

ARSENIC

(Data in metric tons of arsenic unless otherwise noted)

Domestic Production and Use: There has been no domestic production of arsenic trioxide or arsenic metal since 1985. Imports of arsenic trioxide averaged more than 20,000 tons annually during 2001-03 and were used mainly in the production of chromated copper arsenate (CCA) wood preservatives. The grids in lead-acid storage batteries were strengthened by the addition of arsenic metal, and small-arms ammunition used by the United States military was hardened by the addition of less than 1% arsenic metal. Other applications of arsenic metal include its use as an antifriction additive for bearings, in lead shot, and in clip-on wheel weights. Arsenic compounds were used in fertilizers, fireworks, herbicides, and insecticides. The electronics industry used high-purity arsenic (99.9999%) for gallium-arsenide semiconductors that are used for solar cells, space research, and telecommunication. Arsenic may be used for germanium-arsenide-selenide specialty optical materials. Indium-gallium-arsenide was used for short wave infrared technology. The value of arsenic compounds and metal consumed domestically in 2008 was estimated to be about \$7 million.

Salient Statistics—United States:	2004	2005	2006	2007	2008^e
Imports for consumption:					
Metal	872	812	1,070	759	500
Trioxide	6,150	8,330	9,430	7,010	8,000
Exports, metal	220	3,270	3,060	2,490	1,300
Estimated consumption ¹	6,800	5,870	7,340	5,280	7,200
Value, cents per pound, average: ²					
Metal (China)	88	95	160	81	98
Trioxide (China)	49	18	22	42	41
Trioxide (Mexico)	32	67	NA	NA	NA
Net import reliance ³ as a percentage of estimated consumption	100	100	100	100	100

Recycling: Electronic circuit boards, relays, and switches may contain arsenic and should be disposed of at sites that recycle arsenic-containing, end-of-service electronics or at hazardous waste sites. Arsenic contained in the process water at wood treatment plants where CCA was used was recycled. Arsenic was also recovered from gallium-arsenide scrap from semiconductor manufacturing. There was no recovery or recycling of arsenic from arsenic-containing residues and dusts at nonferrous smelters in the United States.

Import Sources (2004-07): Metal: China, 86%; Japan, 10%; and other, 4%. Trioxide: China, 49%; Morocco, 37%; Hong Kong, 5%; Mexico, 3%; and other, 6%.

Tariff: Item	Number	Normal Trade Relations
		12-31-08
Metal	2804.80.0000	Free.
Acid	2811.19.1000	2.3% ad val.
Trioxide	2811.29.1000	Free.
Sulfide	2813.90.1000	Free.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

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Events, Trends, and Issues: Exposure to arsenic may affect breathing, heart rhythm, and possibly increase the risk for bladder cancer. Therefore, in response to these human health issues, the wood-preserving industry made a voluntary decision to stop using CCA to treat wood used for decks and outdoor residential use by yearend 2003. Because of known performance and lower cost, CCA may still be used to treat wood used for nonresidential applications. Human health concerns, regulation, use of alternative wood preservation material, and the substitution of concrete or plasticized wood products will affect the long-term demand for arsenic.

Exports of arsenic metal have increased dramatically since 2004. Exports classified as arsenic metal may include arsenic-containing “e-waste” such as computers and other electronics destined for reclamation and recycling. The exported arsenic may also have been used directly in electronics applications or in the production of small-arms ammunition. Export destinations for arsenic metal were Germany (35%), Japan (34%), and China (31%).

The U.S. Food and Drug Administration (FDA) issued a warning to consumers and recalled certain brands of mineral water that were found to contain from 454 to 674 micrograms per liter ($\mu\text{g/l}$) arsenic; FDA’s standard of quality for bottled water allows no more than 10 $\mu\text{g/l}$. Geologic sources of arsenic and the effects of high levels of arsenic on humans are the focus of global government and university research.

Rice grown in the United States may contain from one to five times the arsenic contained in rice from Bangladesh, Europe, and India. Arsenic was added to chicken feed in order to promote growth, kill parasites, and improve pigmentation of chicken meat; therefore, chicken manure may introduce arsenic to agricultural fields and ultimately to ground water. Arsenic may also be released from coal-burning powerplant emissions and from buried World War I ammunition. Researchers estimated that 1,740 tons of arsenic may be contained in CCA-treated wood and construction debris left by Hurricane Katrina in August 2005. Arsenic trioxide may be used to treat leukemia.

World Production, Reserves, and Reserve Base:

	Production (arsenic trioxide)		Reserves and reserve base ⁴ (arsenic content)
	2007	2008 ^e	
Belgium	1,000	1,000	World reserves and reserve base are thought to be about 20 and 30 times, respectively, annual world production. The reserve base for the United States is estimated to be 80,000 tons.
Chile	11,400	11,500	
China	25,000	25,000	
Kazakhstan	1,500	1,500	
Mexico	1,600	1,500	
Morocco	8,950	7,000	
Peru	4,320	4,000	
Russia	1,500	1,500	
Other countries	630	500	
World total (rounded)	55,900	53,500	

World Resources: Arsenic may be obtained from roasting arsenopyrite, the most abundant ore mineral of arsenic, as well as from copper, gold, and lead smelter dust. Arsenic may be recovered from enargite, a copper mineral; realgar and orpiment in China, Peru, and the Philippines; copper-gold ores in Chile; and associated with gold occurrences in Canada. In Sichuan Province, China, orpiment and realgar from gold mines are stockpiled for later recovery of arsenic. Global resources of copper and lead contain approximately 11 million tons of arsenic.

Substitutes: Wood-treatment substitutes include alkaline copper quaternary, ammoniacal copper quaternary, ammoniacal copper zinc arsenate, copper azole, and copper citrate. In humid areas, silver-containing biocides are being considered as an alternative wood preservative. Other CCA-treated wood substitutes include concrete, steel, plasticized wood scrap, or plastic composites.

^eEstimated. NA Not available.

¹Estimated to be the same as net imports.

²Calculated from U.S. Census Bureau import data.

³Defined as imports – exports + adjustments for Government and industry stock changes.

⁴See Appendix C for definitions.