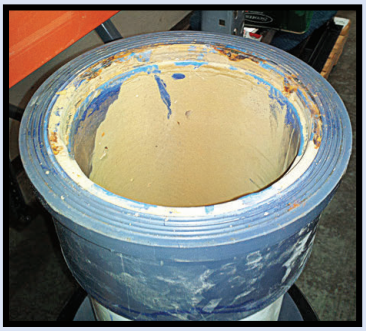
Scale, bacteria, and corrosion control for cooling towers

Headquarters in Phoenix, AZ

Marley MD Cooling Tower

Daikin WMC-290 Chiller



Scale inside the Dolphin reaction chamber

FLOW-TECH HVAC
WATER TREATMENT SYSTEMS

Case Study: Scale control in hard water, 3 Chemical-free systems compared

System: Cooling Tower, Chiller
Installation: March 2015
Issue: Scale accumulation in chiller and cooling tower
Benefits: Restored heat transfer efficiency, reduced energy consumption, reduced corrosion, prevented scale, extended equipment life

As a manufacturer's representative, this Phoenix based company uses their facility to showcase products that they sell. They have tried three different chemical-free water treatment systems on their cooling tower and chiller with varying degrees of success. In 2009 they installed a Dolphin system, in 2012 they replaced it with a Griswold system, and in 2015 that system was replaced by a Flow-Tech system. In all three cases, they worked closely with the respective manufacturer to ensure proper system performance.

From 2009 to 2014, they experienced scale, biofilm, and high corrosion rates in their cooling tower and chiller that lead to decreased heat transfer efficiency and caused the system to shut down due to high head pressure. Borescope images of the chiller tubes and inspection of the cooling tower showed substantial scale accumulation and biological film. The scale that had accumulated with Dolphin and Griswold had to be removed with acid.

Results:

Chiller Tubes: Since the Flow-Tech system was installed in March of 2015, the cooling system has not shut off due to high head pressure - even with extremely challenging and varying water quality. Each year after the cooling season ends, borescope pictures have been taken to view the rifling inside the chiller tubes to verify that optimal surface area is present for heat transfer.

Water Analysis	4/15/2015	5/9/2015	3/8/2016	4/20/2016
pH (S.U.)	8.1	7.0	8.1	8.1
Conductivity µS/cm	1,018	1,025	790	1,080
Calcium Hardness as $CaCO_3$ {mg/L (ppm)}	120	260	160	190
Magnesium Hardness as $CaCO_3$ {mg/L (ppm)}	180	100	120	210
Total Hardness as $CaCO_3$ {mg/L (ppm)}	300	360	280	400
m-Alkalinity (total) as $CaCO_3$ {mg/L (ppm)}	110	130	200	140
Chloride as Cl^- {mg/L (ppm)}	275	100	70	175
Sulfate as SO_4^{2-} {mg/L (ppm)}	90	200	200	44
Silica as SiO_2 {mg/L (ppm)}	10.0	18.0	8.0	7.2
Phosphate as PO_4^{3-} {mg/L (ppm)}	100	2.00	0.03	137
Larson-Skold Corrosion Index (>1.2 indicates very corrosive water)	4.38	2.69	1.54	2.09
Hardness (>10.5 GPG indicates very hard water)	17.5	21.0	16.4	23.4

Dolphin 2009-12

Griswold 2012-15

Flow-Tech 2015-Present

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Boroscope images inside Daikin WMC-290 Chiller Tubes

With Griswold (5/9/2015)

After acid wash (5/9/2015)

1 full cooling season with Flow-Tech (11/4/2015)

2 full cooling seasons with Flow-Tech (11/27/2016)

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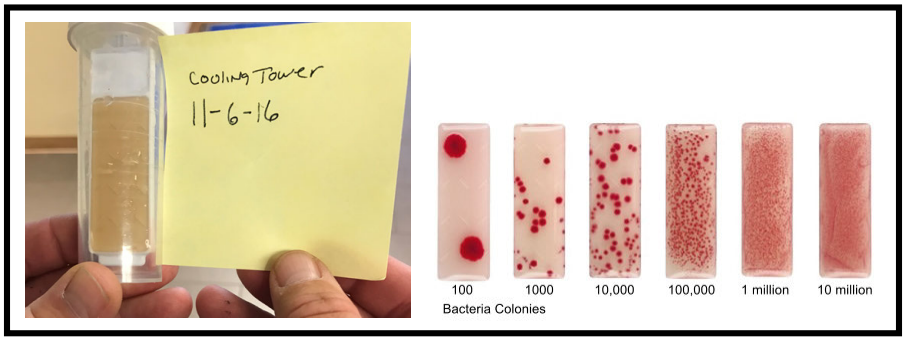
Flow-Tech kept the chiller tubes clean for two full cooling seasons even with very hard and varying water quality where other systems failed. Keeping chiller tubes clean maximized heat transfer efficiency and eliminated unexpected shutdowns due to high head pressure.

Bacteria: While biofilm was observed with previous technologies, Flow-Tech removed and prevented biofilm. By encapsulating bacteria and damaging their cell walls Flow-Tech held bacteria counts to non-detectable levels.



Bacteria dipslide test showing no detected bacteria

Corrosion: Flow-Tech has ensured maximum equipment life by maintaining very good corrosion control even with very corrosive and variable water. Substantial corrosion occurred with the previous technologies.

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CORROSION COUPON EVALUATION

Number	Metal	Location	Installed	Removed	Exposure	Weight Loss	MPY
1572	Mild Steel	Cooling Tower	06/25/15	09/25/15	93 days	226.1 Mg	2.951
1567	Copper	Cooling Tower	06/25/15	09/25/15	93 days	22.3 Mg	0.256
1940	Mild Steel	Cooling Tower	06/28/16	09/28/16	93 days	309.5 Mg	4.040
1718	Copper	Cooling Tower	06/28/16	09/28/16	93 days	18.1 Mg	0.207

Status	Open System	
	TE-599 Mild Steel	TE-600 Copper
Excellent	< 1	< 0.1
Very Good	1.01 - 3	0.101 - 0.25
Good	3.01 - 5	0.251 - 0.35
Fair	5.01 - 8	0.351 - 0.5
Poor	8.01 - 10	0.5 - 1
Severe	> 10.01	> 1.01

Summary: After two difficult cooling seasons in Phoenix, AZ with very hard and variable water conditions, Flow-Tech succeeded where other chemical-free systems failed. The cooling system has experienced no biofilm, low bacteria counts, restored heat transfer efficiency, good corrosion rates, longer equipment life, and optimized water and energy use since 2015.