

## 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 and is thus highly import dependent for its supply. A small amount of bismuth is recycled by some domestic firms. Bismuth is contained in some lead ores mined domestically, but the bismuth-containing residues are not processed domestically and may be exported. The value of bismuth consumed was approximately \$17 million. About 43% of the bismuth was used for metallurgical additives; 24% in fusible alloys, solders, and ammunition cartridges; 31% in pharmaceuticals and chemicals; 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 supply be lead free after August 1998. Bismuth use in water meters and fixtures is one particular application that has increased in recent years. 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; as an additive to free-machining steels; and as an additive to malleable iron castings.

<b><u>Salient Statistics—United States:</u></b>	<b><u>2005</u></b>	<b><u>2006</u></b>	<b><u>2007</u></b>	<b><u>2008</u></b>	<b><u>2009<sup>e</sup></u></b>
Production:					
Refinery	—	—	—	—	—
Secondary (old scrap)	80	80	100	100	100
Imports for consumption, metal	2,530	2,300	3,070	1,925	1,200
Exports, metal, alloys, and scrap	142	311	421	375	290
Consumption:					
Reported	2,390	1,960	2,630	1,090	1,000
Apparent	2,460	2,120	2,740	1,560	1,020
Price, average, domestic dealer, dollars per pound	3.91	5.04	14.07	12.73	7.40
Stocks, yearend, consumer	175	125	138	228	220
Net import reliance <sup>1</sup> as a percentage of apparent consumption	97	96	96	94	90

**Recycling:** All types of bismuth-containing new and old alloy scrap were recycled and contributed about 20% of U.S. bismuth consumption, or 200 tons.

**Import Sources (2005-08):** Belgium, 34%; China, 26%; United Kingdom, 18%; Mexico, 14%; and other, 8%.

<b><u>Tariff: Item</u></b>	<b><u>Number</u></b>	<b><u>Normal Trade Relations</u></b>
		<b><u>12-31-09</u></b>
Bismuth and articles thereof, including waste and scrap	8106.00.0000	Free.

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

**Government Stockpile:** None.

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**Events, Trends, and Issues:** Owing to its unique properties, bismuth has a wide variety of applications, including use in free-machining steels, brass, pigments, and solders, as a nontoxic replacement for lead; in pharmaceuticals, including bismuth subsalicylate, the active ingredient in over-the-counter stomach remedies; in the foundry industry, as an additive to enhance metallurgical quality; in the construction field, as a triggering mechanism for fire sprinklers; and in holding devices for grinding optical lenses. Currently, researchers in the European Union, Japan, and the United States are investigating the possibilities of using bismuth in lead-free solders. Researchers are examining liquid lead-bismuth coolants for use in nuclear reactors. Work is proceeding toward developing a bismuth-containing metal polymer bullet.

The price of bismuth started 2009 at \$9.00 per pound and declined throughout the year, ending August at \$6.75 per pound. The estimated average price of bismuth for 2009 was about 42% below that for 2008. Industry analysts attributed the lower price to reduced world demand in view of a world economic slowdown.

In Canada, an exploration firm announced further progress with the analysis and development of its cobalt-gold-bismuth deposit in Northwest Territories. Another Canadian exploration company reported additional advancements to develop its bismuth-fluorspar-tungsten property in Vietnam. In Bolivia, the Government announced that a bismuth smelter that started up in late 2008 would commence shipments of bismuth ingots in 2009.

In Mexico, a major bismuth producer experienced a 66-day strike by employees seeking a wage increase, in February to April, causing a temporary shortfall in the world bismuth market.

### World Mine Production and Reserves:

	Mine production		Reserves <sup>2</sup>
	2008	2009 <sup>e</sup>	
United States	—	—	—
Bolivia	150	150	10,000
Canada	71	100	5,000
China	5,000	4,500	240,000
Kazakhstan	150	140	5,000
Mexico	1,170	1,200	10,000
Peru	960	960	11,000
Other countries	200	200	39,000
World total (rounded)	7,700	7,300	320,000

**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 based on bismuth content of lead resources because bismuth production is most often a byproduct of processing lead ores; in China, bismuth production is a byproduct of tungsten and other metal ore processing. Bismuth minerals rarely occur in sufficient quantities to be mined as principal products; the Tasna Mine in Bolivia and a mine in China are the only mines that produced bismuth from a bismuth ore. The Tasna Mine had been on standby status since the mid-1990s awaiting a significant and sustained rise in the metal price, and in late 2008 there were reports that it had reopened. Several bismuth-containing deposits are in varying stages of mining feasibility review. These polymetallic deposits include Bonfim in Brazil, NICO in Canada, and Nui Phao in Vietnam.

**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 contain 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. — Zero.

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

<sup>2</sup>See Appendix C for definitions. Reserve base estimates were discontinued in 2009; see [Introduction](#).