

Water Treatment Case History Failure of a Non-Chemical Device in an Open Cooling Water System

Device Evaluated

A Pulse-Powered, Non-Chemical Device (NCD) promoted to control corrosion, deposition, scale and microbiological contamination in an open recirculating cooling tower.

Background



In 1997, a company constructed an Olympic-sized ice hockey rink in Connecticut with an Evapco 200-ton open recirculating cooling tower to remove undesired heat from the ammonia-based refrigeration equipment. Once completed, the facility elected to utilize a pulse-powered, non-chemical device to treat the cooling tower water on the basis of claims made by the manufacturer in product literature and through their website. Rather than relying on traditional chemicals to inhibit corrosion, scale, deposition, and microbiological contamination, the vendor explained that the non-chemical device would: “impart pulsed high frequency electromagnetic energy into flowing water” to achieve desired control of all parameters.

Case History

Operation of the NCD continued continuously through 2008, when a new Facilities Director was assigned to deal with the increasingly unreliable and inefficient operation

of the refrigeration equipment and cooling tower, brought about by unprecedented volumes of calcium hardness scale buildup within the systems. Some of the more measurable inefficiencies in the refrigeration system included the following:

- Compressors were running an average of 20-hours a day
- Excessive mechanical wear was evident within the refrigeration equipment
- Elevated compressor head temperatures and pressures were an ongoing problem
- Monthly electric bills of up to \$24,000 were commonplace

Repair or Replace?

The new Facilities Director was immediately tasked with recommending a solution to the energy inefficiency of the refrigeration system, as well as a proven means of controlling scale buildup in the cooling towers. Exhaustive studies were undertaken with the assistance of refrigeration specialists, mechanical contractors, and cooling tower vendors to determine an optimal solution to the problem. A cost/benefit analysis between cleaning the tower, replacing critical parts, or simply replacing the tower outright concluded that complete tower replacement was the best and lowest priced option. In addition, the “technical” service life of the original cooling tower was reduced from an expected 25 years to an actual 11 years before a determination to replace was made. A crane



was required to remove the existing cooling tower and hoist the replacement unit into position. The new Evapco cooling tower weighed 19,700 pounds empty. The nearly identical original tower that was removed weighed 23,500 pounds total. The difference, or about 3,800 pounds, was determined to be the weight of the scale build-up in the original tower. Workmen who removed the tower described the scale build-up as “blocks of cement”. The excessive scale buildup impeded water flows within the tower, reduced desired evaporation rates, and compromised the efficiency of the entire refrigeration and ice-making system.

Jamestown’s Solid Solutions Water Treatment Program

While neither scale nor microbiological contamination were visibly evident in the recently started but still untreated new tower, the factors leading to scaling and fouling potential were all still present, as confirmed by the makeup water analysis, which indicated relatively high levels of Total Hardness (160 ppm as CaCO₃), “M” Alkalinity (200 ppm as CaCO₃), Conductivity (360 as mmhos), and pH (8.01) in the well water makeup source. Left untreated, once cycled in the tower, these contaminants



would once again quickly result in scaling conditions in the system, dramatic reductions in the operating efficiency of the refrigeration equipment, and significant increases in energy consumption. Over time, scaling and deposition would also accelerate the corrosion of metal surfaces, place extreme strain on equipment operation,

and ultimately lead to unscheduled downtime, costly repairs, and equipment failures.

Based upon the characteristics of the makeup water source, and taking into consideration the operating parameters of the water handling system, Jamestown Technologies recommended its highly successful Solid Solutions® Green Water Treatment Program for this facility. The Solid Solution program recommended consists of two (2) dissolution boards, our C-600 molybdate-based corrosion inhibitor, Solid Solutions BioBrom C-100G Microbiocide, and bromine-based, oxidizing microbiocide tablets.

Program Results

Following the installation of the Jamestown Solid Solutions program at this facility, the following results were quickly noted:

- Makeup and tower water analyses demonstrated improved water conservation, due to higher cycles of concentration in the tower and reduced blowdown rates to the sewer.
- Proper mass balances were finally seen between total hardness and chloride levels in the makeup and tower waters, indicating that scale and deposition problems were under control.
- Routine dip slide analyses and visible observations indicated that proper microbiological control was also being maintained.
- Monthly electric expenses were reduced by nearly 15%, or \$36,000 per year.

Conclusion

The pulse-powered, non-chemical device was in continuous operation at the ice skating facility from July 1997 through July 2010. During that time, deposition and scale build up in the cooling tower was so severe that the equipment could not be salvaged, and was ultimately scrapped. However, the makeup water feeding the system remained constantly poor in quality, and an effective water treatment was still necessary. The Jamestown Solid Solution Green Water Treatment Program implemented at this skating facility solved both the scale and deposit control challenges, while producing scale-free and corrosion-resistant results quickly and economically. Microbiological contamination was also properly maintained.

Epilogue

Several months after the installation of the Jamestown Solid Solution Program in this facility, it was learned that the original supplier of the NCD also competed for the water treatment contract for the new tower. It is interesting to note that their new treatment proposal was not exclusively non-chemical, but included a traditional treatment component to supplement the action of the NCD. Consequently, the Facilities Director selected the Jamestown Solid Solution Program as the optimal choice for the skating facility.