NATIONAL RURAL WATER ASSOCIATION

RURAL WATER

The WaterPro Edition

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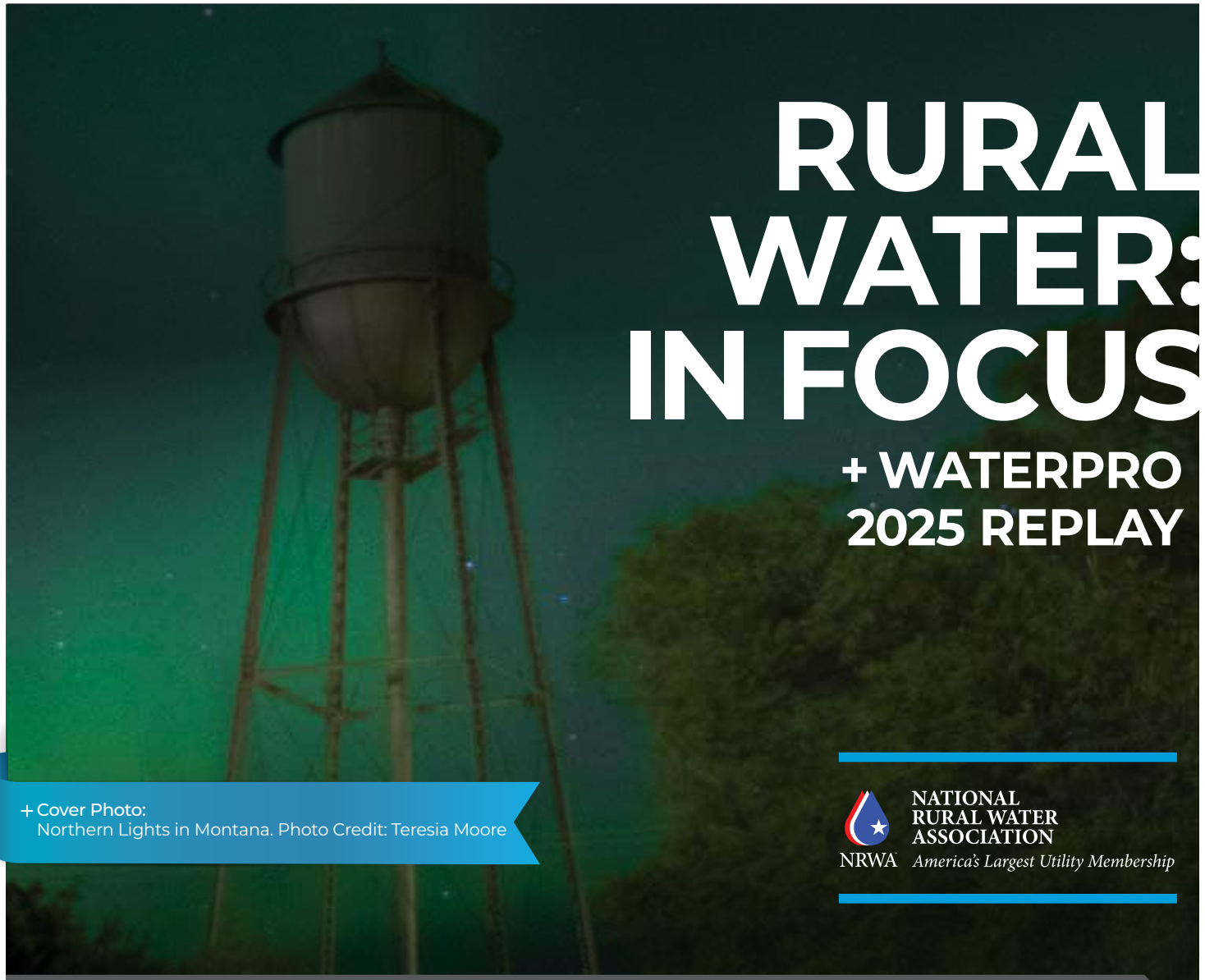

RURAL WATER: IN FOCUS

+ WATERPRO 2025 REPLAY

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Northern Lights in Montana. Photo Credit: Teresia Moore

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Innovation, Inspiration, and Community

NRWA's 23rd President reflects on a year shaped by people, progress, and the true spirit of Rural Water

By Phillip Combs, President, NRWA

Wow! As I write this article, it's hard to believe that it has been a year since I was first elected to serve as your 23rd President of the National Rural Water Association. My wife, Paula, asked me, "Why do you keep referencing the number 23?" My response to her: "Michael Jordan wore number 23 on his jersey and, in my opinion, is the greatest basketball player of all time." Not that I'm saying I'm the greatest president of all time; I just like that number.

I thought I had a good handle on everything that is going on within Rural Water as I stepped in to serve. The fact of the matter is, it's always changing and remains a moving target. As I continue along this journey, I think about all the great people I have surrounding, helping, and supporting me. People, the good Rural Water people—that's what makes this Association special and as successful as we are today.

In September, we finished another successful WaterPro Conference in the "Big Easy," New Orleans—the city that's known for its lively sounds of blues and jazz, delicious Creole cuisine, and a rich, vibrant culture and architectural history. I do have to admit: I'm addicted to beignets and ate my fair share! Like so many of us, I'm hoping you found inspiration in the city's charm, resilience, and spirit. Thank you to Louisiana Rural Water Association for being a gracious host state.

I'm proud to say WaterPro classrooms this year provided specialized training in several areas, including leadership, regulatory issues, strategic federal funding, water policy management, infrastructure, technology, and critical water-related challenges. The exhibit hall showcased a variety of innovative products and services, often with demonstrations and hands-on interaction. It turned out to be a valuable space to network and build relationships with potential partners and clients. In my opinion, it's simply the best!

I want to say thank you to all our Corporate Sponsors for your continued friendship and support! Without you, we wouldn't be successful. Thank you to all our vendors who show up year after year showcasing their new products and services that are available to our industry. I'm amazed each year how the products we use daily evolve and change in such a short period of time.

If you were looking for innovation and cutting-edge technology, you were in the right place at the right time.

Thank you to Matt Holmes and the NRWA staff for putting together another successful conference. You and your team's dedication and commitment to service is never wavering and never ending! It always shows, in the largest to the smallest of details. Rural Water has assembled a team of professionals who are second to none. Keep up the good work!

Lastly, be sure to share your experiences with your friends, colleagues, and coworkers. Let them know how much you learned and enjoyed being a part of this great experience—and how much they missed out on by not being there. Invite them to experience WaterPro for themselves next year in Phoenix, Arizona, as NRWA celebrates its 50th anniversary. With the enthusiasm you experienced and shared about this year's conference, they won't have any choice but to come to see what all the excitement is about!

I'm looking forward to another year as your president and to all the opportunities and challenges we will face together. With your continued help and support, let's continue to "Keep Rural Water Strong"! **RW**

PHILLIP COMBS
is president of the National Rural Water Association (NRWA).

NATIONAL RURAL WATER ASSOCIATION
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NRWA, Hawkins Announce Apprenticeship Scholarship Winners

Hawkins Inc. and the National Rural Water Association (NRWA) have announced the winners of the 2025 national apprenticeship scholarships, awarding ten rural utility systems $3,000 each to support workforce training through NRWA's Registered Apprenticeship Program. Designed to reduce financial barriers, the scholarships help small communities attract, train, and retain qualified water and wastewater operators. This year, NRWA received 68 applications, underscoring the demand for assistance.

Recipients include systems in Idaho, Minnesota, Indiana, Hawaii, Vermont, Illinois, North Dakota, Utah, and Hawaii, with many communities enrolling apprentices for the first time. Apprenticeships are enabling these utilities to develop homegrown talent, address staffing shortages, and prepare for retirements of experienced operators.

Hawkins began sponsoring state-level apprenticeship scholarships in 2021 and expanded nationally in 2024. "By donating apprenticeship scholarships, we hoped to reduce the barrier of entry for at least a few water and wastewater apprentices in small rural communities," said Doug Lange, Vice President of Water Treatment at Hawkins.

Together, NRWA and Hawkins aim to strengthen the future rural water workforce nationwide. **RW**

NRWA Showcases Apprenticeship Program to Senate Leaders

On September 24, the National Rural Water Association (NRWA) welcomed senior staff from the Senate Appropriations Committee and the Senate Environment & Public Works Committee to the Berkeley County Public Service Water District in Martinsburg, West Virginia. The visit spotlighted NRWA's Registered Apprenticeship Program and its role in addressing the nationwide shortage of qualified water and wastewater operators.

Capito team. Photo: NRWA.

Workforce capacity is central to meeting federal water priorities—from regulatory compliance and PFAS treatment to disaster preparedness, cybersecurity, and infrastructure investment. With more than half of today's operators expected to retire within the next decade, building a pipeline of trained workers is critical to protecting both public health and federal infrastructure investments.

NRWA's Apprenticeship Program, the first nationally recognized career path for operators, is active in 36 states with over 1,000 apprentices enrolled or graduated. Participants heard firsthand from apprentices about how the program opens career opportunities while strengthening communities. NRWA expressed gratitude to Senator Shelley Moore Capito for her leadership in ensuring federal resources support rural water utilities. **RW**

Kramer Confirmed to Lead EPA's Office of Water

The National Rural Water Association (NRWA) congratulates Jessica Kramer on her confirmation as U.S. Environmental Protection Agency Assistant Administrator for the Office of Water. Representing over 31,000 small and rural water and wastewater utilities, NRWA hailed Kramer's balanced approach to environmental policy and her commitment to protecting rural communities.


Jessica Kramer. Photo: USEPA.

"Jess Kramer uniquely understands and respects the challenges and opportunities that rural communities face every day," said NRWA CEO Matt Holmes. Kramer's career in water policy, environmental law, and regulatory affairs equips her to lead the Office of Water at a critical time. She is recognized for crafting practical, local solutions while ensuring water utilities are not unfairly burdened with costs for pollution they did not create.

Small and rural water systems, which account for more than 90% of the nation's drinking water utilities, face challenges including aging infrastructure, staffing shortages, and complex regulations. NRWA looks forward to collaborating with Kramer to advance feasible, affordable policies that safeguard public health and sustain rural water systems nationwide. **RW**

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Veterans in attendance join Davis on stage.

Rural Water Replay: WaterPro 2025

Highlights from the industry event of the year

By Kaylyn Branen Snow

The 2025 WaterPro Conference was held in the Big Easy of New Orleans, Louisiana. More than 2,100 people from all 50 states attended the conference and 120 exhibitors filled the sold-out exhibit hall!

EPA members join NRWA for roundtable discussion. All photos courtesy NRWA.

National Rural Water Association (NRWA) was honored to host important guests during the conference's general sessions. The WaterPro Opening Ceremony kicked off with the Pledge of Allegiance and invocation from Rural Water supporter and veteran Jock Davis from Arkansas, alongside Colonel John Edwards. Joining them on stage were all the veterans who were in attendance. Additionally, attendees heard a special message from Rural Water supporter and former WWE wrestler Mayor Glenn Jacobs. On Tuesday, NRWA welcomed Karl Elmshaeuser, Administrator of the Rural Utilities Service at USDA Rural Development, as the guest speaker. During the Wednesday general session, Acting Assistant Administrator for the U.S. Environmental Protection Agency (EPA) Office of Water Peggy Browne, Director for the EPA's Office of Ground Water and Drinking Water Jennifer McLain, and Director of the Office of Wastewater Management Andrew Sawyers joined NRWA for a roundtable discussion. Throughout these general sessions, speakers discussed issues in the rural water and wastewater industry, while also providing updates from their respective agencies. NRWA appreciates these industry leaders taking time out of their schedules to speak.

In addition to these speakers, NRWA presented the State Rural Water Association Awards of Excellence during the Tuesday general session.

NRWA is proud to recognize the following State Rural Water Associations:

OUTSTANDING ACHIEVEMENT IN TRAINING: PENNSYLVANIA RURAL WATER ASSOCIATION

PRWA trained 11,405 people with primacy agency-approved classes in 2024, with 272 new operators receiving training for their certification. While in-person learning remains a cornerstone, with 494 classroom ses-

sions held in 2024, this Association also embraces technological innovation. In 2024, they relaunched a dynamic, self-paced online learning platform featuring 17 primacy-approved courses and 23 exam preparation courses, with many more in development.

OUTSTANDING ACHIEVEMENT IN TECHNICAL ASSISTANCE: ALLIANCE OF INDIANA RURAL WATER

In 2024, AIRW provided more than 3,300 hours of onsite technical assistance and supported 538 unique utility systems. These efforts helped generate over $1 million in direct savings to utilities statewide through leak detection, inventory completion, asset planning, and other critical services.

OUTSTANDING ACHIEVEMENT IN COMMUNICATIONS, PUBLICATIONS, AND PUBLIC RELATIONS: SOUTH DAKOTA ASSOCIATION OF RURAL WATER SYSTEMS

This year, SDARWS proudly launched a Rural Water Hall of Fame for South Dakota, a visionary initiative created to recognize the trailblazers of our industry. Designed to honor individuals whose leadership, service, and commitment laid the foundation for rural water success in the state, the Hall of Fame serves as a bridge between generations, preserving the stories of the past while inspiring future water professionals. Additionally, their comprehensive communication strategy spans print and digital platforms. SDARWS hosts children's water festivals, participates in community events, shares targeted educational handouts, and produces a bi-monthly industry magazine, a digital newsletter, and a consumer-facing publication.

OUTSTANDING ACHIEVEMENT IN LEGISLATIVE INITIATIVES: NORTH DAKOTA RURAL WATER SYSTEMS ASSOCIATION

NDRWSA works diligently to pass common-sense legislative policy that helps small and rural systems remain sustainable. Since 2011, the Association has single-handedly secured yearly operator training reimbursement funds from the state. These funds replaced funding previously received from the EPA. Savings for the state's systems are nearing $1 million.

OUTSTANDING ACHIEVEMENT IN MEMBERS SERVICES: KENTUCKY RURAL WATER ASSOCIATION

KRWA's Compliance Program stands as a benchmark of excellence in Member Services, providing trusted, personalized support that has empowered small and rural water systems for over fourteen years. With 207 participating utilities—representing 62% of the state's public water systems—the program has demonstrated significant growth and measurable impact, delivering over $11.7 million in documented cost savings directly to participating utilities since the program's inception.

2025 STATE ASSOCIATION OF THE YEAR: NORTH CAROLINA RURAL WATER ASSOCIATION

In 2024 alone, NCRWA's training program served over 7,000 water and wastewater professionals, delivering certification, continuing education, and backflow prevention courses in every region of the state. Their engagement on Facebook has increased by 173%, and LinkedIn engagement has grown by 325% since 2023. Beyond social media, NCRWA has redesigned its website and newsletter, shared success stories and crisis updates, and met people where they are—at schools, farmers markets, and community events, often with its beloved water drop mascot. NCRWA's communication strategy tells the story of rural water with heart, clarity, and purpose. With a 98%+ retention rate and consistent annual growth since the pandemic, their Membership Team has built a reputation for outstanding service and responsiveness.

WATERPRO CONFERENCE

Texas Rural Water Association takes first place in WaterPro Feud.

Jock Davis (right) and Colonel John Edwards kick off the opening general session. All photos courtesy NRWA.

NRWA was proud to host the 6th Annual Women in Rural Water Luncheon! Thank you to ServLine for being the lead sponsor of this event. Supporting sponsors include: CoBank, USABlueBook, 120Water, Aquastore, Core & Main, Bermad, and Napoli Shkolnik PLLC. During the event, 243 attendees networked and learned more from other Women in Rural Water.

Christyna Orr receives Women in Rural Water Luminary Award.

At the conclusion of the luncheon, Christyna Orr, Assistant General Manager of Eufaula Water Works in Alabama, was presented with the second annual Women in Rural Water Luminary Award for her impactful leadership, empowerment of women, community engagement, and work in water. Her nominator wrote: "She represents the kind of behind-the-scenes leadership that truly transforms organizations—building capacity, elevating others, and anchoring the mission of rural water in service, equity, and sustainability. She is more than deserving of the Women in Rural Water Luminary Award—she is already living it."

While at WaterPro, attendees participated in exciting competitions, including WaterPro Feud, the Rural Water on Display Photo Contest, and the Ultimate Meter Challenge.

During WaterPro Feud, four randomly selected teams participated in NRWA's own spin-off of the hit game show and competed for gift certificates from the event sponsor, USABlueBook. New this year, the second-place team competed against USABlueBook for a chance to win $2,500 in celebration of USABlueBook's 25th anniversary as a Rural Water sponsor. Congratulations to the Texas Rural Water Association for placing first! Hawaii Rural Water Association came in second, followed by Florida Rural Water Association and Idaho Rural Water Association in third.

Teresia Moore's entry "Northern Lights in Montana" wins the grand prize in the Rural Water on Display Photo Contest.

In the Rural Water on Display Photo Contest, sponsored by Rogue Monkey Media, conference attendees determined the top three winners in each category and an overall winner through popular vote. This year's grand prize winner went to Teresia Moore with "Northern Lights in Montana." Steve Attema placed first in the Tanks & Towers category; Addyson Dorwart placed first in the Water in Rural America category; and Kevin Christenson placed first in the Waterworks category. Congratulations to all our winners on a job well done!

Winners of the Ultimate Meter Challenge (L-R): John Potter, Mark Axelson, Emilio Sanchez (representing Zenner), Kevin Williams, and T. Seth Hanson.

Mark Axelson races to assemble a meter.

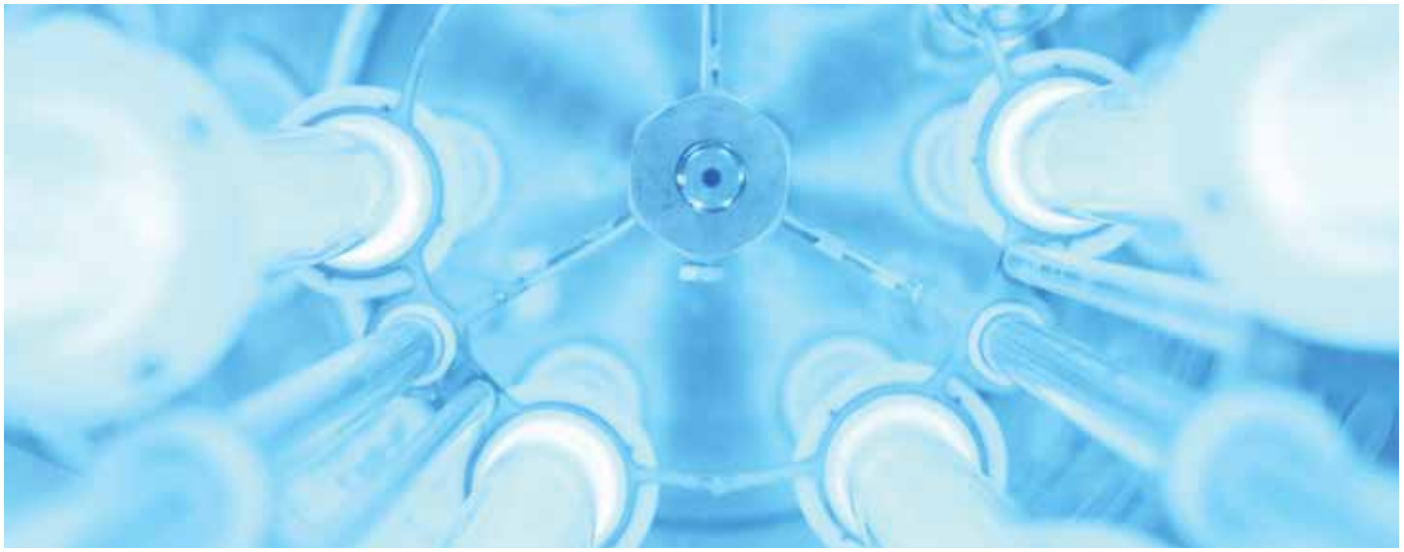
In the Ultimate Meter Challenge, sponsored by Zenner, participants competed head-to-head to assemble a water meter the fastest. In a quick 47 seconds, Mark Axelson of Kansas assembled his meter. Just milliseconds behind him was T. Seth Henson of Missouri. Zenner awarded both contestants a trip to Hawaii! Third place went to Kevin Williams of Florida, and fourth place went to John Potter of Kentucky. Congratulations!

Thank you to all who attended, presented, and exhibited at the 2025 WaterPro Conference. We hope you can join us next year in Phoenix, Arizona, September 14–16, 2026, as NRWA celebrates its 50th anniversary! **RW**

KAYLYN BRANEN SNOW

is the Content & Communications Specialist with the National Rural Water Association.

FEATURE



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UV and the Future of Disinfection

By Dominic Davis

My name is Dominic Davis. I have worked with Colorado Rural Water Association (CRWA) for two years, and I have been all over the state. It has been a great experience. Previously, I worked in a small town as their operator for five and a half years. I have done both water and wastewater during that time, which really allowed me to dip my toes into every aspect of the field.

Now working with CRWA, I was hired as their Wastewater Technical Specialist. While working here, many towns have given me the opportunity to take tours of their facilities. These tours provided a great insight into different wastewater treatment techniques and technologies. I especially noticed the differing ways of disinfection. Working at my previous facility, I am used to calcium hypochlorite, and I have had the pleasure of seeing every type of disinfection now, working with all the towns I have visited.

Ultraviolet (UV) disinfection is a real big interest of mine now that I have seen it in action, and I can see it being the future of wastewater disinfection. Ultraviolet disinfection could beat out chlorination as the main form of disinfection because it has many positive aspects. One thing I like is that it is much safer compared to chlorination. It is safer for both the operators and the environment (see Fig.1).

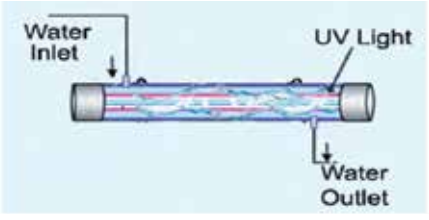

Figure 1. Bulb is with the grain of water, allowing more surface area to be disinfected. All images courtesy of CRWA.

The lights themselves provide disinfection by deactivating the potential pathogens from the wastewater. The lights are more often than not submerged in the effluent and as the water passes over them, the ultraviolet light disrupts the pathogens' ability to multiply. The potential pathogen then lives out the rest of its short lifespan, and the water is then clean (see Fig. 2).

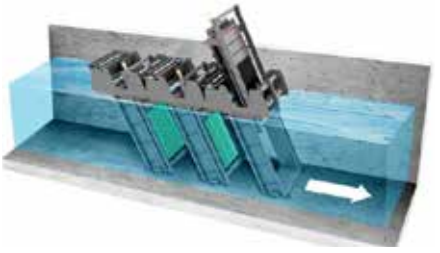

Figure 2. Disinfection within the effluent channel.

The operators using UV disinfection don't have much risk of injury. Chlorine, as most people in the industry already know, is a poisonous chemical. When using the chemical in no matter what form, it kills the pathogens completely. This method has been used for decades to treat wastewater, and it works very well; however, the risk to the environment—and especially the operator—is very high.

Gas is the most dangerous form, with potential leaks being the most common threat. Chlorine exposure can cause very serious injuries—and even death with prolonged exposure. Liquid and calcium chlorine are just as dangerous, with liquid being very acidic, which can cause burns, and calcium, which has dust that, when airborne, can cause breathing problems.

I have personally felt the horrible feeling of chlorine inhalation. As previously mentioned, I used to work with calcium hypochlorite in solid form. It comes in buckets, and at the bottom of those buckets there is normally residual dust, which, when you go to replenish the supply into the machine, becomes airborne. If you are not prepared, you can breathe it in and contaminate yourself. The feeling is horrible; my eyes started burning along with my lungs. After about five minutes of suffering, I ended up vomiting. This was only a short exposure, but it will always be something I remember. Many of you whom I've met have heard me tell this story, but I don't want anyone to have to experience this same feeling and, hopefully, one can learn from my mistake. With UV, you don't have to worry about these risks.

Another thing I like is the ease of upkeep for the operators. Most of the new systems that are out there monitor themselves, partnered with a SCADA system; this can be incredibly useful for the operator to know the output of each bulb (see Fig. 3).

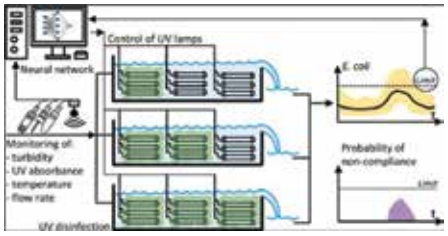

Figure 3. SCADA and UV disinfection working together.

The system can sense when it is not putting out the correct output and will attempt to clean itself. If it is still not correct, it can send out an alarm to the operator for maintenance. This can help reduce unnecessary cleaning and, therefore, save the operator time to pursue other more pressing tasks throughout the plant. When the operator does have to fix a bulb, it is as easy as literally replacing a light bulb (see Fig. 4).

Figure 4. Operator changes UV bulb.

Another reason I like this form of disinfection is that it can help keep the classification of your facility low. For those who do not know, the state [of Colorado] reclassified the level of facilities for many systems several years ago. This can be a big problem for most small systems because most were classified as D facilities, and for the ones that used gas chlorination, they got raised to Bs—and sometimes even A, depending on other circumstances. It can be hard for some towns because they now must get their operators higher certifications to meet the new state rule. One way to help lower it was to change your disinfection—and UV would be a good option for these towns. **RW**

This article originally appeared in Colorado Rural Water Association's *Rural Water Connection* magazine, 2025 Vol. 2, pp. 27–28. Reprinted with permission from Colorado Rural Water Association.

DOMINIC DAVIS

is a Wastewater I Tech Specialist with Colorado Rural Water Association.

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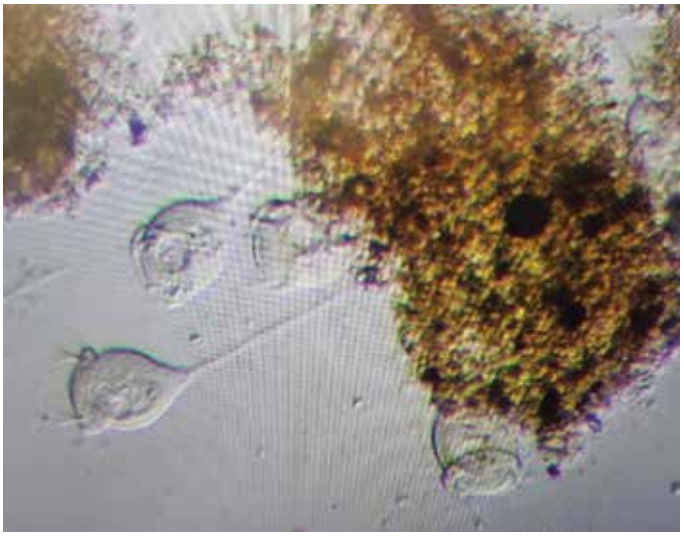
A microscope is one of the most important pieces of equipment in your lab. All photos courtesy Brian Little/PRWA.



The type of microorganisms, or "bugs," in your sample can tell you a lot about the health of your wastewater.

Wastewater Microbiology Made Simple

Unlocking process control through the microscope

By Brian Little

One of the most important pieces of wastewater lab equipment is that microscope sitting over in the corner on your lab countertop. Are you and the operators at your system using the microscope to improve your process control program? If the answer is no, hopefully this article will engage a new way of thinking for you to start looking at the microbiology in your process.

There is so much an operator can take in from doing process control and correlating the process control results with what we observe under the microscope. Remembering that providing safe clean drinking water and protecting public health is our main goal as operators; an established routine process control program will give us the data needed to produce the highest quality effluent to be discharged at our systems. Along with higher quality effluent, these numbers will help us discover a possible process problem before it upsets our entire process.

The microscope can be an intimidating apparatus to some wastewater operators; however, with a little know-how and understanding, that fear can be transferred to satisfaction. Some operators refer to the microorganisms in their systems as "the bugs." That's because when viewing a sample of your mixed liquor suspended solids (MLSS) under the microscope slide from the aeration basin, that's exactly what the microorganisms look like.

In this article, without getting too technical, I hope to help make wastewater microscope analysis more understanding. What microorganisms are good for our systems, and which ones are bad? What kind of "bug" is that? Keeping it simple will help us understand better while advancing knowledge going forward will improve our process.

There are several different treatment processes, and each process will have different characteristics contrary to others. With this understanding, gathering as much data as possible will assist operators to determine the parameters that suit their operational process the best. For example, extended aeration activated sludge processes seem to run better with a slightly higher MLSS between 3,000 and 4,000 mg/L. Whereas conventional activated sludge treatment processes seem to run best with an MLSS range from 2,000–3,000 mg/L. Just remember, every plant is different and has different characteristics, so your numbers could be a bit different than these.

Identifying and quantifying microorganisms is a critical component of treatment process control.

Assuming everything is operating efficiently at your plant, when correlating the MLSS with your 30-minute settleability, the numbers should be comparable. For example, a system with an MLSS of 3,500 mg/L, should settle out to somewhere around 350 ml/L after a 30-minute test.

Now that we have a little bit of an understanding of the solids in our aeration basins, what should we be seeing under our microscopes? When discussing activated sludge/biological nutrient removal (BNR) systems, certain microorganisms will indicate a healthy ecosystem, leading us to believe that we have a high-quality effluent.

The most popular "bug" in my experiences is the stalked ciliate. When observing our microbiology, if we see an abundance of stalked ciliates, especially in clusters, this usually means we have a healthy process. Larger clusters usually mean better settleability and clearer effluent water.

Along with stalked ciliates, crawling ciliates are usually observed in every system. The biggest misconception with the crawling ciliates is that they are considered a microorganism that is present in a young sludge; however, when crawling ciliates are the prominent microorganism and overtake our slide, this could mean we have an old sludge and need to waste more.

Other common microorganisms in the protozoa classification that we will observe are free-swimming ciliates, suctorial, flagellates, and amoeba. Protozoa make up about 4% of the microorganisms in our MLSS, and having a healthy protozoa population is a great indication of a healthy system.

As we grow our MLSS and the sludge age of our activated sludge gets older, we will begin to see more advanced microorganisms under our microscope. These microorganisms have appendages with more distinct features. These microorganisms are classified under the metazoan class and make up about 1% of the microorganisms in our MLSS. The common metazoan microorganisms are rotifers, water bears, and nematodes (worms). In most cases, observing a few metazoan microorganisms along with a healthy abundance of protozoa is a good sign of a healthy system. When we start to observe an overabundance of metazoan microorganisms, our system is considered to have "old sludge," and wasting should be increased to decrease the population of the metazoan microorganisms.

The other 95% of the microorganisms observed under the microscope are bacteria, which can be seen in a few different forms. A few of the most commonly seen are the spirillum, which are observed in little hairlike spirals, which is common in older sludge or septicity. Flocculated bacteria, which have a medium brownish color, is usually the bacteria that indicates a healthy system. When the flocs have that medium brownish tint, are large and gathered together closely, it will usually indicate the sludge is settling very good, leaving a clear and clean supernatant for effluent discharge.

Without getting too deep into filamentous bacteria, the three most common that are observed in our wastewater MLSS are microthrix, thirothrix, and nocardioforms bacteria. With an overabundance of any of these filamentous bacteria, foaming and other issues can form in your aeration basins. Some of these filaments like cold weather, fats, oils and grease (FOG), over-aeration or anoxic conditions. Narrowing down what form of filamentous is present in your system can be done by using the microscope to identify in order to treat the filamentous accordingly. However, it is crucial to have some filamentous bacteria present, which can help pull the flocs together for better settling.

Hopefully this article helps to simplify the understanding of the different microorganisms we observe while helping us create another process control parameter for optimizing our treatment plants. Some operators are intimidated by the microscope and think that it can only be used by a lab technician or a scientist. This is far from true; it just takes the courage to gather the sample, prepare the slide and start browsing the life that lives in the water in your aeration basins.

Just like everything else we do, the more we do it, the better we get at it, and the more we understand it. Keeping track of the numbers of microorganisms and identifying them are the crucial components to an ongoing surveillance in our treatment process. If there is a disruption in our treatment process, having the knowledge to observe our micro-life could help remedy a situation sooner before it becomes a disaster. Again, protecting public health is our main priority, so an established process control program is a must to ensure our treatment process is running to its maximum efficiency. **RW**

This article originally appeared in Pennsylvania Rural Water Association's *Keystone Tap* magazine, pp. 36–38, Summer 2025. Reprinted with permission.

BRIAN LITTLE

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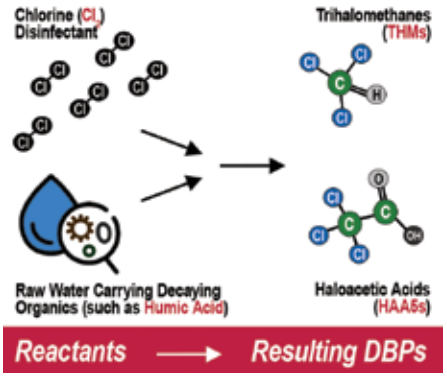
FEATURE

Practical Strategies for Managing Disinfection Byproducts in Municipal Water Systems

Smart adjustments help operators keep DBPs in check and maintain regulatory compliance

By Corey Harper

For water treatment operators, maintaining compliance with drinking water regulations requires balancing multiple priorities: public health protection, operational efficiency, and budget constraints. Among the ongoing challenges, disinfection byproducts (DBPs) are among the most persistent and closely monitored.



Visualization of reaction between chlorine and raw water carrying decaying organics resulting in the formation of disinfection byproducts. All images courtesy Hawkins.

DBPs form when disinfectants such as chlorine react with naturally occurring organic matter in the source water. Common DBPs include trihalomethanes (THMs) and haloacetic acids (HAA5s), both of which are regulated under the Safe Drinking Water Act. The U.S. Environmental Protection Agency sets maximum contaminant levels for these compounds (0.08 mg/L for THMs and 0.06 mg/L for HAA5s), and utilities must routinely monitor and report their concentrations. Exceeding these limits can lead to regulatory violations, public notifications, and, most importantly, potential health risks over long-term exposure.

Hawkins water treatment field training manager collaborating with customer to address water treatment concerns.

What makes DBP control challenging is that the factors contributing to their formation are highly variable. Source water quality changes with the seasons, rainfall events, and temperature shifts. Distribution systems with long water age can increase DBP formation even if treated water leaves the plant well within limits. Infrastructure constraints and budget realities can make major process overhauls difficult to implement quickly.

Because of these realities, utilities often look for targeted strategies that can be applied within existing treatment frameworks. Three proven approaches stand out: reducing DBP precursors before disinfection, optimizing chemical feed locations to limit reactions that generate DBPs, and fine-tuning coagulation to maximize organic removal. When paired with ongoing monitoring and operator engagement, these approaches can bring DBP levels under control without unnecessary disruption.

At Hawkins, we've seen how applying these principles in real-world settings delivers measurable results. Two recent projects—one in Stanford, Kentucky, and one in Russellville, Alabama—demonstrate how a collaborative, data-driven process can solve DBP challenges while fitting each plant's unique conditions.

Water tower in Stanford, Kentucky.

In Stanford, municipal leaders wanted to take a proactive stance on DBP reduction to safeguard both their customers and those of a nearby purchasing utility. Late summer and early fall tend to produce the highest DBP levels due to warmer water temperatures and increased organic activity in surface water sources. To address this, Hawkins worked closely with the plant's operators to test a blended liquid carbon product aimed at removing organics before chlorination.

Timeframe	THM
Pre-process change	0.051 mg/L
Post-process change	0.025 mg/L

Stanford THM levels before and after process adjustment.

The trial was carefully integrated into the plant's operations. Feed rates were adjusted between 30 and 50 mg/L, and operators monitored total organic carbon (TOC) and THM levels daily. The trial achieved up to 50 percent reduction in THMs. Using the learnings from the trial, Stanford decided to implement a permanent carbon slurry feed system to maintain THM compliance.

Settling basin at Russellville, Alabama, water treatment plant.

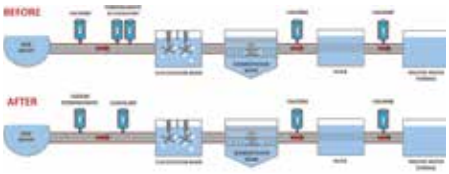
These results highlight one of the most effective strategies for DBP control: targeting the precursors. By reducing

organics before they come into contact with chlorine, operators can make significant progress toward compliance without altering the disinfectant itself. For Stanford, the project demonstrated that a relatively straightforward chemical program, applied at the right time and monitored closely, could keep DBP levels in check even during peak formation periods.

The project in Russellville, Alabama, presented a different challenge. Here, elevated DBP levels had the utility evaluating the installation of a chlorine dioxide generation system—a major capital investment. Before committing, the city sought another opinion, and Hawkins was asked to review the process.

During the site evaluation, Hawkins technical staff noted that pre-chlorination was being applied at the very beginning of treatment, and sodium permanganate was being fed immediately before the coagulant injection point. This configuration limited the contact time for permanganate to work effectively and allowed chlorine to react with organics early, contributing to DBP formation.

The recommended solution was straightforward: remove pre-chlorination from the early stages and relocate permanganate feed to an unused upstream injection point. This adjustment gave the permanganate more time to oxidize organics before coagulation began, reducing the potential for DBP precursors to form.



Russellville water treatment process before and after process adjustments.

Jar studies confirmed that coagulation performance remained strong under the new configuration, with no reduction in flocculation efficiency. To ensure the process changes would be sustainable, Hawkins provided hands-on operator training in jar testing, daily permanganate demand studies, and the use of a newly acquired UV254 analyzer to monitor organics in real time. A bulk storage tank for permanganate was also installed, reducing operator handling of the chemical and improving safety.

After the adjustments were implemented, Russellville's DBP levels dropped by approximately 50 percent and remained well below regulatory limits in the following months. The plant achieved its compliance goals without the need for new generation equipment, illustrating that process optimization can sometimes be more effective and economical than capital upgrades.

Timeframe	THM	HAA5
Q3 2024	0.052 mg/L	0.029 mg/L
Q4 2024	0.056 mg/L	0.040 mg/L
Process Change		
Q1 2025	0.023 mg/L	0.020 mg/L
Q2 2025	0.035 mg/L	0.023 mg/L

Russellville water treatment process before and after process adjustments.

These projects underscore a set of best practices that any utility can consider when facing DBP challenges. First, focus on the removal of organics ahead of disinfection. Every milligram of natural organic matter removed upstream reduces the opportunity for DBPs to form downstream. Second, examine chemical feed points with fresh eyes; even small changes in where and when chemicals are added can have a measurable effect on water quality. Third, validate proposed changes through jar studies and bench testing to minimize risk before full-scale implementation. Finally, invest in operator training and monitoring tools so that improvements can be maintained and adapted as conditions change.

In both Stanford and Russellville, the solutions were successful because they were tailored to the realities of each plant. Hawkins' role was to provide the technical insight, field experience, and product expertise needed to design and support those solutions, but the success was also a credit to the operators who implemented them with care and precision.

Hawkins team member collaborating with customer to implement water treatment process improvement.

DBP regulations are unlikely to become less stringent, and in some cases may tighten further in the years ahead. That makes proactive management essential. By understanding source water characteristics, removing precursors early, optimizing chemical applications, and maintaining strong monitoring programs, utilities can position themselves for long-term compliance.

The experiences in Stanford and Russellville show that with a targeted, collaborative approach, it is possible to make significant gains without overhauling an entire treatment system. Every plant has unique challenges, but the fundamentals remain consistent: know your water, control the inputs that drive DBP formation, and adapt processes as conditions evolve. Hawkins is proud to work alongside municipalities to put these principles into practice, delivering solutions that safeguard public health and ensure the reliability of our most vital resource. **RW**

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Microplastics On My Mind

How tiny plastic particles are reshaping health and the environment

By Heather Jennings

Ubiquitous. It's the word used most frequently to describe many emerging contaminants, including microplastics (MPs). For a little context, we humans have made 8.3 billion metric tons of plastic since the 1950s and are estimated to create 34 billion metric tons by 2050 (Cohen). That's a little disconcerting when we realize that a lot of that production occurred during many of our lifetimes. Additionally, 60% of all plastics ever made are still hanging around.

In 2015, 146 million metric tons of polymer were used to make packaging, of which 141 million were thrown out. What do we do with all that waste? It is estimated that out of all plastics made, only 10% of plastic waste is recycled, 14% is incinerated, and the rest is landfilled (Cai et al., 2023). When you find out that around a teaspoon of microplastics is in brain matter and start seeing the whole picture, it brings to mind the dystopia the Disney Pixar character WALL-E™ faced.

MPs themselves are defined as solid polymeric materials containing chemical additives. They also have three dimensions greater than 1 nm and less than 5 mm (Cook et al., 2021). For this discussion, MPs includes nanoplastics and microplastic fibers (MPFs), very small thread-like fibers that can come from both natural and synthetic fabrics (Cook et al., 2021).

MPs are divided by whether they come from either primary or secondary sources. Primary MPs are manufactured from raw materials. Secondary sources are produced from the breaking down of larger materials. Most of the MPs we interact with daily come from secondary sources. The formation of MPs by fragmentation and degradation of plastic sources depends on a variety of physiochemical factors, such as biotic degradation by bacteria and fungi and abiotic degradation such as photodegradation.

BIOTIC DEGRADATION

In general, plastics are long-chain macromolecules with a single functional group, high molecular weight, hydrophobicity, and crystallinity. These characteristics enhance their performance but greatly limit microbial degradation. MPs are typically not considered suitable substrates for microbes, unlike biodegradable plas-

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tics that can degrade more easily. Despite these challenges, biodegradation is considered a significant method of breaking down plastics.

Biological factors include a wide range of microorganisms such as bacteria (e.g., *Pseudomonas, Bacillus*), fungi (e.g., *Aspergillus, Penicillium*), and biofilms, where communities of microbes cooperate to colonize surfaces. These organisms use plastic-associated carbon as an energy source, producing enzymes that gradually break down polymer chains. Enzymes like protease, PETase or MHETase that can cut the long plastic chains into smaller pieces, such as oligomers and monomers, and sometimes even into simple end products like carbon dioxide and water. How well this process works depends on the type of microbes present, the characteristics of the plastic, and the conditions in the environment. It is also interesting to note that monomers can also enter microbial cells after and can be transformed into biomass for energy production. Although, biodegradation of plastic is also affected by plastic additives and plasticizers used to create plastics.

To improve biodegradation, plastics can be pretreated with different physical or chemical methods that change their structure, for example, by breaking large molecules into smaller ones, weakening chemical bonds, forming surface cracks, or adding new reactive groups. These changes make it easier for microbes to attack the plastic and speed up the biodegradation process.

ABIOTIC DEGRADATION

Abiotic degradation—or physical rather than biological degradation—can take place in a variety of different habitats, under a variety of conditions, and therefore, they can impact plastics and form MPs on a broader scale. These processes are typically non-selective and can impact a wider variety of MPs as well. They may, under certain conditions, also take longer than biotic processes to degrade MPs.

Photodegradation, another form of abiotic degradation, is the absorption of ultraviolet (UV) light from the sun that generates free radicals, initiating a process of oxidation and hydrolysis that weakens the plastic's molecular structure. Anyone who has seen plastic piping sitting out exposed to sunlight can see that, over time, that piping becomes more brittle and breaks down. Due to the greater redox potential of MPs, it is believed that the breaking of polymeric chains can be triggered by photodegradation.

Furthermore, when plastics break into MPs they also develop surface cracks, allowing light and oxygen to penetrate deeper into the material, thereby accelerating the oxidation and further breakdown of the MPs. This breakdown also increases the release of plasticizers and other additives. It is also important to note that different polymeric materials exhibit different degradation patterns, which depend on different exposure conditions. Additional mechanical forces like wave action, sand abrasion or repeated impacts increases the fractionation of MPs.

IMPACTS ON WATER AND WASTEWATER TREATMENT

In general, it is very difficult to identify MPs due to their size and complex chemistry. The tools we have include microscopy to identify morphology, color, and number, with a variety of spectroscopies that are used to identify smaller MPs. Thermal analysis allows you to understand the concentrations of the chemistries involved. Currently, there isn't a standard method for sampling plastics of this size and very few laboratories in the United States can perform all the analysis. Unfortunately, this leads to uncertainty when it comes to treatment and removal of these particles from different types of water.

What we do know is that MPs create opportunities for porous microecosystems, which include primary and secondary coronas plus biofilms, to develop. These layers can contain a cocktail of both pathogenic and antibiotic-resistant bacteria, heavy metals, etc. Think of it as layers of candy shell wrapped around a solid center, with the outer layer called the plastisphere.

These layers further complicate treatment by changing the characterization, toxicity, and degradation of the core plastic. Impressively, these layers can be built within a 24-hour period due to the hydrophobicity of MPs and existing nutrients! It is important to note that MPs with plastispheres already exist in both freshwater and wastewater. In wastewater, this can be a boost to aerobic treatment, but in water, it raises concerns about the efficacy of water treatment and disinfection. In drinking water, coagulation and sedimentation can remove up to 54% of MPs, obtaining up to 88% removal with advanced treatment. Wastewater lagoons remove about 35%, while conventional activated sludge plus additional filtration or advanced treatment can obtain 99% removal!

What are the impacts on disinfection? Can the ultraviolet light, chlorine, etc., penetrate the plastisphere for treatment? Well, that depends. There are some indications of efficacy, but trihalomethanes and nitrogenous disinfection by-products can be enhanced. Haloacetic acids aren't really impacted. There are also indications that disinfection in general is only partially effective at destroying the plastisphere built around plastics, which can allow pathogenic bacteria, antibiotic-resistant bacteria, or even heavy metals to leave treatment.

TOXICITY

It is important to know that these are not considered inert materials due to contaminants that are attracted to MPs as well as the chemicals and plasticizers used during manufacturing of these materials. Bucci (2022) noted: "Microplastics are a multidimensional contaminant, differing in size, shape, polymer type, and chemical cocktail. Each of these dimensions may influence the toxicity of the particle."

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Our own bodies are storing MPs, with liver and brain samples from 2024 having significantly higher concentrations of MPs than in 2016, indicating increased exposure to MPs in our environment (Nihart). On average, humans consume 39,000–52,000 MPs per year via food and beverages, values depending on age and gender. This can be increased by another 90,000 MPs annually with the ingestion of bottled water vs another 4,000 MPs in tap water. (Another reason to appreciate tap water!)

MPs are an issue themselves, but they may contain additives with a large amount of mixed chemical components that may bio-accumulate in the food chain (Cai et al., 2023). While large MPs initially show relatively little toxicity and can't be utilized by the human body, the monomers they break down into are highly toxic. For example, fillers, flame retardants, and plasticizers account for 28%, 13%, and 34%, respectively, of all manufactured additives (Cai et al., 2023). While it takes time for MPs to physically harm you, cause inflammation and eventually lead to illness and cancer, the monomers toxicity is more directly related to neurotoxicity, hepatoxicity, and cancer.

Microplastics represent one of the most persistent and complex contaminants of our time. Their widespread production, limited recyclability, and resistance to degradation have allowed them to accumulate in nearly every corner of the environment. Both biotic and abiotic processes contribute to their breakdown and are often accompanied by the release of harmful additives. Once in water systems, MPs not only persist but also host microbial communities and toxic substances that challenge conventional treatment processes and raise concerns for both environmental and human health. Reducing plastic production, improving waste management, and advancing treatment technologies will be critical in limiting their spread. At the same time, greater standardization in detection and monitoring methods is needed to better understand and mitigate their effects. **RW**

REFERENCES

Bucci, Kennedy, and Chelsea M. Rochman. "Microplastics: A Multidimensional Contaminant Requires a Multidimensional Framework for Assessing Risk." *Microplastics and Nanoplastics*, vol. 2, no. 1, 15 Feb. 2022.

Cai, Zeming, et al. "Biological Degradation of Plastics and Microplastics: A Recent Perspective on Associated Mechanisms and Influencing Factors." *Microorganisms*, vol. 11, no. 7, 26 June 2023, pp. 1661–1661.

Cohen, Julie. "How Do We Break Our Addiction to Plastic?" University of California, 18 Jan. 2018.

Cook, Cayla, Jeff Prevatt, Matthew Magruder, Tanja Rauch-Williams. "Microplastics in Wastewater Treatment Facilities – A review of Occurrence, Toxicology, Treatment, and Current Regulatory Developments", Water Environment Federation, WEFTEC 2021 Conference Proceedings.

Nihart, Alexander J., et al. "Bioaccumulation of Microplastics in Decedent Human Brains." *Nature Medicine*, vol. 31, no. 31, 3 Feb. 2025.

HEATHER JENNINGS

is the Director of Huma Environmental.

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FEATURE

Correlating Water Quality Parameters in Municipal Waste Stabilization Ponds Using Sensor Networks

Investigation reveals how data-driven monitoring improves pond efficiency

By M.P. Hayes, PhD

Waste stabilization ponds (WSPs) are a critical infrastructure component for rural communities to treat wastewater through a combination of natural and mechanical processes. Pond designs can be structured around space availability, with single and tandem ponds used for complete processing.

The three main pond orientations include anaerobic, maturation, and facultative ponds. These configurations can incorporate different pond types in tandem and could include tertiary treatment processes like constructed wetlands and soil infiltration to the final processing stages of WSPs to increase treatment capacity.

An important dynamic is building ponds to suit current and future community needs, while understanding the factors that contribute to operational costs and wastewater treatment. Additionally, the nature of slow water movement through WSPs can create odor issues, necessitate regular sludge removal, and make it difficult to control nutrients. Seasonal variability also impacts the treatment processes in certain areas of high temperature fluctuation and precipitation. To better optimize pond health, the implementation of sensor technology can be used to mitigate challenges and provide savings opportunities for operational resources.

In Louisiana, the warm, humid summers and mild winters support optimal microbial activity in WSPs, while annual rainfall can aid in dissolved oxygen generation. The Louisiana State University Water Quality Extension Lab conducted an investigation of seasonal WSP water quality dynamics in a tandem facultative pond from March 2024 to May 2025. This study aimed to correlate water quality parameters and showcase the use of technology for predictive data to optimize pond treatment.

The pond system used was a municipal WSP permitted for less than 4 million gallons per day. With 6 acres of total pond space, the treatment processes were estimated at a 30-day detention time across both ponds (see Figure 1). Each pond has ten surface aerators ranging from 7.5 to 40 horsepower to mechanically stimulate dissolved oxygen. The facility personnel oscillate two motors off per pond for maintenance and energy-saving purposes.

Figure 1. Pond system. All images courtesy M.P. Hayes.

The pond is designed to have three layers: a natural aerobic zone in the top layer, a mechanically stimulated aerobic zone in the middle layer, and the anaerobic bottom layer. The placement of the team's water quality sensors was 3 feet below the surface to focus on the middle aerobic zone more impacted by mechanical aeration.

To collect data, the team deployed two Yellow Springs Instruments (YSI) EXO2 multiparameter sondes to measure dissolved oxygen (DO) (mg/L), conductivity (µS/cm), temperature (°C), turbidity (FNU), pH, ammonium (mg/L), and nitrate (mg/L). Additionally, a central wiper blade (see Figure 2) was used to prevent fouling of optical probes for the duration of the project. There are many companies that provide water quality sensing services, and it's encouraged for partners to align sensors with impactful data.

Figure 2. Multiparameter sondes with central wiper blade.

For this facility, the personnel were interested in nitrogen species fluctuations and the input of DO. Two sondes were placed at the outfall of the primary settling pond (approximately 15 days into the treatment processes) and at the secondary treatment ponds' effluent basin (day 30 of the processes). The strategic placement

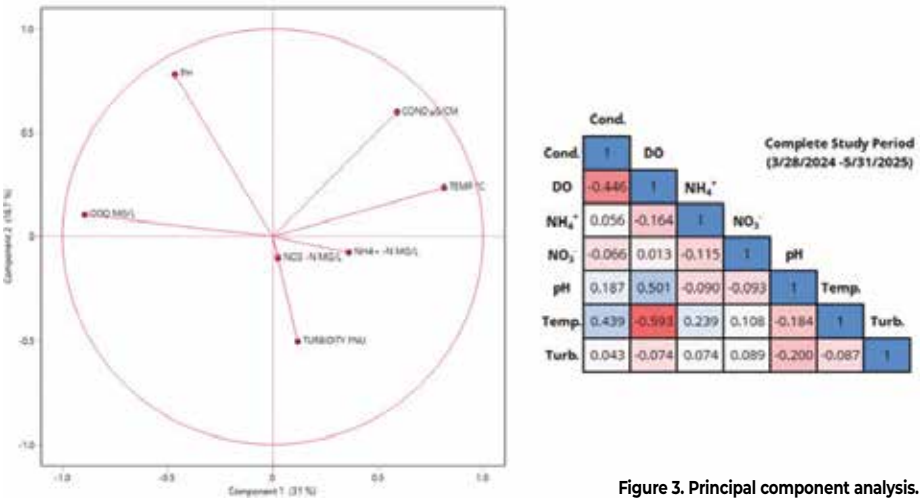

Figure 3. Principal component analysis.

allowed the facility team to see the difference in pond processing and efficiency of the secondary treatment pond based on input water quality.

Bimonthly field checks were performed by the university team to retrieve data from the sensor network, provide needed maintenance and calibrations, and ensure accurate data collection. These units have the capability to be installed for real-time facility access or directly to a supervisory control and data acquisition (SCADA) package. The university used this investigation to provide demonstrations for the simplicity of sonde deployment, maintenance, and data collection. The findings were actively shared with facility personnel and compared to major changes in the pond across the study period.

A multivariate analysis was performed on the datasets to identify correlated parameters and determine relationships in variables. Principal component analysis (PCA) shows a preliminary indicator for trend identification and statistical significance by reducing the datasets for visualization and pattern recognition. Arrows that are closer to the outer edge of the circle plot indicate higher correlations. For instance, Figure 3 (left) shows the PCA for the sonde in the primary settling pond. The DO and temperature arrows are in opposite directions and close to the outer edge, indicating there is a strong negative correlation between the two variables. The relationship of temperature and DO in WSPs is a well-known dynamic due to the solubility of oxygen at a given temperature.

This PCA promotes standard parameters of DO, temperature, pH, and conductivity as strong water quality metrics for trend analysis. The correlation matrix in Figure 3 (right) aligns individual variables after data have been standardized to reduce the influence of variables of different scales. Matrix values greater than 0.40 and less than -0.40 were traced through the dataset to better understand water quality parameter relationships. This provides a more specific understanding of parameter interaction and, in the case of the primary settling pond, indicates there is a strong positive correlation between conductivity/temperature (0.439) and DO/pH (0.501), while also showing a strong negative correlation between conductivity/DO (-0.446) and DO/temperature. (-0.593). The importance of DO for WSPs is evident by the need for aeration but optimizing the concentration of DO for the input nutrients can increase treatment efficiency while saving operational resources.

The deployed sensor network in this study was used to find relationships and compare trends in nutrient cycling. For instance, the month of January had the lowest annual water temperature (partly due to the 2025 Winter Storm in Louisiana) while maintaining the highest DO for the primary settling pond. The concentration of nitrogen species can dictate the needed DO input to maintain efficient processing.

January had low concentrations of ammonium and nitrate, suggesting that less aeration could optimize the treatment processes and conserve resources. The ability to adjust WSP treatment based on inflow parameters is a feasible concept with a tandem pond configuration and strategically placed sensor array.

Additionally, measuring the impact of microbial turnover can estimate the need for additional aeration or recirculation at different times of the year. The facility personnel indicated that early spring and late fall adjustments are needed to increase the processing efficiency. This is in part due to seasonal microbial turnover, which can be mitigated by seeding prior to changes in thermal temperature gradients. The sondes recorded a 3.4°C temperature fluctuation between April/May and September/October at the middle strata of the facultative pond. This fluctuation in temperature not only affects the microbial community, inducing decreased activity, but also increases the nitrogen species present (mostly in the form of nitrate). Annual sensor data can help better prepare facility personnel for indicators of pond health changes to properly seed microbial and maintain active processing for WSP stability.

This investigation has yielded a comprehensive dataset, which is being customized for the partnering facility to better understand their pond configuration. The university team is building a water quality indexing tool to show the change in parameters of the tandem system to better estimate primary and secondary treatment efficiency. In addition, the demonstration has allowed the facility to actively learn the maintenance and calibration of sensors to better prepare for future integration projects.

Facilities that are interested in utilizing a sensor network should consider the ideal location in their pond configuration to determine the number of sensors needed and the water quality parameters most interested in monitoring. The strategic implementation of water quality sensor networks can greatly impact the proactive management of WSPs' water quality and increase treatment efficiency to protect downstream ecosystems.

For more information on this water quality research, please contact Dr. Michael Hayes (mhayes@agcenter.lsu.edu) or check out the Water Quality Extension Lab website. **RW**

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Meter testing in Pleasant Grove.

A Day in the Life of a Circuit Rider: Tim Carey

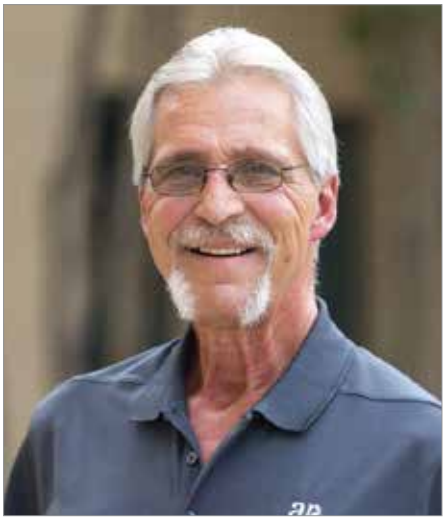
By Angela Godwin

When Tim Carey picks up the phone or climbs into his truck each morning, he doesn't know what the day will bring. It could be a valve rebuild, a citywide leak hunt, or a storm-damaged system needing emergency response. For Tim, a Circuit Rider with the Arkansas Rural Water Association (ARWA), unpredictability isn't the exception—it's the job.

"There's all kinds of challenges we deal with," Tim said. "We do a lot of hands-on work, and we do anything from rate studies to leak detections to water audits." On any given day, he might be elbow-deep in fire hydrants, troubleshooting high-service pumps, or teaching operators how to handle complicated equipment. "It's an enjoyable thing when you can see somebody's eyes light up and they'll say, 'Man, I didn't know it was that easy.' Well, it's not really easy," Tim laughed, "but you can make it easy."

FROM OHIO TO ARKANSAS: AN UNLIKELY PATH

Tim didn't originally set out to become a Circuit Rider. Growing up in Ohio, he saw friends and family cycle through factory layoffs and decided he wanted something different. "When I was in high school, I noticed a lot of people would get laid off at different times of the year," he recalled. "And so, I decided I wanted to go into a field where that wouldn't happen."
Tim hedged his bets. "I graduated police training, I graduated fire training, and got my first water license, all in the same year in the state of South Carolina," he said.
His water career began in the 1980s at a surface water treatment plant in Cayce, South Carolina, before stints in West Columbia, then Portia, Arkansas, and finally Corning. Along the way, he served part-time as a police officer and eventually retired as fire chief of Portia.



Tim Carey is a Circuit Rider for ARWA. All images courtesy Tim Carey/ARWA.

But it was over lunch one day in the early 1990s that Dennis Sternberg, then Executive Director (now retired) of ARWA,

offered him a job as a Circuit Rider—an opportunity that came with a significant boost in pay compared to his city position. With two kids to support, Tim didn't think twice. He's been with ARWA ever since.

More than 30 years later, he's still answering calls, often before dawn and long after dark. "Sometimes our job doesn't end till the next morning at 5 a.m.," Tim said. "We're not going to stop until it's fixed."

DEDICATION ABOVE ALL

When asked what it takes to be a successful Circuit Rider, Tim doesn't hesitate: "Dedication. You have to be able to pick up at a moment's notice and take off because emergencies don't happen at our convenience."

That dedication has led him into some of Arkansas's worst disasters. He estimated that he's responded to about 80 percent of the tornadoes that have struck the state during his tenure.

In Marmaduke, after a devastating storm, he walked into city hall to find the mayor in tears. "She said, 'I don't know what to do, Tim.' And I said, 'Okay, I do know what to do. And, if you'll allow me, we'll get this thing rolling.'" Tim helped organize crews, secure generators, and set up a command structure. Within 24 hours, the town's water and wastewater systems were fully operational again. "That's my mission," he said. "We're not coming in there to wear a white hat. My devotion to the job is being able to say we got the system running the way it's supposed to run, and now we don't have to worry about it."

A DAY IN THE LIFE

No two days look the same, but Tim's weeks usually begin with a plan. "On a Sunday or Monday, I'll put in my proposed schedule," he explained. "Most of the time by Monday morning, it's changed drastically—not because I wanted it to, but because I got four or five calls in at the same time."

One day it might be a simple valve rebuild. Another, it's a crisis with no easy solution—like when both high-service pumps in Pyatt, Arkansas, burned out, leaving residents without water. Replacement pumps would have cost the town nearly $30,000 and taken weeks to arrive. Tim started making calls.

"I found a direct replacement for those pumps," he said. The mayor's husband drove overnight to Texas to pick them up. "We got two pumps, two motors, installed them, and had the system back up and running within 48 hours—for the price of one of the brand-name pumps they had been using."

Leak detection in Blanchard Springs.

Rebuilding a damaged hydrant in Parkin.

That kind of resourcefulness is typical. In Bull Shoals, a small town that had been losing 150,000 gallons of water a day for years, Tim finally tracked down the elusive leak using a correlator. "I put an X on the pavement and told the guys to dig here," he said with a chuckle. "They argued with me, but sure enough, that's where it was. We fixed it, and their usage dropped overnight." The fix created another problem, though—too little turnover in their storage tank. "If it's not one thing, it's another," he smiled.

BONDS BEYOND THE JOB

For Tim, being a Circuit Rider is about more than technical know-how. It's about relationships. "These operators, I've known them for years," he said. "You have meaningful, personal discussions even while you're doing your work. This really is your work family. After all these years, if I don't get to see those people, I start missing them."

That sense of community drives him to keep going, even when the work is grueling. "A lot of people don't enjoy having to get down in a pit and come out with your face all black and your hands all black because of manganese. That stuff doesn't bother me. I'm 63 years old and I've worked all my life. If I got to get dirty, so be it. I enjoy it."

As for what makes him proudest of his work, Tim said it's the little things as much as the big ones: the look on an operator's face when the solution to a problem finally clicks, the relief of a mayor whose town has water again, the gratitude of residents who can shower after days without running water. "When you know that a community is back to normal because of something you helped do—that's the reward right there," he said.

LOOKING AHEAD

Despite decades on the job, Tim still talks with enthusiasm about the science of water treatment, the challenge of leak detection, and the satisfaction of solving problems for small communities. He also keeps an eye on the future, aware of the risks Arkansas faces—from tornadoes to the looming threat of earthquakes along the New Madrid Fault.

Leak detection in Snowball.

But whatever comes, he and his fellow Circuit Riders will be ready. "Nobody can live without water," Tim said simply. "When it's hotter than fire outside and they've been without water for two or three days, and you can get water back for them within hours—that's a good feeling."

For Tim, that feeling is worth every long day, every muddy pit, and every night spent on the road. "When you ask people if they like their job, a lot of them say, 'No, I hate my job.' Well, that's not the case here. I love my job. I always have, and up until the time that I can't do it anymore, I always will." **RW**

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EPA Continues to Take Action on PFAS

By John DeGour, DrPH

On September 12, 2025, the U.S. Environmental Protection Agency (EPA) asked to vacate four PFAS drinking water standards established during the Biden administration, citing procedural violations. The Trump EPA argues that the Biden EPA failed to follow the Safe Drinking Water Act procedural requirements by not allowing adequate public comment on the regulatory determinations for certain PFAS contaminants. The agency claims that the simultaneous proposal and finalization of regulations for GenX, PFNA, and PFHxS violated the required sequential process. While the EPA does acknowledge that the Biden EPA initially defended its process, it now agrees with petitioners that parts of the rulemaking were unlawful.

EPA contends that vacating the standards would allow for a fresh regulatory process, including new public comment periods, and would not disrupt current compliance deadlines. It also believes that maintaining the existing rule could hinder its ability to consider public input effectively in future rulemaking.

EPA TO KEEP CERCLA PFAS RULE AS-IS

Via a September 16, 2025, filing to the U.S. Court of Appeals for the D.C. Circuit, EPA has decided to maintain the designation of PFOA and PFOS as "hazardous substances" under CERCLA. EPA requested the court lift the stay in the case *Chamber of Commerce v. EPA* and asked for a new briefing schedule by Sept. 30, 2025. The agency faced a Sept. 17 deadline to declare its position in the ongoing industry challenge.

On September 17, 2025, EPA Administrator Lee Zeldin announced the next steps regarding regulatory efforts to address the cleanup of PFOA and PFOS. Zeldin stated: "When it comes to PFOA and PFOS contamination, holding polluters accountable while providing certainty for passive receivers that did not manufacture or generate those chemicals continues to be an ongoing challenge. I have heard loud and clear from the American people, from Congress, and from local municipalities about this particular issue. EPA intends to do what we can based on our existing authority, but we will need new statutory language from Congress to fully address our concerns with passive receiver liability. The Trump Administration is fully committed to ensuring all Americans have the cleanest air, land, and water."

COMMENT PERIOD CLOSED FOR DRAFT SEWAGE SLUDGE RISK ASSESSMENT

The EPA's comment period on its draft sewage sludge risk assessment for PFOA and PFOS, also known as PFAS, that found potential health risks from land application or disposal of treated sewage sludge (biosolids) closed on August 14, 2025. The draft assessment, which was released on January 14, 2025, indicates that in some scenarios, the EPA's acceptable risk thresholds may be exceeded when sewage sludge containing PFOA and PFOS is land applied for beneficial reuse or surface disposed.

The draft risk assessment focuses on people living on or near impacted farms or those who rely primarily on their products. The findings presented in the draft risk assessment are preliminary. The EPA expects to publish a final risk assessment after reviewing public comments and revising the draft risk assessment accordingly. Once finalized, the risk assessment will provide information on risk from the use or disposal of sewage sludge and will inform the EPA's potential future regulatory actions under the Clean Water Act (CWA).

The EPA is committed to partnering with states, Tribes, territories, and wastewater treatment plants (WWTPs) to reduce risks from PFOA and PFOS that may occur through the management of sewage sludge, including the land application of sewage sludge. NRWA's regulatory committee submitted comments on the draft on August 4, 2025. **RW**

JOHN DEGOUR, DRPH
is the NRWA Regulatory Affairs Specialist.

If you have a comment or position that you would like to be considered by the NRWA Regulatory Committee, please let us hear from you. Email john.degour@nrwa.org.

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Mayor Glenn Jacobs kicks off opening session at WaterPro 2025. Photo courtesy NRWA.

A Journey of Growth

Celebrating Rural Water's progress and future promise

By Matt Holmes

In the midst of this fast-paced year, with multiple competing demands and priorities, it snuck up on me that I've officially served in the role of CEO for the National Rural Water Association (NRWA) for five years. Each year, I think to myself that this is the year that things get "back to normal." I think I am finally coming to grips with the fact that this thought process just isn't accurate.

Stepping into this role in 2020 in the middle of the pandemic was very demanding, and each year since has brought new and unique challenges and opportunities. For those who might not know, I have been working in the water sector for more than 25 years. Specifically in Rural Water, starting out with the New Mexico Rural Water Association.

At that time, Rural Water could be described as a behind-the-scenes group of organizations who got the work done, advocated for our members, and focused on a few key programs.

I look at Rural Water today and am just astounded by the sheer growth we have seen in just a few short years. From the programs we operate to the impact we have in rural America, and our strength in grassroots advocacy. Rural Water is at the forefront now more than it has ever been, and I don't see this slowing down anytime soon.

A reflection of this growth can be seen in how successful our annual WaterPro Conference has become—from our first convention in 1981 held in New Mexico to this year's event held in New Orleans with over 2,100 attendees and 120 exhibitors. WaterPro truly is THE event of the year, offering over 80 concurrent educational sessions to meet the demands of our ever-changing industry, and featuring top-notch speakers who are key decision makers at our partner federal agencies, such as USDA and EPA.

A big thank you to Mayor Glenn Jacobs, who kicked off our conference this year at the opening session. He shared the message of just how critical our industry is and acknowledged that while our workforce challenges may be tough to wrestle with, staying committed and investing in our future will benefit rural American communities for years to come.

Just as WaterPro is your event, our overall growth and success is yours as well. It is you, the practitioners in rural America, who garner respect from our federal agency partners and champions on Capitol Hill. So, thank you for continuing to uphold our Rural Water values and for your commitment to our work.

Many challenges lie ahead of us, some of which we know—from PFAS regulations to emerging contaminant treatment and an aging workforce. Some have yet to reveal themselves, but I know Rural Water will prevail. We always have, and we always will.

I am honored to represent such a stand-up group of people and industry. Thank you to all those who continue to support, give feedback, and provide guidance on this journey. Let's see what the next five years bring for Rural Water! **RW**

MATT HOLMES

is the Chief Executive Officer of the National Rural Water Association (NRWA).

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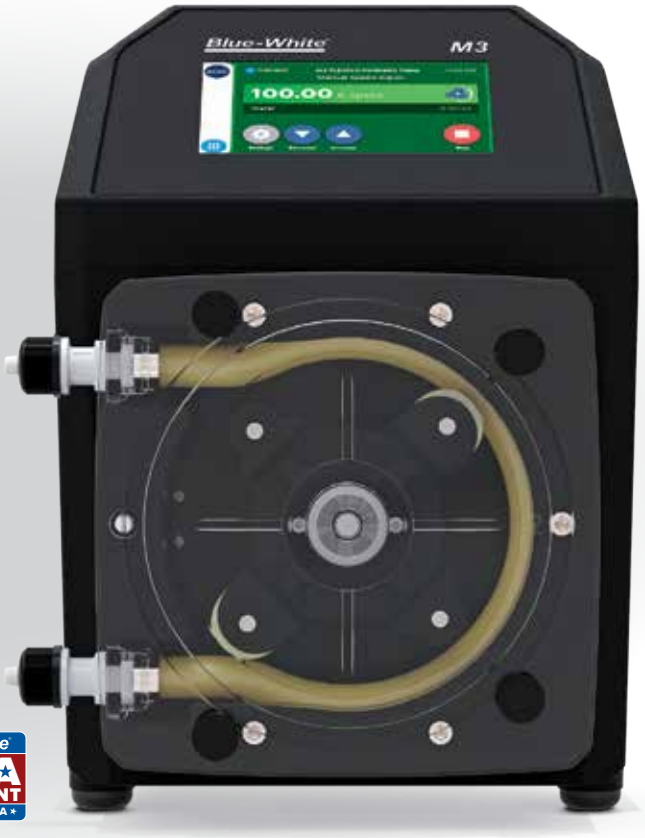

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