ARSENIC

(Data in metric tons of arsenic unless otherwise noted)

Domestic Production and Use: Arsenic trioxide and arsenic metal have not been produced as primary mineral commodity forms in the United States since 1985. However, arsenic metal has been recycled from gallium-arsenide semiconductors. Owing to environmental concerns and a voluntary ban on the use of arsenic trioxide for the production of chromated copper arsenate (CCA) wood preservatives at yearend 2003, imports of arsenic trioxide averaged 6,100 tons annually during 2006–10 compared with imports of arsenic trioxide that averaged more than 20,000 tons annually during 2001–03. Ammunition used by the United States military was hardened by the addition of less than 1% arsenic metal, and the grids in lead-acid storage batteries were strengthened by the addition of arsenic metal. Arsenic metal was also used as an antifriction additive for bearings, to harden lead shot, and in clip-on wheel weights. Arsenic compounds were used in fertilizers, fireworks, herbicides, and insecticides. High-purity arsenic (99.9999%) was used by the electronics industry for gallium-arsenide semiconductors that are used for solar cells, space research, and telecommunication. Arsenic was also 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 2011 was estimated to be about \$3 million.

Salient Statistics—United States:	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	2011 ^e
Imports for consumption:		·			
Metal	759	376	438	769	410
Trioxide	7,010	4,810	4,660	4,530	3,550
Exports, metal	2,490	1,050	354	481	670
Estimated consumption ¹	5,280	4,130	4,740	4,820	3,290
Value, cents per pound, average:2					
Metal (China)	122	125	121	72	70
Trioxide (China)	23	23	18	20	20
Net import reliance ³ as a percentage of					
estimated consumption	100	100	100	100	100

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

Import Sources (2007–10): Metal: China, 83%; Japan, 15%; and other, 2%. Arsenic trioxide: Morocco, 66%; China, 25%; Belgium, 8%; and other, 1%.

Tariff: Item	Number	Normal Trade Relations 12-31-11
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.

Events, Trends, and Issues: Arsenic metal has been recycled from gallium-arsenide semiconductors and scrap. However, overall apparent exports of arsenic metal have continued to increase, and arsenic-containing "e-waste," such as computers and other electronics destined for reclamation and recycling, may also have been included in this export category. The exported arsenic metal may have been intended for use in electronics applications. In 2011, the leading export destinations for this category were Honduras (65%), France (27%), and Guatemala (4%).

ARSENIC

In 1975, the Safe Drinking Water Act mandated that the U.S. Environmental Protection Agency identify and regulate drinking water contaminants, such as arsenic, that may have adverse effects on human health. Ongoing research showed that 60% of total arsenic in source water at test sites in California, Minnesota, Nevada, New Hampshire, and Wisconsin was removed. Arsenic removal technology included adsorptive media, coagulation/filtration, iron removal, and oxidation/filtration systems that have been tested in California, New Mexico, Texas, and Washington. At Lead, SD, adsorptive media was used for 25 months and resulted in the arsenic content of the effluent ultimately being reduced to 0.5 microgram per liter.

In response to 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. However, because of known performance and lower cost, CCA may still be used to treat wood used for nonresidential applications. Arsenic may also be released from coal-burning powerplant emissions. Human health concerns, environmental regulation, use of alternative wood preservation material, and the substitution of concrete or plasticized wood products will affect the long-term demand for arsenic.

World Production and Reserves:

World Froundston und Robot V	Prod	uction trioxide)	Reserves ⁴		
	<u>2010</u>	<u>2011^e</u>			
Belgium	1,000	1,000			
Chile	11,000	11,500	World reserves are thought to be		
China	25,000	25,000	about 20 times annual world		
Kazakhstan	1,500		production.		
Mexico	_	NA			
Morocco	8,000	8,000			
Peru	4,500	4,500			
Russia	1,500	1,500			
Other countries	<u>310</u>	<u>300</u>			
World total (rounded)	52,800	52,000			

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

<u>Substitutes</u>: Substitutes for CCA in wood treatment include alkaline copper quaternary, ammoniacal copper quaternary, ammoniacal copper zinc arsenate, copper azole, and copper citrate. CCA-treated wood substitutes include concrete, steel, plasticized wood scrap, or plastic composite material. The use of silver-containing biocides is being considered as an alternative wood preservative in some humid areas.

^eEstimated. NA Not available. — Zero.

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 resource/reserve definitions and information concerning data sources.