

## ARSENIC

(Data in metric tons of arsenic content<sup>1</sup> unless otherwise noted)

**Domestic Production and Use:** Arsenic trioxide and primary arsenic metal have not been produced in the United States since 1985. 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 in 2017. Ammunition used by the U.S. 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 herbicides and insecticides. High-purity arsenic (99.9999%) was used to produce gallium-arsenide (GaAs) semiconductors for solar cells, space research, and telecommunications. Arsenic also was used for germanium-arsenide-selenide specialty optical materials. Indium-gallium-arsenide (InGaAs) was used for short-wave infrared technology. The value of arsenic compounds and metal imported domestically in 2017 was estimated to be about \$6.9 million.

<b>Salient Statistics—United States:</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017<sup>e</sup></b>
Imports for consumption:					
Arsenic metal	514	688	514	793	1,000
Compounds	6,290	5,260	5,920	5,330	6,300
Exports, arsenic <sup>2</sup>	1,630	2,970	1,670	1,760	1,000
Estimated consumption <sup>3</sup>	6,810	5,940	6,430	6,120	7,300
Value, dollars per kilogram, average:					
Arsenic metal <sup>4</sup>	1.91	1.90	2.04	2.34	2.00
Trioxide (Morocco) <sup>5</sup>	0.60	0.66	0.64	0.68	0.70
Net import reliance <sup>6</sup> as a percentage of estimated consumption	100	100	100	100	100

**Recycling:** Arsenic metal was contained in new scrap recycled during GaAs semiconductor manufacturing. Arsenic-containing process water was internally recycled at wood treatment plants where CCA was used. Although scrap electronic circuit boards, relays, and switches may contain arsenic, no arsenic was known to have been recovered during the recycling process to recover other contained metals. No arsenic was recovered domestically from arsenic-containing residues and dusts generated at nonferrous smelters in the United States.

**Import Sources (2013–16):** Arsenic metal: China, 91%; Japan, 7%; and other, 2%. Arsenic trioxide: Morocco, 52%; China, 41%; Belgium, 6%; and other, 1%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations</b>
		<b><u>12–31–17</u></b>
Arsenic	2804.80.0000	Free.
Arsenic acid	2811.19.1000	2.3% ad val.
Arsenic trioxide	2811.29.1000	Free.
Arsenic sulfide	2813.90.1000	Free.

**Depletion Allowance:** 14% (Domestic and foreign).

**Government Stockpile:** None.

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**Events, Trends, and Issues:** China and Morocco continued to be the leading global producers of arsenic trioxide, accounting for 88% of estimated world production and supplying almost all of United States imports of arsenic trioxide in 2017. China was the leading world producer of arsenic metal and supplied about 90% of United States arsenic metal imports in 2017.

Given that arsenic metal has not been produced domestically since 1985, it is likely that only a small portion of the material reported by the U.S. Census Bureau as arsenic exports was pure arsenic metal, and most of the material that has been reported under this category reflects the gross weight of compounds, alloys, and residues containing arsenic. Therefore, the estimated consumption reported under salient U.S. statistics reflects only imports of arsenic products.

High-purity (99.9999%) arsenic metal was used to produce GaAs, indium-arsenide, and InGaAs semiconductors that were used in biomedical, communications, computer, electronics, and photovoltaic applications. The 2020 projected outlook for global GaAs device sales is estimated at \$7.6 billion. See the Gallium chapter for additional details.

### World Production and Reserves:

	Production <sup>e, 7</sup> (arsenic trioxide)		Reserves <sup>8</sup>
	<u>2016</u>	<u>2017</u>	
United States	—	—	World reserves data are unavailable, but reserves are thought to be more than 20 times annual world production.
Belgium	1,000	1,000	
Bolivia	40	40	
China	25,000	25,000	
Japan	45	45	
Morocco	7,600	7,600	
Namibia	1,900	1,900	
Russia	<u>1,500</u>	<u>1,500</u>	
World total (rounded)	37,000	37,000	

**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; has been recovered 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.

**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, plastic composite material, plasticized wood scrap, or steel.

<sup>e</sup>Estimated. — Zero.

<sup>1</sup>Arsenic content of arsenic metal is 100%; arsenic content of arsenic compounds is calculated at 75.71%.

<sup>2</sup>Most of the materials reported to the U.S. Census Bureau as arsenic exports are thought to be arsenic-containing compounds or residues.

<sup>3</sup>Estimated to be the same as imports.

<sup>4</sup>Minimum 99% arsenic, free on board, United States warehouse. Source: Argus Media group-Argus Metals International.

<sup>5</sup>Calculated from U.S. Census Bureau import data.

<sup>6</sup>Defined as imports.

<sup>7</sup>Chile, Mexico, and Peru were believed to be significant producers of commercial-grade arsenic trioxide, but have reported no production in recent years.

<sup>8</sup>See [Appendix C](#) for resource and reserve definitions and information concerning data sources.