



2020 Minerals Yearbook

BISMUTH [ADVANCE RELEASE]

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BISMUTH

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In 2020, reported consumption of bismuth in the United States was 513 metric tons (t), 6% less than the quantity in 2019 (tables 1, 2). The estimated value of bismuth consumed domestically decreased to \$3.08 million in 2020, 20% less than the value for 2019 owing to a 6% decrease in reported consumption and a 14% decrease in the average U.S. dealer price. In 2020, primary bismuth consumed in the United States was imported, principally from China (including Hong Kong) and the Republic of Korea, accounting for 58% and 29%, respectively, of total imported bismuth (table 4).

In 2020, world refinery production of bismuth equaled 18,900 t, slightly less than the quantity in 2019 (tables 1, 5). China was the world's leading producer of refined bismuth as a byproduct of processing ores of fluorspar, lead, tin, and tungsten, accounting for 85% of the estimated world total, followed by Laos and the Republic of Korea with 5% each (table 5).

Bismuth was last produced domestically as a byproduct of lead refining at a Nebraska refinery that closed in 1997. The last stocks of bismuth in the National Defense Stockpile were sold that same year. Some domestic firms continued to recycle bismuth alloy scrap; however, data were unavailable to make estimates of secondary production for 2020.

Bismuth is one of the rarest elements on Earth, constituting less than an estimated 0.001% of the Earth's continental crust and ranking 65th in abundance among the elements. It occurs in association with lead and, consequently, is most often recovered as a byproduct of lead refining.

Government Actions and Legislation

On April 24, the Office of the U.S. Trade Representative (USTR) granted exclusions from duties on approximately \$200 billion worth of Chinese goods, including bismuth metal [Harmonized Tariff Schedule of the United States (HTS) code 8106.00.00]. Duties of 10% initially imposed in September 2018 by the USTR increased to 25% in May 2019. The April notice of exclusion applied from September 24, 2018, to August 7, 2020. U.S. Customs and Border Protection was tasked to implement these exclusions, including issuing instructions regarding their retroactive nature. In September 2020, the USTR extended the exclusion through December 31, 2020 (Office of the U.S. Trade Representative, 2018, 2019, 2020a, b).

On September 30, the President of the United States signed Executive Order 13953 entitled "Addressing the threat to the domestic supply chain from reliance on critical minerals from foreign adversaries and supporting the domestic mining and processing industries." The order declared the Nation's reliance on critical minerals from sources outside the United States to be an "unusual and extraordinary threat" and declares a national emergency. The order directs Federal agencies to act appropriately "consistent with

applicable law to prioritize the expansion and protection of the domestic supply chain" of critical minerals. Per the order, the U.S. Department of Defense was required to determine whether prior authorities could be used to provide grants for the procurement of mineral-processing equipment. Additionally, the U.S. Department of Energy was required to determine if loan guarantees under title XVII of the Energy Policy Act of 2005 could be extended to projects that "support domestic supply chains for minerals." The Executive order applied to the list of critical minerals published by the U.S. Department of the Interior in May 2018, which included bismuth (U.S. Department of the Interior, 2018; Trump, 2020).

Consumption

Consumption data were developed by the U.S. Geological Survey from voluntary surveys of 30 companies in 2020. Responses were received from 16 of these companies. The amount of bismuth consumed by the companies that did not respond to the survey was estimated based on prior reports or on information from other sources. In 2020, reported consumption was 513 t, a decrease of 6% compared with that in 2019 (table 1).

The leading use of bismuth metal in the United States was in chemicals, accounting for 59% of reported consumption (table 2). Total bismuth used in chemicals in 2020 was 305 t, essentially unchanged from that in 2019. Within the chemicals category, the leading use of bismuth was for pharmaceuticals, including bismuth subsalicylate (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 included superconductors and pearlescent pigments for cosmetics and paints.

Bismuth metal also was used as a major constituent of various alloys, which accounted for 16% of reported consumption. Total bismuth use in alloys in 2020 was 84.3 t, a decrease of 28% from that in 2019 (table 2). One class of bismuth-base alloys, fusible alloys [characterized as having a low melting point, as low as 20 degrees Celsius (°C)], consists of combinations of bismuth with other metals, such as antimony, cadmium, gallium, indium, lead, and tin. Applications for those alloys included fuel tank safety plugs, holders for optical lenses, and other articles for machining or grinding, solders, and fire sprinkler triggering mechanisms.

As a metallurgical additive, bismuth was added in small amounts to aluminum and copper alloys to improve machinability and to malleable iron to prevent formation of graphite flakes. Bismuth is used as a low-toxic alternative to lead, replacing lead in glass, pigments, waterfowl hunting shot, and solder. Although bismuth has been used successfully to replace lead in various applications, tin and tungsten may also substitute for lead in some applications.

Prices

The Fastmarkets AMM annual average free market price for 99.99%-pure bismuth (Rotterdam) was \$2.72 per pound in 2020, a 14% decrease from the 2019 annual average price of \$3.18 per pound (revised) (table 1). The average daily price began 2020 at \$2.63 per pound and fluctuated throughout the year between the low of \$2.54 per pound and the high of \$2.98 per pound, which was the yearend price. United States-imposed tariffs on Chinese goods led to lower bismuth prices throughout 2019 continuing into 2020 (Belda, 2019).

Foreign Trade

The United States imported 1,650 t of bismuth metal, alloys, and waste and scrap in 2020, a 29% decrease from 2,340 t (revised) in 2019 (tables 1, 4). Imported bismuth was sourced principally from China including Hong Kong (58%), followed by the Republic of Korea (29%), Bolivia (3%), and Japan, Laos, and Luxembourg (2% each) (table 4). The United States exported 699 t of bismuth metal, alloys, and waste and scrap in 2020, a 10% increase from 636 t in 2019 (tables 1, 3). United States bismuth was exported principally to Vietnam (56%), followed by China including Hong Kong (10%), Mexico (8%), and Canada (7%) (table 3).

World Review

Bismuth was produced principally as a byproduct of the smelting of lead concentrates; however, it was also a byproduct of processing ores of fluor spar, tin, and tungsten in China; tungsten-polymetallic ore processing in Vietnam; copper smelter flue dust processing in Zambia; and zinc production in Japan. A world production total for mined bismuth ore was not available owing to it being a byproduct. World production data are only available once the bismuth is refined. World refinery production of bismuth equaled 18,900 t in 2020, a slight decrease from 19,200 t (revised) in 2019. China was the world's leading producer of refined bismuth, accounting for 85% of the estimated world total, followed by Laos and the Republic of Korea with 5% each (table 5).

China.—In February, the Government of China imposed global coronavirus disease 2019 (COVID-19) pandemic measures that shut down mineral processing plants in 80 cities across the country. Affected facilities included those run by the Guixi Grand Sanyuan Industry Group Co., Ltd. and Yongxing Zhongde Environmental Protection Technology Co., Ltd., which produced up to 3,000 metric tons per year (t/yr) and 600 t/yr of bismuth, respectively (Argus Metals International, 2020b).

On March 20, China raised export rebate taxes on high-purity bismuth metal from 10% to 13%. The move was announced by China's general administration of taxation and was expected to increase exports of bismuth metal (Argus Metals International, 2020a).

China's exports of bismuth metal including waste and scrap (HTS code 8106.00.00) in the first half of 2020 equaled 2,720 t, a 49% increase from 1,830 t in the same period of 2019. Bismuth exports in the second half of 2020 equaled 1,640 t, a 24% decrease from 2,170 t in the same period of 2019. Full-year

exports of bismuth in 2020 totaled 4,360 t in 2020, a 9% increase from 4,000 t in 2019 (Zen Innovations AG, 2021).

India.—Hindustan Zinc Ltd. planned to double its zinc smelter capacity by 2027. Recovery of minor metals, including bismuth, also would increase. Bismuth capacity was expected to nearly triple to 46 t/yr from 16 t/yr (Surendran, 2020).

Outlook

Globally, most end uses of bismuth are in the industrial sectors of the economy. An increase in global demand depends on economic growth and bismuth being used as a replacement for lead. Emerging uses in data transmission, medical treatment, and solar cells could also potentially increase the demand for bismuth, though these applications are still in the research and development stage. In the short term, supplies of bismuth exceed consumption caused primarily from excess bismuth stock, tariffs, and China's overproduction. These factors are expected to affect the market beyond 2020.

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TABLE 1
SALIENT BISMUTH STATISTICS¹

(Metric tons, unless otherwise specified)

	2016	2017	2018	2019	2020	
United States:						
Consumption, reported, bismuth metal	651	694	570	548	513	
Exports ²	431	392	653	636	699	
Imports for consumption ²	2,190	2,820	2,470 ^r	2,340 ^r	1,650	
Price, average, domestic dealer ³	dollars per pound	4.50 ^r	4.94 ^r	4.61 ^r	3.18 ^r	2.72
Stocks, December 31, consumer, bismuth metal	513	489	346	443	271	
World refinery production	19,700	19,800	20,700 ^r	19,200 ^r	18,900	

^rRevised.

¹Table includes data available through July 16, 2021. Data are rounded to no more than three significant digits; except prices.

²Consists of bismuth metal, alloys, and waste and scrap.

³Based on 99.99%-purity metal at warehouse (Rotterdam) in minimum lots of 1 ton. Source: American Metal Market Daily (Fastmarkets AMM Daily).

TABLE 2
BISMUTH METAL CONSUMED
IN THE UNITED STATES, BY ESTIMATED USE¹

(Kilograms)

Use	2019	2020
Chemicals ²	305,000	305,000
Bismuth alloys	118,000	84,300
Metallurgical additives	W	W
Other	W	W
Total	548,000	513,000

W Withheld to avoid disclosing company proprietary data; included in "Total."

¹Table includes data available through July 16, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes industrial and laboratory chemicals, cosmetics, and pharmaceuticals.

TABLE 3
U.S. EXPORTS OF BISMUTH METAL, ALLOYS, AND WASTE AND SCRAP,
BY COUNTRY OR LOCALITY^{1,2}

Country or locality	2019		2020	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
Argentina	398	\$26	117	\$8
Australia	9,550	132	2,880	35
Brazil	22,200	461	28,500	435
Canada	73,400	1,160	48,200	714
China	8,780	112	38,100	355
Colombia	68	3	360	11
Costa Rica	655	6	290	3
Finland	150	3	286	5
France	2,970	104	1,490	52
Germany	855	41	2,260	57
Hong Kong	29,700	364	32,200	311
Hungary	4,010	70	1,260	24
India	5,450	193	23,900	294
Israel	4,650	50	845	10
Italy	1,970	52	1,960	54
Japan	5,700	105	9,510	115
Laos	22,900	176	18,600	123
Luxembourg	--	--	1,000	35
Malaysia	--	--	305	3
Mexico	46,800	671 ^r	58,000	771
Norway	--	--	3,540	46
Philippines	1,130	28	1,600	15
Singapore	3,740	34	6,400	59
South Africa	914	43	615	27
Taiwan	2,970	27	5,050	57
Thailand	21,600	204	16,000	150
United Kingdom	19,500	184	1,200	18
Vietnam	332,000	3,030	394,000	5,010
Other ³	13,000	177	158	15
Total	636,000	7,460	699,000	8,810

^rRevised. -- Zero.

¹Table includes data available through June 11, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes data for the Schedule B number 8106.00.0000.

³Includes countries and (or) localities to which the United States exported less than 100 kilograms in 2020.

Source: U.S. Census Bureau.

TABLE 4
U.S. IMPORTS FOR CONSUMPTION OF BISMUTH METAL, ALLOYS, AND WASTE AND SCRAP,
BY COUNTRY OR LOCALITY^{1,2}

Country or locality	2019		2020	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
Austria	--	--	40	\$2
Belgium	116,000	\$763	24,200	165
Bolivia	--	--	55,100	296
Canada	5,670	100	5,230	59
China	1,300,000 ^r	9,040 ^r	904,000	5,360
Germany	5,990	162	3,330	63
Hong Kong	97,500	1,140	58,800	750
Hungary	492	7	5,890	45
India	--	--	27	17
Italy	--	--	91	23
Japan	10,500	67	29,700	371
Korea, Republic of	533,000	3,220	487,000	2,610
Laos	--	--	35,100	193
Luxembourg	3,130	7	40,700	238
Mexico	195,000	1,260	3,290	217
Taiwan	1,410	44	1,360	57
Thailand	33,600	265	--	--
Uganda	923	5	--	--
United Kingdom	33,600	305	11	14
Total	2,340,000 ^r	16,400 ^r	1,650,000	10,500

^rRevised. -- Zero.

¹Table includes data available through June 11, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes data for Harmonized Tariff Schedule of the United States code 8106.00.0000.

Source: U.S. Census Bureau.

TABLE 5
BISMUTH: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY^{1,2}

(Metric tons)

Country or locality ³	2016	2017	2018	2019	2020
Bolivia	8	8	39	30 ^{r, e}	30 ^e
Bulgaria ^e	45 ^r	47 ^r	47 ^r	47 ^r	50
Canada	35 ^r	30 ^r	27 ^r	20 ^r	35
China	15,643	14,813	15,537 ^r	16,000 ^e	16,000 ^e
Japan ⁴	428	525	571	570 ^r	570 ^e
Kazakhstan ^e	270	270	280 ^r	230 ^r	230
Korea, Republic of ⁴	700	900	880	930 ^e	970 ^e
Laos	2,013	2,743	3,009	1,062 ^r	1,000 ^e
Mexico	539	513	333	300	10
Total	19,700	19,800	20,700 ^r	19,200 ^r	18,900

^eEstimated. ^rRevised.

¹Table includes data available through June 1, 2021. All data are reported unless otherwise noted; totals may include estimated data. Totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Bismuth is produced as a byproduct of mining and processing other metals, mainly lead and tungsten. Not all mines that produce ores containing recoverable bismuth report their production. Therefore, some bismuth production may only be accounted for at the refinery level.

³In addition to the countries and (or) localities listed, Belgium, India, Romania, and Russia may have produced refined bismuth, but available information was inadequate to make reliable estimates of output.

⁴Refined bismuth was produced as a byproduct of zinc production.

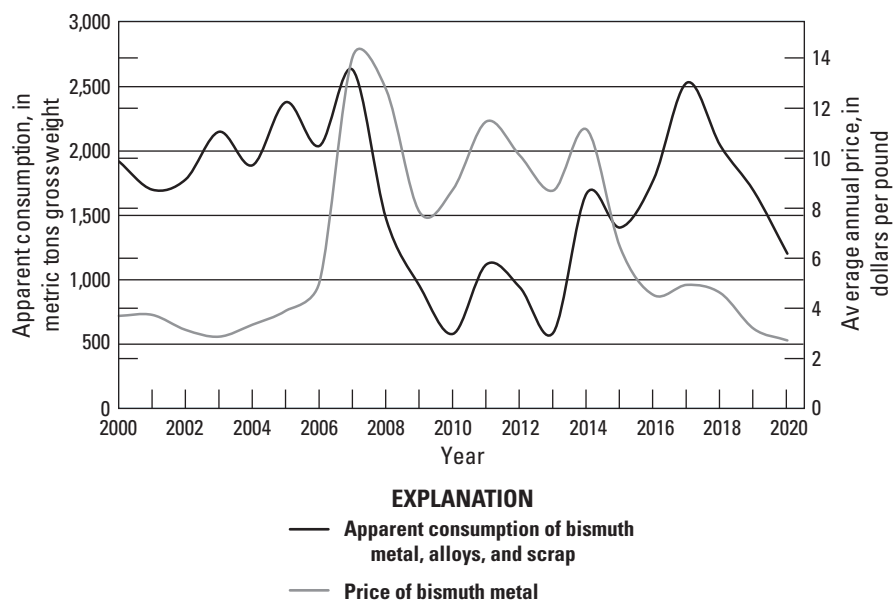


Figure 1. Bismuth metal apparent consumption and price for years 2000–2020.