SALT

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.

Salt, also known as sodium chloride, is composed of the elements sodium and chlorine. Sodium is a silver-colored metal, which is so unstable that it reacts violently in the presence of water, and chlorine is a greenish-colored gas that is dangerous and lethal. Yet the combination of these two elements forms sodium chloride, which is a white-colored compound essential to life itself. Virtually every person in the world has some direct or indirect contact with salt daily. People routinely add salt to their food as a flavor enhancer or apply rock salt to walkways to remove ice in the winter. Salt is used as feedstock for chlorine and caustic soda manufacture; these two inorganic chemicals are used to make many consumer-related end-use products, such as polyvinyl chloride (PVC), a plastic made from chlorine and paper-pulping chemicals manufactured from sodium hydroxide (caustic soda).

Production

U.S. production data for salt are developed by the U.S. Geological Survey (USGS) from an annual voluntary survey of U.S. salt-producing sites and company operations. The four types of salt that are surveyed are classified according to the method of recovery: rock salt, from the surface or underground mining of halite deposits; solar salt, from the solar evaporation of seawater, landlocked bodies of saline water, or primary or byproduct brines; vacuum pan salt, from the mechanical evaporation of a purified brine feedstock; and brine, from the solution mining of underground halite deposits. Data for brine production and consumption represent the anhydrous salt content only and not the weight of the water.

The structure of the U.S. salt industry has changed throughout the years. In 1970, 50 companies operated 95 salt-producing plants in the United States. Market competition, energy and labor costs, less expensive imports, currency exchange rates, and

an excess of production capacity (resulting in the downsizing of the industry through mergers and acquisitions) reduced the size of the industry to 32 companies and 69 plants by 2000. The information and data are fundamental resources for analysis both within and outside the Government. The salt data and information are needed by the public and private sectors to better understand minerals and materials use 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 clients that use the salt data and information are financial institutions, State and Federal agencies, salt-consuming industries (e.g., agricultural, chemical, and food processing), educational institutions, and the general public.

Of the 32 companies to which a survey request was sent, all but 3 responded, representing 95% of the total production shown in this report. Data for nonrespondents were estimated based on their prior responses to previous annual surveys, the 2000 production estimate survey, or brine production capabilities for chloralkali manufacture based upon published chlorine production capacities [1.75 metric tons (t) of salt required per ton of chlorine capacity].

Total U.S. salt production increased by 2% in 2000 to 45.6 million metric tons (Mt) compared with that of 1999. According to the USGS canvass for 2000, 32 companies operated 69 salt-producing plants in 15 States. Of these, 9 companies and 17 plants produced more than 1 Mt each and accounted for 90% and 69%, respectively, of total U.S. production and 90% and 33%, respectively, of total value. Several companies and plants produced more than one type of salt. In 2000, 11 companies (14 operations) produced solar-evaporated salt; 6 companies (18 operations), vacuum pan salt; 11 companies (16 operations), rock salt; and 13 companies (32 operations), salt brine (tables 1-3).

Salt in the 20th Century

In 1900, the United States led the world as the largest salt-producing country, representing about 23% of total world output, followed by the United Kingdom, France, the German Empire, and Italy. Imports of fine salt decreased to 6% of domestic consumption in 1900 from 37% in 1880, because U.S. salt manufacturers steadily increased their production of table, dairy, and other special grades of salt. The major uses of salt at that time were food applications for humans and animals, leather tanning, and fish and meat preservation; however, use of salt as a chemical feedstock was beginning to increase with the development of the first soda ash plant in Syracuse, NY, in 1884 and the first electrolytic chlorine facility in Rumford, ME, in 1892. Although the first domestic automobile was not invented until 1896, the use of salt for road deicing would not begin until the 1930s.

In 2000, the top five salt-producing nations that collectively accounted for 55% of total world output, in descending order of quantity produced, were the United States, China, Germany, India, and Australia. The United States was the largest salt-producing nation, representing about 22% of total world output. The five leading States, in terms of total salt sold or used, were Louisiana, Texas, New York, Kansas, and Utah. The chemical industry, primarily the chlorine and caustic soda sectors, was the largest consumer of salt. Salt for domestic synthetic soda ash manufacture declined and eventually ceased in the last quarter of the 20th century because of environmental and energy issues and competition from natural soda ash. Salt for human consumption, which had been a major end use in the past century, declined to about 3% of total domestic consumption.

SALT—2000 65.1

The five leading States in terms of total salt sold or used were Louisiana with 31%; Texas, 25%; New York, 13%; Kansas, 6%; and Utah, 5% (table 4). Other Eastern States (Alabama, Michigan, Ohio, Tennessee, and West Virginia) accounted for 17% of the domestic total salt sold or used. Other Western States (Arizona, California, Nevada, New Mexico, and Oklahoma) represented 3%.

Since the loss of the Retsof Mine in New York in 1995, progress continued on developing a new mine at Hampton Corners, NY. A group of investors formed American Rock Salt Co. LLC in 1997 and acquired the assets of the Retsof Mine, including a large salt stockpile, and mineral rights at Hampton Corners. On October 2, 1997, American Rock Salt shipped its first truckload of salt from the stockpile, while the company went forward with plans to sink a mineshaft to the underground salt formation. In late 1998, construction began on the mineshaft, and on November 18, 1999, salt was reached in the service shaft. On January 26, 2000, the first truckload of salt was delivered from the new mine. The mine was expected to reach its full capacity of 2.3 Mt by mid-2001 (American Rock Salt Co. LLC, 2001, Company biography and history, accessed May 22, 2001, via URL http://americanrocksalt.com).

In February, IMC Global Inc. announced it was interested in divesting its salt company IMC Salt Co. to refocus on its core crop-nutrient businesses. This divestment would include the rock salt operations in Louisiana and Canada, the vacuum pan salt plants in Kansas, and the solar salt facility in Utah (Chemical Market Reporter, 2000). In a cost-reduction effort, IMC closed its Hutchinson, KS, vacuum pan salt facility and increased vacuum pan salt production at its Lyons, KS, and Hersey, MI, plants (Bertram, 2000). Further capacity reductions in the domestic salt industry also occurred in late 1999 and into 2000, when Cargill Inc. closed its Redwood City, CA, solar salt plant, which had capacity of about 315,000 metric tons per year (t/yr).

Consumption

In 2000, apparent consumption (salt sold or used, plus imports, minus exports) was 51.6 Mt, whereas reported consumption (sales or use as reported by the salt companies including their imports and exports) was 54 Mt, which was an increase of 8% compared with that of 1999. Although these two measures of consumption are not necessarily supposed to be identical, they normally are similar. The 2.4-Mt difference between the two types of consumption for 2000 and 1999, however, can only be explained by stockpiling of imported salt by producers, distributors, and consumers during the year.

The direct and indirect uses of salt number about 14,000, according to industry sources. The USGS annually surveys 8 major categories comprising 29 end uses. The 2000 reported percentage distribution of salt by major end use was chemicals, 42%; ice control, 36%; distributors (grocery and other wholesalers and retailers, etc.), 7%; general industrial, 6%; agricultural, 4%; food processing, 3%; primary water treatment, 1%; and other uses combined with exports, 1%. Distributors represented a substantial share of salt sales by the salt industry; all of this salt is ultimately resold to many different end-users. For a more complete analysis of end-use markets, specific sectors of distribution in table 5 can be combined, such as agricultural and water treatment with agricultural and water conditioning distribution, respectively.

Aside from the different types of salt, there are various

distinctions in the packaging and applications of salt. Salt for human consumption is packaged in different sized containers for several specialized purposes. Table salt may contain 0.01% potassium iodide as an additive, which provides a source of iodine that is essential to the oxidation processes in the body. Kosher salt, sea salt, condiment salt, and salt tablets are special varieties of salt.

Water conditioning and animal feed salt are made into 22.7-kilogram (50-pound) pressed blocks. Sulfur, iodine, trace elements, and vitamins are occasionally added to salt blocks to provide missing nutrients not found naturally in the diet of certain livestock. Salt is also compressed into pellets and used for water conditioning.

Chemical.—The largest consumer of salt, primarily salt brine, is the chemical industry. Within this industry, the chloralkali sector remains the major consumer of salt for manufacturing chlorine, coproduct sodium hydroxide, and synthetic soda ash. Since 1986, when the last synthetic soda ash plant closed because of high production costs and competition with less expensive natural soda ash, no synthetic soda ash has been manufactured in the United States; many countries, however, still produce synthetic soda ash and use vast quantities of salt brine as feedstock.

Salt is used as the primary raw material in chlorine manufacture because it is an inexpensive and widely available source of chlorine ions. For sodium hydroxide production, salt is the main source of the sodium ions. About 98% of the domestic chlorine and sodium hydroxide produced is obtained from the electrolysis of salt brine feedstock by using three-cell technologies. The types of cells and the percentages of chlorine manufactured by them are diaphragm, 78%; mercury, 14%; and membrane, 6%. The remaining 2% of chlorine and caustic soda production is recovered as a byproduct from magnesium and sodium metal manufacture.

It takes about 1.75 t of salt to make 1.0 t of chlorine and 1.1 t of coproduct caustic soda. The electrolytic process ionizes the sodium chloride compound and selectively allows the ions to migrate through special membranes. Chlorine gas forms at the anode, while sodium ions bond with water molecules at the cathode to form sodium hydroxide with hydrogen gas evolving.

Chlorine and caustic soda are considered to be the first generation of products made from salt. These two chemicals are further used to manufacture other materials, which are considered to be the second generation of products from salt. Although most salt brine is produced by the same companies that use it, many chloralkali manufacturers now purchase brine from independent brine supply companies. In certain cases, brine is produced by a chemical company that uses some of it and sells the excess to neighboring competitors. According to a survey of domestic salt-based chlorine facilities, about 48% of the salt used to manufacture chlorine was produced by manufacturing companies, and 31% was purchased brine. Solar salt, rock salt, and vacuum pan salt are also used to manufacture many chemicals (tables 5, 6).

In 2000, according to U.S. Census Bureau data, 12 Mt of chlorine and 11 Mt of sodium hydroxide (caustic soda or lye) were produced. Based on the industry average ratio of 1.75 t of salt required to produce 1.0 t of chlorine and 1.1 t of coproduct sodium hydroxide, the chlorine and caustic soda industry consumed about 21 Mt of salt for feedstock. Reported consumption of total domestic and imported salt for chlorine manufacture was 21.3 Mt (table 5). The difference between the calculated and reported quantities was the amount of salt not

reported to the USGS from imports or captive brine production of chloralkali producers.

Salt also is used as a feedstock in chemical establishments that make sodium chlorate (by the electrolysis of an acidified salt brine using hydrochloric acid adjusted to a pH of 6.5), metallic sodium (by the electrolysis of a molten salt mixture containing 33.2% sodium chloride and 66.8% calcium chloride, which is added to reduce the melting temperature of salt), and other downstream chemical operations. In powdered soaps and detergents, salt is used as a bulking agent and a coagulant for colloidal dispersion after saponification. In pharmaceuticals, salt is a chemical reagent and is used as the electrolyte in saline solutions. It also is used with sulfuric acid to produce sodium sulfate and hydrochloric acid. This subsector is relatively small, representing only 5% of domestic salt sales for the entire chemical sector and only 2% of total domestic salt consumption.

The consumption of salt for metallic sodium has declined during the past several years. Since the 1970s, the number of producers has decreased from three to one; Ethyl Corp. and RMI Titanium Corp. exited the market in 1985 and 1992, respectively, leaving E. I. du Pont de Nemours & Co., Inc., as the sole manufacturer of metallic sodium in the United States. In 1998, the domestic market was less than 30,000 t having decreased from about 126,000 t in 1978. The phasing out of tetraethyl lead and tetramethyl lead gasoline additives were the main reasons for the decline in consumption. In 1978, sodium usage in gasoline represented about 80% of the domestic market. Although there is no information about sodium consumption in 2000, the largest use of sodium in 1998 was for sodium borohydride production, which is the feedstock for sodium dithionite that is used as a reductive bleaching agent by the pulp and paper industry and accounted for about 38% of metallic sodium consumption. Sodium metal also is used to manufacture sodium azide, which is used in automotive airbags. Other promising uses of sodium metal are in the remediation of chemical weapons, pesticides, polychlorinated biphenyls, and chlorofluorocarbons.

Ice Control and Road Stabilization.—The second largest end use of salt is for highway deicing. The developer of the Fahrenheit temperature scale discovered that salt mixed with ice at a temperature below the freezing point of water creates a solution (brine) with a lower freezing point than water by itself. The brine forms below the surface of the ice and snow and prevents the water from freezing into ice and bonding with the road surface, thus causing the snow and ice to melt. Salt is an inexpensive, widely available, and effective ice control agent. It does, however, become less effective as the temperature decreases below about -9.5° C to -6.5° C (15° F to 20° F). At lower temperatures, more salt would have to be applied to maintain higher brine concentrations to provide the same degree of melting. Most winter snowstorms and ice storms occur when temperatures are between -4° C and 0° C (25° F and 32° F), the range in which salt is most effective. An anticaking agent, such as ferric ferrocyanide (Prussian Blue) or sodium ferrocyanide (Yellow Prussiate of Soda), is used to prevent the salt from agglomerating. Both additives are nontoxic and harmless to humans. In fact, sodium ferrocyanide is approved for use in food-grade salt by the U.S. Food and Drug Administration (Food and Nutrition Board, 1966).

In highway deicing, salt has been associated with corrosion of motor vehicles, bridge decks, unprotected steel structures, and reinforcement bar and wire used in road construction. Surface runoff, vehicle spraying, and windblown actions also affect roadside vegetation, soil, and local surface- and ground-water supplies. Although evidence of environmental loading of salt has been found during peak usage, the spring rains and thaws usually dilute the concentrations of sodium in the area where salt was applied.

Salt is also added to stabilize the soil and to provide firmness to the foundation on which highways are built. The salt acts to minimize the effects of shifting caused in the subsurface by changes in humidity and traffic load.

The quantity of salt consumed for road deicing each year is directly related to the severity or mildness of the winter weather conditions. Long-range forecasting of salt consumption in this application is extremely difficult because of the complexities in long-range forecasting of the weather. Meteorologists, however, are becoming more aware of the dynamics of certain weather phenomena that influence the climate in various parts of the world. One of these phenomena is El Niño, which is now believed to be the largest single weather influence on Earth. The mild winters of 1997 and 1998 were attributed to El Niño effects. In 1998, highway deicing salt sales were the lowest since about 1992, which also was an El Niño year (National Broadcast Co., 1998, El Niño facts, accessed July 15, 1998, at URL http://wxnet4.nbcr.com/ elnino.html). The winters of 1999 and 2000 were colder and produced more precipitation that required more salt for road deicing as shown in the rock salt production statistics in tables 1 and 2 and the rock salt consumption data in tables 5 and 6.

Distributors.—A tremendous amount of salt is marketed through various distributors, some of which specialize in markets such as agricultural and water treatment services, two sectors where the salt companies sell directly as well (table 5). Distributor sales also include grocery wholesalers and/or retailers, institutional wholesalers, U.S. Government resale, and other wholesalers and retailers.

General Industrial.—The industrial uses of salt are diverse. They include, in descending order, oil and gas exploration, textiles and dyeing, other industrial applications, metal processing, pulp and paper, tanning and leather treatment, and rubber manufacture.

In oil and gas exploration, salt is an important component of drilling fluids in well drilling. It is used to flocculate and increase the density of the drilling fluid to overcome high down-well gas pressures. Whenever a drill hits a salt formation, salt is added to the drilling fluid to saturate the solution and to minimize the dissolution within the salt strata. Salt is also used to increase the set rate of concrete in cemented casings.

In textiles and dyeing, salt is used as a brine rinse to separate organic contaminants, to promote "salting out" of dyestuff precipitates, and to blend with concentrated dyes to standardize them. One of its main roles is to provide the positive ion charge to promote the absorption of negatively charged ions of dyes.

In metal processing, salt is used in concentrating uranium ore into uranium oxide (yellow cake). It is also used in processing aluminum, beryllium, copper, steel, and vanadium.

In the pulp and paper industry, salt is used to bleach wood pulp. It also is used to make sodium chlorate, which is added along with sulfuric acid and water to manufacture chlorine dioxide, an excellent oxygen-based bleaching chemical. The chlorine dioxide process, which originated in Germany after World War I, is becoming more popular because of environmental pressures to reduce or eliminate chlorinated

SALT—2000 65.3

bleaching compounds.

In tanning and leather treatment, salt is added to animal hides to inhibit microbial activity on the underside of the hides and to replace some of the moisture in the hides. In rubber manufacture, salt is used to make buna, neoprene, and white types. Salt brine and sulfuric acid are used to coagulate an emulsified latex made from chlorinated butadiene.

Agricultural Industry.—Since prehistoric times, humankind has noticed that animals satisfied their salt hunger by locating salt springs, salt licks, or playa lake salt crusts. Barnyard and grazing livestock need supplementary salt rations to maintain proper nutrition. Veterinarians advocate adding loose salt in commercially mixed feeds or in block forms sold to farmers and ranchers because salt acts as an excellent carrier for trace elements not found in the vegetation consumed by grazing livestock; selenium, sulfur, and other essential elements are commonly added to salt licks, or salt blocks, for free-choice feeding.

Food Processing.—Every person uses some quantity of salt in their food. The salt is added to the food by the food processor or by the consumer through free choice, as a flavor enhancer, preservative, binder, fermentation-control additive, texture-control agent, and color developer. This major category is subdivided, in descending order of salt consumption, into meat packers, canning, other food processing, grain mill products, baking, and dairy.

In meat packing, salt is added to processed meats to promote color development in bacon, ham, and other processed meat products. As a preservative, salt inhibits the growth of bacteria, which would lead to spoilage of the product. Early pioneers stored their perishable food in salt barrels for protection and preservation. Salt acts as a binder in sausages to form a binding gel composed of meat, fat, and moisture. Salt also acts as a flavor enhancer and a tenderizer.

In the dairy industry, salt is added to cheese as a fermentation-control agent and as a color- and texture-control agent. The dairy subsector includes companies that manufacture creamery butter, natural and processed cheese, condensed and evaporated milk, ice cream, frozen desserts, and specialty dairy products.

In canning, salt is primarily added as a flavor enhancer and preservative. It also is used as a dehydrating agent, tenderizer, enzyme inhibitor, and carrier for other ingredients.

In baking, salt is added to control the rate of fermentation in bread dough. It also is used to strengthen the gluten (the elastic protein-water complex in certain doughs) and as a flavor enhancer, such as a topping on baked goods.

The food-processing category also contains grain mill products, which consist of milling flour and rice and manufacturing cereal breakfast food and blended or prepared flour.

In the "other food processing" category, salt is used mainly as a seasoning agent. Other food processing includes miscellaneous establishments that make food for human consumption (e.g., potato chips, pretzels) and for domestic pet consumption (e.g., cat and dog food).

Water Treatment.—Many areas of the United States have hard water, which contains excessive calcium and magnesium ions that contribute to the buildup of a scale or film of alkaline mineral deposits in household and industrial equipment. Commercial and residential water-softening units use salt to remove the ions causing the hardness. The sodium ions captured on a resin bed are exchanged for the calcium and magnesium ions. Periodically, the water-softening units must be

recharged because the sodium ions become depleted. Salt is added and dissolved, and the brine replenishes the lost sodium ions.

Stocks

Because bulk salt is stored at many different locations, such as at the plants, warehouses, ports, and terminals, data on the quantity of salt stockpiled by the salt industry is not reliable enough to formulate accurate inventory totals; however, yearend stocks of producers were estimated to be 2 Mt, and consumer inventories also were estimated to be high. Most of these inventories were imported rock salt and solar salt. Many salt producers, States, municipalities, distributors, and road deicing contractors stockpiled additional quantities of salt in anticipation of adverse weather conditions. Deicing salt inventories were extremely large by yearend because the mild winter in the domestic snow belt did not require as much salt as had been stockpiled. For the reasons discussed above, salt stocks are assumed to be the difference between salt production and salt sold or used in calculating apparent consumption.

Transportation

Because the locations of the salt supplies are not often near consumers, transportation can become an important cost. Pumping salt brine through pipelines is an economic means of transportation but cannot be used for dry salt. Large bulk shipments of dry salt in ocean freighters or river barges are low in cost but are restricted in points of origin and consumption. River and lake movement of salt in winter is often severely curtailed because of frozen waterways. As salt is packaged, handled, and shipped in smaller units, the costs increase and are reflected in higher selling prices.

Transoceanic imports of salt have been increasing in some areas of the United States because they are less expensive with respect to transportation costs than that which could be purchased from domestic suppliers using rail transportation. Although shipping in larger vessels reduces shipping costs, transportation costs significantly add to the price of salt. In some cases, shipping costs are higher than the actual price of the salt. Another problem is that many ports are not deep enough to accommodate the larger ships.

Prices

The four types of salt that are produced have unique production, processing, and packaging factors that determine the selling prices. Generally, salt sold in bulk is less expensive than salt that has been packaged, pelletized, or pressed into blocks. Salt in brine is the least expensive salt sold because mining and processing costs are less. Vacuum pan salt is the most expensive because of the higher energy costs involved in processing and the purity of the product.

Price quotations are not synonymous with average values reported to the USGS. The quotations do not necessarily represent prices at which transactions actually took place or bid and asked prices. Yearend prices for salt are no longer quoted in Chemical Market Reporter; this information was last available for 1997. The average annual values, as collected by the USGS and listed in table 7, represent a national average value for each of the types of salt and the various product forms.

Foreign Trade

Under Harmonized Tariff Schedule of the United States (HTS) nomenclature, imports are aggregated under one category named "Salt (including table and denatured salt) and pure sodium chloride, whether or not in aqueous solution, seawater." The same classification also applies to exports. The HTS code for salt is 2501.00.0000. The trade tables in this report list the previous and current identification codes for salt. Although several other HTS codes pertain to various salt classifications, the United States aggregates shipments under one code because the sums of individual subclassifications fail to meet the minimum dollar requirements necessary for individual listings.

Using The Journal of Commerce's Port Import Export Reporting Service (PIERS), which provides additional information on trade data on ocean commerce (no rail or truck traffic between the United States and Canada and Mexico is included) not available from other sources, the U.S. salt industry accounted for 38% of all U.S. salt imports in 2000. The three companies that imported salt were Cargill, IMC Salt, and Morton Salt Co.. Six salt distributors represented 41% of total imports, and the domestic chloralkali industry imported 9% of total salt. Therefore, the salt industry, salt distributors, and the chloralkali industry accounted for 88% of all salt imported in 2000. The majority of U.S. salt exports in 2000 was by five domestic salt producers: Cargill, Morton Salt, U.S. Salt, United Salt, and Western Salt, Inc. According to PIERS data, these five companies exported 84% of the total.

Based on U.S. Census Bureau data, in 2000, the United States exported 642,000 t; this was a 28% decrease compared with that of 1999 (table 8). Salt was shipped to 62 countries through 32 U.S. Customs districts; the Detroit, MI, district exported the most and represented 35% of the U.S. total (table 9). In 2000, the majority of exports, or 77% of the total, was to Canada.

Based on U.S. Census Bureau statistics, the United States imported 8.96 Mt of salt from 37 countries in 2000, which was slightly more than was imported during 1999 (table 10). Table 11 lists the imports of salt by Customs districts. The quantity of imported salt was about 14 times more than that of exports. This indicates the magnitude of the United States' reliance on salt imports. The majority of imported salt was brought into the country by foreign subsidiaries of major U.S. salt producers. Generally, imported salt can be purchased and delivered to many customers at a cost lower than the comparable domestic product because production costs are lower abroad, currency exchange rates are more favorable, and ocean freight rates are less expensive than overland rail or truck rates.

World Review

Table 12 lists world salt production statistics for 111 nations based on reported and estimated information. In 2000, total world production increased slightly compared with that of 1999. The United States remained the world's leading salt-producing country, representing 21% of total world output.

Most countries possess some form of salt production capability with production levels set to meet their own domestic demand requirements and with additional quantities available for export. Many developing nations tend to develop their agricultural resources to feed their population first. Development of easily extractable mineral resources follows, and salt is one of the first commodities to be mined. Some countries, such as the United States, import a substantial amount

of salt to meet total demand requirements because of economic

Australia.—Intense rain and floods from Cyclone Steve in March severely affected Dampier Salt Ltd.'s solar salt production ponds at Dampier and Lake MacLeod in the northwestern part of the country. Although the storm caused production to decline by about 15%, operations were back into full production later in the year (Industrial Minerals, 2000a)

Portugal.—VA Tech Ltd. of Switzerland and Uniteca S.A., a chloralkali producer in Portugal, formed a joint venture to construct a salt plant at Carrico. The plant, with production capacity of 170,000 t/yr, was scheduled to start up in late 2001. The majority of the salt will be used as feedstock for the chlorine facility, with the remainder sold to local markets. The salt will be solution-mined from an underground deposit and crystalized in surface evaporation ponds that will be heated by a natural gas-fired cogeneration plant (Industrial Minerals, 2000e).

Russia.—A solution mining project was scheduled to begin at Koverninsky District, Nizhegorodsky Oblast, where the Belbazh salt deposit with reserves of 711 Mt was discovered in 1973. The salt brine would provide feedstock to the local chloralkali facility. Although the plan was to mine about 1 million tons per year (Mt/yr), the initial output was scheduled to be between 80,000 t/yr to 100,000 t/yr (Industrial Minerals, 2000b). In addition, a new salt facility was commissioned by the joint stock company Silvinit at Solikamsk, Perm Oblast. The plant will produce 500,000 t/yr of technical-grade salt (Industrial Minerals, 2000c).

United Kingdom.—U.S. Salt Holdings L.L.C. of the United States acquired from Stavely Industries, plc, the vacuum pan salt operation operated by British Salt Ltd. The plant at Middlewich, Cheshire, had a capacity of 825,000 t/yr. The majority of salt sales were to the chemical, food processing, and water treatment industries. The only other vacuum pan operation in England was owned by Salt Union Inc., which was purchased by IMC Global, another U.S.-owned salt company, in 1999. IMC was the world's third largest salt producer with more than 15 Mt/yr of world salt capacity (Industrial Minerals, 2000d).

Vietnam.—Two new solar salt projects were announced at Quan The and Ninh Thuan. The domestic chemical industry anticipated that its demand for salt would increase to 1 Mt/yr by 2010 from its current level of 300,000 t/yr (Bertram, 2000).

Outlook

Supplies of salt are more than adequate to meet any surge in demand for the foreseeable future. The new rock salt mines in Michigan and New York that opened recently should increase domestic rock salt production and cause rock salt imports to decline. After a couple of mild winter seasons that reduced the demand for deicing salt, it is estimated that winter weather conditions will return to traditional precipitation patterns that will require greater quantities of rock salt. U.S. production of total salt for 2001 is estimated to be 47 Mt.

References Cited

Bertram, B.M., 2000, Salt: Mining Engineering, v. 52, no. 6, June, p. 57-60. Chemical Market Reporter, 2000, IMC Global reports weak 2Q results; prospects dim for sale of salt biz: Chemical Market Reporter, v. 258, no. 7, August 14, p. 6.

Food and Nutrition Board, 1966, Sodium chloride, in Food chemicals codex

SALT—2000 65.5

(1st ed): Washington, DC, National Academy Press, p. 613-614. Industrial Minerals, 2000a, Cyclone Steve disrupts Dampier salt: Industrial Minerals, no. 393, June, p. 9.

2000b, Exploitation of Belbazh salt deposit to start: Industrial Minerals, no. 396, September, p. 28.

——2000c, Jt.St.Co. Silvinit commissions 0.5m tpa salt complex: Industrial Minerals, no. 393, June, p. 25.

2000d, Stavely sells British Salt: Industrial Minerals, no. 394, July, p. 93.
 2000e, Wabag and Uniteca join forces in salt: Industrial Minerals, no. 396, September, p. 17.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Evaporites and Brines. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Salt. Ch. in Mineral Commodity Summaries, annual.

Salt. Ch. in Minerals Yearbook, annual.

Other

The Chlorine Institute.

Handbook of World Salt Resources. S.J. Lefond, Plenum Press, 1969.

The Material Flow of Salt. U.S. Bureau of Mines Information Circular 9343, 1993.

Salt. Ch. in Canadian Minerals Yearbook, annual.

Salt. Ch. in Industrial Minerals and Rocks, Society of Mining, Metallurgy, and Exploration, Inc., 6th ed., Carr, D.D., ed., 1994

Salt. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

Salt Institute.

Salt. Mining Engineering, annual review of industrial minerals.

Sodium Chloride. American Chemical Society Monograph No. 145, Kaufmann, D.W., ed., Reinhold Publishing Corp., 1960. Solution Mining Research Institute.

TABLE 1 SALIENT SALT STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1996	1997	1998	1999	2000
United States:					
Production: 2/	42,200	41,400	41,200	44,900	45,600
Brine	21,500	21,400	21,100	22,700	22,500
Rock	13,500	12,900	12,900	14,400	15,000
Solar	3,270	3,170	3,190	3,580	3,810
Vacuum and open pans	3,920	3,980	4,040	4,190	4,200
Sold or used by producers	42,900	40,600	40,800	44,400	43,300
Value	\$1,060,000	\$993,000	\$986,000	\$1,110,000	\$1,040,000
Exports	869	748	731	892	642
Value	\$39,300	\$38,000	\$35,200	\$37,000	\$37,800
Imports for consumption	10,600	9,160	8,770	8,870	8,960
Value	\$167,000	\$148,000	\$145,000	\$137,000	\$127,000
Consumption, apparent 3/	52,600	49,000	48,800	52,400	51,600
Consumption, reported	52,800	49,500	44,200	50,000	54,000
World, production	204,000 r/	207,000 r/	200,000 r/	211,000 r/	214,000 e/

e/ Estimated. r/ Revised.

 ${\it TABLE~2}\\ {\it SALT~PRODUCED~IN~THE~UNITED~STATES,~BY~TYPE~AND~PRODUCT~FORM~1/2}}$

(Thousand metric tons)

	Vacuum and				
Product form	open pans	Solar	Rock	Brine	Total
1999:					
Bulk	816	1,910	13,800	22,700	39,300
Compressed pellets	1,270	346	XX	XX	1,620
Packaged	1,900	1,160	549	XX	3,610
Pressed blocks	208	159	72	XX	439
Total	4,190	3,580	14,400	22,700	44,900
2000:					
Bulk		2,000	14,600	22,500	39,900
Compressed pellets	1,270	359	XX	XX	1,630
Packaged	1,960	1,300	390	XX	3,640
Pressed blocks	207	152	67	XX	426
Total	4,200	3,810	15,000	22,500	45,600
VV N-41:1-1-					

XX Not applicable.

 ${\it TABLE~3} \\ {\it SALT~SOLD~OR~USED~IN~THE~UNITED~STATES,~BY~TYPE~AND~PRODUCT~FORM~1/~2/}}$

(Thousand metric tons and thousand dollars)

	Vacuum an	d open pans	So	lar	Ro	ock	Br	ine	T	otal
Product form	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1999:										
Bulk	816	38,000	1,410	38,200	14,100	294,000	22,700	151,000	39,000	521,000
Compressed pellets	1,270	162,000	299	33,300	XX	XX	XX	XX	1,570	196,000
Packaged:										
Less-than-5-pound units	232	NA	3	NA	1	NA	XX	XX	236	XX
More-than-5-pound units	1,650	NA	954	NA	576	NA	XX	XX	3,180	XX
Total	1,890	247,000	957	67,100	577	36,100	XX	XX	3,420	350,000
Pressed blocks:	_									
For livestock	88	NA	118	NA	68	NA	XX	XX	274	XX
For water treatment	120	NA	8	NA	6	NA	XX	XX	134	XX
Total	209	19,000	126	11,800	73	7,280	XX	XX	408	38,100
Grand total	4,190	466,000	2,790	150,000	14,700	337,000	22,700	151,000	44,400	1,110,000

^{1/} Data are rounded to no more than three significant digits.

^{2/} Excludes Puerto Rico.

^{3/} Sold or used plus imports minus exports.

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

TABLE 3--Continued SALT SOLD OR USED IN THE UNITED STATES, BY TYPE AND PRODUCT FORM 1/2/

(Thousand metric tons and thousand dollars)

	Vacuu	m and								
	open	open pans Solar		lar	Rock		Br	ine	T	otal
Product form	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
2000:										
Bulk	773	39,100	1,440	30,500	13,100	252,000	22,500	128,000	37,800	450,000
Compressed pellets	1,260	166,000	320	35,900	XX	XX	XX	XX	1,580	202,000
Packaged:										
Less-than-5-pound units	234	NA	4	NA	1	NA	XX	XX	239	XX
More-than-5-pound units	1,710	NA	1,060	NA	434	NA	XX	XX	3,210	XX
Total	1,950	249,000	1,070	76,200	435	27,100	XX	XX	3,450	353,000
Pressed blocks:										
For livestock	86	NA	119	NA	75	NA	XX	XX	280	XX
For water treatment	120	NA	7	NA	6	NA	XX	XX	133	XX
Total	207	20,900	126	11,800	81	7,360	XX	XX	414	40,100
Grand total	4,190	475,000	2,950	154,000	13,600	286,000	22,500	128,000	43,300	1,040,000

NA Not available. XX Not applicable.

TABLE 4 SALT SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE $1/\sqrt{2}$

(Thousand metric tons and thousand dollars)

1	999	2	000
Quantity	Value	Quantity	Value
2,780	115,000	2,770	114,000
16,500	193,000	13,400	124,000
4,220	209,000	5,440	218,000
10,200	97,500	10,800	104,000
1,890	92,000	2,110	108,000
7,610	323,000	7,480	311,000
1,210	75,800	1,240	64,500
44,400	1,110,000	43,300	1,040,000
45	1,500	45	1,500
	Quantity 2,780 16,500 4,220 10,200 1,890 7,610 1,210 44,400	2,780 115,000 16,500 193,000 4,220 209,000 10,200 97,500 1,890 92,000 7,610 323,000 1,210 75,800 44,400 1,110,000	Quantity Value Quantity 2,780 115,000 2,770 16,500 193,000 13,400 4,220 209,000 5,440 10,200 97,500 10,800 1,890 92,000 2,110 7,610 323,000 7,480 1,210 75,800 1,240 44,400 1,110,000 43,300

e/ Estimated.

 ${\it TABLE~5}$ DISTRIBUTION OF DOMESTIC AND IMPORTED SALT BY PRODUCERS IN THE UNITED STATES, BY END USE AND TYPE 1/2/

(Thousand metric tons)

	Standard	Vacu	um								
	industrial	and oper	n pans	Sola	r	Roc	k	Bri	ne	Grand	total 3/
End use	classification	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Chemical:											
Chloralkali producers	2812	33	31	374	442	841	230	20,200	20,600	21,400	21,300
Other chemical	28 (excludes	255	257	233	168	392	654	115	2	996	1,080
	2812, 2899)										
Total	<u> </u>	288	288	608	610	1,230	885	20,300	20,600	22,400	22,400
Food-processing industry:	_										
Meat packers	201	268	268	50	54	87	81			405	402
Dairy	202	119	120	6	7	2	2			127	129
Canning	2091, 203	149	149	43	40	32	30	(4/)	(4/)	225	220
Baking	205	213	214	7	7	15	13		`	234	234

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

^{2/} As reported at salt production locations, the term "sold or used" indicates that some salt, usually salt brine, is not sold but is used for captive purposes by plant or company. Because data do not include salt imported, purchased, and/or sold from inventory from regional distribution centers, salt sold or used by type may differ from totals shown in tables 5 and 6, which are derived from company totals.

 $^{1/\,\}text{Data}$ are rounded to no more than three significant digits; may not add to totals shown.

^{2/} The term "sold or used" indicates that some salt, usually salt brine, is not sold but is used for captive purposes by plant or company.

^{3/} Includes Alabama, Michigan, Ohio, Tennessee, and West Virginia.

^{4/} Includes Arizona, California, Nevada, New Mexico, and Oklahoma.

TABLE 5--Continued DISTRIBUTION OF DOMESTIC AND IMPORTED SALT BY PRODUCERS IN THE UNITED STATES, BY END USE AND TYPE 1/2/

(Thousand metric tons)

	Standard industrial	Vacu and ope		Sola		Ro	ale	Bri	ima	Crond	total 3/
End use	classification	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Food-processing industryContinued:	ciassification	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Grain mill products	204	95	93	6	11	21	30			121	133
Grain inin products	(excludes	93	93	O	11	21	30			121	133
	2047)										
Other food processing	206-208,	448	505	70	84	49	47	2	1	569	638
Other rood processing	2047, 2099	440	303	70	04	49	4/	2	1	309	038
Total	2047, 2099	1,290	1,350	181	202	206	203	2	2	1,680	1,760
General industrial:		1,290	1,330	101	202	200	203			1,000	1,700
Textiles and dyeing	22	158	138	55	52	14	11	9	8	235	209
Metal processing	33, 34, 35, 37	8	6	14	24	131	82	(4/)		153	112
Rubber	2822, 30	4	3	1	1	131	1	66	66	72	71
Kubbei	(excludes	4	3	1	1	1	1	00	00	12	/1
	3079)										
Oil	13, 29	27	28	174	186	42	49	2.190	2,250	2,430	2,510
Pulp and paper	26	15	16	48	45	30	26	19	19	112	106
Tanning and leather	311	21	16	32	30	50	36			103	82
Othe industrial		99	89	46	50	54	62	(4/)	(4/)	199	202
Total		331	295	370	388	322	268	2,280	2,340	3,300	3,290
Agricultural:		331	273	370	300	322	200	2,200	2,340	3,300	3,270
Feed retailers and dealers mixers	5159	349	385	383	385	478	469			1,210	1,240
Feed manufacturers	2048	60	55	121	126	353	359			533	540
Direct-buying end user	02	5	5	19	20	63	63			87	88
Total		413	445	523	531	894	891			1,830	1,870
Water treatment:		413	773	323	331	074	071			1,050	1,070
Government (Federal, State, local)	2899	17	17	95	82	315	128	4	4	431	231
Commercial or other	2899	129	142	217	184	119	30	2	3	468	358
Total	2000	147	159	312	266	434	157	6	6	899	589
Ice control and stabilization:			10)		200	151	107			0,,	
Government (Federal, State, local)	9621	1	2	594	515	12,900	16,900	(4/)		13,500	17,400
Commercial or other		6	7	53	122	1,760	2,240			1,820	2,370
Total		7	10	647	637	14,600	19,100	(4/)		15,300	19,700
Distributors:			10	017	031	1 1,000	17,100	(1/)		15,500	
Agricultural distribution	5191	90	90	116	121	48	51	(4/)		254	262
Grocery wholesalers and retailers	514, 54	529	528	242	238	60	56			831	823
Institutional wholesalers and end	58, 70	171	113	50	47	41	45	(4/)	(4/)	263	206
users	~ ~ , · ~	- / -			• •			(")	(")	200	200
Water-conditioning distribution	7399	163	152	410	391	27	24			600	568
U.S. Government resale	9199	(4/)	(4/)	1	1	1	1			2	2
Other wholesalers and retailers	5251	774	796	737	755	404	401	(4/)	(4/)	1,920	1,950
Total		1,730	1,680	1,560	1,550	582	578	(4/)	1	3,870	3,810
Other 5/		116	105	54	65	394	341	96	58	663	570
Grand total		4,320	4,330	4,250	4,250	18,700	22,400	22,700	23,000	50,000	54,000

⁻⁻ Zero.

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

^{2/} The quality of imports included in the total for each type of salt is the amount reported by the U.S. salt industry, not the quantity reported by the U.S. Census Bureau that appears in tables 1, 11, and 12.

^{3/} Because data include salt imported, produced, and/or sold from inventory from regional distribution centers, salt sold or used by type may differ from totals shown in tables 1, 3, and 4, which are derived from plant reports at salt production locations. Data may differ from totals shown in table 6 because of changes in inventory and incomplete data reporting.

^{4/} Less than 1/2 unit.

^{5/} Includes exports.

TABLE 6 DISTRIBUTION OF DOMESTIC AND IMPORTED EVAPORATED AND ROCK SALT IN THE UNITED STATE, BY DESTINATION 1/2.

(Thousand metric tons)

		1999				2000		
	Evapora	ted			Evapora	ted		
	Vacuum and	~ .			Vacuum and	~ .		
Destination	open pans	Solar	Rock	Total	open pans	Solar	Rock	Total
Alabama		1	78	149	71	2	73	146
Alaska	2	5	(3/)	7	3	4	(3/)	7
Arizona	13 49	93 2	1 55	107	12 48	95	1 59	109 109
Arkansas	49 185	647	2	106		2 670		868
California		647 79	107	835	196	82	3	
Colorado				202	13		133	228
Connecticut	14	134	77	224	15	119	176	310
Delaware	4	12	3 20	19 21	4	11	3 21	18 23
District of Columbia	1	1 190			1	1	7	
Florida	70 94	190	8 54	268	74 95	206 55	63	288
Georgia				248				212
Hawaii Idaho	1 16	3 74	(3/) 39	3 129	(3/)	1 98	(3/)	2 119
		127			16		2 220	
Illinois	338		1,890	2,360	343	120	2,320	2,780
Indiana	241	118 74	714 473	1,070 708	251	112 89	844 533	1,210 774
Iowa	161				152			
Kansas	93	41	722	856	93	44	592	728
Kentucky	64	6	437	507	64	5	542	610
Louisiana	59	1	536	597	57	1	565	623
Maine		7	163	182	14	6	185	205
Maryland	63	61	175	298	64	82	161	307
Massachusetts	37	152	208	398	32	22	333	387
Michigan	302	36	1,720	2,050	308	38	2,180	2,520
Minnesota		193	523 213	859	138 32	203	624 250	965 282
Mississippi	36	(3/)		249		(3/)		
Missouri	133	35	587	755	131	44	382	557
Montana	1 78	34 44	1 163	36 285	1 79	36	2 171	39 297
Nebraska						46		
Nevada	3	262	15	280	3	276	12	290
New Hampshire	11 110	32 63	173 51	217 224	13 108	28 69	131 134	172 311
New Jersey		76	2	89	15			87
New Mexico New York	11 259	76 78	2,430	2,770	271	71 77	(3/) 3,280	3,630
		78 89		2,770	108	177	3,280 82	,
North Carolina North Dakota	126 7	23	74 10	289 41	108 7	177	82 7	367 32
Ohio	413	58	2,220	2,700	415	56	3,330	3,800
Oklahoma	413	38 19	2,220 98	157	39	19	5,550 63	3,800
	21	145	98 1	167	19	137	2	157
Oregon Pennsylvania	181	143	1,490	1,780	173	104	1,840	
	7	70			7	2	1,840	2,110
Rhode Island			41	118	33			134
South Carolina South Dakota	32 24	11 53	6 40	50	23	13 48	5 40	51
Tennessee		55 5	490	117 605	110	6	403	111 520
	206	125	182	513	212	126	189	528
Texas Utah	9	336	96	442	9	414	(3/)	423
Vermont			275	284	6		335	348
Virginia		2 71	278	432	75	7 81	333 147	303
Washington		171	2/8	196	22	124	3	303 149
West Virginia	23	5	225	245	15	5	204	223
Wisconsin	13 217	125	1,240	1,580	222	129	1,570	1,920
Wyoming	(3/)	23	1,240	1,380	(3/)	24	1,370	1,920
Other 4/		31	291	428	(3/)	48	295	460
Outci 4/	4,320	4,250	271	440	11/	40	493	400

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

^{2/} Each salt type includes domestic and imported quantities. Brine is excluded because brine is not shipped out of State.

^{3/} Less than 1/2 unit.

^{4/} Includes shipments to overseas areas administered by the United States, Puerto Rico, exports, and some shipments to upspecified destinations.

^{5/} Because data include salt imported, purchased, and/or sold from inventory from regional distribution centers, evaporated and rock salt

distributed by State may differ from totals shown in tables 1 and 3, which are derived from plant reports at salt production locations. Data may differ from totals shown in table 5 because of changes in inventory and/or incomplete data reporting.

${\it TABLE~7} \\ {\it AVERAGE~VALUE~OF~SALT,~BY~PRODUCT~FORM~AND~TYPE~1/}$

(Dollars per metric ton)

	Vacuum and			
Product form	open pans	Solar	Rock	Brine
1999:				
Bulk	46.56	27.17	20.91	6.65
Compressed pellets	127.49	111.36	XX	XX
Packaged	130.88	70.15	62.60	XX
Average 2/	112.49	52.08	22.55	6.65
Pressed blocks	91.16	93.59	99.19	XX
2000:				
Bulk	50.58	21.16	19.28	5.70
Compressed pellets	130.97	112.28	XX	XX
Packaged	128.05	71.56	62.34	XX
Average 2/	113.95	50.46	20.67	5.70
Pressed blocks	101.18	93.52	91.14	XX

XX Not applicable.

TABLE 8 U.S. EXPORTS OF SALT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country Bahamas, The Bahrain Canada	Quantity (3/) 1 730 (3/)	Value 2/ 122 191 23,200	Quantity 2 1	Value 2/ 222
Bahrain	730 (3/)	191	_	
	730 (3/)		1	
Canada	(3/)	23,200		221
Cunudu	` /		500	22,800
Chile		58	1	84
China	2	345	(3/)	447
Colombia	1	214	2	413
Costa Rica	1	74	(3/)	67
El Salvador	1	192	1	175
Haiti	(3/)	65	5	1,370
Honduras	4	370	4	469
Hong Kong	1	139	(3/)	78
Israel	1	66	(3/)	6
Italy	2	66	(3/)	50
Japan	4	584	3	575
Korea, Republic of	(3/)	96	1	55
Malaysia	1	232	(3/)	48
Mexico	83	4,760	82	5,270
Netherlands	1	49	(3/)	159
Nicaragua	(3/)	10	1	91
Norway	1	36	(3/)	4
Panama	27	711	1	156
Saudi Arabia	10	883	11	1,360
Singapore	2	113	13	490
Taiwan	3	752	3	269
United Arab Emirates	(3/)	185	1	319
United Kingdom	10	836	3	617
Venezuela	1	655	2	346
Other	5	1,970 r/	5	1,610
Total	892	37,000	642	37,800

r/ Revised.

Source: U.S. Census Bureau.

^{1/} Net selling value, free on board plant, excluding container costs.

^{2/} Salt value data previously reported were an aggregate value per ton of bulk, compressed pellets, and packaged salt. For time series continuity, an average of these three types of product forms is presented that is based on the aggregate values and quantities of the product form for each type of salt shown in table 3.

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

^{2/} Free alongside ship value at U.S. ports.

^{3/} Less than 1/2 unit; included with "Other."

TABLE 9
U.S. EXPORTS OF SALT, BY CUSTOMS DISTRICT 1/

(Thousand metric tons and thousand dollars)

	10	999	20	00
District	Quantity	Value 2/	Quantity	Value 2/
Baltimore, MD	2	169	(3/)	36
Boston, MA	(3/)	14		
Buffalo, NY	25	2,870	27	2,970
Charleston, SC	2	321	1	56
Chicago, IL	(3/)	92	45	1,310
Cleveland, OH	209	3,700	2	255
Detroit, MI	347	8,530	226	7,060
Duluth, MN	(3/)	3	(3/)	14
El Paso, TX	2	121	2	116
Great Falls, MT	6	265	17	1,450
Honolulu, HI	(3/)	5		
Houston, TX	12	2,000	14	2,400
Laredo, TX	74	4,040	73	4,500
Los Angeles, CA	8	2,100	17	1,640
Miami, FL	2	381	4	539
Mobile, AL	1	78	1	82
New Orleans, LA	30	1,110	4	637
New York, NY	8	705	4	1,100
Nogales, AZ	3	99	3	158
Norfolk, VA	2	419	2	480
Ogdensburg, NY	25	657	4	370
Pembina, ND	6	532	17	1,290
Philadelphia, PA	(3/)	407	(3/)	123
Port Arthur, TX	(3/)	33	6	1,580
Portland, ME	(3/)	25	2	127
St. Albans, VT	1	64	4	30
St. Louis, MO	(3/)	10	12	79
San Diego, CA	4	491	(3/)	494
San Francisco, CA	12	687	(3/)	538
San Juan, PR	(3/)	18	(3/)	12
Savannah, GA	(3/)	294	(3/)	206
Seattle, WA	13	490	31	969
Tampa, FL	(3/)	73	(3/)	35
Wilmington, NC			(3/)	23
Other 4/	98	6150	123	7080
Total Zara	892	37,000	642	37,800

⁻⁻ Zero.

Source: U.S. Census Bureau.

 $\label{eq:table 10} \text{U.S. IMPORTS FOR CONSUMPTION OF SALT, BY COUNTRY 1/}$

(Thousand metric tons and thousand dollars)

	19	999	2000		
Country	Quantity	Value 2/	Quantity	Value 2/	
Australia	27	617	(3/)	6	
Bahamas, The	946	10,400	858	9,770	
Bahrain		59			
Bosnia and Herzegovina		411			
Brazil	101	940	217	2,290	
Canada	3,810	66,400	3,470	58,000	
Chile	1,660	20,600	2,050	19,500	
China	1	715	(3/)	695	
Dominican Republic	32	403	167	1,790	

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

^{2/} Free alongside ship value at U.S. ports.

^{3/} Less than 1/2 unit.

 $^{4/\}operatorname{Unknown}$ but assumed to be rail and/or truck shipments to Canada through various points of departure.

TABLE 10--Continued U.S. IMPORTS FOR CONSUMPTION OF SALT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	19	2000		
Country	Quantity	Value 2/	Quantity	Value 2/
Egypt	143	1,100	313	2,500
France	5	1,240	6	1,370
Germany	1	681	10	983
Ireland	50	347	42	295
Israel	(3/)	144	1	455
Italy	15	261	2	353
Japan	1	167	1	149
Korea, Republic of	1	579	1	679
Mexico	1,250	19,300	1,180	17,900
Namibia	12	184	17	283
Netherlands	113	3,760	187	4,460
Netherlands Antilles	101	1,690	132	2,190
Peru	538	4,280	291	2,260
Spain	2	40	(3/)	106
Sweden	2	1,760	(3/)	139
United Kingdom	8	163	15	187
Venezuela	18	148		
Other	3	389	(3/)	385
Total	8,870	137,000	8,960	127,000
7000				

⁻⁻ Zero.

Source: U.S. Census Bureau.

 $\label{eq:table 11} \text{U.s. IMPORTS OF SALT, BY CUSTOMS DISTRICT } 1/$

(Thousand metric tons and thousand dollars)

	1999		2000	
District	Quantity	Value 2/	Quantity	Value 2/
Anchorage, AK	8	186	14	398
Baltimore, MD	723	10,500	766	11,600
Boston, MA	669	6,930	703	6,480
Buffalo, NY	499	9,110	344	7,050
Charleston, SC	142	3,520	179	3,630
Chicago, IL	615	10,900	391	5,380
Cleveland, OH	271	5,920	154	2,470
Columbia-Snake, OR	247	3,420	280	3,580
Dallas-Fort Worth, TX	(3/)	110	(3/)	53
Detroit, MI	795	15,800	824	14,900
Duluth, MN	77	885	146	1,950
El Paso, TX	1	179	(3/)	99
Great Falls, MT	(3/)	26	(3/)	35
Houston-Galveston, TX	(3/)	165	1	256
Laredo, TX	1	159	1	241
Los Angeles, CA	94	2,080	114	2,640
Miami, FL	(3/)	128	1	380
Milwaukee, WI	930	16,200	808	16,300
Minneapolis, MN	(3/)	18	(3/)	3
Mobile, AL	(3/)	14	(3/)	4
New Orleans, LA	214	2,930	32	459
New York, NY	703	9,150	1,400	15,400
Nogales, AZ	(3/)	6	(3/)	78
Norfolk, VA	114	1,180	227	2,570
Ogdensburg, NY	143	2,890	138	2,910
Pembina, ND	3	289	1	101
Philadelphia, PA	539	6,920	705	7,850
Portland, ME	915	10,600	510	4,880
0 0 4 4 4 1 04 11				

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

^{2/} Customs value only.

^{3/} Less than 1/2 unit.

TABLE 11--Continued U.S. IMPORTS OF SALT, BY CUSTOM DISTRICTS 1/

(Thousand metric tons and thousand dollars)

	19	2000		
District	Quantity	Value 2/	Quantity	Value 2/
Providence, RI	393	4,220	358	3,290
St. Albans, VT	8	839	3	294
St. Louis, MO	(3/)	15	(3/)	10
San Diego, CA	1	72	(3/)	22
San Francisco, CA	(3/)	110	(3/)	120
San Juan, PR	8	207	8	156
Savannah, GA	78	1,080	62	1,030
Seattle, WA	342	5,200	297	4,150
Tampa, FL	261	3,460	305	4,130
Washington, DC	(3/)	3		
Wilmington, NC	73	1,430	179	1,960
Total	8,870	137,000	8,960	127,000

⁻⁻ Zero

Source: U.S. Census Bureau.

 ${\small TABLE~12}\\ {\small SALT:~WORLD~PRODUCTION,~BY~COUNTRY~1/~2/}\\$

(Thousand metric tons)

Country 3/	1996	1997	1998	1999 e/	2000 e/
Afghanistan (rock salt) e/	13	13	13	13	13
Albania e/	10	10	10	10	10
Algeria (brine and sea salt)	178	137	172	164 r/ 4/	165
Angola e/	30	30	30	30	30
Argentina:					
Rock salt		(5/)	(5/) e/	(5/)	(5/)
Other salt	1,096	841	850 e/	1,263 r/ 4/	1,000
Total	1,096	841	850 e/	1,263 r/4/	1,000
Armenia	26	26 e/	25	27 4/	30 4/
Australia (brine salt and marine salt)	7,905	8,801	8,879	10,003 4/	8,798 4/
Austria: e/					
Brine salt	367	400	500	400	400
Rock salt	1	1	1	1	1
Total	368	401	501	401	401
Azerbaijan	3 e/	3	6	6	6
Bahamas, The e/	900	900	900	900	900
Bangladesh (marine salt) e/ 6/	350	350	350	350	350
Belarus	231 r/	297 r/	355 r/	400 r/	400
Benin (marine salt) e/	(5/)			15 r/	15
Bolivia	(5/)	1	5	1 r/4/	(5/) 4/
Bosnia and Herzegovina e/	50	50	50	50	50
Botswana 7/	94	185	215	233 r/ 4/	185 4/
Brazil:					
Brine salt	3,870	5,064	5,353	4,528 r/4/	4,500
Rock salt	1,514	1,452	1,484	1,430 r/4/	1,500
Total	5,384	6,516	6,837	5,958 r/4/	6,000
Bulgaria	1,600	1,600	2,400	2,500	2,500
Burkina Faso e/	7	5	5	5	5
Burma e/ 8/	35	35	35	35	35
Cambodia e/	40	40	40	40	40
Canada	12,248	13,264	13,296	12,686 r/ 4/	11,935 4/
Cape Verde e/	5	6	7	2 r/	2
Chile	4,043	5,488	6,207	6,074 r/4/	6,000
China	29,035	30,830	22,420	28,124 4/	31,280 4/

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

^{2/} Customs value only.

^{3/} Less than 1/2 unit.

TABLE 12--Continued SALT: WORLD PRODUCTION, BY COUNTRY 1/2/

(Thousand metric tons)

Country 3/	1996	1997	1998	1999 e/	2000 e/
Colombia:					
Marine salt	153	142 r/	166 r/	157 r/ 4/	160
Rock salt	424	232	330	304 r/4/	300
Total	576 r/	374 r/	496 r/	461 r/ 4/	460
Costa Rica (marine salt) e/	37	37	37	37	37
Croatia	19	17	31	18 4/	20
Cuba e/	180	180	180	180	180
Denmark (sales) e/	600	600	600	600	605
Dominican Republic: e/					
Marine salt	50 4/	50	50	50	50
Rock salt	11 4/	12	12	12	12 4/
Total	61 4/	62	62	62	62 4/
Ecuador e/	110	100	100	95	90
Egypt	1,530	2,024 r/	2,387 r/	2,400	2,400
El Salvador (marine salt) e/	31	95 r/	89 r/ 4/	90	90
Eritrea:					
Marine salt	198	252	114	114 r/	100
Rock salt e/	2				
Total	200	252	114	114 r/	100
Ethiopia (rock salt) e/ 6/	5	1	1	1	1
France:					
Brine salt	1,460	1,475	1,500 e/	1,500	1,500
Marine salt	1,970	1,188	1,200 e/	1,200	1,200
Rock salt e/	160	371 4/	300	300	300
Salt in solution	4,273	4,051	4,000 e/	4,000	4,000
Total	7,860 e/	7,085	7,000 e/	7,000	7,000
Germany:					
Marine salt e/	731 4/	700	700	700	700
Rock salt and other	15,176	15,087	15,000 e/	15,000	15,000
Total	15,907	15,787	15,700 e/	15,700	15,700
Ghana e/	50	50	50	50	50
Greece	147	150	150 e/	150	150
Guadeloupe e/	200	200	200	200	200
Guatemala e/	48	48	48	50	49
Guinea				15	15
Honduras e/	25	25	25	25	25
Iceland e/	4	4	4	4	4
India:	_				
Marine salt	14,464	14,249	11,962	14,450 4/	14,450
Rock salt	2 4/	3	2	3	3
Total	14,466	14,251	11,964	14,453 4/	14,453
Indonesia e/	670	680	650	680	680
Iran 9/	1,000 e/	1,180	1,912 r/	1,600 r/ 4/	1,600
Iraq e/	250	250	250	300	300
Israel	765 r/	750 r/	874 r/	883 r/	863
Italy:	_				
Brine salt and rock salt	2,941	2,910	3,000 e/	3,000	3,000
Marine salt, crude e/ 10/	600	600	600	600	600
Total	3,541	3,510	3,600 e/	3,600	3,600
Jamaica	. 18	16	16	15	15
Japan	1,344 r/	1,329 r/	1,293 r/	1,327 r/ 4/	1,300
Jordan	50 r/	158 r/	263 r/	393 r/	546
Kenya (crude salt)	41	6 4/	22	45 r/ 4/	45
Korea, North e/	590	590	550	500	500
Korea, Republic of e/	770	770	780	800	800
Kuwait e/	100	100	100	100	100
Laos (rock salt) e/	. 14	18	39 4/	40	40
Lebanon e/	4	4	4	4	4
Leeward and Windward Islands e/	. 1	1			
Libya e/	30	30	30	30	40
Saa faatnatas at and of table					

TABLE 12--Continued SALT: WORLD PRODUCTION, BY COUNTRY 1/2/

(Thousand metric tons)

Country 3/	1996	1997	1998	1999 e/	2000 e/
Madagascar	42 r/	37 r/	27	25	25
Mali e/	6	5	6	6	6
Malta (marine salt) e/	(5/)	(5/)	(5/)	(5/)	(5/)
Martinique e/	200	200	200	200	200
Mauritania e/	6	6	6	6	6
Mauritius e/	7 r/	6	6	6	6
Mexico	8,508	7,933	8,412	8,236 r/4/	8,884
Mongolia (mine output)	1	1	1 e/	1	1
Morocco (marine salt and rock salt)	171	258	148	150	150
Mozambique (marine salt) e/	60	60	60	60	60
Namibia (marine salt)	356	493	507 r/	503 r/4/	510
Nepal e/ 11/	7	7	6	6	6
Netherlands e/	5,530 4/	5,000	5,500 4/	5,000	5,000
Netherlands Antilles	366	432	487	500	500
New Zealand e/	67	67	65	65	60
Nicaragua (marine salt) e/	15	14 4/	15 4/	15	15
Niger e/	3	3	2	2	2
Pakistan: 6/					
Marine salt	18 e/	19	15	16 4/	20
Rock salt	940 e/	1,042	1,038	1,019 4/	1,313 4/
Total	958 e/	1,061	1,053	1,035 4/	1,333
Panama (marine salt) e/	22	22	23	23	23
Peru	293	79	80 e/	80	80
Philippines (marine salt)	619 r/	687 r/	728 r/	704 r/ 4/	705
Poland:	017 1/	007 17	720 17	704 1/ 4/	703
Rock salt	923	791	748	923 r/4/	900
Other salt	3,240	3,070	3,257	3,289 r/ 4/	3,300
Total	4,163	3,859	4,005	4,212 r/ 4/	4,200
Portugal (rock salt) e/	610 4/	600	600	600	600
Romania:	010 4/	000	000	000	000
Rock salt	350	350 e/	68	70	70
	2,339	2,300 e/	2,152	2,000	2,000
Other salt					
Total	2,689	2,650 e/	2,220	2,070	2,070
Russia	2,100	2,100	2,200 r/	3,200 r/4/	3,200
Senegal e/	120	120	130	350 r/ 4/	350
Serbia and Montenegro	22	28	78	64 r/ 4/	78
Sierra Leone e/	50	10	100 /	 99 r/4/	100
Slovakia	107	101	100 e/		100
Slovenia e/	5	5	5	5	2
Somalia e/	1	1	1	1	1
Saudi Arabia e/	140	140	140	140	140
South Africa	253	322	356	365 4/	346 4/
Spain: e/	1.700		1.500		1.000
Marine salt and other evaporated salt	1,500	1,500	1,500	1,200	1,200
Rock salt	2,500	2,500	2,000	2,000	2,000
Total	4,000	4,000	3,500	3,200	3,200
Sri Lanka e/	65	65	82 r/ 4/	97 r/4/	96
Sudan e/	50	50	45	50	50
Switzerland e/	300	300	300	300	300
Syria	72	70 e/	163	150	150
Taiwan (marine salt)	233	62	7	77 r/ 4/	80
Tanzania	87	73 r/	75 r/e/	36 r/	36
Thailand:					
Rock salt	530	555	546	740 r/ 4/	792 4/
Other e/	100	100	100	100	100
Total	630	655	646	840 r/ 4/	892 4/
Tunisia (marine salt)	478	394	473	447 r/	481 4/
Turkey	2,068	2,344	2,170	2,200	2,200
	256	217	215 e/	215	215
Turkmenistan	256				
Turkmenistan Uganda e/	10	10	5	5	5

TABLE 12--Continued SALT: WORLD PRODUCTION, BY COUNTRY 1/2/

(Thousand metric tons)

Country 3/	1996	1997	1998	1999 e/	2000 e/
United Kingdom: e/					
Brine salt 12/	1,300	1,300	1,300	1,300	1,300
Rock salt	1,800	1,800	1,800	1,500	1,500
Other salt 12/	3,510	3,500	3,500	3,000	3,000
Total	6,610	6,600	6,600	5,800	5,800
United States, including Puerto Rico:					
United States:					
Brine	21,500	21,400	21,100	22,700 4/	22,500 4/
Rock salt	13,500	12,900	12,900 r/	14,400 4/	15,000 4/
Solar salt	3,270	3,170	3,190	3,580 4/	3,810 4/
Vacuum pan and open pan	3,920	3,980	4,040	4,190 4/	4,200 4/
Puerto Rico e/	45	45	45	45	45
Total e/	42,300	41,500	41,300	45,000	45,600 4/
Venezuela e/	350	350	350	350	350
Vietnam	709 r/	743 r/	717 r/	720 r/	730
Yemen e/	135	146	147	147	150
Grand total	204,000 r/	207,000 r/	200,000 r/	211,000 r/	214,000

- e/ Estimated. r/ Revised. -- Zero.
- 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 July 10, 2001.
- 3/ Salt is produced in many other countries, but quantities are relatively insignificant, and reliable production data are not available. Some salt brine production data for manufacture of chlorine, caustic soda, and soda ash are not reported because of incomplete data reporting by many countries.
- 4/ Reported figure.
- 5/ Less than 1/2 unit.
- 6/ Year ending June 30 of that stated.
- 7/ From natural soda ash production.
- 8/ Brine salt is produced as reported by the Burmese Government in metric tons, was as follows: 1996--71,350; 1997--97,276; 1998--91,992; 1999-- 61,674; and 2000--69,245.
- 9/ Year beginning March 21 of that stated.
- 10/ Does not include production from Sardinia and Sicily, estimated to be 200,000 metric tons per year.
- 11/ Year ending July 15 of that stated.
- 12/ Data captioned "Brine salt" for the United Kingdom are the quantities of salt obtained from the evaporation of brine; that captioned "Other salt" is the salt content of brines used for purposes other than production of salt.