This project is being funded through the Solicited Research Program's Nutrients (NUTR) and Energy (ENER) Challenge Areas, 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. One of the major objectives of the ENER challenge is to develop low energy treatment process alternatives which will help wastewater facilities to better manage energy usage.

Solicited Research RFP

New Approaches for Reduced Aeration Energy Plus Nutrient Removal (RFP #4976)

Project Objectives

The objectives of this project are to investigate the highly sustainable next generation approaches for reduced aeration energy plus nutrient removal wastewater treatment processes and to develop a detailed presentation of the state of development, benefits, current challenges, and research gaps for each process.

Budget

Proposals may request WRF funds up to $30,000. WRF funds requested and total project value will be criteria considered in the proposal selection process.

Background

New or improved approaches for reliable nutrient removal at a lower carbon, energy, and economic footprint are needed to assist water resource recovery facilities (WRRFs) in reducing their energy demands, costs, chemical usage, and excess solids production. A number of highly sustainable processes used for nutrient removal or in enhancing existing nutrient removal processes have emerged during the last decade. Many of these technologies have undergone different stages of research and testing, but have not reached a point where they are ready for consistent reliable full scale-performance. In some cases, technologies (such as deammonification) have been implemented under specific favorable side-stream conditions, but not significantly under full plant flow and variable wastewater influent characteristics and conditions. In other cases, technologies or approaches may not be integral to the process (e.g., carbon diversion, granular sludge applications) but have a significant direct impact on nutrient removal and aeration energy and additional research is needed for wider full-scale use. In a few cases, new innovative processes have been introduced (e.g., IFAS Anitamox) or have been identified (e.g., mainstream deammonification plus effluent ammonia polishing and consistent availability of nitrite for ammonium oxidizing bacteria), but further research or testing is needed towards broad full-scale implementation.

Of the highly sustainable nutrient removal technologies that emerged and result in lower aeration energy consumption, a consensus is developing on a few that have the most potential in terms of

reduced energy nutrient treatment intensification. These include:

- Membrane aerated biofilm reactor (MABR)
- Mainstream deammonification
- Algae-based high rate nutrient removal
- Low-DO processes, including simultaneous nitrification denitrification with phosphorus removal and/or advanced aeration control strategies
- Processes that rely on or benefit from denitrifying polyphosphate-accumulating organisms (DPAOs – with nitrite-nitrogen as electron acceptor)
- Nitrogen recovery processes (e.g., electrodialysis, Zeolite (or other natural) ion-exchange applications with and without other components such as Anammox deammonification or nitrite shunt), low-input ammonia stripping) with economic-feasibility potential
- Carbon diversion applications including high-rate adsorption-based processes to maximize carbon capture
- Granular sludge processes

These next generation approaches provide the opportunity to reduce energy, reduce footprint, retrofit existing infrastructure, enhance nutrient removal, and simplify processes.

This research area has a high chance of success and there exists a large opportunity to change the industry through longer-term and future-oriented research. Though long term, there are short-term opportunities here, such as MABR and mainstream deammonification, for achieving very low effluent limits. This research area is unique in that it is truly process and technology-based research.

Research Approach

This project is the first of a two-phase approach. This first phase includes a literature review and documentation of the selected technologies' state-of-the-science and research gaps. The second phase (future project) would involve selecting two or three of the most promising processes and funding associated research gaps.

For this project, the following tasks are expected to be completed, at a minimum:

- Conduct a thorough literature review of next generation approaches for reduced aeration energy plus nutrient removal processes, including those processes listed above in the background section.
- Develop a detailed presentation of the selected technologies' state-of-the-science including current state of development, benefits, summary of testing and associated results to date, implementation challenges, and delineation of research gaps to be filled to allow wide full-scale adoption and reliable operation by facilities.

The information gathered would answer the following questions for utilities and designers:

- Why are these technologies of high interest?
- What are the challenges to use these technologies and what research is needed to address them? In evaluating the challenges, please address technical as well as other sustainability considerations such as scientific, business, environmental impacts (e.g., greenhouse gas emissions), and societal.
- How can these technologies be applied towards meeting strict effluent nutrient and ammonia limits?

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 have demonstrated 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 funding available from WRF for this project is $30,000. 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 $30,000. **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 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.

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.)**