FLOW-TECH HVAC
WATER TREATMENT SYSTEMS

Comparison of Sessile Bacteria Reduction by Non-Chemical Devices in Cooling Towers

In 2009 ASHRAE commissioned a study through the University of Pittsburgh Department of Civil and Environmental Engineering. The two parties collectively established a protocol to test non-chemical water treatment systems and evaluate their efficacy of controlling biological fouling in cooling water systems. After an eight-month evaluation it was concluded that none of the magnetic, pulsed-power, electrostatic, ultrasonic, or hydrodynamic cavitation systems tested showed sufficient ability to reduce sessile microbial growth rates compared with the control.

In April of 2012 Flow-Tech Systems commissioned the University of Pittsburgh to test their Chemical Free water treatment system with the same equipment and protocol from ASHRAE 1361-RP. The test duration was just under 2 months, and unlike the previous tests the results were very positive. Biofilm coupon samples were pulled and sent to a Special Pathogens Laboratory for culture and counts. The Flow-Tech system reduced sessile bacterial growth by between 1-3 log. On average, sessile heterotrophic plate count concentrations were approximately 50 times higher in T1 (Control) than in T2 (Device) or in other words, the Flow-Tech treated tower realized a 98% reduction in biofilm growth.

Of the seven devices that were tested in the two studies, only Dolphin and Flow-Tech showed any kind of biofilm reduction. Dolphin was retested in order to follow the manufacturer's recommendations regarding cycles of concentration. All devices were tested at 4-5 cycles of concentration. The second Dolphin test was performed at 6-7 cycles of concentration. In the first Dolphin test, the average sessile bacteria were reduced by 1,240,000 CFU/cm2. In the second Dolphin test the pulsed electric field system reduced the average sessile bacteria by 180,000 CFU/cm2. Flow-Tech reduced the average sessile bacteria by 12,721,000 CFU/cm2. No explanation was provided for the observed increase in biofilm with the VRTX, Superior Water Conditioner, Sonoxide, and Fluidtron systems.

The following excerpts and data are from the two tests performed by Radisav D. Vidic, Ph.D., P.E. at the Department of Civil and Environmental Engineering at the University of Pittsburgh and Janet E. Stout, Ph.D. at the Special Pathogens Laboratory.

> During this investigation, two identical pilot-scale cooling towers were operated simultaneously under similar operating conditions. The model cooling tower systems were used to closely simulate realistic field conditions, including heat load, evaporative cooling, blowdown system, and water make-up. The cooling towers were operated to encourage the formation of surface occurring biofilm (sessile biomass) in the tower.

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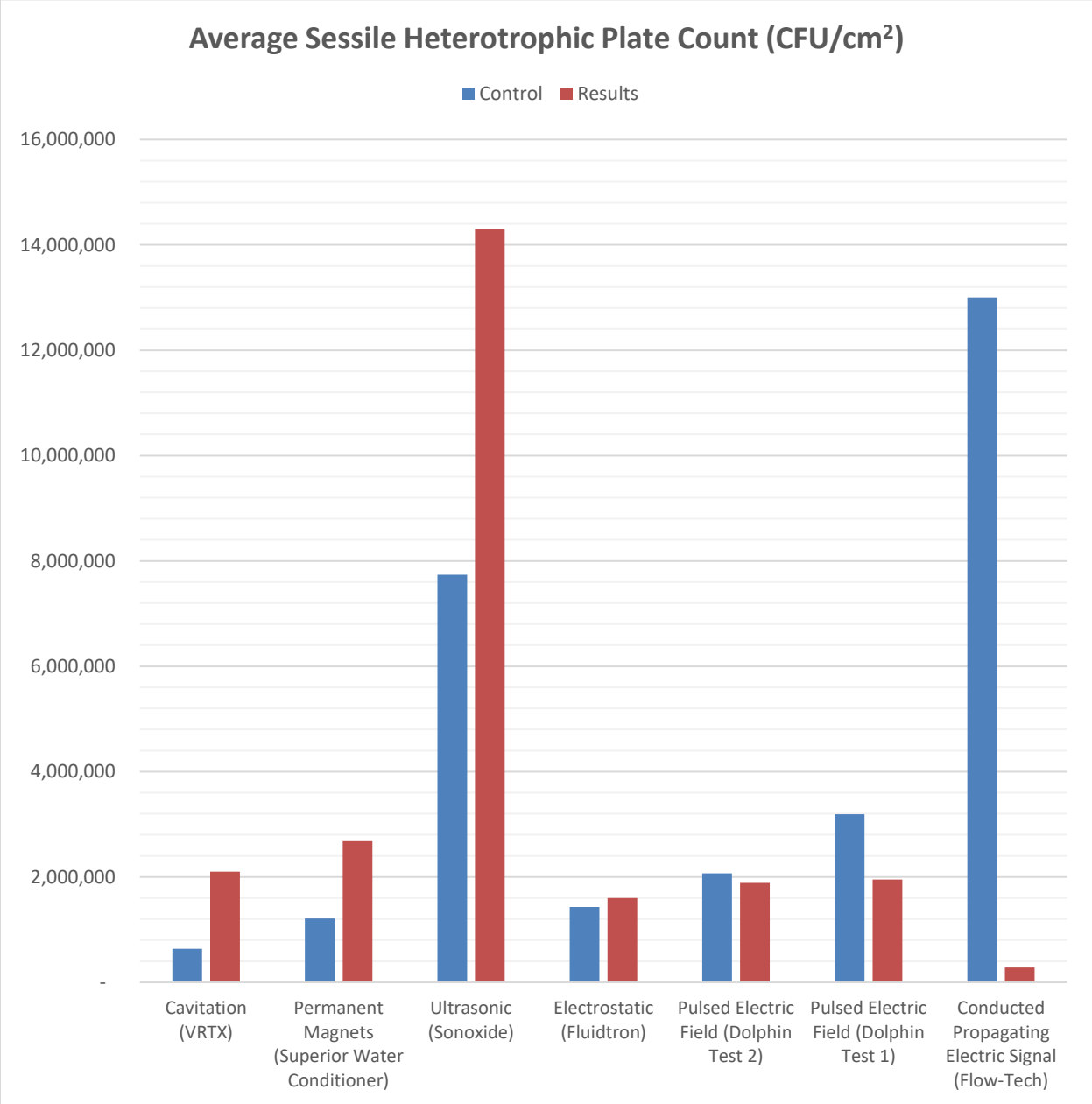

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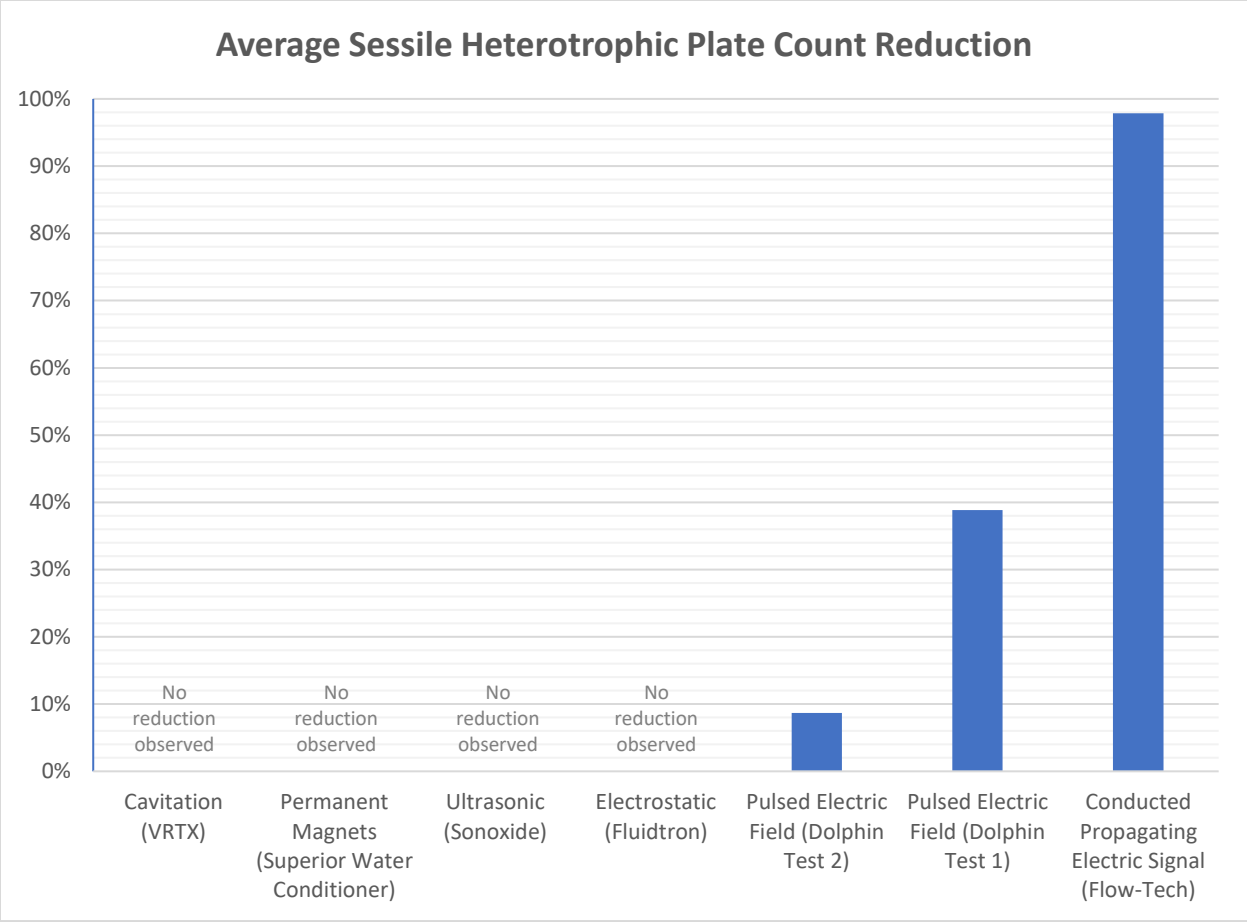

VRTX test results summary statement:

The results presented in this report demonstrate that the hydrodynamic cavitation non-chemical device did not significantly reduce biological activity compared to the “control” tower.

Superior Water Conditioner test results summary statement:

The results presented in this report demonstrate that the magnetic device did not significantly reduce biological activity compared to the “control” tower.

Sonoxide test results summary statement:

The results presented in this report demonstrate that the ultrasonic non-chemical device did not significantly reduce biological activity compared to the “control” tower.

Fluidtron test results summary statement:

The results presented in this report demonstrate that the static electric field non-chemical device did not significantly reduce biological activity compared to the “control” tower.

Dolphin test results summary statement:

The results presented in this report demonstrate that the pulsed electric field non-chemical device did not significantly reduce biological activity compared to the “control” tower.

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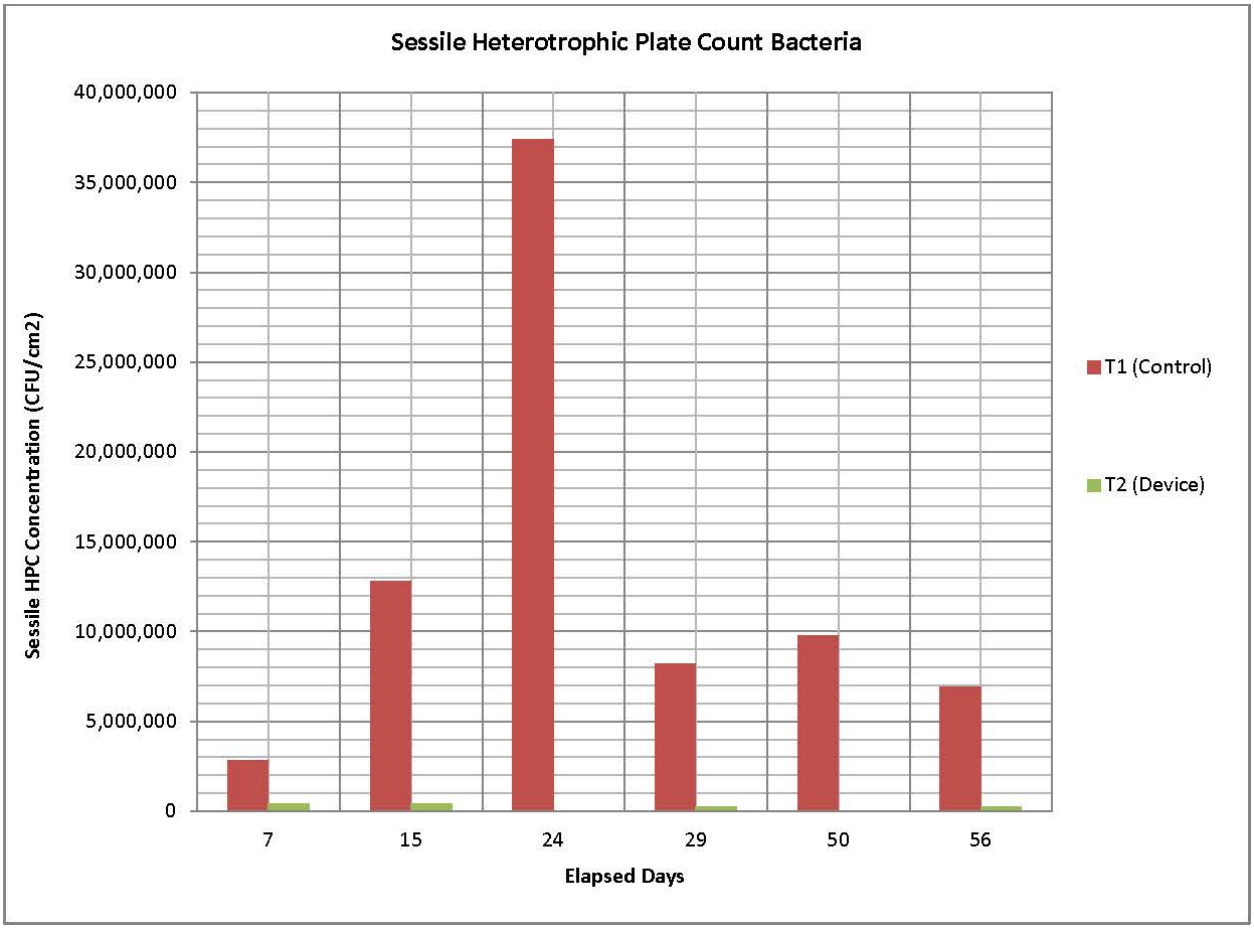
Flow-Tech test results summary statement:

The average observed log sessile HPC concentrations for T1 (Control) and T2 (Device) were 6.98 ± 0.37 and 5.36 ± 0.36 CFU/cm2, respectively. The average non-log transformed sessile HPC concentrations for T1 (Control) and T2 (Device) were 13,000,000 ± 12,400,000 and 279,000 ± 156,000 CFU/cm2, respectively. Sessile bacterial concentrations in T2 (Device) were at least one order of magnitude lower than those in T1 (Control) throughout the testing period, and on average the sessile HPC was 98% lower in T2 (Device) than in T1 (Control). The maximum difference between T1 (Control) and T2 (Device) sessile heterotrophic bacteria concentrations was 37,400,000 CFU/cm2, corresponding to a difference of approximately 3 orders of magnitude. This difference was observed on Day 24 of the study. The addition of sand filtration did not have a direct impact on sessile bacterial growth in either T1 (Control) or T2 (Device).

On average, sessile heterotrophic plate count concentrations were approximately 50 times higher in T1 (Control) than in T2 (Device)



Sessile HPC concentrations in T1 (Control), and T2 (Device). The Day 50 sampling coupon for T2 (Device) was damaged and was not processed.

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