ARSENIC

By Robert G. Reese, Jr.

As has been the case since 1985, the United States recorded no domestic production of arsenic, and the country remained dependent on imports. Nearly all domestic imports were in compound form, primarily as arsenic trioxide, although some arsenic metal was also imported. China remained the principal supplier of arsenic and its compounds to the U.S. market. Although there is no published price for either arsenic metal or arsenic trioxide, the import data for China indicate that arsenic metal had a value of 32 cents per pound in 1997 compared with 40 cents per pound in 1996. For arsenic trioxide, imports from Mexico in 1997 had a value of 31 cents per pound. The comparable value for 1996 was 33 cents per pound.

Consumption

Although there are no data on domestic arsenic consumption, trade data indicate that the United States, with an estimated apparent demand of more than 20,000 metric tons, probably remained the world's largest consumer of arsenic. It was estimated that approximately 95% of the arsenic consumed domestically was in compound form, primarily arsenic trioxide.

The largest end use for arsenic trioxide was in the production of wood preservatives. Despite the continued economic expansion and growth in the domestic housing industry, estimated demand for arsenic in wood preservatives, remained essentially unchanged from that of 1996. The three principal producers of arsenical wood preservatives were: Hickson Corp., Smyrna, GA; Chemical Specialties Inc., Harrisburg, NC; and Osmose Wood Preserving, Inc., Buffalo, NY. Osmose also produces arsenic acid that is used by the glass industry as a fining agent to disperse air bubbles.

Arsenic metal was consumed in the production of some nonferrous alloys. These were used in the manufacture of lead-acid batteries and in a semiconductor material. Arsenic metal is used as a minor additive (0.01% to 0.5%) to increase strength in the posts and grids of lead-acid storage batteries and to improve corrosion resistance and tensile strength in copper alloys. An estimated 15 tons of high-purity arsenic metal, of 99.9999% or higher purity, was used in the manufacture of crystalline gallium arsenide, a semiconducting material used in optoelectronic circuitry, high-speed computers, and other electronic devices.

Arsenic was used in some herbicides for weed control. ISK Bioscience, Mentor, OH, produced the arsenical herbicide monosodium methanearsonate at a plant in Houston, TX.

World Review

Commercial-grade arsenic trioxide was recovered from the smelting or roasting of nonferrous metal ores or concentrates in at least 18 countries. High-arsenic smelter or roaster dusts and residues that usually are not processed to commercial-grade trioxide are recovered in several other countries as well as at plants in countries producing commercial-grade material. This material is frequently stockpiled and could be available for future processing. Most countries do not report their arsenic production, and world production values have a high degree of uncertainty. China was the world's largest producer as well as the major source of U.S. imports.

Commercial-grade (99% pure) arsenic metal, produced through the reduction of arsenic trioxide, accounted for the majority of world arsenic metal production. It is believed that China accounted for nearly all the world's production of commercial-grade arsenic metal.

Approximately 10 companies produced high-purity arsenic, 99.9999% pure or greater, for use in the semiconductor industry.

Outlook

Despite environmental regulation that has led to global dislocations of production over the past decade, including cessation of production in two historically large producing countries, Sweden and the United States, new suppliers have emerged to fill the void. Although environmental pressures may continue to cause curtailment of existing capacity, given the abundance of high-arsenic residues from nonferrous metal processing, world supplies of arsenic trioxide are expected to remain adequate to meet projected need. Environmental regulation may, in fact, encourage commercial production from existing stockpiles of noncommercial material.

With the major market for arsenic being the production of arsenical wood preservatives, the demand for arsenic is closely tied to the home construction market, where wooden decks containing arsenical preservatives have become ubiquitous, and to the renovation of existing structures. As a result, future demand for arsenic is expected to follow that for new home construction, and the replacement and renovation markets. While the prohibition on use of chromated copper arsenate preservatives in certain applications and the greater acceptance of alternative preservatives could negatively affect future demand, it is unlikely that this will have any significant impact in the short term.

Continued growth in market share for maintenance-free automotive batteries, which require little or no arsenic, will likely lower the demand for arsenic metal.

SOURCES OF INFORMATION

U.S. Geological Survey Publications

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Other

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U.S. Bureau of Mines Information Circular 9208, 1988.

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Roskill Information Services Ltd., Arsenic 1992, 8th ed.

1996 Wood Preserving Industry Production Statistical Report, American Wood Preserving Institute, 1997.

TABLE 1
ARSENIC SUPPLY-DEMAND RELATIONSHIPS 1/

(Metric tons, arsenic content)

	1993	1994	1995	1996	1997
U.S. supply:					
Imports, metal	767	1,330	557	252	909
Imports, compounds	20,900	20,300	22,100	21,200	22,800
Total	21,600	21,600	22,700	21,400	23,700
Distribution of U.S. supply:					
Exports 2/	364	79	430	36	61
Apparent demand	21,300	21,500	22,300	21,400	23,700
Estimated U.S. demand pattern:					
Agricultural chemicals	3,000	1,200	1,000	950	1,400
Glass	900	700	700	700	700
Wood preservatives	16,200	18,000	19,600	19,200	20,000
Nonferrous alloys and electronics	800	1,300	600	250	900
Other	400	300	400	300	300
Total	21,300	21,500	22,300	21,400	23,700

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Metal only.

TABLE 2
U.S. IMPORTS FOR CONSUMPTION OF ARSENICALS 1/

	1996		1997	
Class and country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Arsenic trioxide:				
Belgium	579	$314	514	$268
Bolivia	120	55	181	88
Chile	8,790	2,930	9,290	2,790
China	11,000	5,650	15,100	8,090
France	2,480	1,360	1,870	1,070
Hong Kong	1,380	681	550	245
Mexico	2,980	2,140	2,500	1,730
Philippines	612	231	--	--
Other	19 r/	20	1	17
Total	28,000	13,400	30,000	14,300
Arsenic acid:				
Canada	(2/)	2	1	5
China	--	--	106	50
France	--	--	2	8
Israel	1	13	--	--
United Kingdom	--	--	8	23
Total	1	14	117	86
Arsenic metal:				
Belgium	--	--	17	14
Canada	--	--	20	24
China	212	185	783	559
Germany	10	2,110	12	2,590
Hong Kong	--	--	60	53
Japan	29	1,480	13	1,640
Korea, Republic of	--	--	4	55
United Kingdom	(2/)	23	(2/)	1
Total	252	3,790	909	4,930

r/ Revised.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 3
ARSENIC TRIOXIDE: WORLD PRODUCTION, BY COUNTRY 1/ 2/ 3/

(Metric tons)

Country 4/	1993	1994	1995	1996	1997 e/
Belgium e/	2,000	2,000	2,000	2,000	2,000
Bolivia	663	341	362	255 r/	260
Canada e/	250	250	250	250	250
Chile e/	6,200	6,300	6,400	6,400 r/	6,000
China e/	14,000	18,000	21,000	15,000	15,000
France e/	3,000	6,000	5,000	3,000	2,500
Georgia e/	1,000	500	400	400	400
Germany e/	300	300	250	250	250
Ghana	902 r/	3,897 r/	4,409 r/	5,443 r/	4,577 5/
Iran e/	500	500	500	500	500
Japan e/	40	40	40	40	40
Kazakstan e/	2,000	1,500	1,500	1,500	1,500
Mexico	4,447	4,400	3,620 r/	2,942 r/	3,000
Namibia 6/	2,290	3,047	1,661	1,302 r/	500
Peru 7/	391	286	285 e/	285 e/	285
Philippines e/	2,000	2,000	2,000	2,000	2,000
Portugal e/	150	150	100	100	50
Russia e/	2,000	1,500	1,500	1,500	1,500
Total	42,100 r/	51,000 r/	51,300 r/	43,200 r/	40,600

e/ Estimated. r/ Revised.

1/ Including calculated arsenic trioxide equivalent of output of elemental arsenic and arsenic compounds other than arsenic trioxide where inclusion of such materials would not duplicate reported arsenic trioxide production.

2/ World totals and estimated data are rounded to three significant digits; may not add to totals shown.

3/ Table includes data available through April 1, 1998.

4/ Austria, Hungary, the Republic of Korea, South Africa, Spain, the United Kingdom, and former Yugoslavia have produced arsenic and/or arsenic compounds in previous years, but information is inadequate to make reliable estimates of output levels, if any.

5/ Reported figure.

6/ Output of Tsumeb Corp. Ltd. only. Tsumeb Mine closed in 1996, but the smelter is still operating.

7/ Output of Empresa Minera del Centro del Perú (Centromín Perú) as reported by the Ministerio de Energía y Minas.