

Case History Report

Low Cost Water Treatment Program Results in White Rust Corrosion and Premature Cooling Tower Failure

CHR 02/14

History

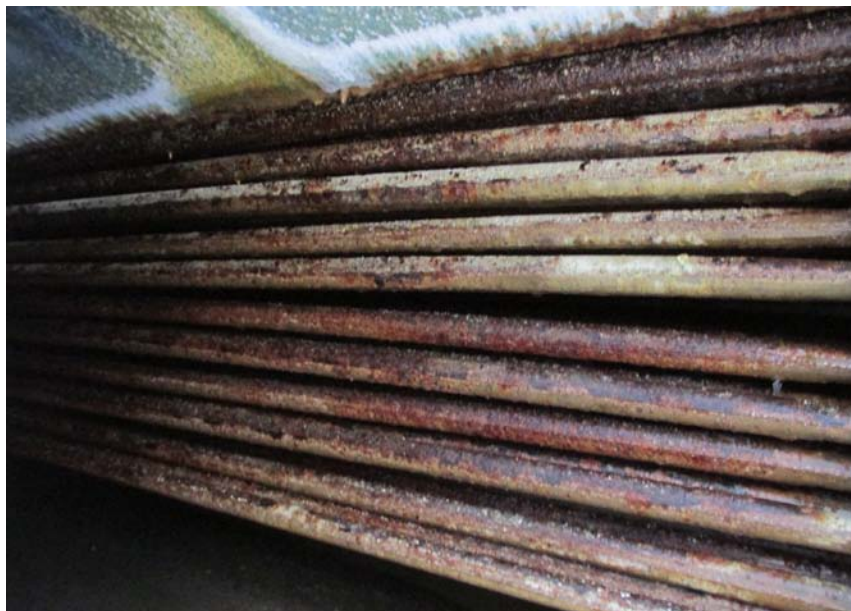
The Edgewater at Hayden Ferry Lakeside Condominium (HFLC) is a tenant owned condominium which was constructed in 2005. ProChemTech was retained by the mechanical contractor to provide start-up service, chemical control equipment, and the water management program per specifications provided by the design engineer. Initial treatment was started on January 16, 2006, with chemical treatment of the closed loop and fluid cooler cooling tower. The primitive feed-bleed control system specified by the design engineer was not optimum from a chemical control standpoint and resulted in substantial swings in inhibitor levels for the approximately four (4) year time period that ProChemTech provided the water management program at this facility.

HFLC decided to replace the ProChemTech water management program with a lower cost program. A low cost firm, Aqua Clear Engineering, started service on April 14, 2010. Aqua Clear was subsequently terminated as the water management supplier sometime after February, 2013, due to excessive corrosion of the fluid cooler cooling tower, being replaced by ChemTreat.

On February 6, 2013, HFLC notified both ProChemTech and Aqua Clear Engineering that they wished both firms to repair or replace the corroded fluid cooler cooling tower. Subsequent letters by attorneys, August 26, 2013, and January 10, 2014, noted that white rust had developed and was the cause of the cooling tower corrosion and subsequent replacement in February, 2014.

System Review

The HFLC fluid cooler cooling tower is an Evapco Model ESW 15324H – two cell unit equipped with a galvanized coil located in the lower part of the cooling tower and galvanized air box. The following pictures, obtained January 29, 2014, document the obvious corrosion damage to the costly to replace coil and upper metal work.





The following table summarizes typical makeup water quality for this installation.

Parameter	City Water	Parameter	City Water
pH	7.8	total alkalinity	165
conductivity	1377	calcium	78.2
magnesium	24.4	iron	<0.03
copper	0.69	zinc	0.570
silicon	9.5	chloride	250
sulfate	106.8	total phosphate	<0.46
total hardness	295.7	saturation index	+0.6

Discussion

During operation of a cooling tower about 80% of the heat load is rejected by evaporation of water from the unit. This evaporation rapidly increases the concentration of dissolved salts and pH in the cooling water, this makeup water reaches a pH of 8.6 at a concentration of just 1.6. White rust corrosion of galvanized metals starts at a pH of 8.2, with the rate of corrosion determined by a combination of pH and alkalinity, corrosion rate increasing with increases in either parameter. In addition to a concentration developed high pH and alkalinity, this makeup water is also high in corrosion inducing chloride and sulfate, making for a scaling and highly corrosive environment.

Being aware of the corrosivity, both typical and white rust, presented by such makeup waters, the treatment program provided by ProChemTech for the first four years of cooling tower operation incorporated our proprietary white rust corrosion inhibitor, ZincGard. A treatment chemistry with ZincGard as a component is more costly by about \$0.50 per pound than a chemistry lacking this component. ZincGard is also a steel corrosion inhibitor; levels that control white rust also reduce corrosion of steel.

Treatment chemistry supplied by Aqua Clear Engineering was less costly than the ZincGard program previously supplied by ProChemTech as it contained no inhibitor to control white rust corrosion. The result is evident from the previous pictures, total failure of the cooling tower due to white rust corrosion removal of the galvanizing, then rapid corrosion failure of the steel coil and cooling tower panels. Replacement cost for the cooling tower is estimated at over \$100,000, the cost savings on the chemical program likely amounted to less than \$2,000/yr.

Conclusion

This study clearly shows the false economics of utilizing low cost water treatment programs and suppliers who have little or no actual knowledge of water treatment chemistry.

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