

**BORON**

(Data in thousand metric tons unless otherwise noted)

**Domestic Production and Use:** Two companies in southern California produced borates in 2017, 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 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. Boron minerals and chemicals were principally consumed in the North Central and the Eastern United States. In 2017, 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>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017<sup>e</sup></b>
Production	W	W	W	W	W
Imports for consumption:					
Refined borax	127	152	136	173	140
Boric acid	53	57	40	46	35
Colemanite (calcium borates)	38	45	35	35	39
Ulexite (sodium borates)	—	34	70	43	23
Exports:					
Boric acid	232	226	195	241	140
Refined borax	489	584	504	552	500
Consumption, apparent <sup>1</sup>	W	W	W	W	W
Price, average value of mineral imports					
Cost, insurance and freight, dollars per ton	433	372	400	550	500
Employment, number	1,180	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 (2013–16):** Borates: Turkey, 78%; Bolivia, 15%; Chile, 3%; Argentina, 1%; and other, 3%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–17</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 world consumption was used in ceramics, detergents, fertilizers, and glass.

Canada, China, India, Malaysia, and the Netherlands are the countries that imported the largest quantities of refined borates from the United States in 2017. 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 remain steady 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:** Reserves for Turkey were updated based on Government information.

	Production—All forms		Reserves <sup>3</sup>
	2016	2017 <sup>e</sup>	
United States	W	W	40,000
Argentina	450	450	NA
Bolivia	150	150	NA
Chile	518	520	35,000
China	160	160	32,000
Kazakhstan	500	500	NA
Peru	663	660	4,000
Russia	80	80	40,000
Turkey	7,300	7,300	950,000
World total (rounded)	<sup>4</sup> 9,820	<sup>4</sup> 9,800	1,100,000

**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 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.

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

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

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

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

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