

## BISMUTH

(Data in metric tons of bismuth content, unless noted)

**Domestic Production and Use:** One refinery in Nebraska produced bismuth as a byproduct of lead refining. Thirty-five companies in the Eastern United States accounted for 84% of the bismuth reported consumed in 1995. Based on the average annual price, reported consumption was valued at \$12.2 million. Bismuth was used in pharmaceuticals and chemicals, 53%; fusible alloys and solders, 28%; metallurgical additives, 17%; and other, 2%.

<b>Salient Statistics—United States:</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995<sup>e</sup></b>
Production, refinery	W	W	W	W	W
Imports for consumption	1,410	1,620	1,330	1,660	1,400
Exports <sup>1</sup>	75	90	70	160	120
Shipments from Government stockpile excesses	57	91	—	145	139
Consumption, reported	1,260	1,300	1,300	1,470	1,500
Price, average, domestic dealer, dollars per pound	3.00	2.66	2.50	3.25	3.75
Stocks, yearend, consumer	247	272	323	297	350
Employment, plant <sup>e</sup>	30	30	30	30	30
Net import reliance <sup>2</sup> as a percent of apparent consumption	W	W	W	W	W

**Recycling:** Bismuth was recovered from fusible alloy scrap, contributing about 5% of the U.S. supply.

**Import Sources (1991-94):** Mexico, 37%; Belgium, 27%; China, 12%; Peru, 8%; and other, 16%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Most favored nation (MFN) 12/31/95</b>	<b>Non-MFN<sup>3</sup> 12/31/95</b>
Articles thereof, including waste and scrap	8106.00.0000	Free	7.5% ad val.

**Depletion Allowance:** 22% (Domestic), 14% (Foreign).

### **Government Stockpile:**

#### **Stockpile Status—9-30-95**

<b>Material</b>	<b>Uncommitted inventory</b>	<b>Committed inventory</b>	<b>Authorized for disposal</b>	<b>Disposals Jan.-Sept. 95</b>
Bismuth	366	136	366	139

**Events, Trends, and Issues:** Growth in the domestic consumption of bismuth was slow despite the development of several new applications designed to provide nontoxic substitutes for lead. New products include bismuth brass, pigments, ceramic glazes, fishing sinkers, shot for hunting, solders, lubricating greases, and crystal ware. In order to make a large impact on the market, lead would have to be restricted or banned for a significant use, such as plumbing fixtures. Seven large faucet makers, representing about one-half of domestic faucet sales, agreed to remove essentially all lead from plumbing fixtures in the settlement of a suit brought by California and the Natural Resources Defense Fund. The brass industry tested several bismuth and bismuth-selenium free-machining brasses that could be used as a replacement for leaded brass in plumbing fixtures. Both machining and leach test results were very encouraging. Selenium is added to lower the amount of bismuth required.

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World production of bismuth also has remained fairly flat due mainly to low prices and level demand. In 1994 and 1995, output from China and Korea decreased because of reduced tungsten production. World lead production has also declined in recent years, limiting the amount of bismuth that can be produced. Concerns over possible shortages caused the price to increase rapidly in July 1994, from about \$2.50 per pound to \$4.00 per pound. Since then, the price has been lowered to \$3.65 per pound. The Defense Logistics Agency (DLA) sold 139 tons of bismuth from the National Defense Stockpile in 1995; this was slightly more than the entire amount authorized for disposal in fiscal year 1995. The DLA was authorized to dispose of 136 tons in fiscal year 1996.

The U.S. Fish and Wildlife Service again conditionally approved the use of 97% bismuth-3% tin shot for waterfowl hunting in the 1995-96 hunting season. Recent studies have shown bismuth-tin shot to be nontoxic to waterfowl. Bismuth-tin shot is an alternative to steel shot, which replaced lead shot for waterfowl hunting several years ago. Bismuth-tin shot has much better dropping power than steel shot.

The feasibility study for the Tasna Mine in Bolivia was completed. It is the only mine in the world where bismuth is the primary product.

### World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves <sup>4</sup>	Reserve base <sup>4</sup>
	1994	1995 <sup>e</sup>		
United States	W	W	9,000	14,000
Australia	—	—	18,000	27,000
Bolivia	—	—	5,000	10,000
Canada	131	150	5,000	30,000
China	700	800	20,000	40,000
Japan	150	150	9,000	18,000
Kazakstan	25	25	5,000	10,000
Mexico	900	950	10,000	20,000
Peru	1,000	1,000	11,000	42,000
Other countries	110	100	15,000	35,000
World total (rounded)	<sup>5</sup> 3,020	<sup>5</sup> 3,200	110,000	250,000

**World Resources:** Bismuth is recovered in the United States during the processing of domestic and imported lead ores and concentrates. Other potential domestic sources include byproduct recovery from molybdenum or tungsten processing, although most of these domestic reserves are subeconomic. World reserves of bismuth are usually associated with lead deposits, except in China and Korea, where bismuth is found with tungsten ores, and Australia, where it is found with copper-gold ores. Bismuth minerals rarely occur in sufficient quantities to be mined as principal products, except in Bolivia and possibly China.

**Substitutes:** Antibiotics, magnesia, and alumina can replace bismuth in pharmaceutical applications. Titanium dioxide-coated mica flakes and fish scale extracts are substitutes in pigment uses. Indium can replace bismuth in low-temperature solders. Resins can replace bismuth alloys in holding jigs for machining. Glycerine-filled glass bulbs replace bismuth alloys as a triggering device for fire sprinklers. Selenium, tellurium, or lead could replace bismuth in free machining alloys.

<sup>e</sup>Estimated. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Includes bismuth, bismuth alloys, and waste and scrap.

<sup>2</sup>Defined as imports - exports + adjustments for Government and industry stock changes.

<sup>3</sup>See Appendix B.

<sup>4</sup>Most of reserves and reserve base represent bismuth recoverable from the lead reserve base. See Appendix C for definitions.

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