

Arsenic

William E. Brooks, U.S. Geological Survey mineral commodity specialist, has compiled the following information on arsenic, an ancient commodity with many important modern uses.

Arsenic has a long and varied history: Although it was not isolated as an element until the 13th century, it was known to the ancient Chinese, Egyptians and Greeks in compound form in the minerals arsenopyrite, realgar and orpiment. In the 1400s, “Scheele’s Green” was first used as an arsenic pigment in wallpaper, and leached arsenic from wallpaper may have contributed to Napoleon’s death in 1821. The 1940s play and later movie, *Arsenic and Old Lace*, dramatizes the metal’s more sinister role. Arsenic continues to be an important mineral commodity with many modern applications.

Until 2003, arsenic was widely used in the United States in the production of chromated copper arsenate wood preservatives, but exposure to arsenic leached from treated wood was a health concern because it could potentially affect breathing, heart rhythm and possibly increase the risk for bladder cancer. Thus, the wood-preserving industry stopped using the preservative to treat wood used for residential purposes. However, chromated copper arsenate may still be used for nonresidential wood applications.

In 2006, the United States was the world’s leading consumer of arsenic, more than half of which was used for the production of wood preservatives, down from about 90 percent prior to 2004. Apparent domestic consumption of arsenic was about 7,300 metric tons, far less than the apparent consumption of 21,600 metric tons in 2003. Much of the remaining demand for arsenic is for agricultural chemicals (either directly or after conversion to arsenic acid) or glass manufacturing applications. Additionally, arsenic trioxide is used to treat leukemia.

Arsenic is also used in alloys and electronics. When alloyed with lead and antimony, arsenic metal is used to harden ammunition, solder and other applications, and can strengthen grids and posts in lead-acid storage batteries, for example. Arsenic is one of several metals used as an anti-friction additive to metals that are used for bearings, and it can also be used in lead shot. The electronics industry uses high-purity arsenic (99.9999 percent) for semiconductors in optoelectronic devices such as LEDs and solar cells, space research and telecommunications.

Arsenic may be produced from roasting arsenopyrite, the most abundant ore mineral of arsenic, and it is also produced as a byproduct of copper smelting. Realgar and orpiment from China, Peru and the Philippines are sources of arsenic, as well as copper-gold ores from Chile and gold occurrences in Canada. China is the world’s leading producer of arsenic. In 2006, the United States imported all of its arsenic, mostly from China. World reserves of arsenic are thought to be about 20 times world production.

Health concerns, regulation, use of alternative wood preservatives and the substitution of concrete or plasticized wood products will affect the long-term demand for arsenic. Geologic sources of arsenic and the effects of high levels of arsenic in groundwater are

the focus of global government and university research. The U.S. Environmental Protection Agency has set the domestic arsenic standard at 0.01 parts per million, and water systems were to meet this standard by Jan. 23, 2006, to protect consumers from the effects of long-term exposure to arsenic. Arsenic can be released from coal-burning powerplant emissions.

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Realgar, an arsenic sulfide, is one source of the commodity arsenic. Image from *Minerals in Your World*.