



Analytica International, Inc.
An Analytica Group Company
3330 Industrial Avenue
Fairbanks, Alaska 99701
(907) 456-3116
Fax: (907) 456-3125

12189 Pennsylvania Street
Thornton, CO 80241
(303) 469-8868
(800) 873-8707
FAX: (303) 469-5254

WATER QUALITY FACT SHEET ARSENIC

Arsenic is a highly toxic contaminant that is present in many groundwater wells in the Fairbanks area, on the Seward and Kenai Peninsulas, and in many wells in Southcentral Alaska.

SOURCE

Natural ore deposits of arsenopyrite, a mineral associated with gold-bearing rocks, are common in the Fairbanks area. Arsenopyrite can yield arsenic to groundwater under anaerobic (no oxygen) conditions. The highest concentrations of arsenic in Fairbanks are in the mineralized area between Pedro and Ester Domes, but arsenic also can be found throughout the surrounding hills. Some stream sediments contain arsenic, particularly those draining through placer mine tailings that are rich in arsenopyrite and exposed to weathering by rain and snowmelt runoff.

When drawn from the tap, arsenic usually is present in the dissolved state as arsenite. This is one of many different states of this semi-metal, but it is the one most toxic to humans. When exposed to air or other oxidants, arsenite converts to arsenate, a form that is less toxic and also more easily removed by filtration. This conversion is chemically similar to the change in oxidation state that occurs as iron transforms from a clear dissolved ferrous form to a yellow or orange precipitate in the ferric form.

TOXICITY

Arsenic is classified as a hazardous substance and is a suspected carcinogen, reportedly causing lung and skin cancers. It is also a teratogen, that is, it is capable of crossing the placental membrane and into the metabolic system of a fetus. The actual toxicity of arsenic to humans varies depending on factors such as general health and diet. Arsenic is a cumulative toxin that slowly passes out of the body through the hair, fingernails, and toenails. In 2001, the U.S. Environmental Protection Agency passed a new, stricter Arsenic Rule, to better protect the public health. The maximum level of arsenic allowed in drinking water was reduced from 0.05 milligrams per liter (mg/L), or 50 parts per billion (ppb), to 0.01 mg/L, or 10 ppb. Public water systems have until 2006 to come into compliance with the new MCL.

TREATMENT

Arsenic can be removed from water by several different technologies, the choice of which depends on the amount of water to be treated, the amount of arsenic in the water, and the presence of other contaminants. At low concentrations in water with few other contaminants, a simple home-sized system approved by the ADEC is available. The U.S. Environmental Protection Agency (EPA), in cooperation with the ADEC, extensively tested the "arsenic filter," an activated alumina filter originally designed for fluoride removal, with follow-up testing in homes in Fairbanks by Northern Testing Laboratories, Inc. (NTL). The activated alumina filter requires no electricity or chemicals, and is highly efficient, removing nearly all of the arsenic. This unit requires occasional regeneration of the filter media by the dealer.

Another effective treatment technology is desalination (salt removal), using distillation or reverse osmosis (RO), which forces the water through a salt-rejecting membrane. RO membrane system technology has improved considerably in the last decade, and costs per unit are decreasing. RO systems may also remove many other contaminants, including nitrate, iron, manganese, and hardness. The membranes are sensitive to fouling, however, so an effective pretreatment system may be required to protect them.

In addition, iron filters using manganese greensand media with potassium permanganate as a regenerant are partially effective, but should only be considered where the arsenic concentration is low and only trace removal is required. Larger systems can use other chemical treatment methods such as coagulation with alum or ferric salts. This method also can be used to improve the arsenic-removal performance of iron filters. These more complex chemical processes are typically used only in systems that are large enough to support a trained water treatment plant operator to maintain the equipment.

TESTING

NTL uses several instruments to analyze for arsenic. The most sensitive is a Perkin Elmer inductively coupled plasma/mass spectrometer (ICP/MS). Our reporting limit for arsenic with the ICP/MS is approximately 0.0005 mg/L (0.5 ppb). If you want to know what the arsenic level in your well water is, we recommend sampling as close to the well as possible, even before the pressure tank. If you are treating your water for arsenic and would like to know what the efficiency of your treatment system is, we recommend sampling both from your kitchen tap and from the well, to evaluate the overall removal.