

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, 2018).

High levels of arsenic can be found naturally in water from tube 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 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 (2017) 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



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 is more difficult than testing for many other chemical contaminants but methods and test kits have improved considerably in recent years (UNICEF, 2018). Arsenic portable field test kits are now available with better accuracy and precision. These rely on the Gutzeit method, which consists of several reaction steps that produce a colour change on indicator paper, allowing an estimate of arsenic concentration by manual or electronic comparison with a colour chart (UNICEF, 2018). Most commercially available portable test kits typically provide colour reference charts, with reported detection limits between 10 – 200 µg/L.

FIELD TEST RESULTS ARE HIGHLY DEPENDENT ON FOLLOWING DEFINED TRAINING PROCEDURES AND RIGOROUS QUALITY CONTROL.

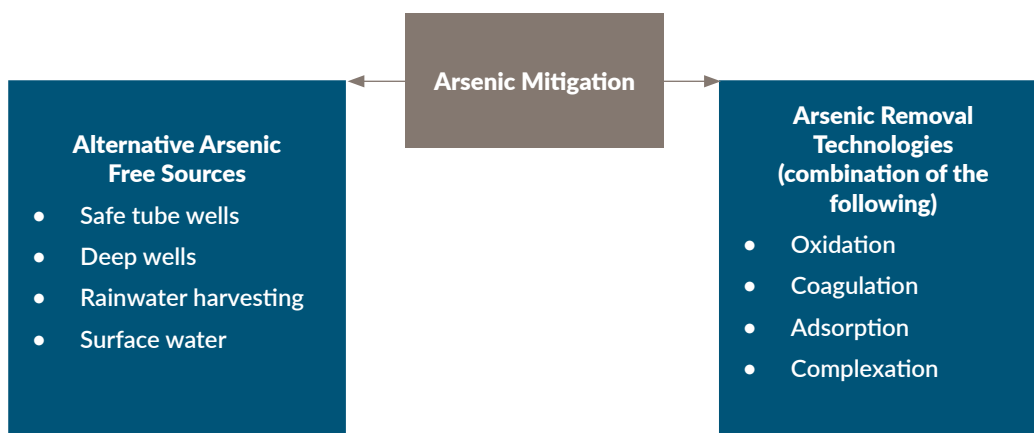
Information about some commercially available portable test kits are provided in CAWST's Drinking Water Quality Testing Product Sheets.

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.





References

United Nations Development Program (2006). Human Development Report 2006: Beyond Scarcity: Power, Poverty and the Global Water Crisis. New York, USA. Available at:

<https://hdr.undp.org/content/human-development-report-2006>

UNICEF (2008). UNICEF Handbook on Water Quality. UNICEF, New York, USA. Available at:

<https://www.unicef.org/media/91301/file/Handbook-Water-Quality.pdf>

UNICEF (2018). ARSENIC PRIMER, Guidance on the Investigation & Mitigation of Arsenic Contamination. Available at:

<https://www.unicef.org/media/91296/file/UNICEF-WHO-Arsenic-Primer.pdf>

World Health Organization (2018). Arsenic Fact Sheet. Available at:

<https://www.who.int/news-room/fact-sheets/detail/arsenic#:~:text=Long%2Dterm%20exposure%20to%20arsenic,increased%20deaths%20in%20young%20adults.>

World Health Organization (2017). Guidelines for Drinking-Water Quality, Fourth Edition Incorporating the First Addendum. WHO, Geneva, Switzerland. Available at:

<https://www.who.int/publications/i/item/9789241549950>

World Health Organization (2012). Rapid Assessment of Drinking-Water Quality: A Handbook for Implementation. WHO, Geneva, Switzerland. Available at:

<https://www.who.int/publications/i/item/789241504683>

This document is open content. You are free to:

- Share – to copy, distribute and transmit this document
- Remix – to adapt this document

Under the following conditions:

- Attribution. You must give credit to CAWST as the original source of the document. Please include our website: www.cawst.org

CAWST and its directors, employees, contractors and volunteers do not assume any responsibility for and make no warranty with respect to the results that may be obtained from the use of the information provided.



B12, 6020 – 2 Street SE
Calgary, Alberta T2H 2L8
Canada
+1 (403) 243-3265
resources@cawst.org
cawst.org

To stay up-to-date and get support on:

- The latest updates to this document
- Other workshop and training related resources
- Using this document in your work

Visit resources.cawst.org