

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 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. In 2013 the value of reported consumption of bismuth was approximately \$17 million.

Chemical production accounted for about two thirds of domestic bismuth consumption, principally in pharmaceutical applications. Bismuth use in pharmaceuticals included bismuth salicylate (the active ingredient in over-the-counter stomach remedies) and other bismuth medicinal compounds used to treat burns, intestinal disorders, and stomach ulcers in humans and animals. Other applications of bismuth chemicals and compounds included uses in superconductors and pearlescent pigments for cosmetics and paints. Bismuth has a wide variety of metallurgical applications, including use as a nontoxic replacement for lead in brass, free-machining steels, and solders. Bismuth is used as an additive to enhance metallurgical quality in the foundry industry, as a triggering mechanism for fire sprinklers, and in holding devices for grinding optical lenses.

<u>Salient Statistics—United States:</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013^e</u>
Production:					
Refinery	—	—	—	—	—
Secondary (old scrap)	60	80	80	80	80
Imports for consumption, metal	1,250	1,620	1,750	1,700	1,700
Exports, metal, alloys, and scrap	397	1,040	628	764	850
Consumption:					
Reported ^e	812	636	696	899	900
Apparent	1,010	660	1,200	1,020	930
Price, average, domestic dealer, dollars per pound	7.84	8.76	11.47	10.10	8.70
Stocks, yearend, consumer	134	133	138	134	130
Net import reliance ¹ as a percentage of apparent consumption	94	88	93	92	91

Recycling: All types of bismuth-containing new and old alloy scrap were recycled and contributed less than 10% of U.S. bismuth consumption, or about 80 tons.

Import Sources (2009–12): China, 55%; Belgium, 37%; United Kingdom, 3%; Korea, 2% and other, 3%.

<u>Tariff: Item</u>	<u>Number</u>	<u>Normal Trade Relations</u>
		<u>12–31–13</u>
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: 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. As a result, a wider market opened for bismuth as a metallurgical additive to lead-free pipe fittings and fixtures, and bismuth use in water meters and fixtures 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. Another new application is the use of a bismuth-tellurium oxide alloy film paste for use in the manufacture of semiconductor devices. Bismuth also was used domestically in the manufacture of ceramic glazes, crystal ware, and pigments, and as an additive to free-machining steels and malleable iron castings. Researchers in the European Union, Japan, and the United States continued to investigate the use of bismuth in lead-free solders. Research examining liquid lead-bismuth coolants for use in nuclear reactors was also ongoing. Work was proceeding toward developing a bismuth-containing metal-polymer bullet.

In Peru, the La Oroya Metallurgical complex, which was shuttered in 2009 owing to financial and environmental problems, was undergoing restructuring in lieu of liquidation. Zinc production was reported to have begun in July 2012 and the lead smelter reportedly resumed operations during the first half of 2013. Although prior to the shutdown the La Oroya complex had been a significant producer of bismuth, it was uncertain whether bismuth production had resumed. Canadian production dropped significantly, owing to ore depletion and closure of the Bathurst Mine (lead-zinc) in northern New Brunswick.

The price of bismuth, which had trended downward during 2012, started 2013 at \$8.40 per pound, decreased to a low of \$7.68 per pound in August, and ended November at \$9.30 per pound. The estimated average price of bismuth in 2013 was about 14% less than that in 2012. Industry analysts attributed the lower price to decreased world demand.

World Mine Production and Reserves:

	Mine production		Reserves ²
	2012	2013 ^e	
United States	—	—	—
Bolivia	50	10	10,000
Canada	121	50	5,000
China	7,000	6,500	240,000
Mexico	940	940	10,000
Other countries	77	90	50,000
World total (rounded)	8,200	7,600	320,000

World Resources: Bismuth, at an estimated 8 parts per billion by weight, ranks 69th in elemental 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 Tasma Mine in Bolivia and a mine in China are the only mines that produced bismuth from bismuth ore.

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

^eEstimated. — Zero.

¹Defined as imports – exports + adjustments for Government and industry stock changes.

²See Appendix C for resource/reserve definitions and information concerning data sources.