

Case History Report Non-Chemical Water Treatment Device

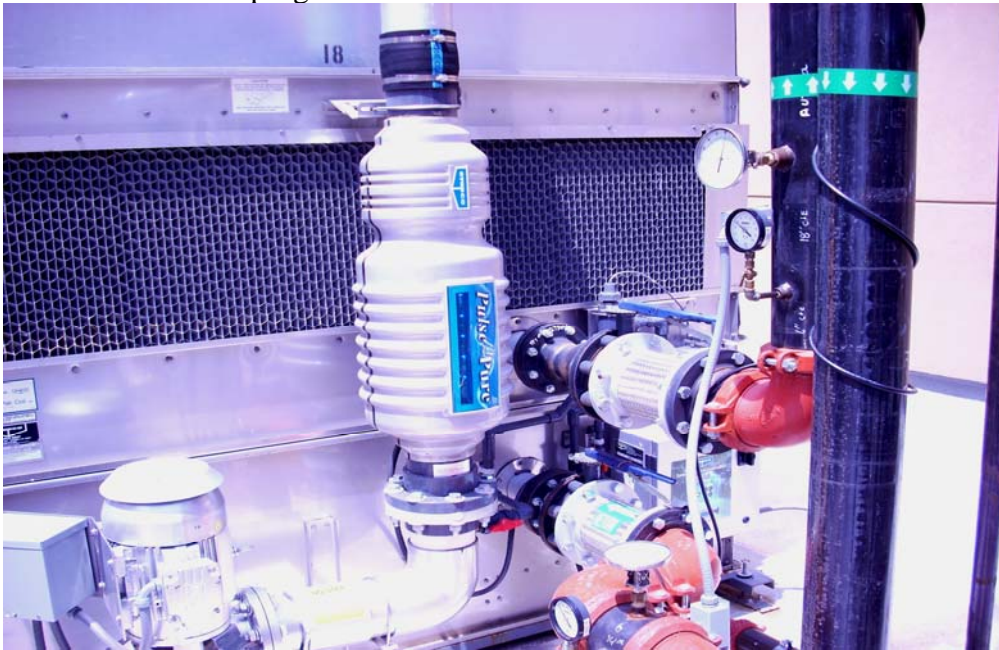
Device Evaluated

An Evapco “Pulse-Pure” non chemical device (NCD) installed on a new cooling tower supplied with makeup water that is highly scaling, having both high hardness and alkalinity, was evaluated. The “Pulse-Pure” device is manufactured and marketed by Evapco, Inc., PO Box 1300, Westminster, MD 21158, 410-756-2600, www.evapco.com.

System Data

The Pulse-Pure device was supplied by Evapco as a component of a new HVAC cooling tower system installed at a medical center in Phoenix, Arizona. At the time of our site review, the system had been in operation approximately two (2) months. We were invited to review the system due to concerns by the owner as to biological growth in the cooling tower related to Legionella bacteria.

One (1), Evapco Model ESWA 102 23 H counter flow evaporative fluid cooler rated at approximately 265 ton capacity is used to provide cooling via the closed loop for a chiller condenser. Cooling tower metallurgy is galvanized steel side panels, stainless steel tower basin, plastic fill, and galvanized coil. A Model “P-6” Pulse-Pure device was specified by the building designer for the water treatment program based on marketing of the device which claimed it to be more “green”, or environmentally friendly, than a “typical” chemical water treatment program.



As part of the Pulse-Pure installation, an Evapco trademarked conductivity based blowdown control was installed for control of cycles of concentration (COC). Makeup water is obtained from the City of Phoenix with the reported analytical data being typical for this area. Note that City of Phoenix water quality varies substantially area to area, and with time, due to use of several water supply sources.

Claims Made

The Evapco WEB site was reviewed in September, 2010, for current claims. We found under product data the following claims for the device: "Controls bacteria in recirculating water ... maximum of 10,000 cfu/ml"; "Controls the formation of mineral scale – even at high cycles of concentration"; "Yields corrosion rates equivalent to typical chemical water treatments"; "Eliminates environmentally hazardous and often toxicity water treatment chemicals .."; and "Saves water and money by operating at higher cycles of concentration compared to liquid chemical programs". Also noted was the statement that it "Can assist with LEED points for LEED projects in the areas of innovation, water saving, and water reuse".

No information was found that discussed in scientific terms how the device functioned to provide the claimed benefits.

History

The Evapco cooling tower, "Pulse-Pure" device, and associated conductivity based blowdown controller were installed concurrent with construction of the building with start-up in 2010. Operation has continued since using only the installed device for treatment of the cooling water until August, 2010, when a ProChemTech MiniBrom Model 2.5 was installed for biological control of the cooling water via addition of electrolytic bromine to the water as a biocide. In September, 2011, a ProChemTech SofTek chemical program was installed to permit operation at higher COC with control of white rust.

Review



PCT personnel visited the site on August 2, 2010, to job walk the system prior to installation of the MiniBrom unit. A first set of makeup and cooling water samples were obtained on this visit. A second visit was made on August 16, 2010, to start-up the MiniBrom, the second set of cooling water samples were obtained during this visit.

As shown in this picture of the cooling tower galvanized coil, substantial white rust formation has already occurred as of August 16, 2010. Inspection of the cooling tower was limited to viewing of the coil located in the base of the unit.

Analytical Results

Makeup (MU) and cooling water (CW) samples were analyzed by Analytical Services, Inc., a state and ISO certified laboratory, with the following results reported.

“Pulse-Pure” Treated Cooling Tower System Water Analysis

Parameter	08/02/10 MU	08/02/10 CW	08/16/10 MU	08/16/10 CW
pH	7.3	8.4	7.6	8.3
total alkalinity	110	220	108	190
conductivity	659	1503	728	1430
calcium	42.0	63.0	41.2	67.0
magnesium	15.3	36.0	13.8	29.6
Ca:Mg ratio	2.7	1.8	3.0	2.3
zinc	0.057	0.188	<0.005	0.080
silicon	4.4	11.2	4.1	9.4
chloride	140	330	135	310
sulfate	54.7	134.6	63.7	135
total phosphate	0.15	<0.15	<0.15	<0.15
cycles – Mg		2.4		2.1
LSI – 100 F	-0.3	+1.3	0.0	+1.1

Discussion

We would first discuss the “green” claims made for the “Pulse-Pure” device, which was found to be operating at 2.4 and 2.1 COC, magnesium based, on two sequential visits. Application of a standardⁱ chemical water management program would permit operation of the cooling tower at 3.1 COC, while a HighCycleⁱⁱ chemistry program would allow 5.1 COC, and a SofTekⁱⁱⁱ program would operate at 9.0 COC. Assuming an annual average thermal load of 132.5 tons, average COC for the Pulse-Pure device of 2.25, and the calculated cycles of concentration for the three types of chemical water management programs, the following annual blowdown requirements can be easily calculated:

Water Management Program	Cycles of Concentration	Annual Blowdown - Gallons
Pulse-Pure	2.25	1,050,477
Standard Chemistry	3.1	625,284
HighCycle Chemistry	5.1	320,267
SofTek Chemistry	9.0	160,503

It is clearly evident from these calculations that the Pulse-Pure device requires substantially more blowdown than any of the chemistry based water management programs. Accordingly, the claims made for the Pulse-Pure as being “green” and environmentally “friendly” as to water use are not true.

The Pulse-Pure literature claims that the unit “Controls the formation of mineral scale – even at high cycles of concentration” was then considered.

First, as noted in the environmental analysis, the Pulse-Pure device was actually operating at a lower cycles of concentration than would be routinely obtained with chemical water management programs. A mass balance done on the water analysis data for both visits shows that calcium was being lost from the cycled cooling water as shown in the following table:

Sample Date	Cycles	Found Calcium	Expected Calcium
08/02/10	2.4	63.0 mg/l	100.8 mg/l
08/16/10	2.1	67.0 mg/l	86.5 mg/l

The mass balance from both samplings show a significant deficiency in calcium, the likely explanation is that the calcium is depositing within the cooling tower fill as calcium carbonate. Looking at the total alkalinity of both cooling waters, we find that there is also a deficiency in this parameter, which would be a reactant in precipitation of calcium carbonate.

Considering the evidence of the two calcium mass balances, it is evident that the claim that the Pulse-Pure device can control mineral scale formation (even at low cycles of concentration!) is incorrect.

An additional claim, “Yields corrosion rates equivalent to typical chemical water treatments”; is likely to be false given the substantial white rust observed on the cooling tower coil. While methods for control of white rust are still open to some discussion, there are at least three proven chemical technologies on the market which have been shown to control it.

Conclusions

Based on the analytical data and observed white rust corrosion; it is evident that the “Pulse-Pure” device does not obtain higher cycles of concentration than chemical water management programs, does not control calcium scale formation, and does not control white rust corrosion with a highly scaling, alkaline makeup water.

Reporter

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ⁱ typically a phosphonate:polymer product at a 1:2 ratio

ⁱⁱ ProChemTech patent pending formulation extensively used in Phoenix

ⁱⁱⁱ ProChemTech patented technology, US patent 7,595,000 and patents pending