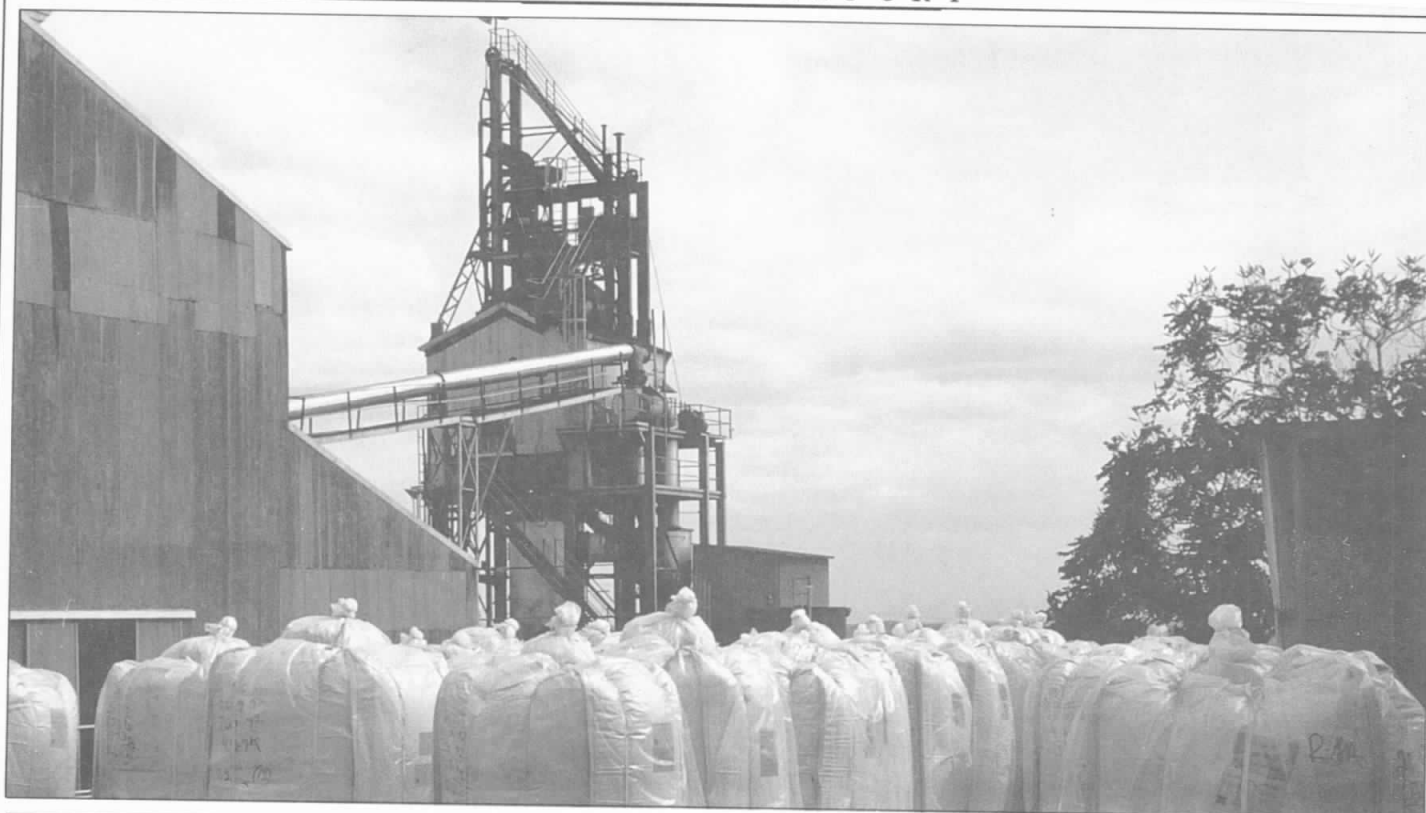




ANTIMONY

By James F. Carlin, Jr.

1993

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF MINES



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ANTIMONY



U.S.
DEPARTMENT
OF THE
INTERIOR

Bruce Babbitt
Secretary



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COVER PHOTO:

Packets of antimony trioxide from one of Laurel Industries Inc.'s production facilities awaiting shipment to Laurel's Houston, TX, plant for refining. Antimony trioxide is a common component in flame retardants. (Photo courtesy of Laurel Industries, Inc.)

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ANTIMONY

By James F. Carlin, Jr.

Mr. Carlin, a physical scientist with more than 30 years of industry and U.S. Bureau of Mines experience, has been the commodity specialist for antimony since 1993. Domestic survey data were prepared by Joi Brown, statistical assistant; and international data were prepared by Ted Spittal, international data specialist.

Domestic consumption of primary antimony products increased substantially in 1993, as did production of primary antimony. Imports of antimony products declined slightly while exports declined substantially.

Primary antimony metal and oxide were produced by six companies operating six plants using both foreign and domestic feed material. Two plants were in Texas, and there was one each in Idaho, Montana, Nebraska, and New Jersey. A very small amount of antimony was recovered as a byproduct from the smelting of lead and silver-copper ores. Virtually all antimony metal (unalloyed) and oxides produced domestically originated from imports. The estimated value of primary antimony metal and oxides produced in 1993 was \$62 million. The estimated distribution of primary antimony uses was as follows: flame retardants, 57%; transportation, including batteries, 22%; chemicals, 8%; ceramics and glass, 7%; and other, 6%.

Antimony produced from domestic source materials was derived mainly from recycled lead-acid batteries. Recycling plus U.S. mine output supplied less than one-half of the estimated domestic demand.

Antimony was mined as a principal product and produced as a byproduct of the smelting of base metal ores in 19 countries. China, the world's leading producer, accounted for 68% of the total world estimated mine production during 1993. China, together with the other three major producing countries, Bolivia, Russia, and the Republic of South Africa, accounted for about 87% of the total

world estimated mine antimony production. (See table 10.)

Identified world antimony reserves at yearend 1993 were estimated to be 4.2 million metric tons.

DOMESTIC DATA COVERAGE

Domestic primary production data for antimony are developed by the U.S. Bureau of Mines from a voluntary survey of U.S. operations. Of the six operations to which a survey request was sent, all responded, representing 100% of the primary smelter production shown in table 1. (See table 1).

ANNUAL REVIEW

Strategic Considerations

Public Laws 99-661 and 102-484 provided authorization for additional antimony monthly sales through 1994 or until the 3,507 short tons authorized for fiscal year 1993 is disposed. Sales of antimony from the National Defense Stockpile took place for the first time since 1988. Sales were conducted on a sealed bid basis, commencing on June 27 and were held the third Thursday of each month. Each month a maximum of 500 short tons of antimony, either Grade A or Grade B, was offered, usually in the form of ingots or cakes. In 1993, a total of 2,656 short tons was sold.

Antimony is stockpiled in Government warehouses in 13 locations, with the Somerville, NJ, depot holding the largest amount.

Domestic Production

Mine Production.—In the Coeur d'Alene district of Idaho, Sunshine Mining Co. produced antimony as a byproduct of the treatment of tetrahedrite, a complex silver-copper-antimony sulfide ore.

Smelter Production.—Primary.—The producers of primary antimony metal and oxide products were ASARCO Incorporated, Omaha, NE; Amspec Chemical Corp., Gloucester City, NJ; Anzon Inc., Laredo, TX; Laurel Industries Inc., La Porte, TX; Sunshine Mining Co., Kellogg, ID; and U.S. Antimony Corp., Thompson Falls, MT.

Secondary.—Old scrap, predominantly lead battery plates, was the source of essentially all of the secondary antimony output. New scrap, mostly in the form of drosses and residues from various sources, supplied the remainder. The antimony content of scrap was usually recovered and consumed as antimonial lead. (See table 2.)

Consumption and Uses

Domestic consumption of primary antimony increased substantially in 1993. The most significant increases occurred in the categories of antimonial lead, ceramics and glass, and plastics (especially as flame retardants). Lead-antimony alloys were used in starting-lighting-ignition batteries, ammunition, corrosion-resistant pumps and pipes, tank linings, roofing sheets, solder, cable sheaths, and antifriction bearings.

Antimony compounds were used in plastics as stabilizers and as flame retardants. Antimony trioxide in an organic solvent was used to make textiles, plastics, and other combustibles flame resistant. Antimony was used as a decolorizing and refining agent in some forms of glass, such as optical glass. The estimated distribution of antimony uses was flame retardants, 74%; transportation, including batteries, 11%; chemicals, 9%; ceramics and glass, 2%; and other, 4%. (See tables 3, 4, and 5.)

Markets and Prices

The New York dealer antimony metal price, published by Metals Week, averaged \$0.77 per pound for the year, continuing the generally downward trend of recent years. The price range for high-tint antimony trioxide was \$1.10 to \$1.20 per pound at the beginning of the year and declined to a range of \$1.00 to \$1.10 per pound by the fourth quarter.

Foreign Trade

Total imports of antimony materials were about the same as those in 1992. China supplied about 60% of the total imported materials. Exports of antimony oxide were about 19% lower than those of the previous year. (See tables 6, 7, 8, and 9.)

OUTLOOK

Antimony demand rose to a new plateau in 1993, but it is not clear whether it can maintain that level or continue increasing. Some of that increased demand was probably due to continued lower antimony prices during the year. Most of the increased demand was registered in the category of flame retardants, and it is anticipated that field should grow, although tin and other metals are gaining as acceptable substitutes with commendable qualities of their own.

It is anticipated that China's dominance as a supplier of antimony will continue for the foreseeable future.

OTHER SOURCES OF INFORMATION

Bureau of Mines Publications

Antimony. Ch. in Mineral Commodity Summaries, annual.
Antimony. Ch. in Mineral Facts & Problems, 1985 ed.

Other Sources

Chemical Abstracts.
Engineering and Mining Journal.
Metal Bulletin (London).

TABLE 1
SALIENT ANTIMONY STATISTICS

(Metric tons of antimony content unless otherwise specified)

	1989	1990	1991	1992	1993
United States:					
Production:					
Primary:					
Mine (recoverable antimony)	W	W	W	W	W
Smelter	'18,720	'19,438	16,032	'17,854	21,723
Secondary	19,501	20,351	19,294	'19,925	17,245
Exports of metal, alloys, waste and scrap	293	588	694	947	315
Exports of antimony oxide	1,850	7,142	3,752	*4,817	*3,896
Imports for consumption	25,165	29,403	28,833	31,204	30,944
Reported industrial consumption, primary antimony	13,424	12,766	11,864	'12,225	17,047
Stocks: Primary antimony, all classes, Dec. 31	6,270	8,175	10,170	'8,741	9,452
Price: Average, cents per pound ¹	94.3	81.8	82.0	79.0	76.9
World: Mine production	'105,239	'94,407	'92,448	'75,011	*73,288

*Estimated. 'Revised. W Withheld to avoid disclosing company proprietary data.

¹New York dealer price for 99.5% to 99.6% metal, c.i.f. U.S. ports.

TABLE 2
SECONDARY ANTIMONY PRODUCED IN THE UNITED STATES,
BY KIND OF SCRAP AND FORM OF RECOVERY

(Metric tons of antimony content unless otherwise specified)

	1992	1993
KIND OF SCRAP		
New scrap: Lead- and tin-base	'1,260	1,213
Old scrap: Lead- and tin-base	'18,665	16,032
Total	'19,925	17,245
FORM OF RECOVERY		
In antimonial lead	19,477	16,977
In other lead- and tin-base alloys	448	268
Total	19,925	17,245
Value millions	\$41	NA

*Revised. NA Not available.

TABLE 3
REPORTED INDUSTRIAL CONSUMPTION OF
PRIMARY ANTIMONY IN THE UNITED STATES

(Metric tons of antimony content)

Year	Class of material consumed				Total
	Metal	Oxide	Sulfide	Residues	
1989	2,523	10,640	27	234	12,067
1990	2,148	9,961	25	632	13,424
1991	2,542	9,296	26	W	11,864
1992	2,451	9,745	29	W	12,225
1993	2,474	13,475	(¹)	(¹)	17,047

¹Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹Withheld to avoid disclosing company proprietary data; included in "Total."

TABLE 4
REPORTED INDUSTRIAL CONSUMPTION OF PRIMARY
ANTIMONY IN THE UNITED STATES, BY PRODUCT

(Metric tons of antimony content)

Product	1989	1990	1991	1992	1993
Metal products:					
Ammunition	521	602	W	W	W
Antimonial lead	1,901	1,985	1,698	1,642	2,659
Bearing metal and bearings	129	90	77	36	45
Cable covering	W	W	W	W	W
Castings	8	8	8	9	14
Sheet and pipe	157	123	W	W	W
Solder	245	208	223	248	242
Type metal	4	3	W	W	W
Other	80	106	915	1,362	1,525
Total	3,045	3,125	2,921	3,297	4,485
Nonmetal products:					
Ammunition primers	20	23	23	25	24
Ceramics and glass	1,050	991	872	928	1,191
Fireworks	5	3	2	3	3
Pigments	196	246	207	314	W
Plastics	1,137	1,171	1,112	717	1,035
Rubber products	71	29	W	W	W
Other	159	151	101	115	508
Total	2,638	2,614	2,317	2,102	2,761
Flame-retardants:					
Adhesives	219	189	200	300	280
Paper	W	W	W	W	W
Pigments	926	502	W	W	W
Plastics	5,851	5,678	4,982	5,113	8,050
Rubber	166	181	250	241	298
Textiles	558	460	513	444	424
Other	21	17	681	728	749
Total	7,741	7,027	6,626	6,826	9,801
Grand total	13,424	12,766	11,864	12,225	17,047

¹Revised. W Withheld to avoid disclosing company proprietary data; included with "Other."

TABLE 5
INDUSTRY STOCKS OF PRIMARY ANTIMONY
IN THE UNITED STATES, DECEMBER 31

(Metric tons of antimony content)

Stocks	1989	1990	1991	1992	1993
Metal	1,873	2,934	3,598	2,450	2,819
Ore and concentrate	W	W	(¹)	(¹)	(¹)
Oxide	4,079	4,380	3,338	2,952	3,663
Residues	302	844	(¹)	(¹)	(¹)
Sulfide	16	17	(¹)	20	20
Total	6,270	8,175	10,170	8,741	9,452

¹Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹Withheld to avoid disclosing company proprietary data; included in "Total."

TABLE 6
U.S. EXPORTS OF ANTIMONY METAL, ALLOYS,
WASTE AND SCRAP, BY COUNTRY

Country	1992		1993	
	Gross weight (metric tons)	Value (thousands)	Gross weight (metric tons)	Value (thousands)
Belgium	267	\$396	32	\$39
Brazil	—	—	35	59
Canada	71	188	94	232
Chile	14	33	—	—
Colombia	35	79	15	28
Dominican Republic	8	33	—	—
El Salvador	5	9	5	9
Japan	17	20	1	10
Mexico	409	505	46	95
Panama	2	4	9	19
Thailand	—	—	9	19
United Kingdom	13	50	(¹)	21
Venezuela	97	211	43	95
Other	19	88	8	89
Total ²	947	1,619	315	871

¹Revised.

¹Less than 1/2 unit.

²Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 7
U.S. EXPORTS OF ANTIMONY OXIDE, BY COUNTRY

Country	1992			1993		
	Gross weight (metric tons)	Antimony content ¹ (metric tons)	Value (thousands)	Gross weight (metric tons)	Antimony content ¹ (metric tons)	Value (thousands)
Belgium	65	54	\$178	76	63	\$228
Brazil	33	27	123	27	22	102
Canada	584	485	1,595	816	677	2,073
Colombia	175	145	452	34	28	147
France	25	21	65	57	47	138
Germany	180	149	481	122	101	372
Indonesia	—	—	—	10	8	36
Israel	90	75	217	72	60	169
Italy	45	37	62	362	300	362
Japan	356	295	1,017	540	448	1,232
Korea, Republic of	—	—	—	28	23	28
Mexico	3,244	2,693	3,743	1,405	1,166	1,621
Netherlands	18	15	19	26	22	26
Singapore	551	457	1,051	748	621	1,385
Spain	36	30	85	—	—	—
Sweden	5	4	5	11	9	11
Taiwan	167	139	673	17	14	62
Turkey	53	44	180	46	38	154
United Kingdom	47	39	117	127	105	328
Venezuela	10	8	32	12	10	39
Other	121	99	349	157	131	374
Total ²	5,804	4,817	10,443	4,694	3,896	8,889

¹Estimated by the U.S. Bureau of Mines.

²Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF ANTIMONY, BY CLASS AND COUNTRY

Country	1992			1993		
	Gross weight (metric tons)	Antimony content ¹ (metric tons)	Value (thousands)	Gross weight (metric tons)	Antimony content ¹ (metric tons)	Value (thousands)
Antimony ore and concentrate:						
Bolivia	267	91	\$505	—	—	—
Canada	893	243	478	1,497	374	\$775
Chile	69	67	94	—	—	—
China	1,079	1,015	1,572	97	83	136
France	103	49	328	29	14	92
Guatemala	—	—	—	48	29	31
Hong Kong	147	123	188	—	—	—
Mexico	388	277	388	48	43	31
Other	83	59	157	—	—	—
Total ²	3,029	1,923	3,710	1,720	543	1,066
Antimony oxide:						
Belgium	704	584	1,973	867	720	2,430
Bolivia	4,025	3,341	5,775	3,354	2,784	5,016
China	5,925	4,918	7,454	7,018	5,825	9,179
France	242	201	557	241	200	521
Germany	118	98	1,272	331	275	1,779
Guatemala	42	35	78	18	15	32
Hong Kong	384	319	585	201	167	349
Kyrgyzstan	124	103	157	661	549	835
Mexico	3,306	2,744	3,149	3,064	2,543	2,539
Netherlands	28	23	87	68	56	202
Russia	163	136	190	198	164	236
South Africa, Republic of	1,794	1,489	647	3,027	2,513	906
Switzerland	57	47	63	—	—	—
United Kingdom	122	101	361	67	55	284
Other	52	43	271	208	174	539
Total ²	17,085	14,181	22,619	19,322	16,037	24,847

¹Antimony ore and concentrate content reported by Bureau of the Census. Antimony oxide content estimated by the U.S. Bureau of Mines.

²Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 9
U.S. IMPORTS FOR CONSUMPTION
OF ANTIMONY METAL, BY COUNTRY

Country	1992		1993	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Bolivia	113	\$156	174	\$230
Chile	36	50	40	54
China	13,066	20,875	12,332	20,366
Hong Kong	1,424	2,400	396	652
Japan	137	1,825	72	1,902
Mexico	171	79	366	184
Russia	41	72	—	—
Taiwan	8	87	11	92
Thailand	40	63	160	224
Other	64	469	812	1,892
Total ¹	15,100	26,077	14,364	25,594

¹Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 10
ANTIMONY: WORLD MINE PRODUCTION, BY COUNTRY¹

(Metric tons)

Country	1989	1990	1991	1992	1993*
Australia ²	1,360	1,420	¹ 1,500	¹ 1,701	1,700
Austria (content of concentrate)	350	352	—	—	—
Bolivia	9,189	8,454	7,287	⁶ 6,022	4,500
Canada ³	2,821	658	469	⁷ 948	741
China ⁴	61,000	⁵ 54,800	⁵ 58,300	45,000	50,000
Czech Republic ⁴	—	—	—	—	250
Czechoslovakia ^{4,5}	600	1,270	1,000	1,000	—
Guatemala	¹ 1,335	¹ 1,068	609	¹ 582	600
Honduras ⁶	10	—	—	—	—
Kyrgyzstan	—	—	—	¹ 2,000	1,600
Macedonia	—	—	—	¹ —	—
Mexico ⁶	1,906	¹ 1,672	¹ 1,469	¹ 1,200	¹ 1,469
Morocco (content of concentrate)	142	192	90	⁷ 90	90
Namibia (content of sodium antimonate)	34	2	10	⁷ 6	8
Pakistan ⁶	8	9	11	12	—
Peru (recoverable)	¹ 304	¹ 307	¹ 278	¹ 339	340
Russia ⁶ (recoverable)	—	—	—	10,000	6,000
Serbia and Montenegro	—	—	—	¹ —	—
Slovakia ⁵	—	—	—	—	450
South Africa, Republic of (content of concentrate)	5,201	4,815	4,485	¹ 3,779	3,500
Spain ⁶	5	—	—	—	—
Tajikistan	—	—	—	¹ 1,500	1,200
Thailand (content of ore and concentrate)	495	326	60	¹ 269	270
Turkey	1,471	⁵ 552	¹ 370	¹ 309	310
U.S.S.R. ^{6,7}	18,000	18,000	16,000	—	—
United States	W	W	W	W	W
Yugoslavia ⁹	798	409	³ 350	—	—
Zimbabwe (content of concentrate)	210	101	160	¹ 254	260
Total	¹ 105,239	¹ 94,407	¹ 92,448	¹ 75,011	73,288

*Estimated. ¹Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total."

¹Antimony content of ore unless otherwise indicated. Table includes data available through June 20, 1994.

²Antimony content of antimony ore and concentrate, lead concentrates, and lead-zinc concentrates.

³Antimony content of antimonial lead alloys, flue dust, and doré slag estimated on the basis of reported gross production.

⁴Formerly part of Czechoslovakia.

⁵Dissolved on Dec. 31, 1992.

⁶Antimony content of ores for export plus antimony content of antimonial lead and other smelter products produced.

⁷Reported figure.

⁸Dissolved in Dec. 1991.

⁹Dissolved in Apr. 1992.

