

BORON

(Data in thousand metric tons unless otherwise specified)

Domestic Production and Use: Three companies in southern California produced borates in 2024, and most of the boron products consumed in the United States were manufactured domestically. Estimated boron production increased in 2024 compared with production in 2023. U.S. boron production and consumption data were withheld to avoid disclosing company proprietary data. The leading boron producer mined borate ores, which contain the minerals kernite, tincal, and ulexite, by open pit methods and operated associated compound plants. Kernite was used to produce boric acid, tincal was used to produce sodium borate, and ulexite was used as a primary ingredient in the manufacture of a variety of specialty glasses and ceramics. A second company produced borates from brines extracted through solution-mining techniques. A third company began mining borates using solution mining techniques in January 2024. Boron minerals and chemicals were principally consumed in the north-central and eastern United States. In 2024, the glass and ceramics industries remained the leading domestic users of boron products. Boron also was used as a component in abrasives, cleaning products, insecticides, insulation, and in the production of semiconductors.

Salient Statistics—United States:

	<u>2020</u>	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024^e</u>
Production	W	W	W	W	W
Imports for consumption:					
Refined borax	174	232	168	156	160
Boric acid	39	54	48	38	42
Colemanite (calcium borates)	18	3	1	2	1
Ulexite (sodium borates)	41	49	38	20	37
Exports:					
Boric acid	257	280	239	253	240
Refined borax	594	607	651	604	590
Consumption, apparent ¹	W	W	W	W	W
Price, average unit value of imports, cost, insurance, and freight, dollars per metric ton	380	394	485	606	560
Employment, number	1,330	1,330	1,400	1,430	1,500
Net import reliance ² as a percentage of apparent consumption	E	E	E	E	E

Recycling: Insignificant.

Import Sources (2020–23): All forms: Turkey, 90%; Bolivia, 6%; and other, 4%.

<u>Tariff:</u>	<u>Item</u>	<u>Number</u>	<u>Normal Trade Relations</u> <u>12–31–24</u>
Natural borates:			
Sodium (ulexite)	2528.00.0005		Free.
Calcium (colemanite)	2528.00.0010		Free.
Boric acids	2810.00.0000		1.5% ad valorem.
Borates, refined borax:			
Anhydrous	2840.11.0000		0.3% ad valorem.
Non-anhydrous	2840.19.0000		0.1% ad valorem.

Depletion Allowance: Borax, 14% (domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: Elemental boron is a metalloid with limited commercial applications. Although the term “boron” is commonly referenced, it does not occur in nature in an elemental state. Boron combines with oxygen and other elements to form boric acid or inorganic salts called borates. Boron compounds, chiefly borates, are commercially important; therefore, boron products are priced and sold based on their boric oxide (B₂O₃) content, varying by ore and compound and by the absence or presence of calcium and sodium. Four borate minerals—colemanite, kernite, tincal, and ulexite—account for 90% of the borate minerals used by industry worldwide. Although borates were used in more than 300 applications, more than three-quarters of world consumption was used in ceramics, detergents, fertilizers, and glass.

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China, India, Canada, Indonesia, and Mexico, in decreasing order of tonnage, were the countries that imported the largest quantities of refined borates from the United States in 2024. Domestic shipments of boric acid were sent to China, the Netherlands, the Republic of Korea, Taiwan, and Brazil, in decreasing order of tonnage. Because China has low-grade boron reserves and demand for boron is anticipated to rise in that country, imports from the United States were expected to remain steady during the next several years.

Interests and investments in boron derivatives continued domestically and abroad. The U.S. Department of Defense under the Defense Production Act, Title III, awarded \$49.6 million to a company headquartered in Golden, CO, in December 2023. The funding was to be used to increase domestic boron carbide production capacity. In April 2024, a domestic company began boric acid production at its small-scale boron facility in Newberry Springs, CA. It began mining borates in January 2024. This facility's initial production capacity was about 1,800 tons per year, and the company planned to increase production to about 8,200 tons per year in the future. The small-scale boron facility was expected to focus on specialty boron products for industries related to defense, electric transportation, food security, and global decarbonization.

One Australia-based mine developer progressed toward construction of its boric acid project in Nevada. In September 2024, the Bureau of Land Management completed its final environmental impact statement and determined that development of the project may proceed. Once constructed, the project was expected to have a 26-year mine life and produce about 175,000 tons per year of boric acid. Initial production was expected to begin in 2028.

About 18 months after opening its first boron carbide facility in March 2023, Turkey opened another boron facility, the Bigadiç Granular Boron Production Facility, in September 2024. The new facility was expected to primarily produce granulated pipes for the fertilizer industry. This facility has a production capacity of 35,000 tons per year. By the end of August 2024, borate production in Turkey had increased by 36% compared with that in the same period in 2023.

World Production and Reserves: Reserve data for China were revised based on Government reports.

	Production—All forms ^e		Reserves ³
	2023	2024	
United States	W	W	48,000
Argentina, crude ore	160	160	NA
Bolivia, ulexite	140	230	NA
Chile, ulexite	420	420	35,000
China, boric oxide equivalent	300	340	9,100
Germany, compounds	38	40	NA
Peru, crude borates	300	300	4,000
Russia, datolite ore	80	80	40,000
Turkey, refined borates	2,500	3,000	950,000
World total ⁴	XX	XX	XX

World Resources:³ Deposits of borates are associated with volcanic activity and arid climates, with the largest economically viable deposits in the Mojave Desert of the United States, the Alpid belt along the southern margin of Eurasia, and the Andean belt of South America. U.S. deposits consist primarily of tincal, kernite, and borates contained in brines, and to a lesser extent, ulexite and colemanite. About 70% of all deposits in Turkey are colemanite, primarily used in the production of heat-resistant glass. At current levels of consumption, world resources are adequate for the foreseeable future.

Substitutes: The substitution of other materials for boron is possible in detergents, enamels, insulation, and soaps. Sodium percarbonate can replace borates in detergents and requires lower temperatures to undergo hydrolysis, which is an environmental consideration. Some enamels can use other glass-producing substances, such as phosphates. Insulation substitutes include cellulose, foams, and mineral wools. In soaps, sodium and potassium salts of fatty acids can act as cleaning and emulsifying agents.

^eEstimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data. XX Not applicable.

¹Defined as production + imports – exports.

²Defined as imports – exports.

³See Appendix C for resource and reserve definitions and information concerning data sources.

⁴World totals cannot be calculated because production and reserves are not reported in a consistent manner by all countries.