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TECHNICAL BULLETIN

HEALTH EFFECTS INFORMATION

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ARSENIC (As)

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Environmental Toxicology Section
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SYNONYMS:

There are no synonyms for arsenic, but some common compounds containing arsenic are called arsenicals, arsenides, arsenates, arsine or arsenites.

USES:

Arsenic has been known and used as a poison for centuries. Major uses in this country have been rodent poisons, insecticides, biocides and weed killers containing arsenic in both organic and inorganic forms. Arsenic is also used as a wood preservative, and it has been used in dyes, paints and pigmenting substances. It is used in glass-making, and electronics manufacturing and leather tanning. It has been used in both human and animal medications and care products, and it is present in many food supplement products.

CHEMICAL AND PHYSICAL PROPERTIES:

In pure form arsenic is a tasteless, odorless white powder or clear crystals. It is not found in pure form in the environment, where it is generally found combined with oxygen, chlorine or sulfur. These mineral (inorganic) forms of arsenic are generally more toxic than its more complex organic compounds found naturally in animal tissues, especially in fish and seafoods. This complexity of arsenic chemistry is the reason for much of the debate about toxicity and about “safe” exposure levels.

WHAT ARE ITS SOURCES AND HOW CAN I BE EXPOSED TO ARSENIC?

Soils and rocks in some areas contain arsenic that can leach into water as erosion occurs. Some arsenic containing rock is found well below the surface of the ground, and well water may be affected by the arsenic. In Oregon, the principle source of arsenic in surface water and groundwater is believed to be native rocks and soil, particularly those of volcanic origin.

Since there are many manmade arsenical products, arsenic is also present in the environment because of these uses. Areas widely treated with pesticides in the past may contain persistent residual levels. Waste disposal sites contain arsenical products which can affect local soil and water. Areas contaminated with industrial paint or with household paint dust may contain significant levels of arsenic. Industrial processes can produce arsenic in liquid waste discharges and in air emissions.

Because arsenic is so widespread, many foods contain significant amounts of arsenic. For most humans our greatest single exposure source is through food and water. Foods may contain 10 to 100 ug of arsenic per kilogram (ppm). The normal dietary arsenic intake is about 25-50 ug per day.

WHAT HAPPENS TO ARSENIC WHEN IT IS RELEASED INTO THE ENVIRONMENT?

Since arsenic is a basic element it cannot be destroyed. It simply changes forms and moves around in the environment. It is generally diluted and moved by air and by water. It may stay in soil for very long periods of time, and it may or may not travel through soil. Some plants absorb arsenic into their tissues as they grow.

WHAT HAPPENS TO ARSENIC IN THE HUMAN BODY?

Arsenic may enter the body by ingestion or it may be inhaled into the lungs. It can be absorbed from the digestive tract and from the lung and is then carried to all parts of the body in the bloodstream. Unabsorbed arsenic is excreted in feces. The liver converts absorbed arsenic to less hazardous forms and the kidneys remove it from the body via urine. These detoxification and elimination processes take time, and harm to organs occurs during this time. If greater amounts of arsenic are absorbed than the body can detoxify and eliminate, the body may develop an increasing burden of arsenic.

WHAT ARE THE HARMFUL EFFECTS OF ARSENIC?

Arsenic may serve a useful function in the body, but only at very low levels. If there is a useful role, the amounts found naturally in foods are enough or more than is needed. Excessive exposure is clearly harmful. At very high dosages arsenic causes immediate (acute) effects including nausea, vomiting, and diarrhea.

Ingestion of two grams or more may be lethal in a very short time. More commonly, arsenic exposure involves much less than this, and may not cause any immediate or observable effects. Arsenic at low doses over a long period of time is known to cause skin changes that may lead to skin cancer. More recently arsenic has been found to cause other kinds of cancer including lung, colon and bladder cancers. It is classified as a Class A (known) human carcinogen by the US Environmental Protection Agency, and has also been associated with harmful effects on the heart and the circulatory system.

Chronic exposure of animals to arsenic in water may also be harmful to them. Prolonged use of arsenic-rich water for irrigation can result in elevated soil arsenic levels that may become harmful to plants, animals and human beings in the area.

DRINKING WATER STANDARDS

The US Environmental Protection Agency established a mandatory drinking water limit known as a Maximum Contaminant Level (MCL) at 10 micrograms of arsenic per liter of water (ug/l, also referred to as parts per billion or ppb). Formerly, the limit was 50 ug/L, but USEPA reduced the MCL to 10 ug/l because of the growing evidence that it causes cancer and other harm to humans.

CAN ARSENIC BE REMOVED FROM DRINKING WATER?

Yes, arsenic can be reduced or removed entirely from drinking water, but treatment processes are expensive and require careful maintenance and monitoring. Currently available treatment processes include activated alumina, electro dialysis, reverse osmosis and ion exchange resins. Alternatives to treatment may include developing an alternative source or connecting to a safe water source in your area. Temporarily,

water used for drinking, beverage-making or food preparation may be obtained from a known safe source. Non-ingestion uses of water pose much less hazard, but are not entirely safe if arsenic levels are significantly above the drinking water limit. Not all kinds of treatment are effective, and no single treatment method can remove all contaminants from water. Treatment has limitations and disadvantages. Before deciding on treatment equipment you should obtain information and advice from the Department of Human Services, Drinking Water Program at 503-731-4010.