

## BORON

(Data in thousand metric tons gross weight unless otherwise noted)

**Domestic Production and Use:** Two companies in southern California produced borates in 2015, and most of the boron products consumed in the United States were manufactured domestically. U.S. boron production and consumption data were withheld to avoid disclosing company proprietary data. The leading boron producer mined borate ores containing kernite, tincal, and ulexite by open pit methods and operated associated compound plants. The kernite was used for boric acid production, tincal was used as a feedstock for sodium borate production, 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. Boron minerals and chemicals were principally consumed in the North Central and the Eastern United States. In 2015, the glass and ceramics industries remained the leading domestic users of boron products, accounting for an estimated 80% of total borates consumption. Boron also was used as a component in abrasives, cleaning products, insecticides, insulation, and in the production of semiconductors.

<b>Salient Statistics—United States:</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015<sup>e</sup></b>
Production	W	W	W	W	W
Imports for consumption:					
Refined borax	69	86	127	152	164
Boric acid	56	55	53	57	60
Colemanite	—	24	38	45	42
Ulexite	—	1	—	34	74
Exports:					
Boric acid	235	190	232	225	161
Refined borax	492	457	489	584	532
Consumption, apparent	W	W	W	W	W
Price, average value of mineral imports at port of exportation, dollars per ton	553	510	433	372	400
Employment, number	1,180	1,180	1,180	1,180	1,180
Net import reliance <sup>1</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Insignificant.

**Import Sources (2011–14):** Borates: Turkey, 80%; Bolivia, 8%; China, 3%; Argentina, 3%; and other, 6%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–15</b>
Natural borates:			
	Sodium (ulexite)	2528.00.0005	Free.
	Calcium (colemanite)	2528.00.0010	Free.
	Boric acids	2810.00.0000	1.5% ad val.
Borates:			
	Refined borax:		
	Anhydrous	2840.11.0000	0.3% ad val.
	Non-anhydrous	2840.19.0000	0.1% ad val.

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

**Government Stockpile:** None.

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**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 content ( $B_2O_3$ ), varying by ore and compound and by the absence or presence of calcium and sodium. The four borate minerals—colemanite, kernite, tincal, and ulexite—make up 90% of the borate minerals used by industry worldwide. Although borates were used in more than 300 applications, more than three-quarters of the world’s supply is consumed in ceramics, detergents, fertilizers, and glass. Imports of refined borax increased each year between 2011 through 2015, including an 8% estimated increase between 2014 and 2015.

Consumption of borates is expected to increase in the foreseeable future, spurred by demand in the agricultural, ceramic, and glass markets in Asia and South America. Demand for borates was expected to shift slightly away from detergents and soaps toward glass and ceramics.

Canada, China, the Republic of Korea, Malaysia, and the Netherlands are the countries that imported the largest quantities of mined borates from the United States in 2015. Because China has low-grade boron reserves and demand for boron is anticipated to rise in that country, imports to China from Chile, Russia, Turkey, and the United States were expected to increase during the next several years. In Europe and developing countries, more stringent building standards with respect to heat conservation were being enacted. Consequently, increased consumption of borates for fiberglass insulation was expected. Continued investment in new borate refineries and technologies and the continued rise in demand were expected to fuel growth in world production during the next several years.

**World Production and Reserves:** The reserves estimate for Turkey was revised based on data from Government reports.

	Production—All forms <sup>2</sup>		Reserves <sup>3</sup>
	2014	2015 <sup>e</sup>	
United States	W	W	40,000
Argentina	500	500	NA
Bolivia	15	15	NA
Chile	580	580	35,000
China	160	160	32,000
Kazakhstan	30	30	NA
Peru	225	225	4,000
Russia	250	250	40,000
Turkey	4,100	4,200	230,000
World total (rounded)	45,860	45,960	380,000

**World Resources:** Deposits of borates are associated with volcanic activity and arid climates, with the largest economically viable deposits located in the Mojave Desert of the United States, the Alpidic belt in southern Asia, 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. Small deposits are being mined in South America. 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.

<sup>e</sup>Estimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data. — Zero.

<sup>1</sup>Defined as imports – exports.

<sup>2</sup>Gross weight of ore in thousand metric tons.

<sup>3</sup>See [Appendix C](#) for resource/reserve definitions and information concerning data sources.

<sup>4</sup>Excludes U.S. production.