# BORON

(Data in thousand metric tons of boric oxide ($B_2O_3$), unless otherwise noted)

**Domestic Production and Use:** The estimated value of boric oxide contained in minerals and compounds produced in 2002 was $468 million. Domestic production of boron minerals, primarily as sodium borates, by four companies was centered in southern California. The largest producer operated an open pit tincal and kernite mine and associated compound plants. The majority of the remaining output was produced using saline brines as raw material. A third company continued to process small amounts of calcium and calcium sodium borates, and a fourth company used an in situ process. Principal consumption was in ceramics by firms in the North Central United States and the Eastern United States. The reported distribution pattern for boron compounds consumed in the United States in 2001 was as follows: glass and ceramics, 78%; soaps and detergents, 6%; agriculture, 4%; fire retardants, 3%; and other, 9%.

| Salient Statistics—United States: | 1998 | 1999 | 2000 | 2001 | 2002[e] |
|---|---|---|---|---|---|
| Production[1] | 587 | 618 | 546 | 536 | 620 |
| Imports for consumption, gross weight: | | | | | |
| Borax | 14 | 8 | 1 | 1 | 7 |
| Boric acid | 23 | 30 | 39 | 56 | 48 |
| Colemanite | 47 | 42 | 26 | 35 | 11 |
| Ulexite | 170 | 178 | 127 | 109 | 80 |
| Exports, gross weight: | | | | | |
| Boric acid | 106 | 107 | 119 | 85 | 87 |
| Colemanite | 17 | NA | NA | NA | 5 |
| Refined sodium borates | 453 | 370 | 413 | 221 | 153 |
| Consumption: | | | | | |
| Apparent | 412 | 534 | 356 | 482 | 559 |
| Reported | NA | 416 | 360 | 347 | NA |
| Price, dollars per ton, granulated pentahydrate borax in bulk, carload, works[2] | 340 | 376 | 376 | 376 | 376 |
| Stocks, yearend[3] | NA | NA | NA | NA | NA |
| Employment, number | 900 | 900 | 1,300 | 1,300 | 1,300 |
| Net import reliance[4] as a percentage of apparent consumption | E | E | E | E | E |

**Recycling:** Insignificant.

**Import Sources (1998-2001):** Boric acid: Turkey, 42%; Chile, 24%; Canada, 12%; Bolivia, 9%; Italy 6%; and other, 7%.

| Tariff: Item | Number | Normal Trade Relations 12/31/02 |
|---|---|---|
| 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. |
| Boric acids | 2810.00.0000 | 1.5% ad val. |
| Natural borates: | | |
| Sodium | 2528.10.0000 | Free. |
| Other: | | |
| Calcium | 2528.90.0010 | Free. |
| Other | 2528.90.0050 | Free. |

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

**Government Stockpile:** None.

Prepared by **Phyllis A. Lyday [(703) 648-7713, plyday@usgs.gov, fax: (703) 649-7722]**

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**Events, Trends, and Issues:** The United States was the world's largest producer of boron compounds during 2002, and about one-half of domestic production was exported. The largest company produced ore from an open pit mine with processing also in the State of California. The production of boron, sodium carbonate, and sodium sulfate production from a second company that processed underground brines continued, and the company continued with plans to sell its assets. The domestic underground mine in California continued to process ore in Nevada for overseas export.

The parent company of the largest borate producer in the United States announced plans to invest $2.6 million to construct a new boric acid plant adjacent to its current refinery operations in Campo Quijano, Argentina, which has a workforce of 180 people. Construction, which began in August 2002, was to be completed by early 2003. About $2 million was invested to upgrade equipment that included installing new furnaces, centrifuges, and a magnetic concentration plant to both improve efficiency and lower environmental impact. Market sectors are textile fiberglass, 35%; frits and ceramics, 15%; borosilicate glass, 8%; cellulose insulation, 5%; and other uses, 37%.

The parent company of the largest borate company in the United States and the world's leading talc producer joined to introduce borate autocausticizing technology into the kraft paper process. Borates react with a portion of the sodium carbonate in the recovery boiler to form a borate compound that when hydrated converts to sodium hydroxide. The process reduces lime and energy requirements with little capital investment. Trials have shown no change in viscosity, brightness, or strength of the paper produced. Talc is used as a coating pigment and as a pitch control agent, and is used as a filler in paper.

Exported U.S. borate materials competed with borax, boric acid, colemanite, and ulexite primarily from Turkey, the largest producer of boron ore in the world. A subsidiary of Turkey's largest mining company was building a boric acid plant at Emet that will produce 100,000 tons per year by early 2003. Production at the Bandirma plant was planned to be increased from 45,000 tons per year to 60,000 tons per year during 2002. Turkey is building a 274,000-ton-per-year plant at Bandirma that will use pyrite to supply sulfuric acid for the boric acid plants at Bandirma and Emet.

**World Production, Reserves, and Reserve Base:**[5]

| | Production—all forms | | Reserves[6] | Reserve base[6] |
|---|---|---|---|---|
| | 2001 | 2002[e] | | |
| United States | 1,050 | 1,200 | 40,000 | 80,000 |
| Argentina | 500 | 500 | 2,000 | 9,000 |
| Bolivia | 34 | 35 | Moderate | Moderate |
| Chile | 338 | 330 | Large | Large |
| China | 150 | 150 | 25,000 | 47,000 |
| Iran | 1 | 1 | 1,000 | 1,000 |
| Peru | 30 | 30 | 4,000 | 22,000 |
| Russia | 1,000 | 1,000 | 40,000 | 100,000 |
| Turkey | 1,500 | 1,500 | 60,000 | 150,000 |
| Yugoslavia | — | — | 2,000 | 7,000 |
| World total (rounded) | 4,600 | 4,800 | Large | Large |

**World Resources:** Large domestic reserves of boron materials occur in California, chiefly in sediments and their contained brines. Extensive resources also occur in Turkey. Small deposits are being mined in South America. At current levels of consumption, world resources are adequate for the foreseeable future.

**Substitutes:** Substitution for boron materials is possible in such applications as soaps, detergents, enamel, and insulation. In soaps, sodium and potassium salts of fatty acids are the usual cleaning and emulsion agents. Borates in detergents can be replaced by chlorine bleach or enzymes. Some enamels use other glass-producing substances, such as phosphates. Insulation substitutes include cellulose, foams, and mineral wools.

[e]Estimated. E Net exporter. NA Not available. — Zero.

[1]Minerals and compounds sold or used by producers; includes both actual mine production and marketable products.

[2]Chemical Market Reporter.

[3]Stocks data are not available and are assumed to be zero for net import reliance and apparent consumption calculations.

[4]Defined as imports - exports + adjustments for Government and industry stock changes.

[5]Gross weight of ore in thousand metric tons.

[6]See Appendix C for definitions.