

## BISMUTH

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

**Domestic Production and Use:** The United States ceased production of primary refined bismuth in 1997, although a minor amount of secondary bismuth is still recovered from scrap by some domestic firms. Bismuth is contained in some lead ores mined domestically, but the bismuth-containing residues are not currently refined. Approximately 30 companies, mostly in the eastern United States, accounted for more than three-fourths of estimated bismuth consumption in 2003. The value of bismuth consumed was approximately \$14 million. About 46% of the bismuth was used in fusible alloys, solders, and ammunition cartridges; 35% in pharmaceuticals and chemicals; 17% in metallurgical additives; and 2% in other uses.

The Safe Drinking Water Act Amendment of 1996 required that all new and repaired fixtures and pipes for potable water be lead-free after August 1998. Bismuth use in water meters was one particular application that increased. An application with major growth potential is the use of zinc-bismuth alloys to achieve thinner and more uniform galvanization. Bismuth was also used domestically in the manufacture of ceramic glazes, crystal ware, and pigments.

<b><u>Salient Statistics—United States:</u></b>	<b><u>1999</u></b>	<b><u>2000</u></b>	<b><u>2001</u></b>	<b><u>2002</u></b>	<b><u>2003<sup>e</sup></u></b>
Production, refinery	—	—	—	—	—
Imports for consumption, metal	2,110	2,410	2,220	1,930	2,300
Exports, metal, alloys, scrap	257	491	541	131	110
Consumption, reported	2,050	2,130	2,200	2,320	2,200
Price, average, domestic dealer, dollars per pound	3.85	3.70	3.74	3.14	2.90
Stocks, yearend, consumer	121	118	95	111	100
Net import reliance <sup>1</sup> as a percentage of apparent consumption <sup>e</sup>	95	95	95	95	95

**Recycling:** Bismuth was recovered from fusible alloy scrap, but contributes less than 5% of the U.S. supply.

**Import Sources (1999-2002):** Belgium, 35%; Mexico, 22%; China, 22%; United Kingdom, 14%; and other, 7%.

<b><u>Tariff:</u></b> Item	<b><u>Number</u></b>	<b><u>Normal Trade Relations</u></b> <b><u>12/31/03</u></b>
Articles thereof, including waste and scrap	8106.00.0000	Free.

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

**Government Stockpile:** None.

## BISMUTH

**Events, Trends, and Issues:** The outlook for bismuth indicates that demand will probably continue to grow during this decade. Demand for bismuth in the steel sector, although relatively minor compared with other use sectors, appears to be rising. The chemical sector is increasingly turning to bismuth as Japan increases use of the metal as a nontoxic replacement for lead in pigments and lead-free solders.

World lead mine and primary refinery production has remained essentially constant in recent years, limiting the amount of bismuth that can be produced as a lead byproduct. Much of the increase in bismuth production has been associated with the processing of tungsten ores, especially in Asia. The dealer price remained fairly steady throughout 2003, about 7% lower on average than that of 2002.

In February 2002, the Bismuth Institute, headquartered in Brussels, Belgium, discontinued operations and ceased to exist after almost 30 years of service. The Institute had provided bismuth statistics and encouraged research and development as well as new uses for the metal. It had helped open trade with China, now the leader in world bismuth reserves and production. By late 2002, the Bismuth Producers Association had been formed by companies representing more than 85% of the world's annual bismuth production and had taken over many of the Institute's former roles.

**World Mine Production, Reserves, and Reserve Base:** Production held back from markets, shifts in Government policy, and work stoppages caused significant fluctuations in annual bismuth production in Bolivia.

	Mine production		Reserves <sup>2</sup>	Reserve base <sup>2</sup>
	<u>2002</u>	<u>2003<sup>e</sup></u>		
United States	W	W	9,000	14,000
Bolivia	70	50	10,000	20,000
Canada	189	200	5,000	30,000
China	1,300	1,200	240,000	470,000
Kazakhstan	150	150	5,000	10,000
Mexico	1,200	1,000	10,000	20,000
Peru	1,000	1,000	11,000	42,000
Other countries	160	150	<u>39,000</u>	<u>74,000</u>
World total (rounded)	<u>4,070</u>	<u>3,750</u>	<u>330,000</u>	<u>680,000</u>

**World Resources:** Bismuth, at an estimated 8 parts per billion by weight, is the 69th element in order of abundance in the Earth's crust and is about twice as abundant as gold. World reserves of bismuth are usually a byproduct of processing lead ores; in China, it is a byproduct of tungsten ore processing. Bismuth minerals rarely occur in sufficient quantities to be mined as principal products; the Tasna mine in Bolivia is the only mine that produced bismuth from a bismuth ore. This mine has been on standby status since the mid-1990s awaiting a significant rise in the metal price. Several bismuth-containing deposits are in varying stages of mining feasibility review. These polymetallic deposits include NICO in Canada, Nui Phao in Vietnam, and Bonfim in Brazil.

**Substitutes:** Bismuth can be replaced in pharmaceutical applications by alumina, antibiotics, and magnesia. 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 for holding metal shapes during machining, and glycerine-filled glass bulbs can replace bismuth alloys in triggering devices for fire sprinklers. Free-machining alloys can be composed of lead, selenium, or tellurium as a replacement for bismuth.

Bismuth, on the other hand, is an environmentally friendly substitute for lead in plumbing and many other applications, including fishing weights, hunting ammunition, lubricating greases, and soldering alloys.

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

<sup>1</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>2</sup>See Appendix C for definitions.