

Legionnaires' Disease

Appendix II:A-1. Biocides

Traditional oxidizing agents such as chlorine and bromine have been proven effective in controlling Legionnaires' disease bacteria (LDB) in cooling towers.

Continuous chlorination at low free residual levels can be effective in controlling LDB growth.

- It is important that the proper oxidant level be established and maintained because free residual chlorine above 1 mg/L may be corrosive to metals in the system and may damage wood used in cooling towers.
- However, free residual levels below 1 mg/L may not adequately control LDB growth.
- Chlorine also combines with organic substances in water to form toxic by-products that are of environmental concern.
- Frequent monitoring and control of pH is essential for maintaining adequate levels of free residual chlorine.
 - Above a pH of 8.0, chlorine effectiveness is greatly reduced.
 - Proper control of pH will maintain the effectiveness of chlorination and minimize corrosion.

Chloramine is a weaker disinfectant than chlorine, but is more stable, thereby extending disinfectant benefits throughout a water distribution facility.

- Chloramine is not as reactive as chlorine with organic material in water, thereby producing substantially lower concentrations of disinfection byproducts in the distribution system.
- Because the chloramine residual is more stable and longer lasting than free chlorine, it provides better protection against bacterial regrowth in systems with large storage tanks and dead-end water mains.
- Chloramine, like chlorine, is effective in controlling biofilm, which is a slime coating in the pipe caused by bacteria. Controlling biofilms also tends to reduce coliform concentrations and biofilm-induced corrosion of pipes.

Bromine is an effective oxidizing biocide.

- Bromine is frequently added as a bromide salt and generated by reaction with chlorine.
- Bromine's effectiveness is less dependent on the pH of the water than chlorine.
- Bromine is less corrosive and produces less toxic environmental by-products.

Little information exists on the demonstrated effectiveness of many commercial biocides for preventing LDB growth in actual operations.

- Australian studies indicate that fentichlor [2,2'-thiobis (4-chlorophenol)] used weekly for four hours at 200 ppm, or bromo-chloro-dimethyl-hydantoin (BCD) in a slow-release cartridge at an initial concentration of 300 ppm are effective in controlling the growth of LDB. The Australian study also indicates that quaternary ammonium compounds, widely used for control of bio-fouling in cooling towers, are not effective in controlling LDB.
- There are no U.S. suppliers of Fentichlor, although the chemical is licensed by the EPA for water treatment in cooling towers.
- Towerbrom 60M™, a chlorotriazine and sodium bromide salt mixture, has been reported to be effective when alternated with BCD for control of LDB in U.S. studies of contaminated cooling towers.