Executive **Summary**

WATER ENVIRONMENT & REUSE FOUNDATION WE&RF

Water quality guidelines for expanding onsite reuse in buildings and districts

Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-Potable Water Systems (SIWM10C15)

The Central Issue

There is increasing interest in using decentralized non-potable water (DNW) systems (onsite systems) in new and re-development projects on a building and district scale. Yet no national water quality or monitoring standards for such systems exist. In the absence of regulations, how to permit these systems is uncertain. Localities often turn to regulations developed for centralized reuse systems that may not be scale-appropriate. Permitting requests pose challenges in determining which agencies should develop such standards, what those standards should be, and how systems should be monitored to adequately protect public health while also balancing the appropriate risk, cost, and burden of developing and operating systems.

Drivers for DNW Systems:

- Developing "green" (i.e., sustainable and resource-efficient) buildings.
- Meeting certifications for Leadership in Energy and Environmental Design (LEED).
- Reducing demand on local water resources and infrastructure.
- Increasing the reliability and resiliency of water supplies.
- Reducing the discharge to sewers and receiving waterbodies.

Context and Background

The National Water Research Institute (NWRI) formed an Independent Advisory Panel of experts on decentralized systems, wastewater treatment, water quality criteria, and regulations to examine current approaches used to determine water quality criteria and monitoring programs for DNW systems. The panel evaluated the technical, scientific, and regulatory aspects of DNW systems and then established a risk-based framework for determining water quality criteria and management for appropriate uses of DNW systems.

Two workshops with the panel and a stakeholder advisory group comprised of representatives from eight public health agencies and 11 utilities across the country discussed issues and concerns faced when developing and implementing DNW systems to protect public health, and manage cost and operation. The panel listened to stakeholders' experiences, using them to develop a risk-based framework. The panel used a Quantitative Microbial Risk Assessment (QMRA) to determine pathogen reduction targets (human pathogenic viruses, bacteria, protozoa) based on annual "tolerable" risk infection. Source waters addressed include blackwater, graywater, domestic wastewater, roof runoff, stormwater, condensate, and foundation water. End-uses considered included non-potable applications only. Best practices and strategies for sound, safe, and cost-effective monitoring programs for DNW systems over time were also discussed.

Proposed Framework for Implementing Decentralized Non-Potable Water Systems

1. Design

- Select appropriate $\log_{10}$ reduction target (LRT) for the end use.
- Select appropriate treatment process train to achieve the LRT.
- Receive approval by a Professional Engineer.

2. Management Plan

- Specify the Responsible Management Entity (RME) Management.
- Designate the roles and responsibilities of the RME.

3. Permit Application Report Submission

- Specify the design, RME, assurance of reliability via monitoring, commissioning plan, operations and maintenance (O&M) plan, and plan for managing the distribution system.
- Receive sign-off by a professional engineer and approval by the regulatory agency.

4. Construction and Commissioning

- Demonstrate via field verification, when required.
- Submit the Commissioning Report.

5. Operational Monitoring

- Continuously monitor, at high frequency, surrogate water quality and/or operational parameters correlated to the LRTs.
- Include controls for the production of water that is out-of-compliance.

6. Reporting

- Include violations and incidents.
- Use a format for routine reporting that is simple to review.
- Receive approval and enforcement by the regulatory agency.

Findings and Conclusions

The framework in the report provides guidance to develop DNW systems that are reliable, efficient, affordable, and protect public health. The information will allow local and county health officials to develop and approve permits for DNW systems that are protective of public health and that communities can implement in an efficient, effective manner.

Management and Policy Implications

The risk-based framework described in this report seeks to protect public health, while also treating and using "fit-for-purpose" water. Such an approach may help communities better meet water demands locally; reduce transport, treatment, and energy costs associated with water services; and contribute to the broader sustainability of an area's water resources. The framework offers an approach to set water quality criteria and monitoring guidelines that are appropriate for a given DNW system based on the risk potential of that system. The framework utilizes the best available science to date, yet is also flexible to incorporate changes in guidance over time or can be used to develop guidance for water sources and/or end uses not included in this report. It may inform state or national conversations among the regulatory community on how to set appropriate performance standards of these systems to adequately protect public health over the long-term.

Related WE&RF Research

Project Title	Research Focus
Blueprint for Onsite Water Systems: A Step-by-Step Guide for Developing a Local Program to Manage Onsite Water Systems. (SIWM7W14)	Provides a how-to guide for communities interested in developing a program to implement onsite treatment systems. Developed by the SFPUC, WERF, and WRF following a meeting discussing barriers, opportunities, and research needs for these systems.
Using Graywater and Stormwater to Enhance Local Water Supplies: An Assessment of Risks, Costs, and Benefits	Explores alternative water sources, specifically graywater and stormwater, to augment non-potable uses, enhancing water supply reliability and extending the capacity of existing wastewater systems. Non-potable uses include irrigation, toilet flushing, washing, cooling, and groundwater recharge. Research into the risks, costs, and benefits of these uses includes a look at the technical, economic, regulatory, and social issues with these alternative water sources. The work focused on the quality and suitability of water for reuse, as well as treatment and storage technologies. National Academies of Sciences, Engineering, and Medicine. 2016. Washington, D.C.: The National Academies Press. doi:https://doi.org/10.17226/21866. Co-funded by WE&RF.

Additional research on this topic can be found on WE&RF's Decentralized Systems webpage.

Principal Investigator:

Jeffrey J. Mosher, M.S.
National Water Research Institute

Co-Principal Investigators:

Paula Kehoe, M.S.
San Francisco Public Utilities Commission

Suzanne Faubl, M.S., M.E.S.M.
National Water Research Institute

Independent Advisory Panel Members:

Sybil Sharvelle, Ph.D.
One Water, Colorado State University

Nicholas Ashbolt, Ph.D.
University of Alberta

Edward Clerico, M.S., P.E.
Natural Systems Utilities, LLC

Robert Hultquist, P.E.
Environmental Engineering Consultant

Harold Leverenz, Ph.D., P.E.
University of California at Davis

Adam Olivieri, DrPH, P.E.
EOA, Inc.

Public Health Coalition:

Los Angeles County Department of Public Health

New York City Department of Environmental Protection

San Francisco Department of Public Health

Hawaii State Department of Public Health

Oregon Department of Environmental Quality

Minnesota Department of Health

Washington State Department of Health

MIX Paper from responsible sources FSC® C010897

To order: Contact WE&RF at 571-384-2100 or visit www.werf.org and click on Search Research Publications & Tools. **WE&RF subscribers:** Download unlimited free PDFs. **Non-Subscribers:** Charges apply to some products.

Refer to Stock No.: **SIWM10C15**
For more information, contact Katy Lackey at **klackey@werf.org**