

Residual Free Chlorine Analysis (Elementary) Revised October 6, 2006

- **Purpose:** To determine the Free Residual Chlorine concentration in your local drinking water. Find two different locations (drinking water fountain, tap water from the gym etc.) and sample the water into cups provided, label the cups from where the water came before you sample.

The determination will be done by using a test strip method. You will compare the different results, and you will also see if the water meets the Canadian Drinking Water Guidelines.

The current Canadian Guideline is that water should have a 0.1 mg/L Residual Free Chlorine content. Unlike most of the other guidelines this is a minimum concentration allowed.

Materials:

- 2 - Test strip packets with colour chart printed on packet for determining Free Residual Chlorine concentration.
- 2 - Drinking glasses.

Method:

1. Label the two glasses with their respective names.
2. Put about 50 mL of sample in respective glasses (volume is really not critical).
3. Dip one test strip in glass for about **20 seconds** * with constant back and forth motion, so that water passes through the small aperture in the test strip.

* **Temperature compensation Chart** (Adjust mixing time appropriately)

Temp. (Degrees C)	19	20	21	22	23	24	25
Time (Seconds)	28	26	24	22	21	20	19

4. Remove and shake the test strip once, briskly, to remove any excess water on the strip. Allow the test strip to dry for 20 seconds by lying across glass.
5. Match with the best colour to determine the Residual Free Chlorine concentration in mg/L or parts per million (ppm). Complete the colour matching within **one minute**. Do one sample at a time.

6. Write up your results.

Results: Compare results to the Canadian Drinking Water Guidelines of 0.1 mg/L; a lighter colour of blue means that the water **Does Not** meet Canadian Drinking Water Guidelines, a darker colour means that the water treatment plant may be using excessive amounts of chlorine. Please refer to the facts sheets below for more information on chlorine.

Safe Handling of Materials:

Caution must be taken at all times when handling any chemicals. Although this test is safe to use in any area, please be cautious with the materials supplied.

Visit the Safe Drinking Water Foundation Website www.safewater.org to learn more about issues affecting safe drinking water.

Residual Chlorine:

What is Residual Chlorine and why do we test for it?

Chlorine is a chemical that is used to disinfect water prior to it being discharged into the distribution system. It is used to ensure water quality is maintained from the water source to the point of consumption. When chlorine is fed into the water, it reacts with any iron, manganese, or hydrogen sulphide that may be present. If any chlorine remains (residual), it will then react with organic materials, including bacteria. In order to ensure that water is sufficiently treated through the whole distribution system, an excess of chlorine is usually added. This amount is usually adjusted to make sure there is enough chlorine available to completely react with all organics present.

The chlorine will decrease in concentration with distance from the source, until it reaches the point where the chlorine level can become ineffective as a disinfectant. Bacteria growth will occur in distribution systems when very low levels of chlorine are encountered. Therefore, it is important to make sure there is enough chlorine to efficiently disinfect even at the far ends of the distribution system. Chlorination can kill many pathogenic (disease causing) microorganisms such as *E. Coli* but others, like *Cryptosporidium* and *Giardia*, are very resistant to chlorine and require other measures to properly remove them.

Operation Water Drop

Visit the Safe Drinking Water Foundation Website www.safewater.org

There are some important chlorination trends found in drinking water treatment:

- As chlorination increases, the time required to disinfect decreases.
- Chlorination is ~~more~~ effective as the temperature increases.
- Chlorination is less effective as pH increases (becomes more alkaline).
- Chlorination is less effective in turbid water.



Residual chlorine may have a taste and/or odour that some people may find disagreeable. However, most would prefer that to drinking water that contains potentially harmful inorganic and organic materials.

What are the current Canadian recommendations for residual chlorine?

There are two ways in which residual chlorine is measured. Free Chlorine is the chlorine that remains in the water that has not reacted with anything (organic or inorganic). Total Chlorine is the chlorine that remains in the water that is both free and reacted.



The Federal-Provincial-Territorial Committee on Drinking Water recommends a minimum Free Chlorine residual of 0.1mg/L or a minimum Total Chlorine level of 0.5mg/L.

What are the health risks associated with low residual chlorine?

Studies have shown that when residual chlorine levels drop below recommendations, several water quality problems can occur. With regard to public health, bacteria and selected viruses, called bacteriophages, are able to multiply in water that is not properly disinfected and, depending on the species, could potentially cause waterborne illnesses.



It is important to note that, although chlorination has been the most common method of disinfection for over 100 years, there have been recent studies that have shown that chlorine in water can react with otherwise innocent organic material in drinking water and form chemicals called Trihalomethanes (THMs), such as Chloroform. THMs have been shown to be potentially carcinogenic (cancer causing) and are, therefore, carefully monitored in water systems that are routinely chlorinated. While recommendations only state minimum residual chlorine levels, it is important that a careful balance is maintained in drinking water. There needs to be enough chlorine to make sure everything is properly disinfected. However, an extreme excess of chlorine is not necessary and may lead to high levels of THMs and the adverse health risks described previously.

What do I do if my water does not meet residual chlorine recommendations?

In municipal water systems, the drinking water is chlorinated prior to being distributed and chlorine residuals should be measured at the far end of the distribution line. This ensures that the house located furthest from the plant still receives water that is adequately disinfected. If your water does not have appropriate chlorine residual levels, contact your local treatment facility and have them conduct further tests to make sure enough disinfectant is added to the water at the plant. For homes that get their water from wells, either commercial disinfectants or diluted household bleach may be used to adequately treat drinking water. Usually, gaseous chlorine is added to the water at large treatment facilities. However, this form of chlorine is too dangerous to be used for home use and other disinfectants such as those mentioned above are recommended. Contact a local water treatment authority to determine the recommended levels for your well system.