

## BORON

(Data in thousand metric tons of boric oxide (B<sub>2</sub>O<sub>3</sub>) unless otherwise noted)

**Domestic Production and Use:** Two companies in southern California produced borates in 2012, 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 in 2012 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 and the tincal was used as a feedstock for sodium borate production. 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 2012, the glass and ceramics industries remained the leading domestic users of boron products, consuming an estimated 80% of the total borates marketplace. Boron was also used as a component in abrasives, cleaning products, insecticides, and in the production of semiconductors.

<b>Salient Statistics—United States:</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012<sup>e</sup></b>
Production <sup>1</sup>	W	W	W	W	W
Imports for consumption, gross weight:					
Borax	1	1	(2)	(2)	(2)
Boric acid	50	36	50	57	57
Colemanite	30	31	50	20	20
Ulexite	75	28	1	5	5
Exports, gross weight:					
Boric acid	303	171	264	235	190
Refined sodium borates	519	417	423	492	398
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	302	339	361	361	360
Employment, number	1,310	1,220	1,180	1,180	1,190
Net import reliance <sup>3</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Insignificant.

**Import Sources (2008–11):** Borates: Turkey, 50%; Argentina, 15%; Chile, 13%; Russia, 10%; and other, 12%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–12</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 borates—colemanite, kernite, tincal, and ulexite—make up 90% of the borates used by industry worldwide. Although borates were used in more than 300 applications, more than three-quarters of the world’s supply is sold into the following four end uses: ceramics, detergents, fertilizer, and glass.

Consumption of borates is expected to increase in 2012 and the coming years, spurred by strong demand in the Asian and South American agricultural, ceramic, and glass markets. In particular, boron consumption in the global fiberglass industry was projected to increase by 7% annually through 2013, spurred by a projected 19% increase in Chinese consumption. World consumption of borates was projected to reach 2.0 million tons of  $B_2O_3$  by 2014, compared with 1.5 million metric tons of  $B_2O_3$  in 2010. Demand for borates was expected to shift slightly away from detergents and soaps toward glass and ceramics.

Because China has low-grade boron reserves and demand for boron is anticipated to rise in that country, Chinese imports from Chile, Russia, Turkey, and the United States were expected to increase during the next several years. European and emerging markets were requiring more stringent building standards with respect to heat conservation. 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>4</sup>		Reserves <sup>5</sup>
	2011	2012 <sup>e</sup>	
United States	W	W	40,000
Argentina	600	600	2,000
Bolivia	135	140	NA
Chile	489	500	35,000
China	100	100	32,000
Iran	1	1	1,000
Kazakhstan	30	30	NA
Peru	293	300	4,000
Russia	400	400	40,000
Turkey	2,500	2,500	60,000
World total (rounded)	<sup>6</sup> 4,550	<sup>6</sup> 4,600	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 Alpide 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>Minerals and compounds sold or used by producers; includes both actual mine production and marketable products.

<sup>2</sup>Less than ½ unit.

<sup>3</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>4</sup>Gross weight of ore in thousand metric tons.

<sup>5</sup>See Appendix C for resource/reserve definitions and information concerning data sources.

<sup>6</sup>Excludes U.S. production.