Legionella Risk Minimization for Your Cooling Towers
By Rose Lagrimas, Garratt-Callahan Company

With cooling season in full swing, there’s no better time to discuss *Legionella* awareness and risk minimization. Without a diligent and effective system treatment, your towers are at risk of becoming safe havens for *Legionella*.

While *Legionella* outbreaks are a major concern and can carry hefty consequences, this problem is also one of the most ambiguously addressed issues in the maintenance and management of healthcare facilities. Unfortunately, there is currently no unanimously agreed upon “right way” to approach standards for *Legionella* prevention and risk minimization.

Various government agencies and professional organizations in different segments of the water treatment industry have established their position and guidelines for *Legionella* Risk Minimization Management. The entire industry is also anticipating the release of the new ASHRAE Standard SPC 188P, which is expected to be adapted by many of these agencies. However, until it is approved and published, the current obscurity surrounding *Legionella* risk minimization can lead to confusion and frustration on the part of those responsible for keeping their facilities safe. For this reason, the main focus of this article is to review the most common and popular guidelines from industry organizations.

This article is not intended to advocate or recommend specific guidelines to use, but is meant instead to provide a review and summary of generally recognized and recommended “best possible treatment practices” for cooling systems.
Below are steps that are generally suggested by the CDC, health departments, and industry associations to be incorporated into a cooling tower management plan:

**A. Visual Inspection and Periodic Maintenance** enable you to observe bacterial growth, which is the most obvious indication that there is a biological problem within the system. Scale, sediment and bio-fouling within these systems all support bacterial growth including *Legionella*. A maintenance program preventing scale, sediment, and bio-fouling buildup is essential. Remember, a biologically fouled system will also undermine the corrosion and scale control program.

**B. A Committed Biocide Program** is first on the list of a good maintenance program. While visual inspection is important, you should not rely solely on the appearance of the system’s visible areas as bacteria tend to grow primarily out of sight. Bacteria can be controlled with a good biocide program that includes the use of alternating biocides at the required intervals and at the proper legal dosage. A typical biocide program would consist of the use of an oxidizing biocide (halogen donor) alternated with a non-oxidizing biocide (isothiazolone or glutaraldehyde for example).

Deviations from a committed program will almost certainly lead to biological growth problems. An example of an ineffective program would be constant under-dosing of biocide. This will eventually lead to the bacteria within the system developing a resistance to the biocide that was utilized to destroy them. This kind of situation should be avoided at all costs. Maintain written records detailing the type of biocide used, the frequency of biocide additions, and amount of biocide added.

**C. Bio-Dispersants** play an important role in microbiological control programs, particularly against *Legionella*. These chemicals help to improve biocide performance by penetrating and releasing biofilm deposits from the surfaces into the bulk water. This allows the biocides to work more effectively in killing or inhibiting the bacteria since they are now free floating in the water. These bacteria can either be those that contribute to biofilm formation and/or those, like *Legionella*, that use the biofilm as their shelter for proliferation.

**D. A Cleaning Schedule** is essential to a good maintenance program. Debris entering the system can include pollen, insect bodies, feathers, plant parts, and other materials. These promote biological growth, corrosion, and deposit formation. They also tend to neutralize treatment chemicals and must be controlled for the treatment to work effectively.

Keep the tower clean of dirt and other environmental debris via routine manual cleaning. Cooling towers should be shut down and manually cleaned at least twice a year. If the cooling tower receives a high organic load, more frequent cleaning may be required. Perform manual cleaning just before the cooling season starts and at the end
of the cooling season in the fall. Any system that has been off line for an extended period of time must be cleaned before it is brought back on line. Clean new systems before going on line to remove construction debris left within the system. Keep records with dates of all manual cleanings and calendar accordingly.

E. **Periodic Disinfection** of a system is required. This is normally done with a manual cleaning or when there are visible signs of biological fouling. The following chemical disinfection steps were outlined by the Center for Disease Control (L. Sehulster, R.Y. Chinn, *Guidelines for Environmental Infection Control in Health-Care Facilities - Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)*, 2003, Part IV, Appendix C, Section 4.0.):

   a. Turn off the cooling tower fans; keep the make-up water valves open and the recirculation pumps running
   b. Close outdoor air intake vents located within 30 meters of the cooling tower.
   c. Treat the system with an initial Free Residual Chlorine (FRC) of 50 mg/L minimum
   d. Add a dispersant within 15 minutes of chlorine addition
   e. Maintain 10mg/L FRC for 24 hours
   f. Drain and refill the system
   g. Repeat steps c through f at least one more time
   h. Using a brush and water hose, thoroughly clean visible dirt, sediment, sludge, mud or scale from all water-contact areas
   i. Circulate 10 mg/L FRC for one hour, then flush the system until free of all sediment
   j. Refill the system with clean water. Return to service and commence maintenance treatment program

F. **Improve System Design** so that all towers have adequate drift eliminators to minimize the spray created by the action of the water within the tower. It is accepted that the main path of contracting Legionnaire’s Disease is through the inhalation of infected water that has been turned into an aerosol mixture by some kind of mechanical action. Drift eliminators are recommended if the system does not already have them. These are essential to minimize aerosols created when the system is in operation. Side stream filters should be fitted to a system and run continuously. This will help remove particulate matter from the system. Particulate matter is a growth accelerator for bacteria, including *Legionella*. Domestic plumbing systems are well known as the perfect reservoir for bacteria and biofilms where *Legionella* can flourish. The focus on control and prevention in these systems is critical in managing your utility program.
As a note, items B and D are often neglected because of the downtime needed to manually clean systems, and/or if management cannot allocate the man hours. Another problem is that, while biocides should generally be fed at least twice weekly, human error can cause frequently missed doses. The use of automated feeding systems can alleviate this problem. You should also be sure to use pumps that have the proper capacity to introduce the biocide as quickly as possible when a slug dosing program is employed.

While these steps to reducing the risk of a Legionella may be tedious and time-consuming, the effort and resources involved far outweighs that which would be required if an outbreak were to occur. Never has “an ounce of prevention is worth a pound of cure” been truer than when it comes to keeping your system safe by reducing the risk of Legionella.

**Important:** While this serves as a summary review of the guidelines generally agreed upon by several associations, agencies such as the Center for Disease Control (CDC), American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), Cooling Technology Institute (CTI), or the Joint Commission on Accreditation of Health Organizations (JCAHO) should be contacted for additional information on their specific individual recommendations regarding Legionella.

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