearly 55% of the total.

Imports of sodium sulfate were 90,000 tons, or 37% less than the 143,000 tons imported in 1995. More than 29,000 tons of anhydrous sodium sulfate were imported in 1996, primarily from Canada and Mexico. Shipments from Canada represented nearly 97% of total imports of anhydrous sodium sulfate. Belgium, Germany, India, and Japan shipped the remainder. Imports of crude sodium sulfate were almost exclusively from Canada. The total value of all sodium sulfate imports was $96.76 per ton.

World Review

Approximately 67% of the world sodium sulfate production in 1996 was from natural sources; the balance was represented by synthetic sodium sulfate recovered from various chemical and manufacturing processes. Although the USGS collects or estimates data from 31 sodium sulfate-producing countries, other countries are known or assumed to have produced synthetic sodium sulfate, but production statistics are not reported, and available information is inadequate to make reliable estimates of output.

Although the United States is one of the largest producers in the world of natural and synthetic sodium sulfate, its share has decreased from 23% of world production total in 1980 to 11% in 1996.

Spain.—The Spanish sodium sulfate producer, Crimidesa, began constructing a third sodium sulfate facility in Burgos that will have an annual capacity of 150,000 tons. Completion of the project was scheduled for late 1997. The new operation will raise the company's total capacity to more than 500,000 tons.

Demand for sodium sulfate in Europe was a motivating factor for the justification of the new project (Industrial Minerals, 1996).

Outlook

Sodium sulfate consumption by the soap and detergent industry, which has been the largest consumer of sodium sulfate, will continue to remain strong because of the demand for powdered home laundry products. In areas with a depressed economy, powdered home laundry detergents are more in demand because they are less expensive than liquid concentrates or compact alternatives.

U.S. consumption, which had been declining for many years, appears to be growing because of supply and demand changes in North America and in other parts of the world where sodium sulfate trade was important. Domestic sodium sulfate production should remain adequate to meet consumption requirements.

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[1]Prior to January 1996, Published by the U.S. Bureau of Mines.

TABLE 1
SALIENT SODIUM SULFATE STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1992	1993	1994	1995	1996
United States:					
Production, natural	337	327	298	327	306
Production, synthetic	216	210	293 r/	318 r/	246
Synthetic and natural:					
High purity	345	320	W	W	W
Low purity (99% or less)	207	217	W	W	W
Total 2/	552	537	591 r/	645 r/	551
Value 3/	$50,800	$41,100	$48,000 r/	$54,500 r/	$49,000
Per ton	$91.79	$76.53	$81.25	$84.55	$88.90
Exports	155	89	65	66	86
Value	$11,900	$8,540	$7,020	$7,250	$9,140
Imports for consumption	158	163	190	143 r/	90
Value	$13,400	$13,600	$15,700	$11,800	$8,660
Stocks, Dec. 31: Producers	47	42	34	16	19
Apparent consumption	544	616	724 r/	740 r/	552
World: Production	4,630 r/	4,690 r/	4,840 r/	4,870 r/	4,870 e/

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

1/ Data are rounded 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 third quarter 1996 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 1996

Product and company	Plant nameplate capacity (thousand metric tons)	Plant location	Source
Sodium sulfate, natural:			
North American Chemical Co., Westend plant	204	Trona, CA	Dry lake brine.
Ozark-Mahoning Co.	141	Seagraves, TX	Do.
Total	345		
Sodium sulfate, synthetic:			
Courtaulds North American Inc.	45	La Moyne, AL	Rayon manufacture.
East Penn Manufacturing	4	Lyons Station, PA	Battery recycling.
Flour Corp., Doe Run Co.	14	Boss, MO	Do.
FMC Corp.	41	Bessemer City, NC	Lithium carbonate.
4M Paper Corp.	6	Ft. Madison, IA	Pulping process.
GMB Technologies	27	Columbus, GA	Battery recycling.
Hampshire Chemicals 1/	3	Deer Park, TX	Pulping process.
Do. 2/	8	Nashua, NH	Chelating agents.
Indspec Chemical Corp.	35	Petrolia, PA	Resorcinol manufacture.
J. M. Huber	33	Etowah, TN	Silica pigment.
Do.	18	Havre de Grace, MD	Do.
Lenzing A.G.	41	Lowland, TN	Rayon manufacture.
Occidental Chemical Corp.	109	Castle Hayne, NC	Sodium dichromate manufacture.
Roche Vitamins & Chemicals 3/	24	Belvidere, NJ	Ascorbic acid.
Teepak, Inc.	9	Danville, IL	Cellulose manufacture.
Total	417		
Grand total	762		

1/ Formerly Pineville Kraft.

2/ Formerly W.R. Grace & Co.

3/ Formerly Hoffman-La Roche, Inc.

TABLE 3
SODIUM SULFATE YEAREND PRICES

		1995	1996
Sodium sulfate (100% Na_2SO_4):			
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_2SO_4):			
East, bulk, f.o.b. works	do.	82.00	82.00

Sources: Chemical Marketing Reporter. Current Prices of Chemicals and Related Materials. V. 249, no. 1, Jan. 1, 1996, p. 32, and v. 251, no. 1, Jan. 6, 1997, p. 28.

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/
1995:						
Argentina	--	--	14	$205,000	14	$205,000
Australia	56	$5,730	58	511,000	114	517,000
Brazil	19,500	1,490,000	14	24,200	19,500	1,510,000
Canada	17,100	1,470,000	--	--	17,100	1,470,000
China	--	--	32	39,300	32	39,300
Colombia	11,600	690,000	--	--	11,600	690,000
Denmark	--	--	(3/)	3,180	(3/)	3,180
Germany	179	19,600	--	--	179	19,600
Ghana	--	--	(3/)	2,640	(3/)	2,640
Guatemala	4,960	521,000	--	--	4,960	521,000
Jamaica	168	20,300	--	--	168	20,300
Japan	184	19,000	--	--	184	19,000
Korea, Republic of	--	--	70	24,200	70	24,200
Mexico	439	51,200	4,700	1,080,000	5,130	1,140,000
New Zealand	2,000	177,000	2,020	476,000	4,020	653,000
Philippines	305	43,900	--	--	305	43,900
Taiwan	11	3,540	--	--	11	3,540
United Kingdom	--	--	2	15,600	2	15,600
Venezuela	3,060	353,000	(3/)	3,840	3,060	357,000
Total	59,500	4,860,000	6,910	2,390,000	66,400	7,250,000
1996:						
Argentina	--	--	2,300	800,000	2,300	800,000
Australia	--	--	34	508,000	34	508,000
Belgium	28	4,130	--	--	28	4,130
Brazil	15,100	1,400,000	65	663,000	15,200	2,070,000
Canada	26,100	2,120,000	--	--	26,100	2,120,000
China	16	3,500	15	19,800	31	23,300
Colombia	23,800	1,170,000	5	4,680	23,800	1,180,000
Costa Rica	60	14,400	--	--	60	14,400
Dominican Republic	--	--	19	6,300	19	6,300
Guatemala	8,530	1,050,000	--	--	8,530	1,050,000
Haiti	--	--	9	18,900	9	18,900
Israel	--	--	5	7,500	5	7,500
Italy	55	8,240	--	--	55	8,240
Jamaica	80	12,800	--	--	80	12,800
Malaysia	--	--	1	3,360	1	3,360
Mexico	1,870	280,000	778	282,000	2,640	563,000
Netherlands	56	8,290	--	--	56	8,290
New Zealand	--	--	5,370	508,000	5,370	508,000
Panama	--	--	3	4,840	3	4,840
Peru	--	--	1,190	173,000	1,190	173,000
Philippines	142	34,000	--	--	142	34,000
Saudi Arabia	--	--	3	2,520	3	2,520
Spain	--	--	5	12,600	5	12,600
St. Kitts and Nevis	22	2,880	--	--	22	2,880
Thailand	--	--	1	7,590	1	7,590
Venezuela	19	2,760	--	--	19	2,760
Total	75,900	6,120,000	9,810	3,020,000	85,700	9,140,000

1/ Data are rounded 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/
1995:						
Belgium	--	--	1	$1,360	1	$1,360
Canada	69,800	$6,580,000	71,700	4,960,000	141,000	11,500,000
Germany	--	--	37	33,000	37	33,000
India	--	--	58	70,200	58	70,200
Japan	130	16,800	20	24,900	150	41,700
Mexico	--	--	822	153,000	822	153,000
Total	69,900	6,600,000	72,600	5,240,000	143,000	11,800,000
1996:						
Belgium	--	--	300	84,000	300	84,000
Canada	60,000	5,670,000	28,400	2,470,000	88,500	8,150,000
Germany	1	1,480	56	25,200	57	26,600
India	--	--	229	254,000	229	254,000
Japan	--	--	7	8,000	7	8,000
Mexico	--	--	414	140,000	414	140,000
United Kingdom	32	3,150	--	--	32	3,150
Total	60,100	5,680,000	29,400	2,980,000	89,500	8,660,000

1/ Data are rounded 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/	1992	1993	1994	1995	1996 e/
Natural:					
Argentina (mirabilite)	24,796	6,554	7,978 r/	10,604 r/	10,000
Canada 4/	282,000	320,000	317,000	311,000 r/	315,000
Chile e/	13,200	13,200	13,200	13,200	13,000
China e/ 5/	550,000 r/	600,000 r/	600,000 r/	650,000 r/	650,000
Egypt e/	41,000	25,600 6/	25,000	25,000	25,000
Iran	237,459	280,000	280,000 e/	280,000 e/	280,000
Mexico 7/ (bloedite)	534,445	500,000 e/	527,228 r/	500,000 r/ e/	525,000
Netherlands e/	22,000	20,000	20,000	20,000	20,000
South Africa	37,169	36,380	44,544	43,971	41,800
Spain e/ 8/	675,000	650,000	600,000	600,000	650,000
Turkey (concentrates)	75,058	170,680 r/	307,049 r/	300,000 r/ e/	300,000
Turkmenistan e/	100,000	100,000 r/	100,000 r/	100,000 r/	100,000
United States	337,000	327,000	298,000	327,000	306,000 6/
Total	2,930,000 r/	3,050,000 r/	3,140,000 r/	3,180,000 r/	3,240,000
Synthetic: e/					
Austria	120,000	120,000	120,000	100,000	100,000
Belgium	250,000	250,000	250,000	250,000	250,000
Bosnia and Herzegovina	5,000	1,000	500	500	500
Brazil	9,000	9,000	9,000	9,000	9,000
Chile 9/	46,407 6/	46,000	46,400	47,000	46,000
Finland	30,000	30,000	30,000	30,000	30,000
France	77,000 6/	62,000	65,000	70,000	70,000
Germany	113,660 6/	106,789 6/	113,000 6/	110,000	120,000
Greece	6,000	6,000	6,000	6,000	6,000
Hungary	6,000	6,000	6,000	6,000	6,000
Italy	125,000	125,000	125,000	125,000	125,000
Japan	242,771 6/	229,346 6/	200,111 r/ 6/	206,893 r/ 6/	210,000
Macedonia	3,000	1,000	1,000	1,000	1,000
Netherlands	15,000	15,000	15,000	15,000	15,000
Pakistan	1,000	1,000	1,000	1,000	1,000
Portugal	50,000	50,000	50,000	50,000	50,000
Serbia and Montenegro	10,948 6/	3,668 6/	3,500	3,500	3,000
Spain	150,000	150,000	150,000	150,000	150,000
Sweden	100,000	100,000	100,000	100,000	100,000
Turkey	30,000	30,000	30,000	30,000	30,000
United Kingdom	90,000	90,000	90,000	60,000	70,000
United States 10/	216,000 6/	210,000 6/	293,000 r/ 6/	318,000 r/ 6/	246,000 6/
Total	1,700,000	1,640,000	1,700,000 r/	1,690,000 r/	1,640,000
Grand total	4,630,000 r/	4,690,000 r/	4,840,000 r/	4,870,000 r/	4,870,000

e/ Estimated. r/ Revised.

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Table includes data available through May 20, 1997.

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

4/ Excludes byproduct production from chemical plants.

5/ Both natural and synthetic.

6/ Reported figure.

7/ Series reflects output reported by Industries Penoles and an additional 22,000 tons estimated production by Sulfato de Viesca.

8/ N_2SO_4 content of glauberite and thenardite.

9/ Byproduct of nitrate industry.

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