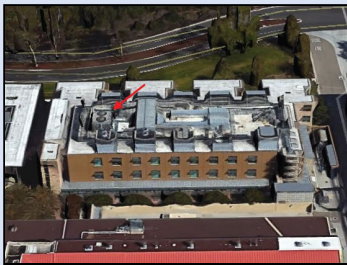


Scale, Bacteria, and  
Corrosion Control +  
Water and Energy Savings



Flow-Tech was installed at  
UCSB as an evaluation



The cooling tower is located  
on the engineering building



400 ton cooling tower



## University of California Santa Barbara: Cooling Tower Water Treatment Test

System: 400 Ton Cooling Tower and Chiller  
Installation: January 2014  
Duration: One Year  
UCSB Issues: Scale, Bacteria, Corrosion, High Energy and Water Consumption

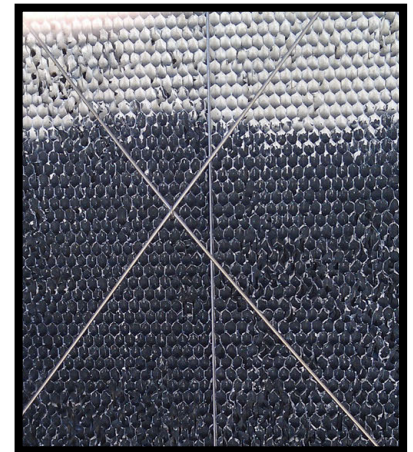
The engineering building cooling tower at the University of California Santa Barbara had substantial scale accumulation due to hard water that averaged over 23 gpg. The insulating scale lead to poor heat transfer and dramatically increased energy consumption. High bacteria counts (~10,000 CFU/mL) caused health concerns for the students, and extremely corrosive water (2.5 Larson-Skold Corrosion Index) aroused concerns about system longevity.

### Results:

**Scale:** Traditional chemical treatment was unable to prevent hard scale from adhering to the tower fill and surfaces throughout the system. During the installation half of the fill was cleaned to show Flow-Tech's ability to prevent and soften existing scale. Flow-Tech prevented new scale from forming and softened existing scale. A garden hose was used to remove remaining scale.



Hard scale located on the cooling tower fill before installation reduced the cooling capacity and life span of the cooling tower.



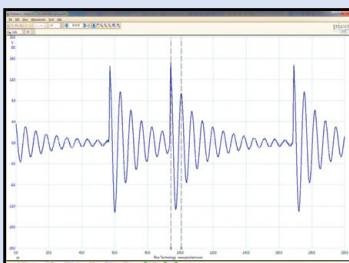
Prior to the Flow-Tech installation, half of the fill was cleaned to show scale prevention and reduction in existing scale.

Flow-Tech's propagating signal provides scale, bacteria, and corrosion control that can be measured throughout the system

Scale, Bacteria, and  
Corrosion Control +  
Water and Energy Savings



Installation required  
no pipe modifications



Signal propagation throughout  
the system was measured by  
an oscilloscope



Eliminated hazardous  
chemicals, reduced liability,  
and improved sustainability



## University of California Santa Barbara: Cooling Tower Water Treatment Test

No new scale formed on the cleaned section of the cooling tower fill. The existing scale on the top half of the cooling tower fill softened and was easily removed with a garden hose.



Without chemicals Flow-Tech  
prevented new scale and  
softened existing scale.



The softened scale was removed  
from the fill with a garden hose.

### Bacteria:

Through the use of a rotation of different oxidizing and non-oxidizing biocides, chemical treatment historically kept bacteria counts around 10,000 CFU/mL. By damaging bacteria cell walls and encapsulating the bacteria, Flow-tech was able to stabilize and reduce total bacteria counts by 77% to 2,300 CFU/mL

SP 14063181:1 Heterotrophic Bacteria Analysis

Customer ID: 2-24705

Project Name: UCSB Water Sample

SAMPLE DESC.	METHOD	RESULT	UNITS	DATE / TIME
FSB Tower	SM 9215	2300	CFU/mL	06/03/2014 13:20



Flow-Tech provides a rapid ROI due to improved heat transfer and  
a reduction in water use, labor, and chemical consumption



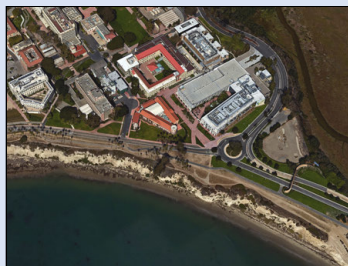
Scale, Bacteria, and  
Corrosion Control +  
Water and Energy Savings



Flow-Tech control panel  
installed at UCSB



Flow-Tech reduced water use



Flow-Tech eliminated chemical  
discharge into the environment



## University of California Santa Barbara: Cooling Tower Water Treatment Test

**Corrosion:** The Larson-Skold Corrosion Index for the makeup water at UCSB was 2.5, indicating extremely corrosive water. Without chemical assistance, Flow-Tech kept the corrosion rates low in a very harsh environment. Both of the results, 0.2 MPY copper and 2.4 MPY mild steel, are considered “very good”.

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

The copper and mild steel corrosion coupons used  
in the test proved “very good” corrosion rates

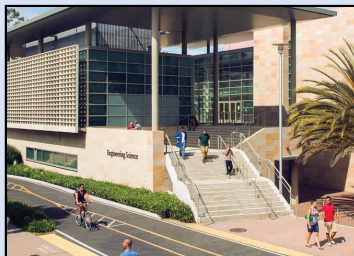
Larson-Skold Index (x)	Description
$x < 0.8$	Chlorides and sulfate probably will not interfere with natural film formation
$0.8 < x < 1.2$	Chlorides and sulfates may interfere with natural film formation. Higher than desired corrosion rates anticipated.
$1.2 < x$	Tendency towards high corrosion rates of a local type should be expected as index increases.

Flow-Tech proved to be very effective even with very corrosive water (2.5)

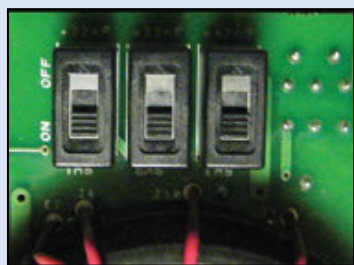
**Water Savings:** By increasing the cycles of concentration from 2.2 to 3.8, Flow-Tech saved 57% of the blow-down water and 26% of all of the water used in the system - or approximately 3,003,429 gallons. At a rate of \$6.53 per HCF for portable water and \$3.26 per HCF for sewer, the university would save approximately \$26,220 and \$13,095 respectively each year.

In most cooling tower installations, Flow-Tech  
saves millions of gallons of water each year

Scale, Bacteria, and  
Corrosion Control +  
Water and Energy Savings



Flow-Tech provided an  
environmentally friendly  
solution



Flow-Tech was tuned onsite to  
ensure signal propagation and  
provide optimal results



Flow-Tech removed all biofilm  
from the system (biofilm is 4x  
more insulating than scale)



## University of California Santa Barbara: Cooling Tower Water Treatment Test

**Energy Savings:** By softening and removing existing scale and preventing new scale formation, the cooling tower and chiller were able to operate according to their original design. Energy consumption was reduced by approximately 27% which translated to an energy savings of approximately \$55,866/year.

**Other Savings:** By preventing scale accumulation on the cooling tower fill, the labor and costs associated with frequent cleaning and descaling were eliminated.

Analyte	Method	Result	Units
Spec Conduct / E.C. (Field)	Field	930	umhos/cm
pH (Field)	Field	7.4	pH Units
<b>General Chemical Analyses</b>			
Alkalinity, Total (as CaCO <sub>3</sub> )	SM 2320 B	170	mg/L
Bicarbonate (HCO <sub>3</sub> )	SM 2320 B	210	mg/L
Carbonate (CO <sub>3</sub> )	SM 2320B	ND	mg/L
Chloride (Cl)	EPA 300.0	25	mg/L
Hardness, Total (as CaCO <sub>3</sub> )	Calculated	390	mg/L
Hydroxide (OH)	SM 2320B	ND	mg/L
Phosphorus (Total as PO <sub>4</sub> )	HACH 8190	0.31	mg/L
Sulfate (SO <sub>4</sub> )	EPA 300.0	300	mg/L
<b>Metals</b>			
Calcium (Ca)	EPA 200.7	78	mg/L
Magnesium (Mg)	EPA 200.7	47	mg/L
Silica (SiO <sub>2</sub> )	EPA 200.7	12	mg/L

Water Analysis 5/9/2014

### Summary:

Over the course of the one year study, the University of California Santa Barbara was able to document Flow-Tech's ability to prevent scale in hard water both on the cooling tower and in the chiller tubes, reduce bacteria counts to low levels, manage corrosive make up water, eliminate chemicals in the blowdown, save water, increase heat transfer efficiency, reduce liability from storing chemicals on the roof of the engineering building, prolong the life of the cooling equipment, and reduce labor to clean the system.

Flow-Tech stabilized and reduced total bacteria counts by  
77% and provided a safer environment for students