



# 2005 Minerals Yearbook

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## ANTIMONY

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There was no domestic antimony mine production during the year. Most domestic smelting consisted of upgrading imported antimony trioxide to a higher purity. Most primary antimony metal and antimony oxide were produced domestically from imported raw material. Primary antimony metal and antimony oxide were produced by one company in Montana. Secondary antimony was recovered in lead alloy from scrapped lead-acid batteries at secondary lead smelters. The amount of antimony used by battery manufacturers was substantially lower than it was 10 years earlier because of changing materials requirements for batteries. Industry stocks declined by 24% owing to rising antimony prices as consumers found the metal harder to obtain (table 1).

About 40% of the primary antimony used in the United States during 2005 went into flame retardants; most of the rest was used by the ceramic, chemical, glass, and transportation industries. Secondary antimony, which was derived almost entirely from recycled lead-acid batteries and contained in antimonial lead, was used in the manufacture of new batteries. In 2005, the average price of antimony was 160.5 cents per pound and was 23% higher than that of 2004.

Antimony was mined as a principal product or was a byproduct of the smelting of base-metal ores in 12 countries. World mine production rose by 8%. Nearly all the world's primary antimony was mined in China (86%), South Africa (4%), Bolivia (2%), Russia (2%), Tajikistan (1%), and Australia (1%) (table 9).

## Production

**Mine Production.**—There was no domestic mine production in 2004. The Nation's last domestic byproduct antimony producer, Sunshine Mining Co. in Idaho, closed its mine in early 2001.

**Smelter.**—The United States had only one antimony smelter, U.S. Antimony Corp. (USAC) based in Thompson Falls, MT. USAC produced antimony metal for bearings, lead alloys, and ordnance; antimony oxide as a raw material for flame retardants; and sodium antimonite for glass and other applications. USAC also recycled antimony-containing products that would otherwise be taken to landfill sites.

A major antimony smelter, Great Lakes Chemical Corp. in Indianapolis, IN, merged with Crompton Corp. of Middlebury, CT, to form a new business entity, Chemtura Corp. based in Middlebury. Although Great Lakes Chemical Corp. had been based in Lafayette, IN, it did not have a domestic antimony smelter, but operated an antimony smelter in Reynosa, Mexico, as part of GLCCLaurel LLC (a 50% joint ownership stake with Occidental Chemical Corp.). The all-stock merger creating Chemtura represented the fourth largest publicly traded

American specialty chemicals producer and the world's largest plastics additives company (Chemtura Corp., 2005).

## Consumption

Of the 137 companies to which a U.S. Geological Survey antimony consumption survey was sent, 66 firms responded. Consumption data were estimated for the remaining 71 firms. Reported and estimated U.S. consumption was only about one-third of net imports.

In 2005, consumption (reported and estimated) of primary antimony declined by 22% from that of 2004 (table 2). Consumption for most categories declined moderately except for flame retardants, which declined by 39% from that of 2004 (table 3). Industry sources attributed the decline in use of flame retardants to increasing competition from ammonium polyphosphate and the movement offshore of some plants that consume the flame retardants.

Lead-antimony alloys were used in ammunition, antifriction bearings, automotive batteries, cable sheaths, corrosion-resistant pumps and pipes, roof sheet solder and tank lining. Antimony trioxide, often dissolved in an organic solvent, was used to enhance the flame-retardant properties of rubber and textiles, plastics, and other combustibles. Antimony was also used as a decolorizing and refining agent in the manufacture of some forms of glass, such as optical glass.

## Prices

In 2005, antimony prices continued the strong upward trend that began in 2002. Antimony prices started the year in the range of \$1.33 to \$1.37 per pound and finished the first quarter in the range of \$1.45 to \$1.50 per pound. Prices remained fairly steady in the second quarter. By the end of the third quarter, prices had risen to a range of \$1.83 to \$1.89 per pound. Prices in the fourth quarter remained rather steady and finished the year at \$1.82 to \$1.89 per pound. The average antimony price for the year increased by 23% compared with that of 2004. The price increase was attributed to increased world demand that outpaced a modest increase in world mine output.

## Trade

U.S. imports of antimony in 2005 were, as has been the case in the past, much larger than exports—about 14-fold larger (tables 5-8). Imports of antimony declined by 13% from the level of 2004, with antimony ore and concentrate experiencing the largest relative decrease. China was the leading supplier to the United States of antimony ore, antimony concentrate,

and antimony metal, while China and Mexico were the leading suppliers of antimony oxide.

## World Review

**Australia.**—A.G.D. Mining Ltd. of Melbourne announced its intention to proceed with its antimony and gold project in Augusta. A.G.D. had launched a \$2.4 million share issue in August 2004 to provide initial equity funding. A.G.D.'s major shareholder, Cambrian Mining plc of Melbourne will contribute \$7.1 million to the mine development and process plant construction. The project was expected to produce an average of 918 kilograms per year (29,500 troy ounces per year) of gold and 3,300 metric tons per year (t/yr) of antimony-in-concentrate over an initial mine life of 3 years. Production was expected to begin early 2006 (Metal-Pages, 2005a§<sup>1</sup>).

Northwest Resources Ltd. of Darling Point, New South Wales announced that it expected to drill extensively in 2006 to develop its existing antimony and gold prospects. The prospects are located in the Nullagine goldfield area in the central Pilbara region of Western Australia. The company planned to concentrate on the Blue Spec Shear project area, which reportedly had a very high-grade gold and antimony mineralization. The separation of antimony and gold during processing was not expected to present significant metallurgical problems (Metal-Pages, 2005b§).

**China.**—China's antimony resources were mainly distributed in Gansu, Guangxi, Guizhou, Hunan, Jianxgi, and Yunnan Provinces. Hunan has taken the place of Guangxi as the leading antimony ore producing area in China. Many significant antimony mines have exhausted more than 80% of their reserves, and the quality and the quantity of the ores were declining. In 2005, the Ministry of Land and Resources released a list of the 291 operations it certified as miners of antimony, rare earths, and tin (Beijing Antaika Information Development Co., Ltd., 2006).

In 2005, antimony smelters faced tighter supplies of raw materials, and many of them depended increasingly on concentrate inventories. Hunan, Guangxi, and Yunnan Provinces, respectively, contributed 59%, 20%, and 10% to the national output of refined antimony. Among antimony refiners reporting an increase in antimony production in 2005 were Dushan County Dongfeng Group Co., Ltd.; Hechi City South Nonferrous Metals Co., Ltd.; Hsikwangshan Twinkling Star Antimony Co., Ltd.; and Yiyang City Hongda Antimony Co., Ltd. Data from the General Administration of Customs (GAS) showed that China imported 21,900 metric tons (t) of antimony concentrates in 2005 compared with 18,000 t in 2004 (Beijing Antaika Information Development Co., Ltd., 2006). In addition the GAS announced that exports of antimony surged during 2005. China exported 29,800 t of antimony in 2005, an increase of 39% compared with that in 2004 (Metal-Pages, 2006a§).

The Ministry of Commerce for China issued a list of 31 state-owned trading companies authorized to export antimony during 2006. Included were Chengyuan Smelting Co., Ltd.; China Minmetals Nonferrous Metals Co., Ltd.; Dongguan Jiefu Co.,

Ltd.; Hechi Wuji Co., Ltd.; Liuzhou China Tin Group Co., Ltd.; Shanxing Antimony Corp., Ltd.; and Yunnan United Antimony Co., Ltd. (Metal-Pages, 2006b§).

There were fewer than 60 antimony smelters maintaining normal production, and only 3 of those (Hsikwangshan Twinkling Star; Hunan Chenzhou Mining Co., Ltd.; and Liuzhou China Tin) had a capacity of more than 5,000 t/yr. There were also three antimony oxide producers with production capacity of more than 5,000 t/yr—Guangxi Huati Chemical Co., Ltd., Hsikwangshan Twinkling Star, and Yunnan Muli Antimony Co., Ltd. Of China's antimony consumption, 50% goes to the flame-retardant industry. China consumed an estimated 30,000 t of antimony in 2005 (Beijing Antaika Information Development Co., Ltd., 2006).

After a 2-month shutdown, production returned to the full capacity of 24,000 t/yr at Hsikwangshan Twinkling Star's Lengshuijiang City facilities in central Hunan Province. A power reduction at the company's North Mine and smelter had forced closure of these facilities and reduced company output by one-half during the 2-month shutdown. Production had continued at the South smelter during the shutdown (Metal Bulletin Daily, 2005).

**Mexico**—USAC announced that Antimonio de Mexico, S.A. de C.V. (50% owned by USAC) began exploration of an antimony and silver property in Mexico that is located in a major silver belt. The Mexican Government previously had reported resources of 1 million metric tons at a grade of 1.8% antimony and 252 grams per metric ton (7.4 troy ounces per metric ton) silver based on exploration work that was carried out in 1969. Metallurgical testing at that time was unable to separate the antimony from the silver. Antimonio has completed preliminary metallurgical testing of the rock and has been able to make an antimony product and a silver product. Should the exploration work confirm substantial reserves, Antimonio intended to build a milling facility close to the open pit mine. The antimony output would be shipped to USAC in Thompson Falls for processing and marketing (Metal-Pages, 2005c§).

## Outlook

The use of antimony as an ingredient in flame retardants is expected to remain its principal use. This is expected to be true for global as well as U.S. markets.

Antimony recovered from old scrap has long been an important part of the total antimony supply, but the recovery decline during the past 25 years as a significant source is expected to continue. Following the advent in the 1970s of low-maintenance and maintenance-free automotive batteries, the antimony content of a typical automotive lead-acid battery in 2005 had fallen to about 0.6% or lower. Industry sources believed the antimony level in lead-acid batteries would reach zero by 2020.

## References Cited

Beijing Antaika Information Development Co., Ltd., 2006, Review on China's antimony market in 2005: China Metal Market—Precious and Minor Metals, no. 73, March, p. 2-3.

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

Chemtura Corp., 2005, Crompton Corporation and Great Lakes Chemical finalize merger, become Chemtura Corporation: Middlebury, CT, Chemtura Corp. press release, July 1, 2 p.  
 Metal Bulletin Daily, 2005, Chinese antimony producer returns to full capacity: Metal Bulletin Daily, no. 8390, April 21, p. 3.

### Internet References Cited

Metal-Pages, 2005a (August 5), AGD Mining to start Augusta Sb/Au mining, accessed August 22, 2005, via URL <http://www.metal-pages.com>.  
 Metal-Pages, 2005b (October 27), Development of Australian antimony-gold project intensifies, accessed October 27, 2005, via URL <http://www.metal-pages.com>.  
 Metal-Pages, 2005c (November 1), U.S. Antimony analyses Mexican deposit, accessed November 1, 2005, via URL <http://www.metal-pages.com>.  
 Metal-Pages, 2006a (January 25), China ups Sb and Mn exports, accessed January 25, 2006, via URL <http://www.metal-pages.com>.

Metal-Pages, 2006b (January 19), Chinese companies approved to export antimony, accessed January 19, 2006, via URL <http://www.metal-pages.com>.

## GENERAL SOURCES OF INFORMATION

### U.S. Geological Survey Publications

Antimony, Ch. in United States Minerals Resources, Professional Paper 820, 1973.  
 Antimony, Mineral Industry Surveys, quarterly.

### Other

Antimony, Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1  
 SALIENT ANTIMONY STATISTICS<sup>1</sup>

(Metric tons of antimony content unless otherwise specified)

	2001	2002	2003	2004	2005
United States:					
Production:					
Primary:					
Mine, recoverable antimony	--	--	--	--	--
Smelter	9,080	W	W	W	W
Secondary	5,380	5,350	5,600	3,650 <sup>r</sup>	3,670
Exports:					
Metal, alloys, waste and scrap      gross weight	1,730	992	771	566	740
Antimony oxide <sup>2</sup>	5,880	3,260	2,910	3,240	1,400
Imports for consumption	37,900	28,500	26,700	33,500	29,200
Reported industrial consumption, primary antimony	13,100	11,500	9,230	11,400 <sup>r</sup>	8,910
Stocks, primary antimony, all classes, December 31	4,990	5,060	6,320	2,830 <sup>r</sup>	2,130
Price, average <sup>3</sup> cents per pound	64.7	88.4	107.5	130.3	160.5
World, mine production	157,000	114,000 <sup>r</sup>	115,000 <sup>r</sup>	129,000 <sup>r</sup>	139,000 <sup>e</sup>

<sup>e</sup>Estimated. <sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits, except prices.

<sup>2</sup>Antimony content is calculated by the U.S. Geological Survey.

<sup>3</sup>New York dealer price for 99.5% to 99.6% metal, cost, insurance, freight U.S. ports.

TABLE 2  
REPORTED INDUSTRIAL CONSUMPTION OF  
PRIMARY ANTIMONY IN THE UNITED STATES<sup>1</sup>

(Metric tons of antimony content)

Year	Class of material consumed			Total
	Metal	Oxide	Other <sup>2</sup>	
2004	1,750 <sup>r</sup>	9,570 <sup>r</sup>	84	11,400 <sup>r</sup>
2005	1,530	7,290	89	8,910

<sup>r</sup>Revised.

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

<sup>2</sup>Includes residues and sulfide.

TABLE 3  
REPORTED INDUSTRIAL CONSUMPTION OF PRIMARY ANTIMONY IN THE  
UNITED STATES, BY PRODUCT<sup>1</sup>

(Metric tons of antimony content)

Product	2004	2005
<b>Metal products:</b>		
Antimonial lead	1,200	W
Bearing metal and bearings	51 <sup>r</sup>	33
Solder	85	81
Other <sup>2</sup>	1,680	2,830
Total	3,020 <sup>r</sup>	2,940
<b>Nonmetal products:</b>		
Ammunition primers	W	W
Ceramics and glass	535 <sup>r</sup>	421
Pigments	536 <sup>r</sup>	535
Plastics	W	W
Other <sup>3</sup>	1,410	1,410
Total	2,480 <sup>r</sup>	2,360
<b>Flame retardants:</b>		
Adhesives	676	W
Plastics	4,680	2,650
Rubber	119	115
Textiles	189	184
Other <sup>4</sup>	63	652
Total	5,910 <sup>r</sup>	3,600
Grand total	11,400 <sup>r</sup>	8,910

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data.

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

<sup>2</sup>Includes ammunition, cable covering, castings, sheet and pipe, and type metal.

<sup>3</sup>Includes fireworks and rubber products.

<sup>4</sup>Includes paper and pigments.

NOTE: Secondary antimonial lead production was 3,650 metric tons (t) in 2004 and an estimated 3,670 t in 2005.

TABLE 4  
INDUSTRY STOCKS OF PRIMARY ANTIMONY  
IN THE UNITED STATES, DECEMBER 31<sup>1</sup>

(Metric tons of antimony content)

Type of material	2004	2005
Metal	483 <sup>r</sup>	425
Oxide	2,330 <sup>r</sup>	1,690
Other <sup>2</sup>	16	17
Total	2,830 <sup>r</sup>	2,130

<sup>r</sup>Revised.

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

<sup>2</sup>Includes ore and concentrate, residues, and sulfide.

TABLE 5  
U.S. EXPORTS OF ANTIMONY METAL, ALLOYS, AND WASTE AND SCRAP,  
BY COUNTRY<sup>1</sup>

Country	2004		2005	
	Gross weight (metric tons)	Value (thousands)	Gross weight (metric tons)	Value (thousands)
Canada	370	\$1,180	390	\$1,290
Costa Rica	3	11	--	--
El Salvador	22	66	--	--
Mexico	97	365	281	1,270
Netherlands	41	143	(2)	36
Sweden	9	144	14	236
Switzerland	2	27	5	107
Other	24	345	50	313
Total	566	2,280	740	3,250

-- Zero.

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

<sup>2</sup>Less than ½ unit.

TABLE 6  
U.S. EXPORTS OF ANTIMONY OXIDE, BY COUNTRY<sup>1</sup>

Country	2004			2005		
	Gross weight (metric tons)	Antimony content <sup>2</sup> (metric tons)	Value (thousands)	Gross weight (metric tons)	Antimony content <sup>2</sup> (metric tons)	Value (thousands)
Argentina	153	127	\$635	--	--	--
Australia	15	12	45	118	98	\$322
Belgium	115	95	656	69	57	198
Brazil	67	56	237	11	9	53
Canada	1,520	1,260	4,400	287	238	982
Chile	12	10	41	34	28	85
China	49	41	136	65	54	280
Colombia	65	54	208	20	17	27
France	96	80	755	36	30	129
Germany	49	41	180	2	2	5
Japan	282	234	926	76	63	317
Korea, Republic of	211	175	690	96	80	277
Mexico	738	613	2,060	524	435	1,670
New Zealand	32	27	138	10	8	48
Pakistan	20	17	111	12	10	71
Singapore	14	12	95	39	32	242
South Africa	41	34	110	--	--	--
Taiwan	26	22	186	41	34	293
Thailand	78	65	230	21	17	71
Turkey	63	52	278	1	1	8
United Kingdom	174	144	749	100	83	402
Other	79	64	306	122	101	374
Total	3,910	3,240	13,200	1,680	1,400	5,860

-- Zero.

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

<sup>2</sup>Antimony content is calculated by the U.S. Geological Survey.

Source: U.S. Census Bureau.

TABLE 7  
U.S. IMPORTS FOR CONSUMPTION OF ANTIMONY, BY CLASS AND COUNTRY<sup>1</sup>

Country	2004			2005		
	Gross weight (metric tons)	Antimony content <sup>2</sup> (metric tons)	Value (thousands)	Gross weight (metric tons)	Antimony content <sup>2</sup> (metric tons)	Value (thousands)
<b>Antimony ore and concentrate:</b>						
China	1,450	1,380	\$3,860	150	147	\$443
Hong Kong	--	--	--	40	40	127
Japan	(3)	(3)	4	(3)	--	4
Peru	--	--	--	18	17	48
Russia	195	194	542	--	--	--
Saudi Arabia	100	100	295	--	--	--
Vietnam	80	80	202	--	--	--
Total	1,820	1,750	4,900	207	204	622
<b>Antimony oxide:</b>						
Australia	--	--	--	(3)	(3)	5
Belgium	2,110	1,750	4,670	1,870	1,550	5,660
Brazil	19	16	38	--	--	--
Canada	--	--	--	1	1	8
China	12,900	10,700	30,700	11,500	9,510	33,600
France	1	1	8	3	3	24
Germany	10	8	141	5	4	80
Hong Kong	520	432	1,370	176	146	522
Iceland	--	--	--	22	18	9
Japan	171	142	765	239	199	2,580
Kyrgystan	126	105	266	--	--	--
Liechtenstein	(3)	(3)	4	--	--	--
Mexico	11,600	9,590	28,500	12,000	9,930	34,100
South Africa	790	656	628	--	--	--
Switzerland	38	32	114	36	30	116
Taiwan	3	2	9	--	--	--
United Kingdom	(3)	(3)	6	--	--	--
Vietnam	20	17	49	1,540	1,280	4,950
Total	28,300	23,500	67,200	27,300	22,700	81,600

-- Zero.

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

<sup>2</sup>Antimony ore and concentrate content reported by the U.S. Census Bureau. Antimony oxide content is calculated by the U.S. Geological Survey.

<sup>3</sup>Less than ½ unit.

Source: U.S. Census Bureau.



TABLE 8  
U.S. IMPORTS FOR CONSUMPTION OF ANTIMONY METAL, BY COUNTRY<sup>1</sup>

Country	2004		2005	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Belgium	168	\$386	701	\$1,850
Bolivia	--	--	20	\$50
Canada	100	826	108	1,130
Chile	20	45	20	50
China	5,820	14,700	3,870	13,500
France	11	29	--	--
Germany	(2)	104	(2)	104
Hong Kong	--	--	135	446
Japan	1	60	1	99
Mexico	785	707	900	844
Netherlands	19	47	--	--
Peru	501	875	461	1,590
Russia	105	258	21	60
South Africa	649	756	--	--
Taiwan	20	56	19	73
United Kingdom	46	102	--	--
Vietnam	20	53	110	569
Other	12	5	5	7
Total	8,270	19,100	6,370	20,400

-- Zero.

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

<sup>2</sup>Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 9  
ANTIMONY: WORLD MINE PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Metric tons)

Country <sup>3</sup>	2001	2002	2003	2004	2005 <sup>e</sup>
Australia <sup>4</sup>	1,380	1,200 <sup>e</sup>	1,300 <sup>e</sup>	1,800	1,900
Bolivia	2,264	2,336	2,911	3,118 <sup>f</sup>	3,100
Canada <sup>5</sup>	278 <sup>f</sup>	173 <sup>f</sup>	153 <sup>f</sup>	112 <sup>f</sup>	120
China <sup>e</sup>	140,000	100,000	100,000	110,000 <sup>f</sup>	120,000
Guatemala	--	--	20	2,686	2,700
Kyrgyzstan <sup>e</sup>	150	150	40	20	10
Peru, refined	274	356	356 <sup>e</sup>	356 <sup>e</sup>	360
Russia, recoverable <sup>e</sup>	4,500	1,000 <sup>f</sup>	2,000 <sup>f</sup>	3,000 <sup>f</sup>	3,000
South Africa <sup>5</sup>	4,927	5,746	5,291 <sup>f</sup>	4,967 <sup>f</sup>	5,000
Tajikistan <sup>e</sup>	2,500	3,000	1,800	2,000	2,000
Thailand, content of ore and concentrate	18	1	38	52 <sup>f</sup>	50
Turkey <sup>e</sup>	330	250	650	900 <sup>f</sup>	900
Total	157,000	114,000 <sup>f</sup>	115,000 <sup>f</sup>	129,000 <sup>f</sup>	139,000

<sup>e</sup>Estimated. <sup>f</sup>Revised. -- Zero.

<sup>1</sup>World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Antimony content of ore unless otherwise indicated. Table includes data available through May 27, 2006.

<sup>3</sup>In addition to the countries listed, antimony may have been produced in Iran, but information is inadequate to estimate output

<sup>4</sup>Antimony content of antimony ore and concentrate, lead concentrates, and lead-zinc concentrates.

<sup>5</sup>Antimony content of concentrate.