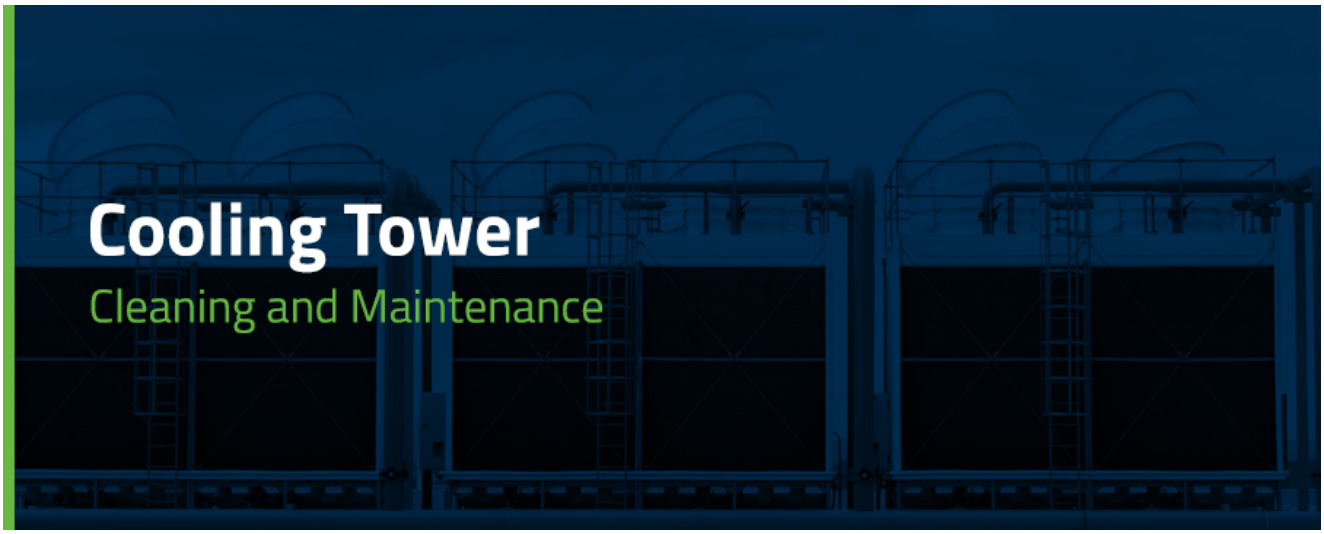
Cooling Towers: How To Clean and Maintain Your System

Cooling Tower Cleaning and Maintenance



Keeping your cooling towers (https://www.chardonlabs.com/cooling-towers/) operating properly requires regular cleaning and maintenance to prevent microorganism growth. Unless you currently have a maintenance plan that includes cleaning, you are not doing enough to keep your tower working as it should. In addition to harboring bacteria, dirty cooling towers can draw debris through piping, reducing the efficiency of the entire system. Learn about the benefits of cleaning your cooling tower and how to do so below.

Why You Should Clean Your Cooling Tower

Cleaning your cooling tower and treating the water inside will prevent damage from happening to your entire system (https://www.chardonlabs.com/resources/why-clean-cooling-towers/) due to clogs and corrosion. Even if you regularly have the water treated, you still need to clean the tower to help keep the system free of bacteria and microbes.

If you drain your towers in the winter due to a reduced need for them, plan one of your two annual cleanings for then to get the most efficient use from your system when you refill the tower when warmer conditions return. Even if you use the towers all year long, you will still need to plan biannual cleanings to prevent fouling that could damage the system.

You will also need to clean and treat the water for your cooling tower if you have a new system. Shipping and installation of the tower components could cause damage or leave materials (https://www.chardonlabs.com/cooling-towers/#link7) on the surfaces that lead to corrosion. Cleaning removes these from the surfaces and prepares the tower for the treated water.

1. Prevent Microorganism Growth

Microbial growth causes numerous problems for your system and your employees. In warm conditions, bacteria and algae proliferate in uncleaned water. Biofilm, a physical film filled with bacteria, can cause micro-biologically influenced corrosion, and these mats of bacteria can also harbor disease-causing microbes, such as *Legionella.* In addition to ongoing use of a bio-dispersant to break up this biofilm layer, a cooling tower cleaning can protect your system from these problems.

The United States Occupational Safety and Health Administration (OSHA) recommends cleaning your cooling tower at least twice a year (https://www.osha.gov/SLTC/legionnairesdisease/control_prevention.html#cooling) to prevent the growth of the potentially deadly *Legionella* bacteria. Following this schedule is critical because most evaporative cooling towers maintain warm water at the ideal temperature for bacterial growth, between 68 degrees Fahrenheit and 122 degrees Fahrenheit. Additionally, due to the evaporation of water into the air nearby, workers in the area could breathe in *Legionella* bacteria, putting them at risk for the disease.

The bacteria *Legionella* causes Legionnaire's Disease and Pontiac Fever. These conditions do not pass between people. Instead, individuals contract it by breathing in the bacteria through

aerosolized water (https://www.osha.gov/SLTC/legionnairesdisease/medical_information.html). Because these diseases can result in death, careful cleaning of your system and treating its water could save lives.

2. Reduce Water Treatment Costs

Not cleaning your system regularly will require more frequent treatments to keep the water clean. Increasing the number of treatments will cut into your budget by adding more costs to maintenance. Skipping cleaning does not save you money, but it will cost you more in repairing damage to the system, inefficient operation and getting more water treatments.

If you start with a clean system, the water treatment will be more effective in preventing corrosion, bacteria, and scale. Your system will also operate much more efficiently, which will also save you money.

3. Prevent Scale Deposits

Cleaning your system and treating the water prevents solid minerals from depositing throughout the system. Scale buildup can reduce water flow, impede cooling and make the system less efficient.

Scale and corrosion occur through natural evaporation of the water used in the system. When water evaporates, it leaves behind any minerals that were in it as solids. Over time, these solids will increase in volume (https://www.epa.gov/sites/production/files/2017-12/documents/ws-commercialbuildings-waterscore-mechanical-systems-guide.pdf#page=4) and sink to the interior surfaces of the cooling towers and system, creating scale and corrosion. Corrosion and scale decrease the efficiency of the system, which is why preventing them through water treatment and tower cleaning is so critical.

Why It's Important to Treat Water in a Cooling Tower

Treating the water in your cooling towers does more than just keep the system clean. It also prevents corrosion and scale formation as well as microbial growth. Without treatment, bacteria and algae will take over, leading to corrosion from bacterial acids and many other issues throughout your

system.

Scale formation and corrosion can lead to physical damage to the tower or its components. While a clean tower can prevent corrosion and scale from using the same water, only through treating the water can you avoid problems of pH imbalances, which can ruin the interior of the system.

When the pH is too high, it can indicate the presence of dissolved carbonates and bicarbonates in the water (https://www.energy.gov/eere/femp/best-management-practice-10-cooling-tower-management), which leads to scale. However, a pH that's too low indicates acidic water that can cause corrosion, pitting or etching of metal components. Professional water treatment will ensure the correct pH to keep the system running optimally.

Water treatment is not a one-time task. Regular care of the water chemistry is required because the products used to prevent bacterial growth and maintain a proper pH need to be continually injected and maintained. The half-life of biocides depends on the product, but these substances, along with scale inhibitors, (https://www.chardonlabs.com/resources/why-clean-cooling-towers/) both need a consistent feed. Discuss the precise interval with your water treatment experts for optimum efficiency.

How to Clean Your Cooling Tower

The process of cleaning a cooling tower helps remove any existing microbes and scale from the system to prepare it for use. In fact, if you go through a cooling tower troubleshooting list and notice debris, scale or corrosion in the tower, the deposits could be the source of your problem. Cleaning the system will fix it.

1. Chlorinate

You have several options for chemical disinfection that can prevent *Legionella* and other bacterial growth. The Centers for Disease Control (CDC) offers tips for making the disinfecting solution to create the necessary free residual chlorine (FRC) level, 50 mg/L (https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/water.html#c4), to keep bacteria at bay.

- Industrial-strength sodium hypochlorite (NaOCl) with 13% to 15% chlorine: Use 3 pounds per 1,000 gallons of water
- NaOCl with 3% to 5% chlorine: Use 10.5 pounds per 1,000 gallons of water
- Calcium hypochlorite (Ca[OCl]) (https://www.chardonlabs.com/oxidizing-biocides/): Use 0.6 pounds per 1,000 gallons of water

Add 10 to 25 pounds per 1,000 gallons of water of automatic dishwashing detergent within 15 minutes of adding the disinfectant. The detergent will help to disperse the disinfectants. Let the chlorinated water remain in the

After letting the water stand for a day, you will drain the system, refill and repeat the disinfecting process. Complete disinfection with a final draining before you begin the mechanical cleaning procedures of scrubbing out components of the tower.

2. Clean the Hot Deck

Clean off the hot deck, including any orifices and nozzles, to remove scale deposits, sediments and bacteria. Cleaning these areas will prevent any debris from contaminating the water after cleaning and treatment. When removing surface deposits on the hot deck, nozzles and orifices, use low-pressure water spray from a hose or a brush (https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/water.html#c4). These items offer the toughness needed for cleaning without damaging the equipment.

While cleaning, if you notice any damaged or missing nozzles, replace them before refilling the tower. Missing nozzles will reduce the tower's heat exchange efficiency (https://www.energy.gov/sites/prod/files/2013/10/f3/waterfs_coolingtowers.pdf#page=2) by reducing the flow of water to the hot deck and through the cooling system.

3. Disinfect Tower Basin and Fan Housing

Disinfecting the tower basin and fan housing prevent bacteria from distributing over the water and becoming aerated. Preventing bacteria from aerating is a critical method to prevent *Legionella* from growing and spreading to those nearby.

This bacteria spreads through the air, and people can inhale the aerosolized particles (https://www.osha.gov/SLTC/legionnairesdisease/medical_information.html). When water with the bacteria blows off the tower, it can take *Legionella* with it, potentially sickening people downwind with Legionnaire's Disease or Pontiac Fever. Properly disinfecting the tower keeps those nearby healthy while improving your tower's efficiency.

4. Open and Clean the Distribution Pans

Open all distribution pans. As with other parts, clean off any sludge, scale, sediments or biofilm. Check for any damaged or missing parts and make repairs or replacements as necessary before moving on.

5. Clean Tower Surfaces and Basin

The surfaces of the tower can also harbor bacteria that deposit onto the surfaces from the cooling water or from the atmosphere. Clean off all surfaces and the basin. Disinfect any surfaces that contacted water.

6. Vacuum the Tower Sump

Vacuum out the tower sump to remove anything that you could not drain out. A vacuum also allows you to remove debris and sludge from areas at times when you may not be able to drain the entire cooling tower.

7. Dispose of Debris

Properly dispose of any debris collected from the cleaning process. You should be able to drain the cooling tower water into the sanitary sewer (https://www.cdc.gov/infectioncontrol/guidelines

/environmental/appendix/water.html#c4) but check with local wastewater disposal laws for any exceptions. Also, check with your local municipality for rules for disposing of any solid debris you may have collected during the cleaning of your tower, such as damaged parts or sludge.

Tips for Developing a Cooling Tower Maintenance Plan

To achieve optimum operation of your cooling tower, regular cleaning of the tower and treatment of the water should be parts of a total maintenance plan. You must calculate water replacement, find ways to reduce it, keep up the coils and expand water sources for cooling. These steps will make your system last longer, run better and help reduce your tower's impact on the environment.

1. Calculate and Understand "Cycles of Concentration"

The cycles of concentration refer to the ratio of the total dissolved solids in the blowdown water (https://www.epa.gov/sites/production/files/2017-12/documents/ws-commercialbuildings-waterscore-mechanical-systems-guide.pdf#page=5) to the solids in the makeup water. Another way to look at this formula is that it shows the cycles in terms of conductivity, which comes from the total dissolved solids (TDS). This formula is:

Cycles based on TDS = TDS of blowdown water ÷ TDS of makeup water

Another way to calculate these cycles is by looking only at the volume of blowdown and makeup water. This method works because the total dissolved solids enter the system via makeup and leave through the blowdown water. Dividing makeup water volume by the blowdown volume will also give you the cycles of concentration based on water.

Cycles based on water = Makeup water volume ÷ Blowdown water volume

Ideally, you want to maximize the cycles of concentration but not make the amount so high that the TDS leads to scale deposits. The majority of cooling towers have cycles between two and four, but if you increase from three to six, you can potentially cut makeup water by 20% (https://www.energy.gov/eere/femp/best-management-practice-10-cooling-tower-management) and blowdown by 50%.

To reduce water usage and maximize the cycles of concentration, reduce the blowdown water as much as possible, which leads to a decrease in the amount of water needed for making up the lost volume.

2. Focus on Minimizing Water Loss and Waste

Reducing water loss and waste lowers your tower's impact on the environment. Reusing water and reducing the amount you need will help to maximize cycles of concentration. However, you can only use recycled water that adheres to your tower's required chemistry to prevent bacteria, scale and corrosion.

3. Develop an Air Handler Coil Maintenance Program

Regularly check the coils of the air handler for signs of scale, sludge or corrosion. Dirty or damaged coils will reduce the efficiency of the system. The cooling tower will have a greater load to maintain temperatures (https://www.energy.gov/eere/femp/best-management-practice-10-cooling-tower-management) because the dirt-covered coils do not allow for heat transfer as they should.

Heavier loads put on the cooling tower increase the electricity used and increase the amount of water needed. These wasteful practices will cost you money that you could have saved by keeping the coils clean and cared for.

4. Expand Water Sources for Cooling

Choosing alternative water sources can reduce the amount of municipal water you need, thus

lowering your costs for maintaining the cooling tower and helping the environment.

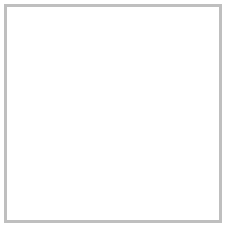
Several alternative water sources include the following (http://mydocs.epri.com/docs/PublicMeetingMaterials/0712/watertreatment_RFI_Final.pdf#page=3):

- Municipal wastewater effluent
- Brackish water
- Blowdown water treated and reused as makeup water
- Moisture recovery from the cooling tower
- Condensate from air handlers, which have a low mineral content (https://www.energy.gov/eere/femp/best-management-practice-10-cooling-tower-management)
- Treated effluent from other processes on site

Get Help With Your Tower Cleaning and Maintenance Concerns

(https://www.chardonlabs.com/contact-us/)

Even with a stellar cleaning regime for your cooling towers, you will still need regular water treatment. At Chardon Labs, our professional technicians will treat your cooling tower water to guarantee a scale-free system at a fixed price. For more information about our water treatment services or help with any questions you have about cleaning your cooling towers, contact us today (https://www.chardonlabs.com/contact-us/).



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Matt Welsh is the Vice President and Water Consultant at Chardon Labs. He helps consult a wide range of customers utilizing various methods of water treatment, from chemical to chemical-free approaches, large and small applications, and across a wide range of geographical influences. With 20 years of water treatment experience, including a wide range of troubleshooting and service in potable water and non-potable HVAC and industrial applications, he is an expert in water treatment chemistry for cooling towers, boilers, and closed-loop systems.

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