

SODA ASH

By Dennis S. Kostick

Domestic survey data and tables were prepared by Jeff Milanovich, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Soda ash, also known as sodium carbonate (Na_2CO_3), is an alkali chemical refined from the mineral trona or naturally occurring sodium carbonate-bearing brines (both referred to as natural soda ash), the mineral nahcolite (referred to as natural sodium bicarbonate, from which soda ash can be produced), or manufactured from one of several chemical processes (referred to as synthetic soda ash).

Production

Soda ash production and inventory data were collected by the U.S. Geological Survey (USGS) from monthly, quarterly, and annual voluntary surveys of the U.S. soda ash industry. A survey request was sent to each of the six soda ash companies, all of which responded, representing 100% of the total production data in this report (table 1). The information and data are fundamental resources for analysis, both within and outside the government. The soda ash data and information are used by the public and private sectors to better understand minerals and materials usage and the ultimate disposition of

materials in the economy and in the environment and to develop public and private sector policies and practices that better utilize our mineral and material resources. Some of the organizations that use the soda ash data and information are financial institutions, State and Federal agencies, soda-ash-consuming industries (e.g., glass, chemicals, and detergents), educational institutions, and the general public.

U.S. production of natural soda ash from California, Colorado, and Wyoming in 2000 was 10.2 million metric tons (Mt), which was virtually the same as that of 1999. Based on about 14.5 Mt (16 million short tons) of total nameplate capacity, the U.S. soda ash industry operated at 70% of total capacity. This capacity utilization rate appears low because it includes the full nameplate capacity of 900,000 metric tons (t) (1 million short tons) for American Soda, L.L.P., which began late in the year with minimal output but was included in the industry total because nameplate capacity is based on the industry total as of December 31 of each year. Furthermore, the capacity utilization rate was low because OCI Chemical Corp. and FMC Wyoming Corp. had idled about 820,000 t (900,000

Soda Ash in the 20th Century

The 20th century has been called the greatest century of industrial progress in the history of civilization. In that time, the world soda ash industry had emerged as an important component of the family of chlor-alkali producers. During the past 100 years, the world soda ash industry expanded rapidly to provide a multitude of new products for millions of users. As the century closed and the new millennium began, the world soda ash industry was undergoing a restructuring as competition increased from new sources and traditional end-use markets changed. The first natural soda domestic soda ash production increased to about 370,000 tons, of which only about 25,000 tons was natural soda ash. In 1900, the majority of U.S. soda ash production was synthetic soda ash produced by four companies operating a total of five plants at Detroit and Wyandotte, MI; Syracuse, NY; Barberton, OH; and Saltville, VA. Natural soda ash was produced from alkaline lakes by five companies operating a total of five plants in Keeler, CA (Owens Lake); Ragtown, NV (Big Soda Lake and Little Soda Lake); Schurz, NV (Double Springs Marsh); and Laramie, WY (Union Pacific Lakes).

Around the beginning of the 20th century, the estimated distribution of soda ash by end use was glass, 25%; sodium bicarbonate and sal soda, 25%; paper manufacture, 20%; soap and chemicals, 20%; and miscellaneous, 10%. Soda ash exports during this period were negligible. As the U.S. population continued to grow after 1900 and the demand for

consumer products increased, soda ash production and consumption also increased.

By 2000, soda ash had already become a mature commodity with a growth rate that followed population growth and gross domestic product trends. The United States had become the world leader in production and trade. Soda ash production in 2000 was exclusively from natural sources; the last synthetic soda ash plant in the United States had closed in 1986. Ironically, this last plant was also the first one built in the country in 1884. The rising cost of energy, issues pertaining to pollution, and competition from natural soda ash were the factors that forced the closure of all the U.S. synthetic soda ash plants and many of the synthetic plants in the world leading up to 2000. The U.S. soda ash industry in 2000 consisted of six producers that mined sodium-carbonate-bearing deposits in California, Colorado, and Wyoming.

Glass was still the largest end use for soda ash in 2000, representing 50% of total domestic consumption. Soda ash was still used for soap and detergents and chemicals, as it was a century before; new uses such as flue gas desulfurization and water treatment also developed. The Belgian company Solvay S.A., which invented the Solvay synthetic soda ash production process and introduced it to the United States in 1884, competed with U.S. producers for most of the 20th century only to become a partner in the last decade and an important member of the U.S. soda ash industry in 2000.

short tons) and 590,000 t (650,000 short tons), respectively, of available capacity until market conditions improved.

At the beginning of 2000, the U.S. soda ash industry consisted of five companies: four in Wyoming operating five plants that produced soda ash from underground trona ore and one in California that produced soda ash from sodium-carbonate-rich brines. A sixth company came on-stream in October that produced soda ash and sodium bicarbonate from underground nahcolite in Colorado. Nahcolite is a mineral that is naturally-occurring sodium bicarbonate (its name is derived from the chemical elements contained in sodium bicarbonate: Na (sodium), H (hydrogen), C (carbon), O (oxygen), and "lite" (stone).

Increasingly, foreign synthetic soda ash producers and consumers had become involved in the U.S. natural soda ash industry. In 2000, foreign investment in U.S. soda ash operations was 36% of total nameplate capacity. The six U.S. companies have partners from Belgium, Japan, and the Republic of Korea (table 2).

In October 2000, the newest U.S. soda ash facility began solution mining at an underground nahcolite deposit in the Piceance Creek Basin of Rio Blanco County in northwest Colorado. The company, American Soda, L.L.P., was formed in 1996 as a joint-venture partnership with Williams Soda Products Co., which was a wholly-owned subsidiary of The Williams Companies, Inc. (60%), and American Alkali, Inc. (40%). The water-soluble nahcolite was associated with oil shale on Federal sodium mineral leases. Hot water was injected into wells drilled to a depth of approximately 670 meters (m). A vertical cavern about 150 m to 180 m long was developed and topped with a cap of nitrogen gas to prevent further dissolution and spalling of the cavern roof. A sodium-bicarbonate-bearing solution was recovered and processed to remove the carbon dioxide gas, and the remaining sodium-carbonate-rich solution was pipelined 71 kilometers to the soda ash refinery at Parachute. On November 3, the first soda ash was produced at the plant. Although a small quantity of product was made for test purposes during the remainder of the year, the first commercial deliveries were not scheduled until January 2001. During its first year of production, the plant was scheduled to operate at a rate of about 545,000 metric tons per year (t/yr), but when fully operable, the facility will have a nameplate capacity of 900,000 t/yr of soda ash and about 135,000 t/yr of sodium bicarbonate.

Consumption

The USGS collects reported consumption data by end use on a quarterly basis from the marketing and sales departments of each company. Every effort has been made to categorize company sales within the correct end-use sector. Quarterly reports are often revised in subsequent quarters because of customer reclassifications or other factors. Because all U.S. soda ash companies responded to the quarterly survey, the data represented 100% of the total reported consumption data found in this report.

In 2000, U.S. apparent consumption of soda ash was 6.43 Mt; reported consumption, however, was 6.39 Mt (table 3). Reported consumption and apparent consumption data do not

necessarily correspond because reported consumption data were based on actual sales, whereas apparent consumption data were the calculated quantity available for domestic consumption based on balancing supply (production, imports, and inventory adjustments) with external demand (exports).

In 2000, U.S. apparent consumption and reported consumption varied by 40,000 t, which was slightly less than 1% of apparent consumption. The discrepancy between the two forms of consumption was attributed to disagreement between the sources of export data used to derive consumption statistics. The two sources were the U.S. Census Bureau, which reports exports upon departure from U.S. ports, and the soda ash producers, which consider a shipment as exported when their export association, the American Natural Soda Ash Corp. (ANSAC), takes consignment of the product at the California, Colorado, or Wyoming plant sites. Transit times between the plant and port, which can take about 2 to 3 weeks before the cargo is actually exported, and carryover export inventories contribute to the discrepancy between reported and apparent consumption as well.

The distribution of soda ash by end use in 2000 was glass, 50%; chemicals, 27%; soap and detergents, 11%; distributors, 6%; flue gas desulfurization and pulp and paper, 2% each; and water treatment and other, 1% each.

Glass.—Glass manufacture represented about 50% of domestic soda ash consumption: the container sector accounted for 48%; flat, 36%; and specialty and fiber, 8% each. There were 57 glass container manufacturing plants in 24 States that produced a variety of different colored glass containers for various products. About 58% of the container market was clear (flint) glass; 35% was brown (amber) glass; 6% was green, and 1% was miscellaneous colors. The containers are made for beverages (beer, carbonated, and noncarbonated drinks), chemical and household products, food, liquor, medical products, and toiletries and cosmetics.

According to U.S. Census Bureau data, production of glass containers decreased by 3% to 8.56 Mt in 2000 from 8.85 Mt in 1999 primarily because of the beverage sector whose use of glass continued to decline because more soft drinks were packaged in plastic containers than in glass bottles. Production of glass containers for the beer industry increased by 1.9% to 4.04 Mt from 3.97 Mt in 1999. From 1980 to 2000, the output of glass beer containers varied between a low of 2.6 million metric tons per year (Mt/yr) to a high of 4.0 Mt/yr; however, the beer container sector composed 30% of the total quantity of glass containers manufactured in 1980, whereas it accounted for 52% of the sector in 2000. This increase is attributed to the decline in such other sectors as glass food containers [narrow neck (30%), and wide mouth (26%)] during that time period, with glass food container production decreasing to 2.0 Mt in 2000 from 3.6 Mt in 1980. Production of beverage containers also declined; however, a large amount of data had been withheld since 1996, which made it difficult to accurately determine how much of a decrease there has been since 1980, when beverage containers accounted for 19% of all glass containers.

Although the domestic glass recycling rate was not published for 1999 or 2000, it is assumed the recycling rate remained the same as that of 1998, which was 35%. Of that, 24% was

estimated to be post-consumer cullet and the remainder being in-house scrap. Some municipalities had started terminating their glass-collection programs because the price of clean, sorted cullet had declined, thereby making it less attractive to recyclers. Another reason was that breakage during collection had affected the quality of material sold to glass container manufacturers.

In March 2000, Miller Brewing Co. and Continental PET Technologies announced they developed a new plastic bottle for beer for widespread distribution. The bottle had been test-marketed since October 1998 in six major cities, and consumer acceptance was favorable. The benefits of the new container were that it kept the beer colder than aluminum cans and as long as glass bottles, was one-seventh the weight of comparable glass containers, was unbreakable, and was recyclable with other polyethylene terephthalate (PET) containers. The PET beer bottle was accepted in areas where glass bottles were not allowed or were as convenient, such as stadiums, pools, concerts, and beaches (Miller Brewing Co., 2000).

In July, a new PET resin was introduced for beer and other hot-fill applications by KoSa. KoSa was formed in December 1998 when Koch Industries, Inc. (through its subsidiaries Koch International Equity Investments B.V. and Koch Equity Investments, Inc.), and IMASAB S.A. de C.V. purchased the polyester business of Hoechst Aktiengesellschaft. The new plastic beer container provides a lightweight, thermally stable bottle that allows the beer to be pasteurized in the bottle, which up to this time could only be done with glass bottles. The PET bottle also can be used for carbonated soft drinks, water, juice, food, and custom container applications (KoSa, 2000).

Chemicals.—Soda ash is used to manufacture many sodium-base inorganic chemicals, including sodium bicarbonate, sodium chromates, sodium phosphates, and sodium silicates.

According to data from the U.S. Census Bureau, production of sodium bicarbonate decreased by 4% to 486,000 t in 2000 from 505,000 t in 1999 (U.S. Census Bureau, 2000).

In addition to American Soda, which began producing soda ash and sodium bicarbonate from Colorado nahcolite, AmerAlia, Inc., received approval of its environmental assessment from the Bureau of Land Management to proceed with the planned construction of a 68,000 t/yr (75,000-short-ton-per-year) sodium bicarbonate plant in Colorado. AmerAlia's partner, U.S. Filter, Inc., drilled three of the five groundwater monitoring wells around the mine site that will detect any excursion of sodium-bicarbonate-bearing solutions from the solution mined caverns. U.S. Filter was financing 80% of the \$40 million project with AmerAlia securing the remaining 20% financing. Startup was scheduled for sometime in 2001 (Industrial Minerals, 2000a).

Soaps and Detergents.—Detergents were the third largest use of soda ash. Soda ash was used as a builder to emulsify oil stains, to reduce the redeposition of dirt during washing and rinsing, to provide alkalinity for cleaning, and to soften laundry water. In addition, soda ash was a component of sodium tripolyphosphate (STPP), another major builder in detergent formulations. Soda ash consumption has been decreasing because phosphatic detergents can contribute to eutrophication, which is an environmental concern. Many regions of the Nation adopted phosphate limitations or bans, affecting about 40% of

the U.S. population. A strong U.S. economy boosted demand for industrial and institutional cleaners and automatic dishwashing detergents in the past couple of years. New technology incorporating enzymes in dishwashing detergents and a move toward liquid cleansers, however, may adversely affect STPP consumption in the future.

In response to the environmental concern that cardboard detergent packaging contributes to the volume of landfill waste, detergent manufacturers changed formulations to make compact and superconcentrated products. These reformulations required sodium silicates and synthetic zeolites, which are made from soda ash. Liquid detergents, which do not contain any soda ash, competed with powdered detergents and commanded about 50% of the household laundry detergent market in 2000 compared with 15% in 1978.

Stocks

Yearend 2000 stocks of dense soda ash in domestic plant silos, warehouses, terminals, and on teamtracks amounted to 245,000 t. Producers indicated that a potential supply problem could exist if inventories fell below 180,000 t. Most consumers of soda ash did not have the storage facilities to accommodate large quantities of soda ash and had to rely on suppliers to provide the material on a timely basis.

Prices

In the domestic market, large-volume buyers of soda ash were primarily the major glass container manufacturers whose purchases were seasonal (more beverage containers made in the second and third quarters for summertime beverage consumption). Soda ash sales to the flat glass sector were usually dependent on the state of the economy because the largest use of flat glass was in automobile manufacture and in residential housing and commercial building construction. These two major industrial sectors were especially sensitive to changing economic conditions, and soda ash sales follow trends in the two sectors.

The average annual value for bulk, dense natural soda ash, free-on-board (f.o.b.) Green River, WY, and Searles Valley, CA, was \$73.00 per metric ton (\$66.23 per short ton), which was a 4% decrease compared with that of 1999. No value data were collected from the Colorado producer because the majority of its yearend output was for test purposes and not for commercial customers. The value is not a price but rather the value of the combined revenue of California and Wyoming bulk, dense soda ash sold on an f.o.b. plant basis at list, spot, or discount prices, on long-term contracts, and for export, divided by the quantity of soda ash sold. The list prices quoted in trade journals or by producers differed from the annual average values reported to and by the USGS. This value may or may not correspond to the posted list prices. The list price for Wyoming bulk, dense soda ash has not changed since it was raised effective July 1, 1995, or as contracts permit, to \$105 per short ton from \$98 per ton. The California price for the comparable product also increased by \$7 per short ton, to \$130 per ton from \$123 per ton (table 4).

FMC announced a soda ash price increase of \$5 per short ton

on August 31, effective October 1 or as contracts permit. The company stated that the increase was necessary in order to bring prices to reinvestment levels and to offset rising energy costs. Despite an oversupply of soda ash in the market, FMC forecasted export sales would increase and certain caustic soda customers would switch to soda ash so long as caustic soda prices were high (Chemical Week, 2000a). One week later, OCI Chemical and Solvay Minerals Inc. followed FMC and announced a \$5 per short ton price increase (Chemical Week, 2000c). General Chemical Corp. was the next to follow, on September 27, with its \$5 price increase (Chemical Week, 2000d); IMC Chemical Co. announced in early October that it would raise its soda ash prices by \$5 effective immediately or as contracts permit (Chemical Week, 2000b). The industry indicated that the price increase attempt was in response to an improving supply-demand balance for soda ash during the fourth quarter of 1999. General Chemical issued another \$5 per short ton price increase effective December 1 that was followed by FMC, which also raised its price by another \$5 per short ton on all grades of soda ash including bulk, bagged, and all material sold through distribution centers, warehouses, and transloaders (Chemical Market Reporter, 2000b). Although there was some success in raising prices in the spot market, the full effect of the increase attempt would not be noticeable until 2001, because 90% of domestic sales were on annual contracts renewable each January.

Foreign Trade

Exports of 3.90 Mt represent about 38% of U.S. soda ash production. The problems in the Asian economies that began in late 1997 continued through 1999 and into 2000. An upturn in the economies in most of the nations, however, was evident by mid-2000, and U.S. soda ash exports began to increase. In 2000, Asia received 44% of the U.S. soda ash exported, accounting for 17% of total domestic output, compared with 38% of total U.S. soda ash exported in 1999 representing 14% of domestic production. The economic problems lasted longer than most market analysts had forecasted, resulting in delays in several domestic soda ash capacity expansions. In 2000, China increased its soda ash production by 9% compared with that of 1999, to 8.34 Mt from 7.65 Mt. Increases in Chinese soda ash production, industry rationalization, and improving economic conditions in Asia may affect the U.S. soda ash export market (Chemical Market Reporter, 2000c).

The U.S. soda ash industry exported the majority of its soda ash through its export association, ANSAC. Because of rising energy and transportation costs, ANSAC raised its selling price by \$10 per metric ton, effective November 1 (Chemical Market Reporter, 2000a).

After 2 years of declining export sales, U.S. soda ash exports in 2000 were 3.90 Mt, which was 8% greater than that of 1999. In 2000, U.S. exports to 47 countries, on a regional basis, were as follows: Asia, 44%; North America and South America, 21% each; Europe and the Middle East, 4% each; Africa and Oceania, 2% each; and Central America, 1% (table 6). Shipments to the Caribbean were negligible. The average free-alongside-ship value was \$122.52 per ton in 2000 compared with \$123.48 per ton in 1999. Although the data in tables 1 and

6 are rounded to three significant digits, the unit values shown are based on the actual unrounded statistics and not the rounded data. The top 10 countries, representing 72% of total U.S. soda ash exports, in decreasing order and percent of total, were: Mexico, 16%; the Republic of Korea, 10%; Japan, 9%; Brazil, 7%; Indonesia, 6%; Taiwan, 5%; Venezuela, 5%; Chile, 4%; and Thailand, 4%. About 57% of all U.S. soda ash exports went through the Columbia-Snake River customs district; the Laredo, TX, customs district was the second largest, with 15% of the total (table 5).

Imports of soda ash decreased by 18% to 75,000 t. The majority (99%) came from Canada, where General Chemical operated a synthetic soda ash plant in Amherstburg, Ontario. The remainder was imported from Bulgaria, Hong Kong, Italy, Japan, Mexico, Turkey, and the United Kingdom. The average customs-insurance-freight value of imported soda ash was \$114.32 per ton.

World Review

The largest consumers of soda ash were, for the most part, developed nations; these countries, however, also usually have lower growth rates compared with developing countries, which usually have greater demands for consumer products. Although the production and consumption quantities varied among the countries, the end-use patterns were basically the same; glass, chemicals, and detergents were the major sectors (table 8).

Nine countries had the capacity to produce more than 1 Mt/yr. They are, in descending order, the United States, China, Russia, India, Germany, France, Italy, Poland, and the United Kingdom. Bulgaria, Romania, and Ukraine had production installations that were rated at about 1 Mt/yr; adverse economic conditions, however, had caused these nations to produce below their design capacities. Recent acquisitions or joint ventures with major European soda ash producers that have soda ash manufacturing expertise should reverse this situation in the next few years. Most of these soda-ash-producing countries have large populations that require consumer products made with soda ash. The less developed nations tend to have higher soda ash demands and higher growth rates as soda-ash-consuming industries are developed. In 2000, world soda ash production was estimated to be 34.2 Mt, which was a 3% increase compared with that of 1999.

Canada.—Overcapacity, high energy costs, and low profitability were cited as reasons why General Chemical announced it would close its synthetic soda ash plant in Amherstburg, Ontario, in April 2001 and would reopen the plant when market conditions improved. The plant, which was built in 1919, had a nameplate capacity of 500,000 t/yr (Chemical and Engineering News, 2000).

Germany.—IMC Chemicals closed its synthetic soda ash plant in Duisburg in January 2000. The plant was formerly owned by Matthes & Weber GmbH and had a capacity of 280,000 t/yr, which was about 5% of the European soda ash industry capacity (Industrial Minerals, 2000d).

India.—ANSAC filed a petition with the U.S. Trade Representative to suspend the Generalized System of Preferences for India until there was progress toward fair and equitable access to Indian soda ash markets. The import tariff

on soda ash was 38.5%, which was the highest in the world, and other import fees brought the total to 69.9%. Reports indicated that the tariffs would have to be reduced to 12% before U.S. soda ash could be competitive, bringing the net effective import fee to 38.92%, which would include the 12% tariff, a 10% surcharge, an 18% countervailing duty tax, and special import fees (North American Mineral News, 2000).

Japan.—Asahi Glass Co., Ltd., announced it planned to permanently close its synthetic soda ash plant in Kitakyushu by the end of the first quarter of 2001. The decision to close the plant was based on the large capital expenditure required to modernize the facility and the company's investment in the U.S. soda ash industry. Through its subsidiary AG Soda Corp., Asahi has a 20% partnership with Solvay Minerals in its Wyoming operation (Industrial Minerals, 2000b).

Pakistan.—ICI Pakistan, Ltd., which was owned by ICI plc (76%) and private investors (24%), announced a \$10 million expansion at its synthetic soda ash plant in Khewara, northern Punjab. The expansion would increase the facility's capacity from 190,000 t/yr to 225,000 t/yr. The operation supplied about 80% of the domestic soda ash requirements of the country's detergent, glass, and paper industries (Industrial Minerals, 2000c).

Outlook

As the 20th century drew to a close, the number of producers in the world soda ash industry became smaller because of the closures of many synthetic soda ash plants in Europe, South America, and Asia during the 1990s. At the beginning of the new millennium, three dominant groups have survived to become the world leaders in soda ash—Solvay S.A. of Belgium, ANSAC of the United States (which represents all six domestic producers), and the Chinese soda ash industry. In years to come, these three soda ash suppliers will produce and export soda ash to many customers all over the world. Because the glass container sector is the largest soda-ash-consuming sector, the demand for soda ash for glass containers may decline as consumers slowly accept their food and beverages packaged in the newer PET containers.

The outlook for soda ash for the next 5 years is favorable. Domestic soda ash is expected to grow between 0.5% and 1.0% per year, and world demand is forecast to range from 2.0% to 2.5% per year for the next several years. Asia and South America remain the likeliest areas for increased soda ash consumption in the near future.

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TABLE 1
SALIENT SODA ASH STATISTICS 1/

(Thousand metric tons and thousand dollars, except value per ton)

	1996	1997	1998	1999	2000
<u>United States:</u>					
Production 2/	10,200	10,700	10,100	10,200	10,200
Value 2/	\$926,000	\$915,000	\$842,000	\$779,000	\$748,000
<u>Value, average annual:</u>					
Per short ton	\$82.60	\$77.25	\$75.30	\$69.11	\$66.23
Per metric ton	\$91.05	\$85.15	\$83.00	\$76.00	\$73.00
Production, Wyoming trona	16,300	17,100	16,500	15,900	15,700
Exports	3,840	4,190	3,660	3,620	3,900
Value	\$508,000	\$547,000	\$478,000	\$447,000	\$477,000
Imports for consumption	107	101	83	92	75
Value	\$14,700	\$13,400	\$10,800	\$11,100	\$8,570
Stocks, December 31, producers'	271	259	273	248	245
<u>Consumption:</u>					
Apparent	6,480 r/	6,670	6,560	6,740	6,430
Reported	6,390	6,480	6,550	6,430	6,390
World, production	31,800	33,100	32,400 r/	33,200 r/	34,200 e/

e/ Estimated. r/ Revised.

1/ Data are rounded to no more than three significant digits, except value per ton.

2/ Natural only; soda liquors and purge liquors are withheld to avoid disclosing company proprietary data.

TABLE 2
U.S. PRODUCERS OF SODA ASH IN 2000

(Million short tons, unless otherwise noted)

Company	Plant nameplate capacity	Plant location	Source of sodium carbonate
American Soda, L.L.P. 1/	1.00	Parachute, CO	Underground nahcolite.
FMC Wyoming Corp. - Green River 2/	3.55	Green River, WY	Underground trona.
FMC Wyoming Corp. - Granger 3/	1.30	Granger, WY	Do.
General Chemical (Soda Ash) Partners 4/	2.80	Green River, WY	Do.
IMC Chemical Co. 5/	1.45	Trona, CA	Dry lake brine.
OCI Chemical Corp. 6/	3.10	Green River, WY	Underground trona.
Solvay Minerals Inc. 7/	2.80	do.	Do.
Total	16.00		
Total	million metric tons	14.50	

1/ Came on-stream October 2000. A joint venture with Williams Sodium Products Co., which is a subsidiary of The Williams Companies, Inc. (60%), and American Alkali, Inc. (40%).

2/ Formed joint venture (20%) in February 1996 with Sumitomo Corp. and Nippon Sheet Glass Co., Ltd., both of Japan.

3/ Tg Soda Ash Inc. was sold to FMC Wyoming Corp. in July 1999.

4/ A joint venture between General Chemical Corp. (51%), Owens-Illinois, Inc. [acquired Australian Consolidated Industries International (ACI) in 1998] (25%), and TOSOH Wyoming Inc. of Japan (24%), which purchased part of ACI's share in June 1992. An expansion was completed in 1998.

5/ IMC Global, Inc., acquired North American Chemical Co. in April 1998; operation renamed.

6/ Rhône-Poulenc Basic Chemicals Co. of France sold its 51% share to Oriental Chemical Industries Chemical Corp. of Korea on February 29, 1996; Anadarko Petroleum Corp. (acquired Union Pacific Resources Co. in 2000) owns 49%. An 800,000-metric-ton expansion, brought on-stream in November 1998, increased plant capacity to 3.1 million short tons; however, the company planned to take 900,000 metric tons out of service temporarily for equipment refurbishment.

7/ Solvay Soda Ash Joint Venture is owned by Solvay S.A. of Belgium (80%) and Asahi Glass Co. of Japan (20%), which became a partner in February 1990. Capacity increase of 272,000 metric tons (300,000 short tons) installed December 1995 and 454,000 metric tons (500,000 short tons) in October 2000.

TABLE 3
REPORTED CONSUMPTION OF SODA ASH IN THE UNITED STATES, BY END USE, BY QUARTERS 1/

(Metric tons)

SIC code	End use	1999	2000				Total
			First quarter	Second quarter	Third quarter	Fourth quarter	
32	Glass:						
3221	Container	1,620,000	381,000	401,000	378,000	368,000	1,530,000
3211	Flat	1,130,000	272,000	290,000	288,000	304,000	1,150,000
3296	Fiber	263,000	62,200	62,500	60,000	62,100	247,000
3229	Other	254,000	61,800	63,000	58,600	56,500	240,000
	Total	3,270,000	777,000	817,000	785,000	791,000	3,170,000
281	Chemicals	1,670,000	404,000	421,000	439,000	455,000	1,720,000
284	Soaps and detergents	729,000	171,000	180,000	190,000	175,000	715,000
26	Pulp and paper	121,000	30,800	29,000	25,400	28,500	114,000
2899	Water treatment 2/	104,000	21,200	21,800	26,400	20,400	89,800
	Fluegas desulfurization	130,000	29,400	27,700	30,600	32,900	121,000
	Distributors	329,000	92,000	98,700	95,600	85,400	372,000
	Other	75,300	20,100	18,500	19,800	32,700	91,100
	Total domestic consumption 3/	6,430,000	1,550,000	1,610,000	1,610,000	1,620,000	6,390,000
	Exports 4/	3,850,000	841,000	1,030,000	1,050,000	1,080,000	4,010,000
	Canada	242,000	49,100	49,600	44,200	59,500	202,000
	Total industry sales 5/	10,300,000	2,390,000	2,650,000	2,660,000	2,700,000	10,400,000
	Total sales from plants	10,100,000	2,290,000	2,640,000	2,600,000	2,690,000	10,200,000
	Total production	10,200,000	2,390,000	2,530,000	2,580,000	2,740,000	10,200,000

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes soda ash equivalent from soda liquors and purge liquors sold to powerplant for water treatment. Sales of mine water are excluded.

3/ Imports reported by the producer/importer have been distributed into appropriate end-use categories listed above.

4/ Includes Canada. As reported by producers; may not necessarily agree with that reported by the U.S. Census Bureau for the same periods.

5/ Represents soda ash from domestic origin (production and inventory changes) and imports and for exports. Includes soda ash sold by coproducers and distributed by purchasers into appropriate end-use categories.

TABLE 4
SODA ASH YEAREND PRICES

(Dollars per short ton)

	1999	2000
Sodium carbonate (soda ash):		
Dense, 58% Na ₂ O 100-pound, paper bags, carlot, works, f.o.b.	153.00	153.00
Bulk, carlot, same basis, tons	105.00	105.00
Light 58% 100-pound, paper bags, carlot, same basis	210.00	210.00
Bulk, carlot, same basis, tons	173.00	173.00

Sources: Chemical Marketing Reporter. Current Prices of Chemicals and Related Materials, v. 257, no. 1, January 3, 2000, p. 24; and v. 259, no. 1, January 1, 2001, p. 21.

TABLE 5
REGIONAL DISTRIBUTION OF U.S. SODA ASH EXPORTS, BY CUSTOMS DISTRICTS, IN 2000 1/

(Metric tons)

Customs districts	North America	Central America	South America	Caribbean	Europe	Middle East	Africa	Asia	Oceania	Total	Percentage of total
Atlantic:											
Baltimore, MD	--	--	--	--	313	--	--	5	--	318	(2/)
Miami, FL	--	--	40	302	--	--	284	--	--	626	(2/)
New York, NY	--	--	--	--	410	23	--	30	--	463	(2/)
Savannah, GA	--	--	--	--	--	--	--	364	--	364	(2/)
Gulf:											
Houston-Galveston, TX	--	--	806	354	20	--	35	--	--	1,220	(2/)
Port Arthur, TX	--	2,010	240,000	10,800	--	--	84,700	--	--	337,000	9
Pacific:											
Columbia-Snake River	--	35,800	265,000	--	163,000	138,000	--	1,530,000	72,000	2,210,000	57
Los Angeles, CA	--	--	--	--	--	--	--	746	--	746	(2/)
San Diego, CA	12,400	--	328,000	--	4,850	--	--	166,000	14,100	525,000	13
San Francisco, CA	--	--	--	--	19	--	--	--	--	19	(2/)
Seattle, WA	24,100	--	--	--	--	--	--	--	--	24,100	1
North-central:											
Chicago, IL	--	--	--	--	36	--	--	--	--	36	(2/)
Detroit, MI	136,000	--	--	--	326	--	--	--	--	136,000	3
Duluth, MN	767	--	--	--	--	--	--	--	--	767	(2/)
Great Falls, MT	16,500	--	--	--	--	--	--	--	--	16,500	(2/)
Pembina, ND	6,430	--	--	--	--	--	--	--	--	6,430	(2/)
Northeast:											
Buffalo, NY	16,800	--	--	--	--	--	--	--	--	16,800	(2/)
Ogdensburg, NY	1,220	--	--	--	--	--	--	--	--	1,220	(2/)
St. Albans, VT	91	--	--	--	--	--	--	--	--	91	(2/)
Southwest:											
El Paso, TX	1,260	--	--	--	--	--	--	--	--	1,260	(2/)
Laredo, TX	598,000	--	--	--	--	--	--	--	--	598,000	15
Unknown:	21,700	--	--	--	--	--	--	--	--	21,700	1
Total	835,000	37,800	834,000	11,400	169,000	138,000	85,000	1,700,000	86,100	3,900,000	100
Percentage of total	21	1	21	(2/)	4	4	2	44	2	100	XX

XX Not applicable. -- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Less than 1/2 unit.

Source: U.S. Census Bureau. Reviewed by the U.S. Geological Survey using trade data and information from the Journal of Commerce.

TABLE 6
U.S. EXPORTS OF SODA ASH, BY COUNTRY 1/

Country	1999			2000		
	Quantity (thousand metric tons)	Value 2/ (thousands)	Unit value	Quantity (thousand metric tons)	Value 2/ (thousands)	Unit value
Argentina	114	\$15,800	\$139.08	114	\$16,200	\$142.54
Australia	45	5,370	118.66	64	8,460	132.22
Belgium	118	14,500	123.36	60	7,290	121.55
Bolivia	2	426	173.48	2	271	135.50
Brazil	301	39,300	130.61	261	36,200	138.86
Canada	259	21,400	82.82	223	20,000	89.87
Chile	150	21,800	145.46	165	23,800	144.06
China	40	3,230	81.10	135	11,600	86.23
Colombia	73	10,300	140.50	82	12,600	153.20
Costa Rica	9	1,440	160.19	17	2,680	157.53
Ecuador	5	646	129.00	10	1,430	143.40
France	84	9,430	112.18	47	4,940	105.04
Germany	1	71	109.96	--	--	--
Guatemala	16	2,660	165.12	17	2,840	167.12
Indonesia	272	33,600	123.65	243	26,200	108.02
Italy	5	688	135.00	10	925	92.50
Jamaica	5	914	188.83	2	288	144.00
Japan	312	41,400	132.48	353	45,500	128.84
Korea, Republic of	227	30,600	134.52	390	48,200	123.69
Malaysia	95	13,400	141.29	117	15,500	132.66
Mexico	545	60,200	110.57	612	67,500	110.22
New Zealand	21	2,310	108.89	22	2,390	108.55
Nigeria	8	792	100.83	9	4,480	497.89
Pakistan	--	--	--	10	1,180	118.10
Panama	--	--	--	4	556	139.00
Peru	20	2,980	152.25	15	2,220	147.80
Philippines	64	8,320	129.50	74	8,740	118.12
Portugal	5	658	130.00	5	671	134.20
Saudi Arabia	92	8,950	97.29	117	10,800	92.44
Singapore	16	1,980	127.87	13	1,420	108.92
South Africa	84	10,600	127.08	76	9,960	131.00
Spain	100	10,300	103.13	40	4,160	104.03
Taiwan	157	20,200	128.26	186	23,600	126.95
Thailand	194	26,900	138.76	163	19,100	117.28
Trinidad and Tobago	11	1,930	170.42	9	1,400	156.00
United Arab Emirates	18	1,600	88.83	21	1,790	85.05
United Kingdom	8	1,100	144.82	6	856	142.67
Uruguay	1	116	146.60	--	--	--
Venezuela	138	20,000	145.03	185	29,700	160.56
Vietnam	9	783	87.00	15	1,460	97.13
Other 3/	1	113 r/	113.00 r/	1	256	256.00
Total	3,620	447,000	123.34	3,900	477,000	122.52

r/ Revised. -- Zero.

1/ Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

2/ F.a.s. value.

3/ Includes Aruba (2000), The Bahamas (1999), the Dominican Republic (2000), Finland (2000), Ghana (2000), Hong Kong (2000), Norway, Russia, Suriname (1999), Switzerland (2000), and Tonga (1999).

Source: U.S. Census Bureau. Reviewed by the U.S. Geological Survey using Journal of Commerce trade data and information.

TABLE 7
U.S. PRODUCTION OF SODIUM COMPOUNDS, BY MONTH 1/

(Thousand metric tons)

	1999		2000	
	Soda ash	Wyoming trona 2/	Soda ash	Wyoming trona 2/
January	835	1,490	809	1,380
February	749	1,230	740	1,330
March	877	1,480	841	1,390
April	833	1,320	839	1,290
May	886	1,450	810	1,220
June	859	1,370	881	1,230
July	911	1,140	871	1,110
August	803	1,180	875	1,400
September	824	1,280	835	1,350
October	888	1,290	966	1,490
November	899	1,290	897	1,310
December	884	1,350	880	1,220
Total	10,200	15,900	10,200	15,700

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Includes solution-mined trona.

TABLE 8
SODA ASH: ESTIMATED WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1996	1997	1998	1999	2000
Australia	300	300	300	300	300
Austria	200	150	150	150	150
Bosnia and Herzegovina	15	15	15	15	15
Botswana	119 3/	200 3/	196 3/	234 r/ 3/	225
Brazil	200	200	200	200	200
Bulgaria	800 3/	800	800	800	800
Canada	300	300	300	300	300
China	6,693 3/	7,258 3/	7,440 3/	7,654 3/	8,343 3/
Egypt	50 r/	50 r/	50	50	50
France	1,100	1,053 3/	1,000	1,000	1,000
Germany	1,400	1,400	1,400	1,400	1,400
India	1,500	1,500	1,500	1,500	1,500
Italy	1,100 3/	1,000	1,000	1,000	1,000
Japan	926 3/	801 3/	722 3/	722 r/ 3/	685
Kenya 4/	223	258 3/	243 3/	246 r/ 3/	246
Korea, Republic of	320	320	300	310 r/	310
Mexico	290	290	290	290	290
Netherlands	400	400	400	400	400
Pakistan	215 3/	220	220	230	230
Poland	909 3/	950 3/	1,000	926 r/ 3/	950
Portugal	150	150	150	150	150
Romania	537 3/	548 3/	550	550	550
Russia	1,449 r/ 3/	1,652 r/ 3/	1,538 r/ 3/	1,918 r/ 3/	2,199 3/
Spain	500	500	500	500	500
Taiwan	128	128	126 r/	140 r/	140
Turkey	400	500 3/	500	500	500
Ukraine	375	367 3/	390	460 3/	500
United Kingdom	1,000	1,000	1,000	1,000	1,000
United States 4/	10,200 3/	10,700 3/	10,100 3/	10,200 3/	10,200 3/
Total	31,800	33,100	32,400 r/	33,200 r/	34,200

r/ Revised.

1/ World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through April 19, 2001. Synthetic unless otherwise specified.

3/ Reported figure.

4/ Natural only.