THE WATER COLLECTION FACT SHEET:

Water Treatment- Disinfection: Chlorination

WAM TECHNOLOGY

How does Disinfection by means of Chlorination take place?

Chlorine is a strong oxidising agent and it reacts and oxidises some of the essential systems of micro-organisms, thereby inactivating or destroying them. The different forms, in which chlorine is used for disinfection, have different oxidising powers:

- **Chlorine Gas**
  Delivered to the plant in gas cylinders and the chlorine are introduced into the water by means of special dosing devices (chlorinators). Chlorine gas is the form of chlorine that is most commonly used at large-scale plants.

- **Calcium Hypochlorite** (commonly known as HTH)
  Available in granular or tablet form and is therefore a very convenient to use, especially for smaller or rural plants. It contains between 65% and 70% of available chlorine, it is relatively stable and can be stored for long periods (months) in a cool dry environment.

- **Sodium Hypochlorite** (commonly known as household bleach)
  Bleach is available as a solution, containing about 6 to 8 % available chlorine. It is relatively unstable and deteriorates fairly rapidly, especially when exposed to sunlight, forming HOCl and OCl- upon dissociation.

- **Monochloramine** (NH2Cl or combined available chlorine)
  Formed when HOCl is added to water that contains a small amount of ammonia. The ammonia reacts with HOCl to form monochloramine. It is much less effective as a disinfectant than HOCl, however, it has the same advantage of being much more stable in water than free available chlorine, rendering it more suitable for providing residual protection in larger distribution systems.

How is disinfection by means of chlorine controlled?

- **Chlorine concentration**. Normally, sufficient chlorine must be added to water to give a free chlorine residual of not less than 0,2 mg/l after 20 minutes contact time.
- **Chlorine contact time.** This is the time of contact between the dissolved chlorine and each unit or "pocket" of water.
- **pH.** Tables are available that give combinations of dosage and contact time at different pH values
- **Turbidity**. When water contains colloidal particles, they may "shield" the micro-organisms from the action of the disinfectant, or alternatively react with the chlorine and in this way prevent effective disinfection
- **Exposure to sunlight and water temperature**. Chlorine in water is rapidly broken down by sunlight to the inactive chloride ion Cl-, which has no disinfecting power. Therefore chlorine contact tanks should always be covered and chlorine compounds should be stored in the dark.

Advantages:

- Chlorination is a well-established technology.
- Presently, chlorine is more cost-effective than either UV or ozone disinfection.
- Chlorine disinfection is reliable and effective against a wide spectrum of pathogenic organisms.
- Chlorine is effective in oxidizing certain organic and inorganic compounds.
- Chlorine can eliminate certain noxious odors while disinfecting.

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Disadvantages:

- All forms of chlorine are highly corrosive and toxic. Thus, storage, shipping, and handling pose a risk, requiring increased safety regulations.

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References: DWAF (2002): Quality of domestic water supplies. Vol 4: Treatment Guide