Disinfection Fact Sheet

Purpose of Disinfection

The goal of water disinfection is to inactivate waterborne microorganisms that can cause illnesses or death when present in drinking water. Typical waterborne microorganisms of concern include bacteria, viruses, and protozoa.

- **Bacteria:** *Escherichia coli (E. coli)*, *Legionella*, *Shigella*
- **Viruses:** Adenoviruses, Enteroviruses, Noroviruses
- **Protozoa:** *Giardia*, *Cryptosporidium*

A dedicated disinfection step is required within the water treatment process train to prevent the transmission of waterborne diseases.

Common Disinfectant Chemicals

Chlorine is the most common chemical used for disinfection of drinking water. Chlorine is applied using sodium hypochlorite (liquid), calcium hypochlorite (powder), or chlorine gas. Alternative disinfectants include chlorine dioxide, ozone, ultraviolet (UV) radiation, and chloramines. All chemical used in drinking water treatment applications **must be NSF 60 Certified**.

Primary Disinfection

Primary disinfection is the removal, inactivation, or destruction of pathogenic organisms.

- Efficacy of primary disinfection is dependent on free chlorine concentration, disinfectant contact time, and pH and temperature of the water. This relationship is known as the Concentration x Time (CT) Concept.
- CT is the product of the residual concentration of disinfectant (measured at the outlet of the chlorine contact chamber or at the first customer service) and the amount of disinfectant contact time (measured in minutes).
- In Newfoundland and Labrador, all water entering a water distribution system must have a minimum residual of 0.3 mg/L after a minimum of 20 minutes contact time at peak hourly flow. This is equivalent to a CT of **6 mg·min/L**.
- Newfoundland and Labrador Water Resources Management Division has developed a standard operating procedure for calculating CT.

Disinfection Fact Sheet

Secondary Disinfection

Secondary disinfection is the maintenance of a disinfectant residual within the distribution system to prevent bacterial regrowth.

- In Newfoundland and Labrador, a detectable free chlorine and total chlorine residual must be provided at all points throughout the entire drinking water distribution system.
- The maximum allowable free chlorine residual is 4.0 mg/L.

Note: Typically, primary and secondary disinfection are practiced in one process.

Measuring Chlorine Concentrations

Field chlorine measurements are typically measured using a pocket (handheld) chlorine colorimeter. A common unit is the HACH Pocket Colorimeter II, whereby a small amount of DPD powdered reagent is added to a 10 mL sample of water. The reaction causes the water sample to turn pink, and the intensity of the colour change is proportional to the amount of chlorine in the water. The test kit can be used for measuring both free and total chlorine. The reagents for the two parameters come in similar packages, so verify that the proper reagent is being used for each test. The reagent also has an expiry date, so verify that the reagent is up-to-date.

Newfoundland and Labrador Water Resources Management Division has developed a standard operating procedure for performing this test, which is available online.

Free Chlorine and Total Chlorine

Matter in the water may exert chlorine demand. As a result, the amount of chlorine that is applied is not equivalent to the amount of free chlorine residual that is available when measured. Matter that exerts chlorine demand include ammonia, iron, manganese, hydrogen sulfide, and natural organic matter.

Free Chlorine is the amount of chlorine present in the form of dissolved gas, hypochlorous acid, and hypochlorite ion that is not combined with ammonia or other compounds in the water. Efficacy of disinfection should be based primarily on free chlorine measurements. **Combined Chlorine** is the sum of the reaction of free chlorine with the various materials in the water and is not very reactive.

Total Chlorine is the sum of free and combined chlorine.