

ARD-EHP-1

2009

Arsenic: Health Information Summary

Arsenic is a naturally occurring metal-like element common in the earth's crust. It is produced commercially as a byproduct of refining other metals and is used to tan animal hide. Arsenic was used extensively in pesticides and herbicides until the late 1960s; most agricultural uses have now been banned. Arsenic was also a major component of the preservative solution chromated copper arsenate (CCA) used in "pressure-treated" lumber. Use of this preservative essentially ended as of 2004. Arsenic is also found as a contaminant in coal ash.

Arsenic in drinking water may be due to either man's past activities or the leaching of arsenic from certain types of rock. In most cases of arsenic contamination of drinking water, it is difficult to distinguish whether it is man-made or natural. Although arsenic levels in water are generally low, drinking water obtained from wells drilled in arsenic-containing bedrock may have relatively high concentrations from arsenic leaching from the rock.

Arsenic is found in organic and inorganic forms. Most of the arsenic in drinking water is inorganic arsenic that may be present as a combination of arsenic species called arsenate (As V) and arsenite (As III). Arsenic has no taste or odor at the concentrations found in drinking water, therefore testing is the only reliable way to determine if it is present.

For the general population, food is the most significant source of arsenic exposure. Most foods contain low levels of arsenic taken up from the soil. Some fish and shellfish build up arsenic in their tissues, but most of it is in an organic form that is not toxic. The total adult daily dietary intake of the inorganic forms of arsenic in the typical U.S. diet averages in the range of about 8 to 14 micrograms (ug).

Health Effects

Absorption

After absorption, arsenic distributes throughout the body and some may accumulate in the nails, hair, bone and skin. Most of the arsenic taken into the body is excreted within one week of exposure. Although there are only a few studies on absorption through the skin, they indicate that only a small percentage is absorbed by this route.

Short Term (acute) Effects

Oral exposure to arsenic at levels much higher than those typically found in the environment may result in symptoms soon after ingestion. Symptoms include abdominal pain, vomiting, and diarrhea. Eventually coma and death may follow. It is estimated that 70,000 ug of arsenic can be a fatal dose, indicating that arsenic is considered extremely toxic from acute exposure.

Long Term (chronic) Effects

The most sensitive signs of chronic arsenic poisoning involve the skin. First, a freckling of small dark spots may appear on the trunk, neck, face, arms and legs. Next, small corn-like growths can develop, especially on the palms of the hand and soles of the feet. Although skin effects are often the first observable sign of arsenic toxicity, researchers consider these effects to result from ingested arsenic rather than exposure through the skin. With higher exposures, other symptoms may include numbness, tingling or burning sensations in the arms and legs, fluid accumulation causing swelling in the face and ankles, diarrhea, stomach cramps, and anemia. Eventually, liver, kidney, and central nervous system damage may occur. Recent evidence indicates that arsenic may increase the risk of several other diseases including diabetes, lung, and cardiovascular disease. Basic research suggests that arsenic may cause some of these diseases by interfering with chemical messengers such as hormones that act as signals in the body to regulate many processes.

Carcinogenic (Cancer-causing) Effects

Corns resulting from arsenic exposure may ultimately develop into non-melanoma forms of skin cancer. Researchers have also observed a relationship between higher levels of arsenic in drinking water and an increased risk of bladder, lung, kidney, liver, and prostate cancer. The evidence for skin, bladder, and lung cancer are the strongest. Arsenic was a Group A (known human carcinogen) under the old Environmental Protection Agency (EPA) classification system and would fit into the "human carcinogen" classification group under the current cancer guidelines.

Health Standards and Criteria

Maximum Contaminant Levels (MCLs) are enforceable federal drinking water standards for public water supplies, determined by balancing the adverse health effects of a particular chemical against the feasibility and costs of treating contaminated water. Studies conducted in recent years in several countries found strong associations between arsenic exposure from drinking water and an increased risk of cancer of the lung and bladder. Therefore, the EPA reduced the MCL for arsenic from 50 ppb, equivalent to micrograms per liter (ug/L), to the current level of 10 ppb. Exposure assumptions used to calculate MCLs include consuming two liters (0.53 gallons) of water per day by a 70 kilogram (154 lb) adult for a 70-year exposure duration.

Medical Testing for Arsenic Exposure

Because arsenic is cleared from the blood in only a few hours, blood arsenic is generally not a useful measurement of exposure. Measurement of arsenic in urine is considered the most reliable indicator of recent arsenic exposure if testing is done no more than a few days after exposure ceases. Consumption of fish or shellfish within two days before a urine test occurs can influence the results because of the largely non-toxic organic arsenic present in these foods. Therefore, they should be avoided before you are evaluated for exposure to inorganic arsenic.

Some arsenic is stored in parts of the body rich in the protein keratin, such as hair, finger- and toenails. Levels in these tissues can be a useful indicator of past exposure, but results can be misleading because arsenic tends to strongly bind externally to hair and nails. Arsenic bound externally to hair and nails is not absorbed.

Testing for Arsenic in Water

Since private wells are not subject to regular testing as are public water supplies, the EHP recommends that all private well owners have their water tested for arsenic if they have not done so previously.

Although the evidence indicates that bedrock wells are at greater risk due to naturally occurring arsenic leaching from rock, dug or shallow wells are more likely to be impacted by man-made contamination. Dug wells located in former agricultural land, particularly fruit orchards or potato fields, crops for which arsenic-containing pesticides were often heavily used, are likely to be at greater risk.

Information on water testing and treatment options can be obtained by contacting the DES Drinking Water and Groundwater Bureau (603-271-2513) or from fact sheet WD-WSEB 3-2 "Arsenic in Drinking Water,"

<http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-3-2.pdf> . For health questions, please contact the DES Environmental Health Program, 29 Hazen Drive, PO Box 95, Concord, NH 03302-0095; (603) 271-4608.