



THE
Water
Research
FOUNDATION

FOCUS AREA RFP

This project is being funded through the Focus Area Program, which enables WRF to solve broadly relevant subscriber issues and challenges with a targeted, sustained research effort. The program is developed around research Focus Areas: a topic area that is of high interest and priority to WRF subscribers because of a challenge or opportunity that is present, emerging, or anticipated, and for which research will help subscribers manage and address the challenge or optimize the opportunity. A focus area includes a discrete challenge or opportunity statement, measurable objectives, and one or more projects that will lead to applied solutions and benefits for WRF subscribers within a specified, relevant time frame.

*This project is funded under the Focus Area titled, **Non-Regulated Disinfection By-Products in Drinking, Recycled, and Desalinated Water: Occurrence, Toxicological Relevance, and Control Strategies** and is intended to support the Focus Area objective(s):*

- *Develop a better understanding and identify the factors that impact the formation of non-regulated DBPs during water treatment processes.*
- *Develop control strategies that minimize the formation of regulated DBPs while preventing the formation of non-regulated DBPs of potential health concern.*
- *Identify sources of bromide, iodide, and dissolved organic nitrogen (DON), and develop removal strategies.*
- *Provide guidance to utilities to comply with regulations while minimizing unintended consequences.*

The Impact of Pre-Chlorination and GAC Treatment on DBP Formation and Overall Toxicity in Drinking Water (RFP #4916)

Project Objective

The objective of this project is to investigate the impact of pre-chlorination followed by GAC on the removal of cytotoxicity and genotoxicity of drinking water, using appropriate bioassays.

Budget

Proposals may request WRF funds in the range of \$275,000-\$300,000. WRF funds requested and total project value will be criteria considered in the proposal selection process.

Background

Over the last 30 years, significant research efforts have been directed toward increasing our understanding of disinfection byproduct (DBP) formation, occurrence, and health effects. More than 600 DBPs have now been reported in the scientific literature, though only 11 are currently regulated by the US EPA. Various control strategies are available to ensure that water utilities provide adequate primary disinfection while minimizing DBPs in the distribution system. Some control strategies focus on alternatives to chlorine for disinfection practices (e.g., chlorine dioxide, ozone, or UV for primary disinfection and chloramination for residual disinfectant), while others focus on greater degree of removal of DBP precursors through source water protection, enhanced coagulation, powdered activated carbon (PAC) adsorption, or granular activated carbon (GAC) adsorption, to name a few.

This current RFP is specifically designed to fund an investigation of how the use of GAC in combination with various pre-GAC oxidation and post-GAC disinfection strategies (in terms of oxidant choice and point of application) would impact the formation of regulated and non-regulated DBPs, including nitrogenous DBPs (N-DBPs) such as nitrosamines, haloacetamides (HAMs), haloacetonitriles (HANs), and halonitromethanes (HNMs). Additional carbonaceous DBPs (C-DBPs) could include haloacetaldehydes (HALs), haloketones (HK), iodinated trihalomethanes (I-THMs), iodinated haloacetic acids (I-HAAs), and each of the chlorinated and brominated haloacetic acids (HAA9, including 5 regulated and 4 non-regulated).

The recently completed WRF Project 4560 (GAC Control of Regulated and Emerging DBPs of Health Concern) included a quantitative evaluation of approximately 70 C-DBPs and N-DBPs across GAC and biologically active GAC (i.e., BAC) in multiple source waters (surface waters, reclaimed water, I⁻ and Br⁻ impacted waters, and algal-impacted waters) and with various pre- and post GAC/BAC oxidation strategies including chlorine and monochloramine. Bench scale, pilot scale, and full-scale studies were completed and included a calculation of cytotoxicity and genotoxicity using methods published by Plewa et al¹ (2017). However, no actual bioassays were conducted to validate the calculated toxicity and to serve as a comparison to validate what percentage the measured DBPs represented relative to actual bioassay measurements.

Research Approach

This project would complement the recently-completed research from Project 4560 by including mammalian cell cytotoxicity and genotoxicity research with GAC treated water preceded and/or followed by chlorination or chloramination, and these would be compared to controls without GAC. Combinations of biologically active carbon filtration could be considered as well, both with free chlorine and chloramines.

To adequately represent a wide range of source water conditions, this research should address the impact of varying bromide and iodide levels in source waters and multiple potential source water types and impacts. Ozone is not specifically called out as a pre-oxidation strategy for investigation; as such, the research team should justify if and why the inclusion of ozone or other pre-oxidation strategies should be a part of the study. The bioassay-derived real toxicology data will provide information on the whole DBP mixture, accounting for both known DBPs that can be measured, and for DBPs that are not yet known. This will allow a true picture of to what extent GAC (with and without pre-chlorination) significantly reduces the toxicity of treated drinking water.

Along with toxicology, quantitative analysis of a suite of C-DBPs and N-DBPs should be included along with total organic chlorine, bromine, and iodine (TOCl, TOBr, and TOI). These measurements will make it easier to correlate toxicology data with the measurable DBPs thus providing practical guidance to water treatment professionals.

In addition, the research team should justify the mix of bench, pilot, and full-scale samples from various geographical areas to maximize our ability to understand the impact of pre-chlorination strategies on genotoxicity and cytotoxicity.

The final deliverable will provide recommendations on how to optimize treatment to minimize the overall toxicity of finished water.

¹ Plewa, M. J.; Wagner, E. D.; Richardson, S. D., TIC-TOX: A preliminary discussion on identifying the forcing agents of DBP-mediated toxicity of disinfected water. *J. Environ. Sci.* **2017**, *58* (Supplement C), 208-216.

Proposal Preparation Instructions

Proposals submitted in response to this RFP must be prepared in accordance with the Water Research Foundation document “Guidelines for Focus Area Program Proposals.” The most current version of these guidelines is available at <http://www.waterrf.org/funding/Pages/proposal-guidelines.aspx>. The guidelines contain instructions for the technical aspects, financial statements and administrative requirements that the applicant must follow when preparing a proposal.

Eligibility to Submit Proposals

This RFP solicits proposals from all technically qualified U.S. based or non-U.S. based applicants, including educational institutions, research organizations, federal or state agencies, local municipalities, and consultants or other for-profit entities. *(If there is any funding from non-WRF sources, check with WRF Grants Management regarding possible eligibility restrictions)*

WRF’s Board of Trustees has established a Timeliness Policy that addresses researcher adherence to 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 Manager listed at the bottom of the RFP.

Administrative, Cost and Audit Standards

WRF’s Focus Area 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 the 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 in the range of \$275,000-\$300,000. A minimum 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 \$300,000. **Proposals that do not meet the minimum 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 which 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 only format and must be fully submitted before August 22, 2018, 5pm Mountain Time. 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. 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, Djanette Khiari, at 303.734.3478 or by e-mail at dkhiari@waterrf.org.

4916 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 when a utility 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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