

# Chlorine

## Sources

Chlorine is produced in large amounts and widely used both industrially and domestically as an important disinfectant and bleach. In particular, it is the most commonly used chemical disinfectant in drinking water treatment and is widely used in the disinfection of swimming pools.

Chlorine is widely used to disinfect drinking water as the final step in the water treatment process. Chemical disinfection using chlorine has the benefits of being relatively quick, simple, and inexpensive. It also allows a residual amount of chlorine to remain in the water to provide some protection against subsequent contamination.

Three things can happen when chlorine is added to water:

1. Some chlorine reacts with the organic matter and pathogens and kills them. This portion of the added chlorine is said to be consumed.
2. Some chlorine reacts with other organic matter and forms new chlorine compounds. This portion is called combined chlorine.
3. Excess chlorine that is not consumed or combined and remains in the water is known as free residual chlorine (FRC).

The objective of chlorination is to add enough chlorine to leave 0.2-0.5 mg/L FRC after half an hour contact time. Factors influencing the effectiveness of chlorine as a disinfectant are concentration, contact time, pH, temperature, and the presence of organic matter in the water. All of these factors can vary day to day and in different seasons.

## Potential Health Effects

Drinking water with high concentrations of chlorine is not known to cause specific adverse health effects. Chlorine, however, can change the taste and smell of water and it may cause people to not use it and to choose another, possibly contaminated, water source instead. People often complain of a strong taste and smell when the FRC concentration is between 0.6-1.0 mg/L (UNICEF, 2008).

## World Health Organization Guidelines

There are no specific adverse health effects of exposure to free chlorine, but the World Health Organization (WHO) has conservatively set a guideline value of 5 mg/L, which is well above the taste and odour threshold (WHO, 2017). Most people are able to taste or smell chlorine in drinking water at concentrations well below 5 mg/L, and some at levels as low as 0.3 mg/L.





For effective disinfection, there should be a residual concentration of free chlorine of  $\geq 0.5$  mg/L after at least 30 minutes contact time at pH  $< 8.0$ . A chlorine residual should be maintained throughout the distribution system. At the point of delivery, the minimum residual concentration of free chlorine should be 0.2 mg/L (WHO, 2017).

### WHO Guideline for Chlorine in Drinking Water $< 5$ mg/L

#### Water Quality Testing Methods

On-site testing is essential for measuring FRC since the concentration can change rapidly during transport and storage (WHO, 2011). Portable digital photometers are available from various commercial manufacturers. These can provide reliable and quantitative measurements of chlorine (UNICEF, 2008). Chlorine can also be easily measured using pool test kits, test strips, or a colour disc comparator.

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

#### Household Water Treatment Options

Generally, people do not try to remove chlorine from their drinking water. Rather, it is often used to treat water to make it safe to drink. However, some people are sensitive to the taste and smell of chlorine in their drinking water. A practical household option to reduce the chlorine level is simply letting the water stand in a container for a period of time ranging from a few hours to a few days so that the chlorine dissipates. Another quick option is to shake a bottle of water to help the chlorine dissipate faster.

#### References

UNICEF (2008). UNICEF Handbook on Water Quality. UNICEF, New York, USA. Available at: <https://www.unicef.org/media/91301/file/Handbook-Water-Quality.pdf>

World Health Organization (2011). Guidelines for Drinking-Water Quality, Fourth Edition Incorporating the First Addendum. WHO, Geneva, Switzerland. Available at: <https://www.who.int/publications/i/item/9789241549950>

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