SofTek tm

A Patented, Safe, and Environmentally Responsible Technology to Minimize Cooling Tower Water Use and Eliminate Scale

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Background

Shortages of fresh water and increased costs for both makeup water and blowdown disposal have created a need to increase the cycles of concentration (COC) in cooling tower systems, which decrease both fresh water makeup and blowdown to sewer. Unfortunately, increased COC also increases the concentration of hardness ions in the cooling water, making the cycled waters highly scale forming. Formation of hardness scale in heat exchangers is unwanted, as even a small amount of scale will decrease the efficiency of heat transfer, resulting in increased power consumption for chiller operation and decreased productivity in industrial processes. In severe cases, scale can completely plug heat exchangers and piping.


Scale

Many facilities, having only hard water sources for makeup, have always confronted the problem of scale control. Typically, hardness scale has been controlled via use of chemical inhibitors, with or without acid addition for pH adjustment. This technology is not always effective, can be extremely costly, risks severe equipment damage due to corrosion with use of acid for pH control, and presents a safety hazard to operating personnel with acid use.

Cooling tower blowdown is often the major water use in many facilities as all blowdown from cooling tower operation must be replaced with fresh makeup water. It is also costly as blowdown carries three costs: purchase price of the water, a sewerage charge for disposal, and the cost of the chemical inhibitor treatment. The volumes can be substantial, for instance, a 1000 ton rated cooling tower running at twice the makeup dissolved solids level (COC = 2) will evaporate 26,550 gallons per day (gpd) with a blowdown of 26,550 gpd. If the dissolved solids concentration is increased to four times (COC = 4) the makeup water level, the blowdown would be reduced to 8,867 gpd. The equations are:

evaporation = tons cooling x 26.55 gpd blowdown = evaporation/COC-1

With conventional, excluding our patented HighCycle technology, non-acid hard makeup water treatment technology, cooling towers can generally be operated at maximum COC values between 2 and 4, based on the makeup water quality due to scale problems if these values are exceeded.

A proven technology, which addresses the need for increased COC while avoiding scale problems, is to soften (cation exchange) the makeup water, removing the scale forming ions prior to use. The problem most often cited in opposition to use of this technology is the **increased corrosivity of cycled, softened water.**

Technology

Operation of cooling towers with softened makeup water was started in 1984 at Brockway Glass Company in a successful program, directed by Timothy Keister, to control scale in extremely high heat flux furnace electrode cooling jackets. ProChemTech International has further developed and refined this ground breaking technology into a complete patented* water management technology, **SofTek,** which addresses the need for increased COC while maintaining control of scale, deposition, and corrosion at a reasonable cost.

Glass Plant

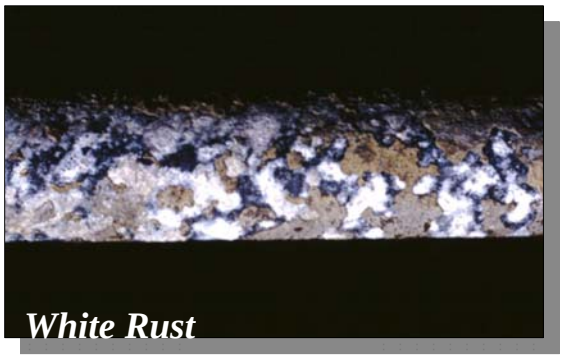
The benefits of this technology are immediately obvious to facilities that have suffered from the problems caused by scale formation in cooling systems or the corrosion damage resultant from upsets in acid feed pH control systems. Use of softened water immediately eliminates the scale potential of the cooling water, rendering it non-scale forming, while completely eliminating any further need for pH control via feed of corrosive, dangerous to handle acids.

With elimination of the potential for scale formation, cooling towers can be operated at much higher COC, generally eight (8) to ten (10), limited mainly by the potential for deposition from solids in the cooling tower air intake. Water savings are substantial; using our previous example of a 1000 ton cooling tower operating at a COC of thee (3), blowdown would be 13,275 gpd. Going to a SofTek program operating at a COC of eight (8) will reduce the blowdown to just 3,793 gpd, **a reduction of 3,460,930 gpy, a substantial amount of water.**

Corrosion Control

Cycled soft water is much more corrosive than hard water and the water management program must provide superior corrosion control chemistry. ProChemTech has developed an entire family of cost effective, patented, SofTek products that control corrosion of ferrous, galvanize, aluminum, zinc, and yellow metals in a soft water environment. Cooling towers using soft water makeup and SofTek chemical technology routinely operate at steel corrosion rates below 2 mil/yr, often attaining rates between 0.25 and 0.5 mil/yr. This performance exceeds that which can be achieved using conventional scale and corrosion control technology with hard water makeup.

"White Rust", an accelerated corrosion of zinc (galvanize), and its alloys, due to chemical attack by high pH/high alkalinity waters, is recognized as a major problem with high COC operation of cooling systems in any area with alkaline makeup waters. Softening hard water actually makes the problem worse; replacing hardness ions with sodium makes the water substantially more corrosive to zinc and its alloys.



White Rust

Our discovery of a proprietary chemical inhibitor to control white rust, **"ZincGard tm",** permits use of softened, high alkalinity waters as makeup water in galvanized cooling towers.

Deposition Control
SofTek products incorporate the latest developments in deposition control, being formulated with dispersant surfactants and terpolymer. Operation of many cooling systems, using softened makeup water since 1984, has demonstrated operation at COC from eight (8) to ten (10) as optimum for control of deposition via dispersants and blowdown. .

For operation of cooling towers at COC higher than 10, up to **zero blowdown**, we utilize multimedia pressure filters, operated in a side stream mode, to remove the suspended solids that cause deposition from the cooling water by filtration. These automatic backwashing units are designed to turn over the volume of cooling water in the cooling tower in 12 to 24 hours.

Biological Control
We have found that use of a single oxidizing biocide is sufficient to establish excellent control of microorganisms in almost all cooling tower systems. Since cycled soft water is generally also high pH, from 8.0 to as high as 9.8, the oxidizing biocide of choice is bromine.

ElectroBrom Unit

Our preferred method of bromine delivery, due to low operating cost and the complete absence of hazardous materials, is our patented* electrolytic bromine technology. We have developed three electrolytic bromine generators; the **SSBrom** is a side stream unit which requires no chemical feed and is suitable for systems up to 75,000 gallons in volume. The **MiniBrom** and **ElectroBrom** generators utilize a concentrated feed stream for electrolysis and can be specified to handle any size cooling tower system up to 2,000 MW power stations. In the event that capital cost must be minimized, our USEPA registered liquid stabilized bromine, PCT 3026, can be utilized in existing chemical control and feed equipment.

System Control
We specify use of automated conductivity controllers for control of blowdown with either the makeup proportional method or a direct measurement technique, such as our patented* **BlueTrak**, employed to control inhibitor feed. Biocide addition is generally on a timed feed basis. The common "bleed-feed" control method of adding inhibitors based on blowdown is not recommended for use with a SofTek program due to generally inaccurate feed of inhibitor. BlueTrak technology has been licensed to Advantage Controls and is available as an option on MegaTron and 2EZ controllers.

Use of Reclaimed Water as Makeup

Reclaimed water, highly treated effluent from publically owned treatment works, is now becoming available in many of the water restricted areas of the country. While use of such water as cooling tower makeup replaces use of fresh water, the maximum COC that can be obtained is often restricted by the presence of phosphate and degradable organics.

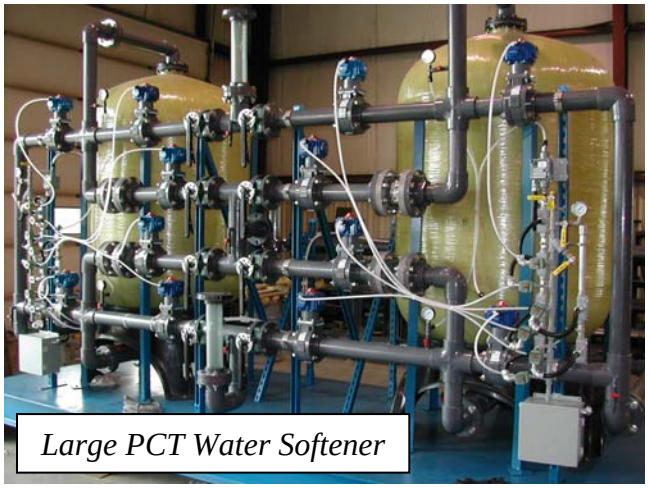
Phosphate

Calcium phosphate readily forms a scale when calcium and phosphate are present in the makeup water to a cooling tower and is difficult to control. Softening the reclaimed makeup water eliminates the calcium and removes the limit imposed on COC by potential calcium phosphate precipitation.

Degradable Organics

Reclaimed water contains substantially higher levels of biodegradable organics plus inorganic nutrients such as nitrate and phosphate; it thus presents a greater challenge for biological control than use of fresh water as cooling tower makeup. We have found that electrolytic bromine is an excellent biocide for use in systems using reclaimed water as it is less reactive towards many organics than chlorine base products. In addition, the result of bromine reacting with ammonia, a common ion in reclaimed water, is bromoamine, an effective biocide in its own right.

Reclaimed Application



Large PCT Water Softener

SofTek is applicable for use with reclaimed water and will allow maximum COC to be obtained without the common calcium phosphate and biological control problems which are typical with use of reclaimed water.

Integrated Supplier

SofTek requires several specific items for successful implementation:

- makeup water softener
- effective microorganism control
- corrosion inhibition chemistry for highly cycled soft water
- effective chemical inhibitor feed control

ProChemTech International, Inc.

"Innovation in Water Management"

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