

Mineral Industry Surveys

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BISMUTH IN THE FIRST QUARTER 2004

Total bismuth consumption in the United States for the first quarter 2004 was 607 metric ton (t), which was a slight decrease as compared with fourth quarter 2003 consumption, according to estimates compiled by the U.S. Geological Survey (USGS). As a result of an ongoing USGS analysis of the bismuth market that was begun during the second quarter of 2003, quarterly end use patterns for the second half of 2003 and first quarter of 2004 contain different assumptions from those of previous quarters (table 1). The consumption breakdown for bismuth in the first quarter 2004 was 46% for metallurgical additives in alloying and galvanizing; 29% for fusible alloys, solders, and ammunition; 24% for chemical and pharmaceutical uses; and 1% for research and other miscellaneous uses (table 2).

The New York dealer price for bismuth, as published in Platts Metals Week, ended the fourth quarter 2003 within a price range of \$2.60 to \$2.90 per pound. In mid-February, 2004, the price range increased to \$2.80 to \$3.10 per pound. By the end of February, the price range was \$2.95 to \$3.25, the highest price since mid-2002. The price remained at this level through the end of the quarter.

Reserves.—Tiberon Minerals Ltd. (Canada) has announced that the Government of Vietnam has granted an investment license for the Nui Phoa project. Key provisions of the license included a 30-year initial term, exclusive rights to 55.66 square kilometers of land, favorable corporate tax rates, and a royalty rate of 3% for bismuth. The joint venture's next step is the submission for a mining license (Metal Bulletin, 2004b; Metal-Pages, 2004d¹). Tiberon acquired an additional 7.5% ownership of the project from Export-Import Investments Co. Thai Nguyen (Intraco), increasing its interest to a 77.5% stake. State-owned Thai Nguyen Mineral Co. owns 15%; 7.5% is still held by Intraco (Platts Metals Week, 2004). It was also announced that the joint venture raised \$11.7 million, which will be used to finance feasibility studies (Tiberon Minerals Ltd., 2004).

Fortune Minerals Limited (Canada) announced the results of flotation metallurgical test work; the metal recovery rates and

concentrate content were confirmed for bismuth. By the end of the quarter, a small-scale pilot plant was expected to be completed to verify the flow sheet for production of salable products (Metal-Pages, 2004b[§]). The bismuth concentrates will be treated off site, most likely at Teck Cominco's Trail smelter in British Columbia (Fowler and van Ballegoie, 2004, p. 7-10). Environmental and archeological study surveys were carried out, and nothing was discovered that would hinder the development of the site. The feasibility study should be completed by the fourth quarter of 2004 (Fortune Minerals Limited, 2004; Metal-Pages, 2004b[§]).

Research and Uses.—The deaths of indigenous water fowl have caused three States (Maine, New Hampshire, and New York) to pass various lead restrictions on fishing tackle. According to a study by Tufts University (MA) School of Veterinary Medicine, 20% to 50% of loon mortalities nationally are attributed to lead sinkers. Other States are following Minnesota's example of offering an exchange of lead tackle for lead-free alternatives. Bismuth is a popular choice since it has similar properties to lead. However, lead sinkers cost about \$1.50 a bag while bismuth or tungsten sinkers cost upwards of \$5 a bag. Alternatives to lead, bismuth, and tungsten are steel or brass, which cost the same as lead but are less desirable because of their size (Saratogian, 2004[§]; Startribune, 2004[§]).

Bismuth is used in a mixture with four other compounds (strontium, calcium, copper, and lead) to create multifilamentary high-temperature superconducting (HTS) wire. The bismuth-based powder is made into ceramic filaments, which are combined with a silver alloy metal matrix to create the HTS wires that are used in transmission lines running from power generation plants to transformers. The HTS wires have zero resistance below 180 K; therefore zero electricity is lost in transmission. With the rolling blackouts on the West Coast and the blackout on the East Coast, government agencies are looking to refurbish the national power grid (American Superconductors, 2004[§]).

The Next Generation Environment-Friendly Soldering Technology (EFOST) released a report on a recycling and resource consumption study. The study examined how to

¹References that include a section mark (§) are found in the Internet References Cited section.

recycle lead-free solder and what impact non-lead material would have on the economical threshold for recycling. The study noted that lead solder requires less energy to produce and recycle than lead-free solder. The result of the study showed that bismuth had little to no impact on the decision to recycle or not. It was projected that with the introduction of lead-free solder the consumption of bismuth would increase by 1,200 t per year worldwide (Deubzer and others, 2004§).

Production.—The prices of raw materials and power shortages in China have caused shortages of bismuth concentrates. China's leading producer, Hunan Shizhuyuan Non-Ferrous Metals Co., has cut its production of bismuth in half to 30 t. The total bismuth production for 2003 is expected to be 400 t, which is 250 t lower than last year. With these shortages, the Chinese producers steadily applied upward pressure to the price of metal (Metal Bulletin, 2004a). Many of these producers have been enjoying higher prices in other metal markets; as a result many industry analysts believe that China is stockpiling bismuth, making the market appear tighter. Others believe that China's supply tightness is caused by long-term commitments and that little is left for the spot market (Metal Bulletin Daily, 2004).

Industrias Peñoles, S.A. de C.V. (Mexico), the largest single producer of bismuth in the world, produced 1,054 t in 2003, which was slightly short of its 2002 bismuth production of 1,103 t. The company was forced to rely on outside sources of feed in 2003, which the foundries had difficulties in processing due to the differing content of the concentrates. That problem has been solved and lead foundries can process material with any grade of concentrates. During the first quarter, the production was 251 t, which was about the same as the 2003 first quarter production of 246 t (Industrias Peñoles, S.A. de C.V., 2004§).

Japanese production of bismuth from January to November 2003 was 457 t, which was up slightly from the previous year's production. Stocks at the end of November were at 50.1 t (Roskill's Letter from Japan, 2004a). Japan continues to import large amounts of bismuth. China was a major source of this material in 2003, exporting 407 t to Japan, a 78% increase compared with that of 2002 (Roskill's Letter from Japan, 2004b).

Teck Cominco Limited's (Canada) bismuth production was not affected by the explosion inside its KIVET lead furnace at its Trail operations. The explosion caused extensive damage to the zinc plant's boiler system but left the lead plant undamaged. The bismuth production was already shut down for maintenance and will not be operational for the first half of 2004 (Metal-Pages, 2004a§; c§).

Consumption.—There was some tightness in the market as Japan is consuming more than usual amounts of bismuth. As of April 1, many lead end products were being replaced by bismuth in Japan, increasing the consumption of bismuth during the first quarter (Metal Bulletin Daily, 2004).

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TABLE 1
SALIENT BISMUTH STATISTICS¹

(Kilograms unless otherwise specified)

| | 2003 | 2004 |
|--|-----------|---------------|
| | | First quarter |
| Consumption ^c | 2,117,000 | 607,000 |
| Exports ² | 108,000 | 39,000 |
| Imports for consumption | 2,317,000 | 502,000 |
| Price per pound, dealer, end of period | 2.87 | 2.94 |
| Stocks, end of period, consumer | 278,000 | 134,000 |

^cEstimated.

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

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

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

(Kilograms)

| Use | 2003 | 2004 |
|-------------------------|-----------|---------------|
| | | First quarter |
| Chemicals ² | 616,000 | 147,000 |
| Bismuth alloys | 646,000 | 177,000 |
| Metallurgical additives | 831,000 | 278,000 |
| Other | 25,000 | 5,640 |
| Total | 2,120,000 | 607,000 |

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

(Kilograms)

| Country | 2003 | | | 2004 | | | |
|--------------------|---------|----------|----------------|---------|----------|--------|---------------|
| | Year | December | Fourth quarter | January | February | March | First quarter |
| Belgium | 10,500 | -- | -- | -- | -- | -- | -- |
| Brazil | 1,800 | -- | 300 | -- | 300 | -- | 300 |
| Canada | 23,500 | 644 | 6,660 | 1,540 | 6,940 | 2,230 | 10,700 |
| China | 992 | 992 | 992 | -- | -- | -- | -- |
| Costa Rica | 492 | -- | -- | -- | -- | -- | -- |
| Dominican Republic | 2,320 | 151 | 380 | 427 | 118 | 416 | 961 |
| Egypt | 448 | -- | -- | -- | -- | -- | -- |
| Germany | 4 | -- | -- | -- | -- | -- | -- |
| Guatemala | 143 | -- | -- | -- | 229 | -- | 229 |
| Hong Kong | 155 | -- | 46 | 46 | 25 | 24 | 95 |
| Hungary | 136 | -- | -- | -- | -- | -- | -- |
| Israel | 7 | 7 | 7 | -- | -- | -- | -- |
| Japan | 30,200 | 4,910 | 4,910 | -- | 145 | 5,050 | 5,200 |
| Korea, Republic of | 496 | -- | 316 | -- | -- | -- | -- |
| Mexico | 33,300 | 3,540 | 7,130 | 4,800 | 2,040 | 4,700 | 11,500 |
| Russia | 1,510 | -- | -- | -- | -- | 1,040 | 1,040 |
| Thailand | 250 | -- | 250 | -- | -- | -- | -- |
| United Kingdom | 1,840 | -- | -- | 8,180 | 729 | -- | 8,910 |
| Total | 108,000 | 10,200 | 21,000 | 15,000 | 10,500 | 13,500 | 39,000 |

-- Zero.

¹Data 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 BISMUTH METAL, BY COUNTRY¹

(Kilograms, metal content)

| Country | 2003 | | | 2004 | | | |
|----------------|-----------|----------|----------------|---------|----------|---------|---------------|
| | Year | December | Fourth quarter | January | February | March | First quarter |
| Bahamas, The | 1,330 | -- | 527 | -- | -- | -- | -- |
| Belgium | 778,000 | 60,400 | 162,000 | 55,100 | 75,800 | 119,000 | 250,000 |
| Canada | 22,500 | 1,040 | 1,060 | 1,500 | 831 | -- | 2,330 |
| China | 573,000 | 93,900 | 133,000 | -- | -- | 37,000 | 37,000 |
| Germany | 67,100 | 18,100 | 18,100 | 20,000 | 21,100 | -- | 41,100 |
| Hong Kong | 105,000 | -- | 53,400 | -- | -- | -- | -- |
| Italy | 500 | 300 | 300 | -- | -- | -- | -- |
| Mexico | 532,000 | 37,800 | 132,000 | 60,000 | 38,100 | 38,200 | 136,000 |
| Netherlands | 57,900 | 495 | 38,300 | -- | 21 | 10 | 31 |
| Peru | 135 | -- | -- | 93 | -- | -- | 93 |
| Spain | 756 | -- | -- | -- | -- | -- | -- |
| United Kingdom | 178,000 | 13,600 | 39,900 | 7,050 | 14,000 | 14,200 | 35,300 |
| Total | 2,320,000 | 226,000 | 578,000 | 144,000 | 150,000 | 209,000 | 502,000 |

-- Zero.

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

Source: U.S. Census Bureau.