



## REQUEST FOR PROPOSALS (RFP)

### *Advancing the Understanding of Nitrous Oxide Emissions Through Enhanced Whole-Plant Monitoring and Quantification (5251)*

#### **Date Posted**

Monday, September 11, 2023

#### **Due Date**

Proposals must be received by 3:00 pm Mountain Time on Tuesday, November 21<sup>st</sup>, 2023.

#### **WRF Project Contact**

Ashwin Dhanasekar, Research Program Manager, [adhanasekar@waterrf.org](mailto:adhanasekar@waterrf.org)

#### **Project Sponsors**

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

#### **Project Objectives**

- Provide accurate whole-plant N<sub>2</sub>O emissions estimates for several water resource recovery facilities (WRRFs) that employ commonly used treatment processes, by employing continuous online monitoring for a minimum one-year period.
- Develop guidance on process conditions that lead to high N<sub>2</sub>O formation risk at the facilities, by monitoring other process conditions alongside N<sub>2</sub>O production.

#### **Budget**

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

#### **Background and Project Rationale**

Nitrous Oxide (N<sub>2</sub>O) emissions are a significant and historically underestimated source of greenhouse gas (GHG) emissions from WRRFs, contributing over 70% of the direct emissions for some utilities. As electrical grids decarbonize and the sector transitions away from fossil fuels, N<sub>2</sub>O will become the largest GHG emission source for many water and wastewater utilities. N<sub>2</sub>O has a global warming potential (GWP) 273 times higher than CO<sub>2</sub> for a 100-year timescale. N<sub>2</sub>O emitted today remains in the atmosphere for more than 100 years on average (EPA 2023). The mechanisms of N<sub>2</sub>O generation in WRRFs are complex and influenced by many factors including microbial populations present, their interactions, and their response to different environmental factors and operating conditions. N<sub>2</sub>O emissions vary widely between different facilities even with similar process configurations and display significant spatial and temporal variations even

within one facility or treatment basin. The most common method of estimating N<sub>2</sub>O emissions is the use of an emissions factor (EF) based on a percentage of influent nitrogen converted to N<sub>2</sub>O. However, all currently available N<sub>2</sub>O emissions factors are crude tools that produce estimates subject to very high uncertainty.

The IWA book, *Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems* (Ye et al. 2022), surveyed all currently available literature on N<sub>2</sub>O monitoring at WRRFs from around the world and identified several research gaps. One of these is continuous monitoring of N<sub>2</sub>O at a whole-plant level. Because N<sub>2</sub>O emissions vary so significantly in both time and space even at a single facility, the growing body of plant monitoring research, much of which is based on periodic sampling campaigns, still leaves significant uncertainty in the whole-plant release estimates. More accurate facility monitoring is needed to quantify the problem, inform EF selection, and help formulate utility N<sub>2</sub>O mitigation strategies.

This project aims to accurately quantify annual whole-plant emissions, from several large facilities that employ commonly used treatment processes. The project will provide the information necessary to answer a larger question, “How significant are wastewater facility N<sub>2</sub>O emissions in the context of country-level GHG inventories?” In addition to N<sub>2</sub>O monitoring, the project will also investigate process conditions that lead to N<sub>2</sub>O formation for each facility studied. This study will provide preliminary guidance on how to mitigate N<sub>2</sub>O emissions, as well as which emissions factor is most appropriate to use for facilities that cannot quantify their N<sub>2</sub>O emissions through monitoring. The outcome of this project will advance the knowledge about direct N<sub>2</sub>O emissions from wastewater systems. Project outcomes will be applicable to all utilities with common mainstream treatment processes.

### **Research Approach**

- Identify facilities for monitoring that meet the following criteria:
  - Ability to monitor whole-plant secondary treatment.
  - Have installed or are willing to install N<sub>2</sub>O sensors on any unit process off-gas or inline liquid phase sensors, which are used to monitor and control the process continuously.
  - A combined measure of greatest applicability to other WRRF utility subscribers (with considerations of common treatment process and size of facility).
  - Some level of nutrient removal practiced (N<sub>2</sub>O formation is linked with nitrogen removal processes). The proposer is encouraged to have plants with both with and without nitrogen removal.
- The proposer is encouraged to describe how to approach monitoring across heterogeneous configurations including details on the plant types and configurations, as well as the plan to monitor at each location.
- Based on best practices, design monitoring programs for each facility to include relevant parameters to meet the goals of the project. If possible, include unit process monitoring in addition to the whole-plant monitoring.

- Analyze and report on data collected from the monitored facilities, commenting on which process conditions led to higher or lower N<sub>2</sub>O formation and the potential mechanisms/pathways responsible.
- Develop a set of process N<sub>2</sub>O emission factors and a simple decision tool to help utilities decide which factor is most appropriate at their facilities.
- Develop an estimate (with uncertainty range) of what total process N<sub>2</sub>O emissions might be in the United States, Canada, Australia and other countries where possible. Using the emission factors derived in this project, compare estimated N<sub>2</sub>O emissions at the facilities identified with emission factors in U.S. EPA National Inventory.
- Develop a standard method for conducting on-site N<sub>2</sub>O monitoring.

### **Expected Deliverables**

- Literature review synthesis built from completed and ongoing research
- A final report including estimates of N<sub>2</sub>O emissions from monitored facilities, analyses of all data collected, insight on N<sub>2</sub>O formation risk factors, a simple decision tool, and recommendations for future research
- One open-access peer-reviewed paper
- Webinars and other outreach efforts

### **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#project-deliverable-guidelines>. 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 24 months from the contract start date.

### **References**

EPA (U.S. Environmental Protection Agency). 2023. "Overview of Greenhouse Gases: Nitrous Oxide Emissions." Accessed August 24, 2023. <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>.

Ye, L., J. Porro, and I. Nopens. 2022. *Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems*. IWA Publishing. <https://doi.org/10.2166/9781789060461>.

## **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 15 points)

Communication Plan, Deliverables, and Applicability (maximum 20 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 current version of these guidelines and the *Instructions for Budget Preparation* are available at <https://www.waterrf.org/proposal-guidelines>. 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/project-report-guidelines#webtool-criteria>.

### **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, 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 \$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* available at <https://www.waterrf.org/proposal-guidelines#RPP-instr-budget-prep> 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, November 21<sup>st</sup>, 2023.

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. Submit your proposal at <https://forms.waterrf.org/cbruck/rfp-5251>.

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Ashwin Dhanasekar at 303.734.3423 or [adhanasekar@waterrf.org](mailto:adhanasekar@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](mailto:cbruck@waterrf.org).

## ***5251 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 on your settings, you may need to click refresh on your browser to load the latest file.)**

### **Anna Schroeder**

Engineering Supervisor  
South Platte Renew  
2900 S. Platte River Drive  
Englewood, CO 80110  
(303) 783-6884  
[Aschroeder@englewoodco.gov](mailto:Aschroeder@englewoodco.gov)

### **Charles Bott**

Director of Water Technology and Research  
HRSD  
1434 Air Rail Ave  
Virginia Beach, VA 23455  
(757) 646-7923  
[cbott@hrsd.com](mailto:cbott@hrsd.com)

### **David Inman**

Innovation Project Manager  
Anglian Water Services  
Thorpe Wood House  
Thorpe Wood Peterborough  
Cambridgeshire PE84LL  
United Kingdom  
(780) 383-0467  
[dinman@anglianwater.co.uk](mailto:dinman@anglianwater.co.uk)

### **Wendy Steffensen**

Environmental Project Manager  
LOTT Clean Water Alliance  
500 Adams St. NE  
Olympia, WA 98506  
(360) 528-5773  
[wendysteffensen@lottcleanwater.org](mailto:wendysteffensen@lottcleanwater.org)

### **Mahmudul Hasan**

CTO, Bureau of Water and Wastewater  
200 N. Holliday Street, 3rd Floor  
Baltimore, MD 21202  
(669) 251-6443  
[mahmudul.hasan@baltimorecity.gov](mailto:mahmudul.hasan@baltimorecity.gov)