

BISMUTH

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

Domestic Production and Use: There is no domestic refinery production of primary bismuth. One refinery in Nebraska formerly produced bismuth as a byproduct of lead refining, but bismuth operations there ceased on June 30, 1997. Bismuth is contained in some domestically mined lead ores, but no byproduct bismuth was produced. Forty-four companies, mostly in the eastern United States, accounted for an estimated three-fourths of the bismuth consumed in 2001. The value of bismuth consumed was estimated at more than \$18 million. About 42% of the bismuth was used in fusible alloys, solders, and cartridges; 37% in pharmaceuticals and chemicals; 19% in metallurgical additives; and 2% in other uses.

Salient Statistics—United States:	1997	1998	1999	2000	2001^e
Production, refinery	W	—	—	—	—
Imports for consumption, metal	2,170	2,720	2,110	2,410	2,500
Exports, metal, alloys, scrap	206	245	257	491	600
Shipments from Government stockpile excesses	229	—	—	—	—
Consumption, reported	1,530	1,990	2,050	2,130	2,200
Price, average, domestic dealer, dollars per pound	3.50	3.60	3.85	3.70	3.80
Stocks, yearend, consumer	213	175	121	118	115
Employment, refinery, number of workers ¹	^e 30	—	—	—	—
Net import reliance ² as a percentage of apparent consumption	W	^e 95	^e 95	^e 95	95

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

Import Sources (1997-2000): Belgium, 32%; Mexico, 23%; United Kingdom, 18%; China, 16%; and other, 11%.

Tariff: Item	Number	Normal Trade Relations 12/31/01
Articles thereof, including waste and scrap	8106.00.0000	Free.

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

Government Stockpile: The final 85 tons of bismuth in the National Defense Stockpile was sold on November 4, 1997.

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Events, Trends, and Issues: Bismuth was used in several applications designed to provide nontoxic substitutes for lead. 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. Other major areas of development included bismuth shot for waterfowl hunting, bismuth-containing solders, and lubricating greases, especially extreme pressure lubricants. The use of new zinc-bismuth alloys in galvanizing to achieve better processing continued to grow. Bismuth was also used in ceramic glazes, crystal ware, and pigments. A bismuth-strontium-calcium-copper-oxide superconducting ceramic was installed as a major part of the electric power transmission infrastructure in Detroit. Denmark and Spain banned the use of lead in certain applications; bismuth could substitute in these cases.

World lead mine production and world primary lead refinery production has not increased significantly in recent years, limiting the amount of bismuth that can be produced as a lead byproduct. But bismuth was also recovered from some copper ores and from tungsten ores, especially in Asia. World mine production of bismuth was steady, and world refinery production increased in 2001. The domestic price decreased from \$4.00 per pound to \$3.85 per pound in January but increased to \$4.15 per pound by the end of the first quarter. The price decreased to \$3.75 per pound during the second quarter, and it stabilized at about \$3.70 per pound for the remainder of the year. The average price for the year increased, but it did not reach the \$4.00-per-pound level.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves ³	Reserve base ³
	2000	2001 ^e		
United States	—	—	9,000	14,000
Australia	—	—	18,000	27,000
Bolivia	740	750	10,000	20,000
Canada	202	225	5,000	30,000
China	2,500	2,450	200,000	470,000
Japan	155	155	9,000	18,000
Kazakhstan	130	130	5,000	10,000
Mexico	1,000	1,000	10,000	20,000
Peru	1,000	950	11,000	42,000
Other countries	150	150	15,000	35,000
World total (may be rounded)	5,880	5,810	290,000	690,000

World Resources: World reserves of bismuth are usually associated with lead deposits, except in China, North Korea, and Vietnam, where economically recoverable bismuth is found with tungsten ores and some copper ores, and in 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 China. Bismuth is potentially recoverable as a byproduct of the processing of molybdenum and non-Asian tungsten ores, although extraction of bismuth from these ores usually is not economic.

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 alloy jigs used for holding metal shapes during machining. Glycerine-filled glass bulbs can replace bismuth alloys as a triggering device for fire sprinklers. Selenium, tellurium, and lead could replace bismuth in free-machining alloys.

^eEstimated. W Withheld to avoid disclosing company proprietary data. — Zero.

¹Data for first 6 months of 1997, until shutdown of only domestic refiner.

²Defined as imports - exports + adjustments for Government and industry stock changes.

³See Appendix C for definitions.