

## BISMUTH

(Data in metric tons, gross weight, unless otherwise noted)

**Domestic Production and Use:** The United States ceased production of primary refined bismuth in 1997 and is highly import reliant. Bismuth is contained in some lead ores mined domestically. However, the last domestic primary lead smelter closed at yearend 2013; since then, all lead concentrates have been exported for smelting.

About 60% of domestic bismuth consumption was for chemicals used in cosmetic, industrial, laboratory, and pharmaceutical applications. Bismuth use in pharmaceuticals included bismuth subsalicylate (the active ingredient in over-the-counter stomach remedies) and other compounds used to treat burns, intestinal disorders, and stomach ulcers. Bismuth is also used in industrial applications for the manufacture of ceramic glazes, crystalware, and pearlescent pigments.

Bismuth has a wide variety of metallurgical applications, including use as an additive to improve metal integrity of malleable cast iron in the foundry industry and as a nontoxic replacement for lead in brass, free-machining steels, and solders. The use of bismuth in brass for pipe fittings, fixtures, and water meters increased after 2014 when the definition of "lead-free" under the Safe Drinking Water Act was modified to reduce the maximum lead content of "lead-free" pipes and plumbing fixtures to 0.25% from 8%. The melting point of bismuth is relatively low at 271 degrees Celsius, and it is an important component of various fusible alloys, some of which have melting points below that of boiling water. These bismuth-containing alloys can be used in holding devices for grinding optical lenses, as plugs for abandoned oil wells, as a temporary filler to prevent damage to tubes in bending operations, as a triggering mechanism for fire sprinklers, and in other applications in which a low melting point is ideal. Bismuth-tellurium-oxide alloy film paste is used in the manufacture of semiconductor devices.

<b>Salient Statistics—United States:</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021<sup>e</sup></b>
Production:					
Refinery	—	—	—	—	—
Secondary (scrap) <sup>e</sup>	80	80	80	80	80
Imports for consumption, metal, alloys, and scrap	2,820	2,470	2,340	1,650	1,500
Exports, metal, alloys, and scrap	392	653	636	699	840
Consumption:					
Apparent <sup>1</sup>	2,530	2,040	1,690	1,200	810
Reported	694	570	548	513	500
Price, average, <sup>2</sup> dollars per pound	4.94	4.61	3.18	2.72	3.65
Stocks, yearend, consumer	489	346	443	271	200
Net import reliance <sup>3</sup> as a percentage of apparent consumption	97	96	95	93	90

**Recycling:** Bismuth-containing alloy scrap was recycled and thought to compose between 5% and 10% of U.S. bismuth apparent consumption.

**Import Sources (2017–20):** China,<sup>4</sup> 67%; the Republic of Korea, 16%; Mexico, 6%; Belgium, 5%; and other, 6%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–21</b>
Bismuth and articles thereof, including waste and scrap		8106.00.0000	Free.

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**Depletion Allowance:** 22% (domestic), 14% (foreign).

**Government Stockpile:** None.

**Events, Trends, and Issues:** The estimated annual average domestic dealer price for bismuth in 2021 was an estimated \$3.65 per pound and increased for the first time since 2017. The price was an estimated 34% higher than that in 2020 and the highest price since 2018. Globally, excess stocks continued to keep prices low compared with those in 2007 through 2014 when the average annual dealer price traded above \$7.84 per pound. Primary production tightened in early 2021 as mines continued to feel effects from shutdowns that began during the first of half of 2020 resulting from the global COVID-19 pandemic. Trade data through August 2021 were mixed when compared with the same period in 2020—whereas bismuth exports increased, imports for consumption decreased. Foreign buyers were reportedly stockpiling bismuth while prices were relatively low compared with previous higher prices.

**World Refinery Production and Reserves:** Available information was inadequate to make reliable estimates of reserves.

	Refinery production <sup>e</sup>		Reserves <sup>5</sup>
	2020	2021	
United States	—	—	Quantitative estimates of reserves were not available.
Bolivia	30	60	
Bulgaria	50	50	
Canada	35	30	
China	16,000	16,000	
Japan	570	600	
Kazakhstan	230	240	
Korea, Republic of	970	1,000	
Laos	1,000	1,000	
Mexico	10	10	
World total (rounded)	19,000	19,000	

**World Resources:**<sup>5</sup> World reserves of bismuth are usually estimated based on the 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 where bismuth has been the primary product. The Tasna Mine has been inactive since 1996.

**Substitutes:** Bismuth compounds can be replaced in pharmaceutical applications by alumina, antibiotics, calcium carbonate, and magnesia. Titanium dioxide-coated mica flakes and fish-scale extracts are substitutes in pigment uses. Cadmium, indium, lead, and tin can partially 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.

<sup>e</sup>Estimated. — Zero.

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

<sup>2</sup>Prices are based on 99.99%-purity metal at warehouse (Rotterdam) in minimum lots of 1 ton; source: Fastmarkets AMM.

<sup>3</sup>Defined as imports – exports + adjustments for industry stock changes.

<sup>4</sup>Includes Hong Kong.

<sup>5</sup>See Appendix C for resource and reserve definitions and information concerning data sources.