



# 2016 Minerals Yearbook

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**SALT [ADVANCE RELEASE]**

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# SALT

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The United States was the world's leading salt-producing nation until 2005, when China surpassed the United States to become the world leader. Total U.S. salt production in 2016 decreased by 8% to 41.7 million metric tons (Mt) compared with production of 2015 (table 1), making the United States the second-leading salt-producing nation. Global salt production in 2016 was 274 Mt with 67 Mt produced in China (table 13).

Salt, also known as sodium chloride, consists of 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 crystalline 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 were developed by the U.S. Geological Survey (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, 2016. 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.

According to survey respondents, 26 companies operated 62 salt-producing plants in 16 States in 2016. Of these, 8 companies and 11 plants produced more than 1 Mt each and accounted for 90% and 61%, respectively, of total U.S. production and for 91% and 39%, respectively, of total value. Several companies and plants produced more than one type of salt. In 2016, 6 companies (17 operations) produced vacuum pan salt; 11 companies (14 operations), solar-evaporated salt; 9 companies (14 operations), rock salt; and 12 companies (26 operations), salt brine.

Five of the seven leading producing States were, in descending order of total salt sold or used, Louisiana with 30%; Texas, 18%; New York, 17%; Kansas, 6%; and Utah, 5%. Ohio

and Michigan were among the top seven salt-producing States in total quantity of salt sold or used, but their rankings were withheld to avoid disclosing company proprietary data (table 5). The distribution of domestic and imported evaporated and rock salt to each State and the District of Columbia in 2016 is reported in table 7.

Of the 26 companies to which a canvass form was sent in 2016, 16 responded, representing 60% of the totals shown in this report. Data for the nonrespondents were estimated on the basis of their responses to previous annual surveys, the 2016 production estimate survey, or brine production capabilities for chloralkali manufacture based upon published chlorine production capacities [that is, 1.75 metric tons (t) of salt required per ton of chlorine capacity]. For rock salt producers, data from the Mine Safety and Health Administration also were used to estimate production.

The USGS does not survey small-scale producers of culinary "sea salt" operating from several locations in the United States. Most of these operations are located along the Atlantic, Gulf, or Pacific coasts but some interior operations extract brine for specialty salt production. These boutique operations, in total, are thought to annually produce less than 100 tons of sea salt.

The four types of salt that were surveyed were classified according to the method of recovery as follows: vacuum pan salt, from mechanical evaporation of a purified brine feedstock; solar salt, from solar evaporation of seawater, landlocked bodies of saline water, or primary or byproduct brines; rock salt, from surface or underground mining of halite deposits; and salt brine, from solution mining of underground halite deposits. Data for brine production and consumption represent anhydrous salt content only and not the weight of the water (tables 3, 4).

In April, American Rock Salt Co., Livingston County, NY, announced plans to expand its underground mine. The expansion was expected to add about 10 years to the life of the mine, which was first opened in the late 1990s and exclusively produces deicing salt (Santora, 2016).

In June, Westlake Chemical Corp. acquired Axiall Corp.; both produce chloralkali among other products, such as olefins, vinyls, and polyethylene. With this acquisition, Westlake was thought to have the third-largest chloralkali capacity in North America. Axiall had salt brine operations in Lake Charles, LA, and New Martinsville, WV (ICIS, 2016).

**Vacuum Pan Salt.**—Vacuum pan salt production was 4.05 Mt in 2016, a 3% decrease compared with the 2015 total of 4.19 Mt. 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 were established by using 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.

**Solar Salt.**—Solar salt production was 2.9 Mt in 2015, an 19% decrease from the 2015 total of 3.59 Mt. Because evaporation rates must exceed 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.

**Rock Salt.**—In 2016, rock salt production was 17.9 Mt, a 12% decrease compared with the 2015 total of 20.4 Mt. Rock salt is mined by the room-and-pillar method, which is similar to that used in coal and trona mining. Rock salt producers operated at lower rates in 2016 because of decreased demand from road salt consumers.

Because most rock salt is used for deicing, the operating rate of rock salt facilities fluctuates with the demand for deicing salt, which is 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) with two working shifts, one maintenance shift per day, and at least one short-term planned turnaround for the mine and mill per year, the production capacities for domestic rock salt operations are as listed in table 2.

**Salt Brine.**—U.S. salt brine production in 2016 was 16.9 Mt, unchanged from the 2015 total. Brine production capacities are difficult to derive because they are based on the variabilities of the injection rate of the solvent and the dissolution 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.

Solution mining is used to obtain a sodium chloride feedstock for vacuum pan salt production and for chlorine, caustic soda, and synthetic soda ash manufacture. Synthetic soda ash, however, is not produced in the United States. 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.

## Consumption

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 2016 reported

consumption (sales or use as reported by the salt companies, including their exports and imports) was 48.4 Mt, and the distribution of salt by major end use was ice control, 42%; chemicals, 39.3%; distributors (grocery and other wholesalers and retailers and so forth), 8.8%; food processing, 3.6%; agricultural, 2.5%; general industrial, 1.7%; other uses combined with exports, 1.1%; and primary water treatment, 1% (table 6).

In 2016, apparent consumption (salt sold or used plus imports minus exports) was 51.6 Mt (table 1). Reported consumption statistics are those reported only by domestic salt-producing companies. Apparent consumption normally is greater than reported consumption because apparent consumption includes additional quantities of salt imported and exported by non-salt-producing companies, such as some chloralkali operations and salt distributors, especially importers along the northeastern coast of the United States, primarily for snow and ice control.

Distributors represented a substantial share of salt sales by the salt industry; all of this salt was ultimately resold to a variety of end users. For a more complete analysis of end-use markets, specific sectors of distribution listed in table 6 can be combined, such as agricultural and water treatment quantities reported by salt producers and those supplied by distributors. Aside from the various types of salt, there are distinctions in packaging and applications of salt. Salt for human consumption is packaged in various sized containers for several specialized purposes.

**Ice Control and Road Stabilization.**—In 2016, U.S. consumption of salt for this application was 20.3 Mt, which was about 10% less than that of 2015. After relatively high consumption for this use from 2013 through 2015, consumption began to decrease in late 2015 and remained at this lower level throughout 2016.

The use of salt brine for road deicing has been increasing during the past several years. Regular rock salt can be dissolved to create a salt brine solution, which is used as pretreatment prior to ice or snow accumulation.

Salt is an inexpensive, widely available, and effective ice-control agent. It does, however, become less effective as temperatures decrease below about 9.5 °C to 6.5 °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 use, spring rains and thaws usually dilute the concentrations of sodium in the area where salt was applied. However, when the salt leaches from the immediate environment adjacent to roads, it sometimes collects in lakes and other inland freshwater bodies, potentially changing water chemistry and affecting ecosystems and communities that use this water.

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.

The winter of 2015–16 was characterized as an El Niño event with unusually warm weather in many parts of the United States starting in late 2015 and continuing into 2016 (Moran, 2016). The warmer weather allowed agencies to maintain satisfactory stocks of salt in most locales throughout the winter. In the first half of January 2016, most snow belt locations had full stockpiles of salt, and only a few locations in the upper Midwest had reported applications of salt for roadways (FOX6 News, 2016; Hayes, 2016; WHIO, 2016). Before the end of January, salt or brine was spread in more locations, including Delaware, Kentucky, Missouri, North Carolina, and Pennsylvania, but no shortages or delivery problems were reported (Campbell, 2016; Hoff, 2016).

In February 2016, most areas had little freezing precipitation because warmer than average temperatures occurred throughout many areas with only occasional average or below average temperatures. Some parts of Illinois, Pennsylvania, and Wisconsin reported significant snow and ice during the month requiring the use of salt or brine (Mannion, 2016; Shatzer, 2016; WISN, 2016).

As the winter wrapped up in March, some road salt users were surprised to find that although the winter was milder and snow fall was less than average, winter road budgets and salt supplies were approaching deficit condition. This situation was reported in parts of Connecticut, Illinois, and Massachusetts where precipitation, although rain and not snow, froze at night and required salt to eliminate hazardous conditions prior to the morning commute. Repeated and frequent freeze and thaw cycles as temperatures fluctuate above and below the freezing point may require more salt applications than sustained periods of subfreezing temperatures (Shaner, 2016; Torres Ocasio, 2016).

Although a few locations used much of their salt, most road salt buyers entered the spring and summer season with some stockpiles of leftover salt and were anticipating buying less salt for the next winter (Carleo-Evangelist and others, 2016; Kincaid, 2016). Throughout the summer and fall, as communities purchased salt for the next winter, quoted prices were generally lower than those of the previous year (Bercik, 2016; Cunningham, 2016).

Severe winter weather began in December for the 2016–17 season, and road crews were active throughout the United States in the East and Midwest (Illinois, Indiana, New York, Pennsylvania, and Wisconsin) and in the West (Colorado, Idaho, Oregon, Utah, and Washington). Compared with the previous year, December 2016 experienced much colder weather and stronger demand for road clearing salts and brines, but most users were well stocked with salt, which was delivered at lower unit prices (Barrett, 2016; Eherts, 2016; Hermiston, 2016; Parkinson, 2016; Payerchin, 2016). The Oregon Department of Transportation (ODOT) increased the use of salt in some areas of the State after complaints of poor road conditions from residents. Traditionally, the ODOT did not use road salt as was done in California and Washington but changed its policy to allow some limited use of salt (Njus, 2016).

In addition to use on highways during winter weather, salt can be added to soil to stabilize it and to provide firmness to the

foundation upon which highways are built. The salt also acts to minimize the effects of changes in humidity and traffic load, which can cause shifting in the subsurface.

**Chemical.**—Since 1941, when the U.S. Bureau of Mines began collecting end-use data for salt, the leading consumer of salt, primarily as salt brine, has been the chemical industry, except for 2011 and 2013–16 when salt for road deicing led. 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 its inability to compete 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 19 Mt in 2016 (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 classified as the first generation of products made from salt. These two chemicals are used to manufacture other materials such as household cleaners, plastics, and solvents for dry cleaning, which are classified as 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 accounted for 12% of the supply, and imported rock, solar, and vacuum pan salt, combined, accounted for 9%.

The industry average ratio is 1.75 t of salt is required to produce 1.0 t of chlorine and 1.1 t of joint-product sodium hydroxide. Reported consumption of total domestic and imported salt for chlorine manufacture was 17.3 Mt (table 6); however, the data do not include salt imported directly by the chlorine producers or captive brine produced by them.

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 9% of domestic salt sales for the entire chemical sector and only 4% of total domestic salt consumption. The amount of salt consumed in this category decreased by 21% in 2016 compared with the historically high levels in 2014 and 2015.

The consumption of salt for metallic sodium has declined during the past several years. The Chemours Co. was the sole manufacturer of metallic sodium in the United States in 2016. The domestic market for metallic sodium decreased because sodium metal was no longer needed to produce leaded gasolines. The leading use of sodium metal was for sodium borohydride production, the feedstock for sodium dithionite, which was 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 and as a power-reducing agent in the alternative polysilicon manufacturing processes. Other potential uses of sodium metal are in the remediation of chemical weapons, chlorofluorocarbons, pesticides, and polychlorinated biphenyls.

**Distributors.**—A large quantity of salt is marketed through 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 4.3 Mt in 2016.

**Food Processing.**—Nearly every person uses some quantity of salt in food. Aside from table salt, sodium is found in many processed foods. Salt is added to food by the food processor or by the consumer as a flavor enhancer, preservative, binder, fermentation-control additive, texture-control agent, and color developer. Table salt may contain 0.01% potassium iodide as an additive to provide a source of iodine, which is essential to the oxidation processes in the human body. Kosher salt, sea salt, condiment salt, and salt tablets are special varieties of salt.

The food-processing category is subdivided, in descending order of salt consumption, into other food processing, meat packers, canning, dairy, baking, and grain mill products. Total salt sold for food processing was 1.76 Mt in 2016, slightly less than that of 2015 (table 6).

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 leads to spoilage of the product. Salt in sausages forms a binding gel made up of meat, fat, and moisture. Salt also acts as a flavor enhancer and as a tenderizer.

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 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 dairy desserts, ice cream, natural and processed cheese, and specialty dairy products.

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, manufactured 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).

**Agricultural.**—Barnyard and grazing livestock need supplementary salt rations to maintain proper nutrition. In 2016, 1.23 Mt of salt was sold to the agricultural industry (table 6). Animal feed and water conditioning salt are pressed into 22.7-kilogram (50-pound) 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.

**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, pulp and paper, metal processing, tanning and leather treatment, and rubber manufacture. Total salt sold to these sectors declined slightly to 832,000 t in 2016.

In oil and gas exploration, salt is an important component of drilling fluids used in well drilling. It is used to flocculate and increase the density of the drilling fluid to overcome high downwell gas pressures. When 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 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, a strong oxygen-based bleaching chemical. The chlorine dioxide process, which originated in Germany after World War I, has become more popular because of efforts to reduce or eliminate other bleaching compounds containing chlorine.

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

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 type rubbers. Salt brine and sulfuric acid are used to coagulate an emulsified latex made from chlorinated butadiene.

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.

**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. Many commercial and residential water-softening units use salt to remove the ions that cause the hardness. Salt is compressed into pellets that are used for water conditioning. 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 2016, 467,000 t of salt was sold for primary water treatment, and an additional 437,000 t was sold for water conditioning by distributors (table 6).

## Transportation

Because the locations of the salt supplies are not often near consumers, transportation costs significantly add to the price of salt. In some cases, shipping costs are higher than the actual value of the salt. 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.

Transoceanic imports of salt have been increasing in some areas of the United States because they are cost competitive with purchasing salt from domestic suppliers and transporting it using barge, rail, or truck. 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. When salt is packaged, handled, and shipped in smaller units, the costs increase and are reflected in higher selling prices.

## 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 of lower mining and processing costs. Vacuum pan salt is the most expensive because of its purity and the higher energy costs involved in processing.

Price quotations are not synonymous with average unit 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 unit values, as collected by the USGS and listed in table 8, represent a national average unit value for each of the types of salt and the various product forms.

## Foreign Trade

In the Harmonized Tariff Schedule of the United States (HTS), 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 HTS code for salt is 2501.00.0000. The same classification also applies to exports. 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 2016, the United States exported 716,000 t of salt; this was a 14% decrease compared with that of 2015 (table 9). In 2016, most exports (81%) were to Canada. Salt was shipped to 101 countries through 39 customs districts; the Cleveland, OH, district exported the most and represented 50% of the U.S. total. No other district exported more than 8% of the U.S. total (table 10). Large percentage increases in exports and imports are normally in response to increased demand for rock salt for deicing related to the

frequency and severity of winter storms in Canada and the United States.

The United States imported 12.1 Mt of salt from 74 countries in 2016, which was 44% less than was imported during 2015; consumption of road salt decreased in 2016 (table 11). Chile was the leading source of imports, supplying about 36% of total imports, followed by Canada (26%). Table 12 lists the imports of salt by customs district. Of the 40 customs districts that imported salt in 2016, the New York City, NY, customs district led in terms of tonnage, accounting for about 15% of the total, followed by Baltimore, MD, and Boston, MA (11% each) and Philadelphia, PA (8%).

The quantity of salt imports was about 17 times that of exports. Net salt imports also represented about 22% of U.S. apparent consumption, indicating the magnitude of the U.S. reliance on salt imports. Most 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 89 countries or localities based on reported and estimated information. In 2016, the total estimated world production decreased slightly to about 274 Mt. The United States remained the second-leading salt-producing country, representing 15% of total world output. China has rapidly increased its production in the 21st century from 37 Mt in 2004 to 67 Mt in 2016, making it the leading salt producer in the world.

**Australia.**—Germany's K+S Group AG announced plans for a new salt operation in the Pilbara region of Western Australia. The development of the Ashburton Salt operation was in response to increasing demand in Asia and was projected to produce 3.5 million metric tons per year (Mt/yr) (Ingram, 2016).

**Canada.**—K&S Windsor Salt Ltd began an expansion of its Ojibway salt mine in Windsor, Ontario. The project to expand the mine and upgrade equipment was expected to extend the life of the mine by 50 years (CBC News, 2016).

**China.**—The Government of China announced plans to dismantle the centuries-old salt monopoly, which controlled all salt movement and sales throughout the country. The China National Salt Industry Corp. determined production levels, prices, and distribution for about 100 companies that operated under license. The change in salt policy was in response to complaints about high salt prices in the country and regional differences in demand (Zhu, 2016).

**India.**—After weeks of protest by salt producers in April and May, the government of the State of Gujarat removed a 5% value-added tax on salt. Gujarat produced around 17 Mt/yr of salt, which represented about 70% of the national consumption (PTI, 2016). Hindustan Salt Ltd. planned to restart a rock salt operation at Bhatog in Mandi district of the State of Himanchal Pradesh. The mine last operated in 2011 (Tribune, The, 2016).

**Indonesia.**—By August, producers anticipated a 70% drop in salt production in East Java where 70% of national production was accomplished. A La Niña weather pattern was blamed for the excessive rain that fell in Indonesia, limiting salt production. Salt from Australia was expected to supplement domestic production when needed (Boediwardhana, 2016).

**Kazakhstan.**—A second salt operation was opened on Inder Lake in Atyrau. Initial salt production of 30,000 metric tons per year of sodium hypochlorite was intended for use in water purification (Suzdykbayev, 2016).

**Laos.**—The Veunkham Salt Co. Ltd in the Xaythany district worked to improve its export potential by garnering international certification. The company sought International Organization for Standardization (ISO) certification to ship salt to regional consumers in Cambodia, Japan, the Republic of Korea, and Malaysia (Vientiane Times, 2016).

**Malta.**—A project was completed to restore solar salt production at a historic site near the Salini Port on St. Paul's Bay. The new operation, predicted to produce thousands of tons of salt each year, was partially funded by the European Union (Castillo, 2016).

**Namibia.**—Gecko Namibia (Pty) Ltd conducted feasibility studies and pilot testing for several salt claims in the Cape Cross salt pan area. The company reported more than 330 Mt of rock salt in the area with 55 Mt in Gecko's mineral licenses, which it planned to market for deicing and chemical production (Weidlich, 2016).

## Outlook

The United States continues to be one of the leaders in salt production, consumption, and world trade. 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 be between 40 and 45 Mt/yr through 2018. Rock salt production and consumption are heavily dependent on the severity of winter weather. Milder winter weather in many parts of the United States during the 2016–17 winter season will likely decrease salt consumption and production in 2017.

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. As energy prices change, 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 with population growth.

China and the United States are both net importers of salt, and the leading exporters of salt are Australia, Chile, India, and Mexico. Most growth is projected to come from the chemicals sector because production of chloralkali products will consume an additional 30 Mt of salt through 2018.

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TABLE 1  
SALIENT SALT STATISTICS<sup>1</sup>

(Thousand metric tons and thousand dollars)

	2012	2013	2014	2015	2016
United States: <sup>2</sup>					
Production:					
Vacuum and open pans	4,240	4,130	4,140	4,190	4,050
Solar	2,760	3,580	3,900	3,590	2,900
Rock	13,300	14,800	20,000	20,400	17,900
Brine	16,900	17,400	17,300	16,900	16,900
Total	37,200	39,900	45,300	45,100	41,700
Sold or used by producers:					
Quantity	34,900	43,100	46,000	42,800	40,200
Value	1,460,000	1,980,000	2,180,000	2,360,000 <sup>r</sup>	2,190,000
Exports:					
Quantity	809	525	935	830 <sup>r</sup>	716
Value	90,300	88,800	147,000	141,000 <sup>r</sup>	146,000
Imports for consumption:					
Quantity	9,880	11,900	20,200	21,600	12,100
Value	292,000	348,000	589,000	578,000	390,000
Consumption:					
Apparent <sup>3</sup>	44,000	54,500	65,300	63,600	51,600
Reported	36,900	47,600	55,600	52,300	48,400
World, production	261,000	280,000 <sup>r</sup>	275,000 <sup>r</sup>	277,000 <sup>r</sup>	274,000

<sup>r</sup>Revised.

<sup>1</sup>Table includes data available through August 29, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Excludes Puerto Rico.

<sup>3</sup>Sold or used plus imports minus exports.

TABLE 2  
U.S. SALT COMPANIES BY PRODUCTION CAPACITY, LOCATION, AND TYPE IN 2016<sup>1,2</sup>

(Thousand short tons)

Company and location	Vacuum and open pans	Solar	Rock	Brine
American Rock Salt Co., Hampton Corners, NY	--	--	4,500	--
Boardwalk Louisiana Midstream, LLC, Plaquemine, LA	--	--	--	(3)
California Supreme Salt, LLC, Twentynine Palms, CA	--	20	--	--
Cargill, Inc.:				
Akron, OH	350	--	--	(3)
Avery Island, LA	--	--	2,700	(3)
Breux Bridge, LA	250	--	--	--
Cleveland, OH	--	--	4,000	--
Freedom, OK	--	300	--	--
Hersey, MI	300	--	--	--
Lake Point, UT	--	850	--	--
Lansing, NY	--	--	2,500	--
Hutchinson, KS	450	--	--	--
Newark, CA	150	750	--	(3)
St. Clair, MI	425	--	--	--
Watkins Glen, NY	450	--	--	--
Chemours Co., The, New Johnsonville, TN	230	--	--	--
Corpus Christi Brine Services, Inc., Benavides, TX	--	--	--	(3)
Huck Salt Co., Fallon, NV	--	20	--	--
Hutchinson Salt Co., Hutchinson, KS	--	--	750	--
Independent Salt Co., Kanopolis, KS	--	--	750	--
Key Energy Services, LLC, Hobbs, NM	--	--	--	(3)
Kissner Group Holdings, LP, The:				
Lyons, KS	--	--	750	--
Detroit, MI	--	--	2,000	--
Moab Salt, Inc., Moab, UT	--	250	--	--
Morton International, Inc.:				
Fairport, OH	--	--	2,000	--
Glendale, AZ	--	150	--	--
Grand Saline, TX	150	--	400	--
Grantsville, UT	--	500	--	--
Manistee, MI	360	--	--	--
Rittman, OH	600	--	--	--
Silver Springs, NY	375	--	--	(3)
South Hutchinson, KS	350	--	--	--
Weeks Island, LA	--	--	1,800	(3)
New Mexico Salt and Mineral Corp., Loving, NM	--	125	--	--
North American Salt Co.: <sup>4</sup>				
Cote Blanche, LA	--	--	3,500	--
Lyons, KS	425	--	--	--
Ogden, UT <sup>5</sup>	--	1,500	--	--
Occidental Chemical Corp., Wichita, KS	--	--	--	(3)
Olin Corp.:				
Freeport, TX <sup>6</sup>	--	--	--	(3)
McIntosh, AL	--	--	--	(3)
Plaquemine, LA <sup>6</sup>	--	--	--	(3)
PB Energy Storage, Inc.: <sup>7</sup>				
Dale, NY	--	--	--	(3)
Napoleonville, LA	--	--	--	(3)
Redmond Clay & Salt Co., Inc., Redmond, UT	--	--	150	--
Searles Valley Minerals, Inc., Trona, CA	--	250	--	--
South Bay Salt Works, Chula Vista, CA	--	125	--	--
Tetra Technologies, Inc., Amboy, CA	--	75	--	--
Texas Brine Corp.:				
Baytown, TX	--	--	--	(3)
Beaumont, TX	--	--	--	(3)
Chacahoula, LA	--	--	--	(3)
Clemville, TX	--	--	--	(3)

See footnotes at end of table.

TABLE 2—Continued  
U.S. SALT COMPANIES BY PRODUCTION CAPACITY, LOCATION, AND TYPE IN 2016<sup>1,2</sup>

(Thousand short tons)

Company and location	Vacuum and open pans	Solar	Rock	Brine
Texas Brine Corp.—Continued				
Houston, TX	--	--	--	(3)
Napoleonville, LA	--	--	--	(3)
Plaquemine, LA	--	--	--	(3)
Wyoming, NY	--	--	--	(3)
US Salt L.L.C., Watkins Glen, NY	375	--	--	(3)
United Salt Corp.:				
Baytown, TX	400	--	--	(3)
Carlsbad, NM	--	400	--	--
Hockley, TX	--	--	150	--
Saltville, VA	200	--	--	--
Westlake Chemical Corp. <sup>8</sup>				
Lake Charles, LA	--	--	--	(3)
New Martinsville, WV	--	--	--	(3)
Total production capacity	5,840	5,320	26,000	16,900

-- Zero.

<sup>1</sup>Table includes data available through August 29, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>The data in this table are rated capacities for mines and refineries as of December 31, 2016. 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.

<sup>3</sup>Includes 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, oilfield chemicals, and so forth. Total brine production capacity is the quantity of brine produced for the year.

<sup>4</sup>Owned by Compass Minerals, Inc.

<sup>5</sup>Owned by Compass Minerals, Inc.; operated by Great Salt Lake Minerals Corp.

<sup>6</sup>Acquired from Dow Chemical Corp.

<sup>7</sup>Associated with Texas Brine Corp.

<sup>8</sup>Formerly operated by Axiall Corp.

TABLE 3  
SALT PRODUCED IN THE UNITED STATES, BY TYPE AND PRODUCT FORM<sup>1</sup>

(Thousand metric tons)

Product form	Vacuum and open pans	Solar	Rock	Brine	Total
2015:					
Bulk	1,090	2,510	20,100	16,900	40,600
Compressed pellets	1,170	340	XX	XX	1,510
Packaged	1,810	622	266	XX	2,700
Pressed blocks	123	117	37	XX	277
Total	4,190	3,590	20,400	16,900	45,100
2016:					
Bulk	969	1,710	17,500	16,900	37,100
Compressed pellets	1,120	339	XX	XX	1,460
Packaged	1,820	725	306	XX	2,860
Pressed blocks	131	131	37	XX	299
Total	4,050	2,900	17,900	16,900	41,700

XX Not applicable.

<sup>1</sup>Table includes data available through August 29, 2018. Data 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<sup>1,2</sup>

(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
2015:										
Bulk	937	128,000	2,070	151,000 <sup>r</sup>	17,600	954,000	17,000	174,000	37,600	1,410,000 <sup>r</sup>
Compressed pellets	1,210	220,000	425	75,100 <sup>r</sup>	XX	XX	XX	XX	1,630	295,000 <sup>r</sup>
Packaged:										
Less-than-5-pound units	238	NA	17	NA	3	NA	XX	XX	258 <sup>r</sup>	XX
More-than-5-pound units	1,710	NA	791	NA	508	NA	XX	XX	3,010	XX
Total	1,950	425,000	808	111,000 <sup>r</sup>	511	68,500	XX	XX	3,260	605,000 <sup>r</sup>
Pressed blocks:										
For livestock	93	NA	80	NA	15	NA	XX	XX	188	XX
For water treatment	36	NA	78	NA	18	NA	XX	XX	132	XX
Total	129	19,700	158	25,600 <sup>r</sup>	33	5,410	XX	XX	320 <sup>r</sup>	50,700 <sup>r</sup>
Grand total	4,220	792,000	3,460	363,000 <sup>r</sup>	18,200	1,030,000	17,000	174,000	42,800	2,360,000 <sup>r</sup>
2016:										
Bulk	825	107,000	2,140	144,000	15,600	840,000	16,700	139,000	35,300	1,230,000
Compressed pellets	1,190	226,000	399	76,400	XX	XX	XX	XX	1,580	303,000
Packaged:										
Less-than-5-pound units	233	NA	13	NA	3	NA	XX	XX	249	XX
More-than-5-pound units	1,670	NA	609	NA	493	NA	XX	XX	2,770	XX
Total	1,900	441,000	623	95,300	496	73,100	XX	XX	3,020	609,000
Pressed blocks:										
For livestock	89	NA	59	NA	14	NA	XX	XX	162	XX
For water treatment	35	NA	65	NA	18	NA	XX	XX	119	XX
Total	125	20,600	124	21,000	32	5,570	XX	XX	281	47,200
Grand total	4,040	794,000	3,290	337,000	16,100	919,000	16,700	139,000	40,200	2,190,000

<sup>r</sup>Revised. NA Not available. XX Not applicable.

<sup>1</sup>Table includes data available through August 29, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>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 the 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<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

State	2015		2016	
	Quantity	Value	Quantity	Value
Kansas	2,830	207,000	2,560	209,000
Louisiana	12,700	325,000	12,200	306,000
New York	7,320	615,000	6,710	566,000
Texas	7,570	173,000	7,420	169,000
Utah	2,010	226,000 <sup>r</sup>	2,080	212,000
Other Eastern States <sup>3</sup>	8,670	636,000	7,770	562,000
Other Western States <sup>4</sup>	1,710	175,000	1,430	165,000
Total	42,800	2,360,000 <sup>r</sup>	40,200	2,190,000
Puerto Rico <sup>e</sup>	46	1,790	46	1,790

<sup>e</sup>Estimated. <sup>r</sup>Revised.

<sup>1</sup>Table includes data available through August 29, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>The term "sold or used" indicates that some salt, usually salt brine, is not sold but is used for captive purposes by the plant or company.

<sup>3</sup>Includes Alabama, Michigan, Ohio, Tennessee, Virginia, and West Virginia.

<sup>4</sup>Includes 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<sup>1,2</sup>

(Thousand metric tons)

End use	Vacuum and open pans		Solar		Rock		Brine		Total <sup>3</sup>	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
<b>Chemical:</b>										
Chloralkali producers	2	2	277 <sup>r</sup>	283	534	441	16,400	16,500	17,200	17,300
Other chemical	327	314	314	179	994	710	592	551	2,230	1,750
Total	329	316	591	461	1,530	1,150	17,000	17,100	19,500	19,000
<b>Food-processing industry:</b>										
Meat packers	205	217	44	43	25	23	--	--	275 <sup>r</sup>	283
Dairy	145	141	8	9	4	3	--	--	157	153
Canning	156	160	17	19	2	2	--	--	175	181
Baking	167	160	5	4	9	7	--	--	181	171
Grain mill products	95	93	10	9	9	17	--	--	114	119
Other food processing	617	594	178	178	79	78	1	1	875	851
Total	1,390	1,370	262	262	129	130	1	1	1,780	1,760
<b>General industrial:</b>										
Textiles and dyeing	10	10	27	24	2	30	--	--	39	64
Metal processing	6	4	4	5	36	32	(4)	(4)	46	41
Rubber	2	2	(4)	1	1	1	(4)	(4)	3	4
Oil	79	78	149	164	61	68	13	6	302	316
Pulp and paper	6	7	41	38	22	18	--	--	69	63
Tanning and (or) leather	1	1	14	12	23	23	--	--	38	36
Other industrial	84	57	53	81	198	173	(4)	(4)	335	311
Total	189	159	288	323	343	344	13	6	833 <sup>r</sup>	832
<b>Agricultural:</b>										
Feed retailers and (or) dealers mixers	267	270	250	238	332	152	--	--	849	660
Feed manufacturers	62	66	73	67	201	244	--	--	336	377
Direct-buying end user	27	27	20	19	87	143	--	--	134	189
Total	356	363	343	324	620	538	--	--	1,320	1,230
<b>Water treatment:</b>										
Government (Federal, State, local)	83	87	110	102	290	161	1	1	484	351
Commercial or other	37	34	38	36	163	44	1	4	239	118
Total	119	118	148	139	452	205	2	5	721 <sup>r</sup>	467
<b>Ice control and (or) stabilization:</b>										
Government (Federal, State, local)	3	4	376	237	12,600	16,800	(4)	(4)	13,000	17,000
Commercial or other	35	30	287	260	9,440	3,010	--	--	9,760	3,300
Total	38	34	664	497	22,000	19,800	(4)	(4)	22,700	20,300
<b>Distributors:</b>										
Agricultural	77	79	108	108	121	241	--	--	306	428
Grocery wholesalers and (or) retailers	381	366	153	151	173	152	(4)	(4)	707	669
Institutional wholesalers and end users	158	162	78	73	131	96	(4)	(4)	367	331
Water-conditioning	122	130	304	289	13	17	1	1	440	437
U.S. Government resale	(4)	(4)	(4)	(4)	(4)	179	--	--	(4)	179
Other wholesalers and (or) retailers	1,160	1,220	948	882	375	106	(4)	(4)	2,480	2,210
Total	1,890	1,960	1,590	1,500	813	790	1	1	4,300	4,250
Other <sup>5</sup>	129	133	200	207	825	42	2	130	1,160	512
Grand total	4,440	4,450	4,090	3,720	26,700	23,000	17,000	17,200	52,300	48,400

<sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through August 29, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>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, 9, 10, 11, and 12.

<sup>3</sup>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 from these tables may differ from totals shown in tables 5 and 7 because of changes in inventory and (or) incomplete reporting.

<sup>4</sup>Less than ½ unit.

<sup>5</sup>Includes exports.

TABLE 7  
DISTRIBUTION OF DOMESTIC AND IMPORTED EVAPORATED AND ROCK SALT IN THE UNITED STATES, BY DESTINATION<sup>1,2</sup>

(Thousand metric tons)

Destination	2015				2016			
	Evaporated			Total	Evaporated			Total
	Vacuum and open pans	Solar	Rock		Vacuum and open pans	Solar	Rock	
Alabama	44	12	56	112	48	172	41	261
Alaska	1	3	(3)	4	9	3	4	16
Arizona	48	72	1	121	48	71	4	123
Arkansas	45	9	54	108	37	11	45	93
California	256	659	115	1,030	255	512	94	861
Colorado	26	97	34	157	23	70	28	121
Connecticut	16	8	628	652	12	5	507	524
Delaware	7	19	76	102	7	8	61	76
District of Columbia	--	11	35	46	--	--	31	31
Florida	113	144	131	388	114	125	109	348
Georgia	138	95	152	385	131	89	123	343
Hawaii	1	2	--	3	1	2	--	3
Idaho	27	92	(3)	119	24	149	(3)	173
Illinois	339	120	1,910	2,370	342	112	1,870	2,320
Indiana	245	106	711	1,060	254	106	546	906
Iowa	194	100	358	652	129	125	394	648
Kansas	85	43	986	1,110	76	40	585	701
Kentucky	75	5	909	989	72	6	840	918
Louisiana	107	10	175	292	94	10	145	249
Maine	17	3	214	234	18	2	159	179
Maryland	72	138	729	939	72	27	668	767
Massachusetts	39	17	721	777	39	15	604	658
Michigan	246	31	2,100	2,380	264	28	1,780	2,080
Minnesota	116	187	579	882	67	183	716	966
Mississippi	19	5	135	159	19	5	102	126
Missouri	96	97	435	628	104	82	359	545
Montana	1	37	(3)	38	1	32	(3)	33
Nebraska	62	49	27	138	62	45	148	255
Nevada	12	187	23	222	12	64	(3)	76
New Hampshire	10	7	183	200	10	6	60	76
New Jersey	97	32	1,110	1,240	95	28	866	989
New Mexico	26	151	(3)	177	29	152	(3)	181
New York	150	32	3,780	3,960	133	29	3,280	3,440
North Carolina	125	93	115	333	132	53	156	341
North Dakota	6	14	4	24	6	12	5	23
Ohio	437	51	2,640	3,130	445	47	2,420	2,910
Oklahoma	26	30	100	156	26	28	58	112
Oregon	26	46	(3)	72	25	46	1	72
Pennsylvania	189	70	2,970	3,230	184	62	1,680	1,920
Rhode Island	2	1	208	211	2	1	171	174
South Carolina	47	12	60	119	56	15	52	123
South Dakota	27	49	5	81	28	48	371	447
Tennessee	101	12	653	766	89	13	505	607
Texas	313	186	114	613	324	181	96	601
Utah	31	177	39	247	32	215	33	280
Vermont	3	1	340	344	2	1	307	310
Virginia	73	77	591	741	75	33	512	620
Washington	34	219	(3)	253	35	225	--	260
West Virginia	25	6	273	304	23	5	246	274
Wisconsin	205	143	1,270	1,620	205	139	1,410	1,760
Wyoming	4	22	1	27	3	52	1	56
Other <sup>4</sup>	18	(3)	--	18	67	190	324	581
Total <sup>5</sup>	4,420	3,790	25,800	34,000	4,360	3,680	22,500	30,500

See footnotes at end of table.

TABLE 7—Continued  
DISTRIBUTION OF DOMESTIC AND IMPORTED EVAPORATED AND ROCK SALT IN THE UNITED STATES, BY DESTINATION<sup>1,2</sup>

(Thousand metric tons)

-- Zero.

<sup>1</sup>Table includes data available through August 29, 2018. Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Each type of salt includes domestic and imported quantities. Brine is excluded because it is not shipped out of State.

<sup>3</sup>Less than ½ unit.

<sup>4</sup>Includes exports and shipments to overseas areas administered by the United States, Puerto Rico, and unspecified destinations.

<sup>5</sup>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 tables 5 and 6 because of changes in inventory and (or) incomplete reporting.

TABLE 8  
AVERAGE VALUE OF SALT, BY PRODUCT FORM AND TYPE<sup>1</sup>

(Dollars per metric ton)

Product form	Vacuum and open pans	Solar	Rock	Brine
2015:				
Bulk	136.00	72.92 <sup>r</sup>	54.07	10.27
Compressed pellets	181.89	176.67 <sup>r</sup>	XX	XX
Packaged	218.69	137.40 <sup>r</sup>	134.05	XX
Average <sup>2</sup>	188.87	102.04 <sup>r</sup>	56.32	10.27
Pressed blocks	152.82	152.96 <sup>r</sup>	147.38 <sup>r</sup>	XX
2016:				
Bulk	129.49	67.13	53.86	8.29
Compressed pellets	190.96	191.53	XX	XX
Packaged	231.65	152.96	147.38	XX
Average <sup>2</sup>	197.78	99.69	56.74	8.29
Pressed blocks	164.93	169.33	173.06	XX

<sup>1</sup>Revised. XX Not applicable.

<sup>1</sup>Net selling value, free on board plant, excluding container costs.

<sup>2</sup>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 9  
U.S. EXPORTS OF SALT, BY COUNTRY OR LOCALITY<sup>1</sup>

(Thousand metric tons and thousand dollars)

Country or locality	2015		2016	
	Quantity	Value <sup>2</sup>	Quantity	Value <sup>2</sup>
Australia	1	973 <sup>r</sup>	1	1,180
Bahamas, The	2	772	1	492
Bahrain	1	372	1	417
Belgium	6	17,500	7	21,600
Brazil	1	2,580	1	2,970
Canada	699 <sup>r</sup>	52,900 <sup>r</sup>	581	48,400
China	59	28,200 <sup>r</sup>	55	29,300
Colombia	2	845 <sup>r</sup>	3	1,180
Costa Rica	2	610	2	860
Dominican Republic	3	1,010	2	727
El Salvador	1	314	1	308
Germany	3	1,340 <sup>r</sup>	2	915
Honduras	1	216	1	208
Ireland	1	873	1	1,240
Japan	2	1,500	2	2,010
Korea, Republic of	1	690	1	672
Mexico	26	11,000	32	11,300
Netherlands	1	775	1	1,060
Panama	1	297 <sup>r</sup>	1	483
Saudi Arabia	3	1,500	3	1,810
Singapore	3	6,630	3	8,440
United Arab Emirates	1	850	1	735
United Kingdom	4	2,530 <sup>r</sup>	3	2,790
Other	6 <sup>r</sup>	6,520 <sup>r</sup>	10	7,360
Total	830 <sup>r</sup>	141,000 <sup>r</sup>	716	146,000

<sup>1</sup>Revised.

<sup>1</sup>Table includes data available through August 29, 2018. 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.

<sup>2</sup>Free alongside ship value at U.S. ports.

Source: U.S. Census Bureau.

TABLE 10  
U.S. EXPORTS OF SALT, BY CUSTOMS DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Customs district	2015		2016	
	Quantity	Value <sup>2</sup>	Quantity	Value <sup>2</sup>
Anchorage, AK	3	1,150	3	1,110
Baltimore, MD	(3) <sup>r</sup>	378 <sup>r</sup>	1	775
Buffalo, NY	24 <sup>r</sup>	5,830 <sup>r</sup>	22	5,080
Charleston, SC	1	1,050 <sup>r</sup>	1	963
Chicago, IL	4	1,360	1	1,360
Cleveland, OH	420 <sup>r</sup>	17,200	359	16,400
Detroit, MI	83 <sup>r</sup>	11,500 <sup>r</sup>	44	10,300
El Paso, TX	2	496 <sup>r</sup>	2	566
Great Falls, MT	2 <sup>r</sup>	721 <sup>r</sup>	1	588
Houston, TX	8	2,950 <sup>r</sup>	4	1,970
Laredo, TX	17	7,410 <sup>r</sup>	19	7,140
Los Angeles, CA	56 <sup>r</sup>	34,600 <sup>r</sup>	59	41,100
Miami, FL	5	2,200 <sup>r</sup>	5	2,350
New Orleans, LA	2	776	4	1,060
New York City, NY	20	24,000 <sup>r</sup>	13	24,600
Nogales, AZ	4	1,740	8	2,140
Norfolk, VA	3	4,580 <sup>r</sup>	4	5,560
Ogdensburg, NY	15	3,220 <sup>r</sup>	18	3,580
Pembina, ND	3 <sup>r</sup>	1,090 <sup>r</sup>	4	1,320
Philadelphia, PA	1	447 <sup>r</sup>	1	467
San Diego, CA	3	1,360 <sup>r</sup>	3	1,320
San Francisco, CA	1	890	2	1,030
Savannah, GA	1	993	2	963
Seattle, WA	5 <sup>r</sup>	2,000 <sup>r</sup>	7	2,480
St. Albans, VT	4	622 <sup>r</sup>	4	707
Other <sup>4</sup>	143 <sup>r</sup>	12,300	125	11,400
Total	830 <sup>r</sup>	141,000 <sup>r</sup>	716	146,000

<sup>r</sup>Revised.

<sup>1</sup>Table includes data available through August 29, 2018. 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.

<sup>2</sup>Free alongside ship value at U.S. ports.

<sup>3</sup>Less than ½ unit.

<sup>4</sup>Customs district unidentified but assumed to be rail and (or) truck shipments to Canada through various points of departure. Also includes minor shipments through 14 other customs districts.

Source: U.S. Census Bureau.

TABLE 11  
U.S. IMPORTS FOR CONSUMPTION OF SALT, BY COUNTRY OR LOCALITY<sup>1</sup>

(Thousand metric tons and thousand dollars)

Country or locality	2015		2016	
	Quantity	Value <sup>2</sup>	Quantity	Value <sup>2</sup>
Aruba	44	1,100	--	--
Australia	433	12,900	235	4,740
Bahamas, The	672	22,200	206	6,540
Brazil	710	16,000	593	14,300
Canada	6,140	163,000	3,200	109,000
Chile	8,570	180,000	4,340	105,000
China	38	6,140	71	4,710
Dominican Republic	26	710	22	528
Egypt	671	17,500	471	13,700
Germany	170	8,820	2	1,580
India	231	4,110	50	1,080
Ireland	88	4,060	62	11,200
Italy	267	11,700	120	6,870
Korea, Republic of	35	1,780	47	2,240
Mexico	1,850	51,700	1,500	36,200
Morocco	352	16,300	304	8,480
Netherlands	345	10,300	321	10,200
Pakistan	139	5,750	70	10,000
Peru	456	8,030	202	3,590
South Africa	1	1,910	56	2,910
Spain	95	2,770	83	4,230
Tunisia	119	1,860	22	169
Turkey	39	2,880	94	3,840
Other <sup>3</sup>	188 <sup>r</sup>	26,800 <sup>r</sup>	81	30,100
Total	21,600	578,000	12,100	390,000

<sup>1</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through August 29, 2018. 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.

<sup>2</sup>Customs value.

<sup>3</sup>Includes imports from 52 other countries and (or) localities.

Source: U.S. Census Bureau.

TABLE 12  
U.S. IMPORTS OF SALT, BY CUSTOMS DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Customs district	2015		2016	
	Quantity	Value <sup>2</sup>	Quantity	Value <sup>2</sup>
Baltimore, MD	2,690	69,000	1,280	39,800
Boston, MA	1,970	43,800	1,380	30,200
Buffalo, NY	169	5,330	223	7,820
Charleston, SC	101	3,120	119	4,610
Chicago, IL	1,260	27,800	598	15,700
Cleveland, OH	427	8,580	114	3,870
Columbia-Snake, OR	118	4,640	138	5,370
Detroit, MI	1,570	31,500	766	19,200
Duluth, MN	86	9,160	76	8,280
El Paso, TX	(3)	70	202	167
Houston-Galveston, TX	21	2,560	37	3,760
Laredo, TX	435	3,300	456	3,420
Los Angeles, CA	213	7,120	196	8,890
Milwaukee, WI	1,290	22,600	897	19,300
Minneapolis, MN	463	8,140	175	4,310
New Orleans, LA	1,180	40,900	183	6,700
New York City, NY	3,880	93,400	1,810	56,000
Nogales, AZ	50	1,900	41	2,440
Norfolk, VA	237	10,400	185	16,500
Ogdensburg, NY	122	33,300	85	24,800
Pembina, ND	70	7,020	58	5,540
Philadelphia, PA	2,670	65,300	973	27,300
Portland, ME	1,160	24,000	796	18,400
Providence, RI	703	17,700	400	9,770
San Diego, CA	45	2,040	111	1,980
San Francisco, CA	116	3,980	159	6,150
Savannah, GA	111	3,010	39	1,740
Seattle, WA	25	4,220	71	4,970
Tampa, FL	283	11,000	376	13,800
Wilmington, NC	98	3,430	151	5,440
Other <sup>4</sup>	68 <sup>r</sup>	9,250 <sup>r</sup>	41	13,900
Total	21,600	578,000	12,100	390,000

<sup>r</sup>Revised.

<sup>1</sup>Table includes data available through August 29, 2018. 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.

<sup>2</sup>Customs value.

<sup>3</sup>Less than ½ unit.

<sup>4</sup>Includes imports through 10 other customs districts.

Source: U.S. Census Bureau.

TABLE 13  
SALT: WORLD PRODUCTION, BY COUNTRY OR LOCALITY<sup>1</sup>

(Thousand metric tons)

Country or locality <sup>2</sup>	2012	2013	2014	2015	2016
Afghanistan, rock	147	145 <sup>r</sup>	41 <sup>r</sup>	87 <sup>r</sup>	88
Algeria, brine and sea	178	173	193	181 <sup>r</sup>	180 <sup>e</sup>
Angola	40	40	40	50 <sup>r</sup>	50
Argentina, common	1,844	1,652	1,503 <sup>r</sup>	1,500 <sup>e</sup>	1,500 <sup>e</sup>
Armenia	38	31	30	27 <sup>r</sup>	30
Australia	12,500	12,900	13,000	11,000 <sup>e</sup>	12,000 <sup>e</sup>
Azerbaijan, marketable	5	5	5	5	5
Bangladesh, marine <sup>3</sup>	1,439	1,439	1,461	1,460 <sup>r</sup>	1,500 <sup>e</sup>
Belarus	2,177	2,625	1,821 <sup>r</sup>	2,054 <sup>r</sup>	2,000 <sup>e</sup>
Bolivia, rock	2	2	2	2	2
Bosnia and Herzegovina	862	857	921	992 <sup>r</sup>	1,000 <sup>e</sup>
Botswana <sup>4</sup>	389	521	515	404 <sup>r</sup>	400 <sup>e</sup>
Brazil:					
Rock	1,403	1,349	1,451 <sup>r</sup>	1,450 <sup>r</sup>	1,450 <sup>e</sup>
Sea	6,079	5,926	6,050 <sup>r</sup>	6,100	6,100 <sup>e</sup>
Total	7,482	7,275	7,501 <sup>r</sup>	7,550 <sup>r</sup>	7,550 <sup>e</sup>
Bulgaria	2,100	2,000 <sup>r</sup>	3,300 <sup>r</sup>	3,500 <sup>r</sup>	3,500 <sup>e</sup>
Burma, rock, crude	207	169	188	129 <sup>r</sup>	140 <sup>e</sup>
Canada	12,820 <sup>r</sup>	12,244 <sup>r</sup>	14,473 <sup>r</sup>	14,343 <sup>r</sup>	14,000 <sup>e</sup>
Chile	8,057	6,577	10,533	11,831 <sup>r</sup>	11,000 <sup>e</sup>
China	69,120	73,676	70,497	66,655 <sup>r</sup>	67,000 <sup>e</sup>
Colombia:					
Rock	229	319	340	339 <sup>r</sup>	340 <sup>e</sup>
Sea	78	113	106	79 <sup>r</sup>	90 <sup>e</sup>
Total	307	432	446	418 <sup>r</sup>	430 <sup>e</sup>
Croatia	46	43	33	52 <sup>r</sup>	50 <sup>e</sup>
Cuba	216	222	243	-- <sup>r</sup>	--
Denmark	600	600	600	600	600
Djibouti <sup>c</sup>	4	1	1	1	1
Egypt	2,802	2,194	1,543 <sup>r</sup>	2,200 <sup>e</sup>	2,200 <sup>e</sup>
Eritrea, sea <sup>c</sup>	240	290	300 <sup>r</sup>	300 <sup>r</sup>	310
Ethiopia, rock <sup>e,3</sup>	400 <sup>r</sup>	410 <sup>r</sup>	420 <sup>r</sup>	440 <sup>r</sup>	450
France <sup>e</sup>	5,460 <sup>r</sup>	5,890 <sup>r</sup>	5,810 <sup>r</sup>	6,000	6,000
Georgia <sup>c</sup>	29	30	28	30 <sup>r</sup>	30
Germany:					
Evaporated, including sea	301	297	274	280 <sup>e</sup>	290 <sup>e</sup>
Industrial brines	7,515	8,073	7,709	7,200 <sup>e</sup>	7,300 <sup>e</sup>
Rock and other brines	6,840	9,026	5,355	5,000 <sup>e</sup>	5,300 <sup>e</sup>
Total	14,656	17,396	13,338	12,500 <sup>e</sup>	12,900 <sup>e</sup>
Ghana	250	250	250	250	250
Greece	192	190	146	122 <sup>r</sup>	130 <sup>e</sup>
India	17,000	26,886 <sup>r</sup>	23,017 <sup>r</sup>	24,241 <sup>r</sup>	25,000 <sup>e</sup>
Indonesia	2,072 <sup>r</sup>	1,088 <sup>r</sup>	2,192 <sup>r</sup>	600 <sup>r,e</sup>	1,000 <sup>e</sup>
Iran <sup>5</sup>	2,962	2,079	3,940 <sup>r</sup>	4,448 <sup>r</sup>	4,000 <sup>e</sup>
Iraq	143	182	200 <sup>r,e</sup>	180 <sup>e</sup>	180 <sup>e</sup>
Israel, marketable	415	442	460	333 <sup>r</sup>	350 <sup>e</sup>
Italy <sup>6</sup>	3,098	2,879	1,501	1,600 <sup>e</sup>	1,700 <sup>e</sup>
Japan	925 <sup>r</sup>	929 <sup>r</sup>	928 <sup>r</sup>	938 <sup>r</sup>	930 <sup>e</sup>
Jordan:					
Brine	32	32	35 <sup>r</sup>	40 <sup>r</sup>	40
Dead sea	1	1	1	1	1
Total	33	33	36 <sup>r</sup>	41 <sup>r</sup>	41
Kazakhstan	464	531	597	609 <sup>r</sup>	610 <sup>e</sup>
Kenya, refined	231	207	223	242 <sup>r</sup>	240 <sup>e</sup>
Korea, Republic of	309	421	304	310 <sup>e</sup>	310 <sup>e</sup>
Kuwait	15	15	14	15 <sup>r</sup>	15
Kyrgyzstan, rock <sup>c</sup>	3 <sup>r</sup>	2 <sup>r</sup>	2 <sup>r</sup>	2 <sup>r</sup>	2

See footnotes at end of table.

TABLE 13—Continued  
SALT: WORLD PRODUCTION, BY COUNTRY OR LOCALITY<sup>1</sup>

(Thousand metric tons)

Country or locality <sup>2</sup>	2012	2013	2014	2015	2016
Laos, rock	12	6	9	9	10 <sup>e</sup>
Lebanon <sup>e</sup>	20	15	15	10 <sup>r</sup>	10
Libya	30	30	30	30	30
Madagascar, sea <sup>e</sup>	110 <sup>r</sup>	110 <sup>r</sup>	120 <sup>r</sup>	120 <sup>r</sup>	130
Malta, solar	1	1	2 <sup>r</sup>	2 <sup>r</sup>	2
Mauritania	1	1	1	1	1
Mauritius, sea <sup>e</sup>	4	4	4	2 <sup>r</sup>	2
Mexico	8,730	9,461	10,251	9,088 <sup>r</sup>	9,000 <sup>e</sup>
Montenegro, sea	16	10	--	--	--
Morocco:					
Rock	730	489	439	536 <sup>r</sup>	530 <sup>e</sup>
Sea	25	20	20	20	20 <sup>e</sup>
Total	755	509	459	556 <sup>r</sup>	550 <sup>e</sup>
Mozambique, sea <sup>e</sup>	150	150	160	160	170
Namibia	810	827	797	733 <sup>r</sup>	740 <sup>e</sup>
New Zealand	95	100	100	100	100
Niger	30	30	30	30	30
Oman	13	12	13	13	13
Pakistan:					
Rock <sup>4</sup>	2,029 <sup>r</sup>	2,269 <sup>r</sup>	2,241	2,799 <sup>r</sup>	2,800 <sup>e</sup>
Sea	292	297	300	300	300 <sup>e</sup>
Total	2,321 <sup>r</sup>	2,566 <sup>r</sup>	2,541	3,099 <sup>r</sup>	3,100 <sup>e</sup>
Panama	37	61	57	60 <sup>e</sup>	60 <sup>e</sup>
Peru	1,200	1,205	1,175	1,471 <sup>r</sup>	1,450 <sup>e</sup>
Philippines, sea	775	993	1,016	1,020 <sup>r</sup>	1,000 <sup>e</sup>
Poland:					
Evaporated	658	686	647 <sup>r</sup>	671 <sup>r</sup>	670 <sup>e</sup>
Rock	793	1,321 <sup>r</sup>	775	650 <sup>r</sup>	700 <sup>e</sup>
Other, recovered from brine	2,732 <sup>r</sup>	2,736 <sup>r</sup>	2,705 <sup>r</sup>	2,798 <sup>r</sup>	2,800 <sup>e</sup>
Total	4,180 <sup>r</sup>	4,740 <sup>r</sup>	4,130 <sup>r</sup>	4,120 <sup>r</sup>	4,170 <sup>e</sup>
Portugal, rock	520	473 <sup>r</sup>	70	30 <sup>r</sup>	40 <sup>e</sup>
Romania:					
Rock	40	40	47 <sup>r</sup>	50 <sup>r</sup>	50
Other	2,200	2,200	2,000 <sup>r</sup>	2,080 <sup>r</sup>	2,000
Total	2,240	2,240	2,047 <sup>r</sup>	2,130 <sup>r</sup>	2,050
Russia	627 <sup>r</sup>	553 <sup>r</sup>	526 <sup>r</sup>	783 <sup>r</sup>	790
Saudi Arabia	1,611	1,900	1,990	2,080 <sup>r</sup>	2,000 <sup>e</sup>
Senegal	237	243	245	266 <sup>r</sup>	270 <sup>e</sup>
Serbia	17	14	13	13	13 <sup>e</sup>
Slovenia	6	3	--	2 <sup>r</sup>	2 <sup>e</sup>
South Africa	399	479	494	517 <sup>r</sup>	489
Spain:					
Rock	2,786	2,902	2,900 <sup>e</sup>	2,900 <sup>e</sup>	2,900 <sup>e</sup>
Sea, including evaporated	1,323	1,376	1,400 <sup>e</sup>	1,400 <sup>e</sup>	1,400 <sup>e</sup>
Total	4,109	4,278	4,300 <sup>e</sup>	4,300 <sup>e</sup>	4,300 <sup>e</sup>
Sri Lanka	64	37	102	102 <sup>r</sup>	100 <sup>e</sup>
Sudan	26	21	37	23 <sup>r</sup>	25 <sup>e</sup>
Switzerland	528	652	388 <sup>r</sup>	550 <sup>r</sup>	540 <sup>e</sup>
Syria	34	30	30 <sup>e</sup>	20 <sup>r</sup>	25 <sup>e</sup>
Tajikistan	28 <sup>e</sup>	31 <sup>r</sup>	35 <sup>r</sup>	36 <sup>r</sup>	36
Tanzania	34	36 <sup>r</sup>	55 <sup>r</sup>	92 <sup>r</sup>	93
Thailand	1,364	1,300	1,381	1,386 <sup>r</sup>	1,380 <sup>e</sup>
Tunisia, sea	1,132	1,146	888 <sup>r</sup>	1,700 <sup>r,e</sup>	1,600 <sup>e</sup>
Turkey	5,378 <sup>r</sup>	5,614 <sup>r</sup>	5,331 <sup>r</sup>	10,995 <sup>r</sup>	10,000 <sup>e</sup>
Turkmenistan	220 <sup>e</sup>	220 <sup>r,e</sup>	92 <sup>r,e</sup>	100 <sup>r</sup>	100 <sup>e</sup>
Uganda <sup>e</sup>	15	15	15	15	15
Ukraine	6,189	5,796	2,498 <sup>r</sup>	2,140 <sup>r,e</sup>	2,300 <sup>e</sup>

See footnotes at end of table.

TABLE 13—Continued  
SALT: WORLD PRODUCTION, BY COUNTRY OR LOCALITY<sup>1</sup>

(Thousand metric tons)

Country or locality <sup>2</sup>	2012	2013	2014	2015	2016
United Kingdom <sup>7</sup>	6,460 <sup>r</sup>	6,930 <sup>r</sup>	4,690 <sup>r</sup>	5,000 <sup>e</sup>	5,100 <sup>e</sup>
United States:					
Brine	16,900	17,400	17,300	16,900	16,900
Rock	13,300	14,800	20,000	20,400	17,900
Solar	2,760	3,580	3,900	3,590	2,900
Vacuum and open pan	4,240	4,130	4,140	4,190	4,050
Other, from Puerto Rico	45	45	45	45	45
Total	37,200	40,000	45,300	45,100	42,000
Vietnam	776 <sup>r</sup>	719	906 <sup>r</sup>	991 <sup>r</sup>	1,000 <sup>e</sup>
Yemen	23 <sup>r</sup>	23 <sup>r</sup>	25 <sup>r</sup>	25 <sup>r</sup>	25
Grand total	261,000	280,000 <sup>r</sup>	275,000 <sup>r</sup>	277,000 <sup>r</sup>	274,000

<sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>Table includes data available through November 23, 2017. All data are reported unless otherwise noted. Grand totals, U.S. data, and estimated data were rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Salt was produced in Austria, Guinea, Iceland, Mali, Mongolia, North Korea, and Venezuela, but available information was inadequate to make reliable estimates of output levels. Some salt brine production data for manufacture of chlorine, caustic soda, and soda ash were not reported because of incomplete reporting by many countries and (or) localities.

<sup>3</sup>Production is based on fiscal year, with a starting date of July 1 of year shown.

<sup>4</sup>From natural soda ash production.

<sup>5</sup>Production is based on fiscal year, with a starting date of March 21 of year shown.

<sup>6</sup>Does not include production from Sardinia and Sicily, which is estimated to be 200,000 metric tons per year.

<sup>7</sup>Production is based on fiscal year, with a starting date of July 16 of year shown.