Cooling Tower Water Distribution Affects Mineral Deposits: Better Distribution = Less Mineral Scale

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Proper water distribution in cooling towers is essential in the prevention of mineral scale and deposits in the cooling tower fill. Following are descriptions of some common causes of poor water distribution, related problems, and preventive measures. While this discussion is based on "induced draft cross flow" type cooling towers, the concept can 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, and are said to be "local" if they are only occurring in spots. General deposits are usually caused by poor water treatment, whereas localized 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 what is called the fill, the labyrinth-like packing below the water distribution decks. The fill disperses the flowing water into a larger surface area to enhance evaporation.

Fill Types

Fills can be splash or filming types. Splash-type fills consist of cascading horizontal bars that break up the down-flowing water into droplets. Film-type fills consist of vertical, corrugated-like plates upon which the down-flowing water spreads or film.

The nozzles are designed to disperse the water evenly throughout the fill, while 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.

Treatment May Not Be Enough

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 common 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 a lack of post-water treatment prior to taking down the cooling system for lay-up.

When the nozzles are plugged, flow is reduced through the fill. Typically, the nozzles are plugged up randomly. If this is the case, you will have an uneven flow throughout the fill. Certain areas will have a good water flow, while other areas will barely trickle.

When the cooling tower fan operates, it literally pulls the water toward 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 upon. With these,

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 that 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 deposition.

Plugged Strainers

Plugged strainers can also reduce flow. As the flow is reduced, it may not supply enough water to the distribution basins. The result will be an insufficient water flow to the farthest ends of the basins, leading to poor water distribution in the fill, and again, mineral deposition.

Microbial 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. Microbiological substances can be bacterial or algal. Because of their slimy cell surfaces, they attract various kinds of silts, either airborne or water treatment-induced. As the microbial growth attracts more suspended solids, the water distribution is further restricted.

Inspect Towers Regularly

In addition to proper maintenance of the water treatment chemicals in the cooling water, another significant area of good water treatment administration is the maintenance of proper water distribution.

During operation, water treatment professionals must be diligent in keeping nozzles free of debris, to ensure proper distribution. In addition, the tower must be inspected regularly to ensure the distribution basins are flooded well and the water flow is sufficiently and evenly distributed throughout the fill.

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