

## ARSENIC

(Data in metric tons of arsenic unless otherwise noted)

**Domestic Production and Use:** Arsenic trioxide and primary arsenic metal have not been produced in the United States since 1985. However, limited quantities of arsenic metal have been recovered from gallium-arsenide (GaAs) semiconductor scrap. The principal use for arsenic trioxide was for the production of arsenic acid used in the formulation of chromated copper arsenide (CCA) preservatives for the pressure treating of lumber used primarily in nonresidential applications. Three companies produced CCA preservatives in the United States. 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 GaAs 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 2012 was estimated to be about \$6 million.

<b>Salient Statistics—United States:</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012<sup>e</sup></b>
Imports for consumption:					
Metal	376	438	769	628	950
Trioxide	4,810	4,660	4,530	4,990	5,950
Exports, metal	1,050	354	481	705	220
Estimated consumption <sup>1</sup>	4,130	4,740	4,820	4,910	6,680
Value, cents per pound, average: <sup>2</sup>					
Metal (China)	125	121	72	74	77
Trioxide (Morocco)	19	20	20	22	22
Net import reliance <sup>3</sup> as a percentage of estimated consumption	100	100	100	100	100

**Recycling:** Arsenic metal was recycled from GaAs semiconductor manufacturing, and arsenic 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, though no arsenic was recovered from them during recycling to recover other contained metals. There was no domestic recovery of arsenic from arsenic-containing residues and dusts generated at nonferrous smelters in the United States.

**Import Sources (2008–11):** Metal: China, 86%; Japan, 13%; and other, 1%. Arsenic trioxide: Morocco, 70%; China, 18%; and Belgium, 12%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–12</b>
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:** Human health and environmental concerns led to a voluntary ban on the use of CCA wood preservatives in most residential applications at yearend 2003. However, because of known performance and lower cost, CCA was still allowed in treated wood for use in nonresidential applications. Owing to the residential ban, however, imports of arsenic trioxide declined to an average of 6,800 tons per year gross weight during 2007 to 2011, from an average of almost 28,000 tons per year during 1999 to 2003.

Arsenic metal exports from 2005 to 2008 were at extraordinary high levels. It is likely that much of the material reported as arsenic was arsenic compounds, including arsenic acid and CCA that became available for export following the phase-out of the residential use of CCA preserved wood. Other materials that were reported under this category included arsenical lead and residues containing arsenic, which continue to be reported under this category. As the United States does not produce arsenic metal, it is likely that only a small portion of material exported under this category was pure arsenic metal.

In 2008, the U.S. Environmental Protection Agency (EPA) issued a reregistration eligibility decision (RED) in which it determined that CCA wood preservatives were eligible for reregistration as a pesticide for use in treating lumber for certain outdoor applications, exclusive of those for use in most residential settings. The RED included labeling guidelines and detailed worker and environmental protection guidelines for wood-preserving plants using CCA. By December 31, 2013, all wood-preserving plants using CCA were to be upgraded to fully meet RED requirements.

In 2012, market conditions continued to improve for GaAs-based products. GaAs demand, while still driven mainly by cellular handsets and other high-speed wireless applications, increased owing to rapid growth of feature-rich, application-intensive, third- and fourth-generation “smartphones.” See the section on gallium for details.

### **World Production and Reserves:**

	Production (arsenic trioxide)		Reserves <sup>4</sup>
	<u>2011</u>	<u>2012<sup>e</sup></u>	
United States	—	—	World reserves are thought to be about 20 times annual world production.
Belgium	1,000	1,000	
Chile	10,000	10,000	
China	25,000	25,000	
Morocco	8,000	6,000	
Russia	1,500	1,500	
Other countries <sup>5</sup>	<u>300</u>	<u>300</u>	
World total (rounded)	45,800	44,000	

**World Resources:** Arsenic may be obtained from copper, gold, and lead smelter flue dust as well as from roasting arsenopyrite, the most abundant ore mineral of arsenic. Arsenic has been 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.

**Substitutes:** Substitutes for CCA in wood treatment include alkaline copper quaternary, ammoniacal copper quaternary, ammoniacal copper zinc arsenate, copper azole, and copper citrate. Treated wood substitutes include concrete, steel, plasticized wood scrap, or plastic composite material.

<sup>e</sup>Estimated. — Zero.

<sup>1</sup>Estimated to be the same as net imports.

<sup>2</sup>Calculated from U.S. Census Bureau import data.

<sup>3</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>4</sup>[See Appendix C for resource/reserve definitions and information concerning data sources.](#)

<sup>5</sup>In addition to Bolivia, Iran, Japan, and Portugal, which are included in “other countries,” Mexico and Peru have reported arsenic trioxide production in recent years, but information is inadequate to make estimates for production in current years, if any.