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2008 Minerals Yearbook

BISMUTH [ADVANCE RELEASE]

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BISMUTH

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Bismuth consumption in the United States was estimated to be 1,090 metric tons (t), a decrease of 59% compared with that of 2007 (tables 1, 2); the estimated value of bismuth consumed domestically was $30 million in 2008. As a result of an ongoing U.S. Geological Survey (USGS) analysis and evaluation of the bismuth market that began in 2003, end-use patterns for 2003 through 2006 contain different assumptions than in previous years. The estimated domestic consumption breakdown for bismuth for 2008 was 55% for chemical and pharmaceutical uses, 34% for metallurgical additives for casting and galvanizing, 7% for bismuth alloys, fusible alloys, solder and ammunition, and 4% for research and other uses (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 held in the National Defense Stockpile were sold that same year. In 2008, 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 2008 were China, Mexico, Belgium, and Peru, in descending order. Belgium had no 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 China, Belgium, the United Kingdom, and Hong Kong in descending order.

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

The average annual dealer price for bismuth in 2008 decreased to $12.73 per pound, a 10% decrease from that of 2007. Industry observers attributed the price decline to the world economic slowdown.

Production

Domestic production of primary refined bismuth ceased in 1997. Some domestic firms continued to recover secondary bismuth from fusible alloy scrap in 2008, but secondary production data were not available. Secondary production was estimated to be less than 5% of domestic supply during the year.

Consumption

The USGS surveys domestic bismuth consumption annually. The amount used by nonrespondents is estimated based on reports from prior years or on information from other sources. Accordingly, estimated bismuth consumption was about 1,090 t in 2008, a decline of 59% compared with that of 2007.

Consumption of bismuth in chemical uses (chemicals, cosmetics, and pharmaceuticals) in 2008 decreased by 20% compared with that in 2007. The alloys category of use registered an 89% decline in tonnage compared with that of 2007. Metallurgical additives experienced a 67% decrease in consumption in 2008 compared with that in 2007. These substantial declines, especially for alloys and metallurgical additives, were attributed 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 is 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 is 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 in about 1982. Although bismuth has been used successfully to replace lead in various applications, it has been challenged as a lead substitute by tin and tungsten (Cusack, 1999).

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

Prices

In 2008, the bismuth price generally drifted lower throughout the year. The average annual Platts Metals Week New York dealer price for bismuth declined to $12.73 per pound, a decline of 10% from that in 2007. The average annual price had experienced a steady and substantial rise from 2003 to 2007.

In 2008, the weekly bismuth price started the year at $12.75 to $13.75 per pound. The price rose during the second quarter, then declined in the third quarter, ending the year at $8.50 to $9.50 per pound.

Foreign Trade

U.S. exports of bismuth metal, alloys, and waste and scrap declined by 11% from those in 2007. Notable increases were

recorded in exports to Brazil, Mexico, Thailand, and the United Kingdom. Substantial decreases were noted for Argentina, Belgium, Japan, Singapore, and Vietnam (table 3).

U.S. imports of metallic bismuth decreased by 37% (by weight) compared with the 2007 figures (table 4). Bismuth imports were about five times greater (by weight) than bismuth exports. The leading import source for the United States was China, which supplied 52% of imports. Considerable increases in imports were observed for Hong Kong and Peru. Hong Kong was a transshipment point. Increased imports from Peru were attributed to a decline in Peru's traditional markets in Asia and Europe. There were notable decreases in imports from Belgium, Mexico, and the United Kingdom. These decreases were attributed to a realignment in the traditional European markets for bismuth from these three countries.

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 processing. In Bolivia, the Tasna Mine, the only mine that produces bismuth from bismuth ore, has been on standby since the mid-1990s, awaiting a sufficient and substantial rise in the metal price.

World refinery production of bismuth was 15,000 t, just slightly lower than that in 2007. China was the world's leading producer of refined bismuth with 78% of the world total, followed by Mexico with 8%, and Belgium with 5%.

Six Chinese bismuth producers in Hunan Province formalized a plan to establish a consortium named the Hunan Bismuth Industry Co. The producers were Hunan Shizhuyuan Nonferrous Co., Hunan Jinwang Enterprise Co., Xinhualian Mining Co., Yangshan County Luzai Kongwen Bangsham Lead and Zinc Mine, Yongxing County Tianyuan Nonferrous Metals Co., and Anren County Yongsheng Lead Co. These six firms had a combined capacity of 3,200 metric tons per year of bismuth, which accounted for about 30% of China's refined bismuth metal output. The consortium announced that its goals were to cushion speculation and to improve China's stature in the world bismuth market. Some industry sources believed that this consolidation was a response to the 2007 merger between European bismuth refiners MCP Aramayo Ltd. and Sidech S.A. (Ryan's Notes, 2008).

Outlook

Over the past decade, worldwide bismuth demand has been increasing by about 3% to 5% per year. However, the global economic slowdown in 2008 that extended into 2009 led to a substantial contraction in consumption. Consumption of bismuth in the steel sector, although relatively minor compared with that in other use sectors, decreased. World consumption in the chemical industry seemed to be rising, especially in Japan, as bismuth began to replace lead in pigments.

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 during the next several years. 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 in 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 these moves, world bismuth consumption may increase by about 25% with a move to lead-free solders.

A significant near-term increase in supplies of lead byproduct bismuth was 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 large increases in world demand, supplies from China can be expected to help keep the bismuth market stable.

References Cited

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GENERAL SOURCES OF INFORMATION

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Other

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TABLE 1
SALIENT BISMUTH STATISTICS[1]

		2004	2005	2006	2007	2008
United States:						
Consumption[e, 2]	metric tons	1,880	2,390	1,960 [r]	2,630 [r]	1,090
Exports[3]	do.	109	142	311	421	375
Imports for consumption	do.	1,990	2,530	2,300	3,070	1,930
Price, average, domestic dealer	dollars per pound	3.35	3.91	5.04	14.07	12.73
Stocks, December 31, consumer	metric tons	167	175	125 [r]	138 [r]	228
World production:[e, 4]						
Mine, metal content[5]	do.	5,600	5,400	5,800	6,200 [r]	7,700
Refinery	do.	15,000	14,000	15,000	16,000 [r]	15,000

[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]Data are rounded to no more than two significant digits.
[5]Excludes the United States.

TABLE 2
ESTIMATED BISMUTH METAL CONSUMED
IN THE UNITED STATES, BY USE[1, 2]

(Metric tons)

Use	2007 [r]	2008
Chemicals[3]	744	597
Bismuth alloys	709	75
Metallurgical additives	1,130	375
Other	45	38
Total	2,630	1,090

[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]

	2007		2008	
Country	Quantity (kilograms, metal content)	Value (thousands)	Quantity (kilograms, metal content)	Value (thousands)
Argentina	14,500	$134	8,340	$78
Australia	338	6	319	3
Austria	103	4	140	4
Belgium	66,200	1,500	--	--
Belize	--	--	21	3
Brazil	3,750	37	28,400	264
Canada	63,800	1,080	55,100	866
China	3,880	77	3,210	79
Colombia	--	--	3,120	82
Costa Rica	818	7	2,130	19
Cyprus	--	--	51	7
Czech Republic	1,320	20	3,400	31
Dominican Republic	7,640	149	8,950	81
Egypt	104	11	1,020	38
France	16,900	161	13,600	791
Germany	9,400	92	3,380	39
Honduras	108	4	--	--
Hong Kong	2,410	22	1,730	30
India	533	18	770	14
Ireland	314	13	124	4
Israel	8,730	56	3,490	33
Italy	36	3	--	--
Japan	14,900	250	4,460	117
Korea, Republic of	--	--	54	5
Malaysia	100	5	--	--
Mexico	31,700	362	76,400	998
Saudi Arabia	27	6	1,470	13
Singapore	30,200	291	8,680	103
South Africa	--	--	50	7
Spain	--	--	163	9
Sweden	1,010	17	794	12
Taiwan	638	6	55	9
Thailand	3,240	29	25,500	446
United Arab Emirates	12,400	113	20	4
United Kingdom	41,400	993	101,000	2,370
Vietnam	84,700	770	18,400	174
Total	421,000	6,230	375,000	6,730

-- Zero.

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

Source: U.S. Census Bureau.

TABLE 4

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

Country	2007 Quantity (kilograms)	2007 Value (thousands)	2008 Quantity (kilograms)	2008 Value (thousands)
Belgium	1,020,000	$17,600	509,000	$10,500
Canada	13,200	202	18,500	229
China	437,000	9,950	998,000	24,200
France	23,300	799	23,100	533
Germany	52,800	1,050	696	41
Hong Kong	347	139	93,500	1,980
Italy	277	38	50	7
Japan	--	--	104	15
Mexico	420,000	13,600	40,000	1,080
Netherlands	87	19	416	91
Peru	3,710	111	55,700	1,100
Poland	--	--	80	17
Singapore	1	2	--	--
Spain	775	27	825	29
Switzerland	--	--	6	5
United Kingdom	1,110,000	14,500	186,000	4,890
Total	3,070,000	58,000	1,930,000	44,700

-- 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 2004	Mine 2005	Mine 2006	Mine 2007	Mine 2008	Refinery 2004	Refinery 2005	Refinery 2006	Refinery 2007	Refinery 2008
Belgium	--	--	--	--	--	800	800	800	800	800
Bolivia	62 [3]	44 [3]	155 [r, 3]	147 [r, 3]	150	32 [3]	-- [3]	40	-- [r]	--
Bulgaria	40	40	45	45	45	35 [3]	35	30 [r]	30 [r]	30
Canada[4]	185	185	214 [3]	137 [r, 3]	71 [p]	250	250	250	200	220
China	3,000	3,000	3,000	3,500	5,000	11,700	10,600 [3]	11,800	12,100 [r]	12,000
Italy	--	--	--	--	--	5	5	5	5	5
Japan[5]	26 [r]	23 [r]	21 [r]	20 [r]	20	522	463 [3]	425 [3]	408 [r]	390
Kazakhstan	150	140	140	145	150	130	120	115	120	125
Mexico	1,064 [3]	970 [3]	1,186 [3]	1,200	1,170	1,064 [3]	970 [3]	1,186 [3]	1,200	1,170
Peru	1,000	952 [3]	950 [r]	950 [r]	960	600	600	600	600	600
Romania	40	40	40	40	40	35	35	30	30	30
Russia	50	50	55	55	70	10	10	11	12	13
Total[6]	5,600	5,400	5,800	6,200 [r]	7,700	15,000	14,000	15,000	16,000 [r]	15,000

[p]Preliminary. [r]Revised. -- Zero.

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

[2]Table includes data available through March 31, 2009. 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, 2005–06.

[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.