

This presentation premiered at WaterSmart Innovations

watersmartinnovations.com





CREATIVE WATER SOLUTIONS

Plymouth, MN

www.cwsnaturally.com



History

- Started in 2003
- Commercialization 2004
 - Residential Spas
 - Residential Pools
 - Commercial Spas
 - Commercial Pools
 - Fountains
 - Ponds
 - Aquariums
 - Industrial Water
 - Homes and Potable Water

Sphagnum Moss

- Harvested by hand
- Green
- Sustainable
- Renewable



Sphagnum Moss Bog



First Step in CWS Product Journey

- Select species of Sphagnum moss
- Leaves are separated and cleaned
- CWS products are made from moss leaves



Second Step in CWS Product Journey

- Cut and compressed
- Leaves are pressed and formed into a board
- Boards are cut into correct shapes
- Moss is sterilized



Product for Commercial Applications

- Sphagnum moss for commercial and industrial applications
- Select species
- Patented



Farm Pond

Inflow Pond in August



**Culvert Under the Road and
Pond Naturally**





Farm Pond

**Naturally Reproducing Brown Trout, Bluegills,
and Minnows**





Creative Water Solutions

University of MD/ERC Natatorium

1.2 Million Gallons





UNIVERSITY OF MARYLAND

College Park, MD
1.4 Million Gallons of Water

Annual Results

SAVED 750,000 Gallons of Water

SAVED \$44,000 in Expenses

INCREASED Memberships by 15%

Cooling Towers and Chillers





PoolNaturally® Plus

Submerged Contact Chamber

- PoolMoss® and ProMoss™ are exposed to water using a contact chamber
- Contact chamber is submerged in flowing water
- Flow within the tank allows exposure of the PoolMoss® and ProMoss™ leaves to the water





PoolNaturally® Plus

Non-Surge Tank Application

- Installed off line
- Maintain 15 Gal/min flow
- Plumbed across an existing pump or an auxiliary pump





Known Sphagnum Moss Functions

- Absorbs 20X its dry weight in water
- Absorbs 10X its dry weight in oil
- Absorbs positively charged ions
- Acidifies Water



Cation Absorption into Sphagnum Moss Leaves using Plasma Mass Spectroscopy

	Tap Water (ppm)	ProMoss control (PPB or % Wt)	ProMoss used in CT	% Change Control Moss
Fe	0.0014	0.039	0.17	336
Ca	32	0.25	3.01	1,104
Si	3.4	0.13	0.24	85
Mg	3.3	0.15	0.28	87
Mn		0.006	0.006	0
Na	20	0.079	0.22	178
K	2.9	0.209	0.087	-58
P		0.02	0.042	110
Ti		38	65	71
Sr	0.08	37	68	84
Cu	0.03	1	379	37,800
Zn	0.2	13	240	1,746
Ni	0.0125	0.01	4	39,900

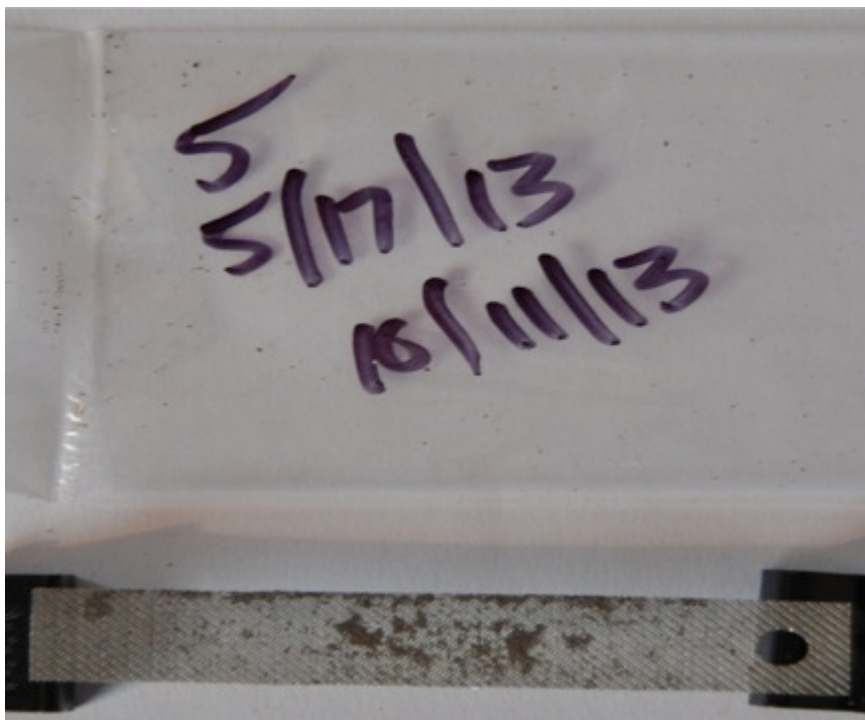


Patented and Patent Application Sphagnum Moss Functions

- Removes and inhibits organic contamination formation
- Removes and prevents scale formation
- Inhibits corrosion
- Inhibits formation of disinfection by products in air and water
- US, Canada, EU, India, China

Cooling Tower Example

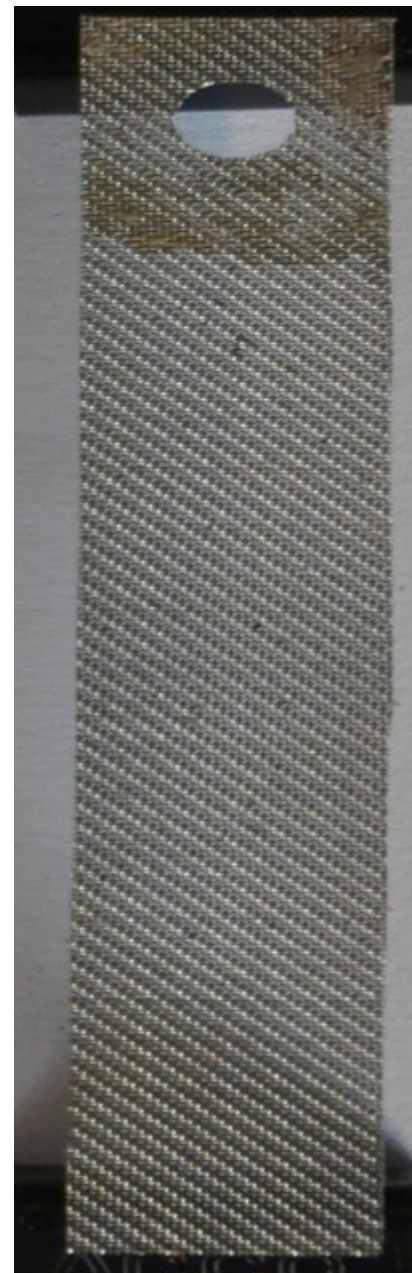
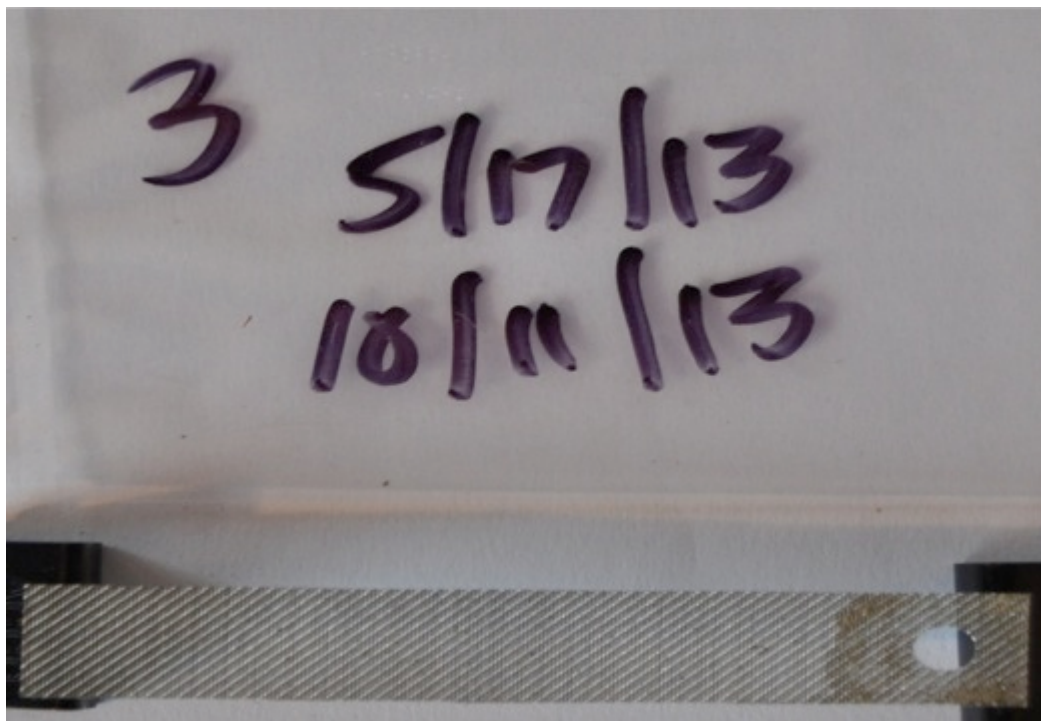
Organic Contamination
No Moss





Cooling Tower Example

Organic Contamination
ProMoss™





ProMoss™ Effect on Scale in a Cooling Tower Rochester, NY

Scale without ProMoss™



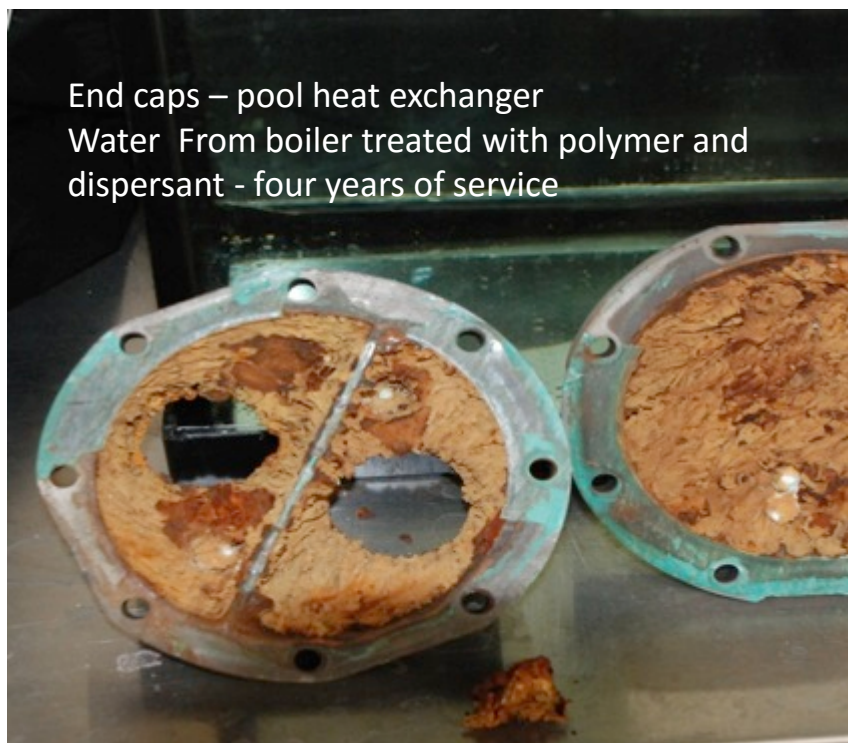
Scale with ProMoss™



Effect of ProMoss™ on Scale

Field Results

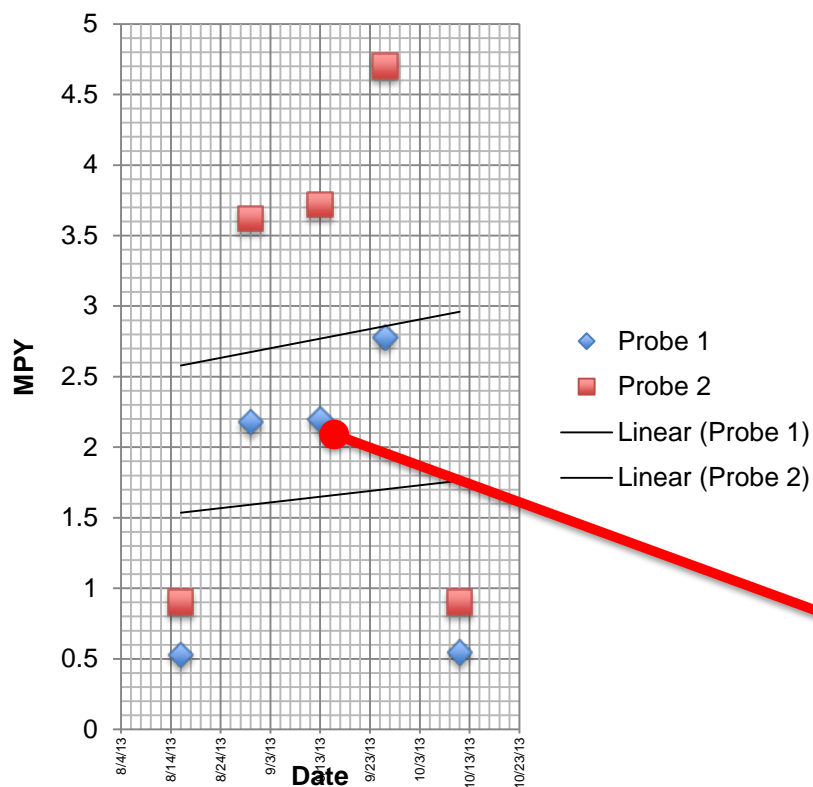
Heat Exchanger Indoor Pool



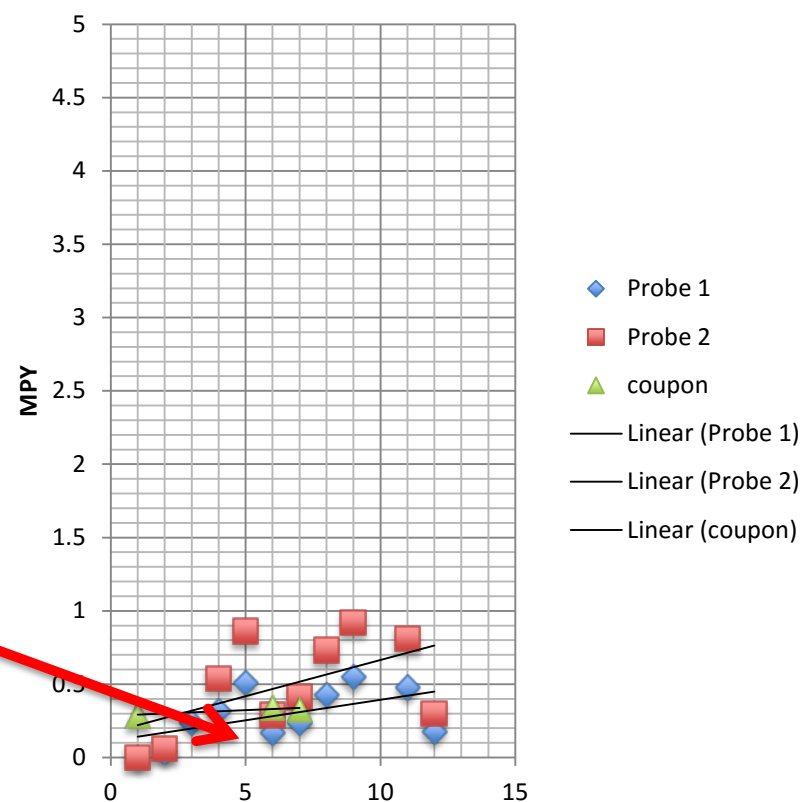
Cooling Tower Example

90% Reduction in Corrosion for Copper

• Tower without Moss



• Tower with Moss

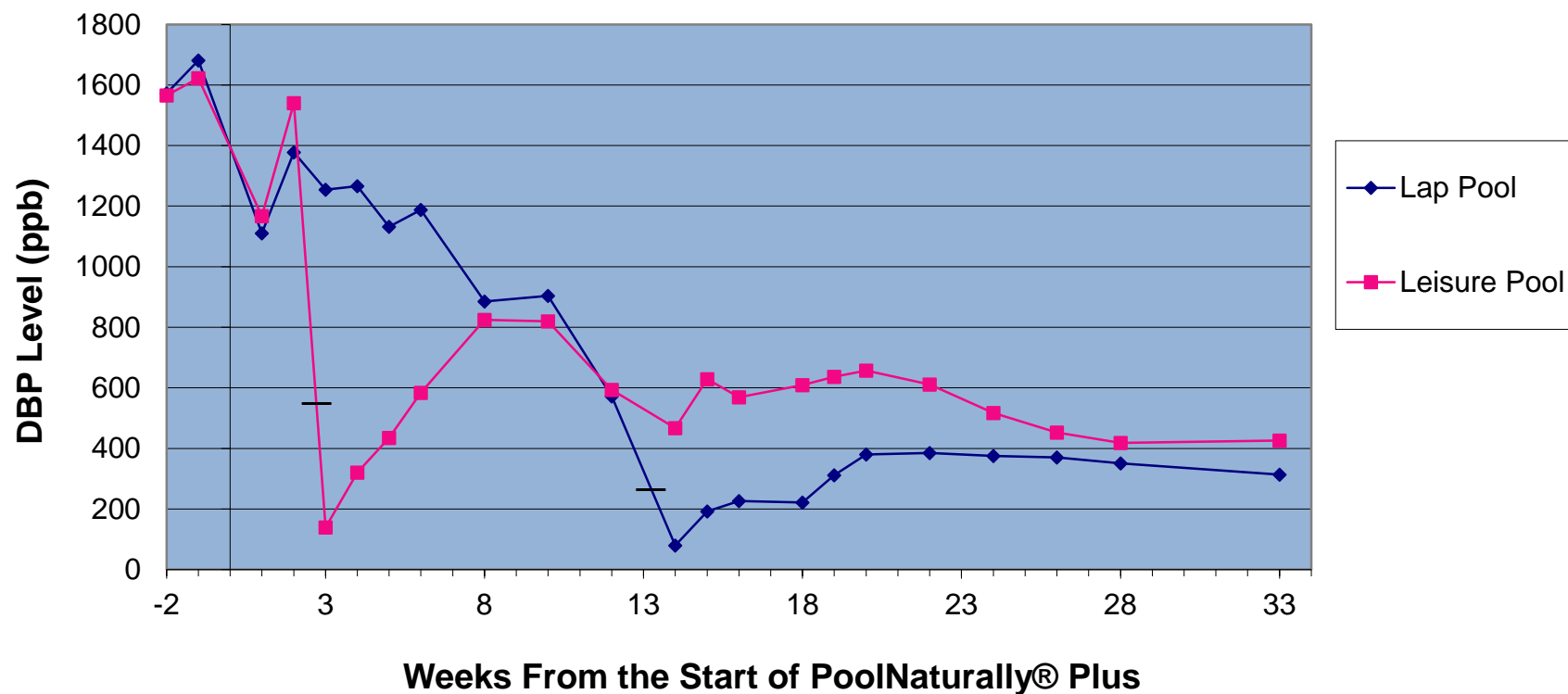




Disinfection-by-Products in the Water

Two Commercial Fitness Club Pools

Effect of PoolNaturally® Plus on DBP Levels in Pool Water



— Pool was drained/refilled



Disinfection-by-Products Measured in the Air

Two Commercial Fitness Club Pools

- DBP Levels in the Air Reduced by 55%

Before: 0.15 +/- 0.020 mg/m³

After: 0.067 +/- 0.008 mg/m³; p<0.001



Industrial Water Examples

Cooling Towers

- Hinckley Minnesota
- Kansas City Missouri
- St. Paul Minnesota



Average Temperature in Hinckley

2011

Max Min Average

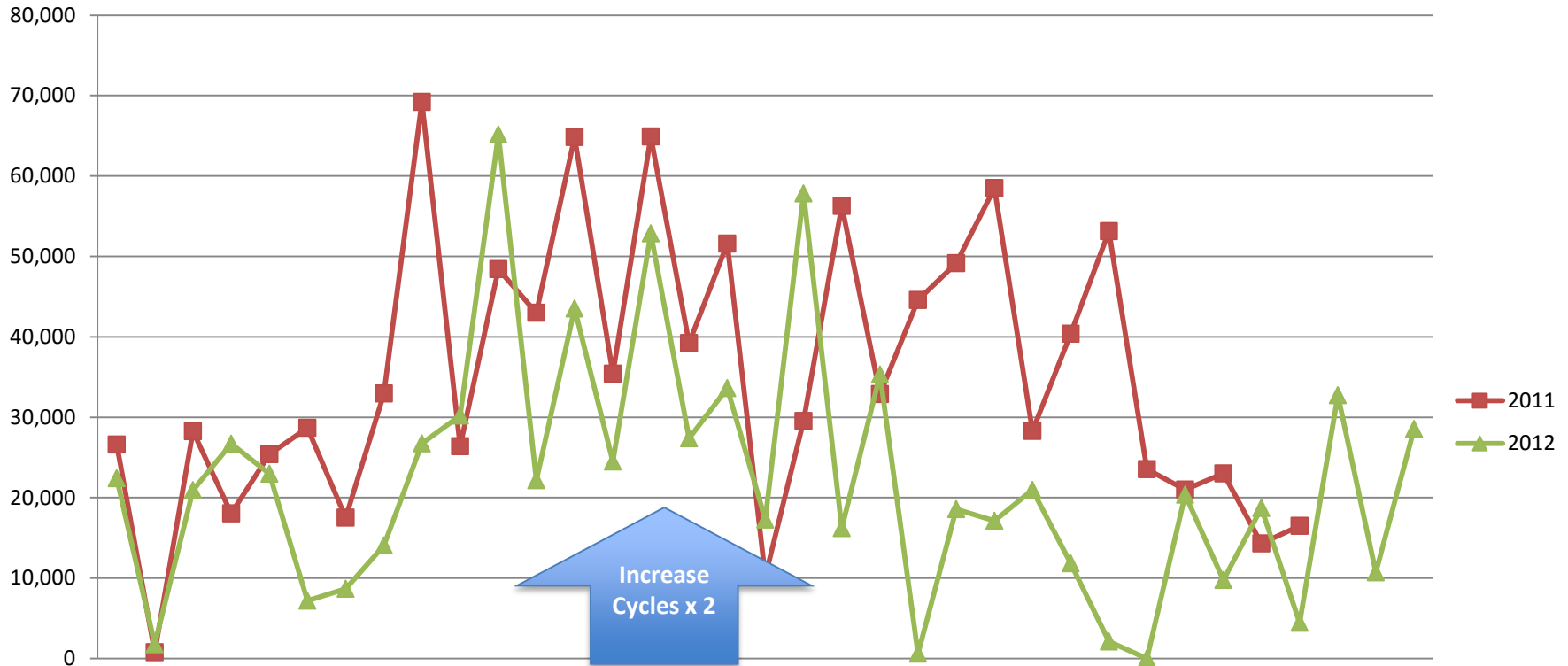
June	71.4	52.8	62.10
July	82.2	62	72.10
August	78.5	57.7	68.10
September	68.6	46	57.30

2012

Max Min Average

June	76.6	53.8	65.20
July	84.9	63.8	74.35
August	77.8	54.9	66.35
September	69.8	42.6	56.20

Hinckley, MN Tower #3 Water Use Comparison



**T Turbidity
C Corrosion -
Galvanized**

**T 1.6
C 0.19
pH 8.5**

**T 1.7
C 0.12
pH 8.5**

**T 1.8
C 0.35**

**T 1.33
C 0.47**

**T 1.86
C 0.63
pH 9.0**

**T 3.56
C 0.68
pH 8.9**

**T 2.4
C 0.27
pH 9.0**

**T 1.36
C 0.27
pH 9.0**

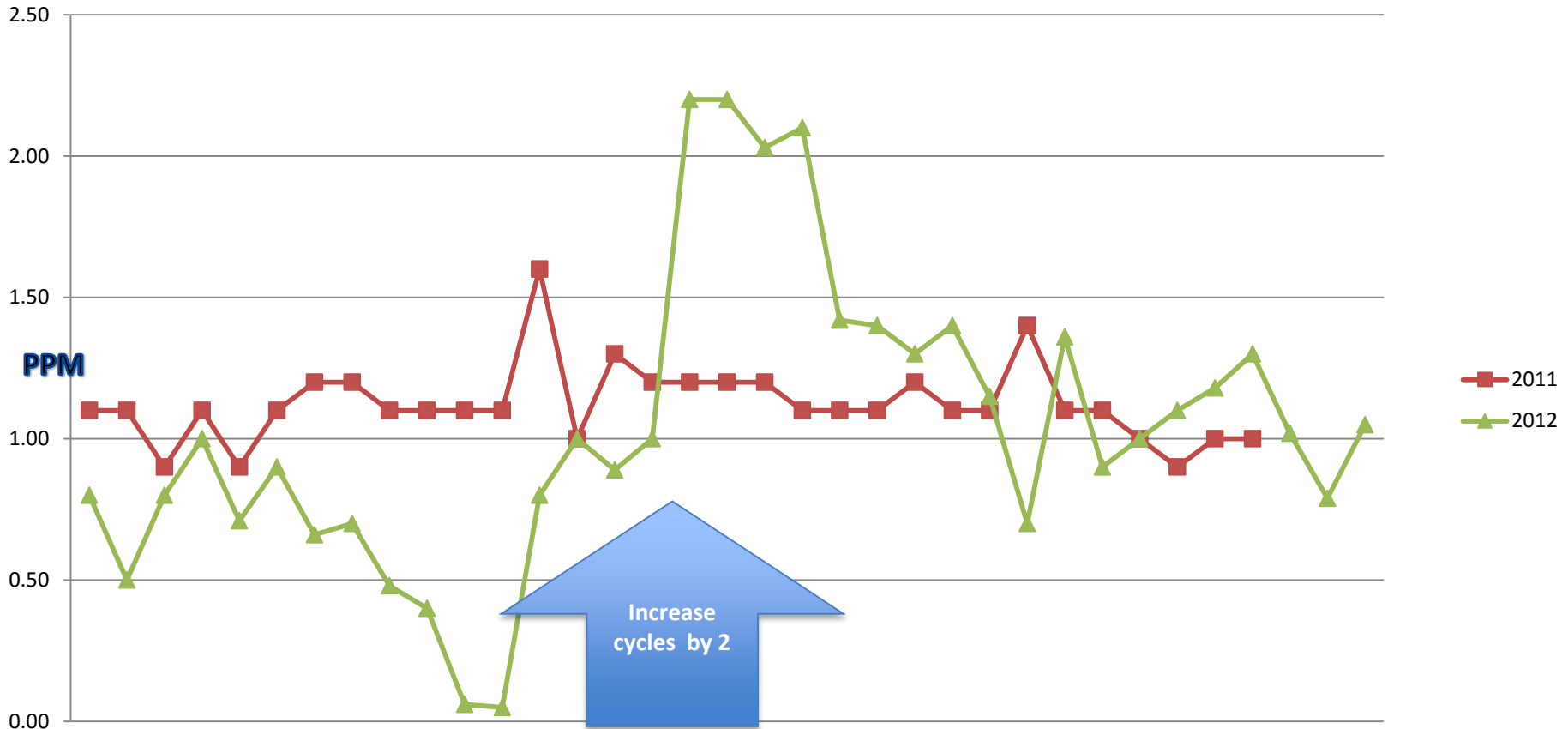




Hinckley, MN Tower #3

Corrosion Inhibitor Concentration

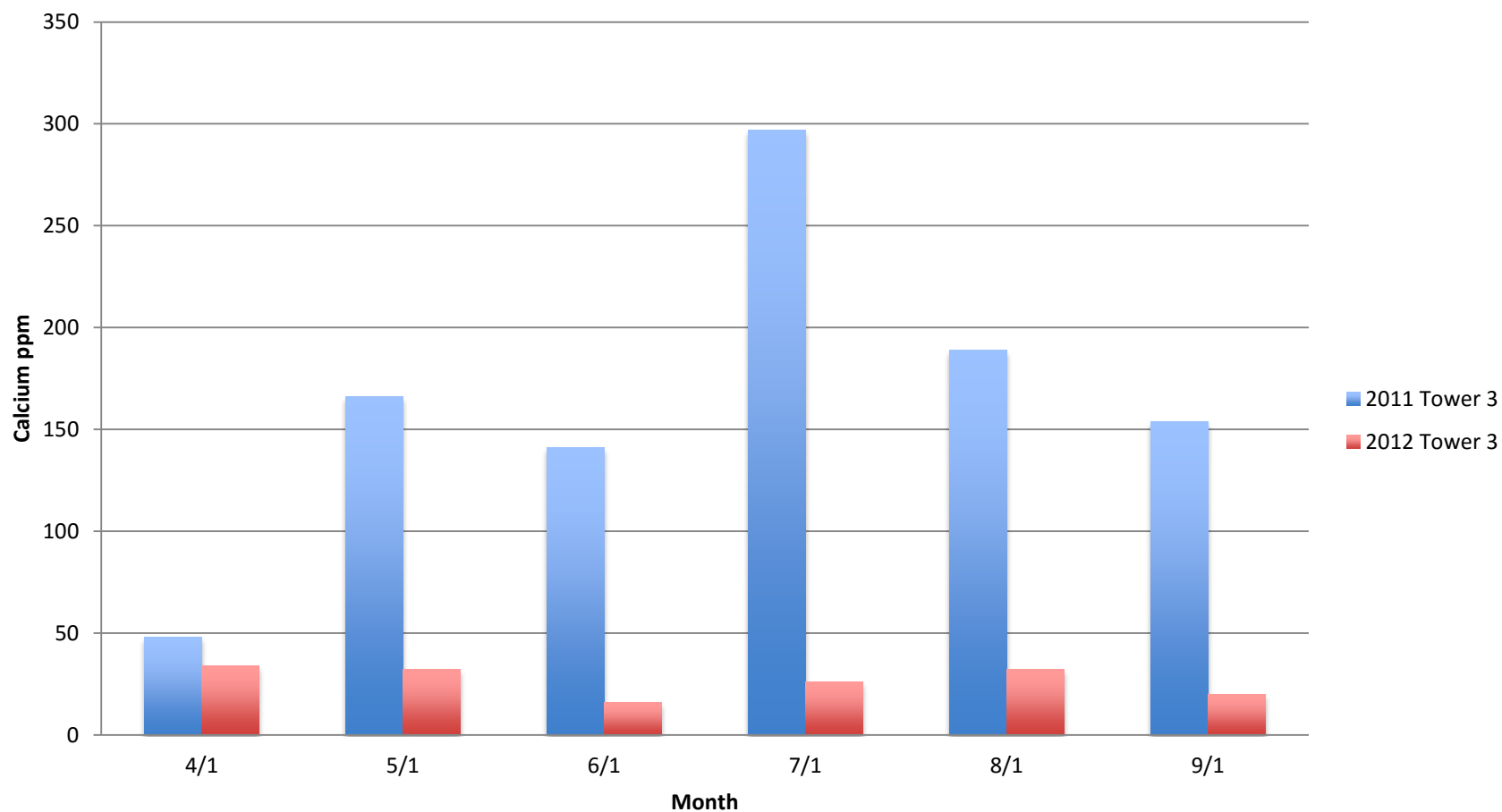
2012 ProMoss™



Observation Points June to September



Tower 3 Calcium 2012 ProMoss™





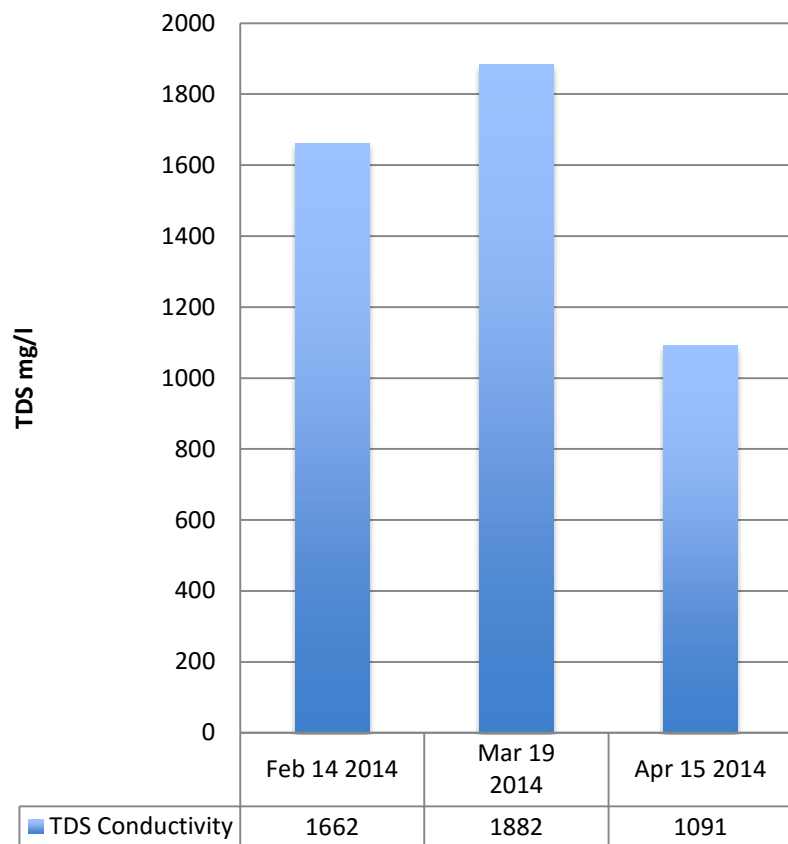
Cooling Tower Treated for Two Months Kansas City, MO

- Three cooling towers were chosen for treatment at a large factory in Missouri
- The three towers empty into a single basin
- They are approximately 15 years old and are slated for replacement in 2015
- ProMoss™ is delivered to the tower basin in a contact chamber that requires no plumbing or change in the cooling tower.

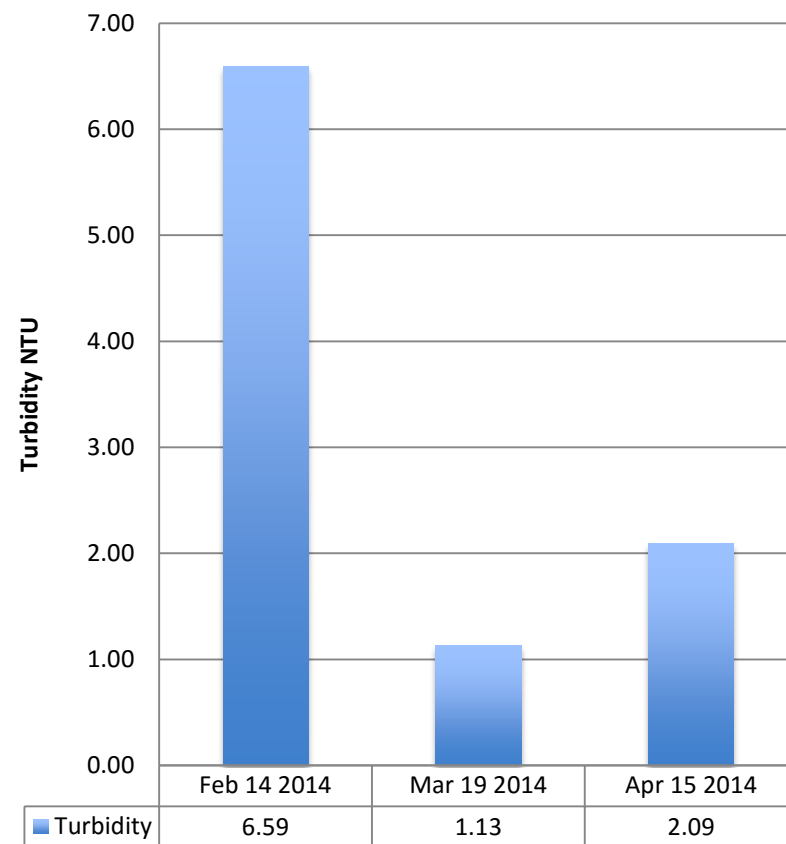


Conductivity and Turbidity

TDS Conductivity



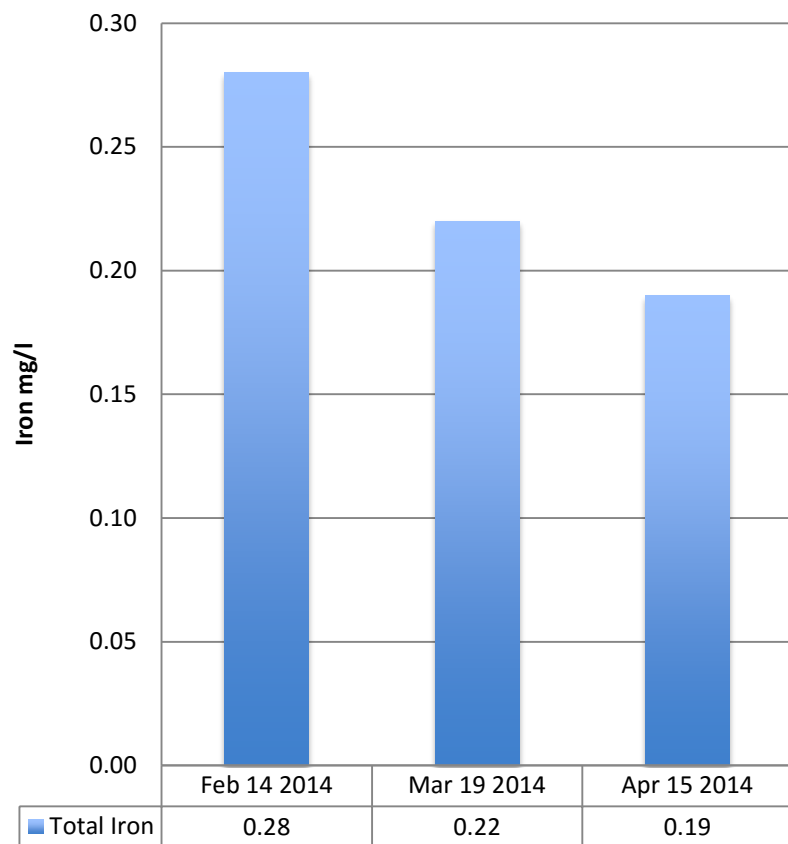
Turbidity



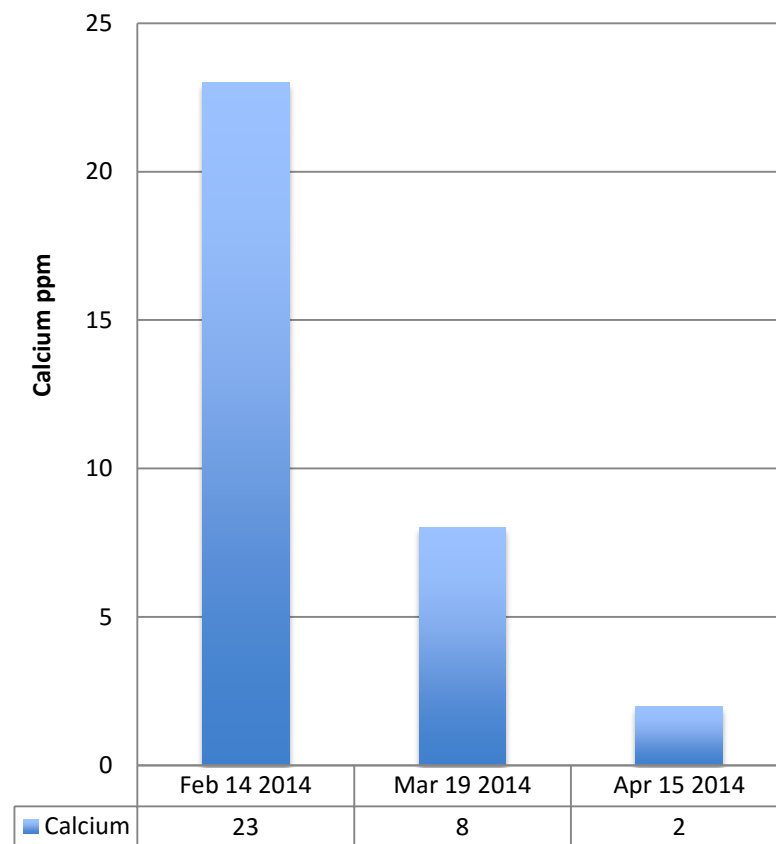


Calcium and Iron Ion Concentrations

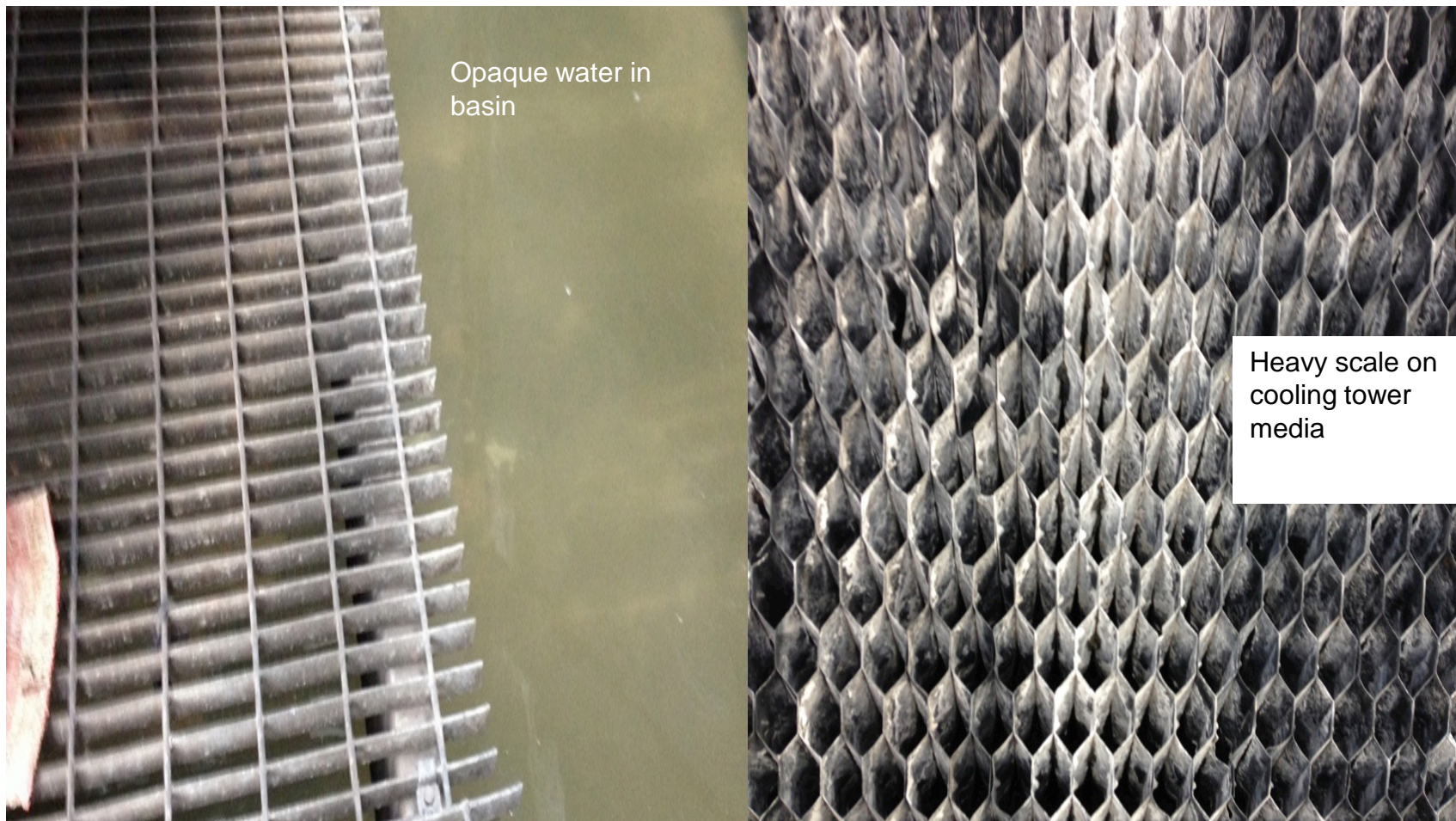
Total Iron



Calcium



Pre-Treatment Photos



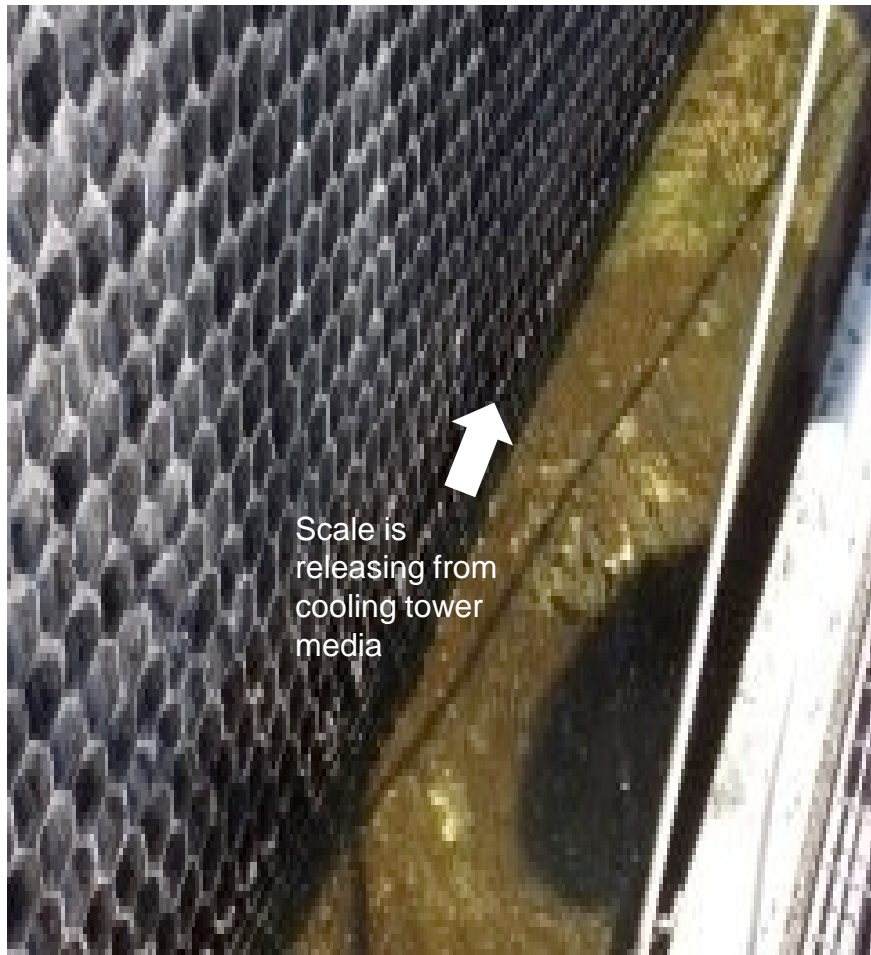
Pre-Treatment Photos



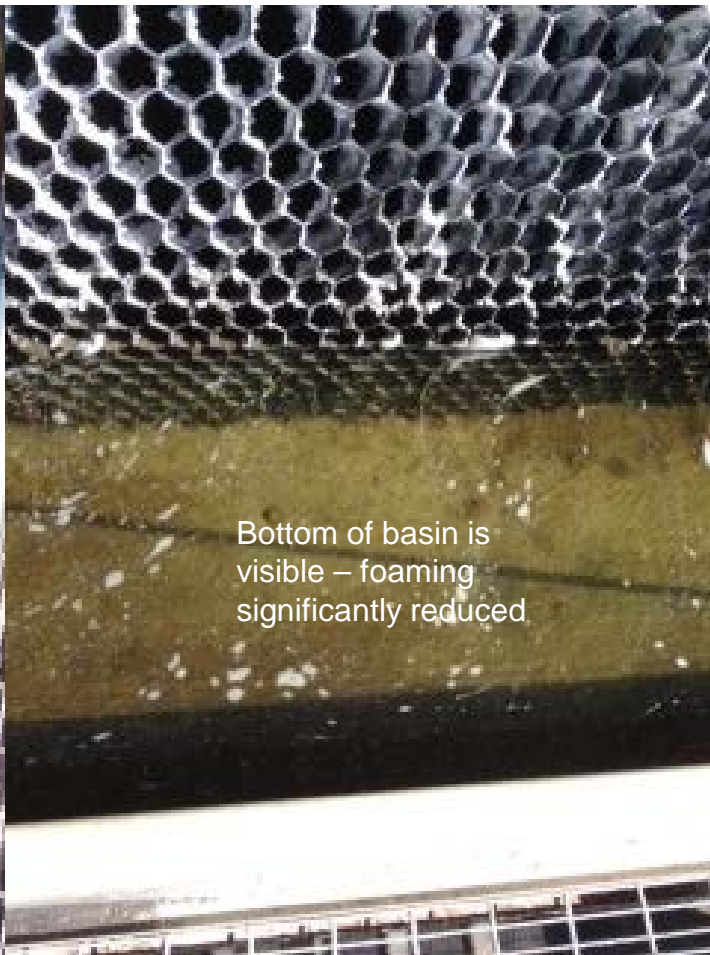
Foaming in return water (note foam coming from the media)



One Month of Treatment with ProMoss™



Scale is
releasing from
cooling tower
media



Bottom of basin is
visible – foaming
significantly reduced



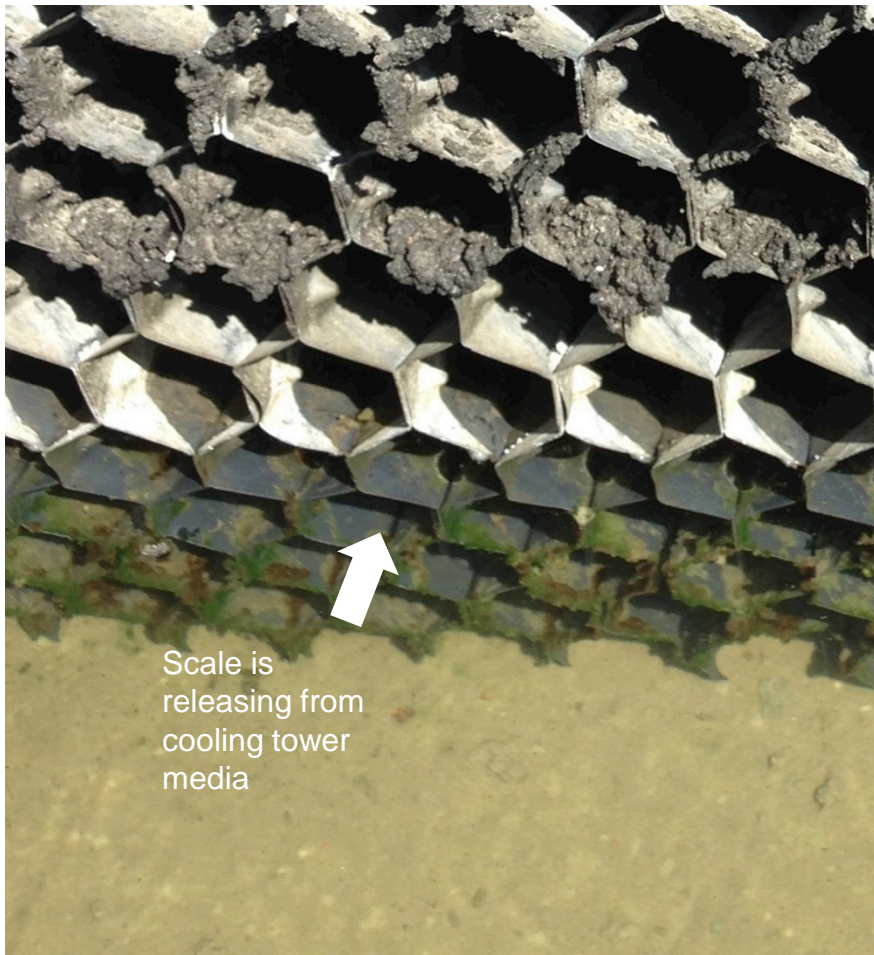
Two Months Treatment with ProMoss™



Note bottom of basin is visible through crystal clear water

Sludge on the floor of the basin starting to loosen

Two Months Treatment with ProMoss™



Scale is
releasing from
cooling tower
media



Bottom of basin is visible –
foaming stopped

Note bottom of
basin is visible
through crystal
clear water



Treatment of a 3M 7000 Ton Cooling Tower 2014

- Built in 1960's
- Structure made from wood and galvanized steel
- Chiller has 3000 hours of service
- Pipes and connections made from mild steel
- Water treated by Nalco
 - Biocide
 - Dispersant
 - Corrosion inhibitor

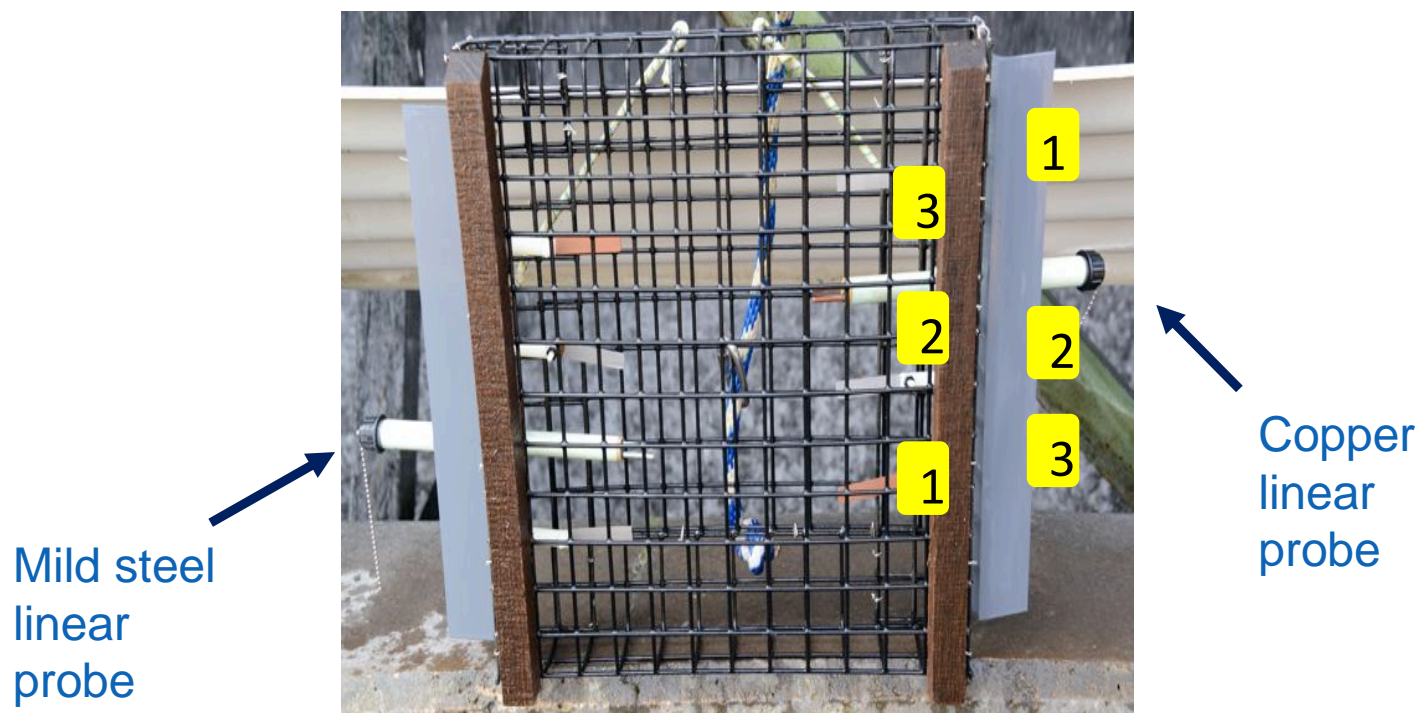


7000 Ton at 3M Corporate Headquarters Cooling Tower 2014 Treatment Protocol

- Month 1 – baseline data collection
- Months 2-4 – Tower 3 treated with ProMoss™
 - Cycles of concentration doubled on month 2
- Months 2-4 – Tower 5 used as a control
- Weekly measurements
 - Corrosion for mild steel, copper using linear polarization probes and coupons, pH, TDS, Alkalinity, LSI, Ca, Fe, bacterial load, and organic contamination

ProMoss™ Treatment Details

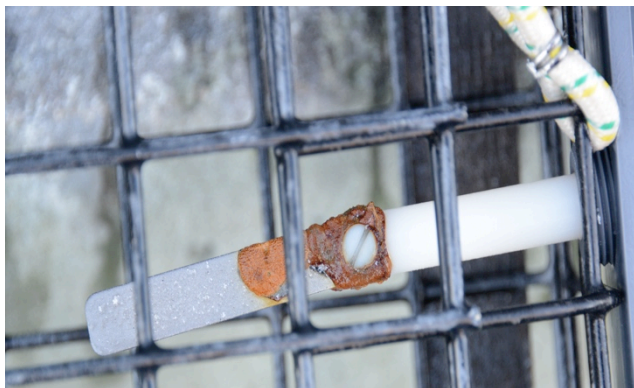
Test cage



1. Organic contamination coupon
2. Mild steel coupon
3. Copper coupon

Coupon Pictures

**Tower 3
Treated with ProMoss™**



Aug 1, 2014



**Tower 5
Control Tower**



Aug 1, 2014



Results from the ProMoss™ Treated Tower



Tower 3 - Aug 8, 2014

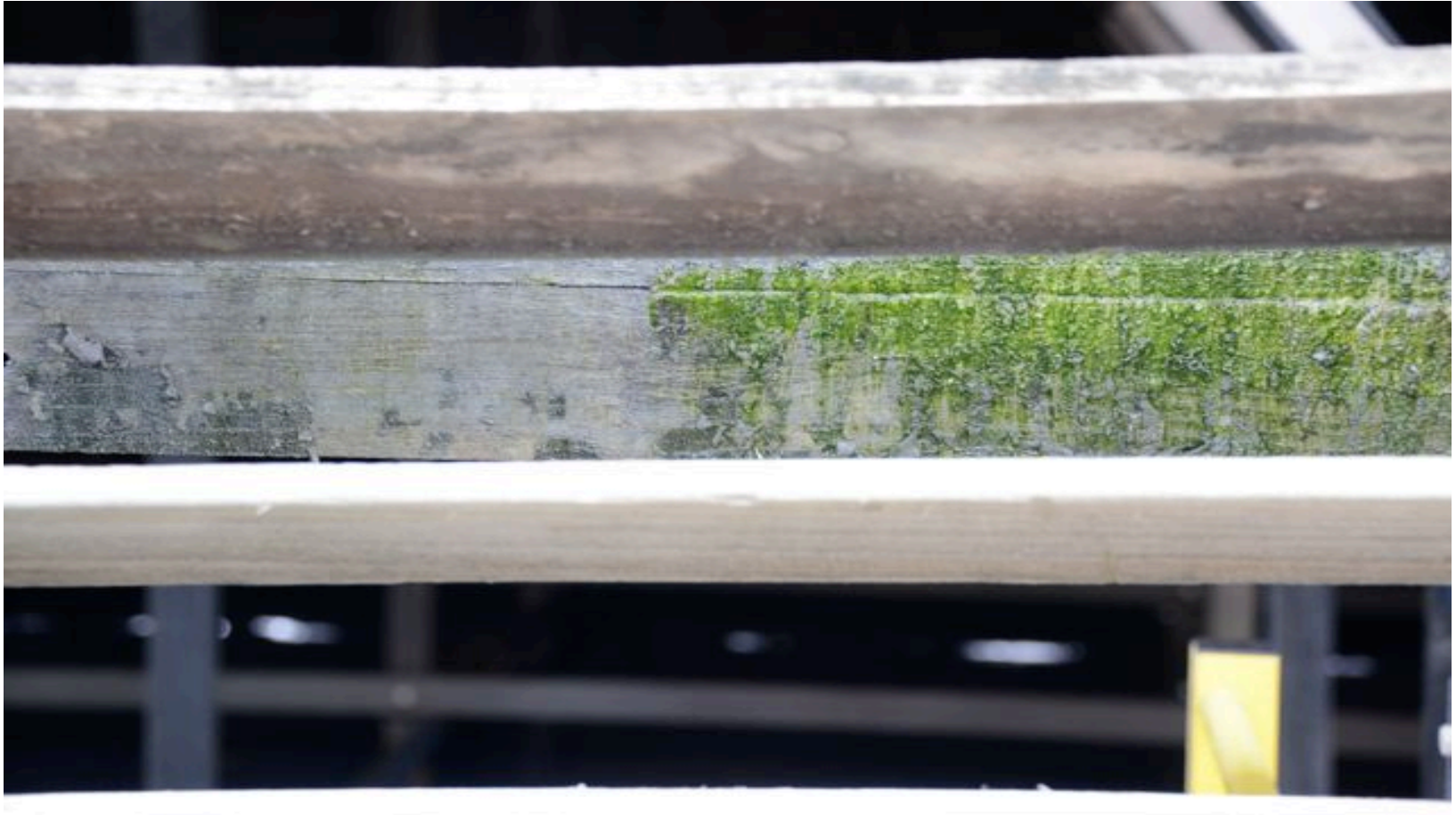


**Sloughed off
organic
contamination
film from the
wood**

Tower 3 - Sept 12, 2014



Results from the ProMoss™ Treated Tower



Tower 3 - Oct 17, 2014

Results from the Treated Tower



Tower 3
ProMoss™
Treated

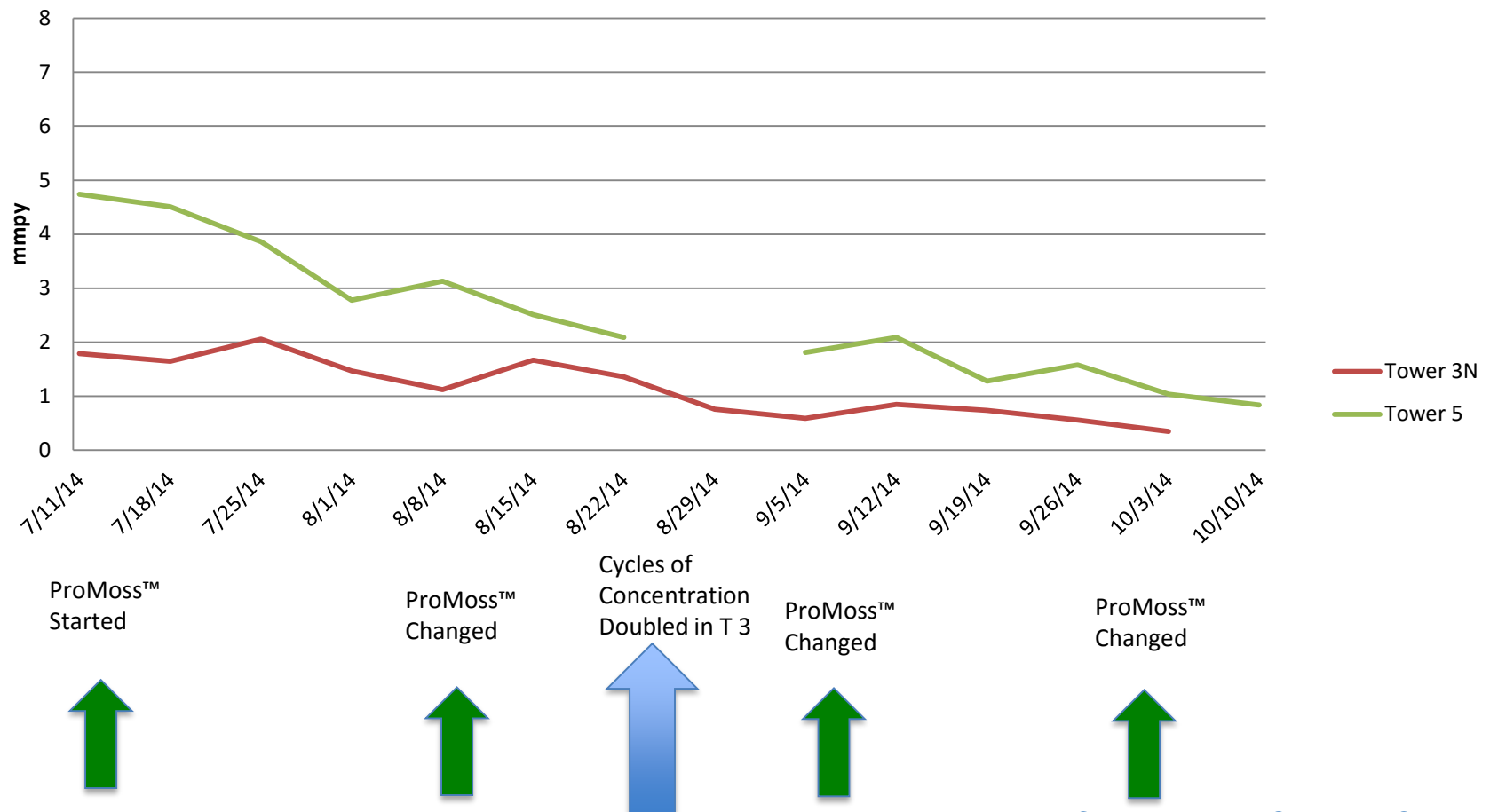


Tower 5 Control



7000 Ton Cooling Tower

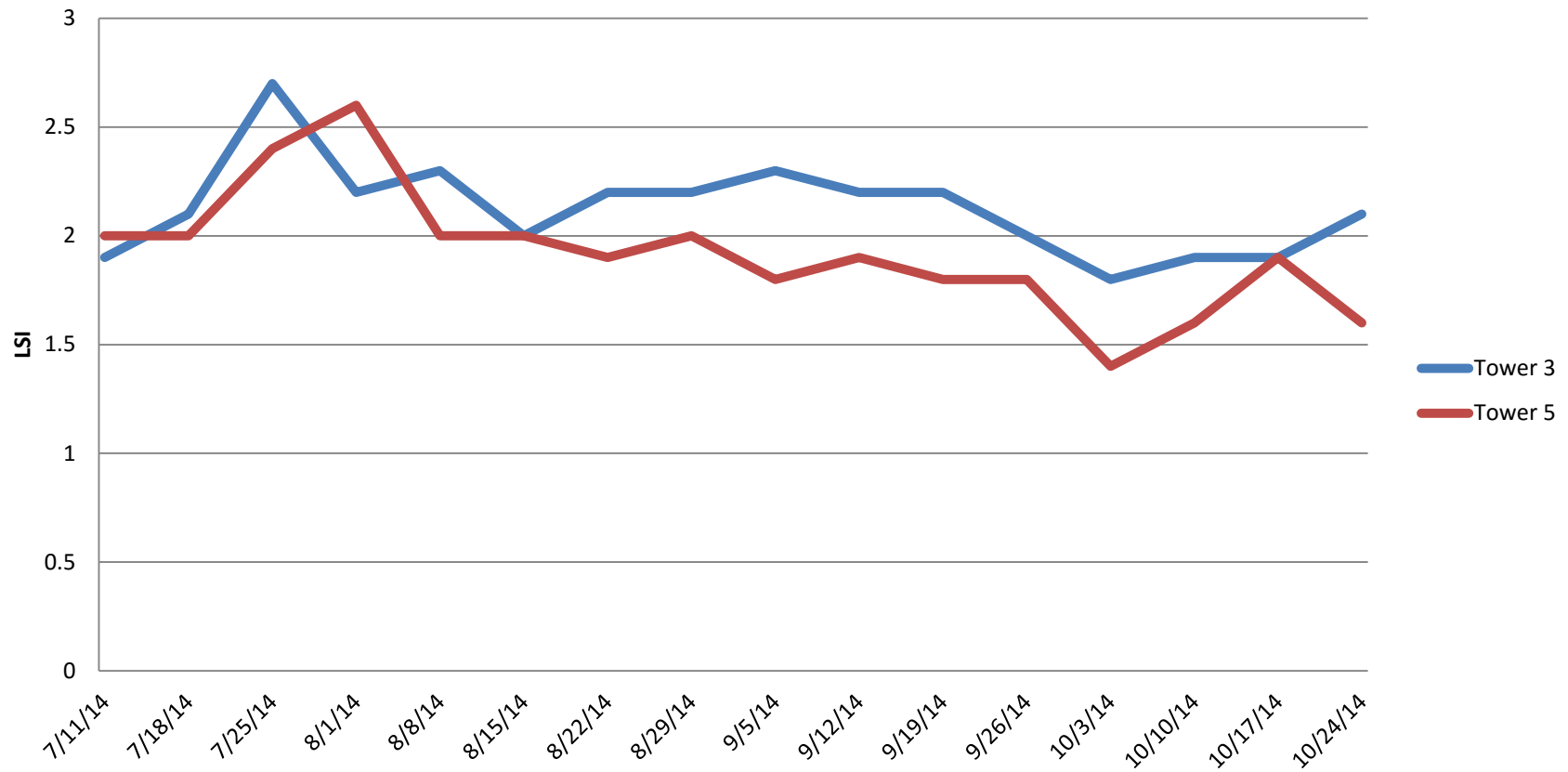
Mild Steel Corrosivity (North)



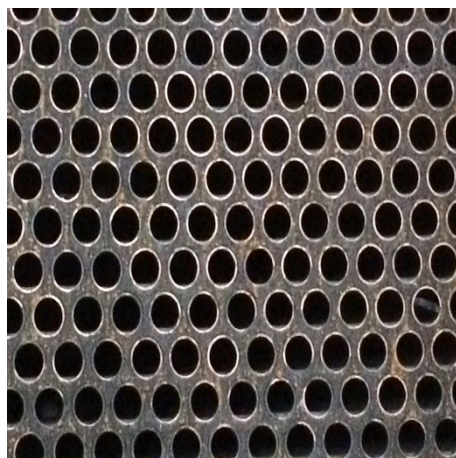
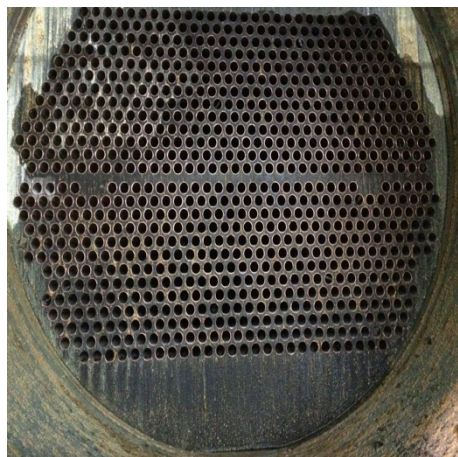


7000 Ton Cooling Tower Langlier Saturation Index

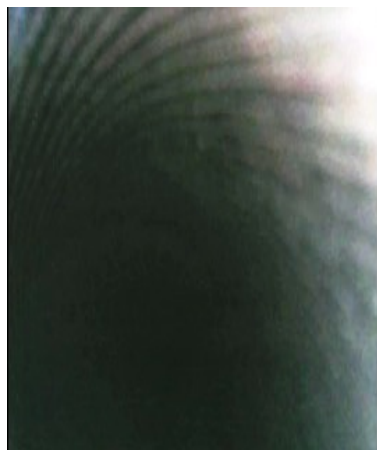
LSI Calculation



Chiller from Treated Tower

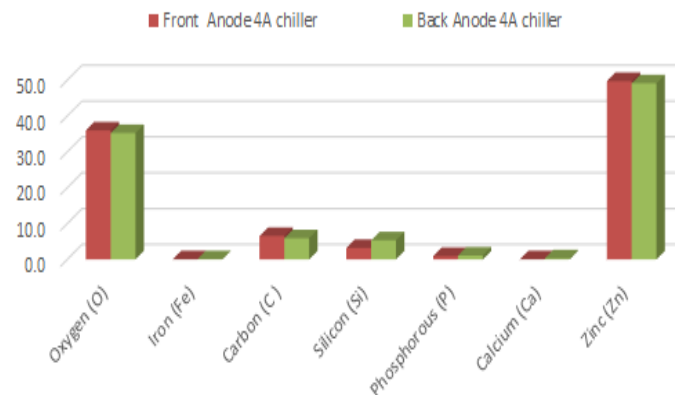


Zinc
Anodes



Inside Chiller
tubes

Elements from chiller samples (mass%)



Mass percent [%]

Element	Front Anode 4A chiller	Back Anode 4A chiller
Oxygen (O)	36.0	35.3
Iron (Fe)	0.047	0.079
Carbon (C)	6.55	5.91
Silicon (Si)	3.20	5.34
Phosphorous (P)	0.946	1.09
Calcium (Ca)	0.046	0.287
Zinc (Zn)	49.8	49.1



Potable Water

- Tea bag for water bottles, coffee makers, tea makers
- Home water systems
 - Treats all the water in the home
 - Replaces water softener
 - Works on municipal and well water
 - Cost approximately \$40/month
- Commercial potable water
 - Commercial buildings
 - Beverage industry
 - Food industry
 - Apartments and condominiums
 - Cosmetology industry
- Water use worldwide
 - Holding tanks
 - Village water treatment
 - Portable water treatment

Home Water System





Municipal Waste Water Treatment Plant Wayland, NY

- Cited for excessive algae discharge into the environment by the state in 2014
- CWS received authorization to treat one of two terminal clarifiers with ProMoss™ in 2015
- Both clarifiers were cleaned in June
- ProMoss™ added to one clarifier
- Egress water from both clarifiers combined before discharge



Wayland, NY Terminal Clarifiers August

Clarifier Without ProMoss



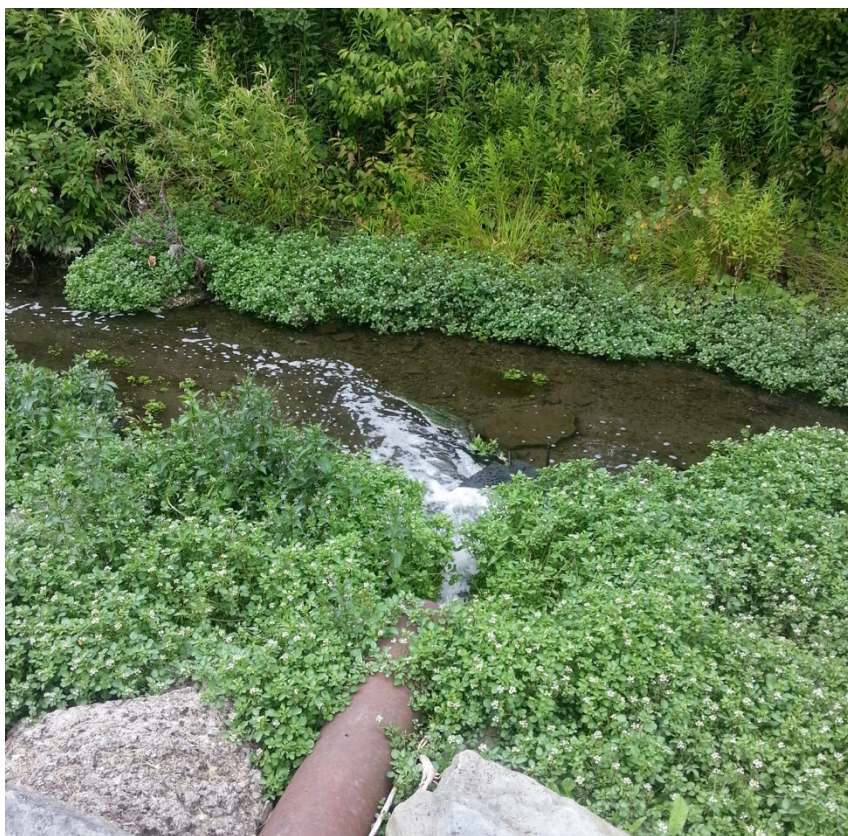
Clarifier With ProMoss





Wayland, NY Municipal Waste Water Treatment - August

Discharge into a Stream



Downstream from Discharge

