MIDWEST TECHNOLOGY ASSISTANCE CENTER
MTAC
SMALL PUBLIC WATER SYSTEMS

MTAC Highlights

Midwest Technology Assistance Center

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January 2007

Arsenic Issue a Priority for MTAC Research Efforts

MTAC produced the following final reports related to Arsenic in 2006, these are available online at the MTAC website: http://mtac.sws.uiuc.edu

Arsenic and Bacteriophage Ms2 Removal from Groundwater by Nanoparticulate Aluminum Oxide Coated Granular Filter Media: A Pilot-Scale Evaluation on the Effect of pH and Coating Density This study involved the development of an innovative physicochemical adsorptive filtration technology for removal of bacteriophage MS2 and arsenic in groundwater, and not only demonstrated the benefits of nanoparticulate aluminum oxide coated filter media but also characterized the potential risks associated with their implementation.

Development of Low Cost Treatment Options for Arsenic Removal in Water Treatment Facilities The objective of this project was to develop an inexpensive treatment option for arsenic removal, suitable particularly for small communities. Improvement of the efficiency of arsenic (III) oxidation to arsenic (V) by hydrogen peroxide addition and addition of more iron to furnish more hydrous ferric oxides (HFO) for adsorption of the arsenic allow removal of arsenic from 40 to 5 :g/L, while increasing chemical costs only slightly, and requiring no large capital equipment costs.

Chemical Oxidation for Arsenic The effects on arsenic (As) removal at iron removal water treatment plants of two common chemical oxidants, potassium permanganate (KMnO4) and sodium hypochlorite (NaOCl), and ferric chloride (FeCl3) were characterized. Experiments were performed using water from three Illinois water utilities whose potable water exceeds the As maximum contaminant level (MCL) of 10 mg L-1. For the utility with the lowest As and highest Fe concentrations, oxidant addition alone was sufficient to satisfy the MCL. For the other two utilities both oxidant and FeCl3 had to be added to meet the MCL.

Temporal Variability of Arsenic in Municipal Well Short-term variations in groundwater arsenic (As) concentrations were characterized at four water treatment plants in Illinois and one in Indiana. The long-term As variations were unique at each facility. For example, at one facility, the minimum and maximum As concentrations were 20 µg/L and 120 µg/L, a factor of 6. At another facility, the range in As was relatively narrow, with minimum and maximum As concentrations of 34 µg/L and 46 µg/L.

Demonstration of Low-Cost Arsenic Removal from a Variety of Illinois Drinking Waters Four groundwater sources used as drinking water in Illinois were treated using the Fenton reaction (hydrogen peroxide + Fe(II)) to oxidize As(III) to As(V) before adsorption of the arsenic to the iron precipitate produced during iron removal by aeration/filtration. For all four waters used, the arsenic concentration could be reduced to below the 10 microgram/liter maximum contaminant level using relatively inexpensive doses of iron and peroxide, despite the need to add iron (Fe(II) or Fe(III) were both tried) in all cases to completely adsorb the arsenic. The estimated chemical cost was $0.04 to $0.07 per thousand gallons in some cases.

MTAC also has several Arsenic Research Projects in Progress:

Fate of Arsenic in the Mahomet Aquifer; the Influence of Added Sulfate and Nitrate Arsenic concentrations in Mahomet aquifer groundwater are high when sulfate concentrations are low. It is hypothesized that biological sulfidogenesis by sulfate reducing bacteria leads directly to the precipitation of arsenic from the groundwater solution.

Non-Community Water System Compliance to the New Arsenic Rule Statewide maps will be produced for USEPA Regions 5 & 7 states showing compliance status of non-community systems.

Workshop for Non-Community Water System Compliance Managers: Status, Progress, and Information Sharing The goal of this workshop is to bring the states together to discuss the issues they are facing regarding non-community system compliance with the new arsenic rule, to describe their programs already being implemented to share what has been successful and what problems they have encountered, as well as to provide insight into the arsenic problem in each state.

Testing of An Anionic Exchange Glass Fiber Substrate POU Device To Remove Arsenic The Department of Materials Science (DMS) at the University of Illinois has developed an anionic exchange system on a glass fiber substrate that initial lab testing has shown is capable of removing As^{5+} to well below one ppb. The testing results will be evaluated and modifications, if necessary, will be completed.

Spatial Variability of Arsenic in Groundwater Several Illinois public water systems have one or more wells with arsenic (As) concentrations above the maximum contaminant level (MCL) of 10 _g/L. To meet the MCL a water utility basically has three options: 1. Purchase water from another utility, 2. Install a new treatment system, 3. Drill one or more new wells. Clearly, the probability of finding source water with low As will influence the decision to drill new wells. This, in turn, depends on the spatial variability of As in groundwater.

MTAC/NCSA Launch CyberCollaboratory

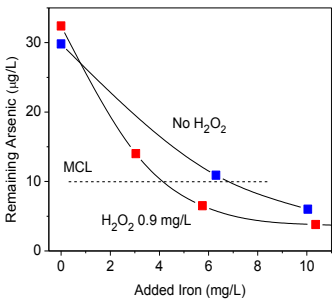
MTAC and NCSA are launching a CyberCollaboratory for Small Water Systems. The collaboration component will include services to promote cooperation, communication, and the sharing of knowledge . The services will be tailored for both synchronous and asynchronous interaction. The site will include: Chat Rooms (can be created on demand), Discussion Boards, Notebooks (store postings to blogs, document libraries, etc.), Polls (vote on existing issues or create new ones), Video Conferencing, and a Who Is Online listing.

MTAC-Sponsored Training Projects

Continuing Education to Support Smaller Water Systems The Office of Continuing Education at the University of Illinois and county governments in the state have recently forged partnerships with industries and local governments to develop continuing education programs via a web portal. The course is designed to help managers of small water systems think holistically about security, including the protection and monitoring of critical assets.

Improved Monitoring for Safe and Secure Water Supplies: An Integrated Approach to Emerging Information Technologies The objective of this project is to identify the steps needed to improve collaboration and information integration among and within small water supply systems, such that sensors and emerging information management systems can be effectively adopted as these technologies emerge.

System Development Charge Development Project Easy to use computer software tool that can be used by a small water system's in-house staff to develop an accurate and justifiable system development charge. Product available at no charge to systems in the MTAC area at http://sspa.boisestate.edu/efc/sdccalculator/



Arsenic removal in pilot scale experiments at the Danvers, IL water treatment plant. With hydrogen peroxide, a lower dose of iron could be used to meet the arsenic MCL.

Midwest Technology Assistance Center

MTAC: Promoting Capacity Development for Small Public Water Systems

We're on the Web!
http://mtac.sws.uiuc.edu

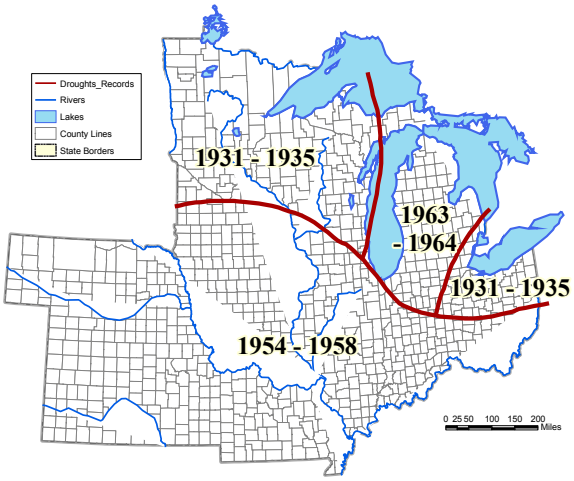
About MTAC…

The Midwest Technology Assistance Center for Small Public Water Systems (MTAC) cooperates closely with other regional technology assistance centers established by the USEPA, and with other partner agencies and organizations in order to ensure efficient response to the highest priority needs of small public water systems and Indian Tribal systems in the Midwest. MTAC is a joint effort of the University of Illinois at Urbana-Champaign and the Illinois State Water Survey. The Illinois State Water Survey is a part of the Illinois Department of Natural Resources. University of Illinois participation is led by the Illinois Water Resources Center.

Drought Planning Process Critical for Long-term Viability of Small Systems

Assessment of the Needs, Requirements, and Available Tools for Drought Planning for Small Public Water Systems in the Midwest evaluates the state of drought preparedness in the Midwest. While there is some drought response planning, there appears to be virtually no *drought preparedness* planning or evaluation. Small community water supply managers and operators should take steps to evaluate the capabilities of their systems to cope with severe and protracted droughts. An awareness and compilation of material regarding 1) state drought plans, 2) state water regulations, 3) an idea of the historical droughts for the area, 4) system behavior in previous drought periods, and 5) an assessment of current and near-future supply and demand, and will go a long way towards a functional plan. The final project report is available online.

Developing Guidelines for Evaluating Drought Impacts to Small Surface Water Supply Systems An initial survey of drought planning studies of the Midwest indicates that most states do not provide guidelines for evaluating the capacity or adequacy of the water supply. The goal of the proposed project is to provide a report or booklet that gives basic information and guidelines to water supply managers and community leaders for understanding and evaluating their water supply, and developing responses that will help communities improve their ability to manage potential drought impacts. This project is in progress with completion expected in late 2007.



Hydrologic Droughts of Record in the Midwest. Serious droughts were more frequent in the first half of the last century.

Other MTAC Final Project Reports from 2006 are now available.

Understanding and Minimizing Impacts of Agricultural Pesticides on Small Water Systems Using Surface Water Several small public water systems in the Midwest have exceeded the maximum contaminant level (MCL) for atrazine, a common herbicide used through Midwestern watersheds. The overall goal of the project was to facilitate source water protection related to agricultural pesticides, with a focus on atrazine, because of the prevalence of atrazine in surface water in the Midwest compared to other agricultural pesticides.

Using Financial, Technical and Managerial Capacity Measures in an Assistance-Oriented Approach to Comparative Performance Assessment of Small Drinking Water Utilities in the Midwest Technology Assistance Center (MTAC) Region Performance measurement has a long history in the evaluation of the quality and level of services provided by public and private utilities. The goal of this project is to provide a practical framework within which to develop and provide comparative performance measures that improve the financial, managerial, and technical capacity of small public and private drinking water utilities within the Midwest Technology Assistance Center Region.

Watershed Modeling to Evaluate Water Quality at Intakes of Small Drinking Water Water quantity and quality at surface water supply intakes are of serious concern nationwide. However, there is no existing model capable of comprehensively simulating all of the hydrologic, upland soil and streambank erosion, sediment transport, and fate and transport of nutrient and pesticide processes necessary to comprehensively assess the water quantity and quality problems and help make the best management decisions to eliminate or minimize those problems.

Introduction to Financial Benchmarking The purpose of this workbook is to introduce the topic of benchmarking, to demonstrate how this approach can be applied to financial management of small drinking water systems, and to identify some of the many resources that managers can use to assess and improve their drinking water systems.

MTAC Research in Progress

Smart Pipe B Nano-sensors for monitoring water quantity and quality in public water system The Smart Pipe will be a module array which has expandable monitoring capability for future available sensor units such as sensors for arsenic or radium. Applying this technology at an affordable cost will help small communities enhance their technical capacity to meet the needs of particular source water and distribution system conditions, and increase the security of water supply.

Development of a Decision Support System for Small Community Water System Capacity Development Phase I To improve small community water system management, increasing effort has gone into development and implementation of small community water board and management trainings (BMT). The outputs of Phase I of this initiative will include: 1) a manual on a proposed methodology for outcome measurement of BMT; and 2) an assessment of BMT as implemented in Illinois, Kansas, Kentucky, Mississippi, and Ohio.

Building Technical, Financial, and Managerial Capacity for Small Water Systems: The Role of Consolidation, Partnership, and other Organizational Innovations The project involves assessing the role of institutional innovation (municipalization, privatization, merger, partnerships, and outsourcing) as a strategy for small water supply systems to gain the technical, financial, and managerial capacity needed to provide safe and reliable drinking water. Econometric choice models will be used in part to help draw conclusions about organizational responses to changing economic, technical, and policy forces.

Emerging Health Concerns Related to Water Treatment DBPs represent an important class of environmentally hazardous chemicals that may represent long-term human health implications. The goals of this project are to (1) begin to generate more information about the occurrence of non-regulated DBPs in selected (representative) small water systems in the region; (2) use the information to begin to engage managers in the issues at hand; and (3) use information derived from goals 1 and 2 to outline a future continuing education module addressing DBPs and regulations for water supply managers.