



Final (RFP 2755) March 2001



REQUEST FOR PROPOSALS

CHARACTERIZATION OF TOX PRODUCED DURING DISINFECTION PROCESSES (RFP 2755)

Objective

The objective of this project is to determine the nature and chemical characteristics of the unknown fraction of the total organic halogen (TOX) produced during chlorination and alternative disinfection processes (i.e., chloramination, chlorine dioxide ozone disinfection). This will be accomplished by: determining the apparent molecular weight distribution of the TOX; differentiating the amounts of total organic bromine (TOBr), total organic chlorine (TOCl), and total organic iodide (TOI) in TOX; and identifying the fraction of the TOX that is hydrophobic and hydrophilic for each disinfection process.

Background

It is well established that chlorination produces larger concentrations of trihalomethanes (THMs), haloacetic acids (HAAs), and TOX in general than alternative disinfectants such as chloramines, and chlorine dioxide. However, the percentage of the TOX that is still non-identified is significantly higher when alternative disinfectants are used.

It is important for drinking water utilities and regulatory agencies to learn more about the specific characteristics of these unknown disinfection by-products (DBPs). Recently, USEPA conducted a workshop on risk assessment of unidentified DBPs in order to evaluate the potential toxicity of unidentified chemical by-products of drinking water disinfection and to identify approaches for incorporating these components when estimating risks posed by DBPs.

Knowing the nature and chemical characteristics of the unknown component of TOX would help utilities to select appropriate treatment technologies to either remove or destroy unwanted disinfection by-products. Khiari and colleagues (1996) researched various source waters treated with chlorination and chloramination to determine the apparent molecular weight distribution of the TOX by the use of ultrafiltration. This research helped elucidate what portion of the TOX may be amenable to gas chromatography/mass spectrometry analytical methods and what portion of the TOX may be of limited bioavailability. In a separate study, Zhang and colleagues (2000) evaluated the DBPs and TOX generated from chlorination, chloramination, ozonation, and chlorine dioxide disinfection of a solution of Suwannee (Georgia) river water containing fulvic

acid and bromide. To better characterize the unknown TOX, this research measured TOCl and TOBr. Research is now needed that would build upon this related research to more fully characterize the unknown TOX.

This project will help in building much needed knowledge in identifying the characteristics of the unidentified chemical by-products of alternative disinfection processes.

Research Approach

The objective of this project is to investigate the nature and characteristics of the unknown portion of TOX produced during chlorination and alternative disinfection processes (i.e., chloramination, and chlorine dioxide disinfection) with and without ozonation.

The researcher will study TOX formation resulting from the use of the major disinfectants (i.e., chlorine, chloramines, chlorine dioxide, and ozone). The study will evaluate TOX formation for a wide range of source waters, with a range of water qualities including, but not limited to, total organic carbon, specific ultraviolet absorbance, bromide, and pH. Ideally, the researcher will apply each of the disinfectants to each water source (at either bench or pilot scale) to determine TOX formation.

The investigator will use various analytical approaches to characterize the nature of the TOX formed in the disinfected waters. At a minimum, the researcher should include the following analyses:

- the TOX should be differentiated into TOCl, TOI, and TOBr
- the apparent molecular weight distribution of the TOX should be determined
- the percentage of the TOX that is hydrophobic or hydrophilic should be determined

The final report will provide information to utilities in characterizing the unknown components of TOX.

Project Advisory Committee

Project Advisory Committees (PACs) are organized by the Awwa Research Foundation (AwwaRF) for each funded project to provide guidance, review all reports and significant materials, and generally monitor project performance in behalf of AwwaRF and the water utility industry.

Quality Assurance

Each proposal must include a description of the procedures that will be used to ensure the quality of the data for the project. If the project involves laboratory analyses, this description should indicate whether the laboratory performing the analyses is accredited or state certified for the particular analysis. If the laboratory is not certified, and/or nonstandard methods are used, detailed quality assurance/quality control procedures must be submitted with the proposal.

Budget and Time Schedule

The maximum funding available from AwwaRF for this project is \$350,000. A minimum 25 percent of the total project cost must be contributed by the contractor. Therefore, the total project cost is \$467,000, (\$350,000 in AwwaRF funds and \$117,000 in contractor contribution). This contribution can either be direct funding or in-kind matching of such items as personnel costs, analytical and support services, facilities, consulting services, etc. The submitting organization may elect to contribute more than 25 percent to the project but AwwaRF's maximum contribution remains fixed at \$350,000. Proposals that request less than \$350,000 from AwwaRF need only contribute 25 percent of the total project cost.

The project period should be realistic, anticipate possible starting delays, and provide ample time for the writing, formatting, and revising of the final report and for PAC review of project results. Progress reports will generally be required on a periodic basis (please see guidelines for solicited proposals). The final report must be completed in accordance with the Awwa Research Foundation's *Format-Style Guide for Preparing Research Reports*, unless other arrangements have been mutually agreed upon. The final report should include a separate chapter on recommendations to utilities. Independent of this contract, AwwaRF will fund the PAC described above.

Federal Funding Requirement

Funds for this research project are provided, in part, by federal funds administered through the United States Environmental Protection Agency. Therefore, AwwaRF contractors will be required to follow the six affirmative steps stated in 40 CFR 33.240 or 40 CFR 31.36(e), as appropriate.

Equal Opportunity and Minority Contractors

AwwaRF has a policy of non-discrimination and abides by all laws, rules, and executive orders governing equal employment opportunity. As employers, AwwaRF contractors may not discriminate on the basis of age, sex, race, religion, color, national origin, handicap or veteran status. AwwaRF expects its contractors to accept the goal of having a workforce that generally reflects the minority composition of the community in which it is located. It is the policy of AwwaRF to encourage proposals from qualified minority owned or directed institutions.

Utility Participation

AwwaRF is especially interested in proposals which include both the participation and contribution of resources from utilities in the research effort. Information on utilities that have indicated an interest in participating in this research project is attached. However these utilities are under no obligation to participate. Their level of participation is solely their decision. If asked to participate by several proposers, the utility may choose to work with any, all, or none of them.

WATERSTATS

A WaterStats database containing water utility information is available from AWWA; see www.awwa.org/h20stats/h20stats.htm for further information.

Past Performance

The AWWA Research Foundation's policy on timeliness can be found on the Foundation's website at www.awwarf.com in Research News in the Proposal Guideline section. Timeliness of researcher performance on past AwwaRF projects will be a factor in proposal selection. Further, researchers who are late in any ongoing AwwaRF sponsored studies without an approved no-cost extension will not be eligible to submit proposals for the 2001 funding cycle either as a principal or co-principal investigator. If you have any questions about your eligibility for 2001 projects, please contact your current AwwaRF project manager directly.

Application Procedure and Deadline

The guidelines for preparing solicited proposals can be downloaded from our website at www.awwarf.com/research/guides/solicited.pdf. The guidelines contain certain provisions that the submitter should be aware of when preparing a proposal. An enforceable page limit on the project description has been defined. **Proposals exceeding the page limit for the project description will not be considered.** Questions to clarify the intent of this Request for Proposals may be addressed to the project manager Dr. Djanette Khiari, at 303.734.3478 or by e-mail at dkhiari@awwarf.com. **Proposals must be postmarked on or before July 16, 2001.** Eight copies of the proposal should be sent to:

**Proposals
Awwa Research Foundation
6666 W. Quincy Avenue
Denver, CO 80235**

General information on AwwaRF can be found at our website.