The Role of UV in Chemical Free Cooling Tower Treatment

Introduction

Providing cool air for comfort or to keep process water chilled is a vital part of today's industrialized world. Removing heat from these processes is accomplished by passing air over cooling fins or through the evaporation of water. There has been a trend in industry to move away from water towers in favor of air-cooled systems, however, size, efficiency and other factors prevent the industry-wide discontinuation of water-based evaporative cooling systems. These air cooled systems tend to have a higher capital cost, a higher power cost, and are larger and heavier, adding to roof loading. On the cooling tower side of the equation, the cost drivers are:

- the cost of chemicals
- issues with the chemical content of blowdown water
- chemical storage
- maintenance costs
- life of the equipment

Therefore, a cooling system limiting the use of chemicals would provide the greatest benefit.

Make Up Water

The basic process by which a cooling tower removes heat is through the evaporation of water. This lost water needs to be replenished on a regular basis. Traditionally, the supply came primarily from municipal water. With today's emphasis on a reduced water footprint, several other sources have been tapped for this use, each with its own challenges to consider.

- City Water – Bacteria, Hardness
- Condensate – Bacteria
- Well Water – Bacteria, Hardness
- Surface Water – Bacteria, Hardness, Particulates
- Reverse Osmosis (RO) Leachate – Bacteria, Hardness, Particulates, Salts

Figure 1 – Industrial Water Innovation's Cooling Tower Skid, 2 x 8 ft.

Chemical Treatment

Treating cooling tower make up water with chemicals has been the standard process for many years. The chemicals come in many formulations, but they are all designed to provide disinfection, corrosion control, and anti-scaling.

Over the years some of these chemicals have been banned or reformulated, to address their carcinogenic potential. In addition, the chemical load associated with blowdown water has caused issues with wastewater treatment systems, due to the

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interference the high chemical load imposes on digestive bacteria.

The disinfection aspect of the chemicals focuses primarily on the prevention of biofilm. Accumulation of biofilm is associated with reduced efficiency of the cooling tower and an impact on the life of the equipment. The chemicals do not generally control all biofilm, so the removal and control of biofilm is one of the maintenance efforts associated with cooling towers.

A more recent concern with cooling towers is the potential for spreading the legionella spores. The CDC had 6,100 reported cases in 2016, and they feel that the number is significantly under reported, by as much as 50%. The CDC also sponsored a study of cooling towers across the country and found that 84% contained the legionella bacteria. While the spores can enter the system via the atmosphere, it is generally recognized that the major source of the bacteria is the makeup water. The legionella bacteria are harmless if ingested but can lead to legionellosis if inhaled. And cooling towers aerosolize the water containing the bacteria. An additional concern with cooling towers is that legionella can also reside in the biofilm, then becoming a concern when sections sluff off and become part of the circulating water.

UV systems can play a significant role in controlling the legionella pathogen and the buildup of biofilm. While the addition of UV will not eliminate biofilm, the use of UV systems will keep a cooling tower free of pathogens and prevent the buildup of biofilm. ASHRAE recognizes UV as a treatment method for the control of legionella.

Figure 2 – Industrial Water Innovation's Cooling Tower Skid, 4x4 ft.

A Chemical Free Design

Industrial Water Innovations (www.industrialwaterinnovations.com) has assembled a best in class set of technologies into a single cooling tower water treatment skid (Figs. 1 and 2). The system is a small 4x4 or 2x8 skid that includes:

- Filters for debris and removal of the particles absorbed into the tower by action of the draft fan.
- Hardness control equipment, to convert calcite and an optional separate technology for silica.
- UV for disinfection to prevent the buildup of biofilm and address legionella concerns
- Mixing Eductors (located in the sump) to ensure water is directed to the system's intake.

These elements address all the cooling tower water treatment requirements. Also, the system is flexible enough to fit most cooling tower applications and is light enough for roof top installation. The system can be installed in existing or new installations as it works as a side stream application (Fig. 3) and doesn't require the removal of any existing piping. An analysis of the water and atmospheric conditions is required to properly size the system.

The filter is an automatic backflushing poly-disc design that requires no manual cleaning or maintenance and can drastically reduce or even eliminate blowdown in many applications. This process reduces the amount of water consumed to the makeup water to cover evaporation, plus a few gallons for the filter flush

Figure 3 – Inside of Cooling Tower

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Hardness chemicals in water adhere to various surfaces of the cooling system, reducing the cooling efficiency of the system as well as shortening the life of the equipment. There are two main elements that cause this scale buildup, calcium (which is part of the TDS) and silica (which is part of the TSS). The skid employs a separate technology for each of these contaminants, converting them to a harmless crystal, or causing them to stick together, which can be filtered out.

Disinfection of the water is required to prevent the proliferation of biofilm and the potential risk of legionella. The system utilizes our unique ***NeoTech Aqua Solution's*** UV technology.

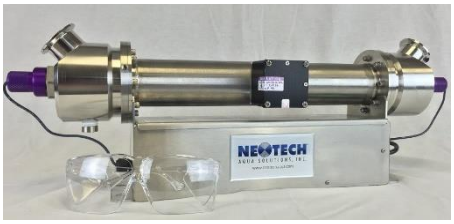

Figure 4 – NeoTech Aqua Solutions, D222

Our UV systems (Fig. 4) are smaller and more efficient than traditional UV, which makes them the ideal solution for the water treatment system. The skid is smaller and easier to maintain, and uses a very small amount of power, as a result.

One of the reasons that many current systems are not properly treated is that some areas in the sump become stagnant. The addition of eductors assures that the entire volume of the sump is treated. The system is designed to circulate the entire volume of the sump a minimum of six times per-hour.

Cost Savings

As a rule of thumb, the ROI of the skid is 1-2 years. Savings come from the following cost elements:

- Elimination or reduction of chemicals
  - Cost of chemicals
  - Storage costs
  - Maintenance personnel training costs
  - Handling costs
  - Permitting costs
- Reduction in electrical costs
- Lower water consumption
- Extended equipment life
- Reduced maintenance effort

Summary

With this innovative technology it is possible to reduce or eliminate the use of chemicals in most applications, resulting in significant cost savings to the cooling tower operator, which makes the decision to use the more efficient water cooling versus air cooling system attractive. The technology addresses four issues associated with cooling towers: biofilm, scale, chemicals, and water use.

The system has been in use for over three years, with just basic maintenance needed for proper operation. The users that have implemented the skid have been amazed by the performance, ease of use, and reduced maintenance effort and cost.

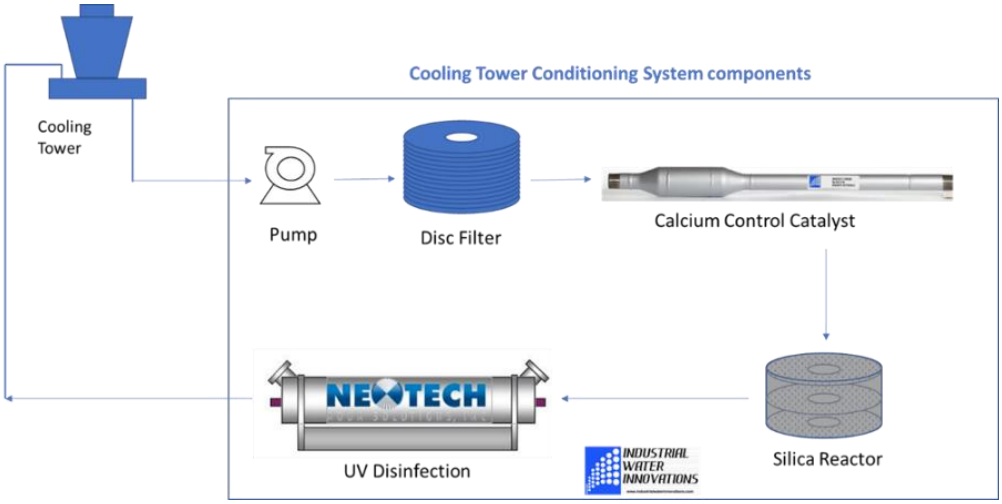

Figure 5 - Cooling Tower Conditioning System Schematic

For more information please contact us at sales@neotechaqua.com or our offices at 858-571-6590 or contact Industrial Water Innovations at sales@industrialwaterinnovations.com or their offices at 480-248-2412.

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