



This project is being funded through the Solicited/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 topics that are 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.

It is a collaborative project that engages objectives from both the Sustainable Integrated Water Management (SIWM) and Compounds of Emerging Concern (CEC) programs at WRF. The objective of the SIWM program is to engage partners to advance sustainable integrated water management for communities. The goals of the CEC program are to provide the frameworks, tools, and data that utility and industry managers need to optimize removal, evaluate potential public health and ecological impacts, support facility design, and enhance effective risk communications and risk management decisions by all stakeholders.

Solicited Research RFP

Expanding the Use of Wastewater Epidemiology Tools to Improve Water Quality, Identify Service Populations under Stress, and Promote One Water Goals for a Thriving City (RFP #4972)

Project Objectives

- To advance our understanding of and the use of existing wastewater epidemiology tools within the context of recent drug use and abuse crises in service areas of various utilities in the U.S.
- To identify specific opioid compounds of interest (e.g., hydrocodone, tramadol, oxycodone, methadone, codeine, dihydrocodeine, nicocodeine) and build upon existing surveillance and monitoring systems with feedback loops to improve water quality and social outcomes.
- To leverage data and water quality controls in the wastewater sector to help cities achieve the interrelated goals of One Water management (environmental, social, and economic).

Budget

Proposals may request WRF funds for up to \$200,000. WRF funds requested and total project value will be criteria considered in the proposal selection process. This project requires at least a 25% in-kind match from the Principal Investigator and/or partners.

Background

As the water/wastewater sector moves towards a One Water approach, utilities are engaging in “silo-busting examples of integrated and inclusive approaches to water” management and services (US Water Alliance, 2016), all while seeking to simultaneously meet social, economic, environmental, public health, and resiliency goals. A One Water approach focuses on achieving multiple benefits for the economy, environment, and society, as well as building innovative partnerships to ensure water security, high water quality, and community resiliency. The health of our waterways and our community members are key aspects of a One Water future.

Wastewater-based epidemiology is a fast growing and innovative approach that provides important information for utilities or health organizations on water quality and source control issues. It can also be used to estimate drug use in stressed service areas, exploring potential for the wastewater sector to inform community health programs. Sampling wastewater for certain drugs can occur at the plant influent or upstream in the collection system to detect habits of smaller communities or areas of a particular community to provide “data on hard-to-measure health behaviors and conditions for an entire community” (Burgard et al., 2017). In fact, such analyses have the “ability to deliver near real-time data is particularly relevant to the mercurial nature of today’s drug problem” in the absence of reporting bias (Castiglioni et al., 2016).

Since 2007, initiatives in Europe and Australia have supported the development of wastewater analyses and epidemiology for tools to estimate drug use and prescription drug abuse. Drugs are detected in wastewater, as ingested substances metabolize in the body and are excreted in urine and feces. While several wastewater studies are working in concert with drug monitoring programs in these countries, this is an understudied area in the U.S. that holds potential for improving both source water controls and public health outcomes. Studies in the U.S. have not been fully implemented in terms of realizing outcomes important to human health. One of the key goals of this project will be to focus on impactful outcomes in the communities by connecting the scientists and social scientists, health care providers, and other community stakeholders to collaboratively develop a framework for making decisions and bringing in needed resources to assist stressed communities.

Wastewater epidemiology to identify the next drug “du jour” in U.S. communities is “an underdeveloped and underused resource in public health and safety research...despite the potential bounty of information” (Burgard et al., 2017). Research indicates that it is possible to measure metabolites and compounds excreted—biomarkers that could be used to estimate the number of people contributing to these compounds at a given time.

However, more research is needed on the particular compounds that serve as good biomarkers for recent drug crises. As drugs biotransform in the environment and increase in potency during anaerobic digestion processes, rather than degrade, such detection can inform the necessary source-water controls, treatment, and social interventions to protect water quality and aquatic life. The more commonly studied drugs and/or metabolites include benzoylecgonines (cocaine), amphetamine, methamphetamine, 3,4-methylene-dioxymethamphetamine (MDMA), 6-monoacetylmorphine (6-MAM, heroin), and THC-COOH (cannabis) (Burgard et al., 2017). Further testing for pharmaceutical opioids, however, will collect valuable data to understand the volume of prescribed drugs that are actually consumed. This will lead to a better understanding of the extent of overprescribing, prescription drug abuse, and give utilities a “leg up” in preparing source controls for future water quality management.

The core mission of wastewater utilities is to protect human health and the environment. This project helps achieve that mission by duly focusing services on parts of the population that need health support and working to provide better source controls and protect water quality. This interdisciplinary and cross-WRF research program project is a demonstration on how to meet multiple goals of the One Water approach including thriving circular cities (#2), social and economic inclusion (#5), and healthy waterways (#6) (US Water Alliance, 2016).

Benefits

- Builds upon the best and most currently available science to advance wastewater testing for sound water quality and social impact decision making.
- Provides source-control data to support improved take-back programs and community education on protecting waterways with proper drug disposal awareness.
- Aligns with and promotes cross-sector collaboration and integration within WRF research programs to achieve the goals of One Water management, particularly goals #2, #5, and #6 for thriving cities, social inclusion, and healthy waterways.
- Provides case studies that will serve as a clearinghouse for utilities interested in using wastewater epidemiology to change pre-treatment processes.

Research Approach

This project will build upon existing evidence-based wastewater epidemiology studies and the fate of compounds of emerging concern research by WRF and others, adapt existing tools from Europe/Australia, and characterize recent drug epidemics in the U.S., such as the opioid crisis.

1. Develop a sampling and monitoring protocol for recent drug epidemics in the U.S. at wastewater utilities.

The project will review existing knowledge and tools in use in Europe/Australia and the feasibility of adapting a tool for use in the U.S. The protocol developed will be piloted in Task 2. The research team will determine the most suitable biomarker for pharmaceutical opioids, as well as sampling procedures at wastewater plants. Tools for consideration may include high resolution mass spectrometry (HR-MS) devices, DNA-based sensing devices, thermal desorption direct analysis in real time mass spectrometry (TD-DART-MS), ion mobility spectrometry (IMS), or other potential analytical methodologies. Consideration should be given to optimizing sample collections and analytic methods for detection in labs.

2. Pilot the surveillance program from Task 1 at three to five utilities in communities around the country.

This project will focus on the detection and monitoring of pharmaceutical opioids, rather than non-pharmaceuticals, fentanyl, or heroin. Compounds of interest, including respective degradation products, will likely include: hydrocodone, tramadol, oxycodone, methadone, codeine, dihydrocodeine, nicocodeine. The research will identify a list of potential pilot communities to be approved by the Project Advisory Committee (PAC). In coordination with local agencies and partners, identify priority target areas using the Overdose Detection Mapping Application Program (ODMap) or other geographical visualization systems, collect samples for a six to 10-month period, and analyze data for quantity of pharmaceutical opioids present, as well as trends over time (e.g., diurnal/nocturnal, weekday/weekend). This will help determine whether these trends match expected use patterns and identify peak flows coming into the facilities.

3. Compare data to reports on the opioid crisis and characterize in the context of wastewater flows.

Data from Task 2 will be compared to self reports on drug use, instances of fatalities, treatment data, and police data. Analyze patterns or discrepancies in trends identified through the wastewater epidemiology studies with public health data. This may involve overlapping ODMAP data, data collected from the pilots, and sewer system maps.

4. Develop recommendations or a framework for improved community-based surveillance monitoring programs at wastewater utilities.

Results from Tasks 1-3 will inform a monitoring framework or surveillance approach for wastewater utilities to adapt in order to reduce drug use and harmful releases to the aquatic environment. Considerations should include improved water quality outcomes, social outcomes, and communication channels between utilities and their service communities. This may include building a framework for testing and wastewater analyses programs that may be adapted for newly emerging or future drug crises. The framework could leverage previous WRF studies (03-CTS-21UR and 03-CTS-22UR) to establish a screening perspective for the suite of potential drugs. For instance, examining whether the suite of drugs act the same as one another or other compounds of emerging concern, identifying methods for removal, and understanding the fate of their transformation.

Deliverables

- Case studies from the three to five utility pilot surveillance programs.
- Final Report to include data comparisons, recommendations, and a framework for future monitoring and surveillance programs.

What Success Looks Like:

- Strong, collaborative, and experienced team with stakeholders/partners including, but not limited to scientists, social scientists, human health organizations, utilities, regulatory agencies, first responders, and community leaders.
- Development of a multi-prong framework that focuses on collaboration and communication among the community stakeholders to achieve results and provide needed resources to stressed communities.
- Development of a framework, with tools, that meets the project goals and can easily be adapted to monitor and screen other drugs or harmful constituents.

Resources and References

Proposers should be aware of these and other resources. A strong proposal will leverage pre-existing information.

Beeson, J. *Overdose Detection Mapping Application Program (ODMap)*. HIDTA: High Intensity Drug Trafficking Areas. Washington/Baltimore.

Burgard, D.; Bisceglia, K.; Banta-Green, C. *Wastewater Testing: A Pipeline to Public Health Data. Research Brief*. Mathematica Policy Research, Inc., 2017.

Castiglioni, S. *Assessing illicit drugs in wastewater: Advances in wastewater-based drug epidemiology*. European Monitoring Centre for Drugs and Drug Addiction, 2016.

Castiglioni, S.; Mueller, J.; Thomas, K.; Vandam, L.; Griffiths, P. *International Wastewater Studies on Drug Use: Success and Hurdles*. Research Brief. Mathematic Policy Research, Inc., 2017.

Drewes, J.E.; Dickenson, E.; Snyder, S. *Contributions of Household Chemicals to Sewage and Their Relevance to Municipal Wastewater Systems*. Project No. 03-CTS-21UR. Water Environment Research Foundation (WERF): Alexandria, VA, 2009.

EMCDDA. *Wastewater analysis and drugs: a European multi-city study*. European Monitoring Centre for Drugs and Drug Addiction, 2016.

National Wastewater Drug Monitoring Program: Report 4. Australian Criminal Intelligence Commission. University of Queensland, Australia, University of South Australia, Queensland Alliance for Environmental Health Sciences. Commonwealth of Australia, 2018.

Sisco, E.; Verkouteren, J.; Staymates, J.; Lawrence, J. Rapid detection of fentanyl, fentanyl analogues, and opioids for on-site or laboratory based drug seizure screening using thermal desorption DART-MS and ion mobility spectrometry. *Forensic Chemistry*, 2017, 4, 108-115.

“Town of Cary wants to screen sewage to find opioid users.” WRAL.com News, February 22, 2018. Available online: <https://www.wral.com/town-of-cary-wants-to-screen-sewage-to-find-opioid-users/17364027/>. Accessed: 10 May 2018.

US Water Alliance. *One Water Roadmap: The Sustainable Management of Life’s Most Essential Resource*. The US Water Alliance: San Francisco, CA and Washington, D.C., 2016.

Stephenson, R.; Oppenheimer, J. *Fate of Pharmaceuticals and Personal Care Products Through Municipal Wastewater Treatment Processes*. Project No. 03-CTS-22UR. Water Environment Research Foundation (WERF): Alexandria, VA, 2017.

Selection Process and Criteria

Selection of proposals is a very competitive process. Proposals will be reviewed by WRF and the PAC. This external review team may be complemented as needed by subject matter experts. As part of the evaluation process, WRF reserves the right to request interviews, either via conference call or in person, with qualified proposers if necessary.

Proposers are encouraged to develop and submit their intended research plan that meets the research goals of this RFP, provide sufficient details of their budget, as well as schedules and milestones that can successfully deliver on the stated research goals, objectives, and tasks that are proposed.

WRF will evaluate proposals on the following components:

- **Understanding the Problem and Responsiveness to RFP (20%)**
Does the proposal adequately explain the problem? Does it reflect knowledge of the issue and how solving the problem will benefit the water industry? Have the RFP objectives been adequately

addressed? If proposed objectives differ from the RFP, do stated objectives address current or future needs of the water industry? Are data quality objectives specified?

- **Technical Approach and Scientific Merit (40%)**

Is the proposal prepared with supportive information and is it self-explanatory and clearly understandable? Is the proposed effort technically defensible? Is the approach practical? Can the project objectives be achieved in the stated time period with the allotted personnel and budget?

- **Management and Communication Plans (10%)**

Are the roles, responsibilities, and assignments clear? Do the supporting organizations on the team have complementary skills? Does the lead organization have adequate resources to provide the appropriate level of management, oversight, and project implementation? Is the Quality Assurance/Quality Plan acceptable? Are schedules and deliverables clearly defined?

- **Budget and Schedule (10%)**

Is the budget within the advertised budget for the project? Has the applicant provided appropriate (at least 25%) and significant in-kind contributions to the project? Is the level of effort allocated to each task logical? Is the Indirect Cost Rate reasonable (35% or less is competitive) and has it been detailed in the proposal? Is the schedule realistic? Do the proposed budget and schedule match funding needs to milestones and demonstrate the value of the research relative to the proposed cost?

- **Qualifications of Organization and Key Personnel (10%)**

Does the lead organization have demonstrated experience and expertise in the issues and objectives discussed in the RFP? Do the key project personnel have experience in the proposed area of research? Have key personnel committed an appropriate amount of time to the project? Are water and wastewater agencies involved?

- **Staff Evaluation and Input Based on Past Performance (10%)**

Proposal Preparation Instructions

Proposals submitted in response to this RFP must be prepared in accordance with The Water Research Foundation's document *Guidelines for Focus Area Program Proposals*. These Guidelines are applied to the Solicited program as well. The most current version of these guidelines is available at: <http://www.waterrf.org/funding/ProposalDocuments/GuidelinesForFocusAreaProgramProposals.pdf>. The guidelines contain instructions for the technical aspects, financial statements, and administrative requirements that the applicant must follow when preparing a proposal.

Please note that the selection criteria listed here are different from those listed in the Guidelines for Focus Area Program Proposals document. The selection criteria in this RFP will be used to evaluate the proposal.

Eligibility to Submit Proposals

This RFP solicits proposals from all technically qualified applicants, including educational institutions, research organizations, federal or state agencies, municipalities, 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 <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 staff listed at the bottom of this RFP.

Administrative, Cost, and Audit Standards

WRF's Solicited Research Program standards for administrative, cost, and audit compliance are based upon, and comply with, Office of Management and Budget Uniform Grants Guidance, 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 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 maximum funding available from WRF for this project is \$200,000. 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 the WRF funds requested). For example, if an applicant requests \$100,000 from WRF, a minimum of \$33,333 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 25 percent to the project but the maximum WRF funding available remains fixed at \$200,000. **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 that 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 format. Proposals must be submitted before 2:00 PM Mountain Time, Tuesday, June 4, 2019. 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, Stephanie Fevig, at 303-347-6103 or by e-mail at sfevig@waterrf.org.

UTILITY AND ORGANIZATION PARTICIPANTS

To date, no utilities have indicated an interest in participating in this research. As utilities express interest, their information will be added below within 24 business hours of receipt of 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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