

# Cooling Tower Safety and Maintenance

## Aligning Debris Management and Water Treatment Procedures Is Key to Cooling Tower Safety and Efficiency

By Randy Simmons

The following is an important reminder of the need for all companies that use cooling towers, to adopt and keep diligent in their maintenance and water treatment program. Why? because what's at stake is a company's worker health and safety, the company's reputation and operational efficiency; these can be dramatically affected by the unsafe condition of a single cooling tower.

In 2001 a major worldwide auto manufacturer experienced a tragedy when four of its facilities maintenance employees became ill with pneumonia-like symptoms that ultimately claimed the lives of two. The cause -

Legionnaires Disease caused by the Legionella bacteria found in one of the manufacturers process cooling towers. The company quickly moved to conduct a "cause analysis" by inspecting its cooling towers worldwide to identify how systems were being maintained and to determine best maintenance practices. This ultimately led to the establishment of a world class monitoring and maintenance procedure that ensures such a tragedy will never be repeated at the company.

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### How a Legionella Tragedy Can Happen

Interestingly, when someone becomes ill from an unsafe cooling tower it most often is *not* the result of a company's blatant negligence; rather, it's typically the result of a company not having a clear understanding of the need for their water treatment program to be in alignment with an effective debris management and cooling tower maintenance program. While it may seem obvious that if the amount of debris inside of a cooling tower exceeds the established biocide dosage, the demand placed on the dosage will quickly be consumed and will have little impact on the bioactivity. In other words, the debris and bioactivity occurring in a cooling tower can overwhelm the chemical dosage. It is well known and important to remember that cooling towers are highly efficient air scrubbers; anything drifting past a cooling tower is likely to get caught in its draft and be sucked-in.

When organic debris such as cottonwood seed, leaves, insects, pollen, grass, birds and their droppings, etc. get into the water and decompose, it along with the relatively warm temperatures of the water create a nutrient rich environment for bacterial growth including Legionella. Further, it's important to recognize that if the volume of decomposing debris exceeds the chemical dosage's ability to provide control, the cooling tower will silently grow dangerous even while chemical dosing continues. The fact of the matter is that it's easy for companies to develop a false sense of security that their cooling towers are safe either because they are treating the water themselves or, because they've hired a water treatment service to establish dosage levels that should ensure the tower is safe. In either case, if organic debris management isn't in alignment with water treatment dosage levels and made integral to the maintenance process, there is an increased probability of the tower becoming a health and safety hazard. It doesn't matter how large or small a company or a cooling tower is; bacteria including Legionella doesn't discriminate - it will thrive in any poorly managed cooling tower!



## An Obvious Question



This photo shows serious maintenance neglect. Tower has high organic content and heavy scaling. This tower is a health and safety hazard.

"What is the needed ratio of water treatment chemicals to that of debris load inside the cooling tower to ensure cooling tower safety?" Although the question is obvious, the answer isn't. Organic debris is drawn into cooling towers in different concentrations depending upon location and time of year. Every type of debris places a different demand upon the biocides and scale inhibitors being dosed into the water; therefore, there is no known ratio that will hold constant for every cooling tower. However, it is safe to say that if you don't deploy diligent maintenance procedures that specifically call for the prevention of organic debris from getting into the cooling tower or its periodic removal, more water treatment

chemicals will be required to keep it safe. Some may say, "Load the tower up with chemicals to ensure safety", however, federal and state EPA guidelines place restrictions on the amount and type of chemicals that can be used, therefore the use of chemical treatment alone is not the solution. Furthermore, adding chemicals to offset poor maintenance practices is a shortcut that will do little to prevent fouling and clogging of the fill, strainers, blow down valves, chiller and heat exchangers and could eventually lead to health and safety problems and a reduction in equipment performance. Although the answer to the *chemical ratio to debris* question isn't apparent, the answer to how to keep a safe cooling tower is crystal clear and can be simply stated - **"Keep the cooling tower free of debris and deploy a good water treatment program and your cooling tower will operate safely and efficiently."** This may sound like an over simplification, but in reality if you keep the debris out of the cooling tower, you will break the bacteria supporting food chain. Additionally, when you chemically treat the water you create an environment non-conducive to bacteria habitation. In short, when you eliminate food and shelter for bacteria it won't take-up residence in your cooling tower!

## How to Keep a Safe Cooling Tower

In recent years ASHRAE has established excellent recommendations for cooling tower maintenance known as Guideline 12. In addition to recommending maintenance activities, it also calls for establishing procedures that are measurable. Although ASHRAE guidelines are excellent, companies must ultimately weigh the operational and economic realities of any maintenance procedure they deploy. As the old saying goes "There's more than one way to skin a cat". If on the one hand maintenance procedures are too frequent, cumbersome or complex, it commonly results in more downtime, lost productivity and higher maintenance costs. Furthermore, the natural human tendency is to take shortcuts to quickly complete an unpleasant job - often times with

unsatisfactory results. Conversely, if the intervals between maintenance are too long, it may be more cost effective, but the condition of the cooling tower at each interval may be less than desirable and potentially place maintenance workers, employees, tenants and the public at risk. So the answer largely lies somewhere in the middle where water treatment and managing debris



Legionella as found in cooling towers and boiler systems

Photo Compliments of  
Centers for Disease Control



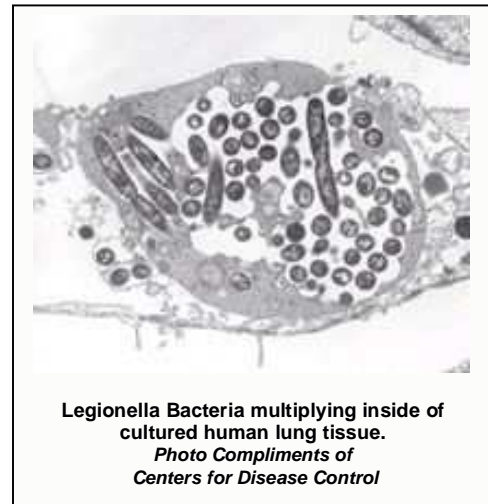
in the tower come together. Today, companies have many options available to them for managing debris; they include a variety of water based filtration technologies and air intake filtration technology. Water filtration can help manage waterborne and other debris after it gets into the cooling water while Air intake filtration technology is highly effective at stopping airborne debris from getting into the tower by filtering the air as it enters the system. . Furthermore, air intake filtration can be used in glycol based cooling systems and on other air-cooled condenser systems to keep airborne debris

out of the coils, enabling optimal cooling efficiency.

When determining what maintenance and debris management technology to use, it is important to first determine what the source of debris is. If the source of debris is waterborne (e.g.; sediment, algae from pond or river, or water with high dissolved solids content), water filtration in combination with a good water treatment program is typically the best solution and will protect the chiller and heat exchanger from scaling and fouling. If on the other hand, the source of debris is airborne related (cottonwood seed, insects, leaves, pine needles, paper, birds & droppings, harvest chaff, construction debris, etc), then water filtration systems will not stop the debris from getting into the cooling tower (especially the fill). For airborne debris related problems, the best solution is to prevent the debris from getting into the system by using air intake filtration technology that filters the air as it enters the system. Air intake filtration in combination with a good water treatment program is highly effective in stopping the kind of debris that clogs strainers, blow down valves, fill, chillers and heat exchangers - In short, air intake filtration effectively protects the entire system. In extreme cases where both waterborne and airborne debris is problematic, both air intake filtration and water filtration in combination with a good water treatment program may be required in order to keep the cooling tower safe and operating efficiently.

### Personal Safety

No matter what procedures are adopted in maintaining cooling towers, personal safety precautions must be integral to the maintenance procedures. Best practices require workers to wear respirators, gloves and protective clothing to help prevent exposure to bacteria, especially Legionella. *Important Note:* cooling water doesn't have to look dirty to be dangerous - just because the water is clear doesn't mean it's clean or free of bacteria - Every cooling tower can harbor bacteria. *Always, always* take precautions because unless the water is routinely tested for Legionella and other bacteria, the bacteria will never announce its presence until it's too late.



Legionella Bacteria multiplying inside of cultured human lung tissue.  
Photo Compliments of Centers for Disease Control

### Consider the Costs of a Sick Tower

Companies that don't take appropriate precautions and insist upon diligent cooling tower maintenance procedures put not only their employee's health and safety at risk, but also their business and reputation. Consider the cost of a single cooling tower related Legionella incident:

- Reduced employee moral and productivity due to an unsafe work environment.
- Negative customer perceptions of the company and their willingness to buy goods & services should a Legionella outbreak become public. (especially risky for food and related processors)

- Loss of income to families when a loved one becomes ill or dies from Legionella.
- High cost for litigation which can follow.
- Higher company insurance costs when claims due to job related sickness or death occur.

In comparison to the cost of a proactive maintenance initiative, the incidents listed above when considered individually or collectively carry staggering cost.

### **Follow a Leader**

So you may be wondering exactly how the major automotive company mentioned at the beginning took a tragic situation and turned it into a world-class maintenance program. They formed an oversight committee sponsored by executive management that was charged with the responsibility of working with consultants, water treatment professionals and maintenance employees to establish a global water management program that encompasses specific maintenance tasks, maintenance methods & procedures, maintenance schedules, management accountabilities and reporting guidelines at the facility level. The representative at each facility is accountable to a regional representative who reports activities and results to the oversight committee. The establishment of the oversight committee and its global management network ensures uniformity of their program plus, gives the company a vehicle to quickly implement changes and enhancements that provide continuous improvement to their global water management program.

### **It Doesn't Take Rocket Science**

It simply requires that companies using cooling towers "step-up to the plate" and initiate proactive and on-going maintenance procedures that align effective debris management technology with effective water testing and treatment techniques because when these elements are in alignment, the result is a safe, healthy and efficient operation.

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