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TECHNICAL PUBLICATION

INFORMATION & STRATEGY FOR THE FACILITY MANAGER

The Importance of Proper Water Distribution in Cooling Towers

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Proper water distribution in cooling towers is essential in the prevention of deposits in the cooling tower fill. Below is a short summary of the common causes of poor water distribution, the concomitant problems, and the preventive measures. This article is based on "induced draft cross flow" type cooling towers, but the concept should also apply to other types.

General vs. Local Deposits

Scale deposits can occur generally or locally. The deposits are said to be "general" if they are occurring all over. The deposits are said to be "local" if they are only occurring in spots. General type deposits are usually caused by poor water treatment. Whereas, localized type deposits on the fill are usually caused by poor water distribution.

Evaporation Concentrates Minerals

Cooling towers are designed to evaporate water to dissipate the heat in the water to the atmosphere. Typically, cooling water is pumped to the distribution basins, where it flows down the cooling tower by gravity, passing through nozzles and fill. The nozzles are designed to disperse the water evenly throughout the fill. The fill is designed to increase the surface area of water to enhance evaporation.

As the water evaporates, it leaves minerals behind, increasing their concentration, and thus increasing their potential to precipitate. With proper water treatment, this precipitation potential can be reduced or prevented. However, even with proper water treatment, if you do not have sufficient water to keep the minerals in solution, the minerals will precipitate. To prevent precipitation and deposition, you must also ensure adequate water distribution.

The following are common causes of inadequate water distribution.

Plugged Nozzles

It is not uncommon to find nozzles plugged with rust chips especially during Spring start-up. The rust chips are caused by corrosion during the Winter lay-up. The corrosion is caused by the lack of post-water treatment prior to taking down the cooling system for lay-up. When the nozzles are plugged up, it reduces flow through the fill. Typically, the nozzles are plugged up randomly. As such, you will have an uneven flow throughout the fill. Certain areas will have a good water flow, while other areas will be barely trickling.

When the cooling tower fan runs, it literally pulls the water towards it. In areas where the water flow is already minimal, this suction force is enough to temporarily pull any remaining water off the fill, leaving a microscopic amount of minerals behind. These microscopic minerals act as nucleation points for new deposits to build on. They act like magnets for other minerals to adhere to. As such, more minerals are precipitated every time the fan cycles on and off. The resulting deposition is usually more pronounced in the outer edges of the fill. This phenomenon is sometimes referred to as the Dryness of Evaporation.

Broken or Missing Nozzles

Distribution basins are equipped with nozzles which aid in dispersing the water evenly over the fill. A broken or missing nozzle will not disperse the water evenly, and will cause the water to "channel" narrowly down the fill, leading to poor water distribution, and thus deposition.

Plugged Strainers

Plugged strainers can also reduce flow. As the flow is reduced, it may not be able to supply enough water to the distribution basins. As such, you will have an insufficient water flow to the farthest ends of the basins, leading to poor water distribution in the fill, and thus deposition.

Microbio Growth on the Fill

Insufficient water flow may also result in insufficient contact with the biocides. In turn, this may indirectly result in localized microbial growth. Microbio can either be bacterial or algal. Because of their slimy cell surfaces, they attract all kinds of silts, either air borne or water treatment induced. As the microbial growth attracts more suspended solids, the water distribution is further restricted.

Summary

In addition to the proper maintenance of the water treatment chemicals in the cooling water, another big part of good water treatment administration is the maintenance of proper water distribution. During operation, you must be diligent in keeping the nozzles free of debris, to ensure proper distribution. The tower must be inspected regularly to ensure that the distribution basins are flooded well, and that the water flow is sufficiently and evenly distributed throughout the fill. The primary cause of plugged nozzles is the presence of rust chips that are generated during the Winter lay-up. To prevent this problem, it is imperative that you implement a proper post-treatment program prior to taking the cooling towers off service.