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Improving The Efficiency of Cooling Tower

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Abstract: **Cooling tower are an integral components of many refrigeration systems, providing comfort or process cooling across a broad range of application. They are the point in the system where heat is dissipated to the atmosphere throughout the evaporative processes, and are commonly used in industries such as oil refining, chemical processing, power plants, where process cooling is required. They are also commonly used to provide comfort cooling for large commercial buildings including airport, office building, conference center, hospital, and hotel etc. This project concerns with the efficiency improvement of cooling tower. In this project we suggested the methods to improve the efficiency of cooling tower .The first method is to remove the scaling deposited on the cooling tower .The another method is to improve the efficiency by improving the water quality by various water treatment processes. Then we also use the effective fill design than current fill design of cooling tower.**

Keywords: **Cooling tower, evaporative processes.**

IMPROVING WATER QUALITY IN COOLING TOWER

Cooling tower water treatment can be both chemical and physical. New physical treatment systems based on electromagnetic energy are presenting opportunities to manage cooling tower water quality without dependence on chemical systems. Because of CDPH's requirements for biocide addition to recycled water used in cooling towers, combined systems that use physical treatment for corrosion and depositional control and chemical treatment for microbiological control can provide an effective "hybrid" system

•Chemical Treatment:

It is most common for chemical treatment programs to be used for controlling corrosion, deposition, and microbiological growths. Prior to installing a chemical treatment system, or introducing a new chemical treatment agent, contact your local fire department's hazardous materials unit for regulatory, reporting, and permitting requirements.

•Corrosion Control (Inhibitors):

Corrosion is an electrochemical process in which metals are oxidized by transferring electron from an anodic site to a cathodic site. Cathodic inhibitors reduce the amount of cathodic surface available and anodic inhibitors reduce the amount of anodic surface available. Sometimes both types of inhibitors are needed to prevent corrosion. Phosphates, zinc salts, moly dates, and polysilicates, while organic nitrogen based compounds (azoles) are copper alloy corrosion inhibitors.

•Deposition Control:

Several different types of deposits can form in cooling water systems, necessitating different approaches for control:

•Depositional Inhibitor Control focuses on either solubilizing agents to prevent scale from Precipitating or crystal modifiers to alter the nature of precipitate to prevent adhesion to surfaces.

•Dispersants and Surfactants are charged molecules that adsorb suspended solids and cause a mutual repulsion, which keeps solids as smaller particles.

• Acid, Phosphonates and Water-Soluble Polymers are typical mineral scale inhibitors.

Deposition control is particularly critical in systems with high levels of calcium hardness.

•Microbiological Growth Controls:

The hydroxyl radicals, hydrogen peroxide and hypochlorite (bleach), and chlorine gas are oxidizer that kills microbiological growth. CDPH requires the use of microbiological growth controls when recycled water is used for cooling tower applications

The table below illustrates common conditioning chemicals, their use and their recommended maximum concentrations.

Conditioning Chemical Additives:

Conditioning Chemical	Use	Recommended Maximum Concentration
Organophosphates (phosphates)	Control scaling for steel	20 mg/l as PO4
Orthophosphates, Polyphosphates	Inhibit corrosion and control scaling	20 mg/l as PO4
Sodium silicate	Inhibit corrosion	100 mg/l as SiO2
Aromatic triazoles	Inhibit corrosion	2-4 mg/l
Molybdates	Inhibit corrosion	40 mg/l as molybdenum
Non-Oxidizing Biocides such as: Isothialozin Dibromoitrilopropionamide Quaternary amines	Inhibit biological growth	See notes
Oxidizing Biocides Chlorine Bromine	Inhibit biological growth	0.5 mg/l

Physical Treatment (Electromagnetic Systems):

The operating principles of these devices are based on four essential methods of action: electromagnetic signal; interaction of the induced electric field with colloidal particles; control of microbial populations; and corrosion control. Pulsed-power systems work by changing how calcium carbonate and other dissolved minerals precipitate from solution. Pulsed power field activate colloidal nucleation sites in the bulk solution. These activated sites become the preferential nucleation sites for precipitation. The amorphous precipitate, generated by a pulsed-power system, does not adhere to the pipe wall but remain with the bulk solution and is removed via blow down and/or side-stream filtration. The systems use colloidal science instead of inorganic chemistry to control scaling.

Pulsed power systems are a bacteriostatic product rather than a true bactericide. Although the bacteria are not killed, they are controlled through two mechanisms. The first relates to the well-established effect in water treatment that coagulation and calcium carbonate precipitation will result in a microbial reduction. The second mechanism involves sub-lethal injury that controls bacteria even when there is no precipitation occurring. This mechanism is based on the interaction of the low frequency radiation generated by the pulsing with the bacteria. In California, CDPH requires that biocides be used in cooling towers with recycled water feed water regardless.

Corrosion inhibition is accomplished indirectly by maintaining sufficient cycles of concentration to force the system into the alkaline mode at the saturation point of calcium carbonate, which is a cathodic corrosion inhibitor. In this type of water system, the expected corrosion rate on mild steel is 2 to 5 mils per year (mpy). The Cooling Technology Institute Guideline WTP-130 lists corrosion rates in cooling towers on mild steel of 2 to 5 mpy as “good” and 0 to 2 mpy as “excellent”. In many municipal water systems, phosphates or silicates are used as corrosion inhibitors to meet EPA’s copper/lead requirements. Where these systems are cycled up, the corrosion rate on mild steel is typically less than 2.0 mpy.

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