



REQUEST FOR PROPOSALS (RFP)

Occurrence and Impact of Simultaneous Nitrification/Denitrification (SND) in BNR Processes (RFP 5423)

Date Posted

Monday, July 27, 2026

Due Date

Proposals must be received by 3:00 pm Mountain Time on Monday, September 14, 2026.

WRF Project Contact

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Project Sponsors

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

Project Objectives

- Establish a definition of “successful” simultaneous nitrification/denitrification (SND) based on a compilation of published and unpublished datasets. Develop a framework for where SND has worked and where it has struggled.
- Identify and characterize the operational, physical, and biological conditions that promote or inhibit SND occurrence at full-scale water resource recovery facilities (WRRFs). This should include an evaluation of the microbial community and the impact of different carbon sources on SND performance.
- Assess current modeling capabilities using commonly used modeling software for accuracy and limitations in SND prediction versus current operations. Provide recommendations for modeling improvements and calibration approaches.

Budget

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

Background and Project Rationale

Nitrification and denitrification processes are conventionally used in municipal WRRFs as part of biological nutrient removal (BNR) to eliminate nitrogenous compounds from wastewater. The nitrification process is performed by ammonia-oxidizing bacteria (AOB) and nitrite-oxidizing bacteria (NOB) that convert ammonia into nitrite and then to nitrate. The denitrification process is performed by heterotrophic denitrifying bacteria that convert nitrate into nitrogen gas (N₂) under anoxic conditions. Due to different functional microorganisms affiliated with

different oxygen environments, conventional plants typically employ separate basins or cyclic aeration for nitrification and denitrification processes. However, numerous facilities have observed the occurrence of both reactions within the same basin, known as SND, in some cases without being intentionally designed for this process. SND has the potential to reduce energy consumption, decrease plant footprint, reduce sludge production, and lower costs by utilizing endogenously available carbon rather than requiring external addition.

Although SND has been observed and reported at a variety of WRRFs, including those operating activated sludge suspended growth systems, it is not reliably achievable or predictable at full scale, even between utilities operating under similar conditions. Furthermore, there is currently no universal definition or specific metric for “successful” SND. As such, the sector’s understanding of SND remains largely empirical, highly site-specific, and poorly predictable, hindering the ability to optimize for it during plant design.

The goal of this project is to better understand the occurrence of SND in activated sludge suspended growth systems by evaluating data from WRRFs where it has been observed, or conversely, designed for but not observed. Researchers will leverage available data to characterize SND occurrence at WRRFs, including the specific microbial consortia associated with these processes, identify operational conditions that promote SND, and quantify the potential capacity impacts of effective SND. The results will enable the development of preliminary guidance for promoting conditions that will foster SND and identify knowledge gaps where experimental work and sampling studies could best provide answers.

Currently, modeling of SND in activated sludge systems is challenging, and the need for improved SND modeling techniques is well recognized. A secondary goal for this project is to provide guidance and recommendations for how to best apply it to activated sludge models.

Research Approach

A successful research approach will, at a minimum, include the following elements:

- Collect and compile published and unpublished data on SND in activated sludge suspended growth systems at WRRFs, including operational data, process design configuration, microbial community data, permit requirements, and physical plant information.
- Use this dataset to:
 - Establish a definition of “successful” SND.
 - Establish a standard way to quantify SND efficiency.
 - Identify any commonalities in process design and operations.
 - Characterize the BNR mechanisms, key microbial organisms, and biomass properties underpinning effective SND.
 - Identify the theoretical and practical limits of nitrogen (N) removal from SND processes.
 - Evaluate the effect of carbon type and availability, carbon-to-nitrogen (C:N) ratios, dissolved oxygen (DO), aerobic solids retention time (SRT), and ancillary processes (e.g., hydrocyclones) on SND performance.

- Synthesize key findings and knowledge gaps regarding system performance, testing for SND, and successful SND performance criteria in activated sludge suspended growth systems, including both systems where SND was intentionally considered in the design and where it was not considered, yet has been observed.
 - Establish a preliminary framework, including main factors that influence the SND performances for conditions under which SND has worked and where it has been unsuccessful.
 - Characterize additional benefits of SND, such as potential reductions in operating costs through energy and chemical savings, biological phosphorous removal, operations and maintenance or capital savings, etc.
- Develop actionable operational guidance to help plants facilitate successful SND and describe which design processes and operational parameters are important for promoting reliable SND. These should include, but are not limited to, DO setpoint, mixing and aeration design, SRT, and carbon source management.

While analysis of SND in other types of BNR systems (e.g., biofilm systems) is not a required component of this project, proposers are welcome to incorporate a wider range of processes, if feasible, in addition to the required focus (activated sludge suspended growth systems).

Expected Deliverables

- Research report (must use WRF's [Research Report Template](#)).
- Assessment of current model capabilities and limitations for SND prediction, with recommended modeling improvements and calibration approaches.
- Operational guidelines for promoting reliable SND and monitoring SND performance.
- Decision framework for when SND can be reliably credited in design and optimization.
- Validated diagnostic protocols for confirming and quantifying SND occurrence.
- Standardized lab- or pilot-scale test protocol for determining a facility's SND potential
- 1-2 case studies of successful SND featuring nitrogen removal performance data, process design criteria, and operation parameters for achieving long-term and reliable SND.

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 36 months from the contract start date.

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 20 points)
- Communication Plan, Deliverables, and Applicability (maximum 15 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 guidelines include instructions on 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, spreadsheets, 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 both U.S.-based and non-U.S.-based entities, including educational institutions, research organizations, governmental agencies, consultants, or other for-profit entities.

WRF's Board of Directors has established a [Timeliness Policy](#) that addresses researchers' 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.

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. 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](#).

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% 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 \$250,000. Proposals that do not meet the minimum 33% of the project award will not be accepted. Consult the *Instructions for Budget Preparation* on the [Outbound Grants page](#) 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 are contractually obligated to adhere to it. 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 for utilities and other organizations that have indicated an interest in this research. Proposers are responsible for negotiating utility and organization participation in their proposals. The listed utilities and organizations are under no obligation to participate, and the proposer is not obligated to include them in their proposal.

Application Procedure and Deadline

Proposals are accepted exclusively through WRF's Portal, and they must be fully submitted before 3:00 pm Mountain Time on Monday, September 14, 2026.

To learn how to submit a proposal for this RFP, please visit www.waterrf.org/proposals and follow the instructions on the page.

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Maitreyi Nagarkar, PhD, at 571.384.2117 or mnagarkar@waterrf.org. Questions about how to submit proposals through WRF's Portal should be directed to [WRF's Customer Care Form](#).