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REQUEST FOR PROPOSALS (RFP)

Implementation of Innovative Biological Nutrient Removal Processes through Improvement of Control Systems and Online Analytical Measurement Reliability and Accuracy (RFP 5087)

Due Date: Proposals must be received by 2:00 pm Mountain Time on **Thursday, October 15, 2020**

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

- Evaluate the best technologies, approaches, operations and maintenance (O&M) practices, and requirements for sensors and control systems for intensive biological nutrient removal (BNR) processes with a focus on innovative, but also appropriate, levels of process control complexity.
- Develop a baseline evaluation of sensors available for implementing intensification of water resource recovery systems with particular emphasis on the performance, and necessary O&M requirements, as well as annual cost estimates for maintenance including parts and labor per instrument per manufacturer.
- Identify additional improvements of sensor performance in existing facilities and pave the way for a consistent approach for utilities to reliably operate their BNR processes.
- Engage with utility subscribers through the BNR LIFT Focus Group and other program activities such as LIFT LINK.

Budget

Applicants may request up to \$100,000 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 use of sensors in water treatment has been evolving since the Clean Water Act in the 1970s where designers identified improved treatment efficiency and the ability to intensify treatment processes. Intensification of BNR processes refers to decreasing chemical and energy demands and reducing the process footprint (or increased capacity in an existing footprint) while providing the same level of nutrient removal as traditional methods. Implementation of online monitoring and automated control strategies are an integral part of process efficiency and intensification, which can only be achieved with highly accurate and reliable sensors. These sensors (with or without wet chemistry) require additional maintenance which must be accounted for as part of the intensification benefit. This project will

concentrate on sensors or wet chemistry analyzer performance to identify the most appropriate technology for specific uses.

The reliability of the sensors is both inherent with the sensor itself and the level of attention that it requires and receives. A high level of sensor maintenance requirement can “doom” the process to failure if this attention cannot be provided. There have been a number of instances in which sensors were not robust enough and the control system was abandoned for a host of reasons, including failure of the sensors to remain calibrated and excessive maintenance requirements. In some cases, wet chemistry analyzers may offer better performance for specific applications.

Sensor accuracy and reliability has improved, but the history of these failures has made many senior designers and operators cautious and hesitant in implementing these systems. There is a general lack of a central database on the various sensors available, sensor performance, and O&M procedures. A single peer-reviewed document does not exist.

This research aims to fill this knowledge gap and provide a source for WRF Subscribers who are moving forward with BNR processes and implementing sensor-driven control strategies. The practical implementation of sensor technologies, along with the challenges and maintenance of these sensors will provide designers, operators, and maintenance and management staff a dependable document on this subject.

Research Approach

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

- Review complimentary work conducted under WRF Project 4973, *Guidelines for Optimizing Nutrient Removal Plant Performance*. Contact the WRF Research Program Manager, Stephanie Fevig sfevig@waterrf.org, for information as the project is currently in progress.
- Provide an assessment of online sensors utilized for BNR processes including, but not limited to, dissolved oxygen, oxidation-reduction potential (ORP), and nitrogen (ammonia, nitrite, nitrate, NOx) and phosphorous sensors, based on an evaluation of field data at various water resource recovery facilities of sensors from various vendors.
 - Present sensor performance including precision and accuracy under different operating conditions and various concentration ranges, taking into consideration operational and maintenance factors and conditions such as sensor location, fouling (reversible and irreversible), interfering ions, influence of aeration and mixing, solids concentration and frequency of calibration, and mixed liquor characteristics.
 - Evaluate and identify the labor (e.g., skillsets, hours, manufacturer versus facility staff) and expense for O&M procedures, including probe cleaning, calibration, and maintenance.
- Provide an evaluation of various real-time process control systems currently being used to improve operational efficiency and stability of nutrient removal processes. The evaluation will present information on the beneficial use of such systems, including but not limited to, ammonia-based aeration control, ammonia vs. NOx (AvN) control, aerobic solids retention time (SRT) control, ammonia load-based flow equalization, nitrate-based supplemental carbon feed, the required online sensors, and the strategies for the use of these systems under varying conditions. Proprietary versus open source systems should also be identified.
- Identify what common problems associated with the use of sensors were encountered and how they were rectified.
- Develop a benchmark of reliable sensor performance.

Expected Deliverables

Proposers are open to suggest creative and alternative project deliverables in lieu of a single final report and in collaboration with LIFT. The deliverables should include:

- Recommendations of suitable process control systems/approaches to achieve reliable performance of various BNR process configurations.
- Recommendations of suitable online sensors and their installation, O&M practices to support the implementation of the recommended process control systems.
- Real life evidence to support the above recommendations.
- Documentation of innovative sensors and controls into LIFT LINK.
- Documentation of sensor and control system implementation in the LIFT LINK Projects webpage.
- A LIFT BNR Focus Group webcast to present the project findings.

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 18 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.

- The Water Research Foundation. [BNR Process Monitoring and Control with Online Nitrogen Analyzers for Nitrogen Credit Exchange Program in Connecticut](#) (1526/NUTR1R06y).
- The Water Research Foundation. [Guidelines for Optimizing Nutrient Removal Plant Performance](#) (2020-2021) (4973).
- WEFTEC 2019 Workshop: Advanced Use of Online Analyzers to Meet Nutrient Removal Limits.

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.

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 \$100,000. 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 \$100,000. **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 2:00 pm Mountain Time on Thursday, October 15, 2020. All proposal documents must be compiled into two PDF files consisting of your technical review documents and your financial review documents. All forms and components of the proposal are available in the *Proposal Component Packet* zip file on the proposal website at <https://proposals.waterrf.org/Pages/RFPs.aspx>. An FAQ and a tutorial are also available. A login is required to access the proposal website and download the packet. Proposers are encouraged to create logins and verify the validity and compatibility of the system well in advance in order to avoid last-minute errors or delays.

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.

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.

5087 Utility and Organization Participants

The following utilities have indicated 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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