



2013 Minerals Yearbook

BISMUTH [ADVANCE RELEASE]

BISMUTH

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In 2013, consumption of bismuth in the United States was estimated to be 774 metric tons (t), 20% more than that in 2012 but about 5% less than that in 2009 (tables 1, 2). The estimated value of bismuth metal consumed domestically was \$15 million in 2013.

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. In 2013, all primary bismuth consumed in the United States was imported, with China being the leading source. A small amount of bismuth was obtained by recycling old scrap. The leading reported producer of refined bismuth in 2013 was China with 91% of world production, followed by Mexico (5%) and Japan (3%) (table 5). In Belgium, one company was thought to produce refined metal from imported anode slimes, concentrates, smelter residues, and flue dusts, although data on their production was unavailable.

Production

Although domestic production of primary refined bismuth ceased in 1997, some domestic firms continued to remelt bismuth alloy scrap. Secondary production was estimated to be less than 5% of domestic supply during 2013.

Consumption

The U.S. Geological Survey surveys domestic bismuth consumers on an annual basis. In 2013, 35 companies were surveyed for bismuth consumption, of which 15 responded, accounting for about 50% of consumption shown in table 1. Data for nonrespondents to the survey were estimated based on prior-year reports or information from other sources.

Bismuth chemicals accounted for about 70% of estimated domestic consumption of bismuth. Bismuth use in pharmaceuticals, the leading end use for bismuth, 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. Bismuth nitrate is the initial chemical used for the production of most bismuth pharmaceutical compounds. Other applications of bismuth chemicals and compounds include superconductors and pearlescent pigments for cosmetics and paints.

Bismuth metal is used as a principal constituent of various alloys and as a metallurgical additive (table 2). One class of bismuth-base alloys, fusible (low melting point, as low as 20 °C) alloys, are combinations of bismuth with other metals, such as antimony, cadmium, gallium, indium, lead, and tin. Applications for those alloys include fuel-tank safety plugs,

holders for optical lenses and other articles for machining or grinding, solders, and fire sprinkler triggering mechanisms. Bismuth also was added in small amounts to aluminum and copper alloys to improve machinability and to malleable iron to prevent formation of graphite flakes.

Bismuth also is used as a substitute for lead in glass, pigments, shot for water fowl hunting, and solder, and to improve machinability in certain steel products. Bismuth competes with tin and tungsten as a lead substitute in some applications.

Prices

In 2013, the average Platts Metals Week New York dealer price for bismuth was \$8.71 per pound, a decrease of 14% from that in 2012, and the lowest annual average since 2009. The weekly average bismuth price range began 2013 at \$8.35 to \$8.50 per pound and cycled between a low range of \$7.70 to \$7.80 in August and a high range of \$9.00 and \$9.60 at yearend. Lower average prices were attributable to lower or flat demand in Europe, China, and the United States, and price fluctuations were attributable to sporadic buying and reported efforts by producers in China to boost prices by withholding material from the market. China's "rare metals" Fanya Metal Exchange Co. Ltd. began trading bismuth in March 2013 and by yearend reported that inventories in Fanya approved warehouses had risen to more than 5,100 t. The yearend increase in bismuth prices was attributed to tight bismuth supplies on the spot market as producers and investors in China moved bismuth metal into Fanya warehouses, which reportedly had the capacity to hold 20,000 t of bismuth. Despite the increase in Fanya bismuth inventories, China's exports of unwrought bismuth increased by 17% to 4,055 t in 2013 (Chao, 2014a, b; Shanghai Metals Market, 2014).

Foreign Trade

Imports of bismuth metal totaled 1,710 t in 2013, essentially unchanged from those in 2012. China, Belgium, and Peru, in descending order by weight, accounted for about 93% of bismuth metal imports (table 4). China, the leading supplier of U.S. imports of unwrought bismuth, reported shipping only 342 t of bismuth to the United States compared with U.S. Census Bureau data indicating U.S. receipts of 1,050 t. The discrepancy may partially reflect the transit time between China and the United States but may also reflect transshipment of material through Belgium. China reported exporting 3,060 t of bismuth to Belgium (Chao, 2014a). U.S. exports of bismuth alloys, metal, and waste and scrap were 816 t, an increase of 7% from those in 2012 (table 3).

World Review

Bismuth was produced principally as a byproduct of the smelting of lead ores. In China, however, it was also a byproduct of fluorspar, tin, and tungsten ore processing.

World refinery production of bismuth was estimated to be 17,000 t (table 5), essentially unchanged from that in 2011 and 2012. China was the world's leading producer of refined bismuth accounting for 91% of the estimated world total, followed by Mexico with 5%.

Bolivia.—The Karachipampa smelter, owned by the state-run mining company Corporación Minera de Bolivia (Comibol) and last operated during the late 1980s, was reportedly preparing to resume processing multimetallic ores to produce antimony, bismuth, copper, lead, silver, and zinc oxide. Originally scheduled to start production by yearend 2013, startup was pushed back to late 2014. In 2005, Comibol entered into a joint venture with Atlas Precious Metals Inc. (Canada) to rebuild the smelter and, in 2011, Comibol acquired full control of the stalled project. The original smelter was completed in 1988 and used Soviet technology to process the ores (Evans, 2013b; Metal Bulletin Newsletter, 2014).

Canada.—Fortune Minerals Ltd. (Fortune) was developing the NICO gold-cobalt-bismuth-copper deposit in the Northwest Territories. Concentrates were to be transported to a proposed processing plant in Saskatchewan. In July, Fortune announced that it had received approval for the mine and mill from Federal and local governments, allowing the company to complete required water and land-use permits, and in November, Fortune announced that it had selected Hatch Ltd. to construct the open pit mine and concentrator. Fortune reported combined open pit and underground reserves (proven and probable) of 33.1 million metric tons (Mt) containing 34,500 kilograms (1.11 million troy ounces) of gold, 37,800 t of cobalt, 46,300 t of bismuth, and 12,300 t of copper (Fortune Minerals Ltd., 2013, 2015).

China.—Bismuth producers in Hunan Province, the leading source of China's bismuth, reportedly accounting for about 75% of China's bismuth output, met in Chenzhou City in September to form the Chenzhou Bismuth Association for the stated purpose of collaborating in market activities and collectively lobbying local governments on policies affecting the bismuth industry. The reported goal of the association was to improve competitiveness in the bismuth sector and to have greater influence in bismuth pricing, given the recent price decreases and fluctuations (See section on Prices). According to Shanghai Metals Market, Hunan produced about 11,000 t of bismuth metal in 2012 and accounted for 73% of China's bismuth reserves (Shanghai Metals Market, 2013).

Peru.—The La Oroya smelter complex, operated by the administration firm, Right Business S.A., resumed production of zinc in July 2012 and production of lead during the first quarter of 2013. The facility had closed in April 2009, when then operator Doe Run Perú decided to remove its personnel and close the complex, owing creditors \$163 million. Since then, La Oroya has been in the hands of the administrators chosen by the creditors. Although no bismuth production was reported for 2013, at the time of closure, the complex was producing bismuth

and other byproduct metals. Resumption of production was short lived, however, and the complex closed again in July 2014 (Evans, 2013c; Emery, 2015).

Vietnam.—In 2013, Vietnam's Ma San Group Corp. (Masan) commissioned its Nui Phao multimetallic mine and processing plant that had a reported mill capacity of 3.5 million metric tons per year of ore. By the end of the fourth quarter, Masan reported that its four product streams—bismuth, copper, fluorspar, and tungsten—had all generated revenue. The company reported that the Nui Phao deposit had proven and probable ore reserves of 52.5 Mt with average grades of 0.1% bismuth, 8% calcium fluoride, 0.21% copper, and 0.21% tungsten trioxide (Ma San Group Corp., 2014a; 2014b, p. 30, 146). In October, Canada's specialty metal and chemical producer 5N Plus announced that it had signed an exclusive long-term offtake agreement for a majority of the bismuth produced at Nui Phao (Evans, 2013a).

Outlook

Most of bismuth's end uses, especially its use as a metallurgical additive, are in the industrial sectors of the economy. An increase in demand will likely depend on economic growth in emerging nations. The accumulation of large stocks of bismuth on China's Fanya Metal Exchange continued into 2014, indicating that global supplies were more than adequate to meet demand. In the medium term, global mine and refinery production are expected to increase with the commissioning of several new and significant mine producers of bismuth, and supplies are expected to be more than adequate to meet industrial demand.

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TABLE 1
 SALIENT BISMUTH STATISTICS¹

		2009	2010	2011	2012	2013
United States:						
Consumption ^e	metric tons	812	636	696	647	774
Exports ²	do.	397	1,040	628	764	816
Imports for consumption of metallic bismuth	do.	1,250	1,620	1,750	1,700	1,710
Price, average, domestic dealer	dollars per pound	7.84	8.76	11.47	10.10	8.71
Stocks, December 31, consumer	metric tons	134	133	138	134	50
World production: ^{e,3}						
Mine, metal content	do.	7,500	7,700	8,100	8,500 ^r	8,400
Refinery	do.	14,000	16,000	17,000	17,000 ^r	17,000

^eEstimated. ^rRevised. do. Ditto.

¹Data are rounded to no more than three significant digits, except prices.

²Includes bismuth metal and the bismuth content of alloys and waste and scrap.

³Data are rounded to no more than two significant digits.

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

(Kilograms)

Use	2012	2013
Chemicals ²	434,000	549,000
Bismuth alloys	52,100	62,400
Metallurgical additives	W	W
Other	W	W
Total	647,000	774,000

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

¹Data 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 COUNTRY¹

Country	2012		2013	
	Quantity (kilograms, metal content)	Value (thousands)	Quantity (kilograms, metal content)	Value (thousands)
Belgium	56,100	\$1,110	--	--
Brazil	2,350	32	7,200	\$83
Canada	72,000	712	136,000	1,270
China	36,200	337	33,700	309
Colombia	4,710	45	125	9
Costa Rica	7,960	90	6,100	63
France	2,610	24	--	--
French Guiana	1,410	13	4,790	44
Germany	3,270	51	76,000	1,530
Hong Kong	32,100	292	51,800	487
India	2,270	21	--	--
Israel	1,470	13	1,390	19
Japan	--	--	1,300	28
Jamaica	1,280	12	--	--
Malaysia	581	5	11,000	100
Mexico	159,000	1,680	37,300	578
Netherlands	1,670	46	20,200	383
Singapore	4,500	80	4,880	68
South Africa	91	12	1,360	18
Taiwan	36	8	1,310	19
Thailand	8,930	87	26,500	241
United Kingdom	13,300	210	12,200	247
Vietnam	351,000	3,190	382,000	3,470
Other (8 countries) ²	1,950 ^r	46 ^r	1,570	64
Total	764,000	8,110	816,000	9,040

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes countries with a quantity less than 1,000 kilograms in 2012 and 2013.

Source: U.S. Census Bureau.

TABLE 4
U.S. IMPORTS FOR CONSUMPTION OF METALLIC BISMUTH, BY COUNTRY¹

Country	2012		2013	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
Belgium	505,000	\$11,700	389,000	\$7,430
Canada	11,400	330	13,000	719
China	1,070,000	23,600	1,050,000	20,300
Germany	200	11	24,400	451
Indonesia	--	--	50	5
Korea, Republic of	45,000	860	35,000	629
Malaysia	--	--	3,700	383
Netherlands	127	27	170	39
Peru	--	--	144,000	2,540
Sweden	128	7	--	--
United Kingdom	63,800	1,550	43,300	1,090
Total	1,700,000	38,100	1,710,000	33,600

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 5
BISMUTH: ESTIMATED WORLD MINE AND REFINERY PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country ⁴	Mine ³					Refinery				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Bolivia ⁵	54	87	41	10	10	73	--	31	--	--
Bulgaria ⁶	--	2 ^r	4 ^r	-- ^r	--	--	2 ^r	4 ^r	-- ^r	--
Canada ⁷	86 ⁵	91 ⁵	92 ⁵	121 ⁵	35	150	150	150	145	100
China	6,000	6,500	7,000	7,500 ^r	7,500	12,300	14,000	15,000	15,000	15,500
Italy	--	--	--	--	--	5	5	5	5	5
Japan ⁸	--	--	--	--	--	423 ⁵	454 ⁵	460	470	500
Kazakhstan	--	--	--	--	--	90	150	150	150	150
Mexico ⁶	854	952	935	800	824	854 ⁵	952 ⁵	935 ⁵	800 ⁵	824 ⁵
Peru ⁶	423	--	--	--	--	423 ⁵	--	--	--	--
Russia	65	50	50	40	40	12	10	10	8	8
Total ⁹	7,500	7,700	8,100	8,500 ^r	8,400	14,000	16,000	17,000	17,000 ^r	17,000

^rRevised. -- Zero.

¹Estimated data are rounded to no more than three significant digits.

²Includes data available through May 14, 2014. Bismuth 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.

³Metal content.

⁴In addition to the countries listed, Belgium and Romania produced refined bismuth; available information is inadequate to make reliable estimates of output levels.

⁵Reported figure.

⁶Mine production not reported and assumed to be equal to refinery production.

⁷Figures listed under mine output are the metal content of concentrates produced.

⁸Refined bismuth was produced as a byproduct of zinc production.

⁹World totals are rounded to no more than two significant digits.