INTRODUCTION AND HISTORY OF ARSENIC

Arsenic is a versatile metal, forming various compounds, either inorganic or organic. Inorganic arsenic is widely distributed in nature, usually in the trivalent form (As3+) but also as pentavalent arsenic (As5+). Most rocks contain 1-5ppm of arsenic. The trivalent forms include arsenic trioxide, sodium arsenite, and arsenic trichloride. Organic arsenic, much less toxic than inorganic arsenic, is produced in a biomethylation process by many organisms including humans and shellfish. Though arsenic occurs naturally in rocks and soil, the majority of arsenic released into the environment is from industrial smelting.

Uses

Arsenic use and production has declined with recognition of its toxicity and the development of suitable replacements. It is not mined but produced as byproduct of smelting for copper, lead, and zinc. The last U.S. smelter producing arsenic closed in 1985 in Tacoma, Washington. (See Tacoma Smelter.) Smelters typically released the trivalent arsenic trioxide and lead into the atmosphere, which contaminated the local environment and left an unwelcome legacy for local residents.

Arsenic is used in the manufacture of silicon-based computer chip technology and in glass manufacture to control color. Inorganic arsenic is no longer used as a pesticide in cotton fields and orchards, but some forms of organic arsenic continue to be applied to cotton fields. The wood preservative CCA, chromated copper arsenate, has been phased out for use residentially and in children's play areas by the US EPA. (See the next page, Case Studies, for more information on CCA.) Inorganic arsenic is also released from coal-fired electric generation facilities, and cigarette smokers inhale some arsenic from tobacco. Organic arsenic compounds are also used as a feed additive to enhance growth of poultry and swine. The import of arsenic into the US has declined from 20,000 metric tons in 2002 and 2003 to less that 8,000 metric tons in 2007.

Exposure

We are exposed to constant but low levels of arsenic, unless receiving greater exposure in an occupational setting or from arsenic-contaminated drinking water. Normally, the background air contains less than 0.1 µg/m3 and drinking water less than 5 µg/L, but water levels can be significantly higher. Food usually supplies less than 10 µg/day of arsenic but can be higher with the consumption of fish and particularly shellfish, which can have arsenic levels up to 30 µg/g.

The majority of arsenic in food is organic, a form that is generally less toxic than inorganic arsenic. The total average daily exposure to arsenic is about 20 µg/day from food and water (assuming 2000 mL/day average water consumption at 5 µg/L arsenic). Children have higher levels of exposure, particularly if drinking water concentrations of arsenic are elevated, because of their smaller size and greater consumption of water relative to their size. Several state health departments and public interest groups have expressed concern about children repeatedly exposed to arsenic form playing on arsenic-treated desk or play structures. Some exposure and associated risk calculations exceed EPA's acceptable risk levels. Arsenic exposure can also occur if arsenic-treated wood is burned or if sawdust from treated wood is inhaled.

Arsenic poisoning from well water remains a serious worldwide human health concern. In West Bengal and Bangladesh, more than 75 million people are exposed to arsenic-laden water that threatens their health. (See Arsenic Poisoning in Bangladesh.) People of Argentina, Chile, and Taiwan also have elevated arsenic in their drinking water. In the United States, federal agencies fiercely debate arsenic drinking water standards, which would limit the amount of arsenic in municipal wells. This is particularly relevant to areas of the western United States that have elevated levels of arsenic in drinking water.

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