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REQUEST FOR PROPOSALS (RFP)

Development of Innovative Predictive Control Strategies for Nutrient Removal (RFP 5121)

Due Date: Proposals must be received by **3:00 pm Mountain Time**
on Tuesday, September 28, 2021

WRF Project Contact: Stephanie Fevig, PE, 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

- Develop one or more artificial intelligence (AI)/machine learning (ML) predictive tools for nutrient removal.
- Demonstrate testing of new predictive control strategies, with a focus on Technology Development Level 2 or 3 (Technology Readiness Level 6-8), with field testing at one utility. This field testing will be complemented by desktop analysis comparing predictive and reactive control strategies.

Budget

Applicants may request up to \$200,000 in WRF funds for this project. WRF funds requested and total project value are evaluation criteria considered in the proposal selection process.

Background and Project Rationale

The Advisory Committee (AC) for WRF's Nutrients Treatment: Intensification, Reliability, and Efficiency research area recently held a [Virtual Research Summit](#) with WRF subscribers, including utilities, consultants, and academics, to identify key research needs and develop project concepts for potential WRF funding. This project is one of the top project concepts that resulted from the summit.

Implementation of online monitoring and automated control strategies is an integral part of achieving process efficiency and intensification at water resource recovery facilities (WRRFs). Many control strategies currently in place at WRRFs are based on reactive approaches that require large design safety factors to ensure reliability in the absence of more advanced, precise controls. Implementation of modern data-driven, predictive control tools has shown promise to improve reliability of operations, with better overall process performance, and with an immediate return on investment (ROI).

This project will focus on innovative predictive control tools for nutrient removal, as well as provide guidance related to applications and comparison to more reactive control strategies including:

- Demonstration of novel predictive control concepts in pilot/full-scale systems.
- Comparison of predictive and reactive control strategies based on application, benefits, and drivers.
- Assessment of the impacts of control strategies on the ability to achieve efficient and reliable reduction of nutrients in the effluent.
- Evaluation of the feasibility of using process modeling in advanced process control.
- Identification of a few specific control strategies that could be implemented based on effluent requirements.
- Description of gaps and considerations that would need to be identified as the tool is used/refined in the future (e.g., long-term reliability, accuracy, and dependency).

This research aims to fill these knowledge gaps and provide a resource for WRF subscribers who are looking to utilize predictive tools to improve and optimize their control systems to not only achieve stringent effluent nutrient limits, but also to operate their systems more reliably and cost-effectively.

Research Approach

This RFP is intentionally flexible in the research approach to encourage creativity and originality from proposers. Proposers should describe how they will conduct the research to meet the objectives listed above, and the proposal shall include or address the following elements in the research approach:

- Problem statement detailing the research gap or question being answered.
- Identify and thoroughly discuss the ML approach(es) that will be investigated/tested in this study, including identification of the existing models that will be reviewed and improved upon. Team expertise and experience with existing models and ML applications should be clearly described in the proposal.
- Identify data sources (online instrument data, lab data, external data such as precipitation data, etc.).
- Data reliability and data validation
- Data pre-processing
- Data QA/QC protocol (with consideration of other industry protocols)
- Real-time data connectivity/data architecture
- Data security
- Desktop model development
- Deployment approaches/automated workflow pipeline
- Strategy for deployment and validation of the model
- Continuous retraining/model validation, and model accuracy updates once model has been deployed. Success will be dependent on the accuracy, reliability, and ease of calibration of the on-line sensors and data collection equipment of the partnering utility for both the inputs and outputs of the tool. The approach and rationale for using specific sensors or analyzers should be clearly stated in the proposal.
- ROI (including cost savings [e.g., chemicals], reduced risks, etc.)
- Transferred learning
- Staffing and training requirements (e.g., education, frequency of training, etc.)

Expected Deliverables

This project is open to creative deliverable products, such as a final report or guidance document on predictive tool implementation along with the modeling approach and a demonstration or recording of the model and ML tool being practically applied at a utility.

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>. 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 24 months 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.

- U.S. Department of Energy-Funded Project (*in contracting*): Crossing the Finish Line: Integration of Data-Driven Process Control for Maximization of Energy and Resource Efficiency in Advanced Water Resource Recovery Facilities (see [Piloting of Emerging Technologies webcast](#))
 - WRF project 5087: [Implementation of Innovative Biological Nutrient Removal Processes through Improvement of Control Systems and Online Analytical Measurement Reliability and Accuracy](#)
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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 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/sites/default/files/file/2021-07/WebToolCriteria.pdf>.

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 \$200,000. 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 \$200,000. **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> 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, September 28, 2021.

The online proposal system allows submission of your documents until the date and time stated in this RFP. Submit your proposal at <https://forms.waterrf.org/212006408384853>

Please ensure you upload the required documents before the deadline. **Proposals submitted after the deadline will not be accepted.**

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.

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.)**

Proposers are strongly encouraged to engage in discussions with potential partner utilities as soon as possible to ensure there is agreement with the proposed study testing requirements and data accessibility needs.

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