REQUEST FOR PROPOSALS (RFP)

Reducing Nitrification Risks Through Collaboration Between Drinking Water Wholesalers and Consecutive Systems (RFP 5348)

Date Posted
March 4, 2025

Due Date
Proposals must be received by 3:00 pm Mountain Time on Wednesday, May 7, 2025.

WRF Project Contact
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Project Sponsors
This project is funded by The Water Research Foundation (WRF) as part of WRF's Emerging Opportunities Program. **The Emerging Opportunities Program has unique proposal requirements. Please follow the submission instructions on page 7.**

Project Objectives
The objective of this research project is to improve nitrification risk management in consecutive drinking water distribution systems. The specific objectives are:

- To catalog the roles and responsibilities of wholesale and consecutive systems—including regulatory requirements, water quality, and operations—and to develop best practices for roles and responsibilities of wholesale and consecutive systems.
- To identify and share strategies that promote communications and collaborations between drinking water wholesale and consecutive systems.
- To develop best practices for effective collaboration between wholesale and consecutive systems in managing nitrification risks.
- To provide guidance to consecutive utilities on preventing, detecting, and responding to nitrification events, including low-level nitrification events.

Budget
Applicants may request up to $100,000 in WRF funds for this project. In-kind support is encouraged, though not required.

Background and Project Rationale

The use of chloramine as a secondary disinfectant for drinking water has significantly increased in the United States (U.S.) since the U.S. Environmental Protection Agency (EPA) implemented its Microbial and Disinfection Byproduct Rules (MDBP) under the 1996 Safe Drinking Water Act Amendments. Today, approximately 30 percent of U.S. drinking water systems use chloramine (Khiari, 2019).

Chloramine is widely adopted because it helps reduce risks associated with regulated chlorine disinfection byproducts, such as haloacetic acids and trihalomethanes, and provides a stable disinfectant residual. Chloramine is also more effective at controlling biofilms that may harbor pathogens, including *Legionella*.

Despite these benefits, the use of chloramine poses challenges, particularly in the promotion of nitrification in the distribution system. If not carefully managed, nitrification can degrade water quality, reduce disinfection residual, increase bacterial growth, and lead to customer complaints, operational difficulties, regulatory violations, and public health concerns. Approximately two-thirds of systems using chloramine experience nitrification (Khiari, 2019).

Managing nitrification risks can be especially challenging for consecutive systems, which often face unique challenges due to limited control over the quality of water they receive and fewer options for addressing nitrification events. Higher temperatures and prolonged water age in distribution systems increase these risks, especially in warmer climates and during summer months. Even if wholesalers deliver water that complies with regulatory standards, external factors—such as climate and water retention time—can still render it vulnerable to nitrification in the consecutive systems' distribution networks.

Effective nitrification management requires a clear understanding of the roles and responsibilities of both wholesalers and consecutive systems. These roles are often defined by the terms of the contract between the two entities, which can vary depending on the specific system and location.

Wholesalers should maintain an adequate disinfectant residual and proper chloramine formation as they deliver potable water to consecutive systems. The regulatory minimum disinfectant residual at the entry point to the distribution system is 0.2 mg/L, and a disinfectant residual cannot be less than this concentration for more than four hours in any 24-hour period. However, wholesalers should maintain levels above this threshold. This residual may be collaboratively negotiated or adjusted temporarily to address specific events or risks, and these adjustments should be clearly defined in the contractual agreement or through event-related discussions.

Once the water reaches the consecutive system, it becomes the responsibility of the consecutive system to manage nitrification risks throughout its distribution network. Consecutive systems are tasked with compliance with all regulatory standards, including monitoring water quality, performing booster disinfection if needed, ensuring that distribution

system operation does not compromise water quality, and maintaining the system through flushing. Storage tanks require additional operation and maintenance efforts, including limiting water age, providing adequate cycling and mixing, and routine cleaning. These activities are crucial in ensuring that nitrification does not compromise water quality or lead to excessive disinfectant decay and increased bacterial growth.

Currently, there is a lack of clear guidance on how wholesale and consecutive systems can communicate, collaborate, and manage these risks effectively. Utilities have identified this gap as a critical need, especially in light of anticipated revisions to the MDBP rules. EPA is expected to propose updates to these rules in 2025, and as part of its rule review process, the agency has sought recommendations from the National Drinking Water Advisory Council (NDWAC). Among its 11 proposed revisions, NDWAC highlighted three key areas directly relevant to wholesaler-consecutive system relationships and the use of chloramine:

1. Developing a numeric disinfectant residual requirement.
2. Addressing data gaps related to disinfection byproducts of emerging concern.
3. Creating model contracts and improving communication between wholesalers and consecutive systems.

If implemented, these recommendations will necessitate stronger collaboration and communication between wholesale and consecutive systems to proactively mitigate nitrification risks. NDWAC also emphasized the importance of establishing communication channels and technical support to enhance utilities' collective ability to manage nitrification and ensure the delivery of high-quality drinking water to consumers.

This project focuses on collaborative efforts between wholesalers and consecutive systems, including treatment, monitoring, operation, reporting, and communication. It will provide actionable guidance to wholesale and consecutive water systems to effectively manage nitrification risks, support public health, improve water quality and operational efficiency, and enhance the overall resilience of drinking water systems.

Research Approach
The following research approach is expected:

1. **Literature review**: Conduct a targeted literature review on nitrification, with a specific focus on wholesale and consecutive water systems. Key focus areas include:
    - Define low-level nitrification events.
        - Analysis of recent studies, reports, and agreements between wholesalers and consecutive systems regarding water quality.
        - Data on nitrification risks, pre-existing conditions such as water age, flow and temperature, and water quality conditions that may exacerbate nitrification.
        - Challenges posed by low-level nitrification events, including their potential to restrict water supply delivery, accelerate regulatory violations, or escalate to severe nitrification risks.

This foundational literature review ensures that subsequent workshop discussions are informed by the latest trends, research gaps, and practical insights.

2. **Survey or Interview**: Conduct surveys or interviews with wholesalers and retailers who have experience with nitrification in their systems. The purpose of this task is to:
   - Gather first-hand insights into the real-world challenges of managing nitrification, especially low-level events, for water systems in a wholesaler-retailer relationship.
   - Collect data on past nitrification occurrences, risk factors, mitigation strategies, and corrective actions used in their systems.
   - Identify any gaps in current understanding or practices related to nitrification.
   - Use this data to inform the workshop discussions, ensuring they are grounded in practical, real-world experiences. The survey should target large chloraminated wholesale agencies and their customers, but smaller utilities should also be encouraged to participate.

3. **Workshop**: Following the Tasks 1 & 2, a full-day, in-person workshop will be conducted. WRF has identified a suitable venue for the workshop, and the project team will coordinate with the WRF Research Manager on workshop logistics. This event will feature interactive participation from stakeholders, including wholesale and consecutive system representatives. Key objectives include:
   - Sharing lessons learned from significant nitrification events.
   - Generating actionable recommendations and strategies for managing nitrification risks, particularly low-level detection events.
   - Developing voluntary model contracts for water quality management.
   - Reviewing existing data sharing platforms and dashboards used for water quality management between wholesale and consecutive systems.
   - Evaluating training programs and tabletop exercises for nitrification event response.
   - Strengthening cooperative communication tools and strategies to enhance collaboration between systems.

   To ensure meaningful participation and preparedness, virtual pre-workshop sessions may be included. *Make sure to allocate a portion of the budget to support participants' travel expenses, if they cannot provide in-kind support for their travel. The budget should include associated costs with hosting the event.*

4. **Final deliverable**: The outcomes of Tasks 1, 2, and 3 will be synthesized into a final research deliverable, documenting:
   - A definition of low-level nitrification events.
   - A definition of specific risk factors that may trigger nitrification events, including significant events.
   - Examples of past nitrification events that involved both wholesale and consecutive systems, incorporating input from utility staff and their regulatory partners as primary sources.
   - Documentation of successful implementation strategies for managing nitrification risks in consecutive systems, including low-level events.

- Practical suggestions from wholesale and consecutive systems, as well as primacy agency representatives, to decrease nitrification occurrences and collaboratively manage nitrification risks.

This report will aim to establish clearer communication channels and technical support mechanisms to enhance the collective capacity of water utilities to manage nitrification and improve the overall quality of drinking water supplied to customers.

Expected Deliverables

- Literature review
- Workshop
- Final report
- Practical guidance documents based on insights from the literature review, survey, and workshop discussion.
- Webcast

Communication Plan

Please review WRF's *Project Deliverable Guidelines* for information on preparing a communication plan. Conference presentations, webcasts, peer-reviewed publication submissions, and other forms of project information dissemination are typically encouraged.

Project Duration

The anticipated period of performance for this project is 12 months from the contract start date.

References and Resources

The following list includes examples of research reports, tools, and other resources that may be helpful to proposers. It is not intended to be comprehensive, nor is it a required list for consideration.

- American Water Works Association, 2013, M56 Nitrification Prevention and Control in Drinking Water, 2nd Edition.
- Do, T., J. Fairey, A. Pifer, D. Wahman, and W. Zhang. 2020. *Assessing Fluorescence as an Early-Warning Indicator of Biological Ammonia Oxidation in Chloraminated Water.* Project 4687. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/assessing-fluorescence-early-warning-indicator-biological-ammonia-oxidation
- Fairey, J., T. Do, R. Hickman, and M. Ware. 2022. *Development and Validation of a Real-Time Fluorescence Sensor Prototype for Early Detection of Nitrification in Drinking Water Distribution Systems*. Project 5073. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/development-and-validation-real-time-fluorescence-sensor-prototype-early

- Khiari. 2019. *The Role and Behavior of Chloramines in Drinking Water*. Denver, CO: The Water Research Foundation: https://www.waterrf.org/sites/default/files/file/2019-12/Chloramines_StateOfTheScience.pdf
- Najm, I. Forthcoming. *A Simple and Cost-Effective Alternative Analytical Method for Monitoring and Optimizing Chloramine Chemistry in a Distribution System*. Project 5215. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/simple-and-cost-effective-alternative-analytical-method-monitoring-and-optimizing
- Regan, R., A. Cho, and S. Kim. 2007. *Monitoring Ammonia-Oxidizing Bacteria in Chloraminated Distribution Systems.* Project 2899. Denver, CO: AWWA Research Foundation. https://www.waterrf.org/research/projects/monitoring-ammonia-oxidizing-bacteria-chloraminated-distribution-systems
- Starke, J., S. Yilmaz, A. Gorzalski, D. R. Noguera, and G. W. Harrington. 2013. *Characterizing the Microbial Community Responsible for Nitrification*. Project 4165. Denver, CO: Water Research Foundation. https://www.waterrf.org/research/projects/characterizing-microbial-community-responsible-nitrification

Proposal Evaluation Criteria

The following criteria will be used to evaluate proposals:

- Understanding the problem and responsiveness to RFP (maximum 20 points)
- Technical and scientific merit (maximum 30 points)
- Qualifications, capabilities, and management (maximum 15 points)
- Communication plan, deliverables, and applicability (maximum 20 points)
- Budget and schedule (maximum 15 points)

Proposal Preparation Instructions

The Emerging Opportunities Program has unique proposal requirements. Please follow the submission instructions below. Proposals not adhering to the guidelines below will not be accepted.

The entire proposal, ***excluding*** the proposal cover worksheet, resumes, budget form, budget narrative, co-funding support form (when applicable), schedule, and references, should **not exceed ten pages in length**. Proposals must include the following components.

- Proposal Cover Worksheet
- **Background and Statement of Need:** Provide a brief summary of the current state of knowledge for the issue that the proposed research will help address, and the drivers for the proposed research.
- **Objectives:** The proposed research objectives should be clearly identified in one or two sentences.
- **Technical Approach:** Describe how the proposed research will be conducted and the tasks necessary to accomplish the objectives.
- **Benefit to WRF Subscribers:** Identify the practical benefits of the proposed research to water utilities and the water community.
- **Research Team and Other Participants:** Identify the key members of the research team and provide brief statements of their qualifications to conduct the proposed research. Identify any other organizations that have committed to collaborate on the proposed research. Curriculum vitae or resumes for research team members are required.
    - **Budget:** A detailed budget is required. The proposal should identify the amount of WRF funds requested and any other cost-share, in-kind, or cash support for the proposed research. Cost-share, in-kind, and cash support are encouraged but not required for submission. The following items will need to be included with the budget. Consult the *Instructions for Budget Preparation* for more information and definitions of terms.
    - Proposal Budget Form
    - Budget Narrative (see *Instructions for Budget Preparation*)
    - Emerging Opportunities Co-Funding Support Form (when applicable): Each co-funding organization providing cash to the project payable directly to WRF must complete a separate *Emerging Opportunities Co-Funding Support Form* and include it with the proposal package.
- **Schedule:** A detailed schedule is required.
- **References** (optional): Detailed citations are not required in the proposal, but may be provided at the discretion of the researcher.

Proposals that include the production of web- or software-based tools, such as websites, Excel spreadsheets, Access databases, etc., must follow the criteria outlined for web tools presented in the *Technology Deliverables Guidance*.

Eligibility to Submit Proposals
Proposals will be accepted from domestic or international entities, including educational institutions, research organizations, governmental agencies, and consultants or other for-profit entities.

WRF's Board of Directors has established a *Timeliness Policy* that addresses researcher adherence to the project schedule. Researchers who are late on any ongoing WRF-sponsored studies without approved no-cost extensions are not eligible to be named participants in any proposals. Direct any questions about eligibility to the WRF project contact listed at the top of this RFP.

Period of Performance
It is WRF's policy to negotiate a reasonable schedule for each research project. Once this schedule is established, WRF and its sub-recipients have a contractual obligation to adhere to the agreed-upon schedule. Under WRF's *No-Cost Extension Policy*, a project schedule cannot be extended more than nine months beyond the original contracted schedule, regardless of the number of extensions granted.

Utility and Organization Participation
WRF encourages participation from water utilities and other organizations in WRF research. Participation can occur in a variety of ways, including direct participation, in-kind contributions, or in-kind services. To facilitate their participation, WRF has provided contact information, on the last page of this RFP, of utilities and other organizations that have indicated an interest in this research. Proposers are responsible for negotiating utility and organization participation in their particular proposals. The listed utilities and organizations are under no obligation to participate, and the proposer is not obligated to include them in their particular proposal.

Application Procedure and Deadline
Proposals are accepted exclusively online in PDF format, and they must be fully submitted before 3:00 pm Mountain Time on Wednesday, May 7, 2025.

The online proposal system allows submission of your documents until the date and time stated in this RFP. To avoid the risk of the system closing before you press the submit button, do not wait until the last minute to complete your submission. Submit your proposal at https://forms.waterrf.org/cbruck/rfp-5348.

Questions to clarify the intent of this RFP and WRF's administrative requirements may be addressed to the WRF project contact, Grace Jang at 303-347-6112 or hjang@waterrf.org. Questions related to proposal submittal through the online system may be addressed to Caroline Bruck at 303.347.6118 or cbruck@waterrf.org**.**

Utility and Organization Participants

The following utilities have indicated an interest in possible participation in this research. This information is updated within 24 business hours after a utility or an interested organization submits a volunteer form, and this RFP will be re-posted with the new information. **(Depending upon your settings, you may need to click refresh on your browser to load the latest file.)**

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