REQUEST FOR PROPOSALS (RFP)

Head-to-Head GHG Measurement Comparisons: Evaluating Plant-wide and Process-specific Quantification Methods (RFP 5310)

Date Posted
Monday, September 9, 2024

Due Date
Proposals must be received by 3:00 pm Mountain Time on Thursday, November 14, 2024.

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

Project Objectives
To perform greenhouse gas (GHG) measurements using multiple techniques at the same time at two or more water resource recovery facilities (WRRFs) to inform the industry of the advantages and disadvantages of each technique.

Budget
Applicants may request up to $350,000 in WRF funds for this project.

Background and Project Rationale
Many utilities currently report their GHG emissions solely using available calculational methodologies from protocols, particularly to estimate fugitive process emissions. There is a need to gather actual emissions data to inform and improve existing calculation methods, as well as to develop recommended methods for gathering such data, because no standard measurement protocols currently exist. Existing monitoring methods range from broad, plant-wide methods to local, process specific methods.

Examples of methods include:

- Using methane (CH4) or nitrous oxide (N2O) gas concentration measurements in ducts to quantify mass emissions (which are then used to estimate emissions based on correlated, normally recorded operational data)

- Installing fixed measurement devices either in liquid process trains (principally for N2O), ductwork, or adjacent to specific equipment/processes within the plant that are typically large sources of GHG emissions
- Using point-in-time plantwide measurement campaigns (through plant perimeter sampling, using methods such as downwind ground-based drive-bys, airplane flights, or drone-flux-walls)

The project aims to evaluate the performance and limitations of various GHG measurement techniques. The evaluations can guide future studies to determine ways to reduce GHG emissions from wastewater treatment processes. While a number of measurements have been made using these kinds of methods, many have been done without knowing the limitations, shortcomings, and/or advantages of one method over another. As a result, it is very difficult to assess the accuracy and effectiveness of different methods and their suitability in different scenarios. This project should try as many of these techniques at the same time, at plants in diverse climates with diverse process flow sheets, to better inform the industry as to the pros/cons of each GHG-detection-and-quantification approach.

This research effort based on the perspective from North America expects to connect with multiple national-level organizations and their respective global networks to enhance the information exchange and advance the best practices.

Research Approach

The research team will conduct a comprehensive literature review including WRF's research efforts to date (please refer to selected examples in the "References and Resources" section). The research team will conduct an online survey and virtually interview selected utilities, focusing on the perspective of utilities in North America and synthesizing the latest real-world practices and case studies across diverse geographic regions, including those techniques used beyond the water sector (e.g., oil and gas sector.)

The research team should identify at least two candidate WRRFs in different climates to test combinations of techniques. Ideally, each plant would be tested with methods for whole-plant screening and combinations of suitable local/portable methods and local/possibly permanent methods for individual process GHG sources. The research team will look into other ongoing efforts for greater synergy and more cohesive connection. A summary of advantages and limitations for different GHG measurement methods across different geographic/climate regions should be prepared. The selection of WRRFs for field monitoring will be in discussion with WRF and WRF's Project Advisory Committee (PAC). As resources allow, this could include real-time or near real-time monitoring techniques by considering technology advancement. In addition, advanced technique and data science methodology, such as artificial intelligence (AL)/machine learning (ML) that can support a rigorous data-driven method comparison, should be considered as a supplementary addition.

Because there are known to be more Scope 1 sources of methane and nitrous oxide at wastewater plants, the selected two or more facilities should ideally be WRRFs from different

climates and geographic regions. They are preferably those with higher GHG mass emissions and more extensive/diverse process flow trains (for both mainstream and solids treatment). It is envisioned that different methods will result in different quantifications and developed site-specific methodologies. It is also envisioned that the differences will inform a method's appropriateness, accuracy, and completeness. The general approach is to concurrently use the whole-plant methods to scan WRRFs to identify upwind process-unit GHG sources and then use more targeted/local measurements to assess unit-process emissions. Then the correlations among the methods should be analyzed. The methods should be applied during different times of a day to show diurnal variations, as well as summer and winter at a minimum, to account for seasonal extremes. Collected data would be correlated to measured plant operating data and used to develop process-unit methodologies and to develop an annual emissions estimate.

Having an annual emissions inventory is important for setting baseline values against which future targeted reductions can be compared. Plant-wide GHG measurement techniques could also be used for plant-wide methodologies. The entire assessment will inform the industry as to which methods best support annual estimate generation, which methods best support identification of actions to reduce emissions, and which methods are most cost-effective in achieving other desired outcomes.

For broader community outreach, the research team will conduct one webcast hosted by WRF and collaborating organizations on the overall findings of this project. The research team should consider additional outreach activities, such as presenting project findings at conferences and submitting a paper to an open access peer-reviewed journal.

Expected Deliverables

Expected deliverables from this project include:

- A comprehensive synthesis on "State-of-the-Practice" based on completed and ongoing research, including annotations for the list of publications and resources used.
- A user-friendly utility-facing guidance document.
    - The guidance document will include an interactive decision tree process for method comparisons (e.g., advantages and limitations; cost range/order-of-magnitude cost information) that can facilitate decision-making at utilities and municipalities in North America.
    - Part of this document will include a chapter that summarizes the knowledge gaps, research needs, and preliminary project concepts for recommended research projects to fill those gaps.
- One invitation-only virtual workshop for utility peer-to-peer information exchange, including workshop planning and all supporting materials (e.g., agenda, presentations, meeting notes, and workshop summary).

- Broader outreach:
  - Webcasts and public outreach materials such as conference presentations. Submit one open access peer-reviewed journal paper.

Communication Plan
Please review WRF's *Project Deliverable Guidelines* for information on preparing a communication plan. 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 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.

- Intergovernmental Panel on Climate Change (IPCC). 2022. *Sixth Assessment Report (AR6).* IPCC. https://www.ipcc.ch/assessment-report/ar6/

- Moore, D. P., N. Li, L. Wendt, S. Castañeda, M. Falinski, J. J. Zhu, C. Song, Z. J. Ren, and M. A. Zondlo. 2023. Underestimation of Wastewater Treatment Methane Emissions in the United States. *Environmental Science & Technology*, 57 (10): 4082–4090. https://pubs.acs.org/doi/10.1021/acs.est.2c05373

- Parravicini V., P. H. Nielsen, D. Thornberg, and A. Pistocchi. 2022. "Evaluation of Greenhouse Gas Emissions from the European Urban Wastewater Sector, and Options for their Reduction." *Science of the Total Environment* 838 (2022) 156322. https://www.sciencedirect.com/science/article/pii/S0048969722034192

- Ren, Z. J., J. L. Schnoor, K. R. Pagilla, A. J. Simon, S. W. Snyder, A. Shaw, K. Chetty, T. F. Chan, E. Lindsey, A. Kadava, B. Stevenson, K. R. Pagilla, P. Parameswaran, J. A. Deaver, S. C. Popat, V. Khanna, M. Kratzer, M. Harclerode, J. M. Sonawane, D. Plant, K. McCullough, S. Klaus, C. Bott, A. Onnis-Hayden, D. Wang, A. Akbari, M. Nguyen, A. Z. Gu, L. Mendez, C. A. Sepulveda-Munoz, M. del Rosario Rodero, I. de Godos, R. Munoz, M. Urgun-Demirtas, R. Dalke, K. R. Pagilla, B. Xu, S. Huang, C. Wang, T. C. A. Ng, H. Y. Ng, H. R. Molitor, J. L. Schnoor, A. Wang, B. Wang, Z. Guo, W. Cai, W. Liu, J. McQuarrie, J. Qu, H. Ren, H. Wang, K. Wang, G. Yu, B. Ke, H-. Q. Yu, X. Zheng, J. Li, K. B. Newhart, A. S. Hering, T. Y. Cath, J. A. Turgeon, S. A. Conrad, P. A. Vanrolleghem, and G. T. Daigger. 2022. *Pathways to Water Sector Decarbonization, Carbon Capture and Utilization*. Edited by Z. J. Ren, and K. Pagilla. IWA Publishing. https://doi.org/10.2166/9781789061796

- Song, C., J. J. Zhu, J. L. Willis, D. P. Moore, M. A. Zondlo, and Z. J. Ren. 2023. Methane Emissions from Municipal Wastewater Collection and Treatment Systems. *Environmental*

Science & Technology, 57 (6): 2248–2261. https://pubs.acs.org/doi/full/10.1021/acs.est.2c04388

- The Water Research Foundation (WRF). 2024. *Climate Change-Related Projects*. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/topics/climate-change.

- U.S. EPA. 2022. "GHG Inventory Development Process and Guidance." U.S. Environmental Protection Agency. https://www.epa.gov/climateleadership/ghg-inventory-development-process-and-guidance

- Ye, L., J. Porro, M. Pijuan, Y. Zhao, O. Gutierrez, H. Duan, Z. Wu, K. R. Sharma, A. C. Brotto, A. Lake, V. Parravicini, A. Filali, A. Delre, V. Vasilaki, E. Katsou, M. Sperandio, L. Lang, F. Sabba, R. Nerenberg, P. Vanrolleghem, C. Domingo-Felez, B. F. Smets, B-. J. Ni, Z. Yuan, K. Sharma, M. R. J. Daelman, M. C. M. van Loosdrecht, E. I. P. Volcke, X. Flores-Alsina, M. Arnell, L. Corominas, C. Sweetapple, G. Fu, D. Butler, K. V. Gernaey, J. Porro, G. Bellandi, and I. Nopens. 2022. *Quantification and Modelling of Fugitive Greenhouse Gas Emissions from Urban Water Systems*. Edited by L. Ye, J. Porro, and I. Nopens. 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* and *Instructions for Budget Preparation*. These 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 *Technology Deliverables Guidance*.

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. 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.*

Budget and Funding Information
The maximum funding available from WRF for this project is $350,000. 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 $350,000. Proposals that do not meet the minimum 33% of the project award will not be accepted. Consult the *Instructions for Budget Preparation* 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.

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 Thursday, November 14, 2024.

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-5310.

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Harry Zhang, PhD, PE; hzhang@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 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.)**

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