Sodium Chlorite

$NaClO_2$

(liquid or solid)

D Direct Use Chemical

Inputs to Manufacturing Process:
Hydrogen Peroxide, Sodium Hydroxide, Sodium Chlorate

% of Total Domestic Consumption Attributed to Water Sector:
Less than 10%

Product Family:
Chlor-alkali

CAS No.:
7758-19-2

Derivative Water Treatment Chemicals:
None

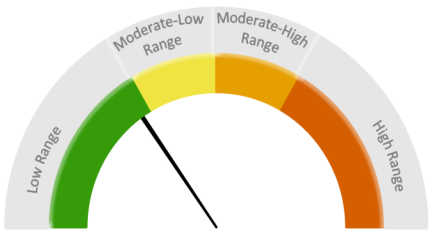
Understanding Chemical Supply Chains

Map of Suppliers & Manufacturers

Shelf Life:
12 Months

RISK OF SUPPLY DISRUPTION (Assessed in 2022)

RISK RATING: Low



RISK DRIVERS

Domestic manufacturing of sodium chlorite is limited, and supply to meet demand is believed to be import-dependent. Supply of two key inputs pose potential risks. Supply of sodium hydroxide, a chlor-alkali co-product, has experienced previous disruptions, while supply of sodium chlorate is import-dependent.

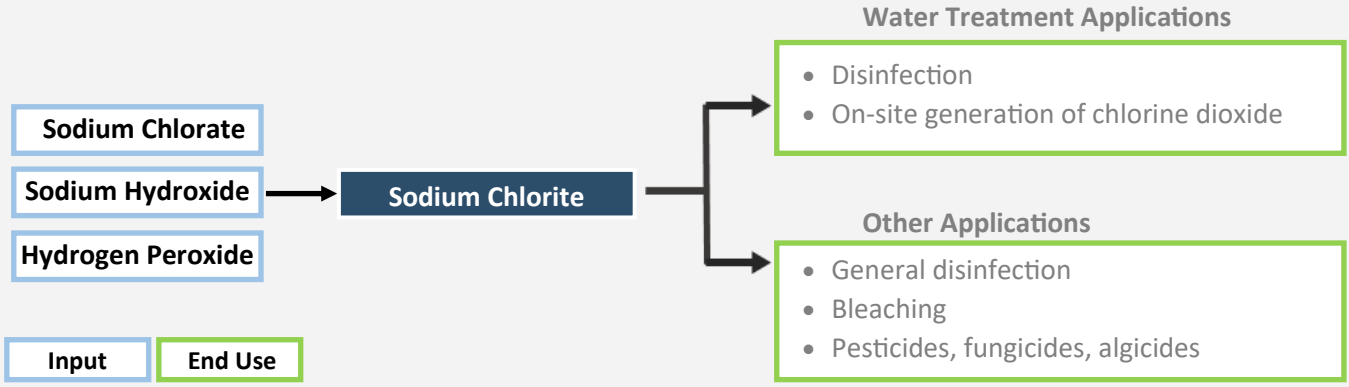
RISK PARAMETERS

Criticality: Moderate-High. Essential for chlorine dioxide generation.

Likelihood: Low. No disruptions in supply that impacted the water sector between 2000 and 2022.

Vulnerability: Moderate-High. Limited domestic manufacturing and reliance on imports to meet demand.

MANUFACTURING PROCESS



DOMESTIC PRODUCTION AND CONSUMPTION, AND INTERNATIONAL TRADE

Domestic Manufacturing Locations (2015):
3, in Utah, Nebraska, and Illinois

International Trade (2019)

Primary Trading Partner (Imports): Canada

Primary Trading Partner (Exports): Canada

Domestic Consumption (2019): 103 M kg

- Domestic Production (0.02 M kg)
- Imports for Consumption (138 M kg)
- Export of Domestic Production (35 M kg)

Product Description

Sodium chlorite ($NaClO_2$), an inorganic chemical and strong oxidant, is widely used for on-site generation of the disinfectant chlorine dioxide, which is generated on-site due to rapid decomposition. Sodium chlorite is also widely used for hydrogen sulfide odor control. The majority of sodium chlorite manufactured in the U.S. is used in cleaning and general disinfection applications.

Use in Water Treatment

Sodium chlorite is used in the on-site generation of chlorine dioxide. Chlorine dioxide is produced by activating sodium chlorite with an oxidizing agent or acid, which in turn is used as an oxidant and disinfectant. It is also used to control hydrogen sulfide odors in wastewater treatment (AWWA, 2018).

Use as a Precursor to Other Water Treatment Chemicals

Sodium chlorite is not used to manufacture other water treatment chemicals.

Other Applications

Sodium chlorite is most commonly used in the activated form as chlorine dioxide. Applications of activated sodium chlorite include water treatment, food manufacturing, oil and gas (sulfide-reducing bacteria control), and in the formulation of herbicides, pesticides, fungicides, and algaecide (ATSDR, 2004; NCBI, 2021).

Primary Industrial Consumers

The majority of sodium chlorite applications rely on the activated form, chlorine dioxide. While wood-pulp bleaching is the largest single use of chlorine dioxide, large scale applications of chlorine dioxide that do not require a high-purity product generally use sodium chlorate as a starting material. Chlorine dioxide disinfection applications requiring a highly-purified product, including water treatment and food production, are the primary domestic applications of sodium chlorite. Water treatment is estimated as less than 10% of overall sodium chlorite consumption (ATSDR, 2004).

Manufacturing, Transport, & Storage

Manufacturing Process

Sodium chlorate, hydrogen peroxide, and sodium hydroxide are the most common starting materials used to produce sodium chlorite. The reaction, illustrated by the equation shown in Figure 1, proceeds from the reduction of chlorine dioxide gas (generated from sodium chlorate) in an alkaline solution (most commonly sodium hydroxide) with hydrogen peroxide (OxyChem, 2015; OxyChem, 2018a).

Chlorine Dioxide (from Sodium Chlorate) + Hydrogen Peroxide + Sodium Hydroxide → Sodium Chlorite + Water + Oxygen

$$2ClO_2 + H_2O_2 + 2NaOH \rightarrow 2NaClO_2 + 2H_2O + O_2$$

Figure 1. Chemical Equation for the Reaction to Manufacture Sodium Chlorite

Product Transport

Sodium chlorite is transported in bulk by truck, rail, barge, and ship as a hazardous material (OxyChem, 2018b).

Storage and Shelf Life

Sodium chlorite, commonly sold as a solid or solution, should be stored in a tightly closed container and kept in a cool place away from the direct sunlight. When stored properly, sodium chlorite can have a shelf life of

approximately 12 months, depending on storage conditions (OxyChem, 2018b).

Domestic Production & Consumption

Domestic Production

Production data was collected from the 2020 Toxic Substances Control Act (TSCA) Chemical Data Reporting (CDR) for the year 2019, while trade data was collected from the U.S. International Trade Commission (USITC) Dataweb, as shown in Table 1. While production data is specific to sodium chlorite, trade data includes sodium chlorite as part of the category for hypochlorites, chlorites, and hypobromites.

Table 1. Sodium Chlorite Production and Trade Data Sources

Production and Trade Data			
Category	**Data Source and Date**	**Identifier**	**Description**
Domestic Production	2020 TSCA Chemical Data Reporting	CAS No.: 7758-19-2	Sodium Chlorite
Imports and Exports	U.S. International Trade Commission	HS Code: 2828.90	Hypochlorites, Chlorites, and Hypobromites

Total U.S. domestic manufacturing of sodium chlorite reported under the CDR was approximately 0.02 million kilograms (M kg) in 2019; however, several leading manufacturers (e.g., *OxyChem*) claimed confidential business information and did not report production volumes to EPA (EPA, 2020). Domestic commercial manufacture of sodium chlorite takes place at only a few identified domestic facilities located in Utah, Nebraska, and Illinois. Most sodium chlorite production facilities rely on the availability of sodium chlorate and sodium hydroxide. The number of domestic manufacturing locations shown in Figure 2 represents operating facilities as of 2015 (EPA, 2016). Supply of NSF/ANSI Standard 60 certified sodium chlorite for use in drinking water treatment is 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).

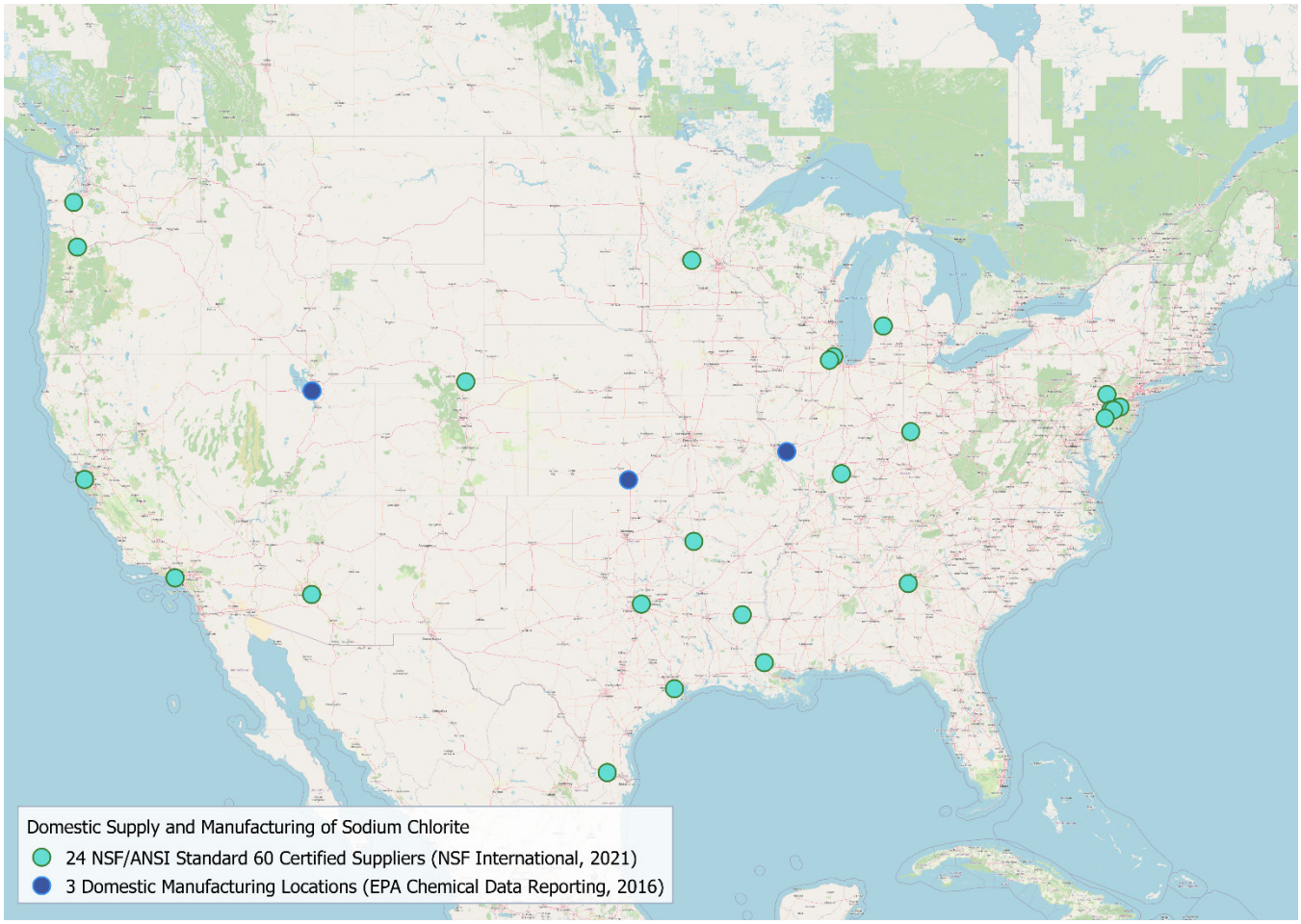


Figure 2. Domestic Supply and Manufacturing of Sodium Chlorite

Domestic Consumption

U.S. consumption of sodium chlorite in 2019 is an estimate based on production of sodium chlorite and trade of a broader category of hypochlorites, chlorites, and hypobromites. Trade of sodium chlorite is believed to be a small percentage of import and export volume in this category. This estimate includes production of 0.02 M kg, import of 138 M kg, minus export of 35 M kg (EPA, 2020; USITC, 2021), as shown in Figure 3.

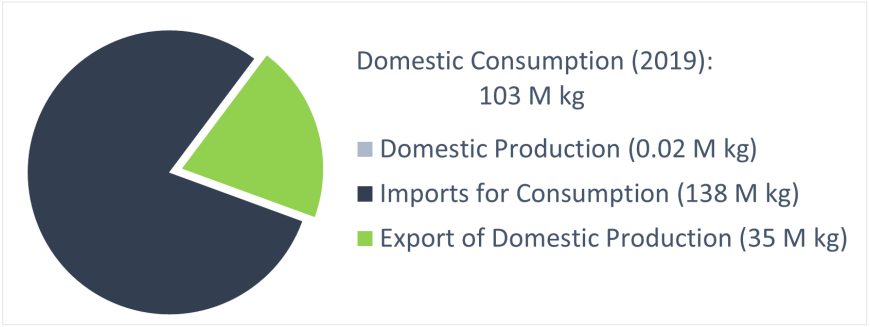


Figure 3. Domestic Production and Consumption of Sodium Chlorite in 2019

Trade & Tariffs

Worldwide Trade

Worldwide import and export data for sodium chlorite are reported through the World Bank's World Integrated

Trade Solutions (WITS), as a category representing a class of compounds including hypochlorites, chlorites, and hypobromites. In 2021, the U.S. ranked eighth worldwide in total exports and first in total imports of hypochlorites, chlorites, and hypobromites. In 2021, China ranked first worldwide in total exports (WITS, 2022), as shown in Table 2. Import and export data specific to sodium chlorite is unavailable from the referenced sources.

Table 2. WITS Worldwide Export and Import of Hypochlorites, Chlorites, and Hypobromites in 2021

2021 Worldwide Trade Hypochlorites, Chlorites, and Hypobromites (HS Code 2828.90)			
Top 5 Worldwide Exporters		Top 5 Worldwide Importers	
China	156 M kg	**United States**	**133 M kg**
Canada	131 M kg	France	74 M kg
Belgium	87 M kg	Canada	56 M kg
Spain	83 M kg	Germany	54 M kg
Germany	72 M kg	Italy	47 M kg

Domestic Imports and Exports

Domestic imports and export data are reported by USITC in a category including hypochlorites, chlorites, and hypobromites. Figure 4 summarizes imports for consumption[1] and domestic exports[2] of hypochlorites, chlorites, and hypobromites between 2015 and 2020. During this period, the overall quantity of exports and imports remained relatively steady, with imports for consumption exceeding domestic exports. Over this five-year period, Canada was the primary recipient of domestic exports and the primary source of imports (USITC, 2021).

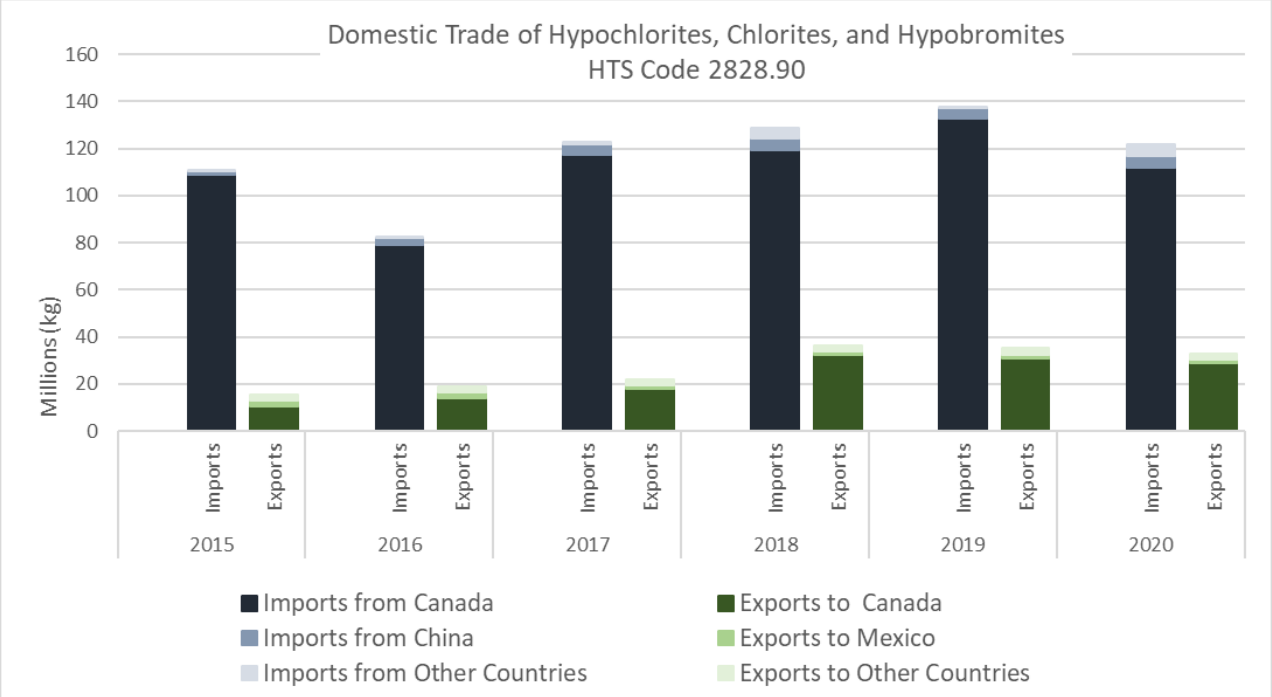


Figure 4. USITC Domestic Import and Export of Hypochlorites, Chlorites, and Hypobromites between 2015 and 2020

[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

There is a 3.7% general duty for import of sodium chlorite and an additional 25% duty on imports from China (USITC, 2022), as summarized in Table 3.

Table 3. 2022 Domestic Tariff Schedule for Hypochlorites, Chlorites, and Hypobromites

HS Code	General Duty	Additional Duty - China (Section 301 Tariff List)	Special Duty
2828.90	3.7%	25%	Free (A, AU, BH, CA, CL, CO, D, E, IL, JO, KR, MA, MX, OM, P, PA, PE, SG)[3]

Market History & Risk Evaluation

History of Shortages

There were no identified sodium chlorite supply chain disruptions impacting the water sector between 2000 and 2022. However, there are specific potential vulnerabilities to the production of sodium chlorite. Domestic production takes place at very few manufacturing locations, and reliance on imports to meet domestic consumption is believed to be significant. Additionally, two key inputs to the production of sodium chlorite, sodium chlorate and sodium hydroxide, are dependent on the chlor-alkali industry. Sodium hydroxide, a primary chlor-alkali co-product has historically been subject to uneven supply and demand patterns and supply disruptions.

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:

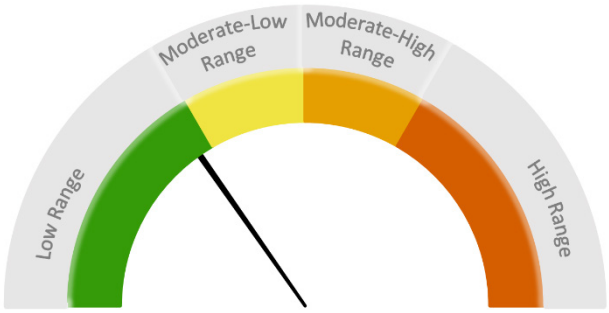
Risk = Criticality x Likelihood x Vulnerability	
Criticality	Measure of the importance of a chemical to the water sector
Likelihood	Measure of the probability that the chemical will experience a supply disruption in the future, which is estimated based on past occurrence of supply disruptions
Vulnerability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

[3] 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 and the General Notes Section of the Harmonized Tariff Schedule https://hts.usitc.gov/current

Table 4. Supply Chain Risk Evaluation for Sodium Chlorite

Risk Parameter Ratings and Drivers		
Criticality: Moderate-High	**Likelihood: Low**	**Vulnerability: Moderate-High**
Sodium chlorite is essential to the water sector for onsite generation of chlorine dioxide and odor control in wastewater treatment. However, chlorine dioxide is not as widely used as other oxidants.	The water sector did not experience any sodium chlorite supply disruptions between 2000 and 2022.	Limited domestic manufacturing capabilities and a significant reliance on imports to meet domestic demand could increase vulnerability.
Risk Rating: Low		



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