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2010 Minerals Yearbook

BISMUTH

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By James F. Carlin, Jr.

Domestic survey data and tables were prepared by Richard H. Kraft, statistical assistant, and the world production table was prepared by Lisa D. Miller, international data coordinator.

Bismuth consumption in the United States was estimated to be 884 metric tons (t), 8% more than that in 2009 (tables 1, 2). The estimated value of bismuth consumed domestically was $16 million in 2010. The estimated domestic consumption breakdown for bismuth in 2010 was 65% for chemical and pharmaceutical uses, 27% for metallurgical additives for bismuth casting and galvanizing, and 8% for bismuth alloys, fusible alloys, solder, and ammunition (table 2).

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 2010, all primary bismuth consumed in the United States was imported. Only a small amount of bismuth was obtained by recycling old scrap. The leading producers of refined bismuth in 2010 were, in descending order, China, Mexico, Belgium, and Peru. Belgium had no bismuth mine production, and its sole bismuth producer refined metal from anode slimes, concentrates, and smelter residues and flue dust, all of foreign origin. The principal suppliers to the United States were, in descending order, by weight, China, Belgium, the United Kingdom, Canada, and Kazakhstan.

In recent years, new uses for bismuth as a nontoxic replacement for lead have been developed. These include the use of bismuth in shot for water fowl hunting, lubricating greases, pigments, and solders.

The annual average dealer price for bismuth in 2010 was $8.76 per pound, an increase of 12% from that in 2009. Industry observers attributed the price increase to a lull in destocking that followed the 2008 world economic crisis.

Production

Domestic production of primary refined bismuth ceased in 1997. Some domestic firms continued to recover secondary bismuth from fusible alloy scrap in 2010. Secondary production was estimated to be less than 5% of domestic supply during 2010.

Consumption

The U.S. Geological Survey conducts a survey of domestic bismuth consumption annually. The quantity used by nonrespondents was estimated based on reports from prior use or on information from other sources. Accordingly, estimated bismuth consumption was about 884 t in 2010, an 8% increase from that in 2009.

Consumption of bismuth in chemical uses (chemicals, cosmetics, and pharmaceuticals) in 2010 remained the same as that in 2009. Consumption of bismuth for alloys increased by 12% compared with that in 2009. Metallurgical additives experienced a 5% decrease in usage compared with that in 2009. Industry observers attributed the generally lower consumption figure of recent years to the general economic slowdown, which especially affected industrial applications.

Bismuth pharmaceuticals include the well-known 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 was the initial material used for the production of most bismuth pharmaceutical compounds. Other applications of bismuth chemicals and compounds include uses in superconductors and pearlescent pigments for cosmetics and paints.

Bismuth metal was used primarily as a major constituent of various alloys and as a metallurgical additive (table 2). One class of bismuth alloys consists of fusible (low-melting-point, as low as 20 °C) alloys, which 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 lens grinding, and other articles for machining or grinding, solders, and fire sprinkler triggering mechanisms.

In addition to lead-free solder noted above, bismuth has been a substitute for lead added to certain steel products to provide greater machinability. A major domestic steel producer began to use a bismuth-containing substitute for the leaded alloy about 1982. Although bismuth has been used successfully to replace lead in various applications, it has been challenged as a lead substitute by selenium and tungsten (Cusack, 1999).

Bismuth was also added in small amounts to aluminum (along with lead) and copper alloys to improve machinability. It was also added to malleable iron graphite flakes. These uses constitute the traditional metallurgical additives category.

Prices

In 2010, the annual average Platts Metals Week New York dealer price for bismuth rose to $8.76 per pound, an increase of 12% from that in 2009. In 2010, the weekly bismuth price started the year at $7.35 to $8.00 per pound and generally rose throughout the year to finish December at $9.10 to $9.60 per pound.

Foreign Trade

U.S. exports of alloys, bismuth metal, and waste and scrap increased by 77% compared with those in 2009. U.S. imports of metallic bismuth increased by 30% compared with the 2009 figures (table 4). Bismuth imports were 56% (by weight) more than bismuth exports. The leading import source for the United States was China, which supplied 54% of the total.

World Review

In much of the world, bismuth is produced as a byproduct of smelting lead ores. In China, it is also a byproduct of fluorspar, tin, and tungsten ore processing. In Bolivia, the Tasna Mine, the only mine in the world known to produce bismuth from bismuth ore, has been on standby since the mid-1990s, awaiting a rise to a sufficient and sustainable metal price.

World refinery production of bismuth was 16,000 t, a 7% increase from that in 2009. China was the world's leading producer of refined bismuth, with 81% of the world total, followed by Belgium and Mexico, each with 5%.

Canada.—MCP Group SA (Tilly, Belgium) announced it had signed a letter of intent with Fortune Minerals Ltd. (London, Ontario) to purchase bismuth from its NiCo mineral deposit in the Northwest Territories. Fortune Minerals planned to begin mining the deposit in late 2012 and expected to produce about 2,000 metric tons per year (t/yr) of bismuth, along with substantial amounts of cobalt, copper, and gold. MCP is a leading world refiner of bismuth, and it has relied on China for much of its bismuth feedstock. Development of the NiCo deposit has been challenging because of the number of regulatory issues along with indigenous tribe issues and infrastructure requirements. If the project does come to fruition, it would add a significant amount of bismuth to the world market, which was estimated to be about 10,000 t/yr (Ryan's Notes, 2010).

China.—Minmetals Corp. (Beijing) announced plans to spend $658 million to $804 million in a 5-year period to explore for bismuth, rare earths, tin, and tungsten in southern Hunan Province. Minmetals signed a strategic cooperation deal with the Chenzhou City government (American Metal Market, 2010).

Outlook

During much of the past decade, worldwide bismuth consumption has been increasing at about 3% to 5% per year. However, the global economic slowdown that began in late 2008 and extended through the first half of 2009 led to a substantial contraction in consumption. World consumption of bismuth in the steel sector decreased, although it was relatively minor compared with that in other use sectors. World consumption in the chemical industry seemed to be rising, especially in Japan, as bismuth began to replace lead in pigments.

Selected segments of the bismuth use markets, such as metallurgical additives in particular, were very much involved in the industrial sectors of the economy, and any improvement there will likely depend on how quickly the world's industrialized nations can rebound from the 2008–09 economic slowdown.

Commercial and research organizations in Europe, Japan, and North America agreed to a framework to eliminate lead from solders in manufacturing. This agreement would tend to increase the demand for bismuth because bismuth is used in some solders. Many Japanese manufacturers were using lead-free solders in some or all of their soldering applications, and studies on how best to develop lead-free solders were being performed independently by the European Union, Japan, the Republic of Korea, and the United States. Although world lead consumption was expected to be reduced by only 0.8% by the elimination in solder, replacement of lead could increase world bismuth consumption by about 25%.

A significant near-term increase in supplies of lead byproduct seemed unlikely because world production of lead from mine sources was expected to be relatively stable, and an increasing portion of lead demand was expected to be met by recycling. A global shortage of bismuth, however, was not anticipated. In China, new technologies have increased world bismuth reserves. Therefore, despite increases in world demand, supplies from China can be expected to help keep the bismuth market stable, unless China decides to restrict bismuth exports as it has done for some other metals.

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GENERAL SOURCES OF INFORMATION

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Other

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TABLE 1

SALIENT BISMUTH STATISTICS[1]

		2006	2007	2008	2009	2010
United States:						
Consumption[e, 2]	metric tons	1,960	2,630	1,090	820 [r]	884
Exports[3]	do.	311	421	375	397	704 [4]
Imports for consumption	do.	2,300	3,070	1,930	1,250	1,620
Price, average, domestic dealer	dollars per pound	5.04	14.07	12.73	7.84	8.76
Stocks, December 31, consumer	metric tons	120	139	228	134	134
World production:[e, 5]						
Mine, metal content[6]	do.	5,800	6,200	7,600	8,300 [r]	8,900
Refinery	do.	15,000	16,000	17,000 [r]	15,000	16,000

[e]Estimated. [r]Revised. do. Ditto.

[1]Data are rounded to no more than three significant digits.

[2]Estimated based on net imports.

[3]Comprises bismuth metal and the bismuth content of alloys and waste and scrap.

[4]Source: U.S. Census Bureau; data as adjusted by U.S. Geological Survey.

[5]Data are rounded to no more than two significant digits.

[6]Excludes the United States.

TABLE 2

ESTIMATED BISMUTH METAL CONSUMED

IN THE UNITED STATES, BY USE[1, 2]

(Metric tons)

Use	2009 [r]	2010
Chemicals[3]	528	589
Bismuth alloys	58	62
Metallurgical additives	232	231
Other	2	4
Total	820	884

[r]Revised.

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

[2]Estimated based on net imports.

[3]Includes industrial and laboratory chemicals, cosmetics, and pharmaceuticals.

TABLE 3
U.S. EXPORTS OF BISMUTH METAL, ALLOYS, AND WASTE AND SCRAP,
BY COUNTRY[1]

	2009		2010	
Country	Quantity (kilograms, metal content)	Value (thousands)	Quantity (kilograms, metal content)	Value (thousands)
Argentina	220	$17	391	$19
Australia	--	--	934	11
Austria	--	--	20,000	190
Belgium	56,600	820	14,800	255
Brazil	13,400	121	10,600	96
Canada	32,900	701	41,400	947
China	28,800	261	26,400	240
Colombia	1,230	29	743	27
Costa Rica	--	--	12,500	130
Dominican Republic	6,550	60	--	--
France	121,000	1,450	286,000 [2]	2,840 [2]
Germany	2,420	37	73,500	668
Guatemala	--	--	1,090	7
Hong Kong	2,410	26	9,260	84
India	121	3	644	8
Japan	11,000	309	4,160	106
Mexico	59,300	1,350	100,000	1,160
Singapore	445	30	2,060	54
Taiwan	219	16	526	13
Thailand	8,590	78	21,700	200
United Kingdom	4,710	50	1,320	29
Vietnam	45,200	411	75,100 [2]	986 [2]
Other	1,570	56	483	62
Total	397,000	5,820	704,000 [2]	8,140 [2]

-- Zero.

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

[2]Source: U.S. Census Bureau; data as adjusted by U.S. Geological Survey.

Source: U.S. Census Bureau.

TABLE 4

U.S. IMPORTS FOR CONSUMPTION OF METALLIC BISMUTH, BY COUNTRY[1]

Country	2009		2010	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
Belgium	450,000	$8,350	674,000	$12,900
Canada	5,740	88	21,300	339
China	554,000	8,180	875,000	15,400
Germany	1,600	94	4,090	205
Hong Kong	--	--	297	2
Italy	50	8	200	45
Japan	--	--	3	4
Kazakhstan	9,850	185	10,000	195
Korea, Republic of	75,100	1,170	40	3
Mexico	59,400	758	373	75
Netherlands	124	22	15	3
Peru	29,400	386	455	8
Russia	3,320	239	499	65
United Kingdom	62,400	1,110	35,800	761
Total	1,250,000	20,600	1,620,000	30,100

-- Zero.

[1]Data 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	Mine					Refinery				
	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010
Belgium	--	--	--	--	--	800	800	800	800	800
Bolivia	155 [3]	147 [3]	28 [3]	54 [r, 3]	87 [3]	1 [3]	-- [3]	92 [3]	73 [r, 3]	--
Bulgaria	45	45	45	45 [r]	45	30	30	30	30 [r]	30
Canada[4]	177 [3]	137 [3]	71	86 [3]	91	250	200	150	150 [3]	150
China	3,000	3,500	5,000	6,000	6,500	11,800	12,100	13,100 [r]	12,300 [r]	13,000
Italy	--	--	--	--	--	5	5	5	5	5
Japan[5]	21	20	20	21	20	425 [3]	408	480 [r]	423 [r]	420
Kazakhstan	140	145	150	150	150	115	120	125	125	125
Mexico	1,186 [3]	1,200	1,170	854	850	1,186 [3]	1,200	1,170	854	850
Peru	950	950	960	1,000 [r]	1,100	600	600	600	600	600
Romania	40	40	40	40	40	30	30	30	30 [r]	30
Russia	55	55	70	65	50	11	12	13	12	10
Total[6]	5,800	6,200	7,600	8,300 [r]	8,900	15,000	16,000	17,000 [r]	15,000	16,000

[r]Revised. -- Zero.

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

[2]Table includes data available through April 20, 2011. Bismuth is produced primarily as a byproduct of other metals, mainly lead and tungsten.

[3]Reported figure.

[4]Figures listed under mine output are the metal content of concentrates produced, according to Natural Resources Canada, 2006.

[5]Mine output figures have been estimated to be 5% of reported metal output figures.

[6]World totals are rounded to no more than two significant digits.