



This project is being funded through the Solicited Research Program's Nutrients Challenge Area (NUTR), which enables WRF to solve broadly relevant subscriber issues and challenges with targeted, sustained research efforts.

The objective of the NUTR challenge is to develop and share credible scientific information about nitrogen and phosphorus in wastewater to help regulators and permittees make informed decisions; and to better understand existing mechanisms of nutrient removal and recovery, best available technologies, and practical limits.

Solicited Research RFP

Practices to Enhance Internal Fermentation of Side-Stream Secondary Sludge and Mixed Liquor Suspended Solids for Biological Phosphorus Removal (RFP #4975)

Project Objectives

The objectives of this project are to develop criteria and guidelines for the design and operation of side-stream secondary sludge and mixed liquor suspended solids (MLSS) fermentation processes and various configurations for enhanced biological phosphorus (Bio-P) removal and to build on the findings of WRF project U1R13/04869 (*Investigation of the Mechanisms for Optimization and Design of a Side-Stream EBPR Process as a Sustainable Approach for Achieving Stable and Efficient P Removal*).

Budget

Proposals may request WRF funds up to \$125,000. WRF funds requested and total project value will be criteria considered in the proposal selection process.

Background

The biological phosphorus removal process has many benefits compared to chemical phosphorus removal including lower cost, lower sludge production, and increased ability to recover phosphorus. Maintaining an adequate supply of readily biodegradable carbon in the anaerobic zone of the biological phosphorus removal process is essential, particularly for facilities with low readily biodegradable chemical oxygen demand (rbCOD)/P ratios in the process influent. Chemical sources of carbon can be added; however, they tend to increase cost and carbon footprint.

Several plants around the U.S. are successfully using primary sludge fermentation for volatile fatty acid (VFA) production for EBPR processes; however, they may not be appropriate for facilities without primary clarifiers or where tank capacity or footprint is limited. In some cases, primary sludge fermentation has been inconsistent and resulted in increased maintenance and operational complexity. Developing process design guidelines for return activated sludge (RAS), mixed liquor, and/or advanced primary sludge fermentation processes is needed following an improved understanding of the fundamental mechanisms and microbial interactions. Process design guidance includes developing design criteria and operational control guidelines for stable operation and optimizing the process for various treatment configurations. Some research has been done in this area, in particular WRF project U1R13 (04869) *Investigation of the Mechanisms for Optimization and Design of a Side-Stream EBPR*

Process as a Sustainable Approach for Achieving Stable and Efficient PRemoval. The goal of the study was to elucidate the fundamental mechanisms involved with side-stream EBPR (S2EBPR). To achieve this, the project team conducted a survey of data from full-scale S2EBPR facilities, simulated side-stream reactor batch testing, performed full-scale pilot testing with side-by-side S2EBPR and conventional EBPR processes, and developed an improved biological process model for S2EBPR.

While many facilities around the world and a few in the U.S. and Canada are using such side-stream fermentation processes, no standard design and operational guidance for optimum operation has been developed to date. Knowledge gaps exist in areas such as the flow proportion of RAS or MLSS diversion, mixing conditions, side-stream hydraulic residence time (HRT) and solids retention time (SRT), optimum redox conditions, and operational strategies and key parameters for process control.

The goal of this project is to develop planning criteria for the design and operation of side-stream secondary sludge and MLSS fermentation processes. This would involve building on the findings from WRF project U1R13 (04869) and identifying the critical parameters needed for optimal design and operations. Addressing potential operational issues with fermentation, such as odor control and struvite formation, are also needed.

The outcomes of this project will help to accelerate the implementation of this new methodology for enhancing the bio-P process and ultimately reduce dependencies on external carbon or chemicals to achieve phosphorus removal goals.

Note: A copy of the report will be provided upon request. Contact Research Manager, Stephanie Fevig, via email at sfevig@waterrf.org.

Research Approach

In order to achieve the objectives, researchers are expected to complete the following tasks, at minimum:

- Review findings from WRF project U1R13 (04869) including the improved EBPR model (with S2EBPR staged cellular maintenance and decay, extent of anaerobic decay, and phosphorus accumulating organism (PAO) and glycogen accumulating organism (GAO) modules and their use in understanding the dynamics in PAO-GAO competition under extended anaerobic incubation) to inform the investigation of design and operational conditions and criteria in this project.
- Investigate and develop a current understanding of the mechanisms to enhance these side-stream fermentation processes. Also include an evaluation of downstream impacts specific to phosphorus recovery and struvite formation.
- Develop criteria for design and operations.
 - Conduct studies to further the current understanding with special focus on the following areas: the role of other PAOs (such as Tetrasphaera) in enhancing EBPR, optimization of side-stream reactor conditions, and impact of percentage of RAS (and where applicable mixed liquor) diversion for side-stream fermentation. Development of the design criteria will likely require a high-resolution investigation of microbial ecology and corresponding characterization of their phenotypic characteristics.
 - Building on this new research and previous studies and following the development of a sufficient understanding of the mechanisms underlying the improved performance of S2EBPR systems, develop design criteria and operational control guidance (e.g., ORP versus SRT).

- Identify additional research needs.

Selection Process and Criteria

Selection of proposals is a very competitive process. Proposals will be reviewed by WRF and the Project Advisory Committee (PAC). This external review team may be complemented as needed by subject matter experts. As part of the evaluation process, WRF reserves the right to request interviews, either via conference call or in person, with qualified proposers if necessary.

Proposers are encouraged to develop and submit their intended research plan that meets the research goals of this RFP, provide sufficient details of their budget, as well as schedules and milestones that can successfully deliver on the stated research goals, objectives, and tasks that are proposed.

WRF will evaluate proposals on the following components:

- **Understanding the Problem and Responsiveness to RFP (20%)**
Does the proposal adequately explain the problem? Does it reflect knowledge of the issue and how solving the problem will benefit the water industry? Have the RFP objectives been adequately addressed? If proposed objectives differ from the RFP, do stated objectives address current or future needs of the water industry? Are data quality objectives specified?
- **Technical Approach and Scientific Merit (40%)**
Is the proposal prepared with supportive information and is it self-explanatory and clearly understandable? Is the proposed effort technically defensible? Is the approach practical? Can the project objectives be achieved in the stated time period with the allotted personnel and budget?
- **Management and Communication Plans (15%)**
Are the roles, responsibilities, and assignments clear? Do the supporting organizations on the team have complementary skills? Does the lead organization have adequate resources to provide the appropriate level of management, oversight, and project implementation? Is the Quality Assurance/Quality Plan acceptable? Are schedules and deliverables clearly defined?
- **Budget and Schedule (10%)**
Is the budget within the advertised budget for the project? Has the applicant provided appropriate (at least 25%) and significant in-kind contributions to the project? Is the level of effort allocated to each task logical? Is the Indirect Cost Rate reasonable (35% or less is competitive) and has it been detailed in the proposal? Is the schedule realistic? Do the proposed budget and schedule match funding needs to milestones and demonstrate the value of the research relative to the proposed cost?
- **Qualifications of Organization and Key Personnel (10%)**
Does the lead organization demonstrate experience and expertise in the issues and objectives discussed in the RFP? Do the key project personnel have experience in the proposed area of research? Have key personnel committed an appropriate amount of time to the project? Are water and wastewater agencies involved?
- **Staff Evaluation and Input Based on Past Performance (5%)**

Proposal Preparation Instructions

Proposals submitted in response to this RFP must be prepared in accordance with The Water Research Foundation's document *Guidelines for Focus Area Program Proposals*. These Guidelines are applied to

the Solicited program as well. The most current version of these guidelines is available at: <http://www.waterrf.org/funding/ProposalDocuments/GuidelinesForFocusAreaProgramProposals.pdf>. The guidelines contain instructions for the technical aspects, financial statements, and administrative requirements that the applicant must follow when preparing a proposal.

Please note that the selection criteria listed here are different from those listed in the Guidelines for Focus Area Program Proposals document. The selection criteria in this RFP will be used to evaluate the proposal.

Eligibility to Submit Proposals

This RFP solicits proposals from all technically qualified applicants, including educational institutions, research organizations, federal or state agencies, municipalities, 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 <http://www.waterrf.org/funding/Pages/policies.aspx>. Researchers who are late on any ongoing WRF-sponsored studies without an approved no-cost extension are not eligible to be a named participant in any proposal. If you have any questions about your eligibility for WRF projects, please contact the WRF research staff listed at the bottom of this RFP.

Administrative, Cost, and Audit Standards

WRF's Solicited Research Program standards for administrative, cost, and audit compliance are based upon, and comply with, Office of Management and Budget Uniform Grants Guidance, 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 Focus Area 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 financial staff should review the detailed instructions included in WRF's annually released *Guidelines for Focus Area Program Proposals*.

Budget and Funding Information

The total funding available from WRF for this project is \$125,000. A minimum of 25 percent of the total project value must be contributed by the applicant (i.e., the applicant's minimum contribution must equal one-third of WRF funds requested). 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 25 percent to the project, but the maximum WRF funding available remains fixed at \$125,000. **Proposals that do not meet the minimum match of 25 percent of the total project value will not be accepted.**

Period of Performance

The proposed project schedule should be realistic, allowing ample time for the preparation of final reports and for review of project results. 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 (9) months beyond the original contracted schedule, regardless of the number of extensions granted. The policy can be reviewed at <http://www.waterrf.org/funding/Pages/policies.aspx>.

Utility and Organization Participation

WRF is especially interested in receiving proposals that include both participation and contribution of resources from water utilities and organizations in the research effort. Information on utilities and/or organizations that have indicated an interest in participating in this research project are listed on the last page of this RFP. While WRF makes utility and organization participation volunteers known to applicants, it is the applicant's responsibility to negotiate utility and organization participation in their particular proposal, and the utilities and/or organizations are under no obligation to participate.

Application Procedure and Deadline

Proposals are now being accepted exclusively online in PDF format. Proposals must be submitted before 2:00 PM Mountain Time, Tuesday, November 27, 2018. All the forms and components of the proposal are available online in the "Proposal Component Packet" zip file. A login is required to download this packet and use the proposal website. *If you have never logged in to WRF's proposal submission system, it is imperative you request a login as soon as possible. It may take up to 48 hours to provide credentials to new users.* This information is available at <https://proposals.waterrf.org/Pages/RFPs.aspx>.

The online proposal system allows submission of your documents until the date and time stated in the 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.

Questions to clarify the intent of this Request for Proposals and WRF's administrative, cost, and financial requirements may be addressed to the Research Manager, Stephanie Fevig, at (303) 347-6103 or by e-mail at sfevig@waterrf.org.

4975 UTILITY AND ORGANIZATION PARTICIPANTS

To date, no utilities have indicated an interest in participating in this research. As utilities express interest, their information will be added below within 24 business hours of receipt of 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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