

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. Some domestic firms recycle small quantities of bismuth. Bismuth is contained in some lead ores mined domestically, but the last domestic primary lead smelter closed at yearend 2013, and all lead concentrates now are exported for smelting. In 2014, the value of reported consumption of bismuth was approximately \$23 million.

About two-thirds of domestic bismuth consumption was for chemicals used in cosmetic, industrial, laboratory, and pharmaceutical applications. Bismuth use in pharmaceuticals included bismuth salicylate (the active ingredient in over-the-counter stomach remedies) and other compounds used to treat burns, intestinal disorders, and stomach ulcers. Bismuth also is used in the manufacture of ceramic glazes, crystal ware, and pearlescent pigments. Bismuth has a wide variety of metallurgical applications, including use as a nontoxic replacement for lead in brass, free-machining steels, and solders, and as an additive to enhance metallurgical quality in the foundry industry. The Safe Drinking Water Act Amendment of 1996, which required that all new and repaired fixtures and pipes for potable water supply be lead free after August 1998, opened a wider market for bismuth as a metallurgical additive to lead-free pipe fittings, fixtures, and water meters. Bismuth is used as a triggering mechanism for fire sprinklers and in holding devices for grinding optical lenses, and bismuth-tellurium oxide alloy film paste is used in the manufacture of semiconductor devices.

Salient Statistics—United States:	2011	2012	2013	2014	2015^e
Production:					
Refinery	—	—	—	—	—
Secondary (old scrap) ^e	80	80	80	80	80
Imports for consumption, metal	1,750	1,700	1,710	2,270	2,200
Exports, metal, alloys, and scrap	628	764	816	567	600
Consumption:					
Reported ^e	696	647	774	727	900
Apparent	1,120	940	978	1,504	1,610
Price, average, domestic dealer, dollars per pound	11.47	10.10	8.71	11.14	7.50
Stocks, yearend, consumer	138	134	50	329	400
Net import reliance ¹ as a percentage of apparent consumption	93	93	92	95	95

Recycling: Bismuth-containing new and old alloy scrap was recycled and thought to compose less than 10% of U.S. bismuth consumption, or about 80 tons.

Import Sources (2011–14): China, 64%; Belgium, 26%; Peru, 3%; United Kingdom, 2%; and other, 5%.

Tariff: Item	Number	Normal Trade Relations 12–31–15
Bismuth and articles thereof, including waste and scrap	8106.00.0000	Free.

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

Government Stockpile: None.

Events, Trends, and Issues: In China, the Fanya Metal Exchange Co. Ltd., which began trading bismuth in March 2013, froze accounts in June, halting bismuth deliveries in or out of the exchange. Additionally, the Ri Jin Bao, an investment product that guaranteed annual returns of at least 13%, had its payments suspended in July. Investors were unable to buy or sell contracts, and the price of bismuth fell dramatically. In August, Fanya entered into a debt-restructuring plan, and Fanya's investors reportedly met with the China Securities Regulatory Commission (China's stock market regulator) and Provincial-level authorities to protest Fanya's actions. At the time deliveries were frozen, Fanya warehouses held 19,000 tons of bismuth.

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The U.S. domestic dealer price of bismuth, which had trended upward in 2014, started 2015 at \$10.90 per pound, decreased steadily throughout the year, and ended October between \$5.80 and \$6.20 per pound. In 2015, the estimated average price of bismuth was about 27% lower than that in 2014. Industry analysts attributed the sharp decrease in price to the events of the Fanya Metal Exchange.

The Nui Phao bismuth-copper-fluorspar-tungsten mine in Vietnam, commissioned late in 2013, reportedly produced 4,950 tons of contained bismuth during 2014, making it one of the leading bismuth producers in the world. In Canada, the NICO gold-cobalt-bismuth-copper mine and concentrator in the Northwest Territories is still under development. In Peru, the administrator of idle La Oroya Metallurgical complex, a past producer of bismuth, was attempting to sell the facility. Although the sale was anticipated in May, it was not completed owing to the environmental operating standards and remediation requirements that were a condition of the purchase.

New bismuth applications under development in 2015 include wearable technology and a new anode for sodium-ion batteries. For wearable devices, bismuth ferrite nanoparticles are added to a polymer alcohol solution, and when dried, the films can be stretched and bent with no loss in magnetic or electrical properties. This new film could be used for bendable or foldable computer screens. Bismuth nanoparticles have also been wrapped with graphene to create a new anode for sodium-ion batteries having superior electrochemical performance and recharging properties.

World Mine Production and Reserves: Production and reserves figures for Vietnam were revised based on new data from the Masan Group.

	Mine production		Reserves ²
	2014	2015 ^e	
United States	—	—	—
Bolivia	10	10	10,000
Canada	3	3	5,000
China	7,600	7,500	240,000
Mexico	948	700	10,000
Russia	40	40	NA
Vietnam	4,950	5,000	53,000
Other countries	—	—	50,000
World total (rounded)	13,600	13,600	370,000

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 and Vietnam, bismuth production is a byproduct or coproduct 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 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 industry stock changes.

²See [Appendix C](#) for resource/reserve definitions and information concerning data sources.