





Onsite Water Reuse Summit

Integration of Science, Policy, and Operation for Safe and Effective Implementation EPA Headquarters, Washington DC, April 10–11, 2024

Summary Notes

The Onsite Water Reuse Summit was collaboratively presented by the U.S. Environmental Protection Agency (EPA), the National Blue Ribbon Commission for Onsite Non-potable Water Systems (NBRC), and the WateReuse Association. The Summit included more than 40 presenters and approximately 200 people from across the country. Different parts of the water sector participated to share experiences, research, goals, and success stories associated with implementing onsite water reuse systems.

The following is a summary of the sessions that occurred during the Summit and key points made by presenters and participants. This document is not a comprehensive account of all presentations and discussions that occurred during the Summit and has not been reviewed by all presenters. The views summarized in this document do not necessarily represent the views or policies of the Summit planning organizations, including the EPA. See Appendix A for the Summit agenda.

Presentation slides from the event are <u>available online</u> under the "Resources" section of the NBRC website. Find more relevant information in the National Water Reuse Action Plan—see WRAP Actions <u>2.18</u> and <u>3.4</u>.









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Day 1: April 10, 2024

Welcome Remarks

Mae Wu (Deputy Assistant Administrator for the EPA Office of Water), introduced by Deborah Nagle (Office Director for Office of Science and Technology, EPA Office of Water)

• The speaker summarized the importance of water reuse to help meet climate adaptation and mitigation goals. She also highlighted the <u>Federal Interagency Water</u> <u>Reuse Workgroup</u>, composed of 15 federal agencies, and key projects developed under the <u>National Water Reuse Action Plan (WRAP</u>), including the <u>REUSExplorer</u>.

Session #1: Ensuring Safe Implementation

Moderator: Brian Good (Denver Water)

Speakers: Dr. Sharon Nappier (EPA); Paula Kehoe (San Francisco Public Utilities Commission [SFPUC]); Dr. Sybil Sharvelle (Colorado State University [CSU]); Dr. Michael Jahne (EPA)

- Dr. Sharon Nappier (EPA)
 - The EPA's Water Reuse Program helps foster collaboration among water reuse stakeholders and advance water reuse applications across the United States. The Water Reuse Program is an active member of the NBRC.
 - The latest <u>WRAP Update on Collaborative Progress</u> highlights activities advancing potable and non-potable water reuse, including in the areas of improving state regulatory and policy clarity, highlighting infrastructure investments, advancing scientific and technological research, and providing technical support and information.
- Paula Kehoe (SFPUC)
 - The NBRC is composed of representatives from municipalities, water utilities, and public health agencies from 15 states, the District of Columbia, the cities of Toronto and Vancouver, the EPA, and the U.S. Army Engineer Research and Development Center. The NBRC advances best management practices to support using onsite non-potable water systems (ONWS) at the building or district scale. It helps address needs by creating guidance documents, developing certification programs for operators, and working with plumbing code organizations to amend conflicting codes and standards in alignment with the best available science.
- Dr. Sybil Sharvelle (CSU)
 - <u>2017 Guidance for Decentralized Non-Potable Water Systems</u> was designed to move away from bacterial water quality testing and toward using a Quantitative Microbial Risk Assessment (QMRA) to develop microbial







treatment targets for onsite sources of water (e.g., greywater, stormwater) and end use applications (e.g., toilet flushing). The 2017 framework was the basis for regulations in several states, including California, Colorado, and Oregon.

- Dr. Michael Jahne (EPA)
 - Microbial log reduction targets (LRTs) included in the 2017 framework have since been updated to reflect the latest science. In addition, LRTs have been calculated for several health benchmarks, including the Disability Adjusted Life Year (DALY) approach, which is commonly used internationally and accounts for severity of disease. Calculated LRTs for the different health benchmarks result in comparable treatment trains.
 - The EPA is now working on a manuscript describing the latest science and a separate State of the Science document on the QMRA framework for water reuse.
 - An Independent Advisory Panel is in progress to develop a risk-based guidance for single-family and appliance-scale reuse systems.

Session #2: Implementing Policies and Programs

Moderator: Tressa Nicholas (Idaho Department of Environmental Quality) **Speakers:** Emily Wong (Colorado Department of Public Health and Environment); Taylor Nokhoudian (SFPUC); Steve Deem (Washington State Department of Health); Alan Cohn (New York City Department of Environmental Protection [NYC DEP])

In this panel discussion, presenters shared their perspectives on developing and implementing onsite water reuse policies and regulations in various parts of the country.

- Emily Wong (Colorado Department of Public Health and Environment)
 - <u>Colorado</u> joined the NBRC and was the first state in the country to implement the risk-based framework as part of its regulations for onsite nonpotable reuse. Denver Water's administration building uses onsite reuse systems for toilet flushing with a system they refer to as "ReUse for US (RUFUS)." Denver Water wanted to be a leader in this area, and through the project at their headquarters building, they helped drive the regulation for onsite water reuse in the state.







- Taylor Nokhoudian (SFPUC)
 - San Francisco established an ordinance in 2012 that set rules and regulations for onsite non-potable reuse. The ordinance started on a voluntary basis and eventually became a mandatory requirement for buildings greater than 100,000 gross square feet to reuse blackwater or greywater onsite. SFPUC wanted to enable onsite reuse implementation and worked with the city to establish the appropriate ordinances.
- Steve Deem (Washington State Department of Health)
 - The state of <u>Washington</u> is in the process of developing an onsite regulation that incorporates LRTs calculated using the DALY health benchmark. A desire to "be green" is currently the primary motivation driving developers to adopt water reuse in Washington.
- Alan Cohn (NYC DEP)
 - In <u>New York City</u>, combined sewer overflows (CSOs) are a major driver for onsite reuse, and NYC DEP considers reuse a tool for reducing CSO events. Reuse initiatives currently implemented throughout NYC are being led by developers who are taking advantage of incentives, including a grant program to cover capital costs and rate incentives to reduce the payback period.
 - Onsite reuse can be implemented as a tool for addressing consent decrees for CSOs in the future. Increasing state recognition and instituting flexibilities for implementing onsite reuse as a solution for responding to litigation can drive down costs for meeting consent decrees for CSOs.

Session #3: Conducting Research to Advance Onsite Water Recycling

Moderator: Justin Mattingly (EPA)

Speakers: Dr. Sam Arden (Eastern Research Group, Inc. [ERG]); Dr. Andy Hur (U.S. Army Corps of Engineers [USACE] Engineer Research and Development Center [ERDC]); Dr. Harry Zhang (Water Research Foundation [WRF]); Dr. Sybil Sharvelle (CSU); Katherine Jashinski (City of Austin); Paula Kehoe (SFPUC)

- Dr. Sam Arden (ERG)
 - The <u>Non-potable Environmental and Economic Water Reuse (NEWR)</u> <u>calculator</u> is a screening tool to evaluate costs of onsite non-potable reuse options for large buildings.
 - The latest update will include revised utility rates and emission factors, combined rainwater/condensate systems, dose-dependent ultraviolet and chlorine unit process models, and DALY health benchmarks.







- Two upcoming publications were highlighted:
 - <u>A Unit Process Log-Reduction Database for Water Reuse Practitioners</u> contains a quick reference on performance information of unit treatment processes.
 - Towards the Definition of Treatment Wetland Pathogen Log Reduction Credits (submitted) will help create pathogen log reduction credits for treatment wetlands.
- Dr. Andy Hur (USACE ERDC)
 - A <u>financial analysis</u> of decentralized, onsite water reuse in U.S. Army buildings concluded that greywater treatment and reuse for showers, laundry, and toilet flushing can provide economic benefits for buildings occupied by approximately 700 personnel, despite high system capital costs. Server cooling blowdown reuse in U.S. Army data centers will be economically favorable when water demand is greater than 130,000 gallons per day, and negative returns on investment (ROIs) observed from baseline results could be reversed under a water disruption event when water supply is limited.
- Dr. Harry Zhang (WRF)
 - WRF has conducted key research focused on onsite water recycling, including:
 - Onsite Water Reuse in the Context of One Water Planning (WRF 5175).
 - One Water Framework (<u>WRF 4660</u>).
 - Successful Implementation of Decentralized Reuse and Treatment Systems (WRF 5040).
 - Onsite Non-Potable Water System: Guidance Manual and Training Modules (WRF 4909).
 - Framework for Successful Implementation of On-site Industrial Water Reuse (WRF 1709).
- Dr. Sybil Sharvelle (CSU)
 - WRF Project 5034: Assessing the Microbial Risks and Potential Impacts from Stormwater Collection and Uses to Establish Appropriate Best Management Practices was shared.
 - Research focused on treating and distributing stormwater for later use was used to develop pathogen LRTs based on the Human Fecal Contamination Analog (HFCA), representing the equivalent dilution of sewage that characterizes stormwater contamination.
 - The variability in the chemical and microbial quality or stormwater, combined with aging infrastructure, lends to a ranged approach for developing treatment targets. An HFCA of 10⁻¹ is recommended as a







conservative default value. Human fecal source markers may be a path forward to assess site-specific contamination levels.

- Katherine Jashinski (City of Austin)
 - Austin Water is collaborating with NBRC to help develop an operator certificate program for ONWS, including an electronic training manual and knowledge-based exams. NBRC anticipates this manual will be released fall 2024, with the exam to follow in mid-2025.
- Paula Kehoe (SFPUC)
 - SFPUC is exploring additional opportunities to further reduce potable water with new technologies in single-family homes, including recirculating showers, recirculating clothes washers, and single-family greywater systems. SFPUC, the EPA, Trussell Technologies, and Eawag jointly hosted a webinar to communicate the "state of the science" for single-family water reuse applications.

Session #4: Deploying Onsite Treatment Systems and Lessons Learned— Implementing in San Francisco, Denver, and Washington, D.C.

Moderator: Taylor Nokhoudian (SFPUC)

Speakers: Doug Obana (San Francisco Department of Public Health [SFDPH]); Steve Panelli (San Francisco Department of Building Inspection); Brian Good (Denver Water); Robert Bornhofen (DC Water)

This was a panel discussion in which presenters shared their perspectives and key lessons learned from implementing and inspecting onsite water reuse systems in San Francisco, Denver, and Washington, D.C.

- Doug Obana (SFDPH) and Steve Panelli (San Francisco Department of Building Inspection)
 - <u>SFDPH</u> issues permits for ONWS. SFDPH oversees the application process, reviews engineering reports, works with the design team to ensure the health code is being met, works with treatment system managers to ensure the system is operating correctly and reviews monitoring reports.
 - Ensuring the public knows the health department is looking at the system on an ongoing basis (i.e., active participation) gives the public a sense of confidence in the system's safety.
 - San Francisco Department of Building Inspection works with the installer and the entity managing the installation in their building to initiate plumbing plan checks and to ensure the system is meeting the plumbing code. Communicating with city plumbing inspectors on the system's design and goals early in the commissioning process is helpful for moving these projects forward.







- Brian Good (Denver Water)
 - <u>Denver Water's ReUse for US System</u>, or RUFUS, implemented in the utility's administration building in downtown Denver is an example of sustainable urban water reuse. Denver Water anticipates the implementation of more of these types of projects in the city.
- Robert Bornhofen (DC Water)
 - <u>DC Water</u> purposely demonstrates responsible water use and has seen broad acceptance of their onsite reuse practices at their LEED-certified facility, which incorporates non-potable water capture and reuse. They illustrated the utility of a color dye additive for reuse water, which can help identify potential cross-connections.
- Q&A Discussion
 - Challenges of implementing onsite water reuse systems include potential cross-connections, integration of onsite treatment systems with other complex systems within a building, signage (e.g., which signs to post, where to post them), public perception, expenses, consideration of the onsite system during transfer of property ownership, supply and demand issues, changing regulatory environments, and unexpected flow interruptions (e.g., COVID-19).
 - Lessons learned from experiences:
 - Set an example, show responsibility, and demonstrate the benefits of responsible resource management.
 - Utilize resources available from those that have successfully implemented onsite reuse (e.g., SFPUC lessons learned document identifies challenges that can easily be avoided early on in the process).
 - Communication between inspectors, directors, building officials, and those adopting the codes is critical to success.
 - The water industry has an opportunity to take a leadership role in onsite reuse to help expand the public water supply in new and different ways.
 - A lot of these projects are new and a first for their community, which presents unique challenges and issues. Utilities and communities can take pride in commissioning these unique systems because they make a difference and illustrate what is possible.







Session #5: Deploying Onsite Treatment Systems and Lessons Learned—Financing ONWS

Moderator: Taylor Nokhoudian (SFPUC)

Speakers: Katherine Jashinski (City of Austin); Sharlene Leurig (Texas Water Trade); Bryce Wilson (Lotus Water); Alison Souders (EPA); Jennifer Walker (National Wildlife Federation, Texas Coast and Water Program)

- Katherine Jashinski (City of Austin)
 - The City of Austin, Texas, developed an <u>Integrated Water Resource Plan</u> titled "Water Forward" to address water supply shortages. Water Forward 2040 targets include 5.72 million gallons per day of new supplies through onsite reuse.
 - Comparisons of per-unit construction costs and monthly rent bills conducted by the City of Austin show small incremental <u>costs to implement</u> <u>onsite reuse</u>, compared to the overall costs associated with the entire building.
- Sharlene Leurig (Texas Water Trade)
 - Despite their benefits, there are relatively few onsite reuse projects in Texas, mainly due to cost (and risks associated with upfront expenses). However, useful and adaptable financial tools exist to overcome the cost barrier.
 - Texas Water Trade's <u>Net Zero Water Toolkit</u> looks at financing vehicles already being used in Texas and indicates the upfront costs of developing onsite systems can be reduced by pairing water reuse with energy efficiency.
- Bryce Wilson (Lotus Water)
 - The speaker discussed the costs and benefits of implementing onsite water reuse at different scales on a variety of example projects.
 - District-scale water reuse projects, in which multiple buildings share one system, can lead to various types of benefits, including financial (e.g., consolidating capital and operation and maintenance costs into one system), operational (e.g., optimizing water balance efficiencies, simplifying shared water demands), and practical (e.g., incorporating scalability and flexibility for future expansion, taking advantage of regulatory synergies) benefits. However, complex ownership structures (e.g., between developers and multiple future occupants) can present logistical challenges.
 - In San Francisco, cost analyses show a dramatic increase in potential for reuse of non-potable water in district-scale projects.
- Alison Souders (EPA)
 - The EPA's Clean Water State Revolving Fund program provides low-cost subsidized loans that are available for public infrastructure to protect water







resources. There are many types of eligible projects, including both municipal and onsite <u>water reuse</u> projects.

- Jennifer Walker (National Wildlife Federation, Texas Coast and Water Program)
 - The speaker presented research focused on onsite reuse in subsidized affordable housing projects to help articulate its positive co-benefits, including financial, environmental, and social benefits.
 - Correctly characterizing cost-benefit analyses is important for adopting onsite reuse in affordable housing.

Session #6: Interactive Session—What Else Is Needed to Expand the Implementation of Onsite Water Treatment Systems?

Moderator: Jay Garland (EPA)

During this session, the moderator posed a series of questions to the audience to identify their perspectives on the status of onsite reuse science, policy, and implementation. The moderator used a digital polling platform called Slido to enable audience members to answer questions on their cellular devices and display the results on the screen in the room to see the collective input and help foster discussion. Key themes from the polling data are summarized below:

- Implementation barriers need to be addressed, including improving access to funding, streamlining regulations, and enabling more collaboration between designers and operators.
- Additional research is needed to address the following:
 - Promote best management practices for controlling environmental pathogens such as *Legionella* in ONWS source waters and distribution systems.
 - Identify and validate real-time or near real-time surrogate monitoring technologies for verifying continued performance of treatment processes.
 - Develop a framework for integrating centralized and decentralized systems.
 - Expand and compile a readily accessible database on the performance for log removal credits for a range of treatment processes for ONWS.
 - Evaluate and develop LRTs for additional use applications, including onsite potable and showering.
 - Understand how to enable ONWS at different scales, including single-family residences.
 - Explore resource recovery and energy efficiency opportunities.
- Case studies highlighting the multiple benefits of ONWS are needed, particularly case studies discussing:
 - Local contexts and considerations (e.g., areas of proposed growth, areas not on sewer connection, large-scale redevelopment neighborhoods).







- Capital, ongoing operations and maintenance, and lifecycle costs, and ROIs.
- Financing mechanisms, including financial incentives.
- Lessons learned on implementation.
- Key areas for technology development include more product standardization and certifications, with emphases on reliability, low-complexity, automation, energy-efficiency, and affordability.
- Expand workforce development opportunities.







Day 2: April 11, 2024

Opening Remarks

Bart Weiss (WateReuse Association President)

- We have reached a transition from planning to implementation, and the decisions and challenges discussed during this summit will advance further adoption of onsite water reuse.
- The WateReuse Association will continue to coordinate with the EPA to execute actions under the WRAP and is dedicating an entire track to onsite reuse at next year's WateReuse Symposium.

Remarks from the U.S. Department of Energy (DOE)

David M. Turk (Deputy Secretary, DOE) introduced by Tanya Mottley (Deputy Office Director for Office of Science and Technology, EPA Office of Water)

- DOE is an active partner in advancing water reuse and continues to spend significant time and resources on the energy/water nexus. In addition, DOE sees the importance of bringing national lab expertise, industry, and academic partners together to lower the cost of nontraditional water supplies.
- DOE is proud to be a key supporter of the National Alliance for Water Innovation (NAWI), which examines the critical technical barriers and research needed to radically lower the cost and energy of water treatment, reuse, and desalination.
- DOE has already invested \$70.5 million into projects supporting desalination and water reuse technologies, including an emphasis on decarbonizing the entire lifecycle of water resource recovery facilities.
- DOE announced their next phase of research funding for "NAWI 2.0," which will provide an <u>additional \$75 million</u> over a five-year period.

Session #7: Aligning Plumbing Codes and Standards

Moderator: Bill Platten (EPA)

Speakers: Rich Anderson (International Code Council [ICC]); Christopher A. Lindsay (International Association of Plumbing and Mechanical Officials [IAPMO]); Derek Deland (National Sanitation Foundation [NSF]); Benjamin Sojka (American Rainwater Catchment System Association [ARCSA]); Lance Davis (General Services Agency [GSA])

This panel discussion featured partners of <u>WRAP Action 2.18</u>, which is focused on incorporating the latest science and risk-based framework for onsite non-potable water reuse into plumbing codes and standards. Panelists discussed the importance and status





of plumbing codes and local regulations—including their incorporation of the LRT framework—which are critical to advancing and enabling onsite water reuse.

- Rich Anderson (ICC)
 - ICC is the organization that establishes the International Plumbing Code. Two new code proposals that recently passed the development committee update the water reuse provisions in the International Plumbing Code and International Residential Code to provide guidance on the level of treatment and intended use (incorporating LRTs, values, and goals) that a design professional can meet.
- Christopher A. Lindsay (IAPMO)
 - IAPMO is the organization that establishes the Uniform Plumbing Code.
 IAPMO has incorporated the LRTs into their Z1324-2022 Standard for Alternate Water Source Systems for Multi-family, Residential, and Commercial Use.
- Derek Deland (NSF)
 - <u>NSF 350</u> is a certification for onsite greywater and wastewater reuse treatment systems. As of April 1, 2024, the risk-based framework has been adopted into NSF 350 as an optional certification. The NSF 350 uses the DALY health benchmark for its LRTs.
- Benjamin Sojka (ARCSA)
 - <u>ARCSA</u> creates design standards for stormwater and rainwater catchment systems and provides third-party certification training for designers, installers, and inspectors for these systems. The ARCSA/ASPE Standard 63 focuses on rainwater harvesting, while ARCSA/ASPE Standard 74 focuses on stormwater harvesting. ARCSA is planning to incorporate the LRT framework into their standard development process beginning summer 2024.
- Lance Davis (GSA)
 - <u>GSA P100</u> is the design standard given to architects and engineers to design and renovate federal buildings. The proposed version of P100 will dictate that 15 percent of potable water must be reused within federal buildings. This percentage requirement will likely continue to increase as GSA works toward a water net zero building goal in the future. The proposed P100 also considers the LRT framework for reusing water onsite within federal buildings.
- Q&A Discussion
 - Training/education is a hurdle for code development organizations.
 - Operators, installers, plan reviewers, plumbing contractors, and water purveyors need to be able to communicate and work together effectively.







Code development organizations have the responsibility to provide resources to train, educate, and move the industry forward.

Session #8: Deploying Onsite Treatment Systems and Lessons Learned—Learning from Designers and Operators

Moderator: Dr. Jay Garland (EPA)

Speakers: Erin English (Biohabitats); Dr. Brian Pecson (Trussell Technologies); Jeannette Laramee (Sherwood Engineers); Robert Drew (Ecovie Water Management); Matt Silver (Cambrian Innovation); Ben Arnold (Aquacell); Zach Gallagher (Natural Systems Utilities [NSU]); Aaron Tartakovsky (Epic Cleantec)

- Erin English (Biohabitats)
 - Nature-based solutions can be further developed for onsite reuse approaches, specifically to offset the need for energy-intensive membrane bioreactors. New tools may be needed to control and operate these systems.
 - Water reuse is most powerful when linked to the ecological context of local watersheds, as these projects protect the places and resources in which people are most invested.
- Dr. Brian Pecson (Trussell Technologies)
 - Designers should stay up to date with advancements in permitting onsite systems, as they may receive pathogen credits for treatment processes already being put in a system to reduce cost and complexity.
 - A systematic approach for validating new technologies is recommended.
- Jeannette Laramee (Sherwood Engineers)
 - Costs associated with monitoring (e.g., daily sampling for fecal indicator bacteria) can be a challenge for smaller or rural systems.
 - Resource recovery and thermal energy capture have technical merits and should be explored further.
 - Roles and responsibilities for delivering an onsite system (i.e., getting a system built and installed) need to be established and communicated early in the process.
- Robert Drew (Ecovie Water Management)
 - Public safety and widespread adoption of onsite systems are the ultimate goals of the design industry; challenges to achieving this include variations in acceptance across states and jurisdictions, incorporation of new technologies, third-party log reduction value crediting protocols, and lack of data on risks.







- Matt Silver (Cambrian Innovation)
 - Commercial and industrial customers can benefit from onsite reuse systems (e.g., co-resource recovery opportunities and incentives); however, complexities of these systems and uncertainty about the economics of water itself can deter industry representatives from adopting these technologies.
- Ben Arnold (Aquacell)
 - Installing, operating, and managing onsite systems requires adaptability to meeting ever-evolving, site-specific situations.
 - The speaker described various operation challenges and solutions stemming from project implementation, including dealing with clogging pumps and associated downtime, and collaborating with design engineers and installation contractors to meet ever-changing project needs.
- Zach Gallagher (NSU)
 - Drivers for onsite reuse are evolving with climate change; local solutions are needed to solve local water challenges.
 - For example, onsite systems are being produced in multiple shapes and sizes and for various uses.
 - Technological advances with onsite reuse are happening and effective technologies are available now; we face an inflection point toward broader implementation.
 - Regulations have not always kept up with the speed of industry and discussions amongst stakeholders who are aware of local challenges are needed to advance the scaling-up of these systems.
- Aaron Tartakovsky (Epic Cleantec)
 - Onsite water reuse technology is available—now, we need to make water reuse approachable to people, especially for the owners and tenants of the buildings where these onsite systems are being installed. Many educational initiatives are being created to translate this story, but we can do more.
 - The speaker described his company's efforts to use relatable stories and products, such as beer brewed with recycled water and an intentional marketing campaign, to improve public awareness and perception of onsite water reuse.
- Q&A Discussion
 - Members of the audience raised that EPA's water reuse and nature-based solutions <u>webpage</u> provides more information on incorporating naturebased solutions into water reuse design.
 - Panel members emphasized that increasing public knowledge and marketing around onsite systems is useful, but it may require leveraging different media sources and strategies.







Session #9: Advancing Beyond Non-Potable Reuse

<u>Speakers</u>: Dr. Miriam Hacker (WRF); Anthony Creech (Virginia Public Health); Dr. Brian Pecson (Trussell Technologies)

- Dr. Miriam Hacker (WRF)
 - Source separation involves separating various water flows (e.g., blackwater, greywater) at their point of collection and managing them individually to recover valuable resources more efficiently from those flows.
 - As discussed in <u>WRF 5040: Successful Implementation of Decentralized</u> <u>Reuse and Treatment Systems</u>, monetary savings, development expansion, volume reduction, nutrient loading reduction, and alignment with sustainability goals are drivers relevant to source separation.
- Anthony Creech (Virginia Public Health)
 - <u>Virginia Department of Health</u> indicated regulations for rainwater harvesting for potable use were recently approved by the Virginia Board of Health.
 - These regulations include materials, system design, treatment, operation and maintenance, and water quality requirements based on four end-tiers. The LRTs are based on the 2017 framework.
- Dr. Brian Pecson (Trussell Technologies)
 - The speaker discussed new challenges associated with a potential shift from onsite non-potable reuse to onsite potable reuse. The evaluation of risk involves focusing on different exposure pathways and degrees of exposure, and it may require a different treatment train.
 - With onsite potable reuse systems, redundancy is important to provide a safety net against failures.
- Q&A Discussion
 - Audience members raised the concept of "near-potable," or treating the water to a level acceptable for non-drinking purposes that historically use potable water (e.g., bathing).







Session #10: Addressing Off the Grid

<u>Moderator</u>: Alex Fairhart (Personal Water Systems) <u>Speakers</u>: Dr. Martin Page (USACE ERDC); Dr. Daniel H. Yeh (University of South Florida); Dr. Doulaye Kone (Gates Foundation)

- Dr. Martin Page (USACE ERDC)
 - USACE ERDC is conducting technology demonstrations of expeditionary, deployable water reuse systems at the point of need within the battlefield. Greywater reuse can reduce water demand by 25–50 percent; future building-scale reuse scenarios have the potential to reduce water demand by 90 percent.
 - Collaboration between the U.S. Department of Defense and NSF through <u>WRAP Action 4.8</u> is aimed at developing a protocol (NSF Protocol P248.03) to evaluate the performance of deployable and decentralized non-potable greywater reuse treatment systems for temporary installations.
 - For example, "ALL-H20" is a shower and laundry system on wheels (with off-road capabilities) providing a weekly provision of water to support approximately 300 personnel per day.
- Dr. Daniel H. Yeh (University of South Florida)
 - Off-grid systems eliminate the use of a sewer system. Considerations for developing off-grid systems include energy supply; remote monitoring; maintenance and repair needs; consumables; solids and chemical/biological wastes; reliability, robustness, and resilience; and emergency backups. When commercializing off-grid systems, it is important to engage commercial partners (i.e., those bringing the product to the market) early during the technology development process.
 - Off-grid systems incorporate a mix of digital controls and mechanical processes to reduce reliance on staff resources, though it is difficult to remove operator interactions entirely.
 - The "<u>NEWgenerator</u>" (nutrients, energy, and water generator), developed by the University of South Florida, is a flushed toilet system that operates on solar energy and uses anaerobic membrane bioreactors to reduce energy demand while maintaining reliability and performance.
- Dr. Doulaye Kone (Gates Foundation)
 - The Bill and Melinda Gates Foundation has invested in the "<u>Reinvented</u> <u>Toilet</u>" to improve sanitation globally. This toilet uses combustion for solids processing and recycled water for flushing. It can fit in an indoor bathroom or be configured to have the treatment system outside (effectively replacing a septic tank). The system utilizes the ISO 30500 standard for non-sewered sanitation systems and is now in 29 countries.







Session #11: Visioning for the Future

Moderator: Paula Kehoe (SFPUC)

<u>Speakers</u>: Dr. Newsha Ajami (Lawrence Berkeley National Lab); Dr. Peter Fiske (NAWI); Dr. David Sedlak (UC Berkeley)

During this session, the three speakers provided their views on the status of current approaches to water management, particularly as it relates to onsite reuse, and the directions in which water management needs to head into the future.

- Dr. Newsha Ajami (Lawrence Berkeley National Lab)
 - The 20th century water infrastructure model is defined by linear/oncethrough systems and large infrastructure that brings water from long distances to meet the demand of the "black box." These once-through systems lead to demand hardening (i.e., losing flexibility and agility to respond to droughts).
 - Transition to the 21st century water infrastructure model (i.e., "hybrid infrastructure"), with distributed solutions at various scales both behind and in front of the water meter, involves a shift from "supply-side thinking" to "demand-side thinking."
 - When rolling out the 21st century infrastructure model, there will be a long runway before impacts to a utility's business model are realized. We must ensure public health protection, manage risk of high-visibility projects, engineer margins of safety, and be overly conservative early on.
 - Affordability of transitioning from 20th century model to 21st century model must be considered; customers who cannot afford to go off the grid will be stuck paying for centralized water infrastructure upgrades to meet demands.
 - Utilities are not currently designed to handle climate change; however, demand, rate setting, and business models are being impacted. A decentralized system can revolutionize everything in a utility's business, including function, rate setting, water being taken out of the environment. This concept is bigger than just one technology.
- Dr. Peter Fiske (NAWI)
 - There is a dramatic expansion of performance and a reduction in costs when new technologies enter the world of manufacturing. Learning rate—as in the rate at which we learn how to do things easier, create special components, market things, and more—is associated with Wright's Law.
 - Onsite technology will become cheaper and more reliable as more units are installed. Decreases in water demand and sewage production may impact existing infrastructure. The existence of onsite treatment systems will impact utility revenues, so there is a need to ensure those who cannot afford these







systems are not blocked out. The greatest impacts will likely be felt outside of larger cities. While onsite systems present challenges, they also present opportunities that can be utilized.

- There may come a point in time when implementing small-scale, distributed systems will be lower in cost than implementing another leg of a centralized system. Consider how to move this trend forward. As an example, the building sector has not yet benefited from the process of manufacturing onsite systems; "tech stacking" water and energy may prove useful.
- To embrace the "one water" concept:
 - Invest in regional water systems and consider what is possible from a regional planning approach.
 - When talking to political leaders, translate to terms they will understand. Get beyond just tracking the amount of water being created. Consider all co-benefits.
 - Make sure to present onsite water systems as being beyond "niche solutions"— they need to be part of a community's toolkit for water management.
- Dr. David Sedlak (UC Berkeley)
 - Revolutions have already occurred with centralized water treatment (e.g., three phases of California water reuse revolution); think about a similar revolution for onsite water reuse, although acceleration is needed.
 - Not including cities, 30 percent of the U.S. population lives outside of megaregions. Rural communities could benefit from having off-the-grid homes providing high-quality water.
 - The biggest impact of work being done with onsite systems will be felt in rural communities and rapidly developing countries.
 - With expanding onsite water reuse in cities, there will be more uptake if expansions are focused on building projects that people are passionate about and emphasizing incentives for non-potable onsite reuse (e.g., increased efficiency, achieving ROI). Consider why the public and public health experts may be enthusiastic about these projects—buildings with onsite systems providing public health protection could improve the existing quality of water.
- Q&A Discussion
 - In response to concerns raised by the audience over infrastructure management and learning from mistakes made with septic systems, panelists suggested investing in "data infrastructure" as a line item when incorporating decentralized, onsite systems (e.g., quantifying these systems and avoiding issues currently being experienced with septic systems).







- In response to the concept of subsidizing onsite water reuse as an alternative water management strategy, panelists emphasized many reasons exist to go beyond just economics to incentivize these systems (e.g., reducing CSOs, natural disaster response). Benefits could encourage subsidies in early years, but eventually these begin to evaporate and create a hybrid model.
 - We need to incentivize onsite reuse and embrace what is coming in the future, rather than fighting it. Uptake of solar panels integrating with electric utilities is a good example. Water utilities can embrace the change like electric utilities embraced the uptake of solar panels.
 - Clarify value propositions beyond just economics. What could more distributed systems mitigate in terms of loss of life (e.g., catastrophic wildfires in California) or environmental impacts (e.g., CSOs in New York City)?
 - Think of onsite water reuse not as something society accepts, but rather something it demands. Onsite water reuse is attractive because it benefits public health, economics, and the community.
 - Incentives that create "winners" and "losers" (e.g., disproportionate impacts to low-income and rural communities) should be avoided.

Session #12: Reflecting on the Summit

During this session, Dr. Jay Garland (EPA and a member of the NBRC) discussed some of his perceptions of the status of science, policy, and operation of onsite water reuse systems based on input from the Summit discussions. A forthcoming onsite roadmap will inform next steps.

Dr. Jay Garland (EPA)

- The evolution of water reuse is not linear. There are multiple solutions moving forward—and that is okay!
- Research themes moving forward include creating robust risk-based treatment best practices, assessing system performance through refined monitoring strategies and the use of real-world data, and developing integrated assessments of onsite reuse scenarios and co-benefits.







APPENDIX A – Summit Agenda

Onsite Water Reuse Summit Integration of Science, Policy, and Operation for Safe and Effective Implementation April 10-11, 2024

U.S. EPA Headquarters William Jefferson Clinton East Building 1201 Constitution Avenue, Washington, D.C.

April 10, 2024

8:30-8:45 Welcome Remarks - Mae Wu (Deputy Assistant Administrator for U.S. EPA Office of Water), introduced by Deborah Nagle (Office Director for Office of Science and Technology, U.S. EPA Office of Water)

8:50-9:55 Ensuring Safe Implementation Moderator: Brian Good, Denver Water

- National Water Reuse Action Plan Update Dr. Sharon Nappier, U.S. EPA
- Overview and Accomplishments of the National Blue Ribbon Commission for Onsite Non-potable Water Systems (NBRC) - Paula Kehoe, San Francisco Public Utilities Commission (SFPUC)
- 2017 Health Risk Based Framework Dr. Sybil Sharvelle, Colorado State University
- Updates to Health Risk-based Frameworks and State of Science QMRA -Dr. Michael Jahne, U.S. EPA

10:00 – 10:35 Implementing Policies and Programs Moderator: Tressa Nicholas, Idaho Department of Environmental Quality

- Colorado Regulations Emily Wong, Colorado Department of Public Health and Environment
- San Francisco and Proposed California Regulations Taylor Nokhoudian, SFPUC
- Proposed Washington Regulations Steve Deem, Washington State Department of Health







• New York City Department of Environmental Protection Program - Alan Cohn, NYC DEP

10:35-10:50 Break

10:50-12:00 Conducting Research to Advance Onsite Water Recycling Moderator: Justin Mattingly, U.S. EPA

- Integrated Onsite NPR Modeling: Risk Tradeoffs and Updates to EPA's NEWR Calculator Dr. Sam Arden, ERG
- Development of Log Reduction Values for Onsite NPR Wetlands and Other Treatment Systems Dr. Sam Arden, ERG
- LCCA on Water Reuse for Resilient Buildings Dr. Andy Hur, USACE ERDC
- Conducting Research for Onsite Water Recycling Dr. Harry Zhang, Water Research Foundation (WRF)
- State of the Science on Stormwater Microbial Quality and Treatment Requirements Dr. Sybil Sharvelle, CSU
- Operator Certificate Program Katherine Jashinski, City of Austin
- Single Family Water Reuse Applications Paula Kehoe, SFPUC
- 12:00-1:10 Lunch On Your Own
- 1:10-1:30 Reenter EPA Building and Go Through Security
- 1:30-2:30 Deploying Onsite Treatment Systems and Lessons Learned Part 1 Moderator: Taylor Nokhoudian, SFPUC Implementing in San Francisco and Washington D.C.
 - SF Permitting Program and Lessons Learned Doug Obana, San Francisco Department of Public Health
 - Steve Panelli, San Francisco Department of Building Inspection
 - Brian Good, Denver Water
 - Treating Water Onsite at DC Water Headquarters Robert Bornhofen, DC Water
- 2:35-3:40 Financing ONWS
 - Assessing Costs of Onsite Water Treatment Systems Katherine Jashinski, City of Austin
 - Net Zero Water Toolkit Sharlene Leurig, Texas Water Trade







• District-Scale Implementation and Costs - Bryce Wilson, Lotus Water

- Federal Funding Opportunities Alison Souders, U.S. EPA
- Opportunities for Affordable Housing and Equity Jennifer Walker, National Wildlife Federation

3:45-4:30 **Polling: What Else is Needed to Scale Up Onsite Water Treatment Systems?**

4:30 Meeting Adjourn

April 11, 2024

- 8:30-8:35 Remarks from Bart Weiss, WateReuse Association President
- 8:35-8:50 Welcome to Day 2 David M. Turk (Deputy Secretary, U.S. Department of Energy), introduced by Tanya Mottley (Deputy Director for Office of Science and Technology, U.S. EPA Office of Water)

9:00-9:35 Aligning Plumbing Codes and Standards Moderator: Bill Platten, U.S. EPA

- International Code Council (ICC) Rich Anderson
- International Association of Plumbing & Mechanical Officials (IAPMO) Christopher A. Lindsay
- American Rainwater Catchment System Association (ARCSA) Benjamin Sojka
- National Sanitation Foundation (NSF) Derek Deland
- General Services Agency (GSA) Lance Davis
- 9:40-11:15 Deploying Onsite Treatment Systems and Lessons Learned Part 2 Moderator: Dr. Jay Garland, U.S. EPA

Learning from Designers and Operators

- Biohabitats Erin English
- Trussell Technologies Dr. Brian Pecson
- Sherwood Engineers Jeannette Laramee
- Ecovie Water Management Robert Drew
- Cambrian Innovation Matt Silver
- Aquacell Ben Arnold
- NSU Zach Gallagher
- Epic Cleantec Aaron Tartakovsky

11:15-11:30 Break







11:30-12:15 Advancing Beyond Non-potable Reuse

- Advancing Equitable and Circular Water Solutions Through Source Separation Dr. Miriam Hacker, WRF
- Rainwater for Potable Use Anthony Creech, Virginia Public Health
- Producing Purified Water at SFPUC headquarters Dr. Brian Pecson, Trussell Technologies

12:15-1:25 Lunch On Your Own

1:25-1:45 Reenter EPA Building and Go Through Security

1:45-2:30 Addressing Off the Grid Moderator: Alex Fairhart, Personal Water Systems

- Research and Development of Deployable Water Reuse Systems for Military Applications Dr. Martin Page, USACE ERDC
- NEWgenerator Resource Recovery Machine for Non-Sewered Sanitation and Onsite Water Recycling Dr. Daniel H. Yeh, University of South Florida
- Transforming Sanitation to Combat the Global Water Crisis How will next generation off-grid sanitation technologies contribute to climate resilience? Dr. Doulaye Kone, Gates Foundation

2:35-3:40 Visioning for the Future Moderator: Paula Kehoe, SFPUC

- Redefining Demand Management: Circular Water Solutions for a Climate-Resilient Future Dr. Newsha Ajami, Lawrence Berkeley National Lab
- The Water Washing Machine: Taking Onsite Water Reuse Product Inspiration from the Appliance, Automotive and HVAC Industries - Dr. Peter Fiske, National Alliance for Water Innovation
- Our Onsite Water Future Dr. David Sedlak, UC Berkeley

3:40-4:10 *Reflecting on the Summit Dr. Jay Garland, U.S. EPA*

4:30 Summit Concludes