

Scientific Evaluation Report “Pulse-Pure” Non Chemical Water Treatment Device

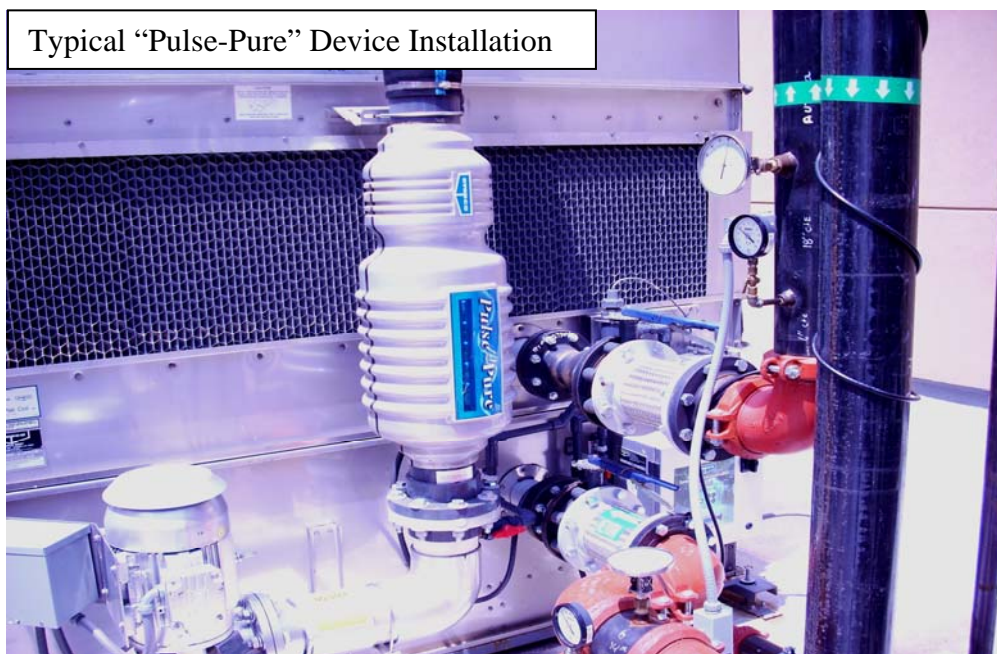
Device Evaluated

This report evaluates an Evapco “Pulse-Pure” non chemical device (NCD) installed on a new cooling tower supplied with very hard makeup water that is non-scaling due to low alkalinity. 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 HVAC cooling tower system installed at a college in St. Augustine, Florida. Samples have been obtained from the NCD treated system three times starting in February, 2011.

One (1), Evapco Model USS 19-914 counter flow cooling tower rated at approximately 350 ton capacity, 1,020 gpm, is used to provide cooling for a chiller condenser. Cooling tower metallurgy is all stainless steel. A Model “P-8 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.



Note that the Pulse-Pure device was supplied with a conductivity based blowdown controller and blowdown valve. Makeup water is obtained from the City of St. Augustine with the reported analytical data being typical for this area.

Claims Made

The Evapco WEB site was reviewed in September, 2010, for product 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 and "Pulse-Pure" device were installed and started up in 2010. Operation has continued since using only the installed device for treatment of the cooling water with our initial sampling on February 10, 2011, and follow-ups on July 7, 2011, and July 20, 2011, to confirm the findings.

Analytical Results

Makeup (MU) and three 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	02/10/11 MU	02/10/11 CW	07/07/11 CW	07/20/11 CW
pH	7.1	7.0	7.2	6.6
total alkalinity	20	27	20	27
conductivity	1078	2180	1661	1761
calcium	60.4	122	89.0	87.0
magnesium	27.4	47.8	54.0	14.3
Ca:Mg ratio	2.2	2.6	2.0	6.1
iron	<0.03	0.03	0.17	0.23
copper	<0.02	<0.02	<0.02	0.15
zinc	0.006	0.030	0.018	-
silicon	5.0	7.0	-	-
chloride	204	432	225	335
sulfate	78	393	352	237
total phosphate	<0.46	<0.46	0.60	<0.46
suspended solids	-	<2	<2	5
COC on conductivity	-	2.0	1.5	1.6
LSI – 100 F	-1.1	-0.8	-0.8	-1.3

Discussion

Environmental

We would first discuss the “green” claims made for the “Pulse-Pure” device, which was found to be operating at 1.5 to 2.0 cycles of concentration (COC), conductivity based, on three sequential visits. Application of a standardⁱ chemical water management program would permit operation of the cooling tower at 6.0 COC, while a HighCycleⁱⁱ chemistry program would allow 8.0 COC. Assuming an annual average thermal load of 175 tons, average COC for the Pulse-Pure device of 1.7, and the calculated cycles of concentration for two 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	1.7	2,422,688
Standard Chemistry	6.0	339,176
HighCycle Chemistry	8.0	242,269

It is clearly evident from these calculations that the Pulse-Pure device requires substantially more blowdown than either a standard, or HighCycle, chemistry based water management program. Accordingly, **the claims made for the Pulse-Pure as being “green” and environmentally “friendly” as to reducing water use are not true.** In fact, operation of this cooling tower system with the Pulse-Pure device has increased blowdown flow by 2,083,512 gallon per year over a standard chemistry water management program and 2,180,419 gallons per year over a HighCycle program.

Scale Control

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 much lower COC than would be routinely obtained with chemistry based water management programs. A calcium mass balance on the water analysis data for the three samplings results in the following table:

Sample Date	Cycles	Found Calcium	Expected Calcium
02/10/11	2.0	122.0 mg/l	120.8 mg/l
07/07/11	1.5	89.0 mg/l	90.6 mg/l
07/20/11	1.6	87.0 mg/l	96.6 mg/l

The mass balance data is not conclusive as to the ability of the Pulse-Pure to control scale as two of the three data points show a slight deficiency in calcium while one shows a slight excess. Given the negative saturation index values of the sampled cooling waters at 100 F, we would not expect any calcium scale formation in these cooling waters, with or without the installed Pulse-Pure device.

Corrosion Control

While the cooling tower is constructed of stainless steel and thus not subject to either white rust or ferrous metal corrosion, the cooling system is piped in steel and the condenser heat exchangers are copper. Looking at the mass balance for iron and copper we find the following:

Sample Date Cycles	Found Iron	Expected Iron	Found Copper	Expected Copper
02/10/11 2.0	0.03	<0.03	<0.02	<0.02
07/07/11 1.5	0.17	<0.03	<0.02	<0.02
07/20/11 1.6	0.23	<0.03	0.15	<0.02

The increased level of iron found, at very low COC, as the cooling system has aged indicates on-going steel corrosion. Unfortunately, Evapco does not provide corrosion coupon racks as part of their non-chemical device package so that actual corrosion rate monitoring could be accomplished. The copper data is inconclusive.

Conclusions

Based on the analytical data, it is clearly evident that the “Pulse-Pure” device does not obtain higher cycles of concentration than chemical water management programs. In fact, NCD treatment of this specific cooling tower system has resulted in a substantial increase in blowdown and subsequent water use.

Results as to control of scale are inconclusive.

Steel would appear to be corroding in the cooling system based on the mass balance data and it may be serious considering the low COC found. Results as to control of copper corrosion are inconclusive.

Reporter

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

ⁱⁱ ProChemTech patent pending formulation