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SALT

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SALT

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For more than 100 years, the United States had been the world's leading salt producing nation. Updated 2005 world production data show that China surpassed the United States and was the leading producing country in the world in 2005 and 2006. Total U.S. salt production in 2006 decreased slightly to 44.3 million metric tons (Mt) compared with that of 2005 (table 1). According to U.S. Geological Survey (USGS) data for 2006, 29 companies operated 64 salt-producing plants in 15 States. Of these, 11 companies and 16 plants produced more than 1 Mt each and accounted for 92% and 60%, respectively, of total U.S. production and for 91% and 37%, respectively, of total value. Several companies and plants produced more than one type of salt. In 2006, 14 companies (32 operations) produced salt brine; 11 companies (15 operations), rock salt; 10 companies (13 operations), solar-evaporated salt; and 6 companies (17 operations), vacuum pan salt.

The five leading States were, in descending order of total salt sold or used, Louisiana with 31%; Texas, 23%; New York, 12%; Kansas and Utah, 6% each. Other Eastern States (Alabama, Michigan, Ohio, Tennessee, and West Virginia) accounted for 19% of the domestic total salt sold or used. Other Western States (Arizona, California, Nevada, New Mexico, and Oklahoma) represented 3% (table 4).

Salt, also known as sodium chloride, comprises the elements sodium and chlorine. Sodium is a silver-colored metal that is so unstable that it reacts violently in the presence of water, and chlorine is a greenish-colored gas that is dangerous and may be lethal, yet combined, these two elements form 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 and sales data for salt are developed by the USGS from an annual voluntary survey of U.S. salt-producing sites and company operations. Production refers to the quantity of salt mined or manufactured that is available for sale. Salt sold or used is the quantity of salt that was sold directly to customers or used by the salt producer, which usually is a chloralkali (chlorine and sodium hydroxide) manufacturer.

Of the 29 companies to which a canvass form was sent, 27 responded, representing 84% of the totals shown in this report. Data for the two nonrespondents were estimated based on their prior responses to previous annual surveys, the 2006 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].

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, increased energy and labor costs, less expensive imports, fluctuations in currency exchange rates, and an excess of production capacity (resulting in the downsizing of the industry through mergers and acquisitions) reduced the number of operations in the industry to 29 companies and 64 plants by 2006.

The four types of salt that are surveyed are classified according to the method of recovery as follows: 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.

***Mining.*—Rock Salt.**—Rock salt is mined by the room-and-pillar method, which is similar to that used in coal and trona mining. The pillar widths are controlled by the percentage of extraction permissible at the various depths and room widths. Most room-and-pillar operations recover about 45% to 65% of the resource, with the remainder left behind as pillar supports for structural integrity of the mine. The salt is drilled, cut, blasted, mucked, crushed, and transported to the surface for processing, which usually involves removing the impurities and screening the material to finer size fractions. Rock salt mining in 2006 was 16.4 Mt, a 7% decrease compared with the 2005 total of 17.7 Mt.

Underground mining practices of bedded halite (commonly referred to as "rock salt") and domal salt formations are similar except for the height differences within the mines of the two types of operations. For example, bedded formations usually are laterally extensive but are vertically restricted. Salt domes are laterally restrictive but are vertically extensive. Some salt domes have depths in excess of 6,100 meters (m) (20,000 feet), whereas others crop out at the surface. The tops of Gulf Coast salt mining operations are generally less than 300 m (1,000 feet) below the surface. Working at greater depths is difficult because of higher temperatures and denser rock.

Solar Evaporation.—Solar salt production in 2006 was 3.64 Mt, which was a 6% increase from the 2005 total of 3.43 Mt. Solar evaporation uses the wind and the sun to evaporate the water and is an effective method of producing solar salt in areas of high evaporation and low precipitation. Along coastal margins in many parts of the world, seawater is collected and allowed to evaporate in specially constructed concentrating and

evaporating ponds. Seawater contains various dissolved salts that will separate depending on their relative solubilities. Calacite (calcium carbonate), which is the least soluble, will crystallize out first. Highly soluble magnesium salts tend to crystallize last. The order of separation of mineral salts from seawater from first to last are calcite, gypsum, halite, astrakainite, epsomite, kainite, hexahydrite, kieserite, carnallite, and bishofite.

Saline lakewater is also processed using solar evaporation. The ponds are separated by levees that isolate the brine during different stages of fractional crystallization. The brine is circulated among a network of interconnecting ponds, with salinity increasing with each transfer. The brine is then treated with lime to remove excess calcium sulfate, pumped to evaporation ponds, and then transferred to harvesting ponds to permit the salt to crystallize. After about 85% of the salt is precipitated, the remaining supernatant liquid, called "bitterns," can be pumped to adjacent ponds for subsequent extraction of bromine, magnesium, potassium, and sodium compounds. The harvesting pond is flooded again with new brine from the lime pond to repeat the cycle. It takes about 5 years once seawater is first introduced into the system for the completion of the crystallization process. The salt is harvested by special tractors equipped with scrapers and is ready for processing.

Solution Mining.—U.S. salt brine production in 2006 was 19.8 Mt, which was slightly less than the 2005 total of 19.8 Mt. The first reported use of solution mining was about 250 B.C. in China, where holes were drilled into deep salt deposits. The brine was brought to the surface by pipes made of bamboo. The brine was evaporated over fires fueled with coal, wood, or unprocessed natural gas. The basis of current technology began in France around A.D. 858. Today, an injection well is sunk, and pressurized freshwater is introduced to hydraulically fracture the bedded salt. Once communication with the production well is established, the brine is pumped to the surface for treatment. Solution mining can also use annulus injection, which uses a pair of concentric pipes (one carries the solvent downward and the other containing the brine upward), or tubing injection, which introduces the solvent at the bottom of the tube.

Solution mining is used to obtain a sodium chloride feedstock for vacuum pan salt production and for chlorine, caustic soda, and synthetic soda ash (excluding the United States) manufacture. The quantity of underground salt dissolved and recovered as brine to make vacuum pan salt usually is not reported as primary salt production; only the quantity of vacuum pan salt manufactured is reported. Vacuum pan salt production in 2006 was 4.45 Mt, which was a 7% increase compared with the 2005 total of 4.17 Mt. The quantity of brine used to make chloralkali chemicals is reported as either the amount of captive brine used or brine sold. The chemical industry is the leading consumer of salt brine worldwide.

***Processing.*—Rock Salt.**—About 77% of total rock salt produced and imported is used for highway deicing. Crushing and screening to the proper physical size is usually the only processing that road salt undergoes. In many operations, these steps are done underground in the mine to minimize haulage and storage costs. In addition, the extremely fine fraction, which often is unusable and would represent a waste product if brought to the surface, remains underground.

Solar Salt.—In the production of solar salt, salt crystals first are harvested; then the salt crystals are washed with dilute brine to remove residual bitterns and impurities. The salt is transferred to processing facilities where it is washed with saline water, dried for about 8 minutes at approximately 160° C (300° F), and screened into fine to coarse sizes, depending on the end use of the salt to be sold. Most operations ship solar salt in bags and in bulk, using barges, rail, and truck transportation.

Mechanical Evaporation.—Vacuum pan salt is not mined but is a type of salt produced using mechanical evaporation technology. Although rock salt, solar salt, and salt brine may be used to make vacuum pan salt, virtually all domestic vacuum pan salt is obtained from solution mining of underground salt formations. Vacuum pan salt is obtained by dehydrating brine using heat alone or in combination with a vacuum. The vacuum pan process conserves energy by utilizing multiple-effect evaporators connected to vacuum pumps. A saturated salt solution will boil at a higher temperature than pure water. When a vacuum is applied, the brine boils at a lower temperature, enabling the superheated vapor that is generated to act as the heating medium for the next evaporator.

The grainer or open pan process uses open, rectangular pans with steam-heated immersion coils to evaporate the water in the brine. Rotating rakes scrape the salt precipitate into a sump or up a ramp, depending on the method, and onto conveyors for debrining and drying treatment. The final product is usually flake shaped rather than the typical cubic form. Flake salt is preferred for the production of baked goods, butter, and cheese.

The Alberger process is a modified grainer operation that produces cubic salt with some flake salt. The pans are shallow circular units with external heating units rather than heating coils. The open pan process cannot be operated successfully in regions with high humidity because the evaporation rate is too slow and more energy is required to evaporate the brine.

Consumption

Depending on the location, winter 2006 was either mild or severe as evidenced by many nationwide newspaper articles regarding road salt use. For example, only light snow fell in the Pittsburgh region in December 2006 and January 2007 (Cristiano, 2007), and mild winter weather in parts of New York kept salt inventories full (Davis, 2007). Some parts of the nation, however, experienced freezing rain and sleet that required road deicing, and others were blanketed with numerous snowfalls that also necessitated using large quantities of road salt. Overall however the winter was a mild one for the nation and by yearend 2006, salt consumption for road deicing was low. The mild winter also had an adverse effect on mine worker employment. American Rock Salt Company was forced to furlough 152 workers for 3 weeks because of surplus rock salt inventories (Associated Press, 2006).

In 2006, apparent consumption (salt sold or used plus imports minus exports) was 49.6 Mt, whereas reported consumption (sales or use as reported by the salt companies, including their imports and exports) was 42.4 Mt. Although these two measures of consumption are not necessarily expected to be identical, they normally are similar. Apparent consumption normally is greater than reported consumption because apparent consumption

includes additional quantities of salt imported and exported by nonsalt-producing companies, such as some chloralkali operations and salt distributors. Reported consumption statistics are those reported only by the domestic salt producing companies.

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 2006 reported percentage distribution of salt by major end use was chemicals, 43%; ice control, 29%; distributors (grocery and other wholesalers and retailers, and so forth), 9%; general industrial, 7%; agricultural, 4%; food processing, 4%; primary water treatment, 2%; and other uses combined with exports, 2% (table 5). Distributors represented a substantial share of salt sales by the salt industry; all 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.

Chemical Industry.—The leading consumer of salt, primarily salt brine, is the chemical industry. Salt brine is extracted from natural underground saline sources or solution-mined halite deposits (salt beds or salt domes), or production from the dissolution of solar salt supplies. 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 was 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. Total salt sold or used by the chemical industry in 2006 was 18.4 Mt, of which 17 Mt was for chloralkali manufacture and 1.35 Mt was for other chemical uses (tables 5, 6).

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 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 liberating.

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 made 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-base chlorine facilities, about 48% of the salt used to manufacture chlorine was captive (produced by the chloralkali companies) and 31% was purchased brine; purchased solar salt and rock salt made up12% of the supply, and imported rock, solar, and vacuum pan salt, 9%.

In 2006, according to the U.S. Census Bureau, 10.3 Mt of chlorine and 8.1 Mt of sodium hydroxide (caustic soda or lye) were produced (U.S. Census Bureau, 2007). 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 18 Mt of salt for feedstock. Reported consumption of total domestic and imported salt for chlorine manufacture was 18.4 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 is also used as a feedstock in chemical plants 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 is used also with sulfuric acid to produce sodium sulfate and hydrochloric acid. The "Other chemical" subsector is relatively small, representing only 7% of domestic salt sales for the entire chemical sector and only 3% 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 to one from three; Ethyl Corp. and RMI Titanium Corp. exited the market in 1985 and 1992, respectively, leaving E.I. du Pont de Nemours and Co., Inc. as the sole manufacturer of metallic sodium in the United States. In 1998, the domestic market for metallic sodium 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 antiknock additives was the main reason for the decline in consumption. The method for making tetraalkyl lead involved the alkylation of a lead-sodium alloy with either ethyl chloride or methyl chloride. The alkyl chloride is introduced into a reactor containing the lead-sodium alloy. After the reaction is completed, the remaining alkyl chloride is vented and the product recovered.

In 1978, sodium usage in gasoline represented about 80% of the domestic market. Although there was no information about sodium consumption in 2006, the leading 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. Sodium for sodium borohydride manufacture accounted for about 38% of metallic sodium consumption. Sodium metal also is used to manufacture sodium azide, which is used in automotive air bags. Other promising uses of sodium metal are in the remediation of chemical weapons, chlorofluorocarbons, pesticides, and polychlorinated biphenyls.

Ice Control and Road Stabilization.—The second ranked end use of salt is for highway deicing. In 2006, U.S. consumption of salt for this application was 12.4 Mt. 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 alone. 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 6.5° C to 9.5° 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 happen 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 (U.S. Department of Health and Human Services, U.S. Food and Drug Administration, Food and Nutrition Board, 1966).

In highway deicing, salt has been associated with corrosion of bridge decks, motor vehicles, reinforcement bar and wire, and unprotected steel structures used in road construction. Surface runoff, vehicle spraying, and windblown actions also affect soil, roadside vegetation, and local surface water 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 also is 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 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 an increase in sea-surface temperatures in the equatorial Pacific Ocean, that is now thought to be the leading weather influence on Earth.

Distributors.—A tremendous amount of salt is marketed through various distributors, some of which specialize in agricultural and water treatment services—two sectors in which the salt companies also have direct sales (table 5). Distributor sales also include grocery wholesalers and/or retailers, institutional wholesalers, U.S. Government resale, and other wholesalers and retailers. Total salt sold to distributors in 2006 was 3.63 Mt.

General Industrial.—The industrial uses of salt are diverse. They include, in descending order of quantity consumed, oil and gas exploration, other industrial applications, textiles and dyeing, metal processing, pulp and paper, tanning and leather treatment, and rubber manufacture. Total salt sold to these sectors was 2.79 Mt in 2006.

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 downwell 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 stratum. 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 also is 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-base 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 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 attract moisture back into 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. In 2006, 1.63 Mt of salt was sold to the agricultural industry.

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

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 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 other food processing, meat packers, canning, baking, dairy, and grain mill products. Total salt sold for food processing in 2006 was 1.77 Mt.

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 made up of meat, fat, and moisture. Salt also acts as a flavor enhancer and as a tenderizer.

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

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

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. These products 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. This category includes miscellaneous establishments that make food for human consumption (such as potato chips and pretzels) and for domestic pet consumption (such as 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 and pipes. Commercial and residential water-softening units use salt to remove the ions that cause 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 brine replenishes the lost sodium ions. In 2006, 953,000 t of salt was sold for primary water treatment and an additional 489,000 t was sold for water conditioning distribution.

Stocks

Because bulk salt is stored at many different locations, such as plants, ports, terminals, and warehouses, data on the quantity of salt stockpiled by the salt industry are 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 distributors, municipalities, road deicing contractors, salt producers, and States stockpiled additional quantities of salt in anticipation of adverse weather conditions. Deicing salt inventories were large by yearend 2006 in anticipation of severe winter weather during late 2006 to early 2007. 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 may be 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.

Transportation costs significantly add to the price of salt. In some cases, shipping costs are higher than the actual value of the salt. Ocean vessels can transport greater quantities of salt than barge, rail, or truck shipments. Transoceanic imports of salt have been increasing in some areas of the United States because they are more cost competitive than salt purchased from domestic suppliers using barge, rail, or truck transportation. One important factor that often determines the quantity of salt that can be imported is the depth of the channels and the ports; many ports are not deep enough to accommodate 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.

Based on U.S. Census Bureau data for 2006, the United States exported 973,000 t; this was an 11% increase compared with that of 2005 (table 8). In 2006, the majority of exports (80%) were to Canada. Salt was shipped to 71 countries through 35 customs districts; the Cleveland, OH, district exported the most and represented 24% of the U.S. total (table 9). Based on U.S. Census Bureau statistics, the United States imported 9.49 Mt of salt from 48 countries in 2006, which was 21% less than was imported during 2005 (table 10). Canada was the leading source of imports, representing about 44% of total imports, followed by Chile (26%), the Bahamas (10%), and Mexico (8%). Table 11 lists the imports of salt by customs districts. Of the 39 customs districts that imported salt in 2006, the New York, NY, customs district was the largest in terms of tonnage, accounting for about 20% of the total. The quantity of imported salt was about 10 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 U.S. customers at prices lower than the comparable domestic product because production costs are lower abroad, currency exchange rates may favor the price of imported salt rather than the price of domestic salt, and ocean freight rates are less expensive than overland rail or truck rates.

World Review

Table 12 lists world salt production statistics for 113 nations based on reported and estimated information. In 2006, the total estimated world production increased to about 251 Mt. The United States remained a major leading salt-producing country, representing 18% of total world output. China is rapidly increasing its production. In 2006, estimated salt production in China was 54 Mt, making it the leading salt producer in the world.

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 to many countries. Many developing nations tend to develop their agricultural resources to feed their population first. Utilization of easily extractable mineral resources follows, and salt is one of the first mineral 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 factors, as previously discussed.

Australia.—Mitsui & Company, Ltd. of Japan purchased 87.3% of Akzo Nobel NV's solar salt company Onslow Salt Pty. in Western Australia for $110.5 million. The facility has an annual producton capacity of 2.5 Mt of solar salt. Mitsui also was the 100% owner of the Shark Bay Salt Joint Venture, which has an annual production capacity of 1.3 Mt (Industrial Minerals, 2006b).

Rio Tinto Minerals' Dampier Salt Ltd. announced a 500,000-t expansion at its Lake MacLeod solar salt operation near Carnarvon. The expansion would bring total annual production capacity to 1.9 Mt. Combined with the facilities at Port Hedland and Dampier, total production would be 9 million metric tons per year (Mt/yr) (Western Australia Business News, 2006).

Chile.—A 99.3% share of Sociedad Punta de Lobos (SPL) was acquired at midyear for $477 million by K+S Aktiengesellschaft, which was a major salt producer in Europe. SPL was the largest salt producer in South America. The company owned a solar salt facility in Brazil (Salinas Diamante Branco), a shipping company (Empremar S.A. in Chile), and a U.S. salt distribution company (International Salt Co.). The remaining 0.7% of the shares was owned by minority shareholders (Industrial Minerals, 2006a).

Outlook

The U.S. salt industry continued as an important leader in terms of high production, consumption, and world trade of salt. Despite the closing and idling of some chlorine plants during the previous several years, remaining chlorine facilities have run at higher capacity utilization rates, thereby offsetting any change in salt brine production and consumption. Because the chloralkali industry is energy-intensive, any increase in energy prices is likely to reduce chlorine manufacture as well as salt brine usage. Solar salt and vacuum pan salt production and consumption have been consistent and are expected to remain stable. The outlook for the U.S. salt industry is favorable for the foreseeable future. Rock salt production and consumption are heavily dependent on the severity of winter weather. Although the severity of the weather is virtually impossible to accurately forecast far in advance, the supplies of salt, from either domestic or imported sources, are more than adequate to meet any anticipated increase in demand.

Because salt is a relatively low-value commodity, the shipping cost for oceanic, rail, or truck transportation can be an important determining factor when attempting to secure supply sources from either domestic or foreign locations. If energy prices increase, one mode of transportation may be more cost-effective than others. Excluding deicing salt, domestic salt consumption may fluctuate but will probably continue to increase in accordance with population growth. U.S. total salt production in 2007 is expected to be an estimated 45 Mt.

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TABLE 1
SALIENT SALT STATISTICS[1]

(Thousand metric tons and thousand dollars)

	2002	2003	2004	2005	2006
United States:					
Production:[2]					
Brine	19,300	20,000	20,500	19,900	19,800
Rock	13,500	16,300	18,300	17,700	16,400
Solar	3,390	3,330	3,520	3,430	3,640
Vacuum and open pans	4,100	4,070	4,100	4,170	4,450
Total	40,300	43,700	46,500	45,100	44,300
Sold or used by producers:					
Quantity	37,700	41,100	45,000	45,000	41,100
Value	1,010,000	1,130,000	1,270,000	1,310,000	1,370,000
Exports:					
Quantity	689	718	1,110	879	973
Value	31,600	37,500	47,600	51,800	54,900
Imports for consumption:					
Quantity	8,160	12,900	11,900	12,100	9,490
Value	129,000	196,000	159,000	180,000	163,000
Consumption:					
Apparent[3]	45,100	53,200	55,800	56,200	49,600
Reported	43,600	50,200	50,700	53,100	42,400
World, production	214,000 r	221,000 r	233,000 r	246,000 r	251,000

rRevised.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Excludes Puerto Rico.
[3]Sold or used plus imports minus exports.

TABLE 2
SALT PRODUCED IN THE UNITED STATES, BY TYPE AND PRODUCT FORM[1]

(Thousand metric tons)

Product form	Vacuum and open pans	Solar	Rock	Brine	Total
2005:					
Bulk	793	2,000	17,300	19,900	39,900
Compressed pellets	1,340	392	XX	XX	1,740
Packaged	1,880	876	355	XX	3,110
Pressed blocks	156	155	78	XX	388
Total	4,170	3,430	17,700	19,900	45,100
2006:					
Bulk	1,040	2,710	15,800	19,800	39,400
Compressed pellets	1,300	315	XX	XX	1,620
Packaged	1,960	523	450	XX	2,930
Pressed blocks	150	93	120	XX	363
Total	4,450	3,640	16,400	19,800	44,300

XX Not applicable.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 3
SALT SOLD OR USED IN THE UNITED STATES, BY TYPE AND PRODUCT FORM[1, 2]

(Thousand metric tons and thousand dollars)

	Vacuum and open pans		Solar		Rock		Brine		Total	
Product form	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
2005:										
Bulk	751	53,500	1,520	41,400	17,700	438,000	19,800	139,000	39,800	672,000
Compressed pellets	1,340	192,000	372	46,600	XX	XX	XX	XX	1,710	238,000
Packaged:										
Less-than-5-pound units	204	NA	9	NA	(3)	NA	XX	XX	213	XX
More-than-5-pound units	1,530	NA	1,000	NA	357	NA	XX	XX	2,890	XX
Total	1,730	254,000	1,010	80,600	357	28,900	XX	XX	3,100	364,000
Pressed blocks:										
For livestock	96	NA	111	NA	73	NA	XX	XX	280	XX
For water treatment	57	NA	26	NA	4	NA	XX	XX	86	XX
Total	152	16,700	137	14,100	78	8,640	XX	XX	367	39,400
Grand total	3,970	516,000	3,040	183,000	18,100	475,000	19,800	139,000	45,000	1,310,000
2006:										
Bulk	970	97,000	1,500	47,200	13,400	312,000	19,800	186,000	35,700	643,000
Compressed pellets	1,280	198,000	381	51,500	XX	XX	XX	XX	1,660	249,000
Packaged:										
Less-than-5-pound units	269	NA	25	NA	31	NA	XX	XX	325	XX
More-than-5-pound units	1,630	NA	967	NA	405	NA	XX	XX	3,000	XX
Total	1,900	310,000	992	88,100	436	37,200	XX	XX	3,330	436,000
Pressed blocks:										
For livestock	114	NA	90	NA	88	NA	XX	XX	292	XX
For water treatment	36	NA	41	NA	19	NA	XX	XX	96	XX
Total	150	16,800	131	14,900	107	10,500	XX	XX	388	42,300
Grand total	4,300	622,000	3,000	202,000	14,000	360,000	19,800	186,000	41,100	1,370,000

NA Not available. XX Not applicable.
[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.
[3]Less than ½ unit.

TABLE 4
SALT SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE[1, 2]

(Thousand metric tons and thousand dollars)

	2005		2006	
State	Quantity	Value	Quantity	Value
Kansas	2,890	135,000	2,600	144,000
Louisiana	13,800	182,000	12,800	158,000
New York	6,840	327,000	4,890	257,000
Texas	9,600	118,000	9,570	132,000
Utah	2,250	132,000	2,350	149,000
Other Eastern States[3]	8,400	347,000	7,660	451,000
Other Western States[4]	1,250	73,500	1,230	79,100
Total	45,000	1,310,000	41,100	1,370,000
Puerto Rico[e]	45	1,500	45	1,500

[e]Estimated.
[1]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
DISTRIBUTION OF DOMESTIC AND IMPORTED SALT BY PRODUCERS IN THE UNITED STATES, BY END USE AND TYPE[1, 2]

(Thousand metric tons)

End use	Standard industrial classification	Vacuum and open pans		Solar		Rock		Brine		Total[3]	
		2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Chemical:											
Chloralkali producers	2812	17	15	301	293	514	369	17,600	16,300	18,400	17,000
Other chemical	28 (excludes 2812, 2899)	274	270	219	183	689	821	78	75	1,260	1,350
Total		291	285	520	476	1,200	1,190	17,700	16,400	19,700	18,400
Food-processing industry:											
Meat packers	201	260	262	62	62	76	55	--	--	398	379
Dairy	202	122	127	8	9	3	4	--	--	134	140
Canning	2091, 203	141	140	33	30	36	38	(4)	--	211	208
Baking	205	187	187	4	4	13	12	--	--	204	203
Grain mill products	204 (excludes 2047)	89	87	6	6	19	18	--	--	133	111
Other food processing	206-208, 2047, 2099	584	576	74	77	75	75	3	2	736	730
Total		1,380	1,380	187	188	222	202	3	2	1,800	1,770
General industrial:											
Textiles and dyeing	22	107	83	32	29	10	9	(4)	(4)	149	121
Metal processing	33, 34, 35, 37	12	10	20	18	74	21	(4)	(4)	107	49
Rubber	2822, 30 (excludes 3079)	3	3	(4)	(4)	1	2	60	61	65	66
Oil	13, 29	31	48	190	113	46	50	1,940	1,940	2,210	2,150
Pulp and paper	26	9	10	41	33	13	12	17	18	81	73
Tanning and/or leather	311	9	8	11	10	35	32	--	--	55	50
Other industrial	XX	131	144	63	61	150	80	(4)	1	344	286
Total		302	306	357	265	330	206	2,020	2,020	3,010	2,790
Agricultural:											
Feed retailers and/or dealers mixers	5159	326	317	391	389	426	384	(4)	(4)	1,140	1,090
Feed manufacturers	2048	41	39	132	122	304	342	--	--	477	503
Direct-buying end user	02	4	4	13	12	22	21	--	--	38	37
Total		371	359	536	523	753	747	(4)	(4)	1,660	1,630
Water treatment:											
Government (Federal, State, local)	2899	17	18	321	181	134	141	3	3	476	343
Commercial or other	2899	169	163	335	346	152	91	8	9	664	609
Total		186	181	656	527	287	232	11	12	1,140	953
Ice control and/or stabilization:											
Government (Federal, State, local)	9621	1	1	948	433	17,300	10,200	--	--	18,200	10,600
Commercial or other	XX	7	6	175	110	2,560	1,650	--	--	2,740	1,770
Total		8	7	1,120	543	19,800	11,800	--	--	21,000	12,400
Distributors:											
Agricultural distribution	5191	68	70	106	96	53	46	--	--	227	212
Grocery wholesalers and/or retailers	514, 54	513	491	234	249	57	30	--	--	803	770
Institutional wholesalers and end users	58, 70	108	113	64	64	55	27	(4)	(4)	228	204
Water-conditioning distribution	7399	119	118	358	347	33	23	1	1	511	489
U.S. Government resale	9199	(4)	(4)	1	1	1	1	--	--	1	2
Other wholesalers and/or retailers	5251	876	857	938	858	374	233	10	1	2,200	1,950
Total		1,680	1,650	1,700	1,620	573	360	11	2	3,970	3,630
Other[5]		96	109	115	65	436	516	238	204	885	894
Grand total		4,320	4,280	5,200	4,200	23,600	15,300	20,000	18,700	53,100	42,400

XX Not applicable. -- Zero.

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

[2]The quantity 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, data for 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/or incomplete data reporting.

[4]Less than ½ unit.

[5]Includes exports.

TABLE 6
DISTRIBUTION OF DOMESTIC AND IMPORTED EVAPORATED AND ROCK SALT IN THE UNITED STATES, BY DESTINATION[1, 2]

(Thousand metric tons)

	2005				2006			
	Evaporated				Evaporated			
Destination	Vacuum and open pans	Solar	Rock	Total	Vacuum and open pans	Solar	Rock	Total
Alabama	81	3	69	154	64	4	74	142
Alaska	5	3	--	9	10	3	--	14
Arizona	12	105	1	118	13	111	1	125
Arkansas	49	3	48	100	53	3	100	156
California	220	648	3	871	214	710	3	927
Colorado	12	83	166	261	12	80	253	346
Connecticut	15	112	198	325	15	65	87	167
Delaware	6	13	5	23	7	12	2	21
District of Columbia	1	35	5	41	1	10	2	12
Florida	84	253	5	341	76	220	4	299
Georgia	87	48	49	184	90	46	41	177
Hawaii	(3)	1	--	1	(3)	1	--	1
Idaho	21	100	1	122	22	111	50	182
Illinois	343	119	2,360	2,820	328	103	1,270	1,700
Indiana	263	122	922	1,310	255	114	466	835
Iowa	133	119	629	882	130	108	422	660
Kansas	86	66	296	448	84	67	260	411
Kentucky	60	6	675	741	60	6	599	666
Louisiana	51	3	342	396	57	3	496	556
Maine	15	15	252	282	17	8	168	193
Maryland	65	172	23	259	69	50	60	179
Massachusetts	34	79	331	444	32	32	190	254
Michigan	281	44	2,900	3,230	270	41	1,500	1,810
Minnesota	134	200	829	1,160	126	198	687	1,010
Mississippi	31	1	219	251	31	1	254	285
Missouri	148	63	367	578	142	62	340	544
Montana	1	42	(3)	43	1	44	1	46
Nebraska	60	46	172	277	56	44	112	212
Nevada	6	256	(3)	262	7	256	19	282
New Hampshire	16	101	187	304	16	54	131	201
New Jersey	118	124	78	320	120	96	71	287
New Mexico	18	70	(3)	88	21	57	--	78
New York	196	40	3,190	3,420	188	34	2,140	2,360
North Carolina	116	61	98	275	122	61	59	242
North Dakota	11	13	5	29	12	14	55	81
Ohio	446	49	3,280	3,780	449	48	1,230	1,720
Oklahoma	33	26	45	104	32	27	93	151
Oregon	17	110	(3)	127	18	100	--	118
Pennsylvania	187	92	2,260	2,540	182	67	1,040	1,290
Rhode Island	5	675	1	681	5	220	1	225
South Carolina	31	6	3	40	32	8	2	42
South Dakota	19	50	47	117	20	60	72	152
Tennessee	127	8	464	598	136	7	437	581
Texas	234	165	150	548	242	151	154	547
Utah	13	286	112	411	14	285	160	459
Vermont	6	5	419	430	6	4	222	233
Virginia	69	147	112	327	70	54	64	188
Washington	27	128	13	168	27	123	4	154
West Virginia	13	7	187	207	12	4	136	151
Wisconsin	215	149	1,720	2,080	211	140	1,280	1,640
Wyoming	(3)	20	2	22	(3)	20	2	22
Other[4]	100	101	399	600	98	56	466	620
Total[5]	4,320	5,190	23,600	33,200	4,280	4,200	15,300	23,800

-- Zero.

[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 ½ unit.

[4]Includes shipments to overseas areas administered by the United States, Puerto Rico, exports, and some shipments to unspecified destinations.

[5]Because data include salt imported, purchased, and/or sold from inventory from regional distribution centers, data for 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.

TABLE 7
AVERAGE VALUE OF SALT, BY PRODUCT FORM AND TYPE[1, 2]

(Dollars per metric ton)

Product form	Vacuum and open pans	Solar	Rock	Brine
2005:				
Bulk	71.23	27.30	24.73	7.03
Compressed pellets	143.73 r	125.18 r	XX	XX
Packaged	146.53 r	79.68 r	80.99 r	XX
Average[3]	120.50 r	77.39 r	52.86 r	7.03
Pressed blocks	109.79 r	102.69 r	110.76 r	XX
2006:				
Bulk	99.97	31.50	23.24	9.39
Compressed pellets	154.64	135.29	XX	XX
Packaged	163.44	88.83	85.23	XX
Average[3]	139.35	85.21	54.24	9.39
Pressed blocks	112.22	113.53	98.58	XX

rRevised. XX Not applicable.
[1]Net selling value, free on board plant, excluding container costs.
[2]Data are rounded to no more than three significant digits; may not add to totals shown.
[3]Salt value data reported prior to 1984 were an aggregate value per metric 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 aggregated values and quantities of the product form for each type of salt listed in table 3.

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

(Thousand metric tons and thousand dollars)

Country	2005		2006	
	Quantity	Value[2]	Quantity	Value[2]
Argentina	1	214	(3)	203
Bahamas, The	1	251	1	311
Bahrain	1	256	1	246
Belgium	2	284	2	226
Canada	686	32,700	775	37,500
Chile	(3)	86	(3)	78
China	9	395	12	772
Colombia	4	461	13	787
Costa Rica	3	355	2	365
Dominican Republic	(3)	135	1	162
El Salvador	1	219	1	269
Germany	20	1,000	1	1,300
Honduras	9	1,220	2	353
Hong Kong	1	310	(3)	275
Israel	(3)	41	(3)	56
Italy	(3)	252	(3)	54
Japan	22	2,860	31	2,420
Korea, Republic of	(3)	224	4	365
Kuwait	(3)	258	(3)	59
Lebanon	1	139	(3)	75
Malaysia	2	85	12	562
Mexico	92	4,270	82	4,040
Netherlands	1	153	2	275
Norway	1	307	--	--
Panama	1	115	1	130
Philippines	2	164	3	112
Saudi Arabia	6	1,480	2	667
United Arab Emirates	1	462	2	297
United Kingdom	3	731	3	491
Other	12	2,360	20	2,500
Total	879	51,800	973	54,900

-- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown. (The Harmonized Tariff Schedule of the United States code for salt is 2501.00.0000.)
[2]Free alongside ship value at U.S. ports.
[3]Less than ½ unit.

Source: U.S. Census Bureau.

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

(Thousand metric tons and thousand dollars)

District	2005		2006	
	Quantity	Value[2]	Quantity	Value[2]
Anchorage, AK	1	260	26	424
Baltimore, MD	5	1,310	1	344
Boston, MA	--	--	(3)	41
Buffalo, NY	34	3,100	118	6,590
Charleston, SC	(3)	11	(3)	24
Chicago, IL	20	2,400	(3)	1,400
Cleveland, OH	373	11,200	234	8,310
Columbia-Snake, OR	--	--	(3)	5
Dallas-Fort Worth, TX	(3)	61	(3)	51
Detroit, MI	60	5,290	181	8,390
Duluth, MN	(3)	47	1	79
El Paso, TX	5	291	1	128
Great Falls, MT	10	888	17	1,730
Honolulu, HI	(3)	44	(3)	271
Houston, TX	18	3,070	11	2,040
Laredo, TX	71	3,370	51	2,920
Los Angeles, CA	34	2,270	54	3,510
Miami, FL	6	1,410	22	1,770
Mobile, AL	2	182	(3)	99
New Orleans, LA	(3)	71	1	400
New York, NY	8	2,300	11	1,540
Nogales, AZ	2	78	2	119
Norfolk, VA	1	318	1	294
Ogdensburg, NY	51	2,750	90	3,820
Pembina, ND	3	597	7	847
Philadelphia, PA	1	124	1	250
Portland, ME	(3)	63	1	73
San Diego, CA	14	546	27	887
San Francisco, CA	36	1,680	19	988
San Juan, PR	--	--	(3)	3
Savannah, GA	(3)	56	(3)	69
Seattle, WA	10	978	13	1,160
St. Albans, VT	(3)	33	1	173
Tampa, FL	1	149	(3)	30
Washington, DC	--	--	(3)	4
Other[4]	114	6,850	80	6,160
Total	879	51,800	973	54,900

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown. (The Harmonized Tariff Schedule of the United States code for salt is 2501.00.0000.)

[2]Free alongside ship value at U.S. ports.

[3]Less than ½ unit.

[4]Unknown but assumed to be rail and/or truck shipments to Canada through various points of departure.

Source: U.S. Census Bureau.

TABLE 10
U.S. IMPORTS FOR CONSUMPTION OF SALT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

Country	2005		2006	
	Quantity	Value[2]	Quantity	Value[2]
Australia	1	112	1	147
Bahamas, The	1,370	14,200	961	11,400
Belgium	1	235	2	620
Brazil	150	2,220	132	1,640
Canada	3,950	62,600	4,150	71,300
Chile	3,840	49,700	2,440	27,900
China	12	2,010	11	2,240
Colombia	4	410	6	590
Egypt	588	5,820	113	2,880
France	30	4,960	37	4,950
Germany	4	1,200	15	1,160
India	(3)	9	1	54
Ireland	17	120	--	--
Israel	2	730	1	776
Italy	49	1,310	68	1,850
Japan	(3)	46	(3)	98
Korea, Republic of	1	761	2	706
Mexico	927	14,700	793	20,500
Netherlands	62	2,180	93	2,680
Netherlands Antilles	270	5,280	125	2,400
New Zealand	4	360	1	142
Pakistan	(3)	59	2	290
Panama	102	1,670	106	1,670
Peru	500	3,930	394	3,300
South Africa	6	461	22	899
Spain	3	1,480	9	1,490
United Kingdom	140	2,220	--	--
Venezuela	40	404	--	--
Other	6	871	13	1,340
Total	12,100	180,000	9,490	163,000

--Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown. (The Harmonized Tariff Schedule of the United States code for salt is 2501.00.0000.)

[2]Customs value only.

[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS OF SALT, BY CUSTOMS DISTRICT[1]

(Thousand metric tons and thousand dollars)

District	2005		2006	
	Quantity	Value[2]	Quantity	Value[2]
Anchorage, AK	23	722	27	668
Baltimore, MD	1,030	18,200	577	13,100
Boston, MA	1,290	16,100	476	9,500
Buffalo, NY	57	1,530	43	803
Charleston, SC	128	3,080	130	2,290
Charlotte, NC	73	2,020	--	--
Chicago, IL	525	7,580	613	8,940
Cleveland, OH	337	4,500	280	4,740
Columbia-Snake, OR	(3)	91	67	1,940
Dallas-Fort Worth, TX	(3)	32	(3)	129
Detroit, MI	1,510	25,000	1,460	29,600
Duluth, MN	67	869	4	236
El Paso, TX	(3)	2	(3)	12
Great Falls, MT	2	210	2	254
Honolulu, HI	(3)	3	(3)	15
Houston-Galveston, TX	4	925	14	782
Laredo, TX	1	289	1	334
Los Angeles, CA	121	3,620	119	4,460
Miami, FL	(3)	166	(3)	137
Milwaukee, WI	839	12,100	1,020	13,200
Minneapolis, MN	44	662	283	4,310
Mobile, AL	(3)	34	(3)	12
New Orleans, LA	19	654	10	867
New York, NY	2,480	34,900	1,870	28,300
Nogales, AZ	(3)	23	(3)	8
Norfolk, VA	112	1,500	87	1,020
Ogdensburg, NY	162	2,390	168	2,710
Pembina, ND	3	499	7	471
Philadelphia, PA	1,110	13,700	602	8,300
Portland, ME	1,060	12,400	822	9,990
Providence, RI	706	7,410	326	4,010
San Diego, CA	1	259	2	682
San Francisco, CA	4	729	6	744
San Juan, PR	4	425	7	674
Savannah, GA	42	1,590	35	1,250
Seattle, WA	2	603	6	967
St. Albans, VT	2	309	1	86
St. Louis, MO	5	315	(3)	101
Tampa, FL	309	4,710	369	5,450
Wilmington, NC	--	--	59	1,850
Total	12,100	180,000	9,490	163,000

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown. (The Harmonized Tariff Schedule of the United States code for salt is 2501.00.0000.)

[2]Customs value only.

[3]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 12
SALT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country[3]	2002	2003	2004	2005	2006[e]
Afghanistan, rock salt[e]	13	13	13	12	12
Albania	23	21	25	25 [r, e]	25
Algeria, brine and sea salt	205	191	183	197	200
Angola[e]	30	30	30	30	30
Argentina	1,080	1,668	1,372 [r]	1,700 [r, e]	1,700
Armenia	30	32	32	35 [r]	35
Australia, salt and marine salt	9,961 [r]	10,256 [r]	11,088 [r]	12,444 [r]	12,000
Austria, rock and brine	497 [r]	1,028 [r]	1,030 [r]	1,024 [r]	1,030
Azerbaijan	5	8	9 [r]	10 [r]	11
Bahamas, The	900 [e]	1,342	1,269	1,270	1,270
Bangladesh, marine salt[e, 4]	350	350	350	350	350
Belarus	1,369 [r]	1,543 [r]	1,833 [r]	1,839 [r]	1,900
Bolivia	4	2	1	1	1
Bosnia and Herzegovina[e]	98	84	85	85	22
Botswana[5]	315	229	208	210	210
Brazil:					
Brine salt	4,835	5,144	5,206	5,738 [r]	5,740 [p]
Rock salt	1,274	1,420	1,442	1,559 [r]	1,600
Total	6,109	6,564	6,648	7,297 [r]	7,340
Bulgaria	1,800 [e]	1,882	1,900	1,900	1,900
Burkina Faso[e]	5	5	5	5	5
Burma[e, 6]	35	35	35	35	35
Cambodia[e]	73 [r]	36 [r]	40	-- [r]	--
Canada	12,736	13,718	14,125	14,500	15,000
Cape Verde[e]	2	2	2	2	2
Chile	3,503	6,213	4,939	6,068 [r]	6,000
China	36,024	32,424	37,101	46,610 [r]	54,030 [7]
Colombia:					
Marine salt	336	248	294	311 [r]	315
Rock salt	192	199	232	162 [r]	170
Total	527	447	526	473 [r]	485
Costa Rica, marine salt[e]	20 [r]	20 [r]	20 [r]	20 [r]	20
Croatia	37	31	23 [e]	25 [e]	25
Cuba	176 [r]	176 [r]	206 [r]	173 [r]	173
Denmark, sales[e]	600	605	610	610	600
Djibouti	171 [r]	137 [r]	26 [r]	78 [r]	138
Dominican Republic:					
Marine salt[e]	50	50	50	50	50
Rock salt	157	107	--	--	--
Total	207	157	50 [e]	50 [e]	50
Ecuador[e]	75 [r]	75 [r]	75 [r]	75 [r]	75
Egypt[e]	2,400	2,400	2,400	2,400	2,400
El Salvador, marine salt	32	31	31	31	30
Eritirea, marine salt	116	5	3	3	3
Ethiopia, rock salt[4]	120 [e]	145	200	87 [r]	90
France, all sources[e, 8]	6,400 [r]	7,400 [r]	7,600 [r]	7,000	7,000
Georgia[e]	30	30	30	30	30
Germany:					
Industrial brines	8,307	9,078	10,432	9,904 [r]	7,200
Rock salt and other	6,572 [r]	6,620 [r]	7,833 [r]	8,834 [r]	9,280
Salt, evaporated, includes marine salt	858	727	572	594 [r]	1,000
Total	15,736 [r]	16,424 [r]	18,838 [r]	19,332 [r]	17,500
Ghana[e]	99	250	265	300 [r]	300
Greece[e]	150	150	150	150	150
Guadeloupe[e]	49	49	49	49	49
Guatemala[e]	50	60	60	60	60
Guinea[e]	15	15	15	15	15
Honduras[e]	42 [r]	42 [r]	42 [r]	42 [r]	40
Iceland[e]	5	5	5	5	5
India:[e]					
Marine salt	14,500	15,000	15,000	15,500	15,500
Rock salt	3	3	3	3	3
Total	14,500	15,000	15,000	15,500	15,500
Indonesia[e]	680	680	680	680	680
Iran[9]	1,664	2,003	1,791	2,000 [e]	2,000
Iraq[e]	203 [7]	50	50	25	25

See footnotes at end of table.

TABLE 12—Continued
SALT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country[3]	2002	2003	2004	2005	2006[e]
Israel	392	376	385 [r]	406 [r]	300
Italy, all sources[10]	3,343 [r]	2,922 [r]	2,876 [r]	2,900 [r]	3,000
Jamaica[e]	19	19	19	19	19
Japan	1,282	1,263	1,273	1,250	1,250
Jordan	407	12	29	29	29
Kenya, crude salt	46 [r]	48 [r]	60 [r]	52 [r]	52
Korea, North[e]	500	500	500	500	500
Korea, Republic of[e]	800	800	800	800	800
Kuwait[e]	45	45	50	50	50
Laos, rock salt	5	16	15	34 [r]	35
Lebanon[e]	4	4	4	4	4
Libya[e]	40	40	40	40	40
Madagascar[e]	60 [r]	60 [r]	60 [r]	70 [r]	70 [r]
Mali[e]	6	6	6	6	6
Malta, marine salt[e]	(11)	(11)	(11)	(11)	(11)
Martinique[e]	200	200	200	200	200
Mauritania[e]	6	(11) [7]	(11) [7]	(11)	(11)
Mauritius	7	7 [e]	7 [r]	8	8
Mexico	7,802	7,547	8,566	9,508 [r]	8,171 [7]
Mongolia, mine output	1	2	2	2	1 [7]
Morocco, marine and rock salt	267	237	254	254	250
Mozambique, marine salt[e]	80	80	80	80	80
Namibia, marine salt	630	698	754 [e]	700 [e]	700
Nepal[e, 12]	5	5	4	2 [r]	3
Netherlands[e]	5,000	5,000	5,000	5,000	5,000
Netherlands Antilles[e]	500	500	500	500	500
New Zealand[e]	70	70	70	100 [r]	100
Nicaragua, marine salt	30	31	52 [r, e]	52 [r, e]	50
Niger[e]	2	2	2	2	2
Oman[e]	14 [7]	15	15	15	15
Pakistan:[4]					
Marine salt[e]	14 [r]	17 [r]	12 [r]	14 [r]	13
Rock salt	1,423 [r]	1,426 [r]	1,640 [r]	1,648 [r]	1,650
Total	1,437 [r]	1,443 [r]	1,652 [r]	1,662 [r]	1,660
Panama, marine salt[e]	18 [r]	18 [r]	18 [r]	18 [r]	18
Peru	279	187	249	250 [e]	250
Philippines, marine salt	600	429 [r]	428 [r]	421 [r]	420
Poland:					
Rock salt	839	848	1,099	1,123 [r]	1,120
Recovered from brine	2,719	3,812	4,043	3,067 [r]	3,000
Total	3,558	4,660	5,142	4,190 [r]	4,120
Portugal, rock salt	604 [r]	602 [r]	662 [r]	588 [r]	600 [p]
Romania:					
Rock salt	46 [e]	47	43	46 [r]	45
Other	2,257	2,417	2,357 [r]	2,374 [r]	2,400
Total	2,303	2,464	2,400 [r]	2,420 [r]	2,450
Russia[e]	2,900 [r]	2,700 [r]	2,900 [r]	2,800	2,800
Saudi Arabia[e]	220	220	230	230	240
Senegal[e]	1,720	235	240	240	240
Serbia and Montenegro	42	78	75 [e]	75 [e]	75
Slovakia	97	133 [r]	121 [r]	150 [r]	150
Slovenia	128	125	125 [e]	125 [e]	120
Somalia[e]	-- [r]	-- [r]	--	--	--
South Africa	429	441	333 [r]	399 [r]	465 [p]
Spain:					
Marine and other evaporated salt	1,334 [r]	1,400 [r]	1,336 [r]	1,350 [r]	1,350
Rock salt	2,560 [r]	2,563 [r]	2,657 [r]	2,500 [r]	2,500
Total	3,894 [r]	3,963 [r]	3,993 [r]	3,850 [r]	3,850
Sri Lanka	73	79	79 [e]	80 [e]	81
Sudan	83	61	62 [e]	62 [e]	62
Switzerland[e]	300	300	300	300	300
Syria	145 [r]	128 [r]	141 [r]	110 [r]	110
Taiwan, marine salt	57	(11)	--	--	--
Tanzania	71	59	57	135 [r]	140

See footnotes at end of table.

TABLE 12—Continued
SALT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country[3]	2002	2003	2004	2005	2006[e]
Thailand:					
Rock salt	909	892	1,031	1,000 [e]	1,000
Other[e]	100	100	100	100	100
Total	1,009	992	1,131	1,100 [e]	1,100
Tunisia, marine salt	616	700 [e]	608	600 [e]	600
Turkey	2,197	2,243	2,158	2,200 [e]	2,200
Turkmenistan[e]	215	215	215	215	215
Uganda[e]	5	5	5	5	5
Ukraine	2,350 [r]	2,757 [r]	3,339 [r]	3,400 [r]	3,500
United Kingdom:[e]					
Brine salt[13]	3,200 [r]	3,200 [r]	2,800 [r]	3,000 [r]	3,000
Rock salt	1,500	1,700 [r]	2,000 [r]	2,000 [r]	2,000
Other salt[14]	1,000 [r]	1,000 [r]	1,000 [r]	1,000 [r]	3,000
Total	5,700 [r]	5,900 [r]	5,800	6,000 [r]	8,000
United States, including Puerto Rico:					
United States:					
Brine	19,300	20,000	20,500	19,900	19,800
Rock salt	13,500	16,300	18,300	17,700	16,400
Solar salt	3,390	333	3,520	3,430	3,640
Vacuum and open pan	4,100	4,070	4,100	4,170	4,450
Puerto Rico[e]	45	45	45	45	45
Total	40,300	43,700	46,500	45,200	44,300
Venezuela[e]	350	350	350	350	350
Vietnam	974 [r]	909 [r]	906 [r]	925 [r]	920
Yemen	125	116	120	120	120
Grand total	214,000	221,000 [r]	233,000 [r]	246,000 [r]	251,000

[e]Estimated. [p]Preliminary. [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 5, 2007.

[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]Year ending June 30 of that stated.

[5]From natural soda ash production.

[6]Brine salt produced, as reported by the Government of Burma in metric tons, was as follows: 2002—59,825; 2003—73,112; 2004—58,395; 2005—58,000 (estimated); and 2006—116,768.

[7]Reported figure.

[8]Includes marine and rock salt and salt solution.

[9]Year beginning March 21 of that stated.

[10]Includes marine salt.

[11]Less than ½ unit.

[12]Does not include production from Sardinia and Sicily, which is estimated to be 200,000 metric tons per year.

[13]Year ending July 15 of that stated.

[14]Data captioned "Brine salt" for the United Kingdom are the quantities of salt obtained from the evaporation of brine; that captioned "Other salt" are for salt content of brines used for purposes other than production of salt.