

Zinc

Raw Material

Zn

(solid)

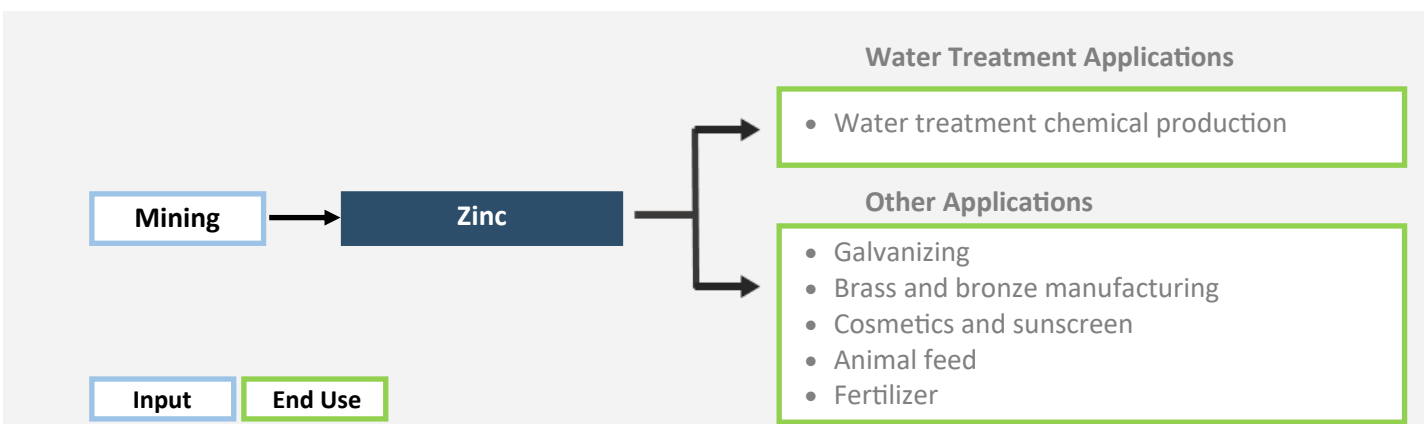


Source of Raw Material: Naturally occurring ore	% of Total Domestic Consumption Attributed to Water Sector: Less than 1%	Product Family: Zinc
Derivative Water Treatment Chemicals: Zinc-based corrosion inhibitors	Understanding Chemical Supply Chains	CAS No.: 7440-66-6
		Shelf Life: 60+ Months

RISK OF SUPPLY DISRUPTION (Assessed in 2022)

<p>RISK RATING: Low</p>	<p>RISK DRIVERS</p> <p>The U.S. produces significant quantities of zinc ores and concentrates, which are exported for smelting. Refined zinc is primarily imported, and is used in significant quantities for galvanizing iron and steel. Fluctuations in these industries may drive domestic demand.</p>	<p>RISK PARAMETERS</p> <p>Criticality: High. Essential for the production of chemicals used in corrosion control.</p> <p>Likelihood: Low. No history of supply disruptions between 2000 and 2022.</p> <p>Vulnerability: Low. The U.S. produces significant quantities of zinc ores. Supply of refined zinc is heavily reliant on imports from foreign smelters.</p>
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PRODUCTION PROCESS



DOMESTIC PRODUCTION AND CONSUMPTION, AND INTERNATIONAL TRADE

<p>Domestic Production Locations (2019): 12, in Alaska, Idaho, Missouri, New York, Tennessee, and Washington.</p>		<p>Domestic Consumption (2018): 18 M kg</p> <ul style="list-style-type: none"> ■ Domestic Production (824 M kg) ■ Imports for Consumption (0.0005 M kg) ■ Export of Domestic Production (806 M kg)
<p>International Trade (2019) Primary Trading Partner (Imports): Peru Primary Trading Partner (Exports): Canada</p>		

Product Description

Zinc (Zn), a widely used naturally occurring element, is not used directly in water treatment. Refined zinc is commonly used to coat ferrous metals for corrosion control. Refined zinc is a primary input in the production of zinc orthophosphate for use in distribution system corrosion control. The U.S. Government has stockpiled refined zinc since 1967 for national defense purposes.

Use in Water Treatment

None.

Use as a Precursor to Other Water Treatment Chemicals

Refined zinc is used to manufacture zinc-based corrosion inhibitors, such as zinc orthophosphate.

Other Applications

Zinc is a widely used metal with a range of applications. All applications of zinc require processing and refining of the ores and concentrates. The leading use of zinc is to coat metals for corrosion prevention. It is most commonly used to produce galvanized steel. Zinc is also used to manufacture brass and bronze, and derivative chemicals. Zinc oxide is used widely in tire manufacturing, cosmetics, and sunscreen, while zinc sulfate is used in animal feed and fertilizers as a micronutrient (ATSDR, 2005; NCBI, 2021; USGS, 2022).

Primary Industrial Consumers

In 2018, approximately 88% of zinc consumed in the U.S. was used in the production of galvanized steel. Production of zinc-based alloys and brass and bronze accounted for 11%, while all other uses accounted for the remaining 1% of zinc consumption in 2018 (USGS, 2022).

Manufacturing, Transport, & Storage

Manufacturing Process

Zinc is found in a variety of widely distributed naturally occurring minerals. Zinc may be produced by conventional underground or surface mining, though underground mining is more common (USGS, 2022). Most ores are low in zinc content and require concentration before smelting and refining (DOE, 2002).

Mined zinc is washed, crushed, screened, and floated before chemical processing can take place. Concentration of the zinc ore may include a sodium hydroxide leaching process, which yields crude zinc. Concentrated zinc may be dried and calcined with sulfuric acid to yield zinc oxide (DOE, 2002).

The majority of domestically-mined zinc is exported as either a raw ore or zinc concentrate, and processed in foreign smelters. As of 2018, only one domestic primary zinc smelter was in operation, located in Tennessee, and this smelter was designed to treat zinc concentrates common to the region in which it operates (USGS, 2022).

Product Transport

Refined zinc, which may be sold as a solid, is routinely transported by ship, rail, truck, and pipeline (USGS, 2022).

Storage and Shelf Life

Zinc is stable and non-reactive over a wide range of temperatures. When stored properly, zinc can have a shelf life in excess of 60 months.

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 zinc ores.

Table 1. Zinc Production and Trade Data Sources

Production and Trade Data			
Category	Data Source	Identifier	Description
Domestic Production	U.S. Geological Survey	CAS No.: 7440-66-6	Zinc Ores and Concentrates
Imports and Exports	U.S. International Trade Commission	HTS Code: 2608.00	Zinc Ores and Concentrates

Total U.S. domestic production of zinc ores and concentrates was approximately 824 million kilograms (M kg) in 2018 (USGS, 2021). In 2018, zinc ores and concentrates were produced in six states (Alaska, Idaho, Missouri, New York, Tennessee, and Washington) at 12 mining operations (USGS, 2022). In 2018, the leading producers (by output) were located in Alaska and Tennessee. Approximately 78% of all recovered zinc was mined in Alaska in 2018 (USGS, 2022).

Domestic Consumption

U.S. consumption of zinc ores and concentrates in 2018 is estimated at 18 M kg. This estimate includes production of 824 M kg, import of 0.0005 M kg, minus export of 806 M kg (USGS, 2021; USITC, 2021), as shown in Figure 1. Imports of zinc ores and concentrates is very limited, in part due to limited domestic smelting capacity.

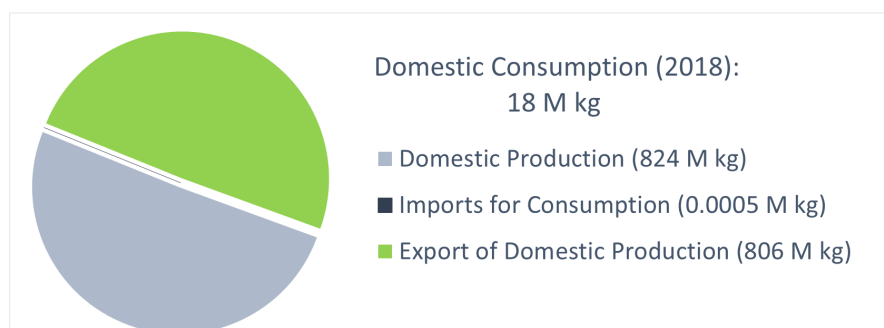


Figure 1. Domestic Production and Consumption of Zinc Ores and Concentrates in 2018

As noted above, the U.S. exports the vast majority of zinc ores and concentrates for smelting, and imports refined zinc in large quantities. In 2018, the U.S. produced 116 M kg of refined zinc, imported 775 M kg, and exported 23 M kg. Domestic consumption of refined zinc in 2018 was estimated at 868 M kg (USGS, 2021).

Trade & Tariffs

Worldwide Trade

Worldwide import and export data for zinc are reported through the World Bank's World Integrated Trade Solutions (WITS) software, as a category specific to zinc ores and concentrates. In 2021, the U.S. ranked fifth

worldwide in total exports and 21st in total imports of zinc ores and concentrates. In 2021, Australia ranked first worldwide in total exports and China ranked first worldwide in total imports (WITS, 2022), as shown in Table 2.

Table 2. WITS Worldwide Export and Import of Zinc Ores and Concentrates in 2021

2021 Worldwide Trade Zinc Ores and Concentrates (HS Code 2608.00)			
Top 5 Worldwide Exporters		Top 5 Worldwide Importers	
Australia	2,102 M kg	China	3,825 M kg
Peru	1,611 M kg	South Korea	1,819 M kg
Turkey	856 M kg	Japan	907 M kg
Bolivia	700 M kg	Spain	885 M kg
United States	658 M kg	Netherlands	508 M kg

Domestic Imports and Exports

Domestic import and export data are reported by USITC in categories specific to zinc ores and concentrates. Figure 2 summarizes imports for consumption¹ and domestic exports² of zinc ores and concentrates between 2015 and 2020. During this period, the overall quantity of imports fluctuated from year to year, with the greatest volume of imports occurring in 2017. The volume of exports, considerably larger than the volume of imports, remained relatively steady. Over this five-year period, Canada was the primary recipients of domestic exports while the primary source of imports was Peru, with a much smaller quantity consistently originating from Canada throughout this period (USITC, 2021).

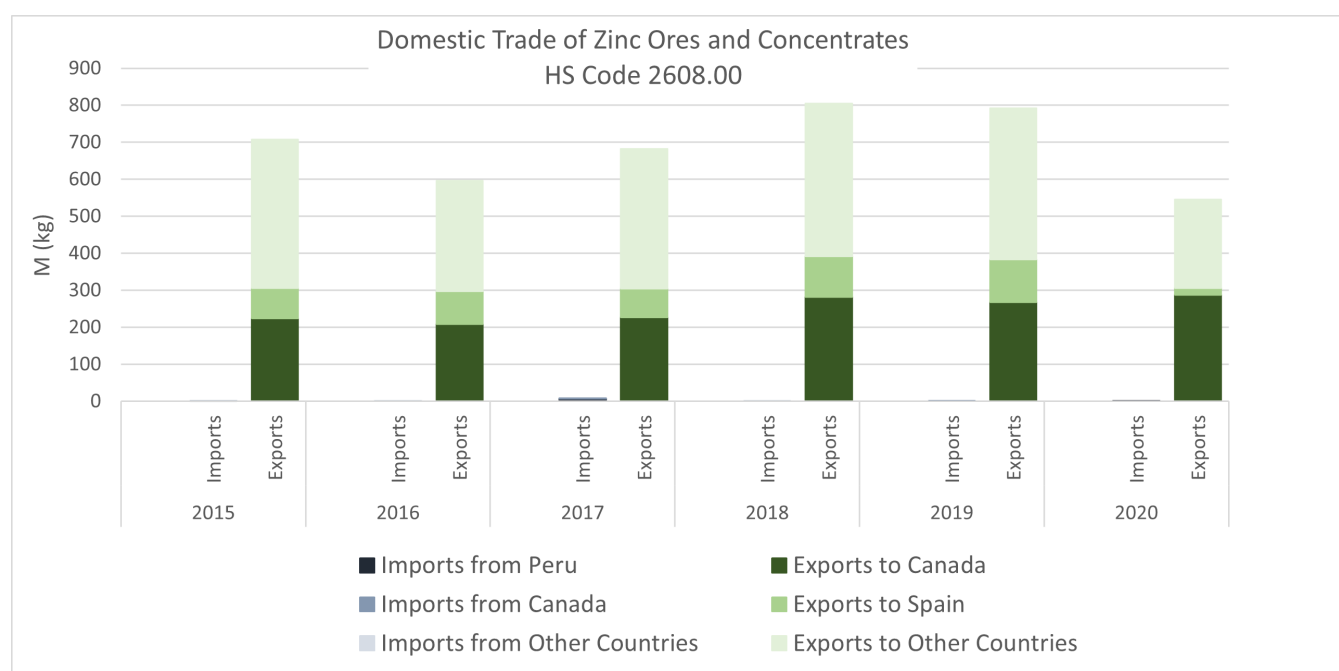


Figure 2. USITC Domestic Import and Export of Zinc between 2015 and 2020

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.

As mentioned previously, the U.S. imports significant quantities of refined zinc. The imported quantity of refined zinc was comparable to or in excess of the quantity of exported zinc ores and concentrates through the period of 2015 through 2020. The primary trade partner for exports and imports of refined zinc is Canada (USITC, 2022).

Tariffs

There is no general or additional duty for import of zinc (USITC, 2022), as summarized in Table 3.

Table 3. 2022 Domestic Tariff Schedule for Zinc

HS Code	General Duty	Additional Duty – China (Section 301 Tariff List)	Special Duty
2608.00	None	None	None

Market History & Risk Evaluation

History of Shortages

The North American market for zinc has long been dominated by use in galvanizing processes for iron and steel, and fluctuations for this end use drive demand in the market. Despite fluctuations in these industries, notable domestic zinc supply chain disruptions between 2000 and 2022 were not identified.

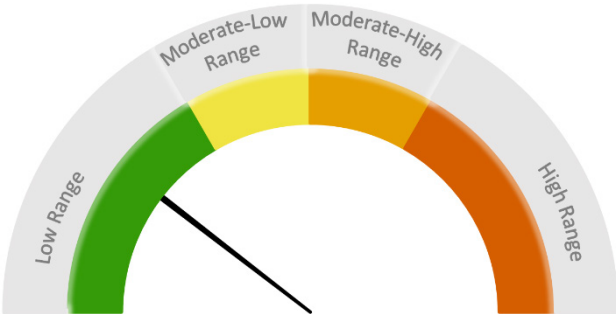
Risk Evaluation

The complete risk assessment methodology is described in *Understanding Water Treatment Chemical Supply Chains and the Risk of Disruptions* (EPA, 2022). 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 Zinc

Risk Parameter Ratings and Drivers					
Criticality	High	Likelihood	Low	Vulnerability	Low
Zinc is essential to production of all zinc-based water treatment chemicals.		There were no identified disruptions in the supply of zinc between 2000 and 2022.		The U.S. produces large quantities of zinc ores and concentrates. However, the majority of zinc ores and concentrates are exported for smelting, and refined zinc is imported for widespread domestic use. Imports of refined zinc are equivalent or greater than exports of zinc ores.	
Risk Rating: Low					
					

References

- Agency for Toxic Substances and Disease Registry (ATSDR), 2005. *Toxicological Profile for Zinc*, retrieved from <https://www.atsdr.cdc.gov/toxprofiles/tp60.pdf>
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