Case Study

ProMoss™ Plant-Based Water Treatment Case study – Program Comparison with Conventional Chemical Treatment

Steve Chewning, CWT, Southeastern Laboratories, Inc. September 2022

Companies adopting sustainable business practices understand that they are most successful when economic and environmental benefits align. Many companies are now positioning their business on a platform of sustainable development that visibly proclaims what they stand for and how they are contributing to their own and their customers' sustainability goals. To be successful in today's market, water treatment service companies will need to be able to offer greener alternatives to supplement or replace their conventional chemical treatment programs.

One such alternative is a treatment process that uses the leaves from a particular species of sphagnum moss that grows naturally in New Zealand and along the US–Canadian border. Minnesota-based Creative Water Solutions has developed a process for harvesting the leaves and packaging them for application in water systems.

ProMoss™ has unique properties that make significant performance contributions to evaporative water systems treatment:

- Acts as a natural water softener, removing impurities such as calcium, magnesium, iron, and other metals that can result in scaling and corrosion problems in water systems. Hydrogen ions are released in the exchange process, effectively neutralizing alkalinity.
- Breaks down the organic "binders" that hold deposits together, resulting in cleanup and removal of deposits from system surfaces.
- Inhibits and remove organic contamination resulting from microbiological activity, which insulates heat transfer surfaces and causes corrosion in water systems. In a lot of applications, this is proving to be a more efficient approach than chemical treatment.

Southeastern Laboratories (SEL) looked at 14 months of data from two identical centrifugal chiller/cooling tower systems at a large data center in the US. Both systems are rated at 1,250 tons and are operated in tandem with similar load factors. Makeup water to the systems is treated surface water provided by a local municipality.

SEL provided the ProMoss™ treatment program. The comparison chemical treatment program was existing and was provided by a large multi-national water treatment provider. ProMoss™ was introduced to the trial system by lowering feed cages into the in-ground concrete sump of the cooling tower system; a feed method that is often used for trials as it facilitates the running of a trial with ProMoss™ without purchasing and piping in specialized feed tank systems.

The chemical treatment program utilized an organo-phosphonate/polymer/azole-based inhibitor product traced with PTSA. Two different biocide chemicals were used for microbiological control, one oxidizing (sodium hypochlorite) and the other non-oxidizing (glutaraldehyde). During the first 10 months of the trial ProMoss™ was used alone with all chemical treatment products eliminated. A Flowmark disinfection generator was added after 10 months, which produces hydrogen peroxide from UV lamps. This is an EPA registered device often used with ProMoss™ to satisfy ASHRAE guidelines that recommend an oxidizing biocide for Legionella bacteria control in cooling towers.

Performance standards for success were agreed to at the start of the trial. Basically, if the same or better performance could be achieved without chemicals, the trial would be a success. Specific performance metrics were listed as follows:

1. **No rise in condenser approach temperature due to scale or fouling**
2. **Mild steel corrosion rates less than 2.0 mils/year**
3. **Copper corrosion rates less than 0.3 mils/year**
4. **Total bacteria counts no greater than 10^4, Target 10^1 to 10^3**
5. **Total ATP levels < 300 RLU's**

An additional goal of the trial was to look at reducing water consumption by increasing cycles of concentration without impacting the perform metrics above.

Here is how the two systems compared:

1. **Condenser Chiller Approach Temperatures – Goal Met**

   The condenser approach temperatures on the ProMoss™ treated chiller trended down during the trial period indicating efficiency improvement due to cleaner heat transfer surfaces. The chemically treated chiller's approach temperatures remained steady. Inspection of the condenser tubes on the ProMoss™ chiller revealed clean surfaces with no biofilm present.

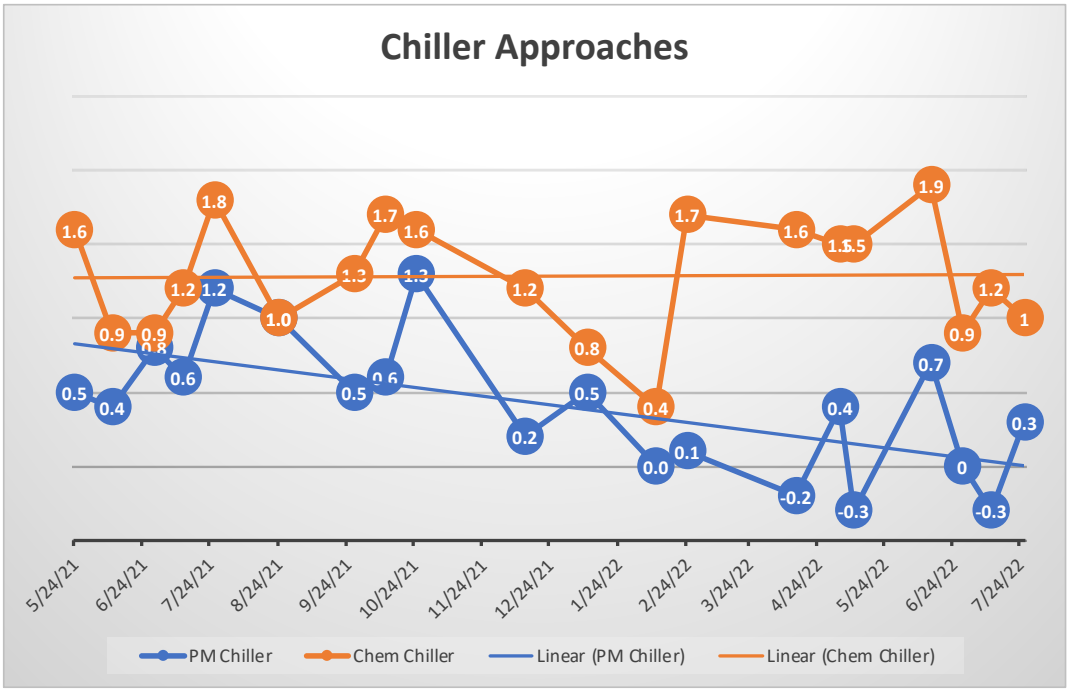


Figure 1 - Chiller Condenser Approach Temperatures

2. **Mild Steel Corrosion Rates – Goal Met**

   Mild steel corrosion rates were in the excellent category in both the chemically treated and ProMoss™ treated systems. Mild steel corrosion rates averaged around 0.2 mils/year in the chemically treated system and around 1.0 mils/year in the ProMoss™ treated system.

3. **Copper Corrosion Rates – Goal Met**

   Copper corrosion rates were in the excellent category in the ProMoss™ treated system and good in the chemically treated system. Copper corrosion rates averaged around 0.3 mils/year in the chemically treated system and around 0.1 mils/year in the ProMoss™ treated system.

4. **Total Bacteria Counts – Goal Met**

Total bacteria counts averaged 5.0 x 10^2 CFU/ml in the ProMoss™ treated system over the 14-month trial period. Total bacteria counts averaged 2.0 x 10^2 CFU/ml during the first 10 months without the hydrogen peroxide biocide generator (interestingly lower).

Total bacteria counts averaged 1.0 x 10^4 CFU/ml in the chemically treated system over the same 14-month period, 50 times higher than with ProMoss™ alone.

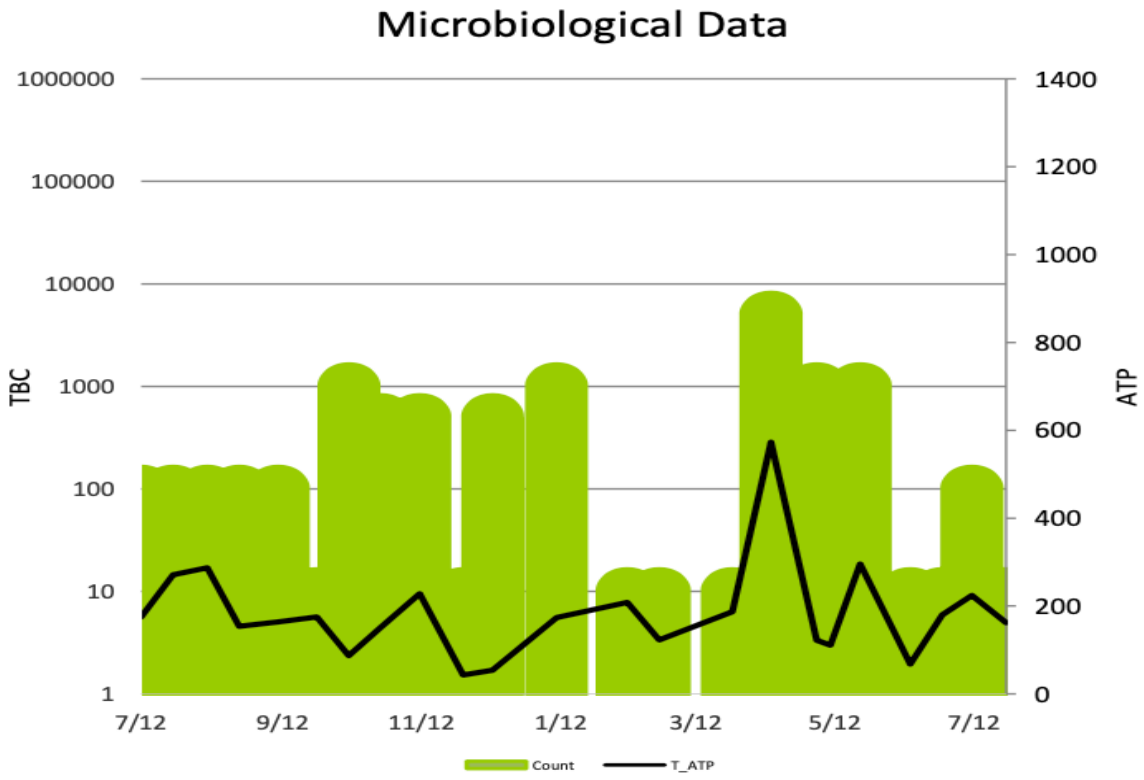


Figure 2 - ProMoss™ Tower

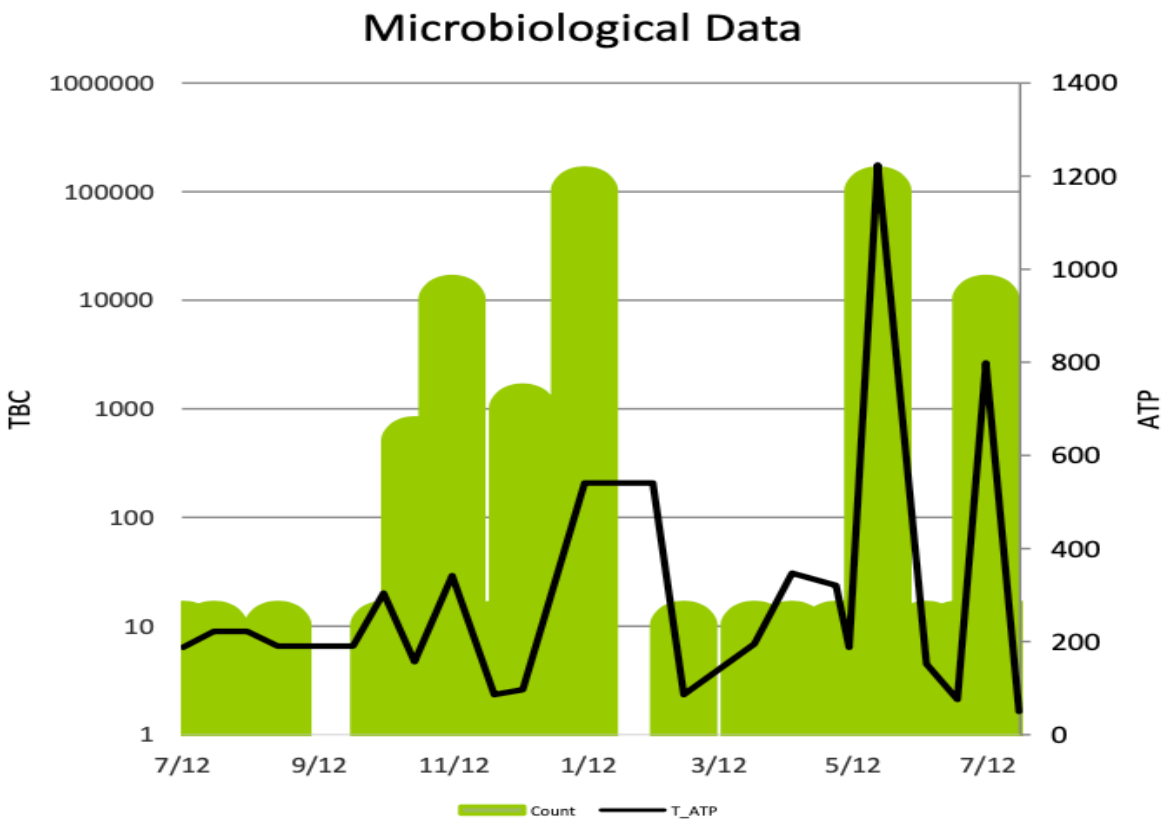


Figure 3 - Chemically Treated Tower

5. ATP (Adenosine Triphosphate) – Goal Met

ATP is an energy-carrying molecule found in the cells of all living things. Measurement of ATP in cooling water systems correlates with microbiological activity. ATP levels averaged 197 RLU's/ml in the ProMoss™ treated system. ATP averaged 295 RLU's/ml in the chemically treated system.

Water Savings

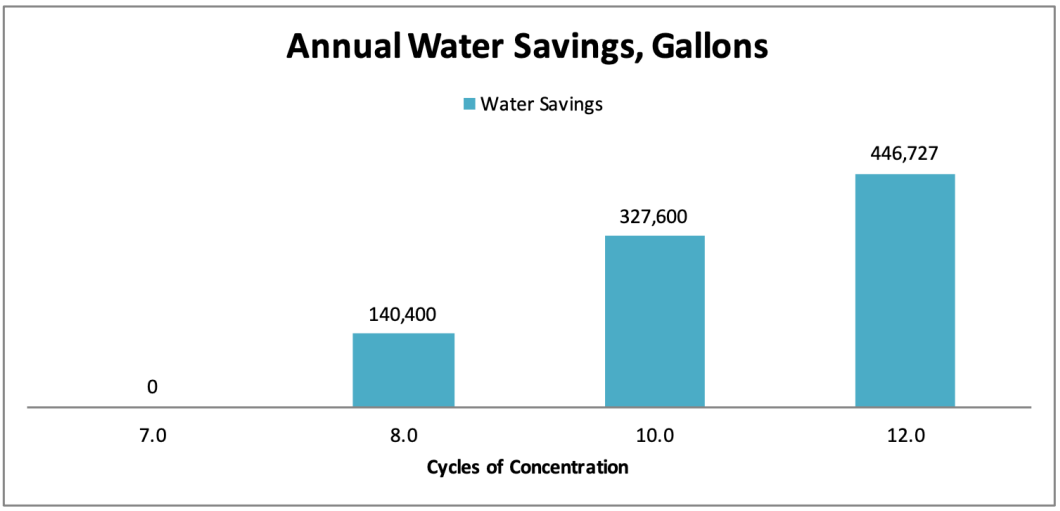
The existing chemical treatment supplier operated these cooling tower systems at a conductivity setpoint of 1,650 µMHOS, which correlates to around 7 cycles of concentration. The ProMoss™ treated tower was operated at the same conductivity setpoint for the trial. Because ProMoss™ reduces cycled hardness and alkalinity due to its' ion exchange capabilities and both of those contribute to the conductivity of the water, higher cycles are realized. Both hardness and alkalinity

are limiting factors in scaling index calculations so we find that blowdown control setpoints can often be adjusted to reduce blowdown with the reduction of these limiting factors.

In the case of this trial, cycles of concentration were increased on the ProMoss™ tower to around 12 cycles resulting in a 45% blowdown reduction and an annual water savings of around 447,000 gallons.

Water Savings 1,250 Ton System
ProMoss™ Versus Chemical Treatment

	Cycles	Makeup	Evaporation	Bleed	Water Savings	% BD Reduction
Chemicals	7.0	6,879,600	5,896,800	982,800	0	0.0%
	8.0	6,739,200	5,896,800	842,400	140,400	14.3%
	10.0	6,552,000	5,896,800	655,200	327,600	33.3%
ProMoss™	12.0	6,432,873	5,896,800	536,073	446,727	45.5%



There are other benefits to the program that are important that should be considered:

- Hazardous chemicals used in conventional chemical treatment programs are no longer stored on site.
- Maintenance of chemical feed and storage systems is eliminated.
- Eliminating chemical feed systems means eliminating potential failure points that effect program performance and potential safety in handling issues with personnel.
- Spent ProMoss™ material can be repurposed as landscape mulch or used as oil absorbent contributing to zero waste goals.
- Blowdown water from ProMoss™ treated systems can be repurposed for irrigation or other uses as it does not contain regulated chemicals.

Feed Systems

Here are photos of typical ProMoss™ feed and control systems. This facility is headed towards full implementation with plans to retrofit their chemical systems to ProMoss™ systems.

Southeastern Laboratories, Inc.

Serving the Water Treatment Industry Since 1973

for more information go to:

selaboratories.com

ProMoss™