

ARSENIC

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As has been the case since 1985, the United States had no domestic production of arsenic in 1999 and, consequently, remained dependent on imports to meet its arsenic needs. Although some arsenic metal was imported, most of the imports were in compound form, primarily arsenic trioxide. China remained the principal supplier of arsenic and its compounds to the U.S. market.

Legislation and Government Programs

On March 23, 1999, the National Research Council (NRC) released the results of its study of arsenic in drinking water (National Research Council, 1999). The study was commissioned by the U.S. Environmental Protection Agency. The NRC concluded that to protect public health, the U.S. Environmental Protection Agency needed to develop a more stringent standard for allowable levels of arsenic in drinking water.

Consumption

Trade data indicated that the United States, with an estimated demand of more than 22,000 metric tons (t) in 1999, probably remained the world's largest consumer of arsenic. The estimated value of arsenic consumed domestically during the year was \$25 million. More than 95% of the arsenic consumed was estimated to have been in compound form, primarily arsenic trioxide. The largest end use for arsenic trioxide was in the production of wood preservatives. 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 used as an additive to improve corrosion resistance and tensile strength in copper alloys, and as a minor additive (0.01% to 0.5%) to increase the strength of the posts and grids in some lead-acid storage batteries. An estimated 15 t of high-purity arsenic metal (99.9999%-pure or higher) was used in the manufacture of gallium arsenide, a semiconductor used in various electronic devices including wireless phones and high-speed computers.

Arsenic also was used in some herbicides for weed control.

World Review

Arsenic trioxide was recovered from the smelting or roasting of nonferrous metal ores or concentrates in at least 16 countries in 1999. High-arsenic smelter or roaster dusts and residues that usually are not processed to commercial-grade trioxide

were recovered in several other countries, as well as at plants in countries producing commercial-grade material. Much of this material was stockpiled and could be available for future processing. Most countries did not report their arsenic production, and world production values had a high degree of uncertainty. China apparently was the world's largest producer in 1999.

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

Worldwide, approximately 10 companies produced high-purity arsenic metal for use in the semiconductor industry.

Outlook

Despite environmental regulations that led to global disruption of production during the last decades of the 20th century, new sources of supply have emerged to fill the void. Given the abundance of arsenic in various waste streams, including nonferrous metal processing, world supplies of arsenic trioxide are expected to remain adequate to meet projected needs.

Because most arsenic is consumed as a compound in the production of arsenical wood preservatives used in home construction and renovation, arsenic demand is expected to correlate with changes in this market. In the short term, prohibitions on the use of arsenical wood preservative in certain applications is not expected to have any significant impact on demand. However, these prohibitions combined with the greater acceptance of alternative preservatives may reduce long-term demand.

Continued growth in the use of maintenance-free automotive batteries which require little or no arsenic, will lower the demand for arsenic metal in this application; this decline, however, is likely to be offset somewhat by the consumption of arsenic to manufacture semiconductors.

Reference Cited

National Research Council, 1999, EPA needs more stringent standard for arsenic in drinking water: Washington, DC, National Research Council press release, March 23, 3 p.

GENERAL SOURCES OF INFORMATION

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U.S. Bureau of Mines Information Circular 9208, 1988.
The Material Flow of Arsenic in the United States, U.S. Bureau of Mines Information Circular 9382, 1994.
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1996 Wood Preserving Industry Production Statistical Report, American Wood Preserving Institute, 1998.

TABLE 1
ARSENIC SUPPLY-DEMAND RELATIONSHIPS 1/

(Metric tons, arsenic content)

	1995	1996	1997	1998	1999
U.S. supply:					
Imports, metal	557	252	909	997	1,300
Imports, compounds	22,100	21,200	22,800	29,300	22,100
Total	22,700	21,400	23,700	30,300	23,400
Distribution of U.S. supply:					
Exports 2/	430	36	61	177	1,350
Apparent demand	22,300	21,400	23,700	30,100	22,000
Estimated U.S. demand pattern:					
Agricultural chemicals	1,000	950	1,400	1,500 r/	1,100
Glass	700	700	700	700	700
Wood preservatives	19,600	19,200	20,000	27,000	19,000
Nonferrous alloys and electronics	600	250	900	1,000	1,300
Other	400	300	300	300	300
Total	22,300	21,400	23,700	30,100	22,000

r/ Revised.

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/

Class and country	1998		1999	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Arsenic trioxide:				
Belgium	371	208	724	429
Bolivia	142	87	280	159
Canada	2	9	--	--
Chile	10,700	3,120	8,870	3,340
China	20,500	11,000	15,500	8,380
France	1,320	823	1,410	862
Germany	(2/)	7	3	34
Hong Kong	3,340	1,990	70	42
Mexico	2,130	1,480	1,680	1,090
Morocco	--	--	148	90
Spain	(2/)	5	--	--
Switzerland	123	76	--	--
Vietnam	--	--	437	251
Total	38,600	18,800	29,100	14,700
Arsenic acid: France	(2/)	5	4	24
Arsenic metal:				
China	890	1,120	1,240	1,600
Germany	16	3,230	16	3,210
Hong Kong	57	57	--	--
Japan	17	1,940	45	3,580
Taiwan	18	19	--	--
United Kingdom	(2/)	3	(2/)	7
Total	997	6,380	1,300	8,390

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/	1995	1996	1997	1998	1999
Belgium e/	2,000	2,000	2,000	1,500	1,500
Bolivia	362	255	282	284 r/	280 e/
Canada e/	250	250	250	250	250
Chile	4,076	8,000	8,350	8,400 e/	8,000 e/
China e/	21,000	15,000	15,000	15,500	16,000
France e/	5,000	3,000	2,500	2,000	1,000
Georgia e/	400	400	400	400	400
Germany e/	250	250	250	200 r/	200
Ghana	4,409	5,443	4,577	5,000 e/	5,000 e/
Iran e/	500	500	500	500	500
Japan e/	40	40	40	40	40
Kazakhstan e/	1,500	1,500	1,500	1,500	1,500
Mexico	3,620	2,942	2,999	2,573 r/	2,500 e/
Namibia 5/	1,661	1,559	1,297 r/	175 r/	--
Peru 6/	285 e/	111 r/	103 r/	122 r/	120 e/
Portugal e/	100	100	50	50	50
Russia e/	1,500	1,500	1,500	1,500	1,500
Total	47,000	42,900 r/	41,600 r/	40,000 r/	38,800

e/ Estimated. r/ Revised. -- Zero.

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

2/ World totals and estimated data have been rounded to no more than three significant digits; may not add to totals shown.

3/ Table includes data available through March 30, 2000.

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

5/ Output of Tsumeb Corp. Ltd. only. Tsumeb Mine closed in 1996, and the smelter and all operations closed in April 1998.

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