



## WATER RESOURCES RESEARCH GRANT PROPOSAL

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**TITLE:** Treatment Technologies for Control of Haloacetic Acids and Disinfection By-Product Precursors as Mandated by U.S. EPA's Disinfectants/Disinfection Byproducts and Information Collection Rules

**DURATION:** September 1, 1996 to August 31, 1997

**FEDERAL FUNDS:** \$31,500

**NONFEDERAL, FUNDS:** \$104,363

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**CONGRESSIONAL DISTRICT:** Fourth

### **CRITICAL REGIONAL WATER PROBLEMS/NEED FOR RESEARCH:**

Two recently proposed rules by the U.S. Environmental Protection Agency have potentially serious regulatory consequences for treatment technology at many water utilities in the southeastern and island (S & I Region). These are the Disinfectants/Disinfection By-Products (D/DBP) Rule and the Information Collection Rule (ICR). Both are driven by the concern to protect consumers from long-term exposure to by-products of drinking water chlorination that result when natural organic matter (NOM) in raw drinking water reacts with chlorine. One of most important elements of the D/DBP rule is a reduction in the maximum contaminant level (MCL) of total trihalomethanes (TrHMs) from 100 down to 80 u/L and the establishment of a new MCL for haloacetic acids (HAAs) of 60 ug/L the HAAs are believed to be a more harmful, major class of halogenated DBPs than THMs. This rule applies to all public water supplies but to give some idea of its impact in the S & I Region, there are 400 community water supplies that serve over 10,000 customers and many more with fewer customers. While the D/DBP rule places specific limits on by-product concentrations, the ICR includes an evaluation of specific advanced technologies to prevent the formation of DBPs by reducing NOM concentration before chlorine is applied. This portion of the rule targets utilities serving over 100,000 customers which have NOM concentrations, as measured by total organic carbon (TOC), of over 4 mg/L but smaller utilities are expected to gain information for their own potential implementation at a later date. The effected utilities must conduct either bench or pilot tests of granular activated carbon (GAC) adsorption and/or membrane technologies. A recent nation-wide survey suggested that about 25% of the water utilities in the S & I Region would be impacted; this would be approximately 16 utilities.

The D/DBP Rule raises concerns especially for the S & I Region with regard to the utilities being able to meet the MCL for HAAs. We base this on our study of eight water utilities in NC where HAA concentrations exceeded THM concentrations by 50-100%. If these findings extend to other water systems in the southeast, HAA concentrations can be expected to be the limiting factor for compliance with the proposed DBP regulations, i.e., utilities that meet the 80 ug/L MCL for PHMs will likely exceed the 60 ug/L MCL for HAAs. Accordingly, one of the objectives of this research is to explore two simple modifications of existing treatment technology (pH adjustment and chloramination) for limiting the formation of HAAs so that utilities can comply with the proposed D/DBP Rule. These methodologies may be sufficient for many utilities which have moderately high concentrations of DBP precursors in the raw water.

With regard to the ICR, we wish to demonstrate the value of bench-scale testing of GAC adsorption and membrane technologies for those water utilities having high NOM concentrations that prevent control of DBPs by simple modifications of existing treatment technologies. Bench-scale testing is far less expensive than pilot-scale testing and could be done by utilities if they gain confidence in procedures. It also allows easy evaluation of the seasonal influences of water quality on DBP precursor control; samples could be collected at different times during the year more easily than starting up and shutting-down of pilot plant operations. The research will include waters from several different utilities for bench-scale tests.

#### **EXPECTED RESULTS, BENEFITS, AND/OR INFORMATION:**

Our overall goal is to provide water utilities in the S & I Region with guidance on process technologies that will reduce the formation of disinfection by-products of long term health consequence as is mandated by both the D/DBP Rule and the ICR. We expect to show from sampling of a number of different water supplies that: 1) current treatment practices may be modified at many utilities to meet the proposed MCLs for both HAAs and THMs without compromising their disinfection practices and 2) bench scale testing of GAC adsorption and membrane separation technologies can yield valuable information for assessment of the effectiveness and cost of DBP precursor control for those utilities affected by this section of the ICR.

Elevating the pH of coagulated and settled water prior to the application of chlorine may be a simple and inexpensive approach to meet the proposed MCL for HAAs, provided that THM formation, which tends to increase with increasing pH, is not excessive and that the increase in pH, which tends to decrease the effectiveness of free chlorine, does not compromise the overall disinfection process. Application of chloramines as a secondary disinfectant, after the application of free chlorine as a primary disinfectant within the treatment plant will be another option. Chloramines are known to arrest THM formation and the formation of trihalogenated acetic acids, but dihalogenated acetic acids, e.g. dichloroacetic acid, will continue to be produced by the reaction of residual natural organic material in the treated water with chloramines, although to a lesser extent than with free chlorine.

Bench-scale test procedures for GAC adsorption and membrane separation for control of DBP precursors in conjunction with the ICR are not necessarily straightforward nor routine, especially for utility personnel. Scale up of rapid, small scale column test (RSSCT) results will be assessed. A variation on the proposed rapid, bench-scale membrane test (RBSMT) in the ICR will be investigated as a simpler alternative. At least four NC utilities will be tested with results applicable to many others in the S & I Region; it will include comparison of bench and pilot plant results.