

## Sodium Carbonate



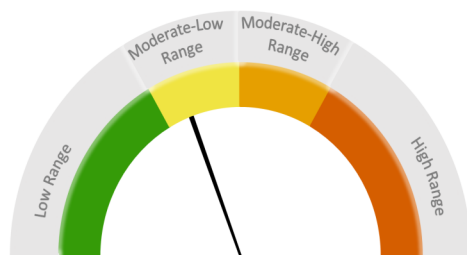
**R**aw Material **D**irect Use Chemical **P**recursor Chemical

(solid) 

 <b>Source of Raw Material:</b> Naturally occurring mineral	 <b>% of Total Domestic Consumption Attributed to Water Sector:</b> Approximately 1%	 <b>Product Family:</b> Sodium Carbonate
 <b>Derivative Water Treatment Chemicals:</b> Sodium Silicate Sodium Orthophosphates	 <a href="#">Understanding Chemical Supply Chains</a> <a href="#">Map of Suppliers &amp; Manufacturers</a>	<b>CAS No.:</b> 497-19-8
		 <b>Shelf Life:</b> 6 Months

## RISK OF SUPPLY DISRUPTION (Assessed in 2022)

RISK RATING: Moderate-Low



## RISK DRIVERS

The U.S. is home to the world's largest deposit of a natural source of sodium carbonate. Periodic price fluctuations and increases have historically been tied to fluctuations in demand for glass from the auto and construction industries and demand on the international market.

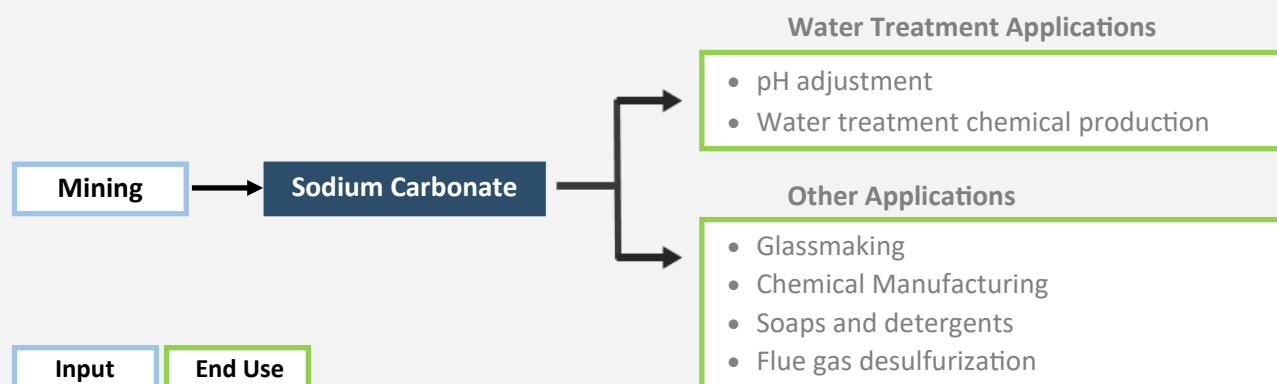
## RISK PARAMETERS

**Criticality:** High. Essential for pH adjustment and production of chemicals necessary for corrosion control.

**Likelihood:** Low. No history of previous disruptions that have impacted the water sector.

**Vulnerability:** Moderate-Low. Domestic production, though abundant, is concentrated in two geographic locations.

## PRODUCTION PROCESS



## DOMESTIC PRODUCTION AND CONSUMPTION, AND INTERNATIONAL TRADE

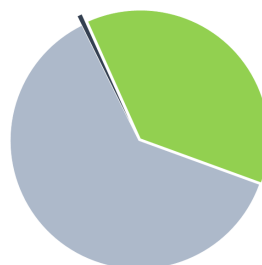
## Domestic Production Locations (2019):

 5, located in Wyoming and California.

## International Trade (2019)

Primary Trading Partner (Imports): Mexico

Primary Trading Partner (Exports): Mexico



Domestic Consumption (2019):  
4,830 M kg

- Domestic Production (11,700 M kg)
- Imports for Consumption (115 M kg)
- Export of Domestic Production (7,020 M kg)

### Product Description

Sodium carbonate ( $\text{Na}_2\text{CO}_3$ ), also known as soda ash, is an inorganic salt widely used in the manufacture of glass, detergents, soaps, and chemicals. 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 carbonate in the U.S. is for glass manufacturing.

### Use in Water Treatment

Sodium carbonate is used directly in water for pH adjustment and water softening (AWWA, 2008).

### Use as a Precursor to Other Water Treatment Chemicals

Sodium carbonate is used to manufacture mono- and disodium orthophosphate and sodium silicate.

### Other Applications

Sodium carbonate has a wide range of applications. The leading use of sodium carbonate is as a fluxing agent to lower the melting temperature of silica in glassmaking processes. It is also widely used in chemical production for soaps, detergents, and other chemicals, and desulfurization of flue gas from fossil-fuel power plants (USGS, 2022).

### Primary Industrial Consumers

In 2019, glass manufacturing accounted for approximately 47% of total sodium carbonate consumed. The chemical industry accounted for approximately 30% of total sodium carbonate sales. The remainder of 2019 domestic consumption includes: commercial market distributors, 6%; soaps and detergents, 6%; miscellaneous applications, 5%; flue gas desulfurization, 4%; pulp and paper, 1%; and water treatment, 1% (USGS, 2021).

## Manufacturing, Transport, & Storage

### Manufacturing Process

Although much of the world's production of sodium carbonate is manufactured synthetically by reacting ammonia dissolved in sodium chloride with carbon dioxide, the domestic commercial market has relied almost exclusively on natural sources (i.e., trona) since 2000. Trona, a mix of sodium carbonate, sodium bicarbonate, and water, is found in a rich deposit in Wyoming. The Green River Basin of Wyoming is home to the largest natural deposits of trona in the world (USGS, 2022). There are two main methods of mining trona: longwall mining method and room and pillar method. Once the trona has been mined, it is conveyed to the surface to be processed into natural sodium carbonate. The trona is ground and calcined, followed by evaporation using evaporative crystallizers to produce sodium carbonate monohydrate crystals. The crystals are concentrated, dewatered, and dried in order to recover anhydrous sodium carbonate (NCBI, 2021).

### Product Transport

Given the limited locations of sodium carbonate production (Wyoming and California), long-range shipping is a crucial aspect of domestic supply (AWWA, 2008; Ciner, 2016; USGS, 2022).

### Storage and Shelf Life

Sodium carbonate is stable and non-reactive over a wide range of temperatures, and should be stored in a cool, dry environment. Exposure to high humidity may cause degradation of the product and conversion to sodium bicarbonate. When stored properly, sodium carbonate can have a shelf life of approximately 6 months (AWWA, 2008; Solvay, 2017).

## 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 carbonate.

**Table 1. Sodium Carbonate Production and Trade Data Sources**

Production and Trade Data			
Category	Data Source	Identifier	Description
Domestic Production	U.S. Geological Survey	CAS No.: 497-19-8	Sodium Carbonate
Imports and Exports	U.S. International Trade Commission	HS Code: 2836.20	Sodium Carbonate

Total U.S. domestic production of sodium carbonate was approximately 11,700 million kilograms (M kg) in 2019 (USGS, 2021). There are five domestic manufacturing locations: four in Wyoming and one in California. The world's largest deposit of trona is located in the Green River Basin of Wyoming. All five domestic production locations are either partially or wholly owned by foreign sodium carbonate producers or consumers (USGS, 2022). A limited number of manufacturers dominate the worldwide production of sodium carbonate, including three of the five domestic producers in the United States and multiple producers in China (USGS, 2022). While US manufacturing relies solely on a natural source of sodium carbonate, industrial and commercial consumption of imported synthetic sodium carbonate is prevalent as well. Additionally, a considerable amount of sodium carbonate is generated during chemical manufacturing and subsequently used in a process rather than captured for use as a distinct end product. The number of domestic manufacturing locations shown in Figure 1 represents operating facilities as of 2019 (USGS, 2021). Supply of NSF/ANSI Standard 60 certified sodium carbonate 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).

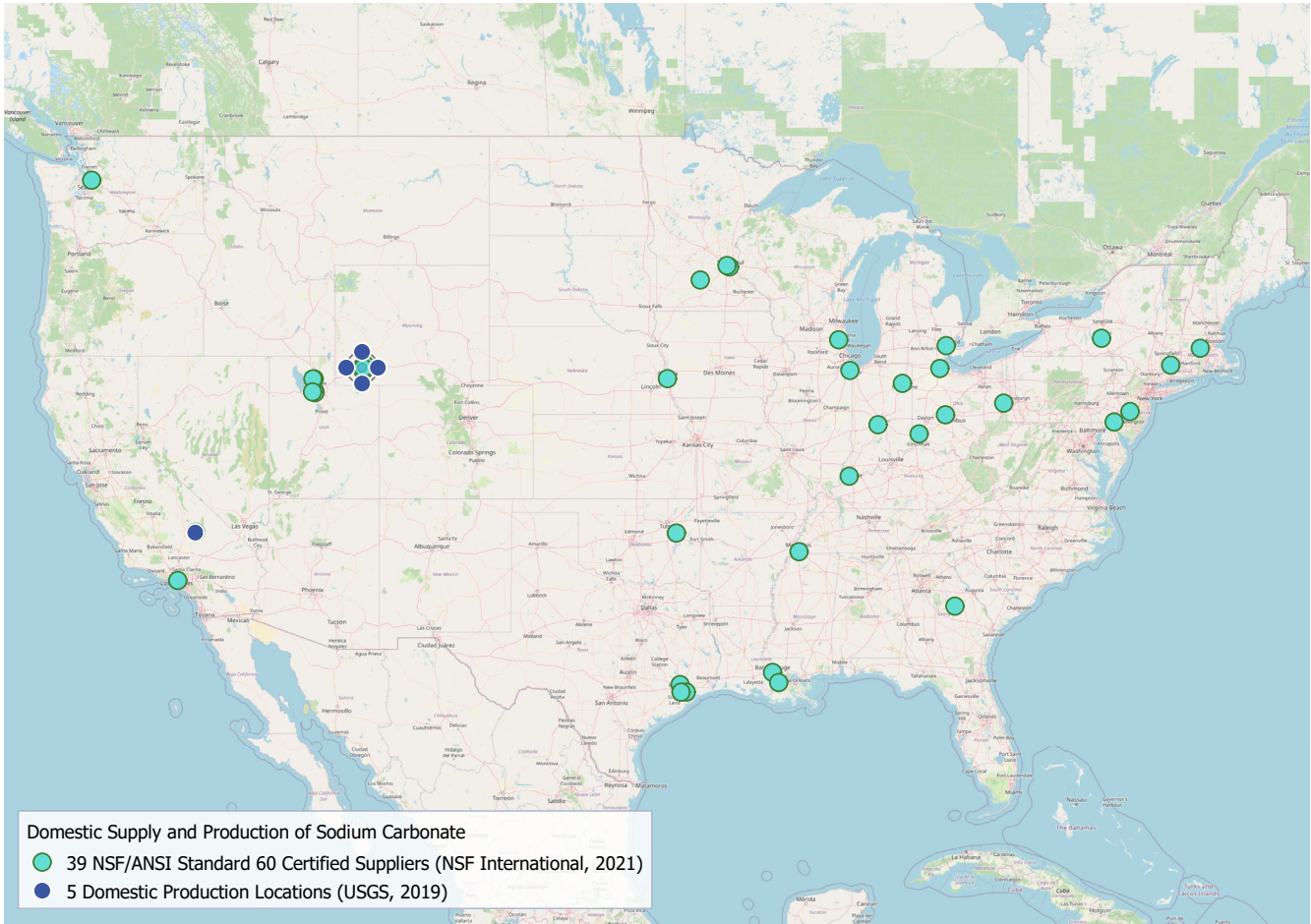


Figure 1. Domestic Supply and Production of Sodium Carbonate

### Domestic Consumption

U.S. consumption of sodium carbonate in 2019 is estimated at 4,830 M kg. This estimate includes production of 11,700 M kg, import of 115 M kg, minus export of 7,020 M kg (USGS, 2021), as shown in Figure 2.

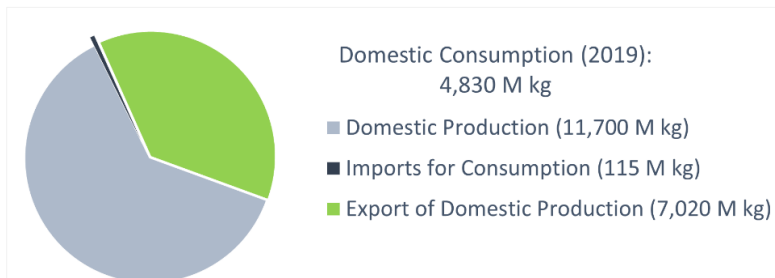


Figure 2. Domestic Production and Consumption of Sodium Carbonate in 2019

### Trade & Tariffs

#### Worldwide Trade

Worldwide import and export data for sodium carbonate are reported through the World Bank’s World Integrated Trade Solutions (WITS) software, as a category specific to sodium carbonate. In 2021, the U.S. ranked first worldwide in total exports and 22<sup>nd</sup> in total imports of sodium carbonate. In 2021, Mexico ranked first

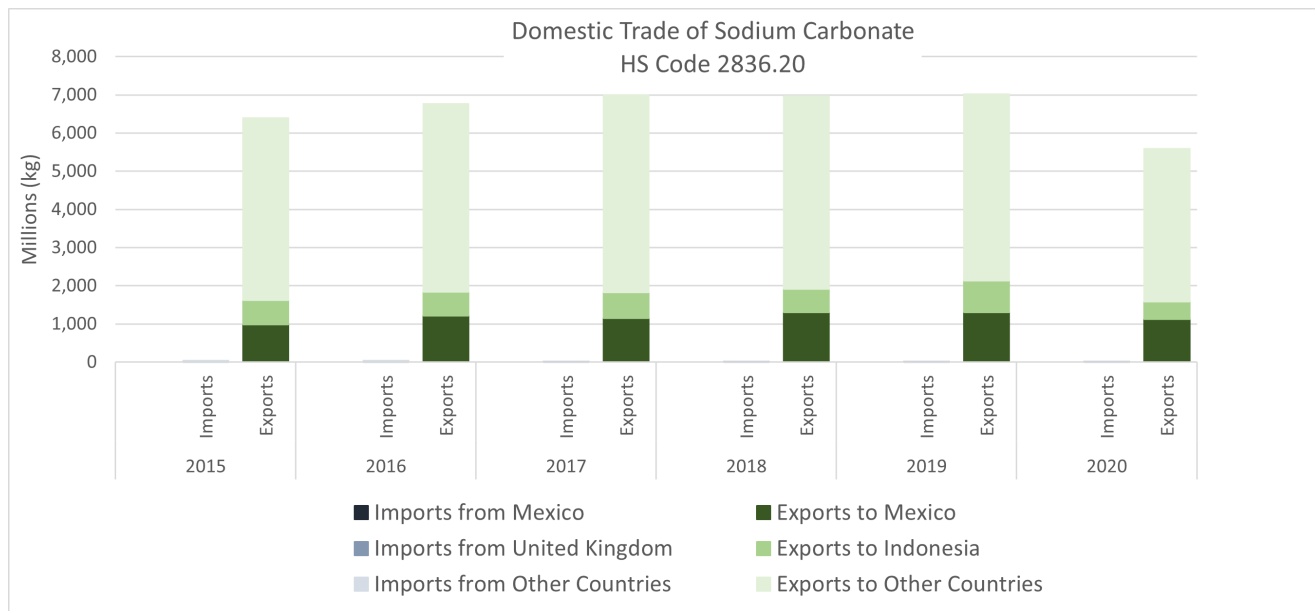
worldwide in total imports of sodium carbonate (WITS, 2022), as shown in Table 2.

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

2021 Worldwide Trade Sodium Carbonate (HS Code 2836.20)			
Top 5 Worldwide Exporters		Top 5 Worldwide Importers	
United States	6,839 M kg	Mexico	1,368 M kg
Turkey	4,530 M kg	Indonesia	821 M kg
Bosnia Herzegovina	408 M kg	Germany	458 M kg
Kenya	303 M kg	Netherlands	420 M kg
Netherlands	109 M kg	Japan	253 M kg

### Domestic Imports and Exports

Domestic import and export data are reported by USITC in categories specific to sodium carbonate. Figure 3 summarizes imports for consumption<sup>1</sup> and domestic exports<sup>2</sup> of sodium carbonate between 2015 and 2020. During this period, the overall quantity of imports steadily decreased, with the greatest volume of imports occurring in 2015; however the volume of exports remained relatively steady, and significantly larger than imports. Over this five-year period, Mexico was the primary recipient of domestic exports and the primary source of imports shifted from the United Kingdom in 2015 to Mexico beginning in 2018 (USITC, 2021).



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

<sup>1</sup> 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.

<sup>2</sup> 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

There is a 1.2% general duty for import of sodium carbonate, and additional 25% duty on imports from China (USITC, 2022), as summarized in Table 3.

**Table 3. 2020 Domestic Tariff Schedule for Sodium Carbonate**

HS Code	General Duty	Additional Duty – China (Section 301 Tariff List)	Special Duty
2836.20	1.2%	25%	Free (A, AU, BH, CL, CO, D, E, IL, JO, KR, MA, MX, OM, P, PA, PE, S, SG) <sup>3</sup>

## Market History & Risk Evaluation

### History of Shortages

There were no identified sodium carbonate supply disruptions between 2000 and 2022. The U.S. is home to the world's largest deposit of a natural source of sodium carbonate. Periodic price fluctuations and increases have historically been tied to fluctuations in demand for glass from the auto and construction industries, as well as export volumes on the international market from the large sodium carbonate-producing countries, including the U.S., Turkey, and China (USGS, 2022). Significant increases in price were noted as a result of reduced exports, imports, and overall consumption during the COVID-19 pandemic (USGS, 2021).

### Risk Evaluation

The complete risk assessment 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:

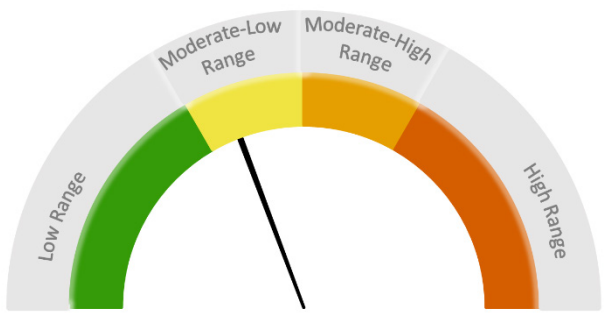
Risk = Criticality x Likelihood x Vulnerability	
<b>Criticality</b>	Measure of the importance of a chemical to the water sector
<b>Likelihood</b>	Measure of the probability that the chemical will experience a supply disruption in the future, which is estimated based on past occurrence of supply disruptions
<b>Vulnerability</b>	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.

<sup>3</sup> Symbols used to designate the various preference programs and trade agreements. A full list of special trade agreements and associated acronyms can be found at [https://help.cbp.gov/s/article/Article-310?language=en\\_US](https://help.cbp.gov/s/article/Article-310?language=en_US) and the General Notes Section of the Harmonized Tariff Schedule <https://hts.usitc.gov/current>



Table 4. Supply Chain Risk Evaluation for Sodium Carbonate

Risk Parameter Ratings and Drivers					
<b>Criticality</b>	<b>High</b>	<b>Likelihood</b>	<b>Low</b>	<b>Vulnerability</b>	<b>Moderate-Low</b>
Sodium carbonate is essential for pH adjustment and the production of chemicals necessary for corrosion control.		The water sector did not experience sodium carbonate supply chain disruptions between 2000 and 2022. Periodic price increases have been tied to fluctuations in demand from the largest industrial consumer, the glass industry.		The U.S. is a leading worldwide producer of sodium carbonate and currently has abundant domestic supply and distribution. However, a limited number of producers and production locations are concentrated to two geographic areas of the U.S.	
Risk Rating: Moderate-Low					
					

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