



2010 Minerals Yearbook

SALT [ADVANCE RELEASE]

SALT

By Dennis S. Kostick

Domestic survey data and tables were prepared by Martha L. Jackson, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

The United States was the world's leading salt producing nation until 2005, when China surpassed the United States to become the leading producing country in the world. Total U.S. salt production in 2010 decreased by 6% to 43 million metric tons (Mt) compared with that of 2009 (table 1). According to U.S. Geological Survey (USGS) data for 2010, 28 companies operated 60 salt-producing plants in 16 States. Of these, 10 companies and 13 plants produced more than 1 Mt each and accounted for 91% and 69%, respectively, of total U.S. production and accounted for 61% and 36%, respectively, of total value. Several companies and plants produced more than one type of salt. In 2010, 13 companies (25 operations) produced salt brine; 11 companies (15 operations), rock salt; 9 companies (12 operations), solar-evaporated salt; and 7 companies (17 operations), vacuum pan salt.

The five leading States were, in descending order of total salt sold or used, Louisiana with 32%; Texas, 21%; New York, 15%; Kansas, 7%; and Utah, 5%. Other Eastern States (Alabama, Michigan, Ohio, Tennessee, Virginia, 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% (table 5).

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 (table 2). 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. The data in table 2 are rated capacities for mines and refineries as of December 31, 2010. Rated capacity is defined as the maximum quantity of product that can be produced in a period of time on a normally sustainable long-term operating rate, based on the physical equipment of the plant, and given acceptable routine

operating procedures involving energy, labor, maintenance, and materials.

Of the 28 companies to which a canvass form was sent, 25 responded, representing 92% of the totals shown in this report. Data for the nonrespondents were estimated based on their prior responses to previous annual surveys, the 2010 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 28 companies and 60 plants by 2009.

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.

Rock Salt.—Rock salt is mined by the room-and-pillar method, which is similar to that used in coal and trona mining. Additional information about rock salt mining can be found in the salt chapter in Minerals Yearbook 2006.

Because the majority of rock salt was used for deicing, the operating rate of rock salt facilities fluctuated with the demand for deicing salt, again dependent on the severity of winter weather conditions. During periods of strong demand, production levels often achieve or exceed in certain situations, the rated capacities. Full mine capacity generally is a function of the hoisting capabilities of the mine. Assuming that the work week is 5 days (250 workdays per year), two working shifts and one maintenance shift per day, and at least one short-term planned turnaround for the mine and mill per year, table 2 lists the production capacities for domestic rock salt operations. In 2010, rock salt mining was 15.8 Mt, a 22% decrease compared with the 2009 total of 20.3 Mt.

Solar Evaporation.—Solar salt production was 4.83 Mt in 2010, which was a 24% increase from the 2009 total of 3.88 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. Additional information about solar salt production can be found in the 2006 salt Minerals Yearbook chapter.

Because evaporation rates must exceed the precipitation rates, the climatic conditions and geographic locations of solar evaporation facilities are critical to the successful production and harvesting of solar salt. Therefore, rated capacities in table 2 generally are based on the historical evaporation patterns within a region and vary depending on the location and the surface acres of the evaporation ponds. Only unpredictable seasonal precipitation and market conditions usually affect the production rates of the facilities.

Solution Mining.—U.S. salt brine production in 2010 was 18.5 Mt, which was about 4% more than the 2009 total of 17.8 Mt. The brine production capacities for table 2 are difficult to derive because they are based on the variabilities of the injection rate of the solvent and the solubility rates of the underground salt bodies, both of which determine the quantity of brine produced. In turn, these production levels are usually dependent on the demand for the products that the brine is being used to manufacture. Brine capacity is assumed to be equal to the amount of annual brine production. In order to avoid revealing company proprietary data, individual company brine capacities are not included in table 2.

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. 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. Additional information about salt brine production can be found in the 2006 salt Minerals Yearbook chapter.

Mechanical Evaporation.—Vacuum pan salt is not mined but is a type of salt produced using mechanical evaporation technology. Vacuum pan salt production was 4.10 Mt in 2010, which was a slight increase compared with the 2009 total of 4.03 Mt. The mechanical evaporation of salt by the vacuum pan process is dependent on the number and size of the vacuum crystallizers operating in series. Rated capacities in table 2 are usually easier to establish because of the proven design performance of the equipment.

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 grainer or open pan process uses open, rectangular pans with steam-heated immersion coils to evaporate the water in the brine. 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.

In October 2010, the Detroit Salt Co., LLC was acquired by the Kissner Group of Canada for an undisclosed price. The mine opened in 1906 and produced rock salt for deicing until about 1982, when the operation closed. It was purchased in 1997 and began operating as Detroit Salt. The Kissner Group was formed in

1878 and sold milled crops and agricultural salt products to local farmers. With the purchase of Detroit Salt, Kissner operates 14 facilities in Canada and the United States (Duggan, 2010).

Consumption

In 2010, apparent consumption (salt sold or used plus imports minus exports) was 55.8 Mt, whereas reported consumption (sales or use as reported by the salt companies, including their imports and exports) was 48.6 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 eight major categories comprising 29 end uses. The 2010 reported percentage distribution of salt by major end use was chemicals, 42%; ice control, 38%; distributors (grocery and other wholesalers and retailers, and so forth), 8%; agricultural and food processing, 4% each; general industrial and primary water treatment, 2% each; and other uses combined with exports, less than 1% (table 6). 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 6 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.—For most years, the leading consumer of salt, primarily as 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 produced through the dissolution of solar salt. Within this industry, the chloralkali sector remains the major consumer of salt for manufacturing chlorine, coproduct sodium hydroxide (caustic soda), and synthetic soda ash. Since 1986, when the last domestic 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 was 20.2 Mt in 2010, of which 19.1 Mt was for chloralkali manufacture and 1.09 Mt was for other chemical uses (table 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. 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 industry sources, about 48% of the salt used to manufacture chlorine was captive (produced by the chloralkali companies) and 31% was purchased brine; domestically purchased solar salt and rock salt made up 12% of the supply, and imported rock, solar, and vacuum pan salt, 9%.

In 2010, according to the U.S. Census Bureau, 9.72 Mt of chlorine and 7.48 Mt of sodium hydroxide (caustic soda or lye) were produced in the United States (U.S. Census Bureau, 2010). 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 17.0 Mt of salt for feedstock. Reported consumption of total domestic and imported salt for chlorine manufacture was 19.1 Mt (table 6). Typically, 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. In 2010, the difference of about 2 Mt have been because of unreported chlorine production data.

Salt is also used as a feedstock in chemical plants that make sodium chlorate, metallic sodium, and other downstream chemical products. 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 with sulfuric acid to produce sodium sulfate and hydrochloric acid. The “Other chemical” subsector is relatively small, representing about 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. E.I. du Pont de Nemours and Co. was the sole manufacturer of metallic sodium in the United States. The domestic market for metallic sodium decreased because sodium metal was no longer needed for the production of leaded gasolines. The leading use of sodium was for sodium borohydride production, which is the feedstock for sodium dithionite used as a reductive bleaching agent by the pulp and paper industry. Sodium metal also is used to manufacture sodium azide, which is used in automotive air bags. Other potential uses of sodium metal are in the remediation of chemical weapons, chlorofluorocarbons, pesticides, and polychlorinated biphenyls.

Ice Control and Road Stabilization.—In 2010, U.S. consumption of salt for this application was 18.7 Mt, which was about 11% more than that of 2009. Additional imports of rock salt by the salt companies were available if needed during 2010.

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 must 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.

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 groundwater 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.

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.

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.

Distributors.—A large 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 6). 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 was 4.02 Mt in 2010.

General Industrial.—The industrial uses of salt are diverse. They include, in descending order of quantity consumed, other industrial applications, oil and gas exploration, textiles and dyeing, pulp and paper, metal processing, tanning and leather treatment, and rubber manufacture. Total salt sold to these sectors was 931,000 t in 2010.

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-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 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.—Barnyard and grazing livestock need supplementary salt rations to maintain proper nutrition. In 2010, 1.84 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 food. Approximately 80% of the sodium intake by people comes from processed and prepared foods. Aside from table salt, sodium is found in many processed foods, such as monosodium glutamate and baking soda. 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 was 1.76 Mt in 2010 (Los Angeles Times, 2010).

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. 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).

Many consumers are confused with the words salt and sodium and often think the two words are synonymous, but they are not. Medical experts agree that the daily sodium intake per person should be 2,300 milligrams (mg) or less, which is the equivalent of one teaspoon of salt, or 5.8 grams (gm). Each gram of salt contains 0.4 gm of sodium, and one gram of sodium is equal to 2.5 gm of salt (Downs, 2010; ScienceDaily, 2010).

A study in the New England Journal of Medicine (NEJM) in January stated that cutting dietary sodium by three grams daily could reduce coronary heart disease and strokes. The report claimed that if everyone reduced their daily salt intake by one-half teaspoon, there would be between 54,000 and 99,000 fewer heart attacks, between 32,000 to 66,000 fewer strokes, between 44,000 and 92,000 fewer deaths, and between 60,000 to 120,000 fewer new cases of coronary heart disease in the United States each year. In addition, the salt reduction would result in an annual savings of \$24 billion in health care costs (Bibbins-Domingo and others, 2010).

The NEJM study received support by the New York City Department of Health and Mental Hygiene that endorsed draft guidelines that recommended a reduction of salt intake by 20% during a 5-year period. The recommendations also were endorsed by 25 other city or State agencies and 17 national health organizations (Caruso, 2010; Felten, 2010).

In an effort to address the concerns of excess sodium in the diet by the medical community and various government agencies, several major food processing companies voluntarily agreed to reduce the salt content in their processed foods. These companies found that consumers responded better to reducing their sodium intake when the sodium content was not emphasized on the labels. Foods that contained more than 500 mg of sodium per 100 gm were considered to be “high sodium” while foods with less than 120 mg of sodium per 100 gm were “low sodium.” Many of the food processing companies began an effort to reduce the salt content in their food products by about 20% during a 3-year period as recommended by the NEJM study, so that the changes were not so noticeable (Brat and Tamman, 2010; RedOrbit Inc., 2010).

Many food processors began to use sea salt in their foods as a replacement for vacuum pan salt (table salt) as a more natural and healthy alternative. By weight, sea salt and table salt contain about the same amount of sodium chloride, and both have the same basic nutritional value. Sea salt is advertized and marketed as containing beneficial trace elements contained in seawater. According to the Mayo Clinic, these trace elements are virtually insignificant for human health but do add some flavor, larger crystal size, and color to the sea salt compared with the table salt that eliminates trace minerals and adds iodine and various free-flowing agents (Phillips, 2010; Zeratsky, 2010).

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 2010, 913,000 t of salt was sold for primary water treatment and an additional 461,000 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 reduced by yearend 2010 because of moderately severe winter weather during late 2010. 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. The annual average values, as collected by the USGS and listed in table 8, 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 2010, the United States exported 595,000 t of salt; this was a 59% decrease compared with that of 2009 (table 9). In 2010, the majority of exports (76%) were to Canada. Salt was shipped to 30 countries through 21 customs districts; the Detroit, MI, district exported the most and represented 32% of the U.S. total (table 10). Based on U.S. Census Bureau statistics, the United States imported 12.9 Mt of salt from 39 countries in 2010, which was 12% less than was imported during 2009 (table 11). Chile was the leading source of imports, representing about 39% of total imports, followed closely by Canada (33%). Table 12 lists the imports of salt by customs districts. Of the 40 customs districts that imported salt in 2010, the New York, NY, customs district was the largest in terms of tonnage, accounting for about 16% of the total, followed by Baltimore, MD (13%); Philadelphia, PA (12%); Boston, MA (9%); Chicago, IL (7%); Detroit, MI (7%); and Ogdensburg, NY (6%). The quantity of imported salt was about 22 times that of exports. Net salt imports also represented about 23% of U.S. apparent consumption. This indicates the magnitude of the U.S. 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 cause the price of imported salt to be lower than the price of domestic salt, and ocean freight rates are less expensive than overland rail or truck rates.

World Review

Table 13 lists world salt production statistics for 113 nations based on reported and estimated information. In 2010, the total estimated world production increased to about 280 Mt. The United States remained a leading salt-producing country, representing 15% of total world output. China has rapidly increased its production. In 2010, estimated salt production in China was about 63 Mt, making it the leading salt producer in the world, or about 22% of total world output.

Most countries possess some form of salt production capability, with production levels set to meet their own domestic requirements and with additional quantities available for export to other 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.

Djibouti.— Salt Investment S.A. planned to construct a new salt plant at Lake Assal between the cities of Tadjoura and Yoboki to serve the markets in eastern Africa. However, the project was indefinitely suspended in March because of insufficient funds (Feytis, 2010).

Outlook

The U.S. salt industry continued to be a leader in terms of production, consumption, and world trade in salt. Despite the closing and idling of some chlorine plants since 2007 and the Nation's economic problems, the remaining chlorine facilities ran at higher capacity utilization rates, thereby increasing chlorine and caustic soda production as well as 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 constant and are expected to remain stable. U.S. salt production is expected to remain at the 2010 level through 2015. 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 is likely to continue to increase in accordance with population growth. U.S. total salt production is expected to be an estimated 44 Mt in 2011.

References Cited

- Bibbins-Domingo, Kirsten, Chertow, G.M., Coxson, P.G., Moron, Andrew, Lightwood, J.M., Pletcher, M.J., and Goldman, Lee, 2010, Projected effect of dietary salt reductions on future cardiovascular disease: The New England Journal of Medicine, January 20, 12 p. (Accessed February 17, 2010, at <http://content.nejm.org/doi/full/10.1056/NEJMoa0907355v1>.)
- Brat, Ilan, and Tamman, Maurice, 2010, Food makers quietly cut down on salt: The Wall Street Journal, January 11, p. B1.
- Caruso, D.B., 2010, Passing on salt—New York officials want sodium cut: The Chronicle Herald [Halifax, Nova Scotia, Canada], January 16. (Accessed January 19, 2010, via http://thechronicleherald.ca/cedrom_archives/.)
- Downs, Jimmy, 2010, New York City wants less salt in processed, restaurant foods: Sherwood, OR, foodconsumer.org, January 13. (Accessed January 14, 2010, at http://www.foodconsumer.org/newsite/Politics/Politics/new_york_city_salt_processed_restaurant_foods_1301100643.html.)
- Duggan, Daniel, 2010, Detroit's underground rock salt mine sold: Crain's Detroit Business, October 18. (Accessed March 11, 2011, at <http://www.craindetroit.com/article/20101018/FREE/101019888/detroits-underground-rock-salt-mine-sold.html#>.)
- Felten, Eric, 2010, Smack is bad, but the crackdown is on salt: The Wall Street Journal, January 15, p. W11. (Accessed January 19, 2010, via <http://online.wsj.com/article/sb10001424052748704281201575002880241611498.html>.)
- Feytis, Alex, 2010, Salt investment puts 4m. tpa salt project on hold in Djibouti: Industrial Minerals, December 8. (Accessed December 8, 2010, at <http://www.indmin.com/article/2728772/salt-investment-puts-4m-tpa-salt-project-on-hold-in-Djibouti.html>.)
- Los Angeles Times, 2010, NYC's proposed sodium cuts come with a tiny grain of salt: Los Angeles Times, January 12. (Accessed January 14, 2010, via http://latimesblogs.latimes.com/booster_shots/2010/01/salt-sodium-reduce-new-york-restaurant-packaged-food.html.)
- Phillips, Jennifer, 2010, Sea salt shaking up food industry—Is it more healthy or just marketing ploy?: Fox Carolina [Greenville, SC], December 6, 1 p. (Accessed December 7, 2010, at <http://www.foxcarolina.com/story/14757419/sea-salt-shaking-up-food-industry-12-06-2010>.)
- RedOrbit, Inc., 2010, Processed foods have too much salt: RedOrbit, Inc., January 26. (Accessed January 26, 2010, at <http://www.redorbit.com/news/health/1813751/processed-foods-have-too-much-salt/#>.)
- ScienceDaily, 2010, Even small dietary reductions in salt could mean fewer heart attacks, strokes, and deaths: Rockville, MD, ScienceDaily, January 21. (Accessed January 21, 2010, at <http://www.sciencedaily.com/releases/2010/01/10012092008.htm>.)
- U.S. Census Bureau, 2010, Production and stocks of inorganic chemicals—2010 summary: U.S. Census Bureau, MQ325A(10)—05, July. (Accessed July 7, 2011, at http://www.census.gov/manufacturing/cir/historical_data/mq325a/index.html.)
- Zeratsky, Katherine, 2010, Sea salt vs. table salt—Which is healthier?: Rochester, MN, Mayo Foundation for Medical Education and Research, October. (Accessed October 5, 2010, at <http://www.mayoclinic.com/health/sea-salt/AN01142>.)

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.

Other

- Chlorine Institute, The.
- Lefond, S.J., 1969, Handbook of world salt resources: New York, NY, Plenum Press, 384 p.
- Material Flow of Salt, The. U.S. Bureau of Mines Information Circular 9343, 1993.
- Salt. Ch. in Canadian Minerals Yearbook, annual.
- Salt. Ch. in Industrial Minerals and Rocks (7th ed.), Society for Mining, Metallurgy, and Exploration, Inc., 2006.
- Salt. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.
- Salt. Mining Engineering, annual review of industrial minerals. Salt Institute.
- Sodium Chloride. American Chemical Society Monograph No. 145, 1960.
- Solution Mining Research Institute.

TABLE 1
SALIENT SALT STATISTICS¹

(Thousand metric tons and thousand dollars)

	2006	2007	2008	2009	2010
United States:					
Production: ²					
Brine	19,800	19,700	18,900	17,800	18,500
Rock	16,500	16,800	20,900	20,300	15,800
Solar	3,640	3,650	4,070	3,880	4,830
Vacuum and open pans	4,450	4,420	4,200	4,030	4,100
Total	44,400	44,500	48,000	46,000	43,300
Sold or used by producers:					
Quantity	40,600	45,500	47,400	43,100	43,500
Value	1,310,000	1,520,000	1,690,000	1,750,000	1,690,000
Exports:					
Quantity	973	833	1,030	1,450	595
Value	54,900	59,600	65,900	74,100	69,300
Imports for consumption:					
Quantity	9,490	8,640	13,800	14,700	12,900
Value	163,000	171,000	282,000	337,000	322,000
Consumption:					
Apparent ³	49,100	53,300	60,200	56,400	55,800
Reported	42,400	53,200	53,100	45,000	48,600
World, production	261,000 ^r	266,000 ^r	276,000 ^r	279,000 ^{r, e}	280,000 ^e

^eEstimated. ^rRevised.

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

²Excludes Puerto Rico.

³Sold or used plus imports minus exports.

TABLE 2
U.S. SALT COMPANIES BY PRODUCTION CAPACITY, LOCATION, AND TYPE IN 2010

(Thousand short tons)

Company	Rock	Solar	Vacuum and	
			Open Pans	Brine
American Rock Salt Co., Hampton Corners, NY	4,500	--	--	--
Cargill, Inc.:				
Akron, OH	--	--	350	(1)
Avery Island, LA	2,700	--	--	(1)
Breux Bridge, LA	--	--	200	--
Cleveland, OH	4,000	--	--	--
Freedom, OK	--	300	--	--
Lake Point, UT	--	800	--	--
Lansing, NY	2,400	--	--	--
Hutchinson, KS	--	--	450	--
Newark, CA	--	750	150	(1)
St. Clair, MI	--	--	425	--
Watkins Glen, NY	--	--	450	--
Corpus Christi Brine Services, Inc., Benavides, TX	--	--	--	(1)
Detroit Salt Co. LLC, Detroit, MI	1,500	--	--	--
Dow Chemical Co., The:				
Freeport, TX	--	--	--	(1)
Plaquemine, LA	--	--	--	(1)
E.I. duPont de Nemours, New Johnsonville, TN	--	--	230	--
Huck Salt Co., Fallon, NV	20	--	--	--
Hutchinson Salt Co., Hutchinson, KS	750	--	--	--
Independent Salt Co., Kanapolis, KS	750	--	--	--
Key Energy Services, LLC, Hobbs, NM ²	--	--	--	(1)
Lyons Salt Co., Lyons, KS	600	--	--	--
Moab Salt, Inc., Moab, UT	--	250	--	--
Morton International, Inc.:				
Fairport, OH	2,000	--	--	--
Glendale, AZ	--	150	--	--
Grand Saline, TX	400	--	150	--
Grantsville, UT	--	500	--	--
Manistee, MI	--	--	360	--
Rittman, OH	--	--	600	--
Silver Springs, NY	--	--	375	(1)
South Hutchinson, KS	--	--	350	--
Weeks Island, LA	1,800	--	--	(1)
The Mosaic Co., Hersey, MI ³	--	--	300	--
New Mexico Salt and Mineral Corp., Loving, NM	--	100	--	--
North American Salt Co. ⁴				
Cote Blanche, LA	3,500	--	--	--
Lyons, KS	--	--	425	--
Ogden, UT ⁵	--	1,500	--	--
Occidental Chemical Corp., Wichita, KS ⁶	--	--	--	(1)
Olin Corp., McIntosh, AL	--	--	--	(1)
PB Energy Storage, Inc. ⁷				
Dale, NY	--	--	--	(1)
Napoleonville, LA	--	--	--	(1)
PPG Industries, Inc.:				
Lake Charles, LA	--	--	--	(1)
New Martinsville, WV	--	--	--	(1)
Redmond Clay & Salt Co., Inc., Redmond, UT	150	--	--	--

See footnotes at end of table.

TABLE 2—Continued
 U.S. SALT COMPANIES BY PRODUCTION CAPACITY, LOCATION, AND TYPE IN 2010

(Thousand short tons)

Company	Rock	Solar	Vacuum and	
			Open Pans	Brine
Searles Valley Minerals, Inc., Trona, CA ⁸	--	200	--	--
South Bay Salt Works, Chula Vista, CA ⁹	--	125	--	--
Tetra Technologies, Inc., Amboy, CA	--	75	--	--
Texas Brine Corp.:				
Beaumont, TX	--	--	--	(1)
Chacahoula, LA	--	--	--	(1)
Clemville, TX	--	--	--	(1)
Corpus Christi, TX	--	--	--	(1)
Houston, TX	--	--	--	(1)
LaPorte, TX	--	--	--	(1)
Wyoming, NY	--	--	--	(1)
US Salt L.L.C., Watkins Glen, NY	--	--	335	(1)
Union Texas Products Corp., Plaquemine, LA	--	--	--	(1)
United Salt Corp.:				
Baytown, TX	--	--	400	(1)
Carlsbad, NM	--	400	--	--
Hockley, TX	150	--	--	--
Saltville, VA	--	--	200	--
Total Production Capacity	25,200	5,150	5,750	20,400

-- Zero.

¹Includes brine for sale and for captive use. Individual brine capacity is assumed to be equal to the quantity of annual brine production, and therefore, considered company proprietary data. Brine producers include those chloralkali producers that produce captive brine and companies that supply brine for chloralkali manufacture, oil field chemicals, etc. Total brine production capacity is the quantity of brine produced for the year.

²Formerly Rowland Trucking Co., Inc.; then became Yale E. Key, Inc.

³Sells salt to North American Salt Co.

⁴Owned by Compass Minerals, Inc.

⁵Owned by Compass Minerals; operated by Great Salt Lake Minerals Corp.

⁶Formerly Vulcan Chemical Co.

⁷Associated with Texas Brine Corp.

⁸Formerly Pacific Salt and Chemical Co.

⁹Formerly Western Salt Co.

Source: U.S. Geological Survey.

TABLE 3
SALT PRODUCED IN THE UNITED STATES, BY TYPE AND PRODUCT FORM¹

(Thousand metric tons)

Product form	Vacuum and open pans				Solar	Rock	Brine	Total
2009:								
Bulk	934	2,990	19,600	17,800				41,400
Compressed pellets	1,220	330	XX	XX				1,550
Packaged	1,730	465	522	XX				2,720
Pressed blocks	140	91	156	XX				387
Total	4,030	3,880	20,300	17,800				46,000
2010:								
Bulk	959	3,880	15,500	18,500				38,800
Compressed pellets	1,230	326	XX	XX				1,560
Packaged	1,770	532	330	XX				2,640
Pressed blocks	138	92	67	XX				297
Total	4,100	4,830	15,800	18,500				43,300

XX Not applicable.

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

TABLE 4
SALT SOLD OR USED IN THE UNITED STATES, BY TYPE AND PRODUCT FORM^{1,2}

(Thousand metric tons and thousand dollars)

Product form	Vacuum and open pans		Solar		Rock		Brine		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
2009:										
Bulk	763	83,200	1,690	63,900	17,600	595,000	17,800	140,000	37,800	882,000
Compressed pellets	1,200	215,000	403	60,700	XX	XX	XX	XX	1,600	276,000
Packaged:										
Less-than-5-pound units	358	NA	1	NA	36	NA	XX	XX	395	XX
More-than-5-pound units	1,510	NA	921	NA	457	NA	XX	XX	2,890	XX
Total	1,870	385,000	922	92,700	493	56,100	XX	XX	3,280	534,000
Pressed blocks:										
For livestock	116	NA	129	NA	151	NA	XX	XX	396	XX
For water treatment	16	NA	1	NA	3	NA	XX	XX	20	XX
Total	132	18,800	130	18,000	154	17,200	XX	XX	416	53,900
Grand total	3,960	702,000	3,140	235,000	18,200	668,000	17,800	140,000	43,100	1,750,000
2010:										
Bulk	750	83,100	3,350	104,000	16,000	542,000	18,500	138,000	38,500	867,000
Compressed pellets	1,230	219,000	399	53,500	XX	XX	XX	XX	1,630	272,000
Packaged:										
Less-than-5-pound units	270	NA	31	NA	6	NA	XX	XX	308	XX
More-than-5-pound units	1,630	NA	717	NA	301	NA	XX	XX	2,640	XX
Total	1,900	396,000	748	71,300	307	34,000	XX	XX	2,950	502,000
Pressed blocks:										
For livestock	128	NA	131	NA	69	NA	XX	XX	328	XX
For water treatment	10	NA	3	NA	1	NA	XX	XX	14	XX
Total	139	19,700	134	14,700	70	11,000	XX	XX	342	45,400
Grand total	4,020	718,000	4,640	244,000	16,300	587,000	18,500	138,000	43,500	1,690,000

NA Not available. XX Not applicable.

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

²As 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.

TABLE 5
SALT SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY STATE^{1,2}

(Thousand metric tons and thousand dollars)

State	2009		2010	
	Quantity	Value	Quantity	Value
Kansas	2,710	188,000	3,080	194,000
Louisiana	13,200	229,000	14,100	234,000
New York	6,240	426,000	6,460	442,000
Texas	8,910	164,000	9,130	173,000
Utah	2,000	152,000	1,940	100,000
Other Eastern States ³	8,680	480,000	7,440	437,000
Other Western States ⁴	1,380	107,000	1,340	107,000
Total	43,100	1,750,000	43,500	1,690,000
Puerto Rico ^c	45	1,500	45	1,500

^cEstimated.

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

²The term “sold or used” indicates that some salt, usually salt brine, is not sold but is used for captive purposes by plant or company.

³Includes Alabama, Michigan, Ohio, Tennessee, Virginia, and West Virginia.

⁴Includes Arizona, California, Nevada, New Mexico, and Oklahoma.

TABLE 6
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	
		2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
Chemical:											
Chloralkali producers	2812	82	89	306	299	527	653	15,700	18,100	16,700	19,100
Other chemical	28 (excludes 2812, 2899)	205	232	200	188	832	668	6	1	1,240	1,090
Total		287	321	506	486	1,360	1,320	15,800	18,100	17,900	20,200
Food-processing industry:											
Meat packers	201	205	219	42	33	24	22	--	--	271	275
Dairy	202	120	155	11	11	5	5	--	--	136	171
Canning	2091, 203	157	198	28	32	30	29	--	--	215	258
Baking	205	308	346	3	5	12	13	--	--	324	364
Grain mill products	204 (excludes 2047)	85	96	5	9	9	8	--	--	100	113
Other food processing	206–208, 2047, 2099	493	406	103	93	77	80	1	1	674	580
Total		1,370	1,420	193	184	158	157	1	1	1,720	1,760
General industrial:											
Textiles and dyeing	22	15	19	30	35	3	5	(4)	(4)	48	59
Metal processing	33, 34, 35, 37	4	5	11	11	8	10	(4)	(4)	24	26
Rubber	2822, 30 (excludes 3079)	2	3	(4)	(4)	2	2	(4)	(4)	5	5
Oil	13, 29	62	67	162	133	80	109	11	16	314	325
Pulp and paper	26	9	8	31	32	18	19	--	--	58	59
Tanning and (or) leather	311	1	1	8	11	22	27	--	--	32	39
Other industrial	XX	120	110	87	91	104	216	(4)	(4)	312	418
Total		213	213	329	314	238	388	12	17	792	931
Agricultural:											
Feed retailers and (or) dealers mixers	5159	384	340	381	353	547	637	--	--	1,310	1,330
Feed manufacturers	2048	42	50	84	89	252	285	--	--	377	425
Direct-buying end user	02	3	4	8	7	10	74	--	--	21	85
Total		429	394	472	450	809	996	--	--	1,710	1,840
Water treatment:											
Government (Federal, State, local)	2899	41	47	297	369	68	170	2	5	409	591
Commercial or other	2899	123	63	341	143	128	109	9	7	602	322
Total		164	110	638	512	197	279	11	12	1,010	913
Ice control and (or) stabilization:											
Government (Federal, State, local)	9621	4	4	482	480	13,800	15,300	--	--	14,200	15,800
Commercial or other	XX	39	56	323	275	2,290	2,510	--	--	2,650	2,840
Total		43	60	805	755	16,000	17,900	--	--	16,900	18,700
Distributors:											
Agricultural distribution	5191	72	74	135	127	151	158	--	--	357	359
Grocery wholesalers and (or) retailers	514, 54	493	432	230	215	89	113	--	--	812	761
Institutional wholesalers and end users	58, 70	121	127	64	70	156	118	(4)	(4)	342	315
Water-conditioning distribution	7399	136	143	315	303	16	13	1	1	469	461
U.S. Government resale	9199	(4)	(4)	(4)	(4)	1	(4)	--	--	1	1
Other wholesalers and (or) retailers	5251	769	854	904	968	258	299	(4)	(4)	1,930	2,120
Total		1,590	1,630	1,650	1,680	671	702	2	2	3,910	4,020
Other ⁵		50	16	164	3	557	2	292	253	1,060	274
Grand total		4,150	4,160	4,760	4,390	20,000	21,700	16,100	18,400	45,000	48,600

-- Zero.

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

²The 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, 9, 10, 11, and 12.

TABLE 6—Continued

DISTRIBUTION OF DOMESTIC AND IMPORTED SALT BY PRODUCERS IN THE UNITED STATES, BY END USE AND TYPE^{1,2}

³Because 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.

⁴Less than ½ unit.

⁵Includes exports.

TABLE 7
DISTRIBUTION OF DOMESTIC AND IMPORTED EVAPORATED AND ROCK SALT IN THE UNITED STATES, BY DESTINATION^{1,2}

(Thousand metric tons)

Destination	2009				2010			
	Evaporated		Rock	Total	Evaporated		Rock	Total
	Vacuum and open pans	Solar			Vacuum and open pans	Solar		
Alabama	42	7	52	101	41	9	45	95
Alaska	3	2	--	5	3	3	--	6
Arizona	12	110	1	123	12	112	1	125
Arkansas	46	6	56	108	48	6	49	103
California	196	754	6	956	197	548	2	747
Colorado	11	66	10	87	12	85	58	156
Connecticut	16	115	115	245	17	165	151	332
Delaware	11	10	2	23	9	9	3	22
District of Columbia	(3)	33	2	35	(3)	43	9	52
Florida	71	215	4	291	68	198	3	269
Georgia	103	55	36	195	105	74	60	238
Hawaii	13	55	(3)	69	(3)	2	--	2
Idaho	8	39	(3)	48	21	90	(3)	111
Illinois	318	99	2,170	2,590	332	105	2,340	2,780
Indiana	249	121	729	1,100	254	108	923	1,290
Iowa	127	99	434	659	128	102	604	833
Kansas	76	44	1,140	1,260	78	45	859	983
Kentucky	64	7	830	900	72	7	1,160	1,240
Louisiana	66	4	235	306	51	7	216	274
Maine	15	8	148	172	20	6	73	99
Maryland	77	167	20	264	83	161	159	403
Massachusetts	32	48	302	382	32	43	238	313
Michigan	268	42	1,950	2,260	269	38	1,740	2,050
Minnesota	114	223	635	973	120	206	766	1,090
Mississippi	21	4	174	198	22	5	197	224
Missouri	119	71	414	604	112	75	532	719
Montana	1	68	(3)	69	1	64	(3)	65
Nebraska	56	39	23	118	56	43	145	244
Nevada	4	211	19	235	4	226	27	258
New Hampshire	15	108	53	176	15	56	42	113
New Jersey	104	118	112	334	105	107	118	330
New Mexico	20	133	(3)	153	21	192	(3)	213
New York	179	35	3,060	3,280	176	30	2,850	3,050
North Carolina	113	97	74	283	107	108	170	386
North Dakota	16	15	6	37	23	17	8	49
Ohio	426	40	2,090	2,550	422	44	2,710	3,180
Oklahoma	30	27	62	119	30	30	122	182
Oregon	19	39	1	59	19	38	(3)	57
Pennsylvania	172	76	1,920	2,170	181	119	2,180	2,480
Rhode Island	3	227	1	231	4	71	(3)	75
South Carolina	44	9	2	55	45	31	2	78
South Dakota	23	54	9	86	24	51	6	81
Tennessee	123	6	366	495	110	6	539	656
Texas	278	158	209 ^r	646	293	168	315	776
Utah	14	307	10	331	15	261	10	285
Vermont	5	1	218	225	5	1	202	209
Virginia	88	77	117	281	99	121	276	496
Washington	25	134	1	159	25	124	17	166
West Virginia	20	7	147	173	26	5	421	452

See footnotes at end of table.

TABLE 7—Continued
DISTRIBUTION OF DOMESTIC AND IMPORTED EVAPORATED AND ROCK SALT IN THE UNITED STATES, BY DESTINATION^{1,2}

(Thousand metric tons)

Destination	2009				2010			
	Evaporated			Total	Evaporated			Total
	Vacuum and open pans	Solar	Rock		Vacuum and open pans	Solar	Rock	
Wisconsin	199	158	1,520	1,870	186	155	1,340	1,680
Wyoming	1	47	(3)	49	2	64	(3)	66
Other ⁴	86	164	555	804	65	1	14	79
Total ⁵	4,150	4,760	20,000	28,900	4,160	4,390	21,700	30,300

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

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

³Less than ½ unit.

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

⁵Because 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 8
AVERAGE VALUE OF SALT, BY PRODUCT FORM AND TYPE^{1,2}

(Dollars per metric ton)

Product form	Vacuum and open pans	Solar	Rock	Brine
2009:				
Bulk	109.05	37.84	33.90	7.85
Compressed pellets	180.00	150.42	XX	XX
Packaged	206.27	100.56	113.74	XX
Average ³	178.67	72.09	36.08	7.85
Pressed blocks	142.57	138.06	111.79	XX
2010:				
Bulk	110.83	31.09	33.95	7.49
Compressed pellets	177.44	134.10	XX	XX
Packaged	209.19	95.33	110.96	XX
Average ³	180.08	50.90	35.40	7.49
Pressed blocks	141.56	110.27	158.23	XX

XX Not applicable.

¹Net selling value, free on board plant, excluding container costs.

²Data are rounded to no more than three significant digits; may not add to totals shown.

³Salt 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 9
U.S. EXPORTS OF SALT, BY COUNTRY¹

(Thousand metric tons and thousand dollars)

Country	2009		2010	
	Quantity	Value ²	Quantity	Value ²
Canada	1,360	50,200	451	40,000
China	1	528	1	797
Colombia	2	341	2	480
Costa Rica	2	362	2	379
Dominican Republic	1	393	1	271
Germany	1	475	1	494
Honduras	1	332	1	233
Japan	3	1,560	3	2,390
Malaysia	3	826	1	378
Mexico	45	7,560	29	6,500
Netherlands	1	704	1	630
Panama	1	133	1	611
Saudi Arabia	4	1,190	8	2,200
United Arab Emirates	1	520	2	609
Other	20	8,980 ^r	91	13,300
Total	1,450	74,100	595	69,300

^rRevised.

¹Data 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.)

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

Source: U.S. Census Bureau.

TABLE 10
U.S. EXPORTS OF SALT, BY CUSTOMS DISTRICT¹

(Thousand metric tons and thousand dollars)

District	2009		2010	
	Quantity	Value ²	Quantity	Value ²
Anchorage, AK	(3)	27	(3)	11
Buffalo, NY	30	5,850	76	9,830
Cleveland, OH	1	163	1	136
Detroit, MI	1,200	30,900	191	15,200
El Paso, TX	1	360	2	288
Great Falls, MT	2	644	2	647
Houston, TX	9	3,200	13	5,510
Laredo, TX	36	5,700	22	4,860
Los Angeles, CA	5	3,400	22	3,150
Miami, FL	3	1,410	3	1,190
Mobile, AL	(3)	36	(3)	108
New York, NY	13 ^r	3,630 ^r	13	4,390
Nogales, AZ	4	1,270	4	1,030
Norfolk, VA	1	594	2	1,490
Ogdensburg, NY	23	3,940	27	5,220
Pembina, ND	5	1,080	2	628
San Diego, CA	3	251	1	321
San Francisco, CA	3	995	3	821
Seattle, WA	5	1,440	34	2,450
St. Albans, VT	4	710	4	771
Other ⁴	102 ^r	8,500 ^r	173	11,300
Total	1,450	74,100	595	69,300

^rRevised.

¹Data 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.)

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

³Less than ½ unit.

⁴Unknown but assumed to be rail and (or) truck shipments to Canada through various points of departure. Also includes minor shipments through 19 other customs districts.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION OF SALT, BY COUNTRY¹

(Thousand metric tons and thousand dollars)

Country	2009		2010	
	Quantity	Value ²	Quantity	Value ²
Australia	1	175	118	3,590
Bahamas, The	811	12,600	935	16,500
Belgium	4	840	3	887
Brazil	168	3,060	208	4,290
Canada	5,940	131,000	4,240	119,000
Chile	5,170	107,000	5,000	96,100
China	9	1,390	9	2,720
Colombia	5	825	5	992
Cyprus	1	170	4	286
Egypt	291	5,560	398	4,930
France	17	6,790	8	6,800
Germany	9	1,340	6	1,820
India	2	424	2	435
Israel	9	3,840	10	4,620
Italy	70	3,830	68	3,970
Japan	32	558	1	96
Korea, Republic of	1	864	9	1,720
Mexico	1,260	33,400	1,000	28,200
Netherlands	217	6,410	362	11,100
Netherlands Antilles	28	1,010	--	--
New Zealand	(3)	65	(3)	91
Pakistan	2	627	2	946
Peru	408	4,150	406	4,420
South Africa	4	1,300	11	1,310
Spain	65	3,660	44	4,160
Switzerland	44	1,000	(3)	7
Syria	--	--	18	290
Tunisia	54	589	--	--
United Kingdom	67	2,690	9	916
Vietnam	1	184	2	219
Other	1 ^r	705 ^r	24	1,840
Total	14,700	337,000	12,900	322,000

^rRevised. -- Zero.

¹Data 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.)

²Customs value only.

³Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 12
U.S. IMPORTS OF SALT, BY CUSTOMS DISTRICT¹

(Thousand metric tons and thousand dollars)

District	2009		2010	
	Quantity	Value ²	Quantity	Value ²
Anchorage, AK	3	167	16	631
Baltimore, MD	850	27,600	1,690	38,100
Boston, MA	1,630	25,400	1,100	17,300
Buffalo, NY	5	583	122	2,780
Charleston, SC	82	1,610	97	2,710
Chicago, IL	1,170	18,200	912	15,400
Cleveland, OH	246	4,710	271	6,720
Columbia-Snake, OR	145	4,880	187	6,580
Dallas-Fort Worth, TX	(3)	81	1	390
Detroit, MI	1,890	33,300	895	19,700
Duluth, MN	36	3,230	28	2,610
Great Falls, MT	2	226	7	844
Los Angeles, CA	116	4,610	152	6,120
Miami, FL	1	336	1	294
Milwaukee, WI	1,470	20,400	675	12,000
Minneapolis, MN	277	4,110	206	4,140
Mobile, AL	2	2,150	2	2,260
New Orleans, LA	484	13,200	137	3,910
New York, NY	2,600	55,000	2,010	49,300
Norfolk, VA	47	866	240	5,210
Ogdensburg, NY	749	45,000	765	45,200
Pembina, ND	4	795	12	1,660
Philadelphia, PA	1,150	24,400	1,600	31,700
Portland, ME	854	14,400	708	12,300
Providence, RI	235	5,500	350	6,860
San Diego, CA	4	1,150	6	2,010
San Francisco, CA	3	1,230	3	1,370
San Juan, PR	5	883	5	1,050
Savannah, GA	39	2,230	42	1,500
Seattle, WA	119	5,670	44	3,110
St. Albans, VT	2	278	1	131
St. Louis, MO	(3)	79	1	320
Tampa, FL	356	6,900	490	9,830
Wilmington, NC	119	4,490	126	4,360
Other ⁴	4 ^r	3,130 ^r	4	3,660
Total	14,700	337,000	12,900	322,000

^rRevised.

Data are rounded to three significant digits; may not add to totals shown.
(The Harmonized Tariff Schedule of the United States code for salt is 2501.00.0000.)

²Customs value only.

³Less than ½ unit.

⁴Includes imports through six other customs districts.

Source: U.S. Census Bureau.

TABLE 13
SALT: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Thousand metric tons)

Country ³	2006	2007	2008	2009 ^e	2010 ^e
Afghanistan, rock salt ^e	12	12	12	12	12
Albania ^e	25	25	25	25	25
Algeria, brine and sea salt	260	183	202	269 ^{r,4}	275 ⁴
Angola ^e	35	35	35	35	45
Argentina	1,918	2,358	1,681	1,478 ^{r,4}	1,500
Armenia	37	35	37	37	40
Australia, salt and marine salt	11,424	10,855	11,160	10,316 ^{r,4}	11,968 ⁴
Austria, rock and brine	807	742	874 ^r	1,038 ^{r,4}	1,000
Azerbaijan	12	7	8	5 ⁴	5
Bahamas, The	1,152	8,823	10,244	10,000	10,000
Bangladesh, marine salt ^{e,5}	350	360	360	360 ^r	360
Belarus ^e	1,900	2,000	2,000	2,000	2,000
Bolivia	1	2	1	2 ^{r,4}	1 ⁴
Bosnia and Herzegovina	416	502	555	556 ^{r,4}	663 ⁴
Botswana ^{e,6}	210	210	210	210	210
Brazil:					
Brine salt	5,122	5,365	5,370 ^e	5,370	5,370
Rock salt	1,624	1,621	1,650 ^e	1,650	1,650
Total	6,746	6,986	7,020 ^e	7,020	7,020
Bulgaria ^e	2,000 ⁴	2,000	2,100	1,300 ^r	1,500
Burkina Faso ^e	5	5	5	5	5
Burma, brine salt	84	71	54	133 ⁴	97 ⁴
Cambodia	59	77	78	-- ^r	--
Canada	14,389	11,862	14,386	14,615 ^{r,4}	10,537 ^{p,4}
Cape Verde ^e	2	2	2	2	2
Chile	4,580	4,404	6,431	8,382 ⁴	8,400
China	56,630	59,760	59,520	58,450 ⁴	62,750 ⁴
Colombia:					
Marine salt	390	310	386 ^r	357 ^{r,4}	375
Rock salt	248	204	245 ^r	255 ^{r,4}	260
Total	638	514	632 ^r	612 ^{r,4}	635
Costa Rica, marine salt ^e	20	20	--	--	--
Croatia	30	33	33 ^e	32	32
Cuba	266	141	157	266 ^{r,4}	260
Denmark, sales ^e	600	600	600	600	60
Djibouti ^e	70 ^r	80 ^r	90 ^r	70 ^r	80
Dominican Republic, marine salt ^e	50	50	50	50	50
Ecuador ^e	75	75	75	75	75
Egypt ^e	1,200 ^e	1,214 ^r	1,879 ^r	2,952 ^{r,4}	3,000
El Salvador, marine salt ^e	30	30	30	30	--
Eritrea, marine salt ^e	60	60	60	60	60
Ethiopia, rock salt ⁵	218	240	260	281 ⁴	290
France, all sources ⁷	8,718	6,140	6,100	6,100	6,100
Georgia ^e	30	30	30	30	30

See footnotes at end of table.

TABLE 13—Continued
SALT: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Thousand metric tons)

Country ³	2006	2007	2008	2009 ^c	2010 ^c
Germany:					
Industrial brines	9,590	7,540 ^r	9,084	9,798 ^{r,4}	9,800
Rock salt and other	9,663	7,819	6,169 ^r	8,816 ^{r,4}	8,800
Salt, evaporated, includes marine salt	593	592	580	325 ^{r,4}	500
Total	19,846	15,951 ^r	15,833 ^r	18,939 ^{r,4}	19,100
Ghana ^c	123	124	239 ^r	200 ^r	200
Greece ^c	150	150	150	150	150
Guadeloupe ^c	49	49	49	49	49
Guatemala ^c	60 ^r	60 ^r	60 ^r	50	50
Guinea ^c	15	15	15	15	15
Honduras ^c	40	40	40	40	40
Iceland ^c	5	5	5	5	5
India: ^e					
Marine salt	15,500	16,000	16,000	16,500	17,000
Rock salt	3	3	3	3	3
Total	15,500	16,000	16,000	16,500	17,000
Indonesia ^c	700	700	700	720	720
Iran ^{e,8}	2,000	2,565 ⁴	2,158 ^{r,4}	2,200 ^r	2,200
Iraq ^e	25	153	109	113 ^r	110
Israel	434	400	421	357 ^{r,4}	400
Italy, all sources ⁹	3,438	2,214	2,200 ^e	2,200	2,200
Jamaica ^c	19	19	19,000 ^r	19,000 ^r	19
Japan ^c	1,166 ⁴	1,190	1,200	1,200	1,250
Jordan	29	17	25 ^r	25 ^r	25
Kazakhstan, salt and sodium chloride	417	228	504 ^r	223 ^{r,4}	229 ⁴
Kenya, crude salt ¹⁰	35	12	24	24 ^{r,4}	24
Korea, North ^e	500	500	500	500	500
Korea, Republic of	286	250	348	382 ^{r,4}	380
Kuwait ^c	13	14	14	14	14
Laos, rock salt ^e	35	35	35	35	35
Lebanon ^c	20 ^r	20 ^r	20 ^r	20 ^r	20
Libya ^c	40	40	40	40	40
Madagascar ^c	75	75	75	75	75
Mali ^c	6	6	6	6	6
Malta, marine salt ^c	(11)	(11)	(11)	(11)	(11)
Martinique ^c	200	200	200	200	200
Mauritania	(11)	(11)	1	(11) ^{r,4}	1
Mauritius	9	8	8 ^e	8	8
Mexico	8,371	8,400 ^e	8,809	7,445 ⁴	8,431 ⁴
Mongolia, mine output	1	1	(11) ^{r,e}	1 ^r	1
Montenegro, sea water evaporate ^c	5 ⁴	20	25	17	17
Morocco, marine and rock salt ^c	250 ⁴	250	250	250	250
Mozambique, marine salt ^c	150	110	110	110	110
Namibia, marine salt	604	811	732	782 ^{r,4}	780
Nepal ^{e,12}	--	2	-- ^r	-- ^r	--
Netherlands ^c	5,000	5,000	5,000	5,000	5,000
Netherlands Antilles ^c	500	500	500	500	--
New Zealand ^c	100	100	100	100	100

See footnotes at end of table.

TABLE 13—Continued
SALT: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Thousand metric tons)

Country ³	2006	2007	2008	2009 ^e	2010 ^e
Nicaragua, marine salt ^e	30	30	30	30	30
Niger ^e	1	1	1	1	1
Oman	26 ^r	10	11 ^r	31 ^{r,4}	30
Pakistan: ⁵					
Marine salt ^e	13	18 ^r	18 ^r	19 ^r	20
Rock salt	2,008	10,153 ^r	10,000 ^r	10,500 ^{r,4}	11,000
Total	2,021	10,171 ^r	10,018 ^r	10,500 ^r	11,000
Panama, marine salt ^e	18	18	18	17 ^{r,4}	17
Peru	1,253	1,185	1,276	1,567 ^{r,4}	1,570
Philippines, marine salt	418	438	510	516 ^{r,4}	520
Poland:					
Rock salt	1,130	591	618	989 ^{r,4}	990
Recovered from brine	2,899	2,931	2,783 ^r	2,534 ^{r,4}	2,530
Total	4,029	3,522	3,401 ^r	3,523 ^{r,4}	3,520
Portugal, rock salt	586	591	560	560 ⁴	561 ⁴
Rock salt	47	51	50 ^e	40 ^r	45
Other	2,574	2,425	2,400 ^e	2,000 ^r	2,000
Total	2,621	2,476	2,450 ^e	2,040 ^r	2,050
Russia	2,900	2,200	2,200 ^e	2,200	2,200
Saudi Arabia	1,752	1,507	1,600	1,600	1,800
Senegal	199	212	241	222 ^{r,4}	200
Serbia	30	30	30	29 ⁴	29
Slovakia	99	101	99 ^{r,e}	38 ^{r,4}	40
Slovenia ^e	2 ⁴	2	2	2	2
South Africa	465	412	416	425 ⁴	396 ⁴
Spain:					
Marine and other evaporated salt	1,469	1,500	1,500 ^e	1,500	1,500
Rock salt	2,834	2,850	2,850 ^e	2,850	2,850
Total	4,303	4,350	4,350 ^e	4,350	4,350
Sri Lanka ^e	88	70	111 ^r	112 ^r	110
Sudan	12	23	11 ^r	36 ^{r,4}	36
Switzerland ^e	300	300	300	300	300
Syria	133	81	81 ^e	78 ⁴	80
Tanzania	35	35	26 ^r	27 ^{r,4}	28
Thailand:					
Rock salt	1,008	1,135	1,212	1,200	1,200
Other ^e	100	100	100	100	100
Total	1,108	1,235	1,312	1,300	1,300
Tunisia, marine salt	1,127	933	1,063	1,000	1,000
Turkey	4,225 ^r	2,366 ^r	2,472 ^r	3,768 ^{r,4}	4,000
Turkmenistan ^e	215	215	215	215	215
Uganda ^e	5	5	5	5	5
Ukraine	5,996	5,548	4,425	5,395 ^{r,4}	5,400

See footnotes at end of table.

TABLE 13—Continued
SALT: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Thousand metric tons)

Country ³	2006	2007	2008	2009 ^e	2010 ^e
United Kingdom: ^e					
Brine salt ^{15, 14}	2,800	2,800	2,800	2,800	2,800
Rock salt	2,000	2,000	2,000	2,000	2,000
Other salt ¹⁴	1,000	1,000	1,000	1,000	1,000
Total	5,800	5,800	5,800	5,800	5,800
United States, including Puerto Rico:					
United States:					
Brine	19,800	19,700	18,900	17,800 ⁴	18,500 ⁴
Rock salt	16,500	16,800	20,900	20,300 ⁴	15,800 ⁴
Solar salt	3,640	3,650	4,070	3,880 ⁴	4,830 ⁴
Vacuum and open pan	4,450	4,420	4,200	4,030 ⁴	4,100 ⁴
Puerto Rico ^e	45	45	45	45	45
Total	44,500	44,600	48,100	46,100 ⁴	43,300 ⁴
Venezuela ^e	350	350	350	350	350
Vietnam	842	857	717 ^r	718 ^r	720
Yemen ^e	47 ^r	53 ^r	61 ^r	65 ^r	65
Grand total	261,000 ^r	266,000 ^r	276,000 ^r	279,000 ^r	280,000

^eEstimated. ^pPreliminary. ^rRevised. -- Zero.

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

²Table includes data available through July 15, 2011.

³Salt 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.

⁴Reported figure.

⁵Year ending June 30 of that stated.

⁶From natural soda ash production.

⁷Includes marine and rock salt and salt solution.

⁸Year beginning March 21 of that stated.

⁹Includes marine salt.

¹⁰Production by Magadi Soda Ash Ltd. only.

¹¹Less than ½ unit.

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

¹³Year ending July 15 of that stated.

¹⁴Data 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.