



Legionella Control in Cooling Towers

History

Legionella was first discovered in 1976 at an American Legion Convention at the Bellevue Stratford Hotel in Philadelphia. Over 200 people contracted what is now known as legionnaires disease and 34 attendees died as a result of infection with the bacterium. There have been numerous outbreaks since the original one in 1976 and most of the outbreaks have been linked to cooling towers. Various studies have shown that 40 to 60% of cooling towers contain *Legionella*.

Legionella pneumophila, the causative agent of legionnaires disease, infects over 25,000 people per year and is responsible for over 4,000 deaths annually. Individuals that smoke, have respiratory problems, are immune compromised or are elderly are particularly susceptible to the disease, which is most often contracted through inhalation of contaminated aerosols.

Ecology

Legionella pneumophila is an aerobic, gram-negative bacteria that is ubiquitous in nature and can be found in almost every ground and surface water. Cooling towers in particular represent an ideal environment for growth of the organism. *Legionella* can grow particularly well in environments where there is sludge, sediment, scale and organic materials, especially biofilms present. Rapid proliferation of the microbe is promoted by the presence of amoebae, which serve as a host for the organism and can aid in shielding it from biocidal treatments. Stagnant water areas with temperatures in the 68°F to 113°F are optimal conditions for growth.

Control

It is generally recommended to maintain a system with a halogen application having a continuous residual of at least 0.1 ppm to 0.3

ppm bromine or 0.3 ppm to 0.5 ppm chlorine for proper control. Traditional scale inhibitors such as polymers, phosphonates and phosphates can enhance the effectiveness of the biocidal treatments by removing scale layers that may harbor *Legionella*. If a *Legionella* issue is present in the system, treatment with a glutaraldehyde product is most preferred for effective remediation.

To the greatest extent possible, water stagnation and process leaks need to be minimized as well.

System Monitoring

It is imperative that cooling tower systems have regular monitoring in order to control *Legionella*. The cleanliness of the system and effectiveness of the biocidal control should be evaluated by visual inspection as well as through routine monitoring of the planktonic and sessile microbial populations. It is generally recommended to target planktonic counts in bulk water of < 10,000 CFU/mL and sessile counts from surfaces of < 100,000 CFU/cm² with no higher life forms observed under microscopic inspection from either parameter. Testing specifically for *L. pneumophila* in cooling tower waters and domestic hot water heaters should be performed at least quarterly.

The Cooling Tower Institute Guideline indicates that “a low *Legionella* count with an undetectable or small population of amoebae/protozoa (higher life forms) and low biofilm counts (low sessile bacteria numbers) is a good indication of a clean, well-maintained system with low risk to health.”