

Chlorine Disinfection in Healthcare Facilities

Chlorine, a commonly used disinfectant, can inactivate both bacteria and viruses given sufficient contact time and concentration. Sphere (2011) outlines several water, sanitation, and hygiene (WASH) actions for healthcare settings, which is especially important to prevent infection and disease outbreak or spreading. To help prevent an outbreak, bathrooms and any frequently touched surfaces must be cleaned and disinfected a minimum of once per day. Some areas may need to be cleaned and disinfected after each use. Clean with regular soap or detergent and water. Then, after rinsing, use the appropriate chlorine solution to disinfect. Microbes and viruses require certain contact times (i.e., the time the surface must remain wet with disinfectant), ranging from 2–10 minutes (CDC, 2019). Both for protection from the chlorine solution and any potential microbes and viruses, always wear gloves when performing this cleaning and disinfection. The table below shows the Water Mission standards for chlorine solutions at healthcare centers and hospitals (Sphere, 2011; CDC, 2019).

Chlorine Concentration	Healthcare Facility Activity
0.5 – 1.0 mg/L	Drinking water (free residual chlorine at point of delivery)
500 mg/L (0.05%)	Handwashing
	Laundry (after cleaning)
5000 mg/L (0.5%)	Cleaning materials, aprons, boots, cooking utensils and dishes
	Washing personal protective equipment (e.g., gloves)
	Rinsing bedpans, buckets
	Cleaning bathrooms and surfaces
10000 mg/L (1%)	Mother solution for chlorinating water
20000 mg/L (2%)	Preparing dead bodies
	Added to excreta and vomit buckets (Cholera)

The turbidity of the water must be less than 5 NTU to be utilized for the above activities for effective chlorination. Additionally, the chlorine solutions must be prepared fresh daily. The chlorine solution must be prepared 30 minutes prior to use (to allow the chlorine 30 minutes of contact time with the water).

Calculating Chlorine Concentration

The following equations show how to calculate the amount of chlorine to be added to a given volume of water to achieve a target solution concentration for three chlorine sources:

Bleach – Diluted Sodium Hypochlorite

Example: 1 Liter of 5.25% bleach per 5 L H₂O to achieve 1% chlorine concentration

$$X \text{ L Bleach} = \frac{(\text{Volume } H_2O, L)}{\left(\frac{\% \text{ Sodium Hypochlorite}}{\text{Target } \%}\right)}$$

*Please adjust the % sodium hypochlorite to match what is indicated on the bleach source.

Calcium Hypochlorite - Granular

Example: 77 grams of Calcium Hypochlorite (65% available chlorine) per 5 L H₂O to achieve 1% chlorine concentration

*Please be aware that Calcium Hypochlorite must ONLY be used to disinfect systems that will use calcium hypochlorite for water chlorination. Shocking with Calcium Hypochlorite and using ACL56 (or opposite) could result in major safety concerns / equipment failure.

$$X \text{ g CalHypo} = \frac{(\text{Target \%}) \times (\text{Volume H}_2\text{O, L})}{(\% \text{ Available Chlorine})} \times \left(\frac{1000 \text{ g}}{\text{L}}\right)$$

*Please adjust to match the % Available Chlorine according to the CalHypo product being used

ACL56 – Granular Dichlor

Example: 90 grams of ACL56 (56% available chlorine) per 5 L H₂O to achieve 1% chlorine concentration

$$X \text{ g ACL56} = \frac{(\text{Target \%}) \times (\text{Volume H}_2\text{O, L})}{(\% \text{ Available Chlorine})} \times \left(\frac{1000 \text{ g}}{\text{L}}\right)$$

Additional WASH Practices for Healthcare Facilities

In general, but especially in the event of an outbreak, the WHO (2009) suggests cleaning hands often. Hand washing is always recommended in situations where microbes and viruses are more likely to be spread (e.g., after blowing one's nose, coughing, or sneezing; after using the toilet; before eating or preparing food; before and after providing routine care for another person). In healthcare facilities, visibly dirty hands must be washed with soap and water for 40–60 seconds. If soap and water is not available and hands are not visibly dirty, an alcohol-based rub (at least 60% alcohol) may be used. If soap or alcohol-based rub are not available, a chlorinated solution (0.05%) can be used but is not ideal. Contaminated linens in healthcare facilities should be machine washed with warm water (60-90°C) and laundry detergent. If machine washing is not available, the linens can be soaked in a chlorine solution (0.05%) for 30 minutes. The cleaned laundry should be rinsed with clean water and allowed to dry completely in sunlight.

References

Center for Disease Control and Prevention (CDC). (2019). *Rationale and Considerations for Chlorine Use in Infection Control for Non- U.S. General Healthcare Settings*. (<https://www.cdc.gov/vhf/ebola/clinicians/non-us-healthcare-settings/chlorine-use.html>), accessed 18 March 2020)

The Sphere Project (Sphere). (2011). *Humanitarian Charter and Minimum Standard in Humanitarian Response* (pp. 100). North Hampton, United Kingdom

World Health Organization (WHO). (2009). *WHO guidelines on hand hygiene in health care settings*. Geneva, Switzerland. (https://apps.who.int/iris/bitstream/handle/10665/44102/9789241597906_eng.pdf?sequence=1&isAllowed=y, accessed 18 March 2020).

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