Virtual Session #	Session Title	Speaker	Speaker Bio	Session Description	Learning Objectives	Poll Questions - Several state operator licencing agencies insist of freqeuent engagement checks
Emergency Preparedness (OS1_09)	DC Water's Journey in Improving Operational and Financial Resilience Through Implementation of Water Infrastructure Digital Twin	Paul West is a senior success manager with Digital Water Works, a Bentley Systems company		Digital twinning is the creation of a digital representations of physical assets. While water utilities have utilized digital systems for many years (i.e. GIS, WORM, LIMS, hydraulic models, SCADA, etc.), the current trend of "digital twinning" integrates these systems, organizes the data (often in the cloud), turns it into actionable intelligence, makes it available across the utility enterprise, enhances staff workflows, mitigates network emergencies, and improves the customer's overall level of service. This presentation provides insight into how DC Water started its "Digital Twin Journey" in late 2020 and was operationally live in middle 2021. Practical	1. Attendees will learn the operational benefits of a water infrastructure digital twin 2. Attendees will learn how to optimize distribution system pressure management and better mitigate pipe breaks as well as how to improve water loss control with an automated monthly water audit by pressure zone or district metered area.	1. What is the purpose and benefit of a district metered area (DMA), pressure managed area (PMA), or virtual DMA as it relates to nonrevenue water and emergency conditions? A. Detect minimum nightly flow trends B.To bill customers accurately C. To detect flow anomalies such as a pipe leak or break **D.Both A and C** 2. What operational conditions in water distribution systems can lead to
Training and Resources (OS2_4)	Reaching Small Systems: EPA Tools and Resources for Implementing Water System Partnerships	Ashley Arayas is a senior associate with the Cadmus Group	They assist small and mid-size sy	The U.S. Environmental Protection Agency (EPA) will provide an overview of water system partnerships and showcase the latest free EPA tools and resources that support the implementation of water system partnerships. Water system partnerships can be designed to address unique challenges facing small water and wastewater systems, bringing systems together to address a variety of concerns and challenges. Among the latest EPA tools is the Partnerships Training Toolbox (PTT), a customizable workshop-in-a-box that allows anyone to host a workshop about identifying and engaging in water system partnerships. The presentation will include an	1. Attendees will learn about the different types of water system partnerships and partnership activities. 2. Attendees will learn what free resources and tools EPA provides to states, technical assistance providers, and water systems interested in partnerships.	2. What is not true about water system partnerships? A. They assist small and mid-size systems in overcoming unique challenges. **B. They must be formal relationships.** C. They build capacity for systems. D. They provide a wide range of opportunities for systems to work together. 2. Which of the following is a possible benefit of partnerships?
Wildfires and Water: Research and Resources (OS2_5)	Rate of Benzene Release from Contaminated Plastic Drinking Water Pipes	Matthew Magnuson is a research chemist with the US Environmental Protection Agency Office of Research and Development		In recent years, several drinking water systems in California have experienced benzene contamination following wildfires. Examples of affected systems include Santa Rosa (2017-2018), Paradise (2018-2019), and Riverside Grove (2020). The source of the benzene has not yet been definitively characterized. However, current research is shedding light on the interactions of the benzene with surviving infrastructure, and the implications for sampling and decontamination. Because benzene is soluble in polyethylene, high-density polyethylene service lines and polyethylene premise plumbing pipes can act as reservoirs for benzene	1. Attendees will learn how benzene contamination in drinking water systems can be resistant to decontamination by flushing. 2. Attendees will learn why benzene absorbed by plastic pipes can escape detection by some standard water sampling techniques.	1. Which of the following pipe materials can be permeated by benzene?A. Polybutylene B. Polypropylene C. Polyethylene **D. All of the above** 2. If a water sample taken immediately after flushing a plastic pipe results in a non-detect for benzene, the pipe is certainly free of benzene. True
Algae Control (OS1_02)	Rising to the Challenge of Harmful Algal Blooms	Peter Fiske, chief strategy officer, Fontius Blue Inc.	Dr. Peter S. Fiske is the chief strategy officer of Fontus Blue Inc., a leader in decision-support tools that save time and money for water treatment plant operators and managers. He is the author of 30 technical articles, most in international peer-reviewed journals, including	Harmful algal blooms (HABs) are growing in frequency and severity across the US and many water utilities are contending with HAB outbreaks in their source water and algal toxins in their system. In this presentation, Dr. Peter S. Fiske will summarize the latest research on HABs: their occurrence, mitigation strategies, and implications for water quality. Fiske will also summarize recent results for optimizing algal toxin treatment at two water plants in Ohio.	1. Attendees will learn the factors that will drive increased harmful algal blooms in freshwater sources, including increased nutrient loading, warmer temperatures, thermal stratification in water bodies, and anoxic conditions in lake bottoms. 2. Attendees will learn the strategies that water operators can employ to reduce the treatment costs associated with harmful algal blooms (HABs), such as more careful monitoring of source water bodies, early application of algicide at locations where	1. What factors drive the growth of harmful algal blooms (HABs) in water bodies? A. Increased nutrient loading B. Warmer temperatures C. Increased mixing **D. All of the above** 2. What strategies can water operators use to detect the presence of HABs in water bodies?
Algae Control (OS1_02)	A Proactive Toolkit to Monitor Harmful Algal Blooms, Taste and Odor Compounds, and Cyanotoxins	J. Hunter Adams, laboratory supervisor, City of Wichita Falls, Texas	J. Hunter Adams holds a bachelor's in biology and a master's in biology from Midwestern State University. He is a licensed Class A water operator and Class C wastewater treatment operator by the Texas Commission on Environmental Quality. He is also	This presentation describes the protocol the City of Wichita Falls has implemented to monitor algae and cyanobacteria and to analyze taste and odor compounds and cyanotoxins in two surface water reservoirs, one holding reservoir, and two water treatment plants. After five years of successful implementation, customer complaints have been completely eliminated. This presentation will provide other water systems with a blueprint for laboratory analyses to create their own protocol.	1. Attendees will learn current methods for harmful algal bloom monitoring. 2. Attendees will learn how to integrate multiple methods to monitor blooms.	1. Algae and cyanobacteria are the same type of organism. **False** 2. Multiple monitoring methods should be used to characterize blooms. **True**
Energy Management (OS1_03)	Stop Your Pumps From Robbing You	Thomas Walski, senior advisory product manager, Bentley Systems, Inc.	Thomas Walski is a senior product manager for Bentley Systems. He is active on many AWWA committees and is a trustee of AWWA's Distribution and Plant Operation Division. He has authored several books, served on numerous manual committees, and authored	Want to find those bad pumps that are wasting money on your energy bills? This presentation gives practical tips on finding those bad pumps and deciding if they can be corrected or if the pump should be replaced.	1. Understand what pump data are telling you and how to use that data. 2. Know how to dig into your energy bills to find wasted energy, which can be part of the decision-making process to rehab or replace pumps.	1. The pump head in pump curves is a. Difference in pressure between suction and discharge side **b. Difference in hydraulic grade between suction and discharge side** c. Discharge pressure d. Discharge hydraulic grade 2. You can tell which pump is running inefficiently by looking at it. True **False**
Energy Management (OS1_03)	Evaluating and Improving Energy Efficiency at Membrane Filtration Facilities	Brent Alspach, director of applied research, Arcadis	Brent Alspach holds both bachelor's and master's degrees in Civil and Environmental Engineering from Cornell University. He joined Arcadis in 1997 and serves as the company's director of applied research. He is the chair of the AWWA Water Quality &	Over the past two decades, membrane filtration has progressed from a relatively boutique treatment process to a broadly viable alternative to media filters with hundreds of installations throughout the United States. Although the pumping requirements necessitate a high specific energy consumption relative to most other treatment processes, there is little information in the literature about MF/UF energy usage with respect to either conceptual values or data from existing installations. Thus, the AWWA Membrane Processes and Research Committee is conducting a project to profile MF/UF energy use at operating facilities to generate a	1. Attendees will be able to recount the primary factors that influence energy use and efficiency in membrane filtration systems. 2. Attendees will be able to cite the range of specific energy consumption values commonly observed in membrane filtration treatment plants.	1. Membrane filtration is the most energy-intensive treatment process in common use. True **False** 2. What factor(s) influence the specific energy consumption of membrane filtration plants? A. Temperature B. Fouling
Water Loss Control (OS1_04)	Nonrevenue Water—What's the Difference Between Real and Apparent Loss?	Randy Lusk, innovations and solutions manager, M.E. Simpson Co., Inc.	Randy Lusk is active in many water-related organizations such as AWWA, Illinois Section AWWA, Indiana Section AWWA, South Suburban Water Works Association, Mid-Central Water Works Association, American Public Works Association, and their local chapters. He is the Illinois Section AWWA Trustee at Large and serves on the National AWWA Member Engagement Committee. He's also the first vendor to become a water operator in the state of Illinois.	This presentation will explore the difference between real and apparent water losses and how utilities can conduct efficient water audits. Real losses (leakage) equate to the volume of water supplied to a distribution system minus all authorized uses (metered and unmetered), apparent losses (metering issues, billing, and accounting issues), and estimates of unauthorized uses.	1. Attendees will learn the difference between real and apparent water losses. 2. Attendees will learn how to accurately measure real losses (water leakage) to optimize water loss control efforts through a water audit.	1. Real losses include leaks from water storage and leaky pipes. **True** False 2. With apparent loss, the water in the distribution system isn't actually lost; rather, the ability to account for that water has been compromised. **True** False
Water Loss Control (OS1_04)	Small Systems Master Meter Testing and Leveraging the Results to Start a Water Loss Control Program	John Van Arsdel is vice president of M.E. Simpson Co., Inc.	John Van Arsdel is the vice president. of M.E. Simpson Co., Inc. He graduated from Valparaiso University with a bachelor's degree in Geography. He has more than 32 years' experience directing projects for water utilities on water loss, water audits, mapping, water metering, leak detection, condition assessment, and flushing programs. He has presented seminars for water operators for more than 26 years at several AWWA Section meetings, AWWA Annual Conference and Exposition meetings, and several specialty water loss conferences. He is a past chair for AWWA's Illinois Section, past chair of the AWWA Water Loss Committee (2010-2014), and a George Warren Fuller award recipient. He currently is serving as the AWWA director for Illinois and is a certified validator for water audits for Indiana and California. He is a lead instructor for water audit validation classes for the Indiana Finance Association.	A water meter is like a utility's cash register. Without proper metering, water utilities lose money because they aren't receiving fair compensation for what they provide to their customers. Water metering provides a way to equitably assess users and encourages responsible, efficient water use. With areas of the United States suffering from long-term drought, proper metering has become more important than ever.	1. Attendees will learn why meter accuracy is critical to a water or wastewater utility's bottom line. 2. Attendees will learn about the problems associated with inaccurate meters and how to correct revenue loss through meter testing.	1. Water quality and how a meter is used in a particular setting are factors that can cause meters to wear out. **True** False 2. Meters should be tested to protect customers against inaccuracies that could result in overcharges from overregistration and to protect water utilities from revenue losses resulting from underregistration. **True** False
SCADA Management and Cybersecurity (OS1_05)	Managing the New Cybersecurity Risks in IoT Solutions	Yair Poleg is chief technology officer at Ayyeka.	Yair co-founded Ayyeka to bring the forefront of technology in the fields of artificial intelligence, cybersecurity, and embedded systems to the underserved infrastructure space. Prior to Ayyeka, Yair served as an officer in the Israel Defense Force's elite intelligence unit and the ministry of defense, where he led pioneering technological projects and cyber operations. Yair holds a PhD in Computer Science from the Hebrew University of Jerusalem.	The hyperconnected ecosystem of physical devices that collect and share data online, also known as the Industrial Internet of Things (IoT), brings functional benefits along with cyberthreats to the world of water utilities. This session will present the unique threats inherent in remote-monitoring solutions, such as denial of service, data manipulation, and eavesdropping. Understanding the risks will help operators make the best technological decisions for their utility when integrating IoT into their systems. To illustrate the importance behind these decisions, we will look at real and practical hallmarks of designing and implementing a cybersecure SCADA system.	1. Operators will learn about the unique threats associated with deploying remote monitoring devices. 2. Operators will learn about important aspects of cybersecurity they need to consider when integrating IoT technology into their systems.	

Groundwater Treatment (OS1_06)	Groundwater Treatment Options Abound	Lee Odell is president of Murraysmith, Inc.	Lee has a wide range of experience managing projects in water resources, water quality and treatment, water reuse design and facilities planning. One of the hallmarks of his career has been helping utilities find innovative and unique ways of addressing their specific problems. He has 31 years of experience as an engineering consultant and four years of experience as a water treatment plant operator and operations supervisor.	This talk will describe myriad treatment technologies that can be used for drinking water treatment issues found in groundwater. The benefits and drawbacks of various technologies will be compared for different groundwater quality challenges such as arsenic, iron and manganese, radium, uranium, nitrate, ammonia and other less common contaminants.	1. Attendees will learn how water treatment processes work, including precipitation, filtration, adsorption, ion exchange, membrane separation, and aeration. 2. Attendees will learn which treatment processes can remove different groundwater contaminants, including iron, manganese, hydrogen sulfide, ammonia, nitrate, arsenic, per- and polyfluoroalkyl substances (PFAS), pesticides and others.	Precipitation can be used for water softening. **True** False Iron and manganese can be removed by ion exchange. **True** False Arsenic removal with adsorption doesn't produce residual wastes. True **False** Which of the following isn't an option for nitrate removal? A. Anion exchange B. Biological removal C. Reverse osmosis **D. Aeration**
Corrosion Control (OS1_07)	Lowering Distribution System Lead Levels with Treatment Plant Optimization	Peter Fiske, chief strategy officer, Fontius Blue Inc.	Dr. Peter S. Fiske is the chief strategy officer of Fontus Blue Inc., a leader in decision-support tools that save time and money for water treatment plant operators and managers. He is the author of 30 technical articles, most in international peer-reviewed journals, including SCIENCE. He received his Ph.D. from Stanford University in 1994 and an M.B.A. from the Haas School of Business at the University of California at Berkeley in 2002.	In this presentation, Dr. Peter Fiske will present the results of a three-year collaboration with the City of Akron (Ohio) to successfully lower distribution system lead levels by optimizing treatment plant operations. Surprisingly, treatment plant optimization can not only deliver better and more stable water quality but can also result in lowered treatment plant chemical use and lower operating expenses.	1. Attendees will learn the complex chemical factors that affect lead levels in drinking water, including pH; presence of other solutes; presence of polyphosphate; and physical factors such as galvanic corrosion, scale disruption, and microbial growth. 2. Attendees will learn how computer models of calcium carbonate precipitation potential and lead solubility can provide more accurate and timely indicators of lead solubility risk than water samples alone.	1. Which of these factors does not lead to increased risk of lead exceedances in a drinking water distribution system: A. Decrease in pH B. Increased galvanic corrosion C. Increased scale disruption **D. Increase in calcium carbonate precipitation potential** Lead coupon sampling in distribution systems is a foolproof method for characterizing lead risk across a distribution system. True **False**
Corrosion Control (OS1_07)	Making Sense of Corrosion Control Testing Alternatives	Damon Roth is senior principal, environmental engineering, Brown and Caldwell	Damon Roth has managed or served as project engineer on treatment studies, designs, and construction projects for drinking water projects through the United States. He is experienced in managing distributed teams of subject matter experts to provide solutions to municipal clients, particularly in areas related to drinking water system planning and treatment optimization, including treatment feasibility evaluations, corrosion control treatment, and capital improvement planning.	Between recent high-profile lead-in-water events in cities such as Flint, Mich., and Newark, N.J., and publication of the Lead and Copper Rule Revisions (LCRR), there is renewed emphasis on adding new or optimizing existing corrosion control treatment for lead and copper. There are several types of corrosion control studies and testing methods that can inform these efforts. This presentation will provide information on several corrosion control testing methods, including bench-scale immersion coupon testing, flow-through pipe testing, and pipe scale analysis. Pros and cons of each method will be presented, and guidance will be provided on selecting the appropriate technology to achieve project goals.	1. Understand the logistical requirements (e.g., the required materials, labor, time, and analytical testing) for conducting each of the following: desktop corrosion control studies, bench-scale immersion coupon testing, and pilot-scale flow-through pipe testing. 2. Understand the strengths and weakness of each of the following corrosion study methodologies and how they can be combined to provide a more comprehensive picture of corrosion control treatment the operator's water system: desktop corrosion control studies, bench-scale immersion coupon testing, pilot-scale flow-through pipe testing, and pipe scale analysis.	1. Bench-scale immersion coupon studies can predict lead levels in the water system's Lead and Copper Rule-compliance sampling. True **False** 2. Which type of study provides empirical evidence of the mechanisms currently limiting lead solubility in a water system: A. Desktop corrosion control study B. Bench-scale immersion coupon testing C. Flow-through pipe testing **D. Pipe scale analysis**
Water Reuse (OS1_08)	Smaller Utilities: Got Some Wastewater You Could Use?	Bruce Macler, retired, is a trustee with the AWWA Small Systems Division.	Dr. Bruce Macler recently retired from the US Environmental Protection Agency after three decades as the Pacific Southwest Region's drinking water toxicologist. During that time, he worked on several drinking water regulations and oversaw EPA-sponsored water research projects. He remains professionally active, primarily with the American Water Works Association. Current research interests include the safety of recycled and alternative water sources, microbial contamination of premise plumbing, and water treatment for small systems. He has a PhD in biochemistry from UC Berkeley and has authored over 70 professional publications.	This talk will address the considerations and issues facing a smaller system that has a source of wastewater at hand and an interest in using it.	1. Attendees will learn ways wastewater and stormwater can be recycled to augment local supplies. 2. Attendees will explore key questions and issues that should be addressed when considering a water recycling program.	1. Water reuse may be particularly useful to smaller drinking water systems in areas with problematic water sources. **True** False 2. Many nonpotable uses for wastewater only require additional disinfection to be safe enough and meet regulatory requirements, especially where salts or trace contaminants aren't issues. **True** False
Emergency Preparedness (OS1_09)	Utility Emergency Preparedness and Disaster Management	J. Hunter Adams, laboratory supervisor, City of Wichita Falls, Texas	J. Hunter Adams holds a bachelor's in biology and a master's in biology from Midwestern State University. He is a licensed Class A water operator and Class C wastewater treatment operator by the Texas Commission on Environmental Quality. He is also a certified water professional and certified in infrastructure protection and infrastructure disaster management by the Texas A&M Engineering Extension Service of Texas A&M University. He has worked in the planning and implementation of microbiological and analytical testing for direct potable reuse and indirect potable reuse systems for the City of Wichita Falls, Texas. He has also successfully implemented a harmful algal bloom and taste and odor monitoring program that has completely eliminated customer complaints for over five years.	To be effective during disasters, utilities have to be trained in emergency preparedness. This involves how to respond to large-scale emergencies and disaster management. This presentation will cover key areas of emergency preparedness and disaster management, including Continuity of Operations Plans (COOPs).	1. Attendees will learn what a COOP is and how it can be utilized. 2. Attendees will see a case study of how a laboratory and water system reacted to a disaster.	1. COOPs should be updated regularly. **True** False 2. The time to prepare for disasters is before the disaster. **True** False
Filtration (OS1_10)	What Is Your Filter Performance Telling You?	Jayme Tuomala is a product manager with Wes Tech Engineering.	Jayme Tuomala is the product manager of general filter and microfloc products for WesTech Engineering. He has been with the company for over 30 years, gaining a wealth of experience with drinking water applications. While with the company, he has served in various other positions such as applications engineer, process engineer, lab manager, and proposals manager. He graduated from the University of North Dakota with a B.S. in Chemical Engineering.	Filtration is often needed to meet treatment objectives. Thus, it's important to maintain the filter properly. Most filters don't require a lot of maintenance, but there are key items to point out such as maintaining any coatings and calibrate instruments such as differential pressure transmitters as per the instructions, plus ensure tubing is free from debris and not plugged. It's important to "listen to what your filter is saying" by paying attention to the performance. Understanding your filter begins with record keeping. Accurate records help define the filters baselines, which can be used for troubleshooting down the road.	1. Attendees will learn how to keep accurate operating records, which will help them understand their plant and see how it reacts under varying conditions. 2. The presentation will offer several trouble shooting tips to help attendees diagnose and solve various issues, including proper filter backwashing techniques.	1. If backwash pressure loss increases over time, the filter underdrain is functioning normally. True **False (This is an indication that the filter underdrain may be plugged.)** 2. In ideal conditions, filter terminal headloss and filter breakthrough occur at the same time? **True** False

Filtration (OS1_10)	Monitor, Assess, and Act to Optimize Biofiltration	Kevin Linder is senior water utility supervisor with Aurora (Colo.) Water Department	Kevin Linder is the Advanced Water Treatment Superintendent for Aurora Water and the Advanced Water Treatment Superintendent at the Binney Water Purification Facility. Kevin was the Treatment Plant Supervisor at the Binney Water Purification and the Wemlinger Water Treatment Plant prior to that. Kevin has been a Partnership for SafeWater PEAC volunteer since 2004, a PEAC Vice-Chair since 2010, and currently the Treatment Chair for the PEAC since 2016. In 2016, the Binney Water Purification Facility achieved the Partnership for Safe Water Phase IV Excellence in Treatment Award. Kevin has led treatment and optimization efforts for more than 25 years and received the Rocky Mountain Section AWWA Ralph R. Leidholt Operator of the Year Award in 2007. Kevin holds a Class "A" Treatment Plant Operator license and a Distribution 4 license for the state of Colorado.	Biofiltration can provide numerous water treatment benefits but can also pose hydraulic and water quality challenges to operations staff. Carefully monitoring and controlling biofilter conditions are important practices for optimizing a biofiltration plant's performance.	1. Attendees will learn basic operational procedures for biofilters as well as an effective pre-oxidation approach for biofiltration. 2. Attendees will better understand biofiltration performance, maintenance, and assessment.	1. Biofilters are not good at particulate removal. True **False** 2. Biofilters have short filter runs. True **False**
Lead Removal and Testing (OS1_11)	From the Main to the Meter: Lead Is So Much More Than a Pipe in the Ground	Melissa Healey is the water quality program supervisor with Halifax Water.	Melissa's primary focus is Halifax Water's Lead Service Line Replacement program. Melissa received her diploma In Environmental Engineering – Water Resources from the Nova Scotia Community College in 2009, followed by her bachelor's degree in Environmental Science from Saint Mary's University in 2011, followed by her master's degree from Saint Mary's University in 2015 where she conducted her research in The Gambia, West Africa.	The goal of this presentation will be to provide a summary of the evolution of Halifax Water's Lead program, including lessons learned from the successful implementation of the new Get The Lead Out program launched in 2021, which includes paying for full lead service line replacement form the main to the meter. Operational lessons learned from implementing our new main to meter replacement program will be included.	1. Attendees will learn how to find lead pipes in their distribution system. 2. Attendees will learn how to set up and execute a lead sampling program, public engagement efforts, barriers to increasing lead service line replacement numbers, and how to build a team capable of executing a full lead service line replacement program.	1. To what grade level should lead service line replacement program communications be targeted? A. Grade 1 **B. Grade 5** C. Grade 8 D. University/college level 2. Why did Halifax Water implement a program to pay for full lead service line replacement from the main to the meter? A. To increase uptake in replacement B. To take control of the project timeline C. To be more cost effective in replacement by coordinating with paving projects, other infrastructure projects and by grouping replacements **D. All of the above**
Lead Removal and Testing (OS1_11)	An Impossible Timeline? Testing for Lead in 3,500 New York City Public Drinking Fountains in 5 Weeks	Evan Trumpatori is a project manager with Woodard & Curran	Evan has 16 years of experience in the environmental consulting industry. He has developed, implemented, and managed large-scale environmental testing programs and site/remedial investigations, including state and federal Superfund remediation projects, groundwater investigations, post-closure landfill management, assessment, operations and maintenance of engineered mitigation and remediation systems, utility investigations, and site/civil construction projects. Evan currently manages the New York City Department of Parks and Recreation portfolio of environmental engineering projects, including post-closure landfill monitoring, green infrastructure and redevelopment pre-design investigations, hazardous building materials assessments, and drinking water lead testing/monitoring programs.	When New York City Mayor Bill de Blasio launched the LeadFreeNYC initiative, the City's Department of Parks & Recreation moved quickly to test for lead contamination in all of its 3,500+ public drinking fountains. What was expected to be an 8-week program was completed in only 5 weeks by applying innovative mobile data collection applications and through close collaboration with operations staff and management. This presentation will discuss the planning and implementation of the testing and future work driven by the data collection effort.	1. Attendees will gain insight to the benefits of robust GIS data and the efficiency of mobile applications to manage drinking water assets. The presenters will share some key examples of errors in mapping and the fix used. 2. Attendees will learn how the collaborative approach between NYC staff and Woodard & Curran staff aided successful completion of testing and facilitated coordination with maintenance and operations staff when repairs or maintenance needs were identified, and allowed for real-time updates on testing status and results to the public.	1. What is the largest utility asset mapping you have accomplished to date and has your utility been updating the database for regular use? 2. Do you understand the risk posed by the errors and omissions in your utility GIS database and specifically how the revised Lead and Copper Rule requirements to locate lead service lines is an opportunity to get a handle on lead issues?
Sampling (OS1_12)	Guidelines and Tips for Getting the Most Out of Field Testing Water Samples	Dan Kroll is director of the Hach Advanced Technology Group.	Dan has worked at Hach for 32 years in a variety of roles. Dan has been the lead researcher on method development projects for the physical, chemical and microbiological quality of water and soils for which he holds several patents. Dan has developed both advanced and simplified methods for a variety of crucial water quality parameters. His simplified arsenic testing method is used throughout the world as the standard field method to screen for this toxic metal. Dan has Bachelors degrees in Microbiology and Genetics and a Masters degree in Water Resource Management and Environmental Engineering from Iowa State University. Dan has been awarded the R&D 100 Award for the event monitor trigger system. The award was given for developing one of the world most innovative products in 2005. He is also the author of the book "Securing Our Water Supplies; Protecting a Vulnerable Resource" available from PennWell Publishers.	Tips and guidelines for obtaining accurate and meaningful data from field analysis will be presented.	1. Attendees will be taught the criteria that can be used to pick the field the testing method that best fits their analytical needs. 2. Attendees will learn the importance of practicing field analytical methods under conditions as close as possible to those that will be encountered in the field, including the use of personal protective equipment.	1. One of the best ways to recognize and control errors in field analytical methods is through the use of standards? **True** False 2. The most advanced technology is always the best choice when planning a field monitoring program? True **False**
Sampling (OS1_12)	How to Juggle Sampling Plans, Schedules, and Monitoring Reports Like a Pro!	Sue Murphy is the water quality specialist with the Solano (Calif.) Irrigation District	For the past 15 years, Sue Murphy has been the water quality specialist responsible for all the Division of Drinking Water regulatory compliance monitoring and reporting for nine "small" Public Water Systems operated by the Solano Irrigation District. These systems have half surface water and half groundwater, so we have every type of challenge.	Participants learn to plan sampling in advance, manage unexpected last-minute changes, and submit great compliance reports on time. You never know when you will have to jump up and take on new tasks!	1. Attendees will learn to determine required monitoring schedules using online records. 2. Attendees will learn how to prepare monitoring plans that incorporate drinking water regulations.	1. Surface water and groundwater systems are required to monitor at the same frequencies True **False** 2. Missing required monitoring is a violation. **True** False

Emergency Power Generation (OS1_13)	Public Safety Power Shutoffs: Preparation, Planning and Implementation for Water Systems	Yvonne Heaney is a chemical engineer with the California State Division of Drinking Water.	Yvonne Heaney has worked with power utilities, industry and water agencies, and hosts of other partners both in and out of California to understand the challenges of Public Safety Power Shutoffs for water and wastewater industries, with the goal of developing proper response protocols to ultimately allow utility functions to continue in the event of power outages. She co-authored a Standard Operating Procedure with the US Environmental Protection Agency, released in 2020.	This presentation will provide comprehensive, detailed instructions on how to prepare, plan and implement proper procedures to survive a Public Safety Power Shutoff event. Practical advice, examples, lessons learned, and much more will be provided.	1. Attendees will learn how to properly prepare for Public Safety Power Shutoff and other power loss events. 2. Attendees will receive practical advice for implementing standalone power supplies.	1. What factors cause Public Safety Power Shutoff events to be implemented? A. High winds, high humidity, low temperatures B. High humidity, low winds, low temperatures **C. High winds, high temperatures, low humidity** D. High humidity, low winds, high temperatures 2. Stored fuel can last indefinitely in proper containers. True **False**
Coagulation and Flocculation (OS2_2)	Using Water Quality Parameters for Feed Forward Control of Coagulant Dose to Provide Confidence in Water Treatment	Kailey Rosema is water operations supervisor, water quality, with Eagle River Water & Sanitation District (Colo.)	Kailey Rosema earned her bachelor's degree in biology with an emphasis in freshwater aquatics and minor in chemistry from Grand Valley State University in Allendale, Mich. She began her career at Eagle River Water and Sanitation District in 2017 as an intern in the water department, and is currently the district's water quality supervisor.	A central Colorado surface water treatment plant utilized historical daily water quality data from 2015 and 2016 to create a feed forward coagulation control empirical model for primary coagulant dose adjustment. This has resulted in an increase in the plant's net production efficiency and improved operator confidence with adjusting primary coagulant dose during challenging water quality events.	1. Attendees will learn how to implement a coagulation control strategy using Excel and historical water quality data. 2. Attendees will learn how to assess and increase surface water treatment plant efficiency using historical water quality parameter correlations.	1. During times of unexpected or rapid shifts in water quality, understanding historical water quality correlations will not play a role in optimizing primary coagulant dosing. True **False** 2. A coagulation control strategy can help improve overall plant efficiency and reduce overall chemical costs. **True** False
Coagulation and Flocculation (OS2_2)	A Granular Media Filtration-Based Jar Test Method to Replace Traditional Jar Testing and All the Problems Associated with It	Amir Alansari is a civil engineer.	Amir Alansari is a civil engineer, researcher, programmer, and modeler with over 10 years of research experience in various areas of water treatment. His research areas include drinking water (treatment processes, plant design, pilot plant design, control systems, and process optimization), coagulation chemistry and flocculation, low-pressure membrane filtration processes, and membrane fouling control strategies.	This presentation will provide a basic overview of coagulation and the process of optimizing coagulation conditions effectively. Discussions will include a comparison of the results obtained from a conventional jar test procedure (based on settling) with the results of a new jar test method that is based on granular media filtration. The results will demonstrate the benefits of optimizing coagulation conditions based on filtered water turbidity in terms of operation and process control, overall performance, and chemical cost savings.	1. Attendees will better understand the relationship between the coagulation factors involved during the jar the process. 2. Attendees will learn how to effectively and efficiently optimize coagulation using a filtration-based jar test procedure.	1. What is the most important process in drinking water treatment? A. Filtration **B. Coagulation** C. Sedimentation D. Disinfection 2. Which of the following statements is true about the new jar test procedure? A. It does not need to be calibrated B. It is based on granular media filtration instead of settling C. Only a single parameter is allowed to vary between the jars **D. All of the above**
Distribution System Monitoring and Response (OS2_3)	Making a Business Case for Distribution System Monitoring and Response Planning	Steven Allgeier is an environmental engineer with the US Environmental Protection Agency, Office of Groundwater and Drinking Water, Water Security Division.	Steve joined U.S. EPA in 1996 where he has worked on a variety of regulatory, security, and technical assistance programs supporting the drinking water sector. Currently Steve's areas of focus include treatment chemical supply resilience, source water contamination preparedness, and distribution system monitoring. Steve is also a member of the American Water Works Association.	Water treatment plants are operated and monitored to ensure that high-quality drinking water is delivered to their distribution systems. However, a wide range of factors can degrade water quality as it travels through a distribution system to customers.	1. Attendees will learn about the components of a Water Quality Surveillance and Response System. 2. Attendees will learn about the operational and preparedness benefits that can be realized through implementating a Water Quality Surveillance and Response System.	1. Which of the following is not a component of a Water Quality Surveillance and Response System? A. Online water quality monitoring B. Water contamination response planning **C. Corrosion control monitoring** D. Public health surveillance 2. Which of the following are potential benefits realized through implementing a Water Quality Surveillance and Response System? A. Improved disinfection residual maintenance B. Early detection of water quality problems C. Improved customer service **D. All of the above**
Distribution System Monitoring and Response (OS2_3)	Guidance Manual for Monitoring *Legionella pneumophila* in Drinking Water Distribution Systems	Mark LeChevallier, retired, is the principal and manager of Dr. Water Consulting	Dr. Mark LeChevallier founded Dr. Water Consulting, a part-time consulting business, after retiring from American Water at the beginning of 2018. Dr. LeChevallier received his bachelor's and master's degrees in Microbiology from Oregon State University, and his Ph.D. in Microbiology from Montana State University. Dr. LeChevallier has authored over 300 research papers and has received numerous awards for his research. He currently serves on the US Environemental Protection Agency Science Advisory Board, the Water Science & Technology Board for the National Academy of Science, and was a member of the NAS Legionella workgroup. He is a fellow of the American Academy of Microbiology.	Legionnaires' disease has become the most commonly identified cause of drinking waterborne outbreaks. With the advent of easy to use methods for *Legionella pneumophila* detection, many utilities have an interest to know that their existing water treatment is effective for control however no guidance exists on developing a monitoring program. Based on prior research, a guidance manual was developed and is being used by utilities to implement their *L. pneumophila* monitoring program. The experiences of these utilities will be presented along with an overview of the guidance manual to share these results with the AWWA community.	1. Utilities should understand that Legionnaires Disease is a common and preventable waterborne disease in drinking water. 2. Guidance is available to utilities in setting up a monitoring program for *Legionella pneumophila* in distribution systems.	1. Legionnaire's Disease has increased over 500% in the past 20 years. **True** False 2. State public health and/or environmental regulators are likely to be uninterested in the results of *Legionella pneumophila* testing, so they don't need to be consulted when planning a monitoring program. True **False**
Distribution System Monitoring and Response (OS2_3)	Backflow and Tampering: Monitoring and Response with Advanced Metering Infrastructure	Nelson Mix is a captain in the U.S. Public Health Service and works for the US Environmental Protection Agency's Water Security Division.	Nelson Mix has a bachelor's in Civil Engineering from Brigham Young University and a master's in Civil Engineering from the University of New Mexico. He began his career in 1993, working with the Indian Health Service at Ft. Defiance, Ariz., as a field engineer on the Navajo Nation, designing and constructing facilities and pipelines to convey potable water. From 1997 to 2001, he was a Federal On-Scene Coordinator for the EPA, working out of the Kansas City, Kan., Region 7 office, responding to oil spills and hazardous material incidents. In March 2001, he began working for the EPA Superfund Program in Crystal City, Va. Following Sept. 11, 2001, and a subsequent EPA re-organization, he worked in Washington, D.C., for the EPA's Office of Emergency Management until 2008, where he was responsible for EPA continuity programs, technical training, and responding to September 11th, anthrax, ricin on Capitol Hill, the shuttle Columbia disaster, Hurricane Katrina, and other incidents. In 2008, he began working at the EPA's Water Security Division within the Office of Water and Office of Groundwater and Drinking Water. He focuses on helping water utilities implement Water Quality Surveillance and Response Systems using Customer Complaint Surveillance, Enhanced Security Monitoring, and AMI components. He is a Professional Engineer, Certified Hazardous Material Manager at the Master Level, and Fellow of the Society of American Military	The US Environmental Protection Agency recently published resources to help utilities incorporate Advanced Metering Infrastructure (AMI) into Water Quality Surveillance and Response Systems. These new documents focus on backflow and tamper alerts. This presentation will highlight and explain parts of the new EPA AMI guidance document. The presentation will cover AMI equipment, communications, information management and alert investigation procedures. Attendees will understand how AMI generates data and alerts that may indicate system contamination or other tampering. Participants will become familiar with the document's embedded, customizable Alert Investigation Procedure Template to guide the methodical investigation of these alerts.	1. Participants will understand how Advanced Metering Infrastructure (AMI) can alert operators for backflow and tampering incidents. 2. Participants will learn how to customize AMI alert investigation procedures for their utilities.	1. EPA has published guidance about investigating AMI backflow and tamper alerts to safe guard water quality. **True** False 2. EPA considers AMI Alert Investigation Procedures a component of AMI, comparable to equipment, communications, and information management. **True** False

Training and Resources (OS2_4)	A Microbiology and Chemistry Review for Operators	J. Hunter Adams, laboratory supervisor, City of Wichita Falls, Texas	J. Hunter Adams holds a bachelor's in biology and a master's in biology from Midwestern State University. He is a licensed Class A water operator and Class C wastewater treatment operator by the Texas Commission on Environmental Quality. He is also a certified water professional and certified in infrastructure protection and infrastructure disaster management by the Texas A&M Engineering Extension Service of Texas A&M University. He has worked in the planning and implementation of microbiological and analytical testing for direct potable reuse and indirect potable reuse systems for the City of Wichita Falls, Texas. He has also successfully implemented a harmful algal bloom and taste and odor monitoring program that has completely eliminated customer complaints for over five years.	Water operators should have a general knowledge of process control testing used in treatment as well as a basic understanding of more advanced concepts and what they mean. This isn't always the case in many Public Water Systems (PWSs), and the industry as a whole should move toward realizing this goal. This presentation will explain why understanding basic microbiology and chemistry is important for water operators, explain what the data means behind the most common tests they do, and briefly explain advanced testing.	1. Attendees will review basic microbiological process control analyses. 2. Attendees will review basic chemical process control analyses.	1. Coliforms are a group of indicator organisms that indicate the possibility of contamination. **True** False 2. Nitrification parameters are important to monitor in distribution systems. **True** False
Wildfires and Water: Research and Resources (OS2_5)	EPA Guides and Funding to Build Wildfire Resilience for Water and Wastewater Utilities	David Goldbloom-Helzner is a physical scientist with the US Environmental Protection Agency	David Goldbloom-Helzner has 34 years of experience in helping critical infrastructures prepare for and respond to disasters. For the past 12 years, he has been with the U.S. Environmental Protection Agency Office of Water, Water Security Division, developing tools to help water and wastewater utilities become more resilient to flooding, earthquakes, wildfires, and other natural disasters; apply for federal disaster funding; and be trained in the incident command system.	Now, more than ever, pressure is on water and wastewater professionals to secure their systems from a wide variety of threats, ranging from devastating cyberattacks to wildfires and other extreme weather events. This presentation will give operators invaluable guidance to help them keep their systems running.	1. Attendees will gain a basic awareness of risks to distribution systems from wildfires. 2 Attendees will learn how to use new EPA products to build resilience of water and wastewater utilities to wildfires as well as best management practices from EPA staff who have supported response and recovery for wildfires from 2018 to the present.	1. Water distribution systems are protected from wildfires because they are underground. True **False** (Not all water mains are buried sufficiently underground to protect from wildfires and many critical components, such as tanks, meters, and pumps, are placed above ground (e.g., tanks, meters, pumps). Benzene is the only chemical of concern from wildfires. True **False** (Benzene is one of the most prevalent, but other volatile organic compounds have been detected. Furthermore, back-siphonage can introduce other contaminants, such as other types of chemicals or bacteriological contamination.)
Contaminant Removal (OS2_6)	Getting an "A" in Arsenic, Ammonia and Aeration	Lee Odell is president of Murraysmith, Inc.	Lee has a wide range of experience managing projects in water resources, water quality and treatment, water reuse design and facilities planning. One of the hallmarks of his career has been helping utilities find innovative and unique ways of addressing their specific problems. He has 31 years of experience as an engineering consultant and four years of experience as a water treatment plant operator and operations supervisor.	This presentation will examine ways to lower arsenic removal levels with the right technology, save money with biological ammonia removal in pressure vessels, and evaluate aeration options for groundwater treatment applications.	1. Attendees will learn how to optimize arsenic removal for ion exchange, precipitation and coagulation, and adsorption removal technologies. 2. Attendees will learn which water quality parameters interfere with arsenic removal?	1. Arsenic coagulation and filtration improve with increased pH. True **False** 2. Ammonia can be removed by ammonia-oxidizing bacteria. **True** False 3. Ammonia has a large chlorine demand. **True** False 4. Multistage bubble aerations can be used to raise the pH of water. **True** False
Regulatory Challenges (OS2_7)	Challenges in Meeting the Lead and Copper Rule Revisions	Philip Brandhuber is the owner of Brandhuber Water Quality/Treatment	Phil has extensive experience in managing inorganic contaminants, including lead, copper, arsenic, chromium, manganese, and perchlorate. He has been the principal or co-principal investigator for numerous research projects sponsored by the Water Research Foundation (WRF) and other agencies. Phil is participating in the AWWA effort to develop a training program for completing corrosion control treatment (CCT) evaluations in compliance with the revised Lead and Copper Rule (LCRR). He also developed AWWA training materials for small system compliance with the LCRR. Phil is the current chair of the AWWA Inorganic Contaminants Committee and Manganese Subcommittee and has 20 years' experience as a consultant, working for McGuire Environmental and HDR Engineering, where he was named an HDR Fellow.	This presentation will highlight experiences and challenges being encountered in developing lead service line inventories, optimizing corrosion control, and targeting communications.	1. Attendees will gain an understand of the major provisions of the revised Lead and Copper Rule (LCRR). 2. Attendees will learn that changes contained in the LCRR can impact how tap lead levels are measured and the method for calculating the 90th percentile value.	1. Performing a lead service line (LSL) inventory is important because A. It can be difficult to reliably identify LSLs. B. You must report results of inventory to regulators and notify customers that they are served by an LSL. C. It can influence your lead and copper sampling pool. **D. All of the above.** 2. Under the revised Lead and Copper Rule, systems that need to re-tier their tap sample sites or perform fifth-liter sampling may find their 90th percentile lead levels to be greater than measured by past sampling. **True** False
Roundtable Discussion (OS2_8)	What Keeps Small System Operators Up at Night?	Moderator Kirk Medina, retired, was the manager for the Pacific City Joint Water-Sanitary Authority, Pacific City, Ore., and is a trustee for AWWA's Small Systems Division.	Kirk Medina has over 40 years of experience providing safe drinking water to customers. He started his career as a water treatment plant operator and later focused on water system supervision and management. He has managed both large and small water systems and has a unique understanding of the differences between the two. As an active member of AWWA, he was Chair of the Cal-Nev Section and is now a Trustee for the Association's Small Water Systems Division. He possesses a Bachelor of Business Administration degree from the University of Phoenix and a Master of Public Administration from UNLV. He also possesses Grade 4 Water Treatment and Grade 4 Water Distribution licenses.	This panel discussion will address various questions related to operating or managing small systems. Before the discussion, each panel member will present examples describing how small water systems experience unique operating challenges based on their size. Panelists will respond to and discuss questions that are submitted during the session.	1. Attendees will learn how small systems can meet water quality standards by providing optimum treatment and monitoring solutions. 2. Attendees will learn ways small systems can address distribution system challenges like water main breaks and water storage issues.	1. Small public water systems are required to have certified operators in responsible charge. **True** False 2. A water main break has more impact on a small water systems because **A. The water lost is a greater percentage of the total daily flow for the system.** B. The water lost costs more for small water systems. C. Customers complain more in areas served by small water systems. D. The main break is harder to fix.

Wildfires and Water: Lessons Learned from California Utilities (OS2_9)	Mitigating Wildfire Impacts on Drinking Water Quality and Operations	Helene Baribeau is distribution system water quality leader with Brown and Caldwell.	Helene focuses on disinfectant and disinfection byproducts, microorganism inactivation and control, corrosion control, impact of treatment processes on distribution system water quality, and regulatory compliance. She is actively engaged in AWWA's Manganese Subcommittee, Lead in Water Subcommittee, Premise Plumbing Committee, and Distribution System Water Quality Committee.	This presentation will cover best management practices, mitigation and response actions taken to respond to fire events, adaptation resources, and lessons learned by California water agencies that have had to respond to fire events.	1. Attendees will discover best management practices, adaptation resources, and lessons learned from California's recent fire seasons. 2. Attendees will learn how wildfire response and the potential impacts of wildfires on water quality vary largely based on location and affected sites.	1. In addition to the potential for direct damage to water reservoirs and treatment and distribution facilities that could disrupt water service, wildfires also threaten the water quality of A. Watersheds B. Streams C. Reservoirs **D. All of the above** 2. Impacts of wildfires on water quality may occur immediately or over a long period of time after the event. **True** False 3. Wildfires can affect several water quality indicators, including: A. General physical–chemical parameters B. Particle load C. Inorganic and organic constituents **D. All of the above** 4. Climate change has exacerbated weather impacts on water systems, from wildfires to flooding to uncharacteristic winter deep freezes. **True** False