

Legionella in Cooling Towers

Background

Various studies have shown that 40-60% of all cooling towers harbor *Legionella* bacteria. Cooling towers are the largest and most common source of Legionnaire's disease outbreaks because of their risk for widespread circulation.

Although 90% of *Legionella* infections in humans are caused by *Legionella pneumophila*, there are 45 named species of *Legionella* of which 19 species have been documented as human pathogens.

A multinational study of community-acquired legionnaires disease identified 508 culture-confirmed cases [Yu VL, Plouffe JF, Pastoris MC, et al., 2002]. *L. pneumophila* was responsible for the greatest percentage of cases (91.5%), followed by *Legionella longbeachae* (3.9%) and *L. bozemanii* (2.4%). The remainder of cases were due to *L. micdadei*, *L. feeleeii*, *L. dumoffii*, *Legionella wadsworthii*, and *L. anisa*.

Legionella in Cooling Towers

Cooling towers, because of their mode of operation, can create ideal conditions for microbial growth and they also deliberately require the creation of sprays and aerosols, which can be dispersed over a wide area if not controlled properly.

Cooling towers operate at temperatures that can provide an environment for the growth of microorganisms in water (20-45°C), including *Legionella*.

Other operating conditions contributing to the growth of *Legionella* in cooling towers include:

- High microbial concentration, including algae, amoebae, slime and other bacteria.
- Presence of biofilm, scale, sediment, sludge, rust and other organic matter.
- Presence of degraded plumbing materials that may provide nutrients to enhance bacterial growth.

Cooling towers must be properly disinfected and maintained to reduce the risk of *Legionella*.

Controlling Legionella

Historically biocides such as chlorine, chlorine dioxide, hypobromite, and ozone have been used for *Legionella* control in cooling towers.

In the natural environment, *Legionella* lives in three forms: as a free swimming form, in a biofouling and as an amoebic parasite (lives within amoebae).

Studies demonstrated that *L. pneumophila* can use free-living amoebae as host cells for



intracellular replication [Skinner et al., 1983; Newsome et al., 1985; Fields, 1993].

Legionella and free-living amoebae may be present simultaneously in aquatic environments, hot systems and cooling towers, thus, free-living amoebae may play a role in the amplification and protection of *Legionella* and could act as a vector in the transmission of Legionnaires' disease [Declerck et al., 2007]).

Amoebae can represent a shield for *Legionella* against disinfection treatment (e. g. chemicals biocides). Previous data shows that amoebae have resistance to a variety of biocides (additional information in page 9) and therefore protect the *Legionella*.