

## BORON

(Data in thousand metric tons unless otherwise noted)

**Domestic Production and Use:** Two companies in southern California produced borates in 2014, and most of the boron products consumed in the United States were manufactured domestically. To avoid disclosing company proprietary data, U.S. boron production and consumption were withheld. 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 2014, the glass and ceramics industries remained the leading domestic users of boron products, consuming an estimated 80% of total borates consumption. Boron also was used as a component in abrasives, cleaning products, insecticides, and in the production of semiconductors.

<b>Salient Statistics—United States:</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014<sup>e</sup></b>
Production	W	W	W	W	W
Imports for consumption, gross weight:					
Borax	(1)	2	2	2	2
Boric acid	50	57	55	53	63
Colemanite	50	20	28	5	41
Ulexite	1	5	12	13	13
Exports, gross weight:					
Boric acid	264	235	190	232	215
Refined sodium borates	423	492	457	514	631
Consumption:					
Apparent	W	W	W	W	W
Reported	W	W	W	W	W
Price, average value of mineral imports at port of exportation, dollars per ton	485	579	569	615	630
Employment, number	1,220	1,180	1,180	1,180	1,180
Net import reliance <sup>2</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Insignificant.

**Import Sources (2010–13):** Borates: Turkey, 81%; China, 3%; Argentina, 3%; Austria, 2%; and other, 11%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations</b> <b>12–31–14</b>
Natural borates:			
Sodium		2528.00.0005	Free.
Calcium		2528.00.0010	Free.
Other		2528.00.0050	Free.
Boric acids		2810.00.0000	1.5% ad val.
Borates:			
Refined borax:			
Anhydrous		2840.11.0000	0.3% ad val.
Other		2840.19.0000	0.1% ad val.
Other		2840.20.0000	3.7% ad val.
Perborates:			
Sodium		2840.30.0010	3.7% ad val.
Other		2840.30.0050	3.7% 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 that has 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 were 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, fertilizer, and glass.

Consumption of borates is expected to increase in 2014 and the coming years, spurred by demand in the Asian and South American agricultural, ceramic, and glass markets. Demand for borates was expected to shift slightly away from detergents and soaps toward glass and ceramics.

Canada, China, Korea, Malaysia, and The Netherlands are the countries that imported the largest quantities of mined borates from the United States in 2014. 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 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:

	Production—All forms <sup>3</sup>		Reserves <sup>4</sup>
	2013	2014 <sup>e</sup>	
United States	W	W	40,000
Argentina	500	500	2,000
Bolivia	150	150	NA
Chile	581	580	35,000
China	160	165	32,000
Kazakhstan	30	30	NA
Peru	100	220	4,000
Russia	250	300	40,000
Turkey	1,770	1,770	60,000
World total (rounded)	<sup>5</sup> 3,540	<sup>5</sup> 3,720	210,000

**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 Turkish deposits 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, enamel, 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.

<sup>1</sup>Less than ½ unit.

<sup>2</sup>Defined as imports – exports.

<sup>3</sup>Gross weight of ore in thousand metric tons.

<sup>4</sup>See [Appendix C](#) for resource/reserve definitions and information concerning data sources.

<sup>5</sup>Excludes U.S. production.