Antimony

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The consumption of antimony declined in 1978 and 1979 from that of 1977. For the fifth consecutive year, the use of antimony metal as a hardening agent in battery grid alloys decreased. Technological changes in the types of alloys used in automotive batteries have drastically reduced the use of antimony as a hardener for battery grids in recent years.

The traditional practice of pricing antimony metal on the basis of RMM and Lone Star brands, which were produced at NL Industries, Inc.'s, Laredo, Tex., smelter, was discontinued in April 1978 owing to the closing of the plant and depletion of residual stocks. Effective April 17, 1978, a new quotation was established on the basis of refined antimony in alloy. The new price, $1.75 per pound, represented the published prices of the two largest alloy producers, NL Industries and RSR Corp. This price was maintained through early 1979, when it was increased to $2 per pound, remaining at that level through the year.

Domestic mine production was at normal levels in 1978 and 1979, but metal production increased substantially in 1979 over that of 1978 because of the reactivation of the smelter in Laredo, Tex. Imports were up significantly in 1978 and 1979 over those of 1977, mainly because of higher imports of concentrate and antimony oxide.

Legislation and Government Programs.—At yearend 1979 the General Services Administration reported that Government stocks of antimony totaled 40,727 tons. The Government stockpile goal remained at 20,130 tons.

Table 1.—Salient antimony statistics

(Short tons)

	1975	1976	1977	1978	1979
United States:					
Production:					
Primary:					
Mine	886	283	610	798	722
Smelter[1]	12,189	14,618	12,827	14,110	15,062
Secondary	17,964	19,799	30,601	26,456	NA
Exports of metal and alloys	340	341	742	556	485
Imports for consumption (antimony content)	18,706	21,770	13,335	17,511	22,125
Consumption[1]	12,987	15,337	13,823	13,152	11,753
Stocks, primary antimony, all classes, (antimony content), Dec. 31	14,957	15,070	8,591	8,201	7,144
Price: New York, average cents per pound	176.58	165.26	178.00	[2]175.00	[2]196.00
World: Production	77,114	[r]75,292	72,483	72,122	79,381

[r]Revised. NA Not available.
[1]Includes primary antimony content of antimonial lead produced at primary lead refineries.
[2]Antimony price in alloy, cents per pound.

DOMESTIC PRODUCTION

MINE PRODUCTION

Domestic mine production of primary antimony in 1979 by two companies was down from that of 1978. The United States Antimony Corp. (USAC) produced antimony from the stibnite mined at the Babitt, Bardot, and Black Jack mines at Thompson Falls, Mont. In 1979, USAC increased pro-

duction of antimony to 299 tons, compared with 207 tons in 1978. The Sunshine Mining Co. operated the Sunshine mine in the Coeur d'Alene district of Idaho and produced 423 tons of antimony, a decrease of 168 tons from the 1978 output. Antimony was produced as a byproduct of the treatment of tetrahedrite, a complex silver-copper-antimony sulfide, one of the principal ore minerals in the Kellogg, Idaho, area. In June 1979, a 19% stock interest in Sunshine Holdings Corp. was sold to Arab Investors Group SA, a Luxembourg corporation.

Antimony was also produced as a byproduct in smelting primary lead from domestic concentrates. The total antimony supply from domestic mines was 1,337 tons in 1978 and 930 tons in 1979. Two primary lead refiners reported production in 1978 and 1979.

Table 2.—Antimony mine production and shipments in the United States

(Short tons)

Year	Antimony concentrate	Antimony	
		Produced	Shipped
1975	4,505	886	966
1976	1,111	283	310
1977	3,496	610	534
1978	4,231	798	863
1979	3,294	722	701

SMELTER PRODUCTION

Primary.—Production of primary antimony products in 1979 was the highest since 1974. Metal production increased after 2 years of decline, and the production of antimony oxide remained strong. The production of metal more than doubled in 1978 with the reopening of the expanded Laredo, Tex., smelter which Anzon America Inc. bought from NL Industries. ASARCO Incorporated produced and sold a small amount of metal in 1979 from its new smelter in El Paso, Tex., but mechanical problems precluded full-scale operation. ASARCO began full production at its Omaha, Nebr., antimony oxide plant in early 1979. The plant, built at a cost of approximately $2.2 million, has a rated capacity of 225 tons of antimony oxide per month and utilizes an enclosed and automated process.

The major producers of antimony oxide were Harshaw Chemical Co., Gloucester City, N.J.; Chemetron Corp., La Porte, Tex.; M&T Chemicals Inc., Baltimore, Md.; and McGean Chemical Co., Inc., Cleveland, Ohio. Producers of antimony metal included Sunshine Mining Co., Kellogg, Idaho, and USAC at Thompson Falls, Mont., which also produced sodium antimonate.

Secondary.—Production of antimony from secondary sources decreased in 1978 from that of 1977. Data were not available for 1979. Secondary smelters recovered 22,371 tons, primary smelters recovered 73 tons, and manufacturers and foundries recovered the remaining 4,012 tons. Old scrap, predominantly battery plates, was the source of most of the secondary output; new scrap, mostly in the form of drosses and residues from various sources, supplied the remainder. The antimony content of scrap is usually recovered and consumed as antimonial lead with removal or addition of antimony as required in the refining stage to meet specifications for various antimonial lead alloys.

Table 3.—Primary antimony produced in the United States

(Short tons of antimony content)

Year	Class of material produced				Total
	Metal	Oxide	Residues	Byproduct antimonial lead	
1975	3,254	7,890	595	450	12,189
1976	3,102	10,628	191	697	14,618
1977	1,877	9,907	277	766	12,827
1978	1,108	12,117	184	701	14,110
1979	2,642	12,141	--	279	15,062

Table 4.—Byproduct antimonial lead produced at primary lead refineries in the United States

(Short tons)

Year	Gross weight	Antimony content				
		From domestic ores[1]	From foreign ores[2]	From scrap	Total	
					Quantity	Percent
1975	6,029	268	182	117	567	9.4
1976	6,743	355	342	33	730	10.8
1977	7,557	598	168	134	900	11.9
1978	5,518	539	162	82	783	14.2
1979	3,750	208	71	20	299	8.0

[1]Includes primary residues and a small quantity of antimony ore.
[2]Includes foreign base bullion and small quantities of foreign antimony ore.

Table 5.—Secondary antimony produced in the United States, by kind of scrap and form of recovery

(Short tons of antimony content)

Kind of scrap	1978	Form of recovery	1978
New scrap:		In antimonial lead[1]	21,620
Lead-base	4,032	In other lead alloys	4,818
Tin-base	36	In tin-base alloys	18
Total	4,068	Total	26,456
		Value (millions)	$92.6
Old scrap:			
Lead-base	22,371		
Tin-base	17		
Total	22,388		
Grand total	26,456		

[1]Includes 73 tons of antimony recovered in antimonial lead from secondary sources at primary plants in 1978.

CONSUMPTION AND USES

Domestic consumption of primary antimony in 1979 declined for the third consecutive year. The use of antimonial lead in the manufacture of starting-lighting-ignition batteries for the automotive industry remained a major outlet, but development of maintenance-free batteries has resulted in a decline in the use of antimony metal in recent years. The lead-calcium-tin alloy in the maintenance-free battery systems uses no antimony. A reduction of 10% in battery shipments in 1979 compared with those of 1978 contributed to lower antimony usage. Antimonial lead alloys were used for solder, ammunition, chemical pumps and pipes, roofing sheets, communication equipment, and antifriction bearings.

The use of antimony in nonmetal products declined in 1979 from that in 1978. Its use in ceramics and glass has generally declined in recent years, but its use in plastics has increased substantially since 1975. Nonmetallic antimony was used in plastics both as a stabilizer and as a flame retardant. Antimony was used as a decoloring and refining agent in some forms of glass such as special optical glasses.

The use of antimony oxide as a flame retardant continued to grow in 1979. The use in plastics and textiles as a flame retardant was the major outlet. When fabrics treated with antimony oxide in an organic solvent are ignited, the flames accompanying the initial combustion are restricted or extinguished by the products of combustion.

Table 6.—Industrial consumption of primary antimony in the United States

(Short tons of antimony content)

Year	Class of material consumed						
	Ore and concentrate	Metal	Oxide	Sulfide	Residues	Byproduct antimonial lead	Total
1975	369	4,229	7,311	33	595	450	12,987
1976	640	3,375	10,397	37	191	697	15,337
1977	160	2,625	9,959	36	277	766	13,823
1978	131	2,709	9,399	28	184	701	13,152
1979	15	1,899	9,528	32	--	279	11,753

Table 7.—Industrial consumption of primary antimony in the United States, by class of material produced

(Short tons of antimony content)

Product	1975	1976	1977	1978	1979
Metal products:					
Ammunition	239	63	138	133	253
Antimonial lead	4,568	3,861	2,936	2,832	1,300
Bearing metal and bearings	402	405	265	279	235
Cable covering	23	19	16	21	--
Castings	18	24	13	15	30
Collapsible tubes and foil	9	23	16	17	24
Sheet and pipe	60	74	56	39	36
Solder	133	188	220	206	199
Type metal	75	79	83	81	37
Other	120	164	104	113	99
Total	5,647	4,900	3,847	3,736	2,213
Nonmetal products:					
Ammunition primers	14	13	13	13	23
Fireworks	10	12	9	5	6
Ceramics and glass	989	1,260	1,547	1,259	1,127
Pigments	321	415	400	410	399
Plastics	1,091	1,277	1,503	1,456	1,580
Rubber products	458	578	473	254	182
Other	658	1,330	266	165	140
Total	3,541	4,885	4,211	3,562	3,457
Flame retardant:					
Plastics	2,501	3,777	3,972	4,063	4,262
Pigments	92	183	149	33	35
Rubber	172	199	219	196	146
Adhesives	126	141	246	298	302
Textiles	748	1,055	997	990	1,143
Paper	160	197	182	274	195
Total	3,799	5,552	5,765	5,854	6,083
Grand total	12,987	15,337	13,823	13,152	11,753

Table 8.—Industry stocks of primary antimony in the United States, December 31

(Short tons of antimony content)

Stocks	1975	1976	1977	1978	1979
Ore and concentrate	8,364	7,899	1,869	1,610	1,757
Metal	1,380	1,662	1,359	1,119	1,184
Oxide	3,886	4,560	4,576	4,906	3,398
Sulfide	32	31	24	19	17
Residues and slags	921	475	516	457	730
Antimonial lead[1]	374	443	247	90	58
Total	14,957	15,070	8,591	8,201	7,144

[1]Inventories from primary sources at primary lead refineries only.

PRICES

In April 1978, Metals Week discontinued the Lone Star and RMM price quotations and began reporting a new price category of antimony in alloy. The price of antimony in alloy was established at $1.75 per pound and remained at that level through February 1979. In March, the price was increased to $2 to $2.02 per pound, where it remained to yearend. The industry price quotation for antimony trioxide was in the range of $1.64 to $1.80 per pound throughout 1978, but fell to $1.50 in February 1979. In mid-1979, the price was increased to $1.65, reflecting rising costs of raw materials. The New York dealer price for antimony metal, quoted in January 1978 at $1.05 to $1.10 per pound, gradually increased to a high in 1978 of $1.25 to $1.35 by November, but finished the year at $1.23 to $1.28. The price rose to $1.53 to $1.60 through the first 5 months of 1979, but declined to $1.45 to $1.50 in the last 4 months of the year. The European market quotation for lump ore, on a 60% antimony basis, was $16 to $18 per metric ton unit for the first 9 months of 1978, but began rising during the fourth quarter and closed at $18.50 to $19.80. Quotations generally rose in 1979 to $23 to $24.75 by yearend.

Table 9.—Antimony price ranges

Type of antimony	Price per pound	
	1978	1979
Domestic metal[1]	$1.75	$1.96
Foreign metal[2]	$1.05-1.35	$1.25-1.60
Antimony trioxide[3]	1.64-1.80	1.50-1.80

[1]Based on antimony in alloy.
[2]Duty-paid delivery, New York.
[3]Quoted in Metals Week.

FOREIGN TRADE

Total imports of antimony (antimony content) in 1979 increased compared with those of 1978. Most of the increase was due to higher imports of antimony concentrates and oxide, both of which have increased since 1977.

Imports of antimony metal from mainland China rose in 1978 and 1979 over those of 1977, making China a major supplier. The Republic of South Africa was the largest single source for imports of antimony oxide in 1978 and 1979, followed by the United Kingdom, France, and mainland China in 1978, and mainland China, France, and the United Kindom in 1979.

Imports of ore and concentrate in 1979 increased significantly over the levels of 1977 and 1978. Compared with imports in 1977, Bolivia, Canada, Chile, and Mexico provided larger quantities of antimony ore, but the Republic of South Africa supplied much less than in the past years.

Belgium-Luxembourg, mainland China, and the United Kingdom emerged as the leading sources of needle and sulfide antimony for the United States in 1978. The Republic of South Africa, which was the leading source of antimony needle and sulfide in 1977 with 83% of the total, supplied none in 1978, and mainland China supplied none in 1979.

Table 10.—U.S. imports for consumption of antimony, by country

Country	1978		1979	
	Quantity (short tons)	Value (thousands)	Quantity (short tons)	Value (thousands)
Antimony metal, including needle or liquated (antimony content):[1]				
Belgium-Luxembourg	187	$409	357	$1,005
Bolivia	349	829	672	1,581
Burma	--	--	1	2
Canada	3	55	23	162
Chile	173	326	11	28
China:				
Mainland	2,186	4,209	1,360	3,369
Taiwan	331	634	(2)	(2)
Dominican Republic	--	--	55	146
Germany, Federal Republic of	(2)	12	(2)	27
Hong Kong	--	--	28	61
Malaysia	(2)	(2)	(2)	(2)
Mexico	640	967	406	410
Peru	99	146	30	54
Spain	100	207	20	50
United Kingdom	12	37	(2)	4
Yugoslavia	99	188	77	201
Total	4,179	8,019	3,040	7,100
Antimony oxide:				
Belgium-Luxembourg	708	1,889	462	1,268
Bolivia	515	1,119	979	2,163
Canada	21	62	38	45
China:				
Mainland	1,214	2,925	1,846	4,351
Taiwan	22	52	42	95
France	2,214	5,846	1,734	4,328
Germany, Federal Republic of	20	23	4	7
Italy	355	834	141	370
Japan	334	631	124	298
South Africa, Republic of	3,033	993	7,268	2,194
Switzerland	--	--	19	122
United Kingdom	2,231	4,429	1,022	2,680
Total	10,667	18,803	13,679	17,921

[1]Includes needle or liquated (value in thousands): 1978-Belgium-Luxembourg 19 tons ($55), Canada[2] ($1), mainland China 22 tons ($33), the United Kingdom 10 tons ($31); 1979-Belgium-Luxembourg 18 tons ($90).
[2]Less than 1/2 unit.

Table 11.—U.S. imports for consumption of antimony ore, by country

Country	1978			1979		
	Gross weight (short tons)	Antimony content (short tons)	Value (thousands)	Gross weight (short tons)	Antimony content (short tons)	Value (thousands)
Bolivia	2,421	1,550	$1,806	2,716	1,694	$2,464
Canada	2,474	1,583	2,267	2,732	1,716	2,924
Chile	576	376	504	1,636	1,067	1,944
China, mainland	40	28	59	--	--	--
Colombia	66	47	47	35	16	28
Denmark	--	--	--	40	10	38
Honduras	6	2	2	6	2	8
Mexico	2,620	631	1,018	5,725	1,613	1,911
Peru	19	18	29	37	35	57
South Africa, Republic of	450	260	442	1,247	733	1,245
Thailand	--	--	--	857	459	777
United Kingdom	--	--	--	449	212	223
Uruguay	--	--	--	265	175	241
Total	8,672	4,495	6,174	15,745	7,732	11,860

Table 12.—U.S. imports for consumption of antimony

Year	Antimony ore			Needle or liquated		Antimony metal[1]		Antimony oxide	
	Gross weight (short tons)	Antimony content (short tons)	Value (thousands)	Gross weight (short tons)	Value (thousands)	Gross weight (short tons)	Value (thousands)	Gross weight (short tons)	Value (thousands)
1977	8,042	3,438	$6,832	259	$580	1,722	$4,536	9,641	$15,150
1978	8,672	4,495	6,174	52	121	4,127	7,897	10,667	18,803
1979	15,745	7,732	11,860	28	90	3,022	7,100	13,679	17,921

[1]Does not include alloy containing 83% or more antimony.

Table 13.—Antimony: World mine production (content of ore unless otherwise indicated), by country

(Short tons)

Continent and country	1976	1977	1978[p]	1979[e]
North America:				
Canada[e 1]	2,535	3,500	3,300	3,300
Guatemala	1,235	1,012	254	250
Honduras	129	77	[e]110	110
Mexico[2]	2,806	2,974	2,708	2,700
United States[3]	283	610	798	[4]722
South America:				
Argentina	2	--	--	--
Bolivia[5]	[r]18,756	13,660	13,968	[4]14,351
Brazil	39	370	279	280
Peru (recoverable)	665	907	987	990
Europe:				
Austria	588	564	561	600
Czechoslovakia	[r]314	[e]330	[e]330	330
Greece	243	--	--	--
Italy	1,112	891	1,026	1,000
Spain	[r]287	543	519	540
U.S.S.R.[e]	8,500	8,700	8,700	9,000
Yugoslavia	2,228	2,478	[e]3,040	3,100
Africa:				
Algeria[e]	([6])	([6])	--	--
Morocco	1,560	1,553	2,437	2,300
Rhodesia, Southern[e]	330	330	280	280
South Africa, Republic of	[r]11,793	12,715	10,024	[4]12,958
Asia:				
Burma	[r]516	551	683	700
China, mainland[e]	13,000	13,000	14,000	17,000
Korea, Republic of	11	--	22	--
Malaysia (Sarawak)	[r]276	488	535	550
Pakistan	[r]61	104	115	120
Thailand	4,047	2,705	3,167	3,200
Turkey	[r]1,890	2,118	[e]2,610	2,700
Oceania: Australia[7]	[r]2,086	2,303	1,669	2,300
Total	[r]75,292	72,483	72,122	79,381

[e]Estimate. [p]Preliminary. [r]Revised.

[1]Partly estimated on the basis of reported value of total production.

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

[3]Production from antimony mines; excludes a small amount produced as a byproduct of domestic lead ores.

[4]Reported figure.

[5]Total national production. (Previous year's data represented production by COMIBOL plus exports by medium and small mines and so-called "other producers.")

[6]Revised to zero.

[7]Antimony content of antimony ore and concentrates, lead concentrates, and lead and zinc middlings.

WORLD REVIEW

Antimony was produced from ores and as a smelter byproduct in about 25 countries. Australia, mainland China, and the Republic of South Africa showed the greatest increase in production in 1979. In 1978, Japanese antimony producers increased production of antimony oxide but reduced production of antimony metal. The only antimony metal refinery in India closed in 1977. In Belgium, Metallurgie Hoboken-

Overpelt, S.A., began construction in 1978 on a new plant to recover antimony oxide from lead smelter residues. In mainland China a new mine designed to produce 3,000 tons of antimony in its first stage of development was opened in the Hochih area of Guangxi Province in 1979.

Australia.—Antimony was produced by Vam Ltd. at its Hillgrove mines near Armidale in New South Wales. The Blue Spec gold-antimony mine in Nullagine, Western Australia, closed in January 1979, and the equipment was sold.

Bolivia.—Bolivia remained the world's largest producer of antimony in 1978 and 1979. Bolivian antimony reserves were estimated to be approximately 400,000 tons at yearend 1978. Empresa Nacional de Fundiciones (ENAF) continued to produce metal and oxide for export. ENAF operated its Vinto refinery at about 75% of capacity in 1979 because of low prices for antimony. Bolivian concentrates and cobbed ore were exported to the United States, Europe, and Japan.

Canada.—Antimony metal was produced in Canada as a byproduct of lead smelting and refining. Cominco Ltd. operated a smelter and refinery at Trail, British Columbia, where antimony was recovered in the form of antimonial lead. Brunswick Mining and Smelting Corp. produced antimony metal at its lead smelter near Belledune, New Brunswick.

Consolidated Durham Mines and Resources Ltd. mined and concentrated antimony near Fredrickton, New Brunswick. The principal ore mined was stibnite. Concentrates averaging 66% antimony were exported mainly to Europe, but smaller amounts were shipped to the United States.

In British Columbia, Placer Development Ltd. and Equity Silver Mines Ltd. began construction of a mine and mill at the Sam Goosly silver-copper deposit. After startup in mid-1980, antimony production was expected to be 1,870 tons per year.

South Africa, Republic of.—Antimony concentrates were produced from the Athens, Gravelotte, Monarch, Mulati, United Jack, Weigel, and Free State mines of Consolidated Murchison Ltd. (CML). The mines are located on the northern Transvaal's "Antimony Line" in the Swaziland schists of the Murchison Range, where stibnite and other sulfides associated with gold exist in large quantities. Antimony was produced as a concentrate and as a high-grade cobbed ore. Most of CML's production was shipped to Europe and North America. Antimony Products (Pty.), Ltd. (APL), continued to produce crude antimony oxide for export using CML concentrates. APL's capacity in early 1978 was 7.2 million pounds per year of crude antimony oxide. Due to increased demand for antimony oxide, the company began installation of two new kilns in 1979 for converting the sulfide to oxide.

Thailand.—Antimony was produced in the north, central, and southern regions. The major producing Provinces were Phrae and Lampang in the North region, Kanchona Buri, Chanthaburi, Rayung, and Rat Buri in the central area, and Nakhon Si Thammarat and Surat Thani in the south. Antimony was exported mainly to Malaysia, Taiwan, Japan, India, North America, Europe, and South Korea.

Turkey.—The major producing mine, the Turhal, is situated near Tokat in central Anatolia. Substantial reserves are located in the Balikesir-Kutahya and Aydin regions. The Turkish Mineral Research and Exploration Institute (MIA) reported that reserves of antimony ore were 2.4 million tons in 1977.

Yugoslavia.—Rudarsko Topionicki Bazen Zajaca (RTB-Zajaca) operated the Rajiceva Gora antimony mine and mill on Kopaonik Mountain in Serbia. Reserves of antimony ore at Rajiceva Gora were estimated to be 10 to 15 million tons. The mine was expected to reach full ore production of approximately 300,000 tons per year by 1980. A new lead refinery under construction at Trepca will provide increased production of antimony byproduct.

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