Behavior of Silica in Ion Exchange Systems
Failure of Water Handling Systems and Managing the Resulting Liability
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### Features

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<td>There is a growing body of claims and litigation surrounding water handling systems.</td>
<td>Bearman, Coldwell &amp; Berkowitz, PC;</td>
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<td>Whether the lawsuits arise from catastrophic equipment failure due to leaks or</td>
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<td>corrosive obstruction or Legionella-related disease, the legal risks and corresponding</td>
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<td>that result, with the objective of mitigating those risks.</td>
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Calendar of Events

Association Events

2018 Annual Convention and Exposition
September 26–29, 2018
Omni Orlando Resort at ChampionsGate
Orlando, Florida

2019 Annual Convention and Exposition
September 11–14, 2019
Palm Springs Convention Center and Renaissance Hotel
Palm Springs, California

2020 Annual Convention and Exposition
September 30–October 3, 2020
Louisville Convention Center and Omni Hotel
Louisville, Kentucky

2021 Annual Convention and Exposition
September 22–25, 2021
Providence Convention Center and Omni Hotel
Providence, Rhode Island

2022 Annual Convention and Exposition
September 21–24, 2022
Vancouver Convention Centre
Vancouver, Canada

2023 Annual Convention and Exposition
October 4–7, 2023
Grand Rapids Convention Center and Amway Grand Hotel
Grand Rapids, Michigan

Also, please note that the following AWT committees meet on a monthly basis. All times shown are Eastern Time. To become active in one of these committees, please contact us at (301) 740-1421.

Second Tuesday of each month, 11:00 am – Legislative/Regulatory Committee
Second Tuesday of each month, 2:30 pm – Convention Committee
Second Wednesday of each month, 11:00 am – Business Resources Committee
Second Friday of each month, 9:00 am – Pretreatment Subcommittee
Second Friday of each month, 10:00 am – Special Projects Subcommittee
Second Friday of each month, 11:00 am – Cooling Subcommittee
Third Monday of each month, 9:00 am – Certification Committee
Third Monday of each month, 3:30 pm – Young Professionals Task Force
Third Monday of each month, 4:30 pm – Standards Task Force
Third Tuesday of each month, 3:00 pm – Education Committee
Third Friday of each month, 9:00 am – Boiler Subcommittee
Third Friday of each month, 10:00 am – Technical Committee
Quarterly (call for meeting dates), 11:00 am – Wastewater Subcommittee

Other Industry Events

NACE, Corrosion Risk Management Conference, June 11–13, 2018, Houston, Texas
AWWA, Annual Conference, June 11–14, 2018, Las Vegas, Nevada
BOMA, Annual Meeting, June 23–26, 2018, San Antonio, Texas
ASHRAE, Annual Meeting, June 23–27, 2018, Houston, Texas
ASH, Annual Convention & Expo, July 15–18, 2018, Seattle, Washington
NACE, Corrosion Technology Week, August 16–20, 2018, Houston, Texas
ACS, Fall National Meeting & Expo, August 19–23, 2018, Boston, Massachusetts
Ironically, making water safe has long been a dangerous job, requiring lots of protective gear and a very strong back. Oxi-King just did for water treatment what Steve Jobs did for computers—made it way friendlier. No exposure to strong odors and accidental chemical spills. Everything is pre-filled and lightweight. One 5 pound pac will treat up to 500,000 gallons with a 0.6 ppm residual and no load. Past winner of the Occupational and Health Safety Magazine New Product of the Year Award in Hazmat Safety!

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I recently attended the AWT Training Seminars in Las Vegas, Nevada. What a great meeting! AWT added a one-day RO training seminar this year. It was very well attended and received. The course reviewed membrane technologies, including how they function, what they do, and how to take care of them. There were a lot of practical takeaways from this session. If you weren’t able to join us this year, you’ll want to attend in 2019.

The Fundamentals and Applications session is a must for anyone with six months to two years of experience. The session was very interactive and brought the mechanical room into the classroom. It focused on real-world examples that we have all faced, and it allowed plenty of time for a question and answer period. I look forward to sending my son, who recently joined the industry, to next year’s training.

The Water Treatment Training session is also incredible! The amount of material they pack into just a few days is amazing. I’ve been in the industry for years and always walk away learning a few new things. I would like to thank all of AWT’s hardworking and dedicated volunteers who donate their time, knowledge, and expertise to these seminars. These programs would not be possible without them.

CWT
We had a large group of people taking the CWT exam. The CWT designation is the water treatment industry’s definitive standard. There is no other credential that gives you the professional credibility you deserve. In the upcoming months, you will see a change in the way we market the CWT as we focus on educating our end-users on the value of hiring a CWT.

If you weren’t able to take the CWT exam in Las Vegas or Cleveland, you can take it at a testing center near you. Visit the AWT website at www.awt.org for more information.

Dale Carnegie
If you weren’t able to take the in-person Sales Training held during AWT’s Training Seminars, you can still get the training you need. AWT recently partnered with Dale Carnegie to offer live online sales and leadership seminars. Thanks to the great work of our Business Resources Committee, we were able to receive a steep discount on training that is crucial to you and your company. All the feedback we have received from current participants has been extremely positive. To find out more, visit the AWT website.

Get Involved
Finally, I’d like to encourage everyone to get involved with AWT. This is a great way for you to share your technical skills or business knowledge. AWT currently has a lot of task forces and work groups that are working on small, short projects, meaning you don’t have to commit to years of service. Instead, you can help on a project for a few months, or as your schedule allows.

To find out more about the opportunities available, contact AWT staff at (240) 404-6478. They can help find the perfect fit for you.

Please don’t hesitate to reach out and provide feedback on AWT. I can be contacted at president@awt.org.
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I’m really looking forward to the 2018 convention. Orlando is a great city to visit, and our educational program is exceptional. We had over 55 quality abstracts submitted for consideration this year—our highest ever! This made for some difficult decisions in developing the agenda, but it also means that the sessions are very strong. Be sure to read page 52 to find out more about the meeting.

Charity
We are still working with Pure Water for the World (PWW) on our charity activities at the convention. There won’t be a duck race this year, although we did think about sending the ducks down the lazy river at the Omni. But PWW has been doing some amazing work. In 2017, PWW directly impacted 14,000 children and adults in Haiti and Honduras, providing them with clean water. Here are some statistics about PWW’s successes last year:

- Improved 23 communities
- Impacted 1,650 family homes and 31 community schools
- Installed 1,441 biosand water filters and 243 single family latrines
- Monitored 93 schools and 720 homes

The work PWW is doing is incredible. I hope you consider getting involved at www.awt.org/about_AWT/giving_back.cfm.

ROI
As a small business owner, I know how difficult it is to be away from the office and clients. And let’s be honest, there is an expense to sending me and my employees, but the convention is an investment. You’ll make new vendor contacts and meet new business associates. These contacts help me grow my business and my bottom line. It’s gone so far as positioning me to get new accounts.

AWT is truly a group of members helping one another succeed, and attending the annual convention is just one more way you can ensure your personal and business success. The bottom line is, you cannot afford to miss another convention. Finally, I’d like to thank all of the generous sponsors and exhibitors who have signed up so far. You enhance the convention experience for all of the attendees!

As we plan and prepare for Orlando, I welcome your input and feedback. I can be reached at dwagenfuhr@h2oeng.com. Thank you for the opportunity, and I look forward to serving you!
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Behavior of Silica in Ion Exchange Systems

Peter Meyers, ResinTech Inc.
Part One: Chemistry of Silica

Silicon is the second most abundant element found on earth. Although silicon itself (Si) is a glassy, insoluble solid, its various oxides (primarily \( \text{SiO}_2 \)) are somewhat soluble in water. Indeed, all natural water supplies contain some dissolved “silica.” Many supplies also contain suspended or colloidal silica.

Silicon is directly underneath carbon on the periodic chart. Silicon, like its sister element carbon, has four covalent bonding sites and can, therefore, form a very large number of potential molecules. Silica chemistry is quite complex, second only to the chemistry of carbon compounds. Because the silicon nucleus is larger than the carbon nucleus, silicon does not easily form double or triple bonds, and silicon does not readily form chains more than six silicon atoms long. Silicon readily forms covalent bonds with oxygen and other elements, less readily with itself. In fact, since the bond energy is lower for silicon than for carbon, it does this rather easily.

In water treatment, we are concerned with silica because of its tendency to form deposits (scale) on surfaces it comes in contact with. In boiler and turbine systems, the deposition is often associated with temperature, pressure, and phase state changes that occur. In microelectronics, the concern is deposition and/or changes to the surface properties of the “silicon” wafers.

The classic formula of “dissolved silica,” as used by water treatment engineers, has traditionally been written as \( \text{SiO}_2 \). This is because amorphous silica and solid silica deposits typically contain a ratio of two moles of oxygen per mole of silicon. We use the formula “\( \text{SiO}_2 \)” because it is convenient, even though it does not apply to the actual silica species found dissolved in water.

As dissolved in water, silica is fully hydrated and generally present as orthosilicic acid \( \text{H}_4\text{SiO}_4 \) (also written as \( \text{Si(OH)}_4 \)). Its formula and tetrahedral shape predicts the very weak acidity and also explains why silica is highly soluble at high pH (surrounded by \( \text{OH}^- \) ions).

![High Five? Because silicon is so heavy, it can't be as flexible with its bonding points.](image)

Silicic acid is considerably weaker than carbonic acid. The ionization constant for silicic acid is considerably smaller than for carbonic acid.

\[
\begin{align*}
\text{Carbonic Acid } & \quad K_1 = 4.3 \times 10^{-7} \\
\text{Silicic acid } & \quad K_1 = 2 \times 10^{-10}
\end{align*}
\]

At pH greater than 10, silica is present as silicate ions and is quite soluble. At neutral pH, the ionization of silicic acid depends on the concentration of hydrogen ions. Since \( K_s \) for silicic acid is very small, not much silicic acid can ionize when \( \text{H}^+ \) is present.

![Figure 1. Ortho-Silicic Acid Model](image)

![Figure 2. Ionization of Ortho-Silicic Acid (under neutral conditions)](image)
At very high pH, silicate becomes divalent. However, divalent silicate only exists when the pH is well up over 11.

Silica readily polymerizes when there is insufficient alkalinity present to prevent this.

Published silica solubility leaves out a number of factors, not the least of which is the importance of alkalinity, which stabilizes silica and helps keep it in solution, sometimes at concentrations well beyond published data. Divalent and trivalent metal precipitants, notably aluminum, magnesium, and calcium, decrease silica solubility, or at least cause silica to coprecipitate in solutions where it otherwise would supersaturate or polymerize.

Part Two: Silica Removal Methods

There are four basic ways to remove silica from water. These include chemical precipitation, membrane processes, evaporative processes, and ion exchange. Since this paper is primarily about ion exchange, the other methods are discussed only briefly.

Silica forms insoluble precipitants with various metals, notably magnesium, but also iron, aluminum, calcium, and others. By adding magnesium (if not already present) and raising the pH, silica can be precipitated out of solution. The precipitation process is enhanced at elevated temperatures. As with other solids separation methods, silica precipitation is messy and can be difficult to control if inlet conditions are not stable.

Reverse osmosis and other membrane processes are able to separate silica (and other salts) from water by creating a membrane barrier. The concentrate side of the barrier is susceptible to fouling when silica solubility is exceeded. Silica precipitation in membranes is almost always associated with a metal cation, although there are examples of pure silica gel formation in membrane concentrates. Silica solubility increases at elevated pH, and membrane systems designed to take advantage of this are able to operate at higher silica concentrations and with lower silica in the product stream.

Evaporative processes work by evaporating and then re-condensing water, leaving silica and other salts behind in a concentrate stream. Evaporative processes are susceptible to the same solubility concerns and constraints as membrane processes.

Silica removal by ion exchange is primarily limited to strong base anion resins. All strongly basic ion exchange resins have the ability to split salts. This means that
they can remove weakly ionized species, such as carbon dioxide and silica, by forcing them to become ions. Although the hydroxide-form strong base anion resin preference for silicate is much lower than for sulfates and chlorides, it is significantly greater than for hydroxide. Hydroxide-form strong base anion resin preference for silicate and alkalinity are similar (at least we know that silica break generally occurs at about the same percentage exhaustion as alkalinity break).

In the chloride form, or any other salt form, strong base anion resin has essentially zero preference for silica. Silica is non-ionized at typical raw water pH and can't enter the resin beads by means of the ion exchange pathways. The simple explanation for why hydroxide-form anion resin removes silica and chloride-form anion resin doesn't is that the release of hydroxide raises the pH and causes silica to become ionized (silicate). Ionized silica, or silicate, is then removed, along with other anions.

Ion exchange methods to remove silica all involve a hydroxide-form strong base anion resin. However, there are a number of variations on the theme, including desilicizers, two beds, mixed beds, and weak base/strong base pairs.

The anion desilicizer is a "poor man's" demineralizer, consisting of a strong cation exchanger in the sodium form (a water softener) followed by a strong base anion exchanger in the hydroxide form. Thank goodness there are not too many of these critters around anymore. They have most of the disadvantages of a demineralizer and few of the advantages. However, they do remove silica along with the other anions.

Over the years, more than one engineer has wondered if it might be possible to operate a desilicizer at a real small caustic dose (or perhaps with brine plus caustic) and use the anion resin as a dealkalizer while still removing some silica. This would avoid the excess causticity created by the complete anion exchange for hydroxides. ResinTech tried this in our lab with a Type II strong base anion resin.

The results were quite interesting. As long as the resin had enough hydroxide exchange sites to remove all the anions, silica was well removed. As soon as the hydroxide sites were depleted, the resin dumped the silica. By the time the hydroxide concentration was substantially reduced in the product water, all the silica had dumped. There was no net removal.

The same dumping phenomenon seen in the previous "desilicizer" experiment can also occur in demineralizers but is less likely because the anion exchanger is seldom operated until every hydroxide exchange site is exhausted. Although silica dumping can and does occur, a substantial concentration of silica is frequently found on exhausted anion resins, even when no hydroxide form capacity is left. This might be due to the concentration of alkalinity on the resin along with the silica, or perhaps because the low pH after the cation exchanger restricts the ability of silica to leave the anion resin and re-enter the water stream.

Perhaps the most widely published and easy-to-use hard copy capacity curves for rating co-flow exchangers are the engineering notes developed by the Rohm & Haas Company. These notes depict the capacity of Type 1 porous anion resin as a function of caustic dose related to FMA, CO₂ and SiO₂. The triangle charts for IRA-402

![Figure 6. Desilicizer (poor man's demineralizer)](image)

![Figure 7. Silica Removal by Dealkalizer Experiment](image)
show extraordinary capacity for silica, in some cases approaching the total capacity of the resin.

Figure 8. Old Triangle Charts for Hydroxide–Form Type 1 Porous Anion Resin Capacity

I remember being told that the probable reason for the high silica capacity was that R&H used synthetic water with "unnatural" and monomeric silica. Therefore, this part of the curve was unreliable. For simple two beds, the fraction of silica to total anions seldom exceeds 50%, and the "inaccurate" part of the curve doesn't matter.

Part 3: Case Studies of Silica Fouling

Many years ago, at L*A Water Treatment, we hoped to determine the relative affinity of strong base anion resin for "pure silica." To avoid the potential "mistakes" caused by using "synthetic" silica, we went out into the California desert and collected some natural volcanic water that contained about 65 ppm of reactive SiO₂. We ran it through cation and weak base ion exchangers, then air sparged to remove carbon dioxide. The solution, when freshly prepared, contained 65 ppm of reactive silica but almost nothing else. About a week later, we re-tested the solution and found the reactive silica to be less than 10 ppm!

Where did all the silica go? At first we thought it must have precipitated, but the water was crystal clear. We then "digested" the sample by adding sodium carbonate and heating. A re-test showed 65 ppm of silica.

We took that pure silica water and passed it through a lab column containing hydroxide-form strong base anion resin. We ran, and ran, and ran, and never got any silica leakage. Eventually, the resin bed plugged up with silica gel. We digested the various effluent samples to expose the original silica and subtracted this from the total. The amount of silica loaded on the resin was several times the resin's capacity.

We gave up. The experiment was declared a "complete success." I now fully believe the Rohm & Haas notes, but also believe it isn't safe to operate a demineralizer in this fashion.

The problem of rating anion resins with very high fractions of silica comes up mainly in multiple bed demineralizer designs with degasifiers, or lime softeners, and with weak base anion exchangers. In these cases, the silica percentage of load on the strong base anion resin can approach 100% of the total anions.

There is another potential problem with high silica loading on an anion resin, which is the concern about silica fouling during the regeneration cycle.

Two cases crossed my desk in the last year that are worth sharing.

The Tale of a Weak Base/Strong Base Pair

A large petrochemical plant in the Houston area reported silica fouling of their weak base anion exchanger. The goo gummed up the resin and caused the water to channel (flow unevenly through the resin), leading to very poor results. Silica in the raw water is a modest 6 mg/L, but the system does have a degasifier, so the silica load on the strong base resin is a large percentage of the total anions. We performed an elution study as a way to evaluate what happened.

A proper elution study on a demineralizer system involves more than specific gravity, as is common for water softeners. Specific gravity only confirms if the distribution system is working properly; it doesn't provide any information about how effectively the chemical is being used. To evaluate chemical efficiency, it is necessary to titrate samples for acidity or basicity. In this case, we also analyzed for silica.

There is a fair amount of work involved in taking the samples and then analyzing them, but it can yield valuable information about how best to operate.
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References
Most strong base/weak base pairs thoroughfare caustic, using it first in the strong base unit and then a second time in the weak base unit. It is common practice to send the first part of the caustic leaving the strong base anion unit to waste. This plant followed that practice. However, it never checked to see where the silica eluted. The elution study showed that the spent caustic was thoroughfare just at the time the silica was reaching its peak concentration.

Later in the year, another similar issue came up at a refinery on the West Coast. This system also has a degassifier and a weak base/strong base pair with thoroughfare caustic, but this plant does not divert to waste any of its caustic from the strong base anion unit. All the spent caustic from the strong base unit goes through the weak base unit. A similar issue with short throughput through the weak base/strong base pair occurred. The refinery elected to do an elution study but only to check specific gravity.

This caused some problems and resulted in a wonderful photo opportunity to showcase what silica gel looks like.
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This sample is one of the weak base effluent samples taken toward the end of the caustic injection. As a good guess, they didn’t get a valid specific gravity reading from that sample!

At L*A, we arbitrarily chose 6 kilograins/cu.ft. maximum safe silica loading, even if the resin wouldn’t be “exhausted” with other anions. The concept that silica capacity is relatively independent of a strong base anion resin’s capacity for other anions has been proposed by George Crits as well as others. No one should seriously consider trying to operate a strong base anion resin without limiting silica loading.

At L*A, we arbitrarily chose 6 kilograins/cu.ft. maximum safe silica loading, even if the resin wouldn’t be “exhausted” with other anions. The concept that silica capacity is relatively independent of a strong base anion resin’s capacity for other anions has been proposed by George Crits as well as others. No one should seriously consider trying to operate a strong base anion resin without limiting silica loading.

Figure 13. Various Rules to Limit Silica Loading on Strong Base Resin

<table>
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<th>Rule</th>
<th>Maximum silica loading</th>
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<tr>
<td>Crits Rule</td>
<td>10 kgms/cuft max (all ions including silica)</td>
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<tr>
<td>L*AWT Rule</td>
<td>6 kgms/cuft max (silica loading only)</td>
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<tr>
<td>German Data</td>
<td>(reported in gm/L as SiO₂)</td>
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- at 25 °C: 3.0 gm/L @ 0.1 mg/L inlet, 6.0 gm/L @ 0.3 mg/L inlet
- at 50 °C: 0.9 gm/L @ 0.1 mg/L inlet, 2.0 gm/L @ 0.3 mg/L inlet

Note: gm/L capacity (as CaCO₃) x 0.436 = kgms/cuft
German Data is for mixed beds

Figure 14. Limiting Risk of Silica Fouling in WBA/SBA Pairs

Importance of alkalinity
All known cases of silica fouling in weak base anion resins have been associated with reduced alkalinity, either by chemical precipitation or by degassification

Dump initial portion of SBA spent caustic to waste
- Allow for displacement volume in SBA vessel
- Add additional time equal to the theoretical amount of caustic absorbed by the SBA resin
- Total is the time before caustic is thoroughfared from the SBA to the WBA

Perform elution study to verify silica elution pattern from the SBA unit

Part 4: Silica Removal by Chloride-Form Strong Base Anion Resins

Conventional ion exchange wisdom teaches that silica is only removed by hydroxide-form strong base anion resins. This “wisdom” has, for more than 70 years, prevented system designers from practicing silica removal by ion exchange, except as part of a demineralizer system that removes all the ions or with a hydroxide-form anion unit sometimes referred to as a “desilicizer.” This brute force approach was for many years the best available technology (BAT) for boiler water and other systems that require deionization for other reasons. However, now that ion exchange is increasing used as pretreatment to other treatment processes that have supplanted demineralizers for bulk ion removal, the need to selectively remove silica without removing everything else has gained importance. A closer look at silica exchange suggests that the problem is that silica is not well ionized at neutral pH, and that chloride-form strong base anion resins, in certain instances, have useful capacities for silicate.

Silicic acid is very poorly ionized. At neutral pH, almost all silica present in water is molecular rather than ionic. Even though strong base resins are capable of splitting salts, molecular silica cannot enter the ion exchange beads by means of the ion exchange pathways and is limited by the rate at which it diffuses into the beads. Chloride form anion resins remove less than 5% of inlet silica, partly due to diffusion limitations and partly due to unfavorable ionization of silica at neutral pH. Diffusion limitations are also a primary reason why the silica selective hybrids and adsorbents have slow and incomplete removal of silica. It simply takes a very long time for silica to reach an adsorption site, much longer than the water is typically in contact with the media.

Figure 15. Silica Removal by Type II Strong Base Anion Resin (other people’s data)

[Graph showing silica removal by Type II strong base anion resin]

Inlet was 100 ppm CaCl₂ plus 100 ppm NaHCO₃ plus 22 ppm SiO₂, flow rate 0.5 BV/min.

Figure 16. Silica Removal by Type 1 Anion Resin in the Chloride Form (Resin Tech data)

[Graph showing silica removal by Type 1 anion resin in chloride form]

Inlet was 100 ppm CaCl₂ plus 100 ppm NaHCO₃ plus 22 ppm SiO₂, flow rate 0.5 BV/min.
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As seen in these examples, silica removal, even at elevated pH, is by no means complete, and since silicate is one of the least preferred species, the presence of other anions and of high TDS reduces efficiency.

**Conclusion**

Silica is poorly ionized at neutral pH and has limited solubility. Membrane and precipitation processes can be quite effective at elevated pH but are either ineffective or less than wonderful at neutral pH. Demineralizers, with hydroxide-form anion resin, remain one of the best methods for removing silica, especially when TDS removal is also required.

Removal of silica without also removing all the other ions is far more problematic, and there are no wonderful methods in the water treatment engineer's toolbox. Of the less than wonderful ways, ion exchange remains one of the available treatment methods, directly applicable as pretreatment to other unit processes or as a standalone method of removing silica along with other ions.

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Failure of Water Handling Systems and Managing the Resulting Liability

Adam Green, Baker, Donelson, Bearman, Caldwell & Berkowitz, PC; and Robert J. Cunningham, P.E., International Water Consultants
Introduction
In recent years, there have been an increasing number of claims and lawsuits arising from building water systems. These disputes range from small equipment issues to catastrophic system failures necessitating the complete removal and replacement of HVAC, fire water, and condenser water systems. In addition to property-related claims, incidents of *Legionella*-related personal injuries and wrongful death involving building water systems as the point source of exposure have been made with increasing frequency.

Review of the resulting lawsuits reflects that no one involved with the system is immune from implication. The architect, design engineer, general contractor, mechanical contractor, equipment supplier, pipe supplier, and property manager are commonly targeted, whether by the injured party or each other. Despite the lack of merit in the claims, chemical water treaters are commonly named as defendants in litigation.

Chemical water treaters are typically provided some degree of access to the premises to perform a limited set of duties for limited pay. Despite these facts, water treaters have become a favored target of lawsuits ranging from system failures to *Legionella*-related injuries. The amount of damages involved in these lawsuits is frequently far in excess of the relatively low monthly revenues earned in connection with treatment of the system. Even if the water treater is ultimately exonerated, the costs involved in defending itself through complex litigation will invariably overwhelm its profit margin.

This is especially true when there is no clear understanding regarding the scope and limits of the water treater’s capabilities, job duties, and limits of its responsibilities. Without a clearly defined role, building owners and engineers frequently regard water treaters as a catchall for anything relating to the water handling system. These allegations force the treater to incur expenses to explain the limits of its access, duties, and corresponding level of pay. Furthermore, treaters are often forced to explain the limits of their capabilities in response to allegations that they should have detected a problem such that the system could be saved.

The case studies in this publication are based on actual events and illustrate the ways that water treaters are implicated and the reasons why. The authors hope that identifying and understanding these risk scenarios will lead to prevention and mitigation of potential liabilities.

Scope and Limits of a Water Treater’s Responsibilities
There is commonly a significant disconnect between the customer and the water treater regarding the scope of a chemical water treater’s responsibilities and the practical limitations inherent in the job. Premises owners and building engineers often assume that anything involving the internals of the water handling system is the responsibility of the chemical water treater who is frequently targeted with the common reprieve: “We don’t know what you are responsible for, so we assume you are responsible for it all.” Consequently, when there is an issue with the system, the chemical water treater is alleged to have failed in its duties, regardless of the realities of the situation. The effect of this position is to regard the monthly chemical water treater as an insurance policy for all ills that may befall the system and the sole guarantor of its welfare.

The reasons for this disconnect range from a true lack of understanding of an inherently complex discipline to feigned ignorance by culpable parties in an effort to deflect blame for unperformed responsibilities. In the context of litigation, plaintiff building owners may indiscriminately implicate the treaters just to add more potential contributors to an aggregated settlement without regard to the merits of the claims. Regardless of motive, clearly worded contracts and job specifications that unambiguously delineate a chemical treater’s scope of work are important.

Job Specifications and Contracts
The scope and limits of a water treater’s job duties are regularly debated. Generally, water treatment contracts provide for a single monthly visit lasting from 30 minutes to one hour, for a limited monthly sum that includes chemicals, freight, and overhead. In the aggregate, the treater has access to the premises for 6 to 12 hours per year, for a gross sum of under $10,000 per year. Nonetheless, in the face of a system failure, those entities with daily responsibilities and unlimited access to the subject equipment regularly deflect culpability to the treater. Premises owners, property managers, and building
engineers regularly shun any responsibility for issues within the system. In so doing, they may retort to the treater: “We hired you to handle the system. You’re the experts.”

The language contained in job specifications or service contracts can serve as the primary focus of these debates. The failure to perform to the exact language of these documents can result in lawsuits that attempt to exploit these discrepancies regardless of whether they had any causal effect on the incident. Such form over substance litigation often places faultless parties in the unenviable and expensive position of proving their innocence. In a complex, technical lawsuit, these expenses can be significant and disproportionate to the revenue generated on the job. This is especially true for water treaters, given the usually small profit margins on a given water treatment account.

Case Study #1—Technical Noncompliance

The condenser water systems of two mixed-use 14-story buildings were designed with a rooftop cooling tower servicing a plate and frame heat exchanger. A closed-loop system on one side of the heat exchanger serviced floors 2 through 14. In addition to this standard design, a third piping run consisting of 4-inch carbon steel pipe ran from the rooftop mechanical room down to the first floor retail spaces of each building. Evidence revealed that the system design experienced areas of significant “low flow,” as the small bore piping had maximum design flowrates of 2.5 linear feet per second. These velocities were inadequate to push water treatment chemical through the system and insufficient to inhibit solid and microbiological depositions, thereby leading to non-uniform corrosion and underdeposit corrosion.

In less than two years of service, this “Retail Loop” experienced leaks incident to massive tuberculation and corrosion completely eating through the pipe wall. The building owner filed a lawsuit seeking over $2.6 million in damages, naming the design engineer, general contractor, mechanical subcontractor, construction phase water treater, and ongoing monthly water treater.

Each of the parties, including the design engineer, testified that the unique system design was an unproven oddity. In the cumulative experience of the parties (which exceeded 100 years), none had ever seen that system design. By corollary, none had seen this system design work. Stated differently, the system design had a 100% failure rate. The design engineer acknowledged prior to completion of the building that the first floor should have received closed-loop water. After the incident, the Retail Loop was converted to a closed-loop design and no further issues occurred.

Despite the failed design being the admitted root cause of failure, both the construction phase and ongoing monthly water treaters were named as defendants on the basis of technical noncompliance.

Failure to Conduct a Water Characterization Study. The project specifications required the construction phase treater to conduct a “complete characterization analysis” of the raw water supply prior to recommending a treatment program. The specification expressly required that the treater “perform an analysis of supply water to determine the type and quantities of chemical treatment needed to keep system free of scale, corrosion and fouling.”

It was further required that the selected chemicals be “specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.”

The construction phase treater did not perform this characterization, citing the fact that it had been actively treating water in the area for the past 20 years and was highly familiar with its chemical makeup. Plaintiff nonetheless contended that the failure to do so in this case was a clear breach of the water treater’s duties. Plaintiff contended that the elevated chloride and sulfate content was not properly identified and thereafter caused Microbiologically Influenced Corrosion.

These allegations could have been avoided with a simple written exchange, wherein the treater explained its long history in the area and secured an agreement during the bidding process that relieved them of the requirement for a water characterization study.

Failure to Train. Project specifications sometimes include obligations for water treaters to train operating personnel. The failure to provide this training can be especially problematic when the building maintenance staff fails to perform adequate maintenance on a building.
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water system. This combination can result in the water treater being implicated for the maintenance staff’s inadequacies and the damage to the system, regardless of the true cause of the system failure.

In the above case example, the project specifications bid by the construction phase treater stipulated that the treater was to provide a training course for the building operating personnel “at the start-up of systems.” Specifically, the treater was to “include two-hour training course for operating personnel, instructing them on installation, care, maintenance, testing and operation of the water treatment systems.”

The building maintenance staff was wholly inexperienced and unprepared to properly maintain the system. The treater testified that it expected building staff to conduct basic maintenance on its own systems, including periodic inspections of the cooling tower, making sure the pumps were working, and to at least visually inspect the chemical treatment station. Furthermore, each field service report recommended that the customer perform routine water testing between service visits. Unfortunately, the building maintenance staff did none of these things.

The treater testified that, while it had the capability to train the maintenance staff, it did not do so on this project. These allegations proved especially problematic. Ultimately, the property owner conceded that its maintenance staff was wholly inept with respect to the ongoing care, maintenance, testing, and operation of the condenser water system. In fact, the majority of the maintenance supervisors were dismissed and replaced with those more familiar with water handling systems.

The plaintiff building owner was able to mask the inadequacies of its maintenance staff by citing the treater’s failure to train operating personnel as the basis for their incompetence. Despite the fact that the root cause of the problem was design related, the failure to provide this training was the basis for liability against the treater.

Retail Loop Not Included in Scope of Work. The construction phase treater was provided job specifications upon which to enter a bid. Those specifications called for the treater to provide chemical treatment for the “building water systems” in general. As such, even though the added retail loop was an uncommon addition, it was expressly included among the systems to be treated.

In contrast, the subsequent ongoing monthly treater was not provided job specifications, as its service period began 16 months after initial startup. As opposed to bidding on job specifications, which called for treatment to all “building water systems,” the subsequent water treater was presented a contract providing that ongoing treatment was to be limited to the “cooling tower and closed loops.” The evidence reflected that neither of the systems expressly listed in the treater’s contract encountered any issues or failures.

The failure to include the Retail Loop in the contract led to substantial argument that the ongoing monthly treater was not contracted or paid to provide specific treatment or reporting for that portion of the system. The building owner argued that the Retail Loop was connected to the open loop condenser water pipes, shared that water, and was therefore part of the “cooling tower” as listed in the contract. The owner argued that the treater should have detected issues in the bulk water supply from problems with the Retail Loop. The treater rebutted that the Retail Loop was not the “cooling tower” and was an unorthodox extra loop that was not included in the contract or reflected in the treater’s pay. The treater successfully emphasized that any issues with the extra loop did not appear in the bulk water supply tested in the rooftop mechanical room due to low flow issues incident to the small bore piping in that extra loop.

Amidst this debate about what systems were included in the scope of service, the course of conduct of both parties became a point of emphasis. The parties had no discussions regarding the Retail Loop during the tenure of the treater’s service period. None of the field service reports reflected treatment or conditions in the Retail Loop. Despite receiving these field service reports every month, neither the building owner nor building engineer inquired about the status of that loop.

The importance of the course of conduct of both the treater and its customer are explored below.

Course of Conduct
Regardless of whether a written contract exists, the parties’ course of conduct can be important evidence of their reasonable intent. In instances where there is
no written agreement, juries are instructed to consider what the contracting parties said and did in light of the surrounding circumstances.1

When asked to interpret the language of a contract in dispute, juries are instructed to decide its meaning by determining the intent of the parties at the time of the agreement. They are also instructed to “consider all of the facts and circumstances surrounding the making of the agreement, the interpretation placed on the agreement by the parties, and the conduct of the parties.”2

In light of the foregoing, the conduct of the parties will invariably be considered to determine if they breached their respective duties. As provided below, the failure to act can be just as important as affirmative acts themselves.

Case Study #2—Testing for Legionella
Five plaintiffs alleged that they contracted Legionnaire’s disease while they were guests of a small hotel. They claimed they inhaled bacteria-laden mist emanating from the hotel’s rooftop cooling tower. Two of the plaintiffs died as a result. The surviving plaintiffs filed a wrongful death lawsuit implicating the hotel owner and the chemical water treater.

There was no written contract between the treater and hotel owner. The parties had a personal relationship and entered a handshake deal. During the initial meeting, the water treater recommended a corrosion inhibitor and dual biocide (oxidating and nonoxidating) program. Testimony reflected that the owner opted not to purchase the oxidizing biocide, citing leftover chemical inventory from a prior treater. There was no documentation to reflect that the oxidizer had been offered or refused.

Pursuant to their verbal agreement, the chemical water treater provided monthly service for over six years prior to the outbreak. At no point during the initial meeting or throughout the tenure of the water treater’s service, did the owner and treater discuss Legionella or its prevention. During this time, the treater provided field service reports for each of the months during the six-year period preceding the outbreak.

After the outbreak, the hotel owner blamed the chemical water treater, asserting that the hotel “followed every one of its recommendations to the letter” and that “we trusted them to handle our system because they’re the experts.” In absence of a written contract delineating the treater’s duties, the conduct of the parties proved significant.

The pre-suit conduct of both the owner and treater consistently reflected that the hotel did not hire, request, or pay the treater to test for or prevent Legionella. The evidence reflected that the water treater was hired by the hotel only to support a routine water treatment plan, which, according to the testimony of the water treatment experts in the case, involved only recommending and selling chemicals that would accomplish the tasks of keeping the heat transfer surfaces of the equipment free of scale, corrosion, and biofilm. The experts’ interpretation of the treater’s job responsibilities was consistent with the widely accepted view of the industry that “[m]ost water treatment programs are designed to minimize scale, corrosion and bio-fouling and not to control Legionella.”3

Furthermore, the charges by the treater and payments made by the hotel did not reflect service beyond those relating to system efficiency. For its standard monthly service, the treater was paid $190 per month. During the relevant timeframe, charges relating to Legionella testing were $460 per test by CDC approved labs. In addition to the lack of charges for any Legionella-related service, none of the six years of field service reports made any mention of Legionella or test results. Despite receiving these reports every month, the hotel owner never inquired about the status of Legionella in the system or any tests to that effect.

In addition, testimony reflected that the hotel never contacted the water treater to complain or otherwise inquire about the ineffectiveness of any expected treatment after learning of the Legionella outbreak at the hotel. Instead, the owner first mentioned the outbreak to the treater in passing when the treater was on the premises for his normal monthly visit.

In light of the conduct of the parties, the Court found no evidence that the treater had assumed any duties with respect to Legionella at the hotel.

Preexisting Conditions
Conditions existing within the water handling system prior to the initiation of the water treater’s program can have a dramatic impact on the system life and on any
litigation resulting from the system’s premature failure. Most water treatment service agreements will contain language disclaiming any responsibility of the water treater for conditions occurring prior to the start of their initial service. An example of such a disclaimer would be as follows:

“Contractor cannot be held responsible for any damage that has occurred prior to the start of the water treatment program or due to any other factors that are beyond its control.”

Such disclaimers can play a significant role in the water treater’s defense. This is especially true in complex litigation where other entities have been sued for causing the system failure due to acts or omissions predating the water treater’s involvement.

The true impact of preexisting conditions is usually a highly debated topic in building water system litigation. The lack of any assessment or investigation of the system internals raises issues regarding the nature and extent of any preexisting conditions that led to system damage and when those conditions existed. In addition, plaintiffs commonly allege that the conditions could and should have been detected by the water treater through normal measures. By extension, plaintiffs frequently allege that had the conditions been detected, some remedial option would have been available to save the system. Essentially, the allegation is that “although you didn’t cause the problem, you should have detected it and saved the system.”

Failure to Passivate During Construction

One of the most prominent causes of premature system failure is the lack of proper passivation. During initial construction, once the pipes are sleeved and in place, the mechanical contractor will commonly conduct one or more hydrostatic pressure tests pursuant to the job specifications. In so doing, the piping system is filled with water and pressurized to test for leaks before insulation is applied and surrounding sheetrock is installed.

A water treatment contractor should be contacted so that the water chemistry itself can be adjusted by the addition of a high level of chemical corrosion inhibitors with the initial introduction of water. Specifically, the exposed metal surface should be chemically “passivated,” to ensure that the piping system metals have some reserve “corrosion resistance” to carry the protection forward. In the absence of proper corrosion and microbial control during this period, the addition of water jumpstarts the microbial proliferation and the ensuing corrosion acceleration, which advances “uninhibited.” Despite the critical nature of passivation, case studies reflect that this step is often overlooked or deprioritized as a line item maintenance task.

Case Study # 3—Initial Passivation

The condenser water system for a 30-story high-rise luxury condominium suffered from corrosion and leaks less than five years from the date the system was commissioned. As a result, the Owner’s Association filed a lawsuit for damages exceeding $8 million. The evidence revealed that the HVAC mechanical subcontractor who constructed the system repeatedly introduced untreated water into the system for more than a year before contracting with the water treatment contractor. When asked about the failure to coordinate this task, the experienced mechanical contractor remarkably testified that he was unaware of the important nature of passivation and effectively regarded the coordination of chemical inhibitor with the initial introduction of water as an inexpensive, low-priority non-event. The mechanical contractor testified that more money was spent on portable toilets for the construction crews than timely passivation of the system. It was undisputed by all parties that this scenario created irreversible corrosion leading to complete system failure.

The testimony revealed that the project was behind schedule and that the mechanical contractor was under “immense pressure” to expedite construction. Accordingly, the riser pipes for the condenser water system were dropped into sleeves by an overhead crane five floors at a time. Upon completion of those five floors, the mechanical contractor would end-cap the pipe and introduce water without inhibitor for hydrostatic pressure testing. If there were no leaks, the water was left in the pipes and the next five floors of pipe were constructed via the same process. Ultimately, it was determined that untreated water remained in the riser pipes for over a year before the water treater was contacted about the use of corrosion inhibitor. Just before startup, the pipes were cleaned and flushed. The treater introduced corrosion inhibitor into the system prior to startup and pursuant
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to the mechanical contractor’s direction. The system encountered catastrophic failure.

Metallurgical experts testified that “introducing water into this system without water treatment is not just the Cardinal Sin—it should be against the law.” In that respect, they testified that the corrosion reached the point of no return within 30 days of when the untreated water came into contact with the inner wall of the pipe. The evidence reflected that the chemical water treater was not contacted to begin service until one year after this occurred.

Nonetheless, the building owner implicated the chemical water treater in the failure, citing each and every instance wherein the treater failed to comply with the exact verbiage of the generic specifications used for the project. The water treatment contractor did not technically comply with the form specifications by failing to (1) provide written reports of each visit to the jobsite; (2) have a service branch office within 50 miles of the jobsite; (3) ensure the administration of the program was under the supervision of a full-time employee with a B.S. in chemistry; (4) submit an affidavit from a corporate officer affirming prior performance of the type and scope of treatment program at issue; and (5) install corrosion coupons and conduct 30-day tests each month. In total, the water treatment contractor failed to comply with the exact language of the specifications in 11 different respects. As a result, the water treater, who was paid $5,500 for a year of treatment, was forced to endure three years of litigation and more than $400,000 in legal expense to successfully prove that its lack of conformity to generic specifications was not the actual cause of the system breakdown.

Critically, experts testified that, with respect to corrosion prevention and inhibition, the treatment contract contemplated a virgin system. They further testified that it was impossible for the treater to perform the material tenets of its contract as the initial introduction of water occurred before the contract was ever presented to the treatment contractor. Ultimately, the treater was completely dismissed from the lawsuit because its failures to comply with the form specifications were determined to be flaws and not defects. In addition, the treater was awarded its attorney’s fees from the mechanical subcontractor.

**Failure to Re-Passivate**

**Case Study # 4—Navigating the Lay-up**

Beyond initial passivation, many systems have extended layup periods (especially those in harsh climates). During these periods, the systems need to be cleaned, flushed, and re-passivated prior to startup during the next season. Building owners frequently assume that the responsibility of coordinating this step is solely within the duties and discretion of the chemical water treater.

A 20-story commercial building in a seasonal climate was equipped with a hydronic system that could be used for heating or cooling. The configuration included an open cooling tower system with a closed condenser loop and a hot water loop. These separate loops would mix at all times between valve exercise and mode operation. Accordingly, at any given time, the water chemistry would be shared among the systems.

During the warmer summer months, the hot water loop would be “laid up” for at least 120 days. As opposed to draining, drying, and cleaning the surface before startup in the fall, the building maintenance crew would leave the hot water loop partially filled and isolated. Ultimately, the system and its attendant equipment failed. The owner and property manager blamed the monthly water treater, citing elevated bacterial levels in the water as the purported root cause of failure. It was discovered in litigation that, because the hot water system was not completely drained and dried, microbiological colonies flourished during the stagnant period. This water contaminated the rest of the system.

Despite the fact that the property manager had full access to the premises 365 days a year, the monthly water treater was promptly blamed for the failure to drain and repassivate. This was the case, although the equipment manufacturer’s written standards advised that “[p]roper cleaning and surface preparation must be completed prior to system startup.” Notably, the water treater’s contract specifically provided that the “[o]wner will not be liable for any charges other than those described and expressly authorized.” The authorized acts were limited to a single monthly service visit for the express purpose of treatment of the systems and water analysis. For that task, the treater was paid a gross sum of $300 per month. The agreement was silent regarding any shutdowns, cleaning, flushing, or passivation.
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Nonetheless, the owner opted not to turn to its property manager that was charging in excess of $20,000 per year. Instead, it opted to target the $300 per month water treater whose contract limited it to a single monthly visit that lasted no more than an hour each month with the chief task of water analysis. When asked where these duties appeared within its contract, the owner stated, “we hired you guys to take care of the system. You’re the experts.”

It was successfully argued that the task of re-passivation was beyond the scope of the limited duties to be completed during the once-per-month visit of the water treater. Further evidence revealed that the hot water loop could not be independently shut down, cleaned, and drained, and that the chemical treater did not have the autonomy or discretion to do so.

**Saving the System**

No matter the root cause of the problem, water treaters are frequently targeted with allegations that they should have diagnosed the initial problem of corrosion in time for some unspecified corrective measure that would have arrested the problem long before failure and “saved the system.” These accusations have become almost universal and are made in complete disregard of the treater’s limited access to the system and the lack of any evidence that the conditions were detectable through ordinary water treatment. This is especially true in cases involving underdeposit corrosion, wherein the corrosive process is concealed from the bulk waters to which the treater has access for testing and treatment.

It is commercially impracticable for a water treater to disassemble or otherwise probe the entirety of an existing system to the degree necessary to adequately ascertain its condition prior to treatment. Nonetheless, despite their limited functions, pay, and access to the property, water treatment contractors can be wrongfully regarded as guarantors of system maintenance and performance.

Examination of case studies reflects that the corrosive process is often undetectable through ordinary water treatment and is frequently so advanced that it is irreversible by the time the treater begins its service. As provided below, these allegations carry challenges as to plaintiff’s legal burden of proving causation. Specifically, depending on whether their allegations sound in contract or tort, plaintiffs may be faced with the burden of distinguishing which damages were caused by which alleged bad actor.

**Case Study # 5—Detecting the Undetectable**

The condenser water pipes in a luxury hotel experience failure due to corrosion and leaks. The evidence reveals that the system was not properly passivated and underdeposit corrosion began to form before the first water treatment chemicals were introduced into the system. Specifically, the evidence reflected that precipitated corrosion products (such as iron oxide) and microbiological deposits (such as iron and sulfate-reducing bacteria, which imbed themselves into iron deposits) formed on the inner wall of the pipe surface. These deposits formed a concrete-like concealing layer that rendered subsequent attempts to introduce corrosion inhibitor ineffective. Once this layer was formed, inhibitors could no longer make physical contact with the inner wall of the pipe they were meant to protect, and corrosion products were hermetically sealed off from the bulk water supply, rendering them inaccessible to subsequent testing or treatment of the bulk waters.

The monthly water treatment contractor was not hired until 16 months after the corrosive process began. Consistent with its contract, treatment entailed monthly site visits by the water treatment representative to collect water samples and review tests of the treated bulk waters that were actually flowing through the system. These tests included monthly readings for conductivity, alkalinity, pH, and other factors. These readings, however, were only for the accessible waters flowing through the pipes. Accordingly, the corrosive process occurring beneath the hardened layer of underdeposit corrosion was concealed from the bulk water supply and was not discovered until leaks occurred when the corrosion breached the other side of the pipe.

The plaintiff alleged that the design engineer was liable for failing to provide any capability for internal inspections of the piping or for inspection under the exterior insulation. The plaintiff alleged that good design practice required the inclusion of spool pieces with upstream and downstream isolation valves and a bypass to permit pipeline segments to be isolated and removed for periodic internal inspections. Despite the allegation that the system design did not allow for internal inspections, the plaintiff concurrently alleged that the monthly water
treater “should have caught the problem.” Specifically, the plaintiff alleged that the water treater should have detected the underdeposit corrosion and somehow “reversed or retarded the corrosive process.”

The field service reports reflected that the levels for all relevant metrics were well within the designated control levels and that the corrosive process was not evident in the accessible waters. Despite these facts, the plaintiff alleged that the treater had extracontractual responsibilities to perform internal inspections of the system piping (as with a borescope), external inspections of the system piping for signs of leaks, and environmental inspections throughout the building to affirmatively find signs of leaks (such as rust stains on insulation or the floor). This case resolved favorably for the treater short of trial.

**Evidentiary Challenges: Contract or Negligence?**

The premise that early detection was possible and would have prompted an unknown corrective process to “save the system” is inherently speculative. This allegation is premised on the layering of assumptions. The argument presumes that a test at some unspecified time could and should have been performed, and that if a test had been performed, some detectable conditions prompting action would have been revealed.

In other words, plaintiffs are alleging without any evidence that the “test the treater did not do, did not show what it would have shown.” In the instance of underdeposit corrosion where corrosive conditions are concealed from the bulk water supply to which the treater has access, these assumptions cannot be safely made. In addition to the foregoing, the argument also presumes that the corrosive conditions, if detected at some early time, were not already so advanced that some correct measure was a viable option to save the system. As a general rule, a presumption of fact cannot rest upon a fact presumed. This argument can be rebutted accordingly.

Determining which defendant was the cause of the corrosion and corresponding damages can present special challenges, depending upon the type of action alleged. In the foregoing case study, the maintenance engineer testified that no assessment or inspection of the system was performed to determine the condition of the condenser water system prior to the monthly water treater beginning its water treatment program some 16 months after initial startup. Accordingly, there was no evidence of the nature or degree of the underdeposit corrosion or damage to the pipe when the treater inherited the system.

In a negligence action, most plaintiffs will allege that the general contractor, mechanical contractor, engineer, pipe supplier, and water treaters are joint tortfeasors who were all negligent. The allegation will be that the separate acts of negligence of these parties combined to cause the damages. In many states, the plaintiff has the option of suing one or more of the tortfeasors, either individually or as a group. If the plaintiff is awarded damages, each joint tortfeasor is responsible for paying a portion of the damages, based on the percentage of the injury caused by their acts or omissions.

In contrast, under a breach of contract action, in many states, plaintiffs cannot aggregate the damages caused by the breach of the water treater’s separate contract with those caused by the other defendants. Sample jury instructions may read as follows:

The plaintiff must demonstrate that the damages complained of were caused by the defendant’s conduct. If the damages were caused by the plaintiff or by someone other than the defendant, then the plaintiff is not entitled to damages from the defendant. Damages cannot be speculative [and] must be computed by rational methods upon a firm factual basis.\(^4\)

Causation is often referred to as those damages that are the direct and natural result of the breach of contract.\(^5\) Without any assessment of the system prior to the water treater beginning its program, the plaintiff will be challenged to prove how the treater’s alleged breach of contract caused any damages or conditions not already caused by another. This is especially challenging in cases involving underdeposit corrosion.

Without a baseline assessment of the system condition, the plaintiff may also be challenged to prove when the damages actually occurred. In Case Study #5, the water treater disclaimed responsibility for “any damage that occurred prior to the start of the water treatment program or any factors beyond its control.”

The plaintiff selectively disregarded the corrosive conditions that arose due to the failed passivation of the
system some 16 months prior to the start of the treater’s monthly program. Myopically, the plaintiff alleged that the damage to the system was the actual leaks that occurred on the current treater’s “watch.” The treater correctly rebutted this argument by emphasizing that the leaks were the result of events occurring exclusively before it was on the project and due to factors that were beyond its control.

Emerging Issues With Legionella Regulations

In summer 2015, there was an outbreak of 133 cases of Legionnaires’ disease, including 16 fatalities, occurring in the South Bronx. In response, the New York City Department of Health and Mental Hygiene adopted a new chapter to the Rules of the City of New York addressing the maintenance and reporting of cooling towers. On April 17, 2016, the Health Department published the final rules requiring registration of all cooling towers, development of maintenance and management plans, quarterly inspections, reporting to the Health Department when testing detects increased levels of Legionella bacteria, and annual certification that the owner has complied with these requirements.

Following the passage of these new regulations, owners of premises equipped with a cooling tower system have been subject to inspections to ensure compliance. Those buildings found to be in violation are receiving Violation Deficiency Reports (VDR) from the CT Compliance Team of the Office of Building Water Supply Oversight. The VDRs detail individual instances of noncompliance and describe what documentation is needed to serve as evidence of compliance. The failure to submit this evidence in a timely manner will result in the owner being summoned to appear before the Environmental Control Board, where fines can be levied.

The issuance of VDR reports and the assessment of the corresponding fines is an obvious potential source of contention between the water treater and its client. This is especially true in those instances where the water treater was the originator of the Maintenance Program or Plan (MPP). The novelty and lack of meaningful experience in the manner of enforcement of these regulations has placed water treaters in an unenviable position. City inspectors equipped with tablets input data in response to a series of questions based on their observations. The software has undergone a number of iterations, with each version seemingly resulting in variations in the inspection criteria. These variables place the treater in the awkward position of trying to accurately advise their clients among moving targets, and without a meaningful course of action upon which to rely.

In keeping with the assumption that the water treater is the guarantor of the system, some owners have attempted to seek reimbursement from the treater for any fines and penalties. This is the case despite the fact that the scope of the regulations are “applicable to all owners and operators of buildings and other premises that are equipped with cooling towers.”

In many instances, the violations are squarely within the responsibility of the building owner and are independent of any plan provided by the water treater. For instance, 24 RCNY §8-05(f)(2) requires that bacteriological process control indicators must be collected, analyzed, and recorded. Owners have been cited for failing to keep these on a weekly basis. Weekly bacteria tests are regularly the province of the site personnel. Similarly, 24 RCNY §8-07(a) requires records of maintenance, water treatment, and testing and related documents to be kept and provided at the time of inspection. The act of maintaining those records, once received, is within the owner’s realm of responsibility.

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References

1 However, they “may not consider the parties’ unexpressed thoughts or intentions.” See e.g., Texas Pattern Jury Charge on Contracts, 101.3.
2 See e.g., Texas Pattern Jury Charge on Contracts, 101.9.
3 ASHRAE at 9, Ex. 5.
5 See e.g. Texas Pattern Jury Charge 115.3, Question on Contract Damages.
7 24 RCNY §8-01.
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Electrochemical Generation

Andrew Boal, Ph.D., MIOX
When you are researching a product, how frustrating is it to conduct your due diligence, only to find answers segmented across dozens of sources? This digestible technical overview of electrochemical generation, also known as on-site generation (OSG), outlines the applications and scientific mechanisms of this revolutionary technology in order to make your life easier and help you do your job better.

Many water treatment professionals are moving to OSG to produce disinfection chemistry on demand, leaving traditional oxidizing and non-oxidizing biocides behind. The benefits speak for themselves:

- Increased safety
- Elimination of storage and transportation of hazardous chemicals
- High-quality disinfection
- Greener operations
- Substantial savings

What is on-site generation?
You may be familiar with the fundamental principles that make this technology possible—namely, the electrolysis of salt-water solutions, which have been known for decades. OSG uses a solution of sodium chloride (salt) and fresh water as feedstock. When electricity is applied to the feedstock, a disinfecting oxidant solution is produced.

Electrochemical generation has a number of applications for disinfection and can be a cost-effective way to replace chlorine gas, bulk sodium hypochlorite, calcium hypochlorite, chlorine dioxide, bromine, glutaraldehyde, and other traditional biocides.

**Disinfection Applications of OSG Technology:**
- Cooling Tower Water Treatment
- Process Water Treatment
- Drinking Water Treatment
- Wastewater Treatment
- ECA Clean-In-Place (CIP)
- Produced Water
- Hydrogen Sulfide Removal
- Aquatics and Decorative Water Features
- Surface Disinfection
- Dairy, Poultry and Swine Sanitation (drinking water, pre- and post-dip, facility)
- Irrigation Line Cleaning

**How does on-site generation work?**
Water coming into the OSG goes through a softener and then splits into two lines. One line is used to feed a salt-filled tank, creating a saturated brine. The other line enters the OSG, acting as a dilution stream prior to the electrochemical process. Saturated brine is then precision-mixed with the softened water stream prior to entering the electrolytic cell. Application of an electrical current to the cell results in the production of an oxidant solution from the diluted brine.

After leaving the electrolytic cell, the oxidant solution is temporarily stored in an oxidant tank. As needed, the oxidant is then metered or injected into the water moving through the treatment process, typically with equipment similar to that used in a bulk hypochlorite dosing system. Injection options include a venturi or other eductor, centrifugal feed pumps, or chemical metering pumps. Sites with multiple injection points may use a combination of these options.

Hydrogen gas is also produced inside the electrolytic cell and is removed from the cell and the oxidant storage tank through vents and/or dilution air blowers.

The OSG operates via a signal from the level switch/transmitter located in the downstream oxidant tank. When the tank is empty, the level switch/transmitter sends a signal to the Programmable Logic Controller (PLC) and puts the OSG online. As soon as the tank is full of oxidant, the transmitter/switch sends a signal to the PLC to put the OSG in standby mode. This means very minimal operator attention is required during normal operation.

**Engineering Note:** A single OSG can be used for multiple applications at a site. This allows operators to take advantage of economies of scale provided by OSG systems that decrease per-volume disinfectant costs.
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- Resistivity
- Salinity
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- Temperature
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- Flow
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- Resistive TOUCH SCREEN user interface
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  - 4-20 mA input
  - Pulse counter, frequency counter, flow rate input
  - Flow switch input
  - % Rejection
  - Up to 3 alarm/control relays, configurable
  - Up to 2 remote alarm outputs
  - 0-10V recorder output
  - 4-20 mA isolated output
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  - User adjustable temperature compensation

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- Protect the Environment

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OSG Process Flow

1. Softened water to electrolytic cell and brine tank.
2. Salt and water mix in the brine tank to form saturated brine.
3. Saturated brine mixes with softened water and the diluted brine enters the electrolytic cell.
4. Electrical current is passed through the electrolytic cell, producing oxidant.
5. Hydrogen gas produced during the electrolysis process is vented outside.
6. Oxidant solution leaves the electrolytic cell and is stored in the oxidant tank.
7. Oxidant solution is dosed into the treatment process by a metering pump.
8. OSG turns ON/OFF from a level switch signal located inside the oxidant tank.

Eliminating Hazardous Chemicals
OSG replaces numerous delivered chemicals for water treatment, including:

**Oxidizing Biocides**
- Bulk Sodium Hypochlorite
- Chlorine Dioxide
- Chlorine Gas
- Iodine
- Hydrogen Peroxide
- Calcium Hypochlorite
- Ozone
- Bromine

**Non-Oxidizing Biocides**
(and other disinfection approaches, depending on the application and/or water chemistry)
- Glutaraldehyde
- Quaternary Ammonium Compounds
- Isothialozine
- Silver Copper Ion
- Ultraviolet Light

The Science
The electrolytic cell, where the oxidants are produced, is central to the OSG process. Electrolytic cells built by MIOX consist of two primary electrodes—the anode and cathode—along with a number of intermediate electrodes. MIOX electrolytic cells are designed to have proprietary electrode geometries, electrolytic scheme, and solution flow characteristics in order to optimize disinfection chemistry and oxidant production efficiency.

The cells are arranged so that all electrodes make contact with the water and brine solution, and when the OSG is activated, an electrical current flows through the cell. In turn, this current causes chemical reactions on the surfaces of both electrodes that eventually produce the oxidant solution.

As the cell operates, calcium and magnesium scales will build up on the cell electrodes, reducing the efficiency of the OSG system. Traditionally, a manual acid-washing procedure is employed to remove these scales.
MIOX has developed a proprietary reverse polarity mechanism that can safely clean electrode surfaces. Instead of using an external acid, the direction the current passes through the cell is reversed, so positive becomes negative and negative becomes positive. When this occurs, scales are dissolved from the surface of the electrodes and removed from the OSG. This automatic process dramatically reduces the need for external acid washing.

**Electrochemical Generation of Sodium Hypochlorite**

The overall chemical equation for the reaction of salt (NaCl) and water (H₂O) to form sodium hypochlorite (NaOCl) is:

\[
\text{NaCl} + \text{H}_2\text{O} \rightarrow \text{NaOCl} + \text{H}_2
\]

Oxidation reactions are carried out at the anode, where two chloride ions (Cl⁻) are stripped of one electron each to produce molecular chlorine:

\[
2\text{Cl}^- \rightarrow \text{Cl}_2 + 2e^-
\]

Depending on the physical and working parameters of the cell (e.g., electrode to electrode spacing, cell applied potential), it is also possible to produce oxidants other than chlorine, which can provide enhanced removal of microbiological contaminants from water and other benefits. After it is produced, the molecular chlorine dissolves in water to produce hypochlorous acid (HOCl) in the same way that bulk chlorine gas from cylinders acts:

\[
\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{HOCl} + \text{H}^+ + \text{Cl}^-
\]

Chlorine production is balanced by the reduction reactions that occur at the cathode, where water (H₂O) is converted into hydroxide ions (OH⁻) and hydrogen gas (H₂):

\[
2\text{H}_2\text{O} + 2e^- \rightarrow 2\text{OH}^- + \text{H}_2
\]

During electrolysis, hydrogen gas is produced as bubbles and must later be removed from the produced oxidant solution to prevent buildup of the gas. The hydroxide ions produced at the cathode then react with the hypochlorous acid produced at the anode, producing the hypochlorite anion (ClO⁻), which is charge-balanced with sodium cations (Na⁺) that originally came from the salt:

\[
\text{HOCl} + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{OCl}^-
\]

Typically, the pH of oxidant solutions produced by OSGs are in the range of 9–10. Dosing water with OSG produced oxidant solutions often does not alter the pH of the water being treated since the produced oxidant solution is used at a volume ratio of at most 1:1000 with the water to be treated under most application scenarios.

This diagram shows the different electrochemical reactions that take place inside of an OSG electrolytic cell:

- **Anode:**
  \[
  2\text{Cl}^- \rightarrow \text{Cl}_2 + 2e^-
  \]

- **Cathode:**
  \[
  2\text{H}_2\text{O} + 2e^- \rightarrow 2\text{OH}^- + \text{H}_2
  \]

**Overall Reaction:**

\[
\text{NaCl} + \text{H}_2\text{O} \rightarrow \text{NaOCl} + \text{H}_2
\]
Electrochemical Generation of Mixed Oxidant Solution (MOS)

MOS is a disinfectant that is produced through the electrochemical process. OSG equipment producing MOS is optimized for the highest levels of bacteria inactivation efficacy through proprietary cell design, control of power, and cell geometry.

MOS is highly effective at controlling microbial populations, biofouling, and biofilm formation in water treatment applications across multiple applications and industries.

Numerous laboratory studies and customer experiences prove that MOS is a much more effective biocide than chlorine alone, a property that is a result of the synergistic antimicrobial action of the multiple oxidants contained within MOS—predominantly sodium hypochlorite with trace hydrogen peroxide.

Benefits of MOS
- Faster and more thorough microbiological inactivation (2–3 times more effective than chlorine at same FAC dose and application pH)
- Superior biofilm removal
- Elimination of Legionella counts
- Enhanced microflocculation, reducing coagulant demand by up to 40%
- Effective iron and manganese oxidation, enabling removal by flocculation and filtration
- Lower required dose
- Longer residual carry in distribution systems with longer detention time
- Reduction in disinfection byproduct (DBP) formation
- Elimination of chloramine boosters
- Improved filter runs
- Lowered final turbidity
- Elimination of taste and odor problems
- Rapid oxidization of hydrogen sulfide

What are the Benefits of Using On-Site Generated Disinfectants?
There are five principal benefits associated with OSGs:
1. Improved operator safety
2. Higher quality chemicals
3. Lower disinfection byproduct formation
4. Greener applications
5. Cost savings

Improved Operator Safety
Chemicals traditionally used in water disinfection pose a variety of hazards to the operator. Chlorine gas and chlorine dioxide are probably the most hazardous disinfectants used for water treatment. Chlorine gas is toxic upon uncontrolled release, and the use of chlorine gas cylinders also poses a pressure hazard for explosion or fire. Chlorine dioxide utilizes precursors—acid combined on site with chlorite or chlorate—both of which are health hazards. Chlorine dioxide production processes utilizing chlorite carry additional workplace
hazards since the chlorite solutions, if spilled and allowed to dry, become a serious fire hazard. Even industrial strength sodium hypochlorite used for water disinfection is typically 12.5 percent by weight chlorine solution at elevated pH, and is highly caustic, requiring proper personal protective equipment (PPE) when being handled by operators.

Alternatively, OSG systems use only water and salt and produce nonhazardous oxidant solutions with a chlorine content that typically contains less than 0.8 percent free available chlorine at moderate pH. Treatment plants that use OSG systems typically face less federal and state regulatory oversight, require less safety training for operators, and have less of an insurance issue compared to those using traditional forms of chlorine.

**Higher Quality Chemicals**
Factors such as time in storage, storage temperature, and exposure to sunlight can accelerate hypochlorite loss through these chemical degradation pathways. As a result of this degradation, aged hypochlorite solutions will contain less and less free available chlorine (FAC) and more degradation products, effectively increasing the per-pound cost of chlorine available for treatment applications.

Storage issues mount in areas that are required to have 30-day or higher supplies of disinfectant chemicals on hand, especially when bulk hypochlorite is stored without significant environmental control in warm climate areas.

OSG systems, on the other hand, produce hypochlorite solutions that contain less than 1% available chlorine, and hypochlorite degradation at these concentrations is extremely low. This, coupled with the built-in engineering controls that limit chloride production to a one- to three-day supply, results in a more cost-effective production of chlorine.

**Lower Disinfection Byproduct Formation**
Recent research has indicated that hypochlorite storage leads to chlorate (ClO₃⁻) and perchlorate (ClO₄⁻) production from hypochlorite anions. Chlorate has been identified as a potential health hazard and was included on the third contaminant candidate list (CCL3) developed by the EPA, indicating that there is a likelihood that the EPA will issue a regulatory limit of this chemical in drinking water in the future. Currently, there is a health reference level of chlorate at 210 ppb, and 37% of water samples from utilities using bulk hypochlorite as a disinfectant were found to have chlorate concentrations higher than this level. Additionally, 52% of water samples from treatment plants using chlorine dioxide were found to have chlorate concentrations above 210 ppb. Due to these findings, and in anticipation of an eventual EPA regulatory limit being established for chlorate, many operators are looking for ways to reduce the introduction of chlorate into their finished water.

One way to achieve this goal is to use hypochlorite produced by OSG systems. While some chlorate is produced as an undesired side reaction in the electrolysis process, hypochlorite solutions produced by OSGs are far less concentrated than bulk hypochlorite and therefore degrade much slower.

OSG is especially beneficial for utilities that are required to have long-term supplies of disinfectant on location. Bulk hypochlorite stored for extended periods of time, especially in warmer climates, can result in substantial chlorate production. In contrast, it is possible to store a long-term supply of the sodium chloride feedstocks for OSG systems to meet the same requirement, and sodium chloride will not degrade upon standing.

**Greener Applications**
OSGs are more environmentally friendly compared to delivered chemicals. In addition to the elimination of the use and potential accidental release of extremely toxic chlorine gas, precursor explosion, accidental inhalation, or chemical burn, transportation of chemicals from factories to the point of application is reduced. This is due to the fact that delivered disinfectant solutions are mostly water; therefore, delivery costs associated with aqueous biocides mostly arise from paying for the delivery of water to the application point. Decreased deliveries reduce delivery cost and logistics expenses and also lower the carbon footprint of the treatment facility because less fossil fuel is needed to supply the disinfectant.

**Reduction in Trucking**
The volumetric space requirements for concentrated hypochlorite are substantially more than the salt required to generate an equivalent amount of dilute
hypochlorite on site. A truckload of palletized salt consists of 18 pallets, for a total of 22 tons of salt. If salt is purchased in bulk and blown pneumatically into a brine silo, the truckload quantity increases to 24 tons of salt. At a typical OSG salt conversion efficiency of 3.5 pounds of salt per pound of equivalent chlorine, a truckload of salt would generate between 12,600 and 13,700 pounds of chlorine equivalent. In contrast, a typical truckload of concentrated hypochlorite is only 4,000 gallons, which means that it would take more than three deliveries of bleach to equal the chlorine equivalent produced by one truckload of salt.

In addition, a typical 12.5% hypochlorite solution weighs around 10.2 pounds per pound of equivalent chlorine. This means that for the same unit of disinfection, delivered hypochlorite weighs about three times more than the salt required for OSG, and it carries a hazardous classification, which also garners a higher transportation cost.

**Cost Advantage**

The cost of bulk chemicals depends on market prices, while the cost of operating an OSG system is tied to the cost of salt and power. In general, the lifecycle cost of OSG is very competitive with chlorine gas alternatives and is typically substantially less than delivered hypochlorite.

OSGs typically produce chlorine at a much lower cost than traditional delivery methods, primarily because there is no need to continuously purchase expensive chemicals. This is especially the case for systems using calcium hypochlorite, chlorine dioxide and other biocides used for industrial applications. Additional savings come from decreased transportation and safety-related costs, decreased logistics effort on the part of the user, and lower insurance premiums. Although OSG systems usually present an upfront capital equipment cost, for most applications, conversion to OSG results in a return on investment in OSG equipment within one to two years, or a matter of months when replacing expensive biocides like chlorine dioxide or stabilized bromine. Additionally, immediate chemical cost savings can be realized via equipment rental or lease options.

Typical operation costs for various disinfectants on a per pound basis (or equivalent to one gallon of 12.5% hypochlorite):

<table>
<thead>
<tr>
<th>Operational Cost</th>
<th>$/lb Free Available Chlorine (FAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Site Generated Sodium Hypochlorite</td>
<td>$0.49 - $0.56</td>
</tr>
<tr>
<td>On-Site Generated Mixed Oxidant Solution</td>
<td>$0.57 - $0.79</td>
</tr>
<tr>
<td>Chlorine Gas</td>
<td>$0.50 - $0.60</td>
</tr>
<tr>
<td>12.5% Sodium Hypochlorite (bulk delivered)</td>
<td>$1.00 - $1.60</td>
</tr>
<tr>
<td>Chlorine Dioxide</td>
<td>$2.50 - $4.00</td>
</tr>
<tr>
<td>Stabilized Bromine</td>
<td>$2.00 - $7.00</td>
</tr>
</tbody>
</table>

In all prospective scenarios, a thorough cost evaluation will explore operating, maintenance, and capital costs to achieve a realistic lifecycle cost analysis. Possible effects on other plant processes should also be considered.

Note that inclusion of delivery costs would reflect an even more marked contrast between salt and delivered hypochlorite. Mileage, impacted by volumetric space, is
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the largest factor in transportation costs. Weight and chemical classification also play a role.

Operational Considerations of Using Electrochemical Generation
There are a few operational topics to consider when evaluating OSGs for a facility:
1. Hydrogen safety
2. Electrical safety
3. Water quality, temperature and pressure
4. Salt quality
5. Electrolytic cell maintenance

Hydrogen Safety
All electrochemical systems that employ aqueous solutions—disinfectant OSGs included—produce hydrogen at the cathode as a byproduct of the electrolysis process. Hydrogen is more than 13 times lighter than air, so it will rapidly dissipate from an electrolytic cell or OSG system. Because OSGs are typically installed inside a building, the system and tanks need to be properly ventilated. Hydrogen safety concerns are mitigated by careful engineering of the OSG itself as well as good planning when the OSG is installed. When considering an OSG system for water treatment, it is important to ensure that the system meets standards set by groups such as Hydrogen Safety, LLC.

Electrical Safety
Basic electrical safety must be adhered to when working with OSGs. This is true of all electrical equipment.

OSG voltage varies depending upon the system size and equipment manufacturer. MIOX OSGs are designed to minimize electrical hazards. For example, MIOX’s small OSG systems are far below voltages normally associated with dangerous conditions. This means that operators can work on the system, touch the electrolytic cell, and perform basic maintenance without risk of lethal shock. Larger systems have higher voltages requiring special precautions, but they are typically designed with an electrical interlock that shuts down the cell when the cell enclosure is opened. On all MIOX systems, high-voltage components are isolated and rarely require maintenance.

Water Quality, Temperature, and Pressure
Water is the largest component of the salt solution that enters the electrolytic cell of an OSG and, thus, the composition of that water is important to ensure the reliable operation of an OSG system. Potable water supplies can feed most OSG electrolytic cells, but it is very important that the water be softened to maintain the feedwater hardness within the maximum recommended range. If hard water is used to provide either the water or brine solutions for an electrolytic cell, scale will rapidly form on the surfaces of the cathodes, causing the electrolytic cell to fail. Similarly, the temperature of the water entering the electrolytic cell should be maintained within a range of 50 °F to 80 °F to avoid damaging the electrolytic cell. If an OSG is installed in an area where water feeding the OSG will be outside of that temperature range, a heater/chiller unit is typically added to the overall system.

Numerous factors related to water quality and temperature can affect the oxidant demand of each individual water system, the oxidant production of the electrolytic cell, or the life of the cell itself:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Oxidant Demand</th>
<th>Chlorine Production</th>
<th>Cell Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hardness</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Fluoride (F)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Silica (SiO2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Bromide</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Cyanide</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Dissolved Sulfides (as H₂S)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Ammonia Nitrogen (NH₃-N)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Organic Nitrogen (Org-N)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>pH</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Water Temperature Range</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

In addition, feedwater pressure should be maintained between 25 and 100 psi to ensure proper OSG operation. A water boost pump or a pressure-reducing valve is installed upstream of the OSG if the feedwater pressure is lower or higher than the operating range.

Salt Quality
Sodium chloride is the only chemical added to the OSG water stream and is required for producing the chlorine-based disinfectants. As is the case with feedwater, it is vital to use high-purity salt to ensure the reliable
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operation of an OSG system. Some contaminants in salt, such as the calcium and magnesium found in brackish waters and sea salt, can cause damage to the electrolytic cell. Another concern is that some salts contain other chemical species that are subject to oxidation, the most common being bromide (Br⁻). In any electrochemical cell that produces chlorine, bromide will be oxidized to form bromates (BrO₃⁻), which are regulated by EPA to have a Maximum Contaminant Limit (MCL) of 0.01 mg/L in drinking water. Food quality salt is the most common form of salt recommended for OSGs.

Electrolytic Cell Maintenance
The electrolytic cell is the most expensive part of an OSG, and appropriate care should be taken to avoid costly replacement events. Flushing the cell with soft water after every use helps to prevent salt-deposit buildup. Most OSG systems perform this action automatically upon system shutdown. Using appropriately softened water and high-quality salt are the two most important factors of cell maintenance. Even under these conditions, though, electrochemical cells will develop scale over time. This scale will impede the ability of the cell to generate chlorine and, if left unchecked, will eventually destroy the electrodes. Wash the cell periodically by flushing it with muriatic acid (hydrochloric acid) to remove the scale and clean the electrode surfaces. How much acid is needed and how often the electrolytic cell needs to be rinsed are factors that rely on variables such as how often the cell is in operation and the quality of water and salt that go into the cell.

Note that low-calcium salts are widely available throughout the United States from a variety of manufacturers. The price differential for a better quality salt usually has a nominal impact on the operational budget, so it may be worthwhile to obtain the best quality salt possible. OSG customers using good-quality salt report acid-washing their cell as infrequently as once per year. For those customers that either cannot obtain high-quality salt or cannot justify the higher cost, the issue can be remedied by a more frequent cell-cleaning program.

Andrew K. Boal is the chief scientist and director of business development for oil and gas at MIOX, a company specializing in the development, manufacture, and installation of on-site generators for chlorine, mixed-oxidants, and other chemistries.

References
1. What is Mixed Oxidant Solution? White paper published by MIOX that contains an overview of research into the composition and microbial inactivation properties of Mixed Oxidant Solution.
5. Boal, A.K. Alternative to Bromine Improves Cooling Water Microbial Control and Overall Treatment 2015. Published by the Cooling Technology Institute as paper number TP15-18 and describes the application of mixed oxidant solution for the treatment of cooling tower waters.
7. Boal, A. K. Disinfection of Cooling Tower Waters at an Ammonia Production Facility Using Only On-Site Generated Mixed Oxidant Solution (MOS) 2017 Published by the Nitrogen+Syngas conference series and describes the application of MOS to disinfection cooling tower water at a large ammonia production facility.
8. Muilenberg, T. and Candir, C. How Stripping Biofilm from the Cooling Water Loop Impacts Power Plant
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AWT partners with The Marcom Group, Ltd. to provide professionals in the water treatment industry with online safety training courses. The program allows you to train, test, and track the safety training of you and/or your employees. There are hundreds of courses to choose from, and the system offers you easy reporting tools to monitor training progress.

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Call (775) 624-5083 and mention "AWT" to receive the discount! 5a
Work is well underway on the 2018 Annual Convention and Exposition, to be held September 26–29, in Orlando, Florida.

Orlando
As a father of young children, I’m looking forward to attending a meeting in Orlando, where I can tack on family time afterwards. We are purposefully ending the meeting before noon on Saturday so that you can spend time enjoying the hotel or exploring the many theme parks in Orlando over the weekend.

You’re never too old to enjoy one of the area's many theme parks, from Walt Disney World® Resort to Universal Orlando® Resort, as well as SeaWorld® Orlando and LEGOLAND® Florida. And Orlando’s natural beauty is the perfect counterbalance to the rush of theme park fun. Eco-tours, natural springs, airboat and swamp tours, birding, nature trails, nature parks, and kayaking are just a few of the options for exploring Orlando’s great outdoors. You can also enjoy arts and culture, shopping, spas, golf, restaurants and dining, shows, and nightlife to build your perfect itinerary.

Hotel
The Omni Orlando Resort at ChampionsGate was just recently voted the #1 resort in Orlando, as winner of the Conde Nast Traveler Readers’ Choice Awards. This Four Diamond resort is one of the nation’s premier golf, meeting, and leisure retreats.

AWT will be taking over almost every room at the property—rooms that are equipped with every modern convenience and a host of luxury amenities. In addition to onsite golf, guests may choose to relax at the spa, dine in one of the nine restaurants, or enjoy 15 acres of pools and recreation activities, including the 850-foot lazy river and Orlando’s only resort wave pool.

If you’re like me, you’ll enjoy the fact that you can enjoy easy access to the attractions in Orlando while enjoying the seclusion the hotel offers. Complimentary scheduled shuttle transportation is provided to the Walt Disney World® Theme Parks. And, the resort is located just 25 minutes from the Orlando International Airport and 20 minutes from Universal Studios and SeaWorld.

Plus, the meeting is right there on property, so it’s just a quick stroll from your room to the sessions.

Educational Program
We’ll start the educational sessions out right, with an inspiring keynote presentation by John Mattone, the world’s top authority on Intelligent Leadership (IL) and former executive coach to the late Steve Jobs. John is respected as someone who can strengthen a leader’s talents, enabling them to realize four outcomes they can leverage in their business and life: Altruism, Affiliation, Achievement, and Abundance (The 4 A’s). The 4 A’s are the seeds to achieving sustained greatness and creating a lasting legacy. We’ll all walk away with great content from this session.

On Friday, we have an extended workshop on water management plans (WMPs). The Education Committee will present from a difference perspective when it comes to Legionella and WMPs. For the past few years, Legionella experts have been educating the AWT membership. This presentation will be from the water treater’s perspective. Using the firsthand experience of water treaters in the field, the session will explore how to work with Legionella experts, explaining Legionella to customers, conducting a site survey, and writing and delivering the WMP, as well as revisiting and updating the plan. The presentation will also include lessons learned from past experiences.
The breakout sessions on Thursday, Friday, and Saturday will include presentations on biocides, biofilm, boilers, corrosion inhibitors, green chemistry, polymers, RO, wastewater, and water reuse.

We’ll also have dynamic, interactive Learning Lounges. They’re a great way to learn and connect with your peers at the same time!

**Business Owner’s Meeting**

Part of AWT’s mission is to help independent water treatment companies survive and thrive. We do this, in part, by collaborating with and supporting each other. This spirit is the overriding ideal behind the owner’s meetings—to help propagate the continued growth of independent water treatment service companies.

This ½ day workshop is an intimate gathering for owners and one other person in top management from their company to learn, share, and network. It will provide learning and development opportunities featuring highly interactive workshops, leadership and personal development sessions, and common interest roundtable discussions. This is one meeting you won’t want to miss!

**Exhibitors and Vendors**

The AWT Exposition provides attendees with an excellent opportunity to discuss the latest technologies and applications with the industry’s leading suppliers. Where else can you meet face to face with such a diverse group of experienced suppliers—all under one roof?

**Exhibitors** (as of 4/12/18)

Aceto Corporation
Advantage Controls, Inc.
Aerobiology Laboratory Associates
AkzoNobel Surface Chemistry
Albemarle Corporation
All-Plus Chemical Co. Ltd
AmeriWater
Amoeba
AMSA, Inc.
Anhui Trust Chemical Co., Ltd.
APTech Group, Inc.
Aquamedix
Aquamonic, LLC
Aquapharm Chemicals Pvt. Limited
Aquaphoenix Scientific Inc.
Aquionics Inc.
BASF Corporation
Bio-Rad Laboratories
Bio-Source, Inc.
Biosan Laboratories, Inc.
Biosolutions, LLC
Brenntag North America
BWA Water Additives
Carlton Meter, Inc.
CDG Environmental, LLC
ChemQuest Chemicals
Chemtrol
Cortec Corporation
Creative Water Solutions LLC
Dow Microbial Control
Droycon Bioconcepts Inc.
Eddington Industries, LLC
Elkem Silicones
EMEC
EMLab P&K
EMSL Analytical Inc.
Enviro Tech Chemical Services, Inc.
Environmental Safety Technologies, Inc.
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Walchem, IWAKI America Inc.
Water Science Technologies
Wincom, Inc.
Networking Opportunities
The AWT Convention is the only place in the water industry where you can meet people who are confronted with the same challenges as you. As small to medium-sized businesses, attendees at the Annual Convention can relate to the exact challenges you face. And as we all know, networking is one key factor to being a successful business owner. The best way to get through tough times, be it a business slump or an incredible growth spurt, is to have a trusted peer in the industry who you can turn to for advice and counsel.

Golf Tournament
It’s just a short walk or shuttle ride over to the International Golf Course, which was recently ranked no. 9 in the top overall ranked courses by GOLF Advisor. The course underwent a rejuvenation project at the end of 2016, which yielded improved playing conditions. Green surrounds and par three tee surfaces were replaced with 419 Bermuda. These changes will allow for firmer, faster playing conditions and more year-round consistency. The replacement turf will also be more tolerant in colder temperatures and able to produce exceptional quality and playing conditions for years to come. Bring your clubs and join us on the golf course!

Annual Reception and Awards Dinner
We’re also looking forward to a great Annual Reception and Awards Dinner, which will again take place on Thursday evening to allow more people to celebrate with us. We’ll be celebrating in style this year, with a Miami-style event featuring champagne and cigars. It will be a fun event and a nice way to honor our award recipients.

Register Today!
This is one convention you can’t afford to miss! Go to www.awt.org/annualconvention18 to find extensive information about the convention. We hope to see you there! 😊

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Cortec® Corporation has developed a biobased corrosion inhibitor specially designed for hydrostatic testing with seawater. EcoLine® VpCI®-642 allows seawater to be utilized in checking the safety and reliability of pipes, vessels, and other fluid-related equipment without the danger of premature corrosive equipment failure. This encounters tremendous cost savings for hydrostatic testing in offshore environments where there is ready access to an abundant supply of seawater.

EcoLine® VpCI®-642 effectively protects ferrous metals in contact with corrosive, high chloride hydrostatic testing fluid by forming a protective layer on metal surfaces and inhibiting cathodic corrosion reactions. Its low dosage of 0.3–0.75% by volume makes it economical and cost-competitive.

As a USDA certified biobased product, EcoLine® VpCI®-642 is also an eco-conscious option for corrosion protection during hydrostatic testing. Chiefly derived from renewable resources, it contains 93% USDA certified biobased content. It provides an excellent replacement for more hazardous products containing nitrite, chromate, and hydrazine.

EcoLine® VpCI®-642 is also biodegradable with an environmentally friendly profile that makes disposal of large quantities of used hydrostatic testing water more likely to comply with local regulations. After treated water is drained, corrosion protection of the vessel can be extended by rinsing with fresh water containing 0.5% by weight of VpCI®-609.

CDC ELITE Program Adds Legiolert® to Proficiency Testing Options

IDEXX Water is pleased to announce that the Legiolert® Test is now accepted for use for routine monitoring by CDC Environmental Legionella Isolation Techniques Evaluation (ELITE) Program laboratories.

The Legiolert Test detects Legionella pneumophila in potable and nonpotable water samples and delivers confirmed, quantified results in 7 days, significantly faster than the 10–14 days for traditional spread-plate culture methods. The Legiolert Test is an extremely simple-to-use culture test. It requires less than 5 minutes hands-on time and provides an objective color change result that is more than 99% repeatable and reproducible. The Legiolert Test’s reliability makes it ideal for confirming that water management plans are effectively controlling Legionella pneumophila, the primary cause of Legionnaires’ disease.

The CDC ELITE Program is incorporating IDEXX’s Legiolert Test method starting with the proficiency test samples available March 26 from the Wisconsin State Laboratory of Hygiene (WSLH). The Legiolert Test is now also available and in use by laboratories in the United States, United Kingdom, Europe, Middle East, and Africa. To learn more or to find a local laboratory that offers cooling tower and building water testing with the Legiolert Test, visit idexx.com/legiolert.
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Pulsafeeder Announces Release of MicroVision EX 3.0

MicroVision EX controller is designed to make water treaters’ life easier. Our advanced controller is simple to install and use, delivers reliable performance, and is versatile for use in various cooling tower applications. And now with MicroVision EX 3.0, water treaters can further improve their productivity, as they can customize and name relays, inputs, and water meters and better track system performance.

Unchanged features of current MicroVision EX:
- Toroidal probe—factory-calibrated and maintenance-free.
- Cloud-based PULSAlink Website and iOS/Android app for live readings on the go.
- Military-grade industry leading AES 256 encryption to prevent unauthorized access.

Enhanced features with MicroVision EX 3.0:
- Customizable names for relays, inputs, and water meters.
- Enhanced charting of system parameters to track water treatment programs’ efficacy.
- Intelligent reporting to help water treaters do their job quickly and more accurately.
- Robust data logging capabilities for higher reliability.

MicroVision EX 3.0 lets water treaters do much more for their customers—and worry even less. Now they have the power to maintain process control, reduce costs, and limit system downtime. To find out how easy it is to put the industry’s most advanced controller technology to work, visit www.pulsatрон.com or call 1-800-333-6677.

Italmatch Chemicals Group Acquires Jiayou Chemical of China

Italmatch Chemicals, a global specialty chemical group leader in the production and marketing of performance additives for water and process treatment, oil and gas, industrial lubricants, and plastics, acquired the Chinese company Jiayou Chemical, active in the phosphonate business, from Ecolab Inc., the global leader in water, hygiene, and energy technologies and services.

This transaction allows Italmatch Chemicals to strengthen its presence in the Asia-Pacific region, with a new plant specialized in production of phosphonates. The new site complements the other dedicated plants located in North America and Europe and makes Italmatch and its brand, Dequest, the global leader in this business, thanks to its regional presence in the world.

Sergio Iorio, CEO of Italmatch Chemicals Group, stated, “After closing 2017 with important acquisitions in North and Latin America, we are happy to begin 2018 with a very significant agreement for Italmatch Chemicals in Asia Pacific. Through this acquisition, Italmatch Chemicals achieves a global presence and a global market leadership in phosphonates, thanks to a new manufacturing presence in China. Today, China represents a fast-growing market—especially in industrial water and process water treatment—characterized by higher quality and high environmental standards, in line with the Central Government’s objectives to elevate environmental standards of chemical companies, which are fully aligned with Italmatch Chemical’s strategic objectives in the Asia Pacific region. In addition, the manufacturing footprint expansion gained through this transaction strengthens Italmatch Chemical’s ability to supply its largest global customers.”

Founded in 1997, Italmatch Chemicals, is a leading innovative chemical group specialized in performance additives for water treatment, oil and gas, lubricants, and plastics, and boasts a wide product range able fulfil the requirements of the most demanding applications, including personal care. For more information, visit www.italmatch.com.
Orlando Testing Laboratory Adds AIHA Certification for Legionella Testing

EMSL Analytical, Inc. is pleased to announce that its Orlando laboratory is now certified for Legionella analysis through the American Industrial Hygiene Association (AIHA-LAP, LLC). EMSL Orlando is in compliance with International Standard ISO/IEC 17025:2005 policies and procedures, along with offering high-quality testing services to its clients. Nationwide, EMSL is the leading Legionella testing laboratory, with 20 CDC ELITE certified locations, including Orlando, throughout the United States and Canada.

Legionella can cause a very serious form of pneumonia known as Legionnaires’ disease, which often has long-term health effects such as cognitive decline and debilitating fatigue long after the patient is released from the hospital. Legionella can also cause a less serious flu-like illness known as Pontiac fever.

“We are proud of EMSL Orlando’s efforts to achieve this AIHA accreditation for Legionella testing,” stated Christopher Goulah, Ph.D., Legionella technical manager at EMSL Analytical, Inc. “Our microbiology divisions companywide are consistently working to earn new qualifications to better assist our clients throughout the country as well as in Canada. EMSL Orlando has talented and qualified personnel offering laboratory support for Legionella outbreaks or routine testing.”

Along with Legionella testing, EMSL Orlando offers asbestos and microbiology testing services. EMSL Orlando is an AIHA-LAP, LLC Environmental Microbiology Proficiency Analytical Testing (EMPAT) participant for fungi and an Industrial Hygiene Proficiency Analytical Testing (IHPAT) participant for asbestos. The Orlando lab is also certified through the AIHA-LAP, LLC Environmental Lead Proficiency Analytical Testing (ELPAT) for paint chips, soil, dust wipes, and air testing.

In addition, EMSL’s Orlando laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk and airborne asbestos analysis. The laboratory is accredited by the State of Florida Department of Health, Bureau of Public Health Laboratories for asbestos testing in drinking water.

To learn more about Legionella and our testing services, please visit www.LegionellaTesting.com.

Tackling Metaldehyde With Powdered Activated Carbon

Evolution and changes in agricultural practices have brought about increased levels of pesticides entering water treatment plants. Metaldehyde is an extremely common pesticide used throughout the UK to attract and kill slugs. Used by both farmers and gardeners alike, metaldehyde can be purchased off the shelf under a variety of brand names.

Unfortunately, unlike other pesticides, metaldehyde cannot be broken down by traditional water treatment processes using chlorine or ozone and is therefore a very difficult compound to remove. Even using advanced water treatment processes, WTWs struggle to fully remove Metaldehyde. The Drinking Water Directive says individual pesticide levels in drinking water must not exceed 0.1 µg/L, with the total pesticide level not exceeding 0.5 µg/L.

Levels of metaldehyde in drinking water have been seen to rise in correlation with the increase of slugs on farmland and crops. Dry spells followed by wet warm weather is the ideal breeding ground for slugs. Farmers often react by increasing their pesticide use, which in turn can easily find its way into the watercourses during above average rainfall.

Some water companies have worked with farmers to try and stop using metaldehyde, but the frequency and whereabouts of metaldehyde use is difficult to track and therefore, almost impossible to try and restrict at the source.

Water companies need a reliable solution that can be ready to tackle metaldehyde if the levels in their water rise above the legal amount. Powdered Activated Carbon (PAC) is a proven solution to adsorb most pesticides, including metaldehyde. While Granular Activated Carbon (GAC) filtration is a proven way of removing metaldehyde, it comes at a price, with the GAC beds requiring regeneration at regular intervals. PAC does not have these operational problems and can be used to remove metaldehyde.

Transvac Systems can supply a wide range of PAC dosing systems, suitable for all types of budgets and installations.
Each system is custom designed to suit the client’s exact process and dosing needs. Transvac uses ejectors to entrain the PAC via high pressure water, mixing the two and discharging into the point of application, often the site clarifiers. The TransPAC system is a fully containerised package and comes complete with a HMI control panel, which can adjust the PAC dosing level required to match the work flow (flow paced). The TransPAC comes complete with both bulk-bag and silo feed options, and is simple to install and operate with no M&E contractor requirement. The TransPAC can be moved from site to site, making it the perfect solution for issues such as metaldehyde spikes that may only happen during warm wet months. While typical metaldehyde spikes are not usually high enough to represent a health risk, it still needs to be removed to bring it in line with European regulations and UK standards. Having the ability to quickly, efficiently, and cleanly start dosing PAC into the waterworks is a winning strategy, keeping the UK’s water clean and pesticide free.

For more information, contact Transvac at www.transvac.co.uk.

Evoqua Acquires Pure Water Solutions, Expanding Its Water Service Capabilities in Colorado and New Mexico

Evoqua Water Technologies announced it has signed a definitive agreement to acquire privately held Pure Water Solutions, a leading provider of high-purity water equipment and systems, service deionization, and resin regeneration, with service operations in suburban Denver and Santa Fe. The acquisition further underscores Evoqua’s industry-leading service capabilities in the water treatment market. Terms of the deal were not disclosed.

Pure Water Solutions serves the ultrapure pharmaceutical and laboratory, medical, commercial, industrial, and agriculture markets throughout Colorado and New Mexico. It serves its customer base with a variety of products and solutions, including reverse osmosis, deionized water systems, ultra-filtration, and portable exchange. It will become part of Evoqua’s Light Industry Technologies division, which is a part of Evoqua’s Industrial Segment, and will extend the company’s unmatched service network.

“Pure Water Solutions has been a leader in the high-purity water market in Colorado and New Mexico for more than 20 years, and their reputation of customer-focus, flexibility and service is well earned,” said Ron Keating, Evoqua chief executive officer. “We welcome Pure Water Solutions to the Evoqua family and look forward to immediately helping them accelerate their growth as part of Evoqua.”

Evoqua has an unmatched service and support network that is four times larger than its next largest competitor. As a result, a certified Evoqua service technician—the best trained in the industry—is no more than two hours away from more than 90 percent of its more than 25,000 industrial customers. For more information, visit www.evoqua.com.
What prompted you to start volunteering with AWT?

My AWT volunteerism began during a sales call with Trace Blackmore nine years ago. In retrospect, I think we both had the same goal in mind that day: to sell something. I was there trying to sell chemical feed equipment, while Trace was selling me on the idea of getting involved in AWT. He was in recruitment mode as he moved into a board position. He was looking for the perfect candidate for his beloved Marketing/Communications Committee that he founded.

The committee’s first project was to design a corrosion coupon poster for *The Analyst*. We were able to deliver a quality product for publication that is still pinned to many walls in water treatment companies across the United States today. I like being involved, and working on the committee was a way I could give back to an industry that has been good to me and ProMinent, my employer. Joining the committee was a way to use my passion for creative marketing and my 20+ years in the water treatment industry to, hopefully, make a beneficial contribution to AWT members. I am appreciative and thankful that Trace personally reached out to me. Otherwise, I am convinced I would have been too intimidated to get involved on my own.

I am also thankful to Cindy Mitchell, Ray Baum Award recipient, for getting me involved. She reached out to me when she and Heidi Zimmerman conceptualized Women of Water, a women’s networking group within AWT. I was excited to co-found this group several years ago, which is still relevant for women today working in our male-dominated industry.

What has been the most rewarding thing about volunteering?

To volunteer is to serve others. Volunteering gives one the ability to be part of a bigger cause, benefitting the entire industry. AWT would not exist were it not for all the volunteers who unselfishly share their time and knowledge. When you stop and think about it, it’s pretty special. For me, being able to network and associate with so many wonderful people has been an honor, and to be in a position to collaborate, even better. I’m fortunate to work for a company that truly believes in passionately serving others with purpose. Volunteering for AWT has given me the ability to contribute in a rewarding way. Short of sounding extremely cliché, the “what’s in it for me mentality” isn’t the best approach to volunteering. Rather, what one receives in return is tenfold. This is definitely my message to others who are contemplating becoming involved.

How has volunteering improved your professional career?

I believe that it has improved my professional career in multiple ways. I always walk away with new ideas from the interaction with other AWT professionals through my committee work. It has also given me more respect for talented leaders. Serving in a leadership capacity isn’t always easy.

Why would you encourage others to become a volunteer?

Considering that most AWT members are employed by small to medium-sized companies, I would encourage everyone to volunteer in some way. Becoming involved gives you to the ability to tap into an endless resource pool. The knowledge and newfound friendships that are gained over the years are truly priceless.

Tell us about a current project you or your committee is working on?

Currently, I am involved with two task forces. The task force I currently chair is focused on assisting with the
development of the online training modules. We have assembled an extremely talented and dedicated team whose expertise in marketing has proved invaluable to the developer. The second task force I am involved with is working on The Analyst. Our goal is to review the current publication and ensure that The Analyst continues to be a premier publication and valuable resource in the water treatment industry. This is not only an important assignment, but it has also been great fun from a collaboration standpoint. Being on this committee has offered the opportunity to work alongside both old and new acquaintances.

What is a past project that your committee produced that you feel has had the greatest impact on AWT and why?
There are two projects that come to mind with regard to impacting AWT and its members. The foldout coupon poster still comes to mind as a highlight for the Marketing/Communications Committee. The team was able to take technical information and create a solid technical resource for AWT members. The Marketing/Communications Committee also assisted in creating ads for the IFMA Journal, bringing water treatment awareness to facility managers and the industry at large.

How have you been able to utilize the expanded business connections you’ve made while volunteering?
I have developed countless valuable connections and friendships whom I can call on to assist with water treatment technical questions, as well as, networking. Developing solid relationships with both the AWT board and AWT members has given me the confidence to connect with individuals in ways that I otherwise do not think are possible. I believe volunteering and contributing has helped provide credibility for me in the marketplace. I am always proud to tell others in the industry about my volunteer roles within AWT. 

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H2TRONICS
What prompted you to obtain your CWT and when did you begin the process by taking the test?
From early in my career at Jaytech, Inc, the president down to the sales managers and sales and service reps all placed a high value on the CWT credential. As a company highly focused on training and education, Jaytech provided me with access to a number of resources early on that helped prepare me for a successful career and to become a CWT. As soon as I hit my years of service, I signed up to take the test, and the rest is history.

What advice would you give those thinking about taking the exam?
Set a date! Too often I speak with other water treatment experts who tell me they plan on taking their CWT exam, but they keep kicking the can down the road. If you meet all of the other requirements for your CWT and just need to take the test, I recommend scheduling a test date TODAY for 4–6 months out. This will get you motivated and allow time to study. The AWT convention in Orlando this fall would be a great time to test!

What was the most difficult aspect of the exam?
Although it will be different for everybody, in my case, the most difficult part of the exam (and most rewarding) was the pretreatment section. Even though I had a lot of experience with softener systems, I was not doing much work with RO skids and demineralizer units. As a person who learns best with hands-on experience, I had to work a little harder to study the material. I also found that going into co-workers accounts who have this equipment made the material I was learning sink in even more.

How did you prepare for the test?
My primary resource was the Technical Resource and Training Manual. Outside of that, I took a number of the CWT continuing education courses that were offered online through AWT. In addition, the practice test provided by AWT once you sign up for the exam was a great way to build my confidence and confirm that I was on track to pass my test the first time around.

Why do you feel this credential was important to have?
Earning my CWT was important because it sent a message to both my employer and my customers that I take my role in industrial water treatment seriously. Besides providing me with a good deal of confidence, having my CWT also showed my customers that I am dedicated to continuing my education and that I adhere to the highest set of ethical standards within our industry.

What are the advantages of having the CWT designation?
Fame, fortune, prestige and, of course, the chance to be interviewed by Trace Blackmore on his podcast, Scaling Up!

What has been your greatest professional accomplishment?
Beyond all else, I am most proud of the education I have provided within our region. Over the past six years, I have had the pleasure of training hundreds of facilities managers, engineers, pipe fitters, and project managers from local, state, and federal government, private industry, engineering companies, and mechanical firms. Helping our customers solve problems and understand the importance of maintaining their equipment is a great feeling!
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Phosphate Levels

Question 1
Has anyone experienced phosphate levels PO4, recommended at 7,000 ppm for a closed condenser loop with 35% PG added?

Answer 1
Most commercial glycols are buffered with potassium diphosphate to get a target pH of 8.5 to 10.5. At the levels typically used, the orthophosphate level will be 7,500 to 8,500 mg/l.

Answer 2
I have not encountered a spec that called for 7,000 ppm in the final solution. However, I have found that a 35% solution of a "HD" PG glycol has about 3,500 ppm ortho-PO4. Before dilution I would expect the level to be above 7,000 ppm in the neat product.

Question 2
Has or does anyone use phosphate as a corrosion inhibitor at 7,000 ppm levels to protect aluminum in a hot water glycol system. I have not, and I’m very skeptical about the performance of that level of phosphate protecting aluminum as well as mild steel and copper.

Answer 1
That is very typical of glycols used as heat transfer fluids. For what it is worth, we treat a manufacturing facility that specifies glycol in all closed systems in all of their plants regardless of where they are located or whether freeezing is a potential problem or not. They claim they see less metals in their systems, i.e. lower corrosion rates when treating a system this way, and they have more than 20 years of data to prove it.

They actually purchased a plant that we had been treating for 12 years and, upon completion of an expansion phase, converted the existing closed systems to glycol. I was surprised they wanted to go to this expense since we had 12 years worth of corrosion coupon reports that were excellent, with corrosion rates consistently less than 0.1 mpy on mild steel, copper, and aluminum on the old systems. What we did not have was 12 years worth of iron and copper levels in each system.

I am becoming a believer in what they are doing. The corrosion rates on the glycol systems are equal to, or better in some cases, to what we were getting in the systems before they had added glycol.

Strictly my own opinion, I think the success they see is related to the attention the systems get, i.e., constant awareness of glycol concentration due to the amount of money involved in keeping them treated. Each of the systems routinely loses water with production change. Because of the money involved, they are keenly aware of what is going on in each system. You never have a chance of identifying a problem during a service visit; they already are aware of whatever you find when you show up.

Answer 2
As others have mentioned, inhibited ethylene and propylene will work well. 7,000 ppm dipotassium phosphate is the approximate level of inhibitor at the prescribed level of glycol. Others have mentioned 25% glycol concentration. It has been my understanding (correctly or incorrectly) that the recommendation is 34% glycol for proper inhibitor level for corrosion protection and biocidal effect.

Answer 3
Many glycol manufacturers are now offering a product specifically designed for systems with aluminum. These products can maintain the proper pH and inhibitor levels much better than the standard glycol products.

Google “Glycol for aluminum heating system” for more info. ☢
Predictions

By Janet Kopenhaver

Although the November elections are still six months away, there are already some clues and intelligence about what the results might be. We are going to predict the results—you heard it here first!

One harbinger of what might happen in the House and Senate will be the results of the two remaining special elections. Two have been held already and did not go well for the Republicans. The first one was the Alabama Senate seat, which was very controversial and the GOP candidate (Roy Moore) extremely volatile. This was a Democratic upset in a very red state. The second special election—held on March 13—resulted in a pickup for Democrats in the House. Pennsylvania voters from the 18th district (which Trump won by almost 20% in 2016) voted in Democrat military veteran Conor Lamb. This was a pretty devastating loss for the Republicans.

On April 24, voters in the 8th district of Arizona will be voting for a replacement for Republican Trent Franks, and on August 7, voters will decide who will take the 12th seat in Ohio. The results of these two elections will be extremely insightful for predicting what will happen in November.

The House of Representatives
Democrats would need to flip 24 seats to take control. However, the GOP is seeing a record number of retirements this year, putting many of these seats in play. At least 41 House GOP seats (compared to 16 for the Democrats) will be open in November, and this number keeps growing. (And, an astonishing nine of these GOP members are current committee chairs.) This represents more retirements than in each of the past three midterm elections when control of the House flipped.

One of the most positive trends benefitting Republican House members going into the 2018 midterm elections is that they hold favorably drawn congressional districts. However, there are several court battles challenging congressional districts due to gerrymandering (North Carolina, Wisconsin, and Maryland). Pennsylvania, which has several open seats, is already set to redistrict after the Supreme Court announced that it would not block a Pennsylvania state court ruling requiring that the districts be redrawn. This decision could definitely help Democrats win some of those GOP seats because they will not be as “safe.”

Also hurting Republicans are the strategic candidates the Democrats are putting forward—especially in competitive districts. Many of these contenders are military veterans—career professionals in defense and security arenas who hold moderate views.

Conversely, a plus for Democrats is that 23 House seats currently held by Republicans went for Hillary Clinton in the 2016 presidential election. Therefore, it is anticipated that these incumbents might have a harder reelection race.

One last advantage for Democrats—the President’s party tends to lose seats in midterms. Since 1950, only in 1998 and 2002 did the president’s party gain a few seats. But both of those were during unusually popular presidencies which is not the case this year, as Trump’s approval ratings are quite low.

My Prediction?
The Democrats will pick up 30–35 seats and therefore will control the House of Representatives.
The Senate

Despite the extremely slim majority the Republicans have in the Senate at a 51-49 split, they still have an edge in the 2018 elections. That is because only eight Republican-held seats are up for reelection compared to 25 for Democrats. And 10 are in states that Trump won in 2016. Of the 10, five are states that Trump won by more than 18 percentage points. However, it is not going to be a “slam dunk” for the Republicans.

For example, the GOP continues to have trouble recruiting top tier candidates which include former Tennessee Governor Bill Haslam, former Minnesota Governor Tim Pawlenty, and Ohio state Treasurer Josh Mandel – all formidable candidates – who have either said no outright or who have dropped their bids. Instead Republicans have a tendency to nominate candidates who are too conservative or outlandish for general election voters. (Remember Roy Moore?) We are already seeing this phenomenon. Consider this: in Arizona, Kelli Ward, a former state senator, is vying for the Senate seat being vacated by Jeff Flake. She has a background in conspiracy theories and convened a state Senate hearing to examine the hypothesis that the government uses aircraft exhaust to sterilize people or control their minds. Also possibly in the mix is controversial Sheriff Joe Arpaio who has expressed interest in running. Conversely, Democrats are recruiting very formidable candidates so far, with at least 6 being former Army Rangers and Navy SEALS running as Democrats.

Republicans are also having trouble matching their Democratic foes in the fundraising arena. For example, in North Dakota Tom Campbell has only raised $570,000 compared to $6 million that Democrat incumbent Heidi Heitkamp has in the bank. In Montana, challengers hoping to unseat Jon Tester have raised less than $500,000. In Indiana and West Virginia, the Democratic incumbents have enormous fundraising leads. For perspective, in 2016 two incumbents that were defeated – Mark Kirk in Illinois and Kelly Ayotte in New Hampshire – faced challengers with more money.

The most endangered GOP incumbent is Dean Heller from Nevada a state that Hillary Clinton won by four percentage points. The Tennessee seat being vacated by Bob Corker might also be a close one as the Republican challenger – Rep. Marsha Blackburn – has some baggage and faces a very strong foe in former Governor Phil Bredesen.

However, across the aisle, there are several vulnerable Democratic incumbents. For one, Clinton only won 26% of the vote in West Virginia in 2016 which could spell trouble for incumbent Joe Manchin. In North Dakota, she only captured 27% of the vote and Heidi Heitkamp faces a popular Rep. Kevin Cramer. Overall, both Manchin and Hetikamp are going to have to attract some Trump supporters to win reelection.

Indiana, Missouri and Florida also are precarious as Clinton won less than 40% of the vote in these states. Joe Donnelly from Indiana will face a strong competitor as all three Republicans running in the primary have name recognition and experience. Claire McCaskill – who was expected to lose her last two re-elections but won primarily because of weak GOP candidates – this year will face Attorney General Josh Hawley – a strong contender. Bill Nelson in Florida could lose if Governor Rick Scott decides to get into the race, and Tammy Baldwin in Wisconsin faces a very tough challenge by Gov. Scott Walker.

In the end, Republicans can lose both Arizona and Nevada, but if they pick up only one of these competitive Democratic seats, they retain the majority at a 50-50 split.

My Prediction?

Republicans will retain control of the Senate and gain 2 or 3 seats.

So, I am now on record with my predictions. Hopefully when we check back in November, I won’t be too embarrassed!

Janet Kopenhaver is president of Eye on Washington and serves as the AWT Washington representative. She can be reached at (703) 528-7822 or via email at janetk@eyeonwashington.com.
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- NorthQuest 4367; 551# drum / 2,755# tote
- NorthQuest 4450; 551# drum / 2,755# tote
- NorthQuest 499; 551# drum / 2,755# tote
- NorthQuest 5000; 551# drum / 2,755# tote
- NorthQuest 5410 DRY; 55# bag
- NorthQuest 5420 DRY; 55# bag
- NorthQuest 5430 DRY; 55# bag
- NorthQuest 5450 DRY; 55# bag
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- NorthQuest 5660 DRY HEDP; 55# bag

Miscellaneous Items: EDTA, Lignosulfonate, Etc.

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- DEAE; 397# drum / 1896# tote
- DEHA; 397# drum / 1896# tote
- Methoxypropylamine (MOPA); 375# steel drum
- Morpholine; 441# steel drum

AZOLES
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- Sodium Benzotriazole 40% Solution; 500# drum / 2,500# tote
- Sodium MBT 50% Solution; 550# drum / 2,750# tote
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- HEDP / NQ6600; 551# drum / 2,755# tote
- NQ6700 [Hydroxyphospho-acetic Acid]; 551# drum / 2,755# tote
- HPAA - Stabilized / NQ575; 551# drum / 2,755# tote
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Dynasty Trusts Are More Valuable Than Ever

The Tax Cuts and Jobs Act (TCJA), signed into law this past December, affects more than just income taxes. It’s brought great changes to estate planning and, in doing so, bolstered the potential value of dynasty trusts.

Exemption changes
Let’s start with the TCJA. It doesn’t repeal the estate tax, as had been discussed before its passage. The tax was retained in the final version of the law. For the estates of persons dying, and gifts made, after December 31, 2017, and before January 1, 2026, the gift and estate tax exemption and the generation-skipping transfer tax exemption amounts have been increased to an inflation-adjusted $10 million, or $20 million for married couples (expected to be $11.2 million and $22.4 million, respectively, for 2018).

Absent further congressional action, the exemptions will revert to their 2017 levels (adjusted for inflation) beginning January 1, 2026. The marginal tax rate for all three taxes remains at 40%.

GST avoidance
Now let’s turn to dynasty trusts. These irrevocable arrangements allow substantial amounts of wealth to grow free of federal gift, estate and generation-skipping transfer (GST) taxes, largely because of their lengthy terms. The specific longevity of a dynasty trust depends on the law of the state in which it’s established. Some states allow trusts to last for hundreds of years or even in perpetuity.

Where the TCJA and dynasty trusts come together is in the potential to avoid the GST tax. It levies an additional 40% tax on transfers to grandchildren or others that skip a generation, potentially consuming substantial amounts of wealth. The key to avoiding the tax is to leverage your GST tax exemption, which, under the TCJA, will be higher than ever starting in 2018.

Assuming you haven’t yet used any of your gift and estate tax exemption, you can transfer $10 million to a properly structured dynasty trust. There’s no gift tax on the transaction because it’s within your unused exemption amount. And the funds, plus future appreciation, are removed from your taxable estate.

Most important, by allocating your GST tax exemption to your trust contributions, you ensure that any future distributions or other transfers of trust assets to your grandchildren or subsequent generations will avoid GST taxes. This is true even if the value of the assets grows well beyond the exemption amount or the exemption is reduced in the future.

Best interests
Naturally, setting up a dynasty trust is neither simple nor quick. You’ll need to choose a structure, allocate assets (such as securities, real estate, life insurance policies and business interests), and name a trustee. Our firm can work with your attorney to maximize the tax benefits and help ensure the trust is in the best interests of your estate.

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Nontax reasons to set up a dynasty trust
Regardless of the tax implications, there are valid nontax reasons to set up a dynasty trust. First, you can designate the beneficiaries of the trust assets spanning multiple generations. Typically, you might provide for the assets to follow a line of descendants, such as children, grandchildren, great-grandchildren, etc. You can also impose certain restrictions, such as limiting access to funds until a beneficiary earns a college degree.

Second, by placing assets in a properly structured trust, those assets can be protected from the reach of a beneficiary’s creditors, including claims based on divorce, a failed business, or traffic accidents.
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Getting to Know Your Credit and Debit Cards a Bit Better

Virtually everyone has a credit and debit card these days. But many of us still live in fear of these plastic necessities because we’re not terribly familiar with the fine print of the arrangements under which they operate. Let’s get to know them a bit better.

Credit cards
If your credit card is used without your permission, you may be responsible for up to $50 in charges, according to the Federal Trade Commission (FTC). If your card is lost or stolen and you report the loss before your card is used in a fraudulent transaction, you can’t be held responsible for any unauthorized charges. Some card issuers protect customers regardless of when—or if—they notify the card company.

When reporting a card loss or fraudulent transaction, contact the card company via phone; many provide toll-free numbers that are answered around the clock. In addition, the FTC advises following up via a letter or email. It should include your account number, the date you noticed the card was missing (if applicable), and the date you initially reported the card loss or fraudulent transaction.

Debit dangers
Debit card liability can be a little riskier. It generally depends on whether the card was lost or stolen or is still in your possession, the type of transaction, and when you reported the loss or unauthorized transaction.

According to the FTC, if you report a missing debit card before any unauthorized transactions are made, you aren’t responsible for the unauthorized transactions. If you report a card loss within two business days after you learn of the loss, your maximum liability for unauthorized transactions is $50.

If you report the card loss after that time but within 60 calendar days of the date your statement showing an unauthorized transaction was mailed, liability can jump to $500. Finally, if you report the card loss more than 60 calendar days after your statement showing unauthorized transactions was mailed, you could be liable for all the funds taken from your account.

If you notice an unauthorized debit card transaction on your statement, but your card is in your possession, you have 60 calendar days after the statement showing the unauthorized transaction is mailed to report it and still avoid liability.

While the lower protections required on debit cards may make you wonder whether you’re safer using a credit card, some debit card companies offer protections that go above what the law requires. Check with your provider.

Risk management steps
Taking a few simple steps can help cut the risk that you’ll be held liable for unauthorized use of your credit or debit card. First, carry only cards you need and destroy old ones, shredding them if possible. Don’t provide your card number over the phone or online unless you’ve initiated the contact.

In addition, choose a PIN that’s not easily guessed and make sure to memorize it. If you have online access, take a few moments to scan transactions every time you log on or at least once a week. If you still use paper statements, be sure to review them when they arrive in the mail. If you notice a transaction that isn’t yours, report it to your credit card issuer or bank right away.

Finally, keep a list of important numbers and relevant data stored separately from the cards themselves. Having this information handy will make it easier to report a missing card or suspicious transaction quickly.

Ins and outs
Many of us have grown so familiar with our credit and debit cards that we take them for granted. But keep in touch with their ins and outs. We can answer any further questions you may have. © 2018 Thomson Reuters
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