

# Chemical Parameters of Drinking Water Fact Sheet: Arsenic

## Sources

Arsenic can naturally occur in groundwater and some surface water. It is one of the greatest chemical problems in developing countries. The World Health Organization (WHO) considers arsenic to be one of the chemicals of greatest health concern in some natural waters and a high priority for testing in drinking water sources (WHO, 2011; WHO, 2012).

High levels of arsenic can be found naturally in water from deep wells in over 70 countries, including India, Nepal, Bangladesh, Indonesia, Cambodia, Vietnam, Lao PDR, Mexico, Nicaragua, El Salvador, and Brazil. In South Asia alone, it is estimated that 60 to 100 million people are affected by unsafe levels of arsenic in their drinking water. Bangladesh is the most severely affected, where 35 to 60 million of its 130 million people are exposed to arsenic contaminated water. It is possible that arsenic may be found in other locations as more water quality testing is done.

## Potential Health Effects

Arsenic is poisonous, so if people drink water or eat food contaminated with arsenic for several years, they develop chronic health problems called arsenicosis.

Melanosis is the first symptom of drinking arsenic contaminated water over a few years. Melanosis is light or dark spots on people's skin, often on the chest, back, or palms. The next step is that hardening skin bulges develop on people's palms and feet – called keratosis. Drinking high amounts of arsenic for a longer time may cause cancer in the lungs, bladder, kidney, skin, liver, and prostate. Arsenic may also cause vascular diseases, neurological effects, and infant developmental defects.

Arsenicosis can be partially reversed and treated in the early stages by making sure people stop drinking arsenic contaminated water and by improving their nutrition. There is currently no effective cure for arsenic poisoning. The only prevention is to drink water that has safe levels of arsenic.

According to the United Nations Development Program (2006), the projected human costs over the next 50 years include 300,000 deaths from cancer and 2.5 million cases of arsenic poisoning.

## World Health Organization Guidelines

It is difficult to measure arsenic levels below 1-10 µg/L, and removing arsenic in drinking water to concentrations below 10 µg/L is difficult in many circumstances. In view of the practical difficulties in testing and removing arsenic, the WHO (2011) suggests that drinking water should have less than 10 µg/L of arsenic (10 µg/L is the same as 0.01 mg/L, 0.01 ppm or 10 ppb.)

**WHO Guideline for Arsenic in Drinking Water <10 µg/L**

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Many countries have their own standards which are less strict than the WHO Guidelines, ranging from 25 mg/L to 50 µg/L (25-50 ppb). Many Southeast Asian countries that have an arsenic problem have adopted a temporary standard of 50 µg/L because it is difficult to test accurately to 10 µg/L and to treat water to meet that level.

### Water Quality Testing Methods

Testing for arsenic in drinking water, especially at the µg/L level, is difficult. There are no simple paper test strip or colour disc comparator field kits available. Arsenic testing used to be only possible in a laboratory. However, as a result of the discovery of significant arsenic contamination of groundwater in Asia and elsewhere, a variety of portable test kits are now available. All of these rely on the Gutzeit method, which consists of several steps (UNICEF, 2008).

Most commercially available portable test kits typically provide colour reference charts, with reported detection limits around 10 µg/L. However, evaluations have shown that the results are semi-quantitative at best, especially at lower levels (<100 µg/L). The kits are most effectively used in a positive/negative format with a reference value of 50 µg/L, which is the drinking water standard in many countries. At this level, most samples containing 50-99 µg/L are identified as positive, and nearly all samples containing 100 µg/L or more result in positive test results, though the quantitative result may be incorrect (UNICEF, 2008).

However, in recent years manufacturers of portable test kits have modified designs in an effort to lower the detection limit for arsenic. The newer kits are probably still not capable of reliably quantifying arsenic at such low levels, but should have lower false negative rates when used in a positive/negative format (UNICEF, 2008).

Information about commercially available portable test kits are provided in CAWST's Drinking Water Quality Testing Product Sheets.

### Household Water Treatment Options

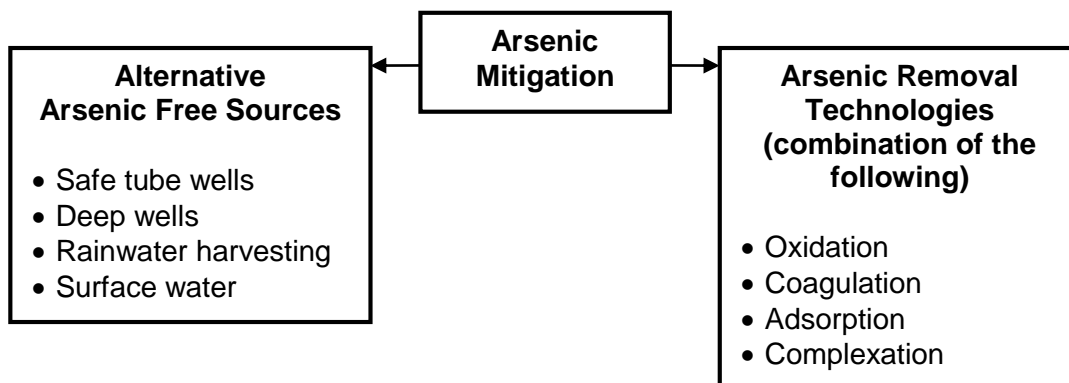
One way to deal with arsenic in groundwater is to use a different source of drinking water, such as rainwater or surface water. Some people collect and store their rainwater and use it for drinking and cooking instead of arsenic contaminated groundwater. If people change to drinking surface water, they will probably need to treat the water to remove turbidity and pathogens.

If people are unable to change to a water source that does not have arsenic, there are various household water treatment options that have been developed to remove arsenic from water. Each technology has advantages and limitations. Many of these technologies are being used in Bangladesh where the arsenic problem is widespread. See CAWST's Household Water Treatment for Arsenic Removal Fact Sheets for more information on the different technologies.

The following illustration shows the different mitigation options for arsenic in drinking water.

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### References

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