REQUEST FOR PROPOSALS (RFP)

Evaluation and Demonstration of Biotechnological Tools and Methods for Improving Biofiltration Operation and Optimization (5254)

Date Posted
Monday, September 11, 2023

Due Date
Proposals must be received by 3:00 pm Mountain Time on Tuesday, November 21, 2023

WRF Project Contact
Grace Jang PhD, hjang@waterrf.org

Project Sponsors
This project is funded by The Water Research Foundation (WRF) as part of WRF's Research Priority Program.

Project Objectives
This project aims to enhance our understanding of how microbial community structure, function, and dynamics contribute to biofiltration performance and process optimization. With this goal in mind, the specific objectives are:

- To evaluate effects of microbial community structure, function, and population dynamics on biofilter operation and optimization using biotechnological tools and methods.
- To assess usefulness, applicability, implementability, and cost-effectiveness of the tools and methods.
- To recommend the most suitable tools and methods for biofiltration optimization for water utilities.
- To develop a user-friendly utility guidance document to facilitate informed decision-making for effective biofilter operation and optimization.

Budget
Applicants may request up to $300,000 in WRF funds for this project.

Background and Project Rationale
Biological filtration has a long history in water treatment, starting with slow sand filtration in the early 1900s. It relies on the activity of microbial communities present in the biofilter to degrade organic matter and contaminants, converting them into less harmful end products. Over the years, biofiltration has proven to be an effective and sustainable treatment method.

The traditional approach to assessing biofiltration performance primarily focuses on hydraulics and water quality parameters, neglecting the crucial role of microbial communities in the process. However, with advanced biotechnological tools, such as DNA sequencing, metagenomics, and metatranscriptomics, it is now possible to comprehensively analyze microbial communities and determine their respective niches in biofilters. By characterizing the microbial community structure, function, and dynamics, valuable insights can be gained on microbial presence and interactions, metabolic and co-metabolic contaminant degradation pathways, process performance, and approaches for optimizing the system. Understanding how microbial communities contribute to treatment efficacy can help identify key microbial populations or functional pathways responsible for contaminant removal or transformation.

While microbial community analysis offers promising advantages, several challenges have also been identified. WRF project 4620, *Guidance Manual for Monitoring Biological Filtration of Drinking Water,* has highlighted potential challenges, such as data replication, interpretation, and cost considerations, associated with implementing biotechnological tools for monitoring biofilter performance.

This project aims to systematically evaluate how biotechnological tools and techniques can be utilized for effective biofilter operation and optimization. The project will also comprehensively assess the usefulness, applicability, implementability, and cost-effectiveness of these analyses. Furthermore, this project will provide user-friendly utility guidance for informed decision-making on biofilter operation and optimization.

Research Approach

The proposed research approach should be comprehensive and systematic. While this RFP encourages proposers to be creative and original, the following approach can serve as a starting point:

1) **Literature Review**: Conduct a comprehensive literature review to gather existing knowledge on using microbial community analysis techniques in biofiltration. There are several WRF resources as a starting point (see reference section).
2) **Sampling and Data Collection:** Select at least three representative drinking water biofiltration systems for sample collection. Collect samples from different locations (e.g., biofilter influent and effluent, and media bed) and stages of biofiltration process (e.g., immediately before and after a backwash, after a shutdown, during poor performance, etc.) to capture variations in microbial community structure, function, and population dynamics. Apply and evaluate appropriate sampling techniques to ensure the reliability and representativeness of the collected data. Consider investigating effects of seasonal variations, including effects of temperature changes, and comparison between ozone-biofiltration and biofiltration systems.
3) **Microbial Community Analysis**: Choose an advanced biotechnological tool to analyze the collected samples and justify your selection. The selected tool should be able to provide

information, such as key microbial taxa, functional groups, and metabolic pathways that correlate with biofiltration performance and treatment efficacy.

4) **Data Analysis:** Process and analyze the microbial community data using appropriate bioinformatics and statistical methods.
5) **Performance Evaluation:** Correlate the findings from microbial community analysis with traditional parameters for biofiltration performance evaluation (i.e., hydraulic and water quality parameters). Evaluate the relationships between microbial community structure, function, and dynamics with the overall treatment efficiency and contaminant removal in biofilters.
6) **Optimization Strategies**: Based on the insights gained from microbial community analysis and performance evaluation, develop targeted strategies for biofilter optimization. For example, adjustments in operational parameters, media selection, biomass control, or microbial community management approaches to enhance treatment efficacy and system performance.
7) **Utility Guidance**: Translate the research findings into a user-friendly utility guidance document. Develop practical recommendations and guidelines for utilities to implement microbial community analysis in biofilter operation and optimization. Clearly describe the advantages and limitations of microbial community analysis tools and utility expectations regarding how and when the tools and methods can provide useful data/information.

Proposers must provide details on the experimental setup, methodology, data analysis, and any additional research activities they plan to undertake to address the objectives. This RFP encourages creativity, so proposers should consider innovative approaches, advanced analytical techniques, or novel methodologies that can contribute to a more comprehensive understanding of microbial parameters for biofilter operation and optimization.

Expected Deliverables

This RFP is intentionally flexible and encourages proposers to be creative and original in their approach. While specific deliverables may vary depending on the proposed research project, here are a few examples of potential deliverables:

- Research report (must use WRF's Research Report Template, which can be found at https://www.waterrf.org/project-report-guidelines#research-report-template).
- Literature review
- Webcast, conference presentation, etc.
- Peer-reviewed journal article
- Utility guidance manual

The specific deliverables should align with the proposed research project. Proposers are encouraged to suggest innovative and relevant deliverables that can effectively communicate and disseminate the research outcomes to maximize the impact of the study.

Communication Plan
Please review WRF's *Project Deliverable Guidelines* for information on preparing a communication plan. The guidelines are available at https://www.waterrf.org/project-report-guidelines#project-deliverable-guidelines. Conference presentations, webcasts, peer-reviewed publication submissions, and other forms of project information dissemination are encouraged.

Project Duration
The anticipated performance period for this project is 24-36 months from the contract start date.

References and Resources

- Pruden, A., C. Bott, M. Blair, J. Miller, and R. Vaidya. *Characterization of Organic Carbon and Microbial Communities for the Optimization of Biologically Active Carbon (BAC) Filtration for Potable Reuse.* Project 4872. Denver, CO: The Water Research Foundation.
- Pruden, A., P.J. Vikesland, L.C. Marr, L. Zhang, L.S. Heath, and E. Garner. *The Use of Next Generation Sequencing (NGS) Technologies and Metagenomics Approaches to Evaluate Water and Wastewater Quality Monitoring and Treatment Technologies.* Project 4961. Denver, CO: The Water Research Foundation.
- Hooper, J., C. Lauderdale, K. Vickstrom, P. Evans, C. Alito, and S. Black. *Guidance Manual for Monitoring Biological Filtration of Drinking Water.* Project 4620. Denver, CO: The Water Research Foundation.

A copy of the reports will be provided upon request.

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

Proposals submitted in response to this RFP must be prepared in accordance with WRF's *Guidelines for Research Priority Program Proposals*. The current version of these guidelines and the *Instructions for Budget Preparation* are available at https://www.waterrf.org/proposal-guidelines. The guidelines contain instructions for the technical aspects, financial statements, indirect costs, and administrative requirements that the applicant must follow when preparing a proposal.

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 *Web Tool Criteria and Feasibility Study for The Water Research Foundation Project Deliverables* at https://www.waterrf.org/project-report-guidelines#webtool-criteria.

Eligibility to Submit Proposals
Proposals will be accepted from both U.S.-based and non-U.S.-based 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. The policy can be reviewed at https://www.waterrf.org/policies. 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.

Administrative, Cost, and Audit Standards
WRF's research program standards for administrative, cost, and audit compliance are based upon, and comply with, Office of Management and Budget (OMB) Uniform Grants Guidance (UGG), 2 CFR Part 200 Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, and 48 CFR 31.2 Contracts with Commercial Organizations. These standards are referenced in WRF's *Guidelines for Research Priority Program Proposals*, and include specific guidelines outlining the requirements for indirect cost negotiation agreements, financial statements, and the Statement of Direct Labor, Fringe Benefits, and General Overhead. Inclusion of indirect costs must be substantiated by a negotiated agreement or appropriate Statement of Direct Labor, Fringe Benefits, and General Overhead. Well in advance of preparing the proposal, your research and financial staff should review the detailed instructions included in WRF's *Guidelines for Research Priority Program Proposals* and consult the *Instructions for Budget Preparatio*n, both available at https://www.waterrf.org/proposal-guidelines.

Budget and Funding Information
The maximum funding available from WRF for this project is $300,000. The applicant must contribute additional resources equivalent to at least 33% of the project award. For example, if an applicant requests $100,000 from WRF, an additional $33,000 or more must be contributed by the applicant. Acceptable forms of applicant contribution include cost share, applicant in-

kind, or third-party in-kind that comply with 2 CFR Part 200.306 cost sharing or matching. The applicant may elect to contribute more than 33% to the project, but the maximum WRF funding available remains fixed at $300,000. Proposals that do not meet the minimum 33% of the project award will not be accepted. Consult the *Instructions for Budget Preparation* available at https://www.waterrf.org/proposal-guidelines#RPP-instr-budget-prep for more information and definitions of terms.

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. The policy can be reviewed at https://www.waterrf.org/policies.

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 Tuesday, November 21, 2023.

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-5254 .

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Dr. 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.

5254 Utility and Organization Participants

The following utilities have indicated 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 on your settings, you may need to click refresh on your browser to load the latest file.)**

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