

currents



ONE WATER LA 2040

plus

Renewed
Interest
in PFOS/PFOA

UVWTP, UT:
20 MGD
for Free

MBRs in
Potable
Water Reuse?

Approach for
Austin's WTP 4
– Delivery is Key



LOOKING downstream...

By **Jess Brown, PhD, PE**, R&D Practice Director

Welcome to the inaugural issue of *Currents*! As you page through this issue, you'll notice some changes in style, format, and tone from *Research Solutions*. We did this in response to lots of feedback from our readers about what they like (and maybe weren't too crazy about) with RS. The bottom line is, the goal of *Currents* is to keep you informed about new technologies and tools, emerging trends, and ways we're helping our clients solve new challenges.

In this issue you'll read about One Water LA—the landmark water planning project Carollo is heading up, what the EPA is doing to raise awareness of perfluoroalkyl substances (a good cocktail party topic), how a Utah client got 20 mgd of treatment capacity for free, why membrane bioreactors might be the next tool for potable water reuse, and how alternative delivery helped make Austin's Water Treatment Plant 4 a success.

We hope you enjoy *Currents*, though you can be confident we'll be tweaking and adjusting the magazine over the next few issues to make sure we get everything just right. If you have a comment or suggestion, please feel free to send it to me at jbrown@carollo.com. Thanks for reading!

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New EPA Health Advisory Levels Spark Renewed Interest in PFOS and PFOA: The Who, What, When, and How

By Eva Steinle-Darling, PhD, PE

"Who" are PFOS and PFOA?

Perfluorooctanyl sulfonate (PFOS) and perfluorooctanoic acid (PFOA) belong to a group of chemicals referred to as perfluoroalkyl substances (PFAS). These compounds repel both water and oil and are resistant to chemical and physical degradation, which made them ideal for industrial, commercial, and consumer products, including non-stick coatings, fire-fighting foams, insecticides, metal plating, and semiconductors.

Between 2000 and 2002, 3M, the main manufacturer of PFOS, voluntarily phased out this compound. Between 2006 and 2015, eight major PFOA manufacturers also phased them out. Yet, even today, there are still certain exceptions, such as fire resistant aviation hydraulic fluids, semiconductor manufacturing, and metal finishing.

When do these new Health Advisories take effect?

The EPA announced the new Health Advisory (HA) levels for PFOAs and PFOSs on May 19, 2016. Unlike Maximum Contaminant Limits (MCLs), they are non-enforceable, but considered immediately applicable. Indeed, many forward-thinking utilities consider an HA to have the full force of law behind it. The new HA level is given as 70 ng/L for each individually, and for the sum of both constituents, which represents nearly a factor of 10 reduction compared to the sum of the provisional HAs promulgated in 2009.

How do you treat for PFOS and PFOA?

Conventional water treatment processes are generally ineffective in removing PFAS from drinking water. However, PFOS and PFOA can be removed with reverse osmosis (RO) or GAC. Ion exchange is a viable alternative to GAC and experience removing PFAS from industrial wastewaters indicates that some resins are significantly more selective than GAC for the removal of PFOS and PFOA. However, these wastewater streams contain PFAS at concentrations that are significantly higher than the new HAs. Ongoing work by Carollo and others will demonstrate whether ion exchange is cost-effective in comparison to GAC at these much lower concentrations.

For each of these treatment processes, the challenge remains that the PFAS are not destroyed; they are simply removed into a waste stream (RO concentrate, spent GAC or resin, or regeneration waste). Current research by Carollo and others is actively looking at treatment alternatives that defluorinate PFOS and PFOA, which would allow them to be degraded into environmentally benign constituents.

What is the issue with PFOS and PFOA?

The US EPA notes that PFAS have been linked to adverse health effects in laboratory animals, and may represent a health risk to humans as well. The US EPA also describes PFOS and PFOA as persistent, meaning they are bioaccumulative and resist degradation in the environment. Consequently, human exposure to PFAS is widespread. According to a 2007 study, most people tested in the United States have PFOA in their blood, but the source of exposure is not clear. They have been found in wastewater treatment plant effluent, sediments, and biosolids, as well as raw water sources used for drinking water, especially groundwater.

Before their respective phase-outs, some aqueous film-forming foams (AFFFs) contained PFOS and PFOA and resulted in groundwater contamination when these constituents were used at military and civilian fire training facilities.

Source: McDonald, Dale M., 1949-2007. NAS Key West firefighters applying AFFF foam around an old Skywarrior military plane during a training class. 1992. Color photonegative, 35 mm. State Archives of Florida, Florida Memory. <<https://www.floridamemory.com/items/show/102212>>, accessed 14 June 2016.



CAROLLO LEADING HISTORIC WATER PLANNING EFFORT: ONE WATER LA 2040

By Pavitra Rammohan, PE (prammohan@carollo.com), Tom West, PE, Paul Flick

Los Angeles, CA, sprawls across 500 square miles of coastal basin, surrounded by mountains on three sides and hemmed in by the Pacific Ocean on the fourth. With a population of more than 4 million, Los Angeles is California's most populous city and home to some of the world's largest companies and industries. The growth and vitality of any city depends on a reliable water supply, but the persistent drought conditions across Southern California have strained the City's ability to effectively manage its various supplies and sources.

On October 14, 2014, Los Angeles Mayor Eric Garcetti issued Executive Directive Number 5 in response to the lack of rainfall and persistent drought. From this directive was born the City's "One Water LA 2040 Plan," which is an integrated approach for combining water supply augmentation, wastewater treatment, and stormwater runoff capture and management into a \$10-20 billion capital improvement program. Once complete, this collaborative plan will both chart the course for managing the City's future water needs for the next 25 years and answer Mayor Garcetti's call to make the City's water supply more resistant to the effects of drought and climate change.

Carollo is partnering with the City in developing and implementing the One Water LA Plan—an effort that is forging new collaborative relationships across the City and driving the development of new tools and technologies to meet the City's project goals.

Integrating Not Just Water Sources, But a Community

stakeholder input. Using this layered approach, the City has been able to more quickly and more effectively get the input needed. In fact, with Carollo's support, the One Water LA program has held stakeholder outreach meetings and town hall events for more than 80 neighborhood councils, 15 council districts, and more than a dozen local, state, and federal agencies.

But external communication is only one part of the overall integration process. To accomplish this unprecedented level of ongoing coordination among City departments and with regional agencies, the City established clear leadership with the Bureau of Sanitation and the Department of Water and Power. Both agencies selected and dedicated key staff members from their departments to manage both the internal effort and hire specialized consulting support—including the Carollo Team.

Water Planning, Meet Blue Plan-it™

On the technology side, the actual One Water LA Plan began with a comprehensive, integrated water model that linked multiple water types and sources to create a water balance tool. This involved an innovative adaptation of Carollo's Blue Plan-it™ model, which was configured to account for all the City's key water supply sources, including a dozen sewersheds, four wastewater treatment plants, and hundreds of miles of storm drains and channels.

Once the Blue Plan-it™ modeling framework was in

including resiliency to climate change, distributed versus centralized infrastructure, and cost. In addition, the City was able to explore a number of sensitivity scenarios to determine the overall robustness of potential solutions to various kinds of uncertainty. The results of these efforts will become detailed facility plans for the production and maximization of recycled water to augment local water supplies, the capture and infiltration of more than 100,000 acre-feet per year of runoff to augment groundwater supplies, and the capture and targeted reuse of 85 percent of the stormwater traditionally lost to the ocean. Each of these plans will include triggers that establish clear guidelines for when the City proceeds with subsequent phases of facility construction.

The Future of Integrated Water Management is Here

One Water LA is demonstrating the ability for a major metropolitan city to come together, cooperate both internally and externally, and make the significant capital planning decisions needed to secure a reliable and sustainable water supply for both new residents and future generations. For Los Angeles, the overall result will be greater public and business confidence which, in turn, will help with raising the funding necessary to implement the One Water LA program. While the lessons learned in Los Angeles will translate to similar cities across the country, until that happens, the One Water LA Program will set the standard for integrated

With Blue Plan-it™, our clients can manage complex, interconnected water and wastewater infrastructure, storage, treatment, conveyance, and distribution systems.



UVWTP Retrofit Provides 20-MGD EXPANSION for Free

By Alan Domonoske, PE (adomonoske@carollo.com)

Since water is all we do, Carollo attracts talented and dedicated water engineers with direct experience in water treatment who understand and appreciate our clients' issues. This allows us to collaborate closely with our clients to deliver innovative, robust solutions that work. One recent example is the Utah Valley Water Treatment Plant Process Improvements Project (UVWTP PIP), completed in 2016 for the Central Utah Water Conservancy District (CUWCD). The project was so successful that the plant can now operate at 25 percent higher capacity than the original project objectives—effectively providing an extra 20 mgd of treatment capacity at no additional cost.

PIP Goals

The UUVWTP has reliably produced exceptional water quality over the years and has become the second plant in the country to complete all four phases of EPA's Partnership for Safe Drinking Water program. CUWCD has maintained UUVWTP's Phase IV status for more than 15 years. However, the actual plant capacity prior to the UUVWTP PIP was substantially lower than permitted due to seasonal source water quality challenges, operational challenges and limitations associated with the existing

plant processes, and more stringent water quality requirements.

The objectives of the UUVWTP PIP were to extend filter runtimes during algae-clogging events, reduce disinfection byproduct formation to comply with the more stringent regulations, increase solids handling capacity, treat a new raw water source, and accommodate a future expansion to 120 mgd on this space-constrained 10-acre site. The major upgrades included new pre-ozone, conversion to conventional treatment with high rate sedimentation, new mechanical dewatering using gravity thickeners and belt presses, and new chemical feed systems.

Planning Ahead

Carollo identified and implemented several innovations that were critical to project success on the space-constrained site:

- ▶ Pre-ozone was configured to fit within the existing plant hydraulic profile and with space-saving features.
- ▶ Innovative temporary facilities and construction sequencing allowed the plant to remain in service while the floc effluent channels were cut off to extend the floc basins for sedimentation.
- ▶ Future expansion was accommodated by configuring the sedimentation

basins with extra floc time and space for future plate settlers, eliminating the need for an additional set of basins.

- ▶ Filter inlet valve and weir modifications accommodated higher filtration rates.

More Bang for Their Buck!

The major improvements worked so well during the first year of operations that CUWCD has permitted and can reliably operate the facility at 100 mgd—20 mgd more than the original goals and 40 mgd higher than its previous capacity. Settled water turbidity exceeds operational expectations and Phase IV partnership goals, and filter run times and unit filter run volumes have increased by approximately 400 percent. The new ozone disinfection process, which addresses periodic taste-and-odor events, has reduced chemical costs by \$45,000 per month. Finally, our close collaboration with CUWCD during the design of the new chemical building footprint resulted in an additional 4,000 square feet of office, conference, and storage space on this tight site. Each decision made during the course of the project represented not only Carollo's commitment to our client's success, but validated the importance of having dedicated water experts on hand to analyze, innovate, and implement solutions to meet the project goals.

POTABLE WATER REUSE: Can MBRs Make the Cut?

By Nicola Fontaine, PE (nfontaine@carollo.com) and Andrew Salvesson, PE. Carollo Team Support from Brianna Juhrend, Austa Parker, PhD, PE, and Julian Inoue

BACKGROUND

A water district in Northern California is looking at a variety of potential potable water reuse projects. One such project involves taking filtrate from a future membrane bioreactor (MBR) at a wastewater pollution control plant to produce 10 mgd of purified water. MBRs produce high-quality filtered effluent and are used across the world to produce non-potable reclaimed water. Yet, within the United States, there is only one operating MBR facility that is part of a potable water reuse treatment train: the Hamby facility in Texas.

SATISFYING THE REGULATORS

For potable water reuse applications, the State of California has set a pathogen log reduction target of 12-log virus, 10-log *Giardia*, and 10-log *Cryptosporidium*, from the point of raw wastewater to the point of water consumption. Treatment may include primary and secondary treatment, tertiary filtration (such as microfiltration [MF] or ultrafiltration [UF]), reverse osmosis (RO), and ultraviolet light advanced oxidation (UV AOP). Further treatment can occur through a groundwater basin, either through a combination of percolation (spreading) or injection and subsurface transport. Within that treatment train, the MF or UF process is relied upon for 4-log removal of protozoa (*Giardia* and *Cryptosporidium*). Carollo is looking at achieving the 4-log credit with MBR, rather than the more conventional secondary treatment and MF/UF filtration process.

MBRs are subject to harsher conditions than tertiary membrane filters, resulting in increased damage and potentially more difficulty passing daily direct integrity testing monitoring.



Further, the caking of solids on the MBR, even after a backwash, are presumed to mask membrane failures that will only show up after MBR chemical cleans, which are not done on a daily basis. In essence, the industry concern about MBRs is that they may have membrane failures that go unnoticed, which would reduce their effectiveness as a pathogen barrier. Carollo's job is to answer the big question: How much pathogen removal occurs in full-scale MBRs under normal operational modes?

RESULTS TO DATE

The results analyzed to date are very positive, demonstrating robust removal of protozoa and virus at four different full-scale MBR sites (Hamby, Ironhouse Sanitation District, Modesto, Healdsburg). Indeed, no pathogen has been detected in the MBR filtrate for any test at any location, and pathogen removal immediately after cleaning and "relax" events is no worse than pathogen removal with fouled membranes. Beyond that, protozoa and virus removal

has also been very effective, giving us confidence that MBRs can become another viable tool in potable water treatment systems.

The sampling will continue into late 2016, but agencies across California are already looking into building their own MBR potable water reuse demonstration facilities. Carollo and our teaming partners will continue to meet with the California Division of Drinking Water to gain their input, enhance testing, and work towards gaining full pathogen removal credit for MBRs.

ACKNOWLEDGMENTS

- ▶ Analytical Support from Southern Nevada Water Authority, NV, and BioVir
- ▶ MBR Equipment Suppliers Providing Support: GE and Evoqua
- ▶ MBR Facility Support from Hamby, TX; Ironhouse Sanitary District, CA; Modesto, CA; and Healdsburg, CA



CITY OF AUSTIN REAPS BENEFITS OF WTP 4'S ALTERNATIVE DELIVERY APPROACH

By Paul Walker, PE
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Source: (LEFT) Golden-cheeked Warbler photo courtesy of Greg Lasley/U.S. Fish and Wildlife Service; (MIDDLE) Black-capped Vireo photo courtesy of R. M. Buquoi Photographics, www.rmbphotographics.com; (TOP RIGHT) Golden-cheeked Warbler photo courtesy of Isaac Sanchez, <https://www.flickr.com/photos/isaacsanchez/16989574336/in/photolist-eabPxd-e5frFZ-rTj1xs-wHAd4r-ea69p2-e5frKZ-eabPj3-ea69jF-qYNPpT/>

City of Austin, Texas

Travel just a bit northwest of Austin, TX, and you will soon find yourself traveling through forested hill country that is part of the Balcones Canyonlands Preserve. The forests are home to endangered songbird species like the Golden-cheeked Warbler and Black-capped Vireo.

Today, the Preserve has a new neighbor: the City of Austin's Water Treatment Plant No. 4 (WTP 4). WTP 4 is an exceptional achievement of sound engineering and environmental stewardship that supplies 50 mgd of treated water to Austin's customers and fulfills a nearly 50-year goal to establish a new source of high-quality water for the City.

The water's journey to WTP 4 begins at Lake Travis, a World War II-era reservoir covering nearly 19,000 acres across Travis and Burnet counties. A large tap penetrates the bottom of the lake, connecting the multi-level intake to a 9-foot diameter tunnel that travels more than 3/4 of a mile to the raw water pump station. The multi-level intake allows operators to adjust the withdrawal depth to provide the best quality water for treatment, which ultimately saves chemical costs for the City.

The 1,500-hp pumps in the raw water pump station send the water to the treatment plant, where coagulation, lime softening, filtration, and disinfection treatment processes work together to provide a reliable and high-quality treated supply to Austin's customers.

Because of the sensitive environmental surroundings, Carollo designed the facilities to blend in with the aesthetics of nearby communities, but also to minimize disturbance within the forested area while providing sufficient space to expand the facility to 300 mgd in the future. Sustainability is also a key feature, as both the administration and maintenance buildings were designed to LEED® Silver standards while incorporating local-sourced materials to create structures that blend with the Texas hill country style. Finally, WTP 4's elevation gives operators the ability to supply treated water from the facility into the distribution system by gravity flow instead of pumping, reducing Austin's greenhouse gas emissions throughout the water and wastewater system by 13 percent.

Originally conceived as a conventional design-bid-build project, the City recognized that the size and complexity of the treatment plant and intake facilities required a different delivery approach. At the 60-percent design stage, the City converted the project to a Construction Manager at Risk (CMAR) delivery method. Integrating the CMAR team into the project while still adhering to the project schedule and \$375-million construction cost was a challenging endeavor that was met through collaboration and keeping focus on the overall goals and priorities of the project. Today, the plant operates in harmony with nature, protecting the surrounding environment while sustaining the water supply needs of Austin's more than 1 million customers across its 540 square mile service area.

