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Subject: Non-Chemical Treatment of Cooling Tower Water

Applicability: Directive and Guidance

References:

- a. Presentation on “Non-Chemical Treatment of Cooling Water,” U.S. Army Corps of Engineers 2011 Infrastructure Conference, Alfred D. Beitelman
 - b. Zeta Water Management System, (2009). Water and Cost Analysis of High Voltage Capacitance Based Technology (HCVB) at Four US military Bases, Rodrigo F.V. Romo
 - c. ASHRAE report of April 2010 ”Biological Control in Cooling Water Systems Using Non-Chemical Treatment Devices.” Principal Author: Radisav D. Vidic, Contributing Authors: Scott M. Duda, Janet E. Stout
 - d. ERDC-CERL TR-09-20 report: “Demonstration of Electronic Capacitor-Based Water Treatment System for Application at Military Installations,” Alfred D. Beitelman, M. Michael Pitts Jr. PhD, Rodrigo F.V. Romo, and Carolyn B. Pitts
1. Non-chemical treatment of cooling tower water has been found to be a viable option for many projects. Significant water and cost savings can be realized depending on the projects cooling systems size, amount of yearly operating time for the system and condition of the make-up water. There are various types of non-chemical treatment such as: hydrodynamic cavitation, pulsed and static electric field, ultra-sonic, and magnetic. CERL has performed a study on a pulsed electric-field type of non-chemical treatment (High Voltage Capacitance Based – HVCB) used on the cooling systems at four U.S military bases. The bases selected had a wide range of make-up water use and climatic conditions. This system operated by installing high voltage electrodes into the cooling tower piping creating a strong electrostatic field in the water stream. The CERL study found:
- a. By charging the dispersed particles of the cooling tower water, particle deposition and agglomeration onto the heat transfer surfaces is greatly reduced. As a result tower water flushing and refilling was greatly decreased as compared to chemically treated water.

The average annual water costs savings was found to range from approximately \$2,700 to \$20,599 with initial system costs ranging from \$21K to \$32K. The return on investment ranged from 19 to 43 months.

b. Rather than monthly testing of the water's scale and biological content with chemically treated systems the non-chemical system utilized remote wireless monitoring and control. This provided the capability to detect potential corrosion or biological growth problems in a much shorter time as compared to awaiting chemical test results.

c. The flushed water can be used for gray water usage directly after being flushed without having to be filtered.

d. The HVCB system demonstrated as good or improved scale deposit control at all four military base sites

e. Corrosion control – chemical and the non-chemical treatment were equivalent in all four test sites

f. Biological control – the HVCB system was equal to or exceeded the chemically treated systems in controlling bacterial growth

g. All four bases used significantly less water as compared to when chemically treating the tower water

2. The water savings and use of gray water could contribute to LEED points and compliance with ASHRAE 189.1 (Standard for the Design of High-Performance Green Buildings Except for Low-Rise Residential Buildings)

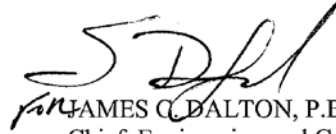
3. While biological control was found to be very good with the HVCB system other non-chemical systems may not provide as good of results as the chemically treated in addressing biological control. This is especially important with the legionella issue. The planner/designer must be wary of manufacturer's claims. An ASHRAE report of April 2010 "Biological Control in Cooling Water Systems Using Non-Chemical Treatment Devices" is a good reference for a comparison of the various non-chemical treatment methods on this issue.

4. Significant water and cost savings can be realized and abundant gray water can be made available for use in utilizing non-chemical treatment systems. The CERL study indicated very good cost and water savings results for the HVCB system. However, whatever non-chemical system is considered the designer/planner must perform a life cycle cost analysis for their specific project as the smaller systems may not reap the cost saving benefits as compared to the larger systems.

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