



Date Posted: Tuesday, May 16, 2023

REQUEST FOR PROPOSALS (RFP)

Advancing Partial Denitrification Anammox (PdNA) Full-Scale Applications (RFP 5183)

Due Date: Proposals must be received by **3:00 pm Mountain Time on Tuesday, July 25, 2023**
WRF Project Contact: Stephanie Fevig, sfevig@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 will continue the work of WRF project 5095 by:

- Conducting remaining research and finalizing design and operational guidance for partial denitrification anammox (PdNA) full-scale implementation (integrated and polishing processes).
- Advancing the integration of PdNA with biological phosphorus (P) removal through anoxic uptake of P as the main driver of nitrite production from the proof of principle stage towards full-scale testing.

Budget

Applicants may request up to \$250,000 in WRF funds for this project.

Background and Project Rationale

Over the last few decades, nutrient removal technologies for water resource recovery facilities (WRRFs) have mainly focused on biological removal of nitrogen (N) via nitrification-denitrification, and on biological and/or chemical removal of P. These processes are typically energy-, cost-, and footprint-intensive and often involve the addition of costly external carbon. Mainstream shortcut nitrogen removal and mainstream deammonification processes represent a paradigm shift for the sector. Relatively new mainstream approaches and processes such as PdNA (alone or integrated with P removal through anoxic P uptake, which offers additional cost reductions) offer significant advantages, including an increase in treatment capacity; enhancement of overall WRRF efficiency; and reductions in energy, carbon, sludge production, and overall capital and O&M costs.

Integrated and polishing (tertiary) PdNA applications have been proven to meet medium and low total N levels. However, further research is needed to continue advancing full-scale implementation of PdNA, including how to best incorporate it into secondary sludge applications. This project will address key research gaps and build on WRF's current work on PdNA including:

- *Partial Denitrification Anammox as Alternative Pathway to Achieve Mainstream Short-Cut Nitrogen Removal (5027)*

- *Mainstream Deammonification with Biological Phosphorus Removal (5095)*—EPA Science to Achieve Results (STAR) grant number 84008601-0, When a Detour Becomes a Shortcut: Going Full-Scale with Partial Denitrification/Anammox as an Alternative Strategy for Mainstream Deammonification and Incorporating Biological Phosphorus Removal

This project will provide WRF subscribers with implementation (design) guidance on how to potentially integrate these processes into existing or new facilities in response to increasingly restrictive effluent discharge limits and/or to improve the overall cost effectiveness of WRRFs. Key considerations and requirements to fully integrate these new PdNA processes will be identified, along with the level of effluent quality reliability that can be achieved.

Research Approach

The intent of this project is to further refine existing guidance for the integrated and polishing process configurations identified in the *Practitioner's Blueprint/Guidance Document* (project 5095) along with additional configurations (noted below). The project objectives, including key gaps and areas of research advancement, are:

1. Conduct remaining research and to finalize design and operational guidance for PdNA full-scale implementation (integrated and polishing processes) by building on current research and addressing key gaps including:
 - Understanding and management of internally stored carbon (pilot- and full-scale).
 - Pilot- and full-scale testing of first-stage anoxic integrated fixed-film activated sludge configuration (with wastewater carbon, internally stored carbon).
 - Pilot- and full-scale testing of PdNA without advanced aeration controls (e.g., ammonia versus NO_x), such as step-feed flow optimization.
 - Continuation of full-scale testing of PdNA in second anoxic zone.
 - Sustainability analysis for including aspects related to build-up of intermediates such as nitrite and nitrous oxide.
 - Identification of expected full-scale process performance and reliability of meeting effluent permit limits with each configuration.
 - Identification of opportunities for intensification and quantification of capacity gains for each configuration.
 - Providing guidance and limitations for facility retrofits for full-scale implementation.
 - Developing a checklist of information required to develop a full life cycle cost to implement the particular PdNA process modification. This would include appropriate pre-treatment requirements such as implementation of fine screens, piping modification, control system capabilities, and maintenance of instrumentation. Examples of developing business cases for a minimum of two full-scale implemented modifications should be incorporated into the report.
 - Finalizing design guidelines and developing operational process control strategies building on lessons learned from existing full-scale testing.
2. Advance the integration of PdNA with biological P removal through anoxic uptake of P by building on current research and addressing key gaps including:
 - Identification of current knowledge gaps for integration of denitrifying polyphosphate accumulating organisms (dPAOs) and denitrifying glycogen accumulating organisms into PdNA.
 - Pilot-scale testing of approaches to enhance dPAO activity in carbon-efficient PdNA.
 - Identification of challenges and additional research needs.

Expected Deliverables

WRF is open to various types of deliverables that are user-friendly, including practical guidance documents for subscribers to evaluate and implement PdNA.

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 review publication submissions, and other forms of project information dissemination are typically encouraged.

Project Duration

The anticipated period of performance for this project is 2-3 years 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.

- *Mainstream Deammonification with Biological Phosphorus Removal* (5095). Contact Stephanie Fevig for a copy of the draft blueprint/guidance document.
- Riffat, R., H. De Clippeleir, C. Bott, and K. Chandran. 2022. *Partial Denitrification Anammox as Alternative Pathway to Achieve Mainstream Short-Cut Nitrogen Removal*. Project 5027. Denver, CO: The Water Research Foundation.

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 the WRF document *Guidelines for Research Priority Program Proposals*. The current version of these guidelines is available at <https://www.waterrf.org/proposal-guidelines>, along with *Instructions for Budget Preparation*. 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 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. 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 Preparation*, both available at <https://www.waterrf.org/proposal-guidelines>.

Budget and Funding Information

The maximum funding available from WRF for this project is \$250,000. The applicant must contribute additional resources equivalent to at least 33 percent 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 percent to the project, but the maximum WRF funding available remains fixed at \$250,000. **Proposals that do not meet the minimum 33 percent 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, July 25, 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/231294633149862> .

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Stephanie Fevig at (303) 347-6103 or sfevig@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.

5183 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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