

Sodium Chloride

NaCl

(solid)



Raw Material Direct Use Chemical

Source of Raw Material:
Naturally occurring mineral

% of Total Domestic Consumption Attributed to Water Sector:
Less than 1%

Product Family:
Chlor-alkali

Derivative Water Treatment Chemicals:
Chlorine Sodium Hydroxide
Sodium Chlorate

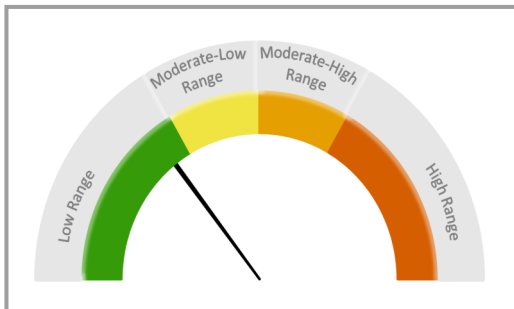
[Understanding Chemical Supply Chains](#)
[Map of Suppliers & Manufacturers](#)

CAS No.:
7647-14-5

Shelf Life:
60+ Months

RISK OF SUPPLY DISRUPTION (Assessed in 2022)

RISK RATING: Low



RISK DRIVERS

Though sodium chloride is essential as a raw material for a number of critical water treatment chemicals, the U.S. is one of the leading sodium chloride-producing nations and has an abundant supply of rock salt and brines.

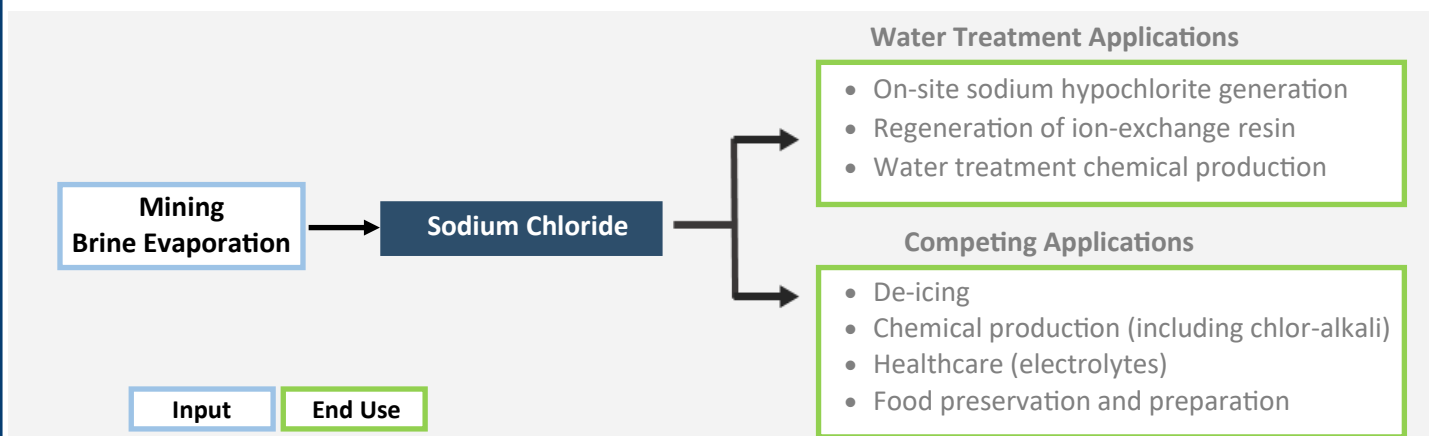
RISK PARAMETERS

Criticality: High. Essential for the production of water treatment chemicals.

Likelihood: Low. No history of sodium chloride supply disruptions between 2000 and 2022.

Vulnerability: Low. The U.S. is a leading producer of sodium chloride.

PRODUCTION PROCESS



DOMESTIC PRODUCTION AND CONSUMPTION, AND INTERNATIONAL TRADE

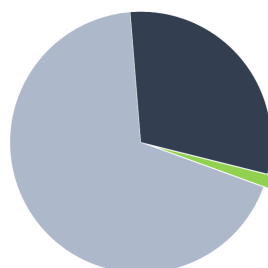
Domestic Manufacturing Locations (2019):

62, distributed throughout the U.S.

International Trade (2019)

Primary Trading Partner (Imports): Mexico

Primary Trading Partner (Exports): Canada



Domestic Consumption (2019):
59,580 Million kg

- Domestic Production (42,000 M kg)
- Imports for Consumption (18,000 M kg)
- Export of Domestic Production (1,000 M kg)

Product Description

Sodium chloride (NaCl), an inorganic salt, is the foundational raw material of the chlor-alkali industry and is widely produced in the US. It is used directly in water treatment and as an important raw material in the production of other water treatment chemicals. The single largest use of sodium chloride in the U.S. is for road de-icing applications.

Use in Water Treatment

Sodium chloride is used directly in water treatment in the on-site generation of sodium hypochlorite, and as a brine for ion exchange resin regeneration (AWWA, 2017).

Use as a Precursor to Other Water Treatment Chemicals

Sodium chloride is used to manufacture chlorine, sodium hydroxide, and sodium chlorate (NCBI, 2020).

Other Applications

Sodium chloride has a wide range of applications. The leading use of sodium chloride is as a de-icing material for roadways and walkways. It is also widely used in chemical production via the chlor-alkali process, as a bulking agent in powdered soaps and detergents, flavor and preservation of food products, and for electrolyte balance in healthcare settings (NCBI, 2020).

Primary Industrial Consumers

In 2019, road de-icing accounted for about 43% of total sodium chloride consumed. The chemical industry accounted for approximately 37% of total sodium chloride sales, with chlor-alkali producers being the largest consumers within the chemical industry. The remainder of 2019 domestic consumption includes: commercial market distributors, 9%; food processing, 4%; agricultural applications, 3%; general industrial applications, 2%; and primary water treatment, 1%. The remaining 1% was other uses combined with export (USGS, 2020a).

Manufacturing, Transport, & Storage

Manufacturing Process

Sodium chloride is a naturally occurring mineral that is abundant throughout the earth and can be found in deposits and extracted from seawater. Sodium chloride may be manufactured by conventional underground mining, solution-mining of an underground salt deposit, or evaporation of seawater or brine. 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 (AWWA, 2017; USGS, 2020b).

Rock salt is mined directly from deposits (mostly underground) and used with little processing. Rock salt accounts for the largest form of sodium chloride produced domestically (USGS, 2020b).

Salt brine is produced through introduction of water to underground salt bodies or recovery of natural underground saline sources. Brine accounts for the second largest form of sodium chloride produced domestically and is the preferred form for use in the manufacture of chlorine and sodium hydroxide through the chlor-alkali process (USGS, 2020b).

Solar salt is recovered from a brine which may originate from sea water or from the recovered mixture of water pumped into an underground salt deposit. The brine is placed in an outdoor pond under conditions where evaporation outpaces precipitation. Salt crystals can be recovered after sufficient evaporation of water. This process yields a high purity sodium chloride (USGS, 2020b).

Product Transport

Manufacturers and suppliers of sodium chloride for water treatment and food or beverage industries supply various sodium chloride grades that include lump, granular, powder, slurry, and micron sized product. Packaging options such as pails, paper bags, fiber drums, and flexible intermediate bulk containers and custom sizes are also offered (OxyChem, 2020).

Sodium chloride is commonly transported through many means of transport, however transportation costs significantly add to the price of sodium chloride, as locations of supplies are not often near industrial consumers. Pumping brine through pipelines is an economic means of transport for industrial consumers, but cannot be used for dry salt (USGS, 2020b).

Storage and Shelf Life

Sodium chloride is stable and non-reactive over a wide range of temperatures and is highly soluble in water. It may form chlorine gas when in contact with strong acids (NCBI, 2020). When stored properly, sodium chloride can have a shelf life in excess of 60 months (Cargill, 2022).

Domestic Production & Consumption

Domestic Production

Production data was collected from U.S. Geological Survey (USGS), while trade data was collected from the U.S. International Trade Commission (USITC) Dataweb, as shown in Table 1. Both production and trade data are specific to sodium chloride.

Table 1. Sodium Chloride Production and Trade Data Sources

Production and Trade Data			
Category	Data Source	Identifier	Description
Domestic Production	U.S. Geological Survey	CAS No.: 7647-14-5	Sodium Chloride
Imports and Exports	U.S. International Trade Commission	HS Code: 2501.00	Sodium Chloride

Total U.S. domestic production of sodium chloride was approximately 42,000 million kilograms (M kg) in 2019. Domestic commercial manufacture of sodium chloride takes place at facilities located throughout the contiguous U.S. There are many facilities owned by several different companies including *Cargill, Inc.*, *Morton International, Inc.*, *Texas Brine Corporation*, and *North American Salt Company* (USGS, 2020b). In 2016, *Cargill, Inc.* was the largest reported domestic producer of sodium chloride. The number of domestic manufacturing locations shown in Figure 1 represents operating facilities as of 2016 (USGS, 2020b). Supply of NSF/ANSI Standard 60 certified sodium chloride for use in drinking water treatment is widely distributed throughout the U.S. (NSF International, 2021). For a more current listing of manufacturing locations and supplier locations, visit the U.S. Environmental Protection Agency's (EPA's) [Chemical Locator Tool](#) (EPA, 2022a).

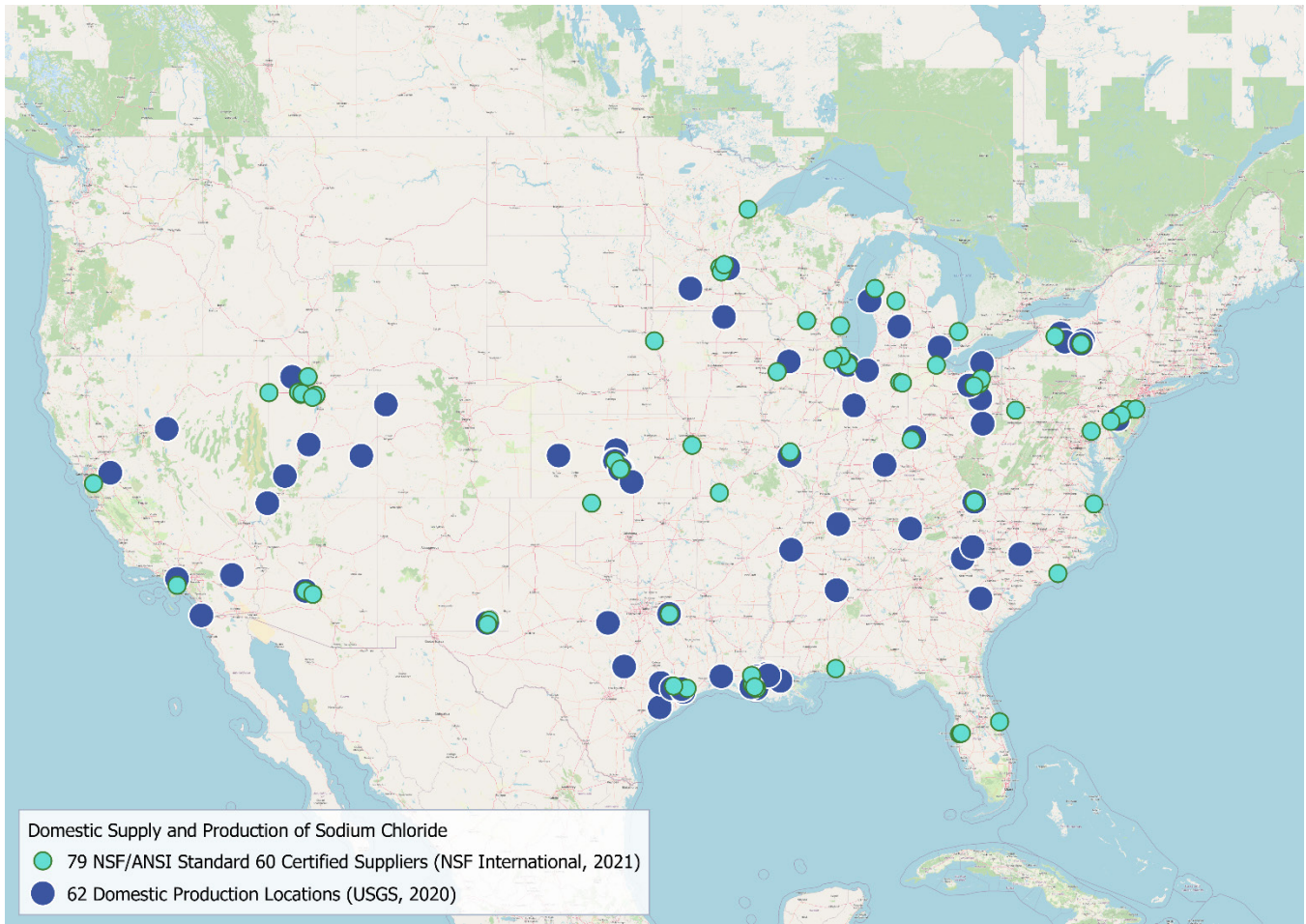


Figure 1. Domestic Supply and Production of Sodium Chloride

Domestic Consumption

U.S. consumption of sodium chloride in 2019 is estimated at 59,580 M kg. This estimate includes production of 42,000 M kg, import of 18,000 M kg, minus export of 1,000 M kg (USGS, 2020a), as shown in Figure 2.

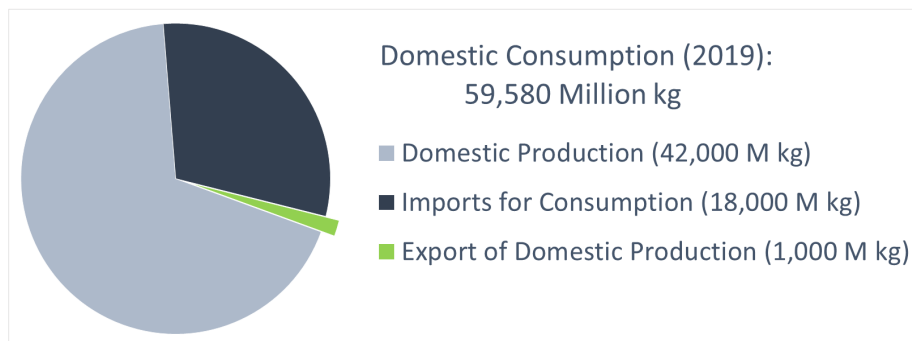


Figure 2. Domestic Production and Consumption of Sodium Chloride in 2019

Trade & Tariffs

Worldwide Trade

Worldwide import and export data for sodium chloride is reported through the World Bank’s World Integrated

Trade Solutions (WITS) software, as a category specific to sodium chloride. In 2021, the U.S. ranked 12th worldwide in total exports and first in total imports of sodium chloride. In 2021, India ranked first worldwide in total exports (WITS, 2022), as shown in Table 2.

Table 2. WITS Worldwide Export and Import of Sodium Chloride in 2021

2021 Worldwide Trade Sodium Chloride (HS Code 2501.00)			
Top 5 Worldwide Exporters		Top 5 Worldwide Importers	
India	8,512 M kg	United States	24,689 M kg
Chile	7,446 M kg	China	5,185 M kg
Canada	5,939 M kg	South Korea	4,726 M kg
Netherlands	4,598 M kg	Indonesia	2,831 M kg
Germany	4,361 M kg	Germany	2,641 M kg

Domestic Imports and Exports

Domestic import and export data are reported by USITC in categories specific to sodium chloride. Figure 3 summarizes imports for consumption¹ and domestic exports² of sodium chloride between 2015 and 2020. During this period, the overall quantity of imports has varied, with the greatest volume of imports occurring in 2020; however the volume of exports has remained relatively steady. Over this five-year period, Canada has been the primary recipient of domestic exports while the primary source of imports shifted from Chile in 2015 to Mexico and Canada beginning in 2018 (USITC, 2021).

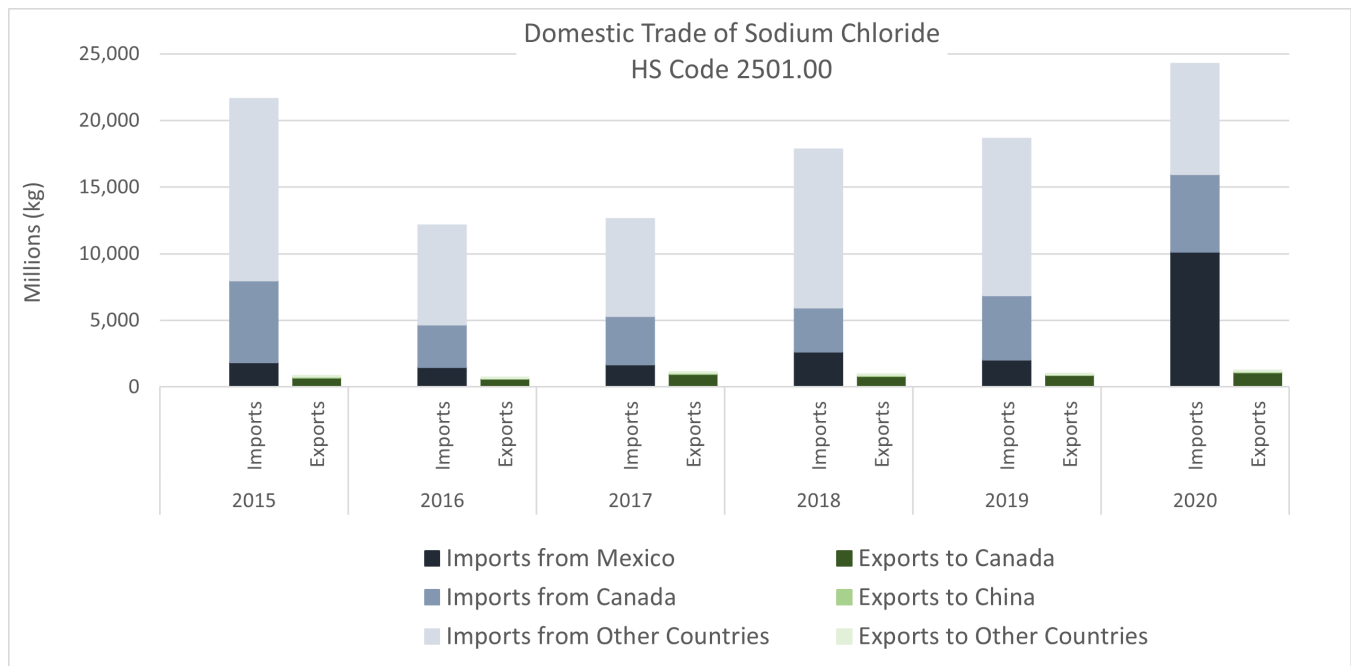


Figure 3. USITC Domestic Import and Export of Sodium Chloride between 2015 and 2020

¹ Imports for consumption are a subset of general imports, representing the total amount cleared through customs and entering consumption channels, not anticipated to be reshipped to foreign points, but may include some reexports.

² Domestic exports are a subset of total exports, representing export of domestic merchandise which are produced or manufactured in the U.S. and commodities of foreign origin which have been changed in the U.S.

Tariffs

Imports of sodium chloride are primarily supplied from Chile, Canada, and Mexico. There is no general duty for import of sodium chloride, but there is an additional 25% duty on imports from China (USITC, 2022), as summarized in Table 3.

Table 3. 2020 Domestic Tariff Schedule for Sodium Chloride

HS Code	General Duty	Additional Duty – China (Section 301 Tariff List)	Special Duty
2501.00	None	25%	None

Market History & Risk Evaluation

History of Shortages

There is no known history of sodium chloride shortages between 2000 and 2022. USGS reports substantial deposits of sodium chloride in principal salt-producing countries, of which the United States is one. In addition, sodium chloride can be purified from sea water. As of 2016, USGS indicated that the U.S. continues to be one of the leaders in sodium chloride production (USGS, 2020b).

Risk Evaluation

The complete risk evaluation methodology is described in *Understanding Water Treatment Chemical Supply Chains and the Risk of Disruptions* (EPA, 2022b). The risk rating is calculated as the product of the following three risk parameters:

Risk = Criticality x Likelihood x Vulnerability	
Criticality	Measure of the importance of a chemical to the water sector
Likelihood	Measure of the probability that the chemical will experience a supply disruption in the future, which is estimated based on past occurrence of supply disruptions
Vulnerability	Measure of the market dynamics that make a chemical market more or less resilient to supply disruptions

The individual parameter rating is based on evaluation of one or more attributes of the chemical or its supply chain. The ratings and drivers for these three risk parameters are shown below in Table 4.

Table 4. Supply Chain Risk Evaluation for Sodium Chloride

Risk Parameter Ratings and Drivers		
Criticality	High	Likelihood
Sodium chloride is essential to the chlor-alkali industry, which in turn is essential to the water sector.		Low
		Vulnerability
		Low
There were no identified disruptions in the supply of sodium chloride between 2000 and 2022.		The U.S. is a leading worldwide producer of sodium chloride and currently has abundant domestic supply and distributed production. These factors provide some resilience to supply disruptions.
Risk Rating: Low		

References

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