3. Overview of Drinking Water Quality Management And Wastewater Control

Presenter

Mrs.Sally C. Gutierrez, USEPA

U. S. Drinking Water Quality Management and Wastewater Control

Current Research Issues

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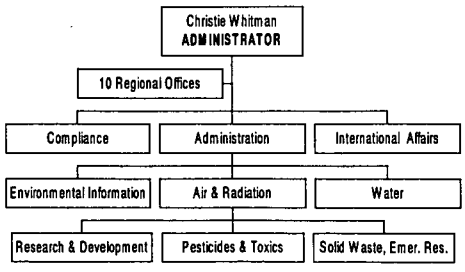
Overview

- Background
- Current & Future Drinking Water Research Priorities
- Homeland Security
- Current & Future Wastewater & Water Quality Research Priorities
- Summary

BACKGROUND

U.S. EPA Organizational Structure



Office of Research and Development

ORGANIZED ACCORDING TO THE RISK PARADIGM

- Risk Assessment
- Risk Management
- Risk Communication

Office of Research and Development

- National Health and Environmental Exposure Research Laboratory
- National Exposure Research Laboratory
- National Risk Management Research Laboratory
- National Center for Environmental Assessment
- National Center for Environmental Research
- National Center for Homeland Security - NEW

National Risk Management Research Laboratory

- Focused research on technologies and approaches to remove and control contaminants regulated or contemplated for regulation by the Agency.
- Covers all media
  - Air
  - Water
  - Waste

Water Supply and Water Resources Division

- Primary mission is to provide treatment and control information for drinking water contaminants regulated or considered for regulation by the Office of Ground Water & Drinking Water
- Also responsible for leading watershed management research program for the Laboratory including urban wet weather flow

Water Supply and Water Resources Division

- Problem-focused
- Applied
- Largely in-house
- Is performed at bench, pilot and full-scale

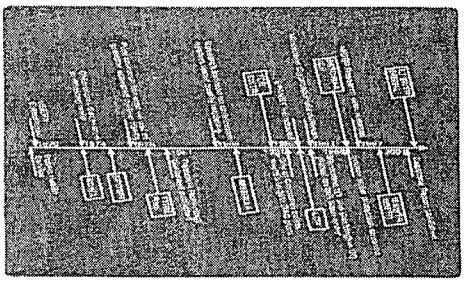
Research Emphasis over the Last 10 Years

Research Focus 1990-2000

- Control of *Cryptosporidium* and Giardia
- Arsenic
- Control of Disinfection By-Products

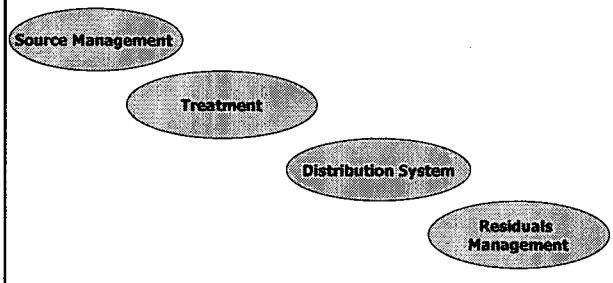
EPA

Controlling Disinfection By-Products and Microbial Contaminants in Drinking Water



Current and Future Drinking Water Research Priorities

Contaminant Management Framework



Major Research Themes

-Contaminant Candidate List (chemical and microbial)

-Implementation/Revision of M/DBP Rule

-Implementation/Revision of Arsenic Rule

-Distribution System

Major Research Themes

-Source Water Protection

-Six -Year Review

-Emerging Issues

Future Research Priorities

- **Contaminant screening**
- **Holistic treatment approaches – rather than contaminant-by-contaminant**
- **Infrastructure – develop cost effective ways to extend life/preserve/monitor condition**
- **Monitoring approaches – amount and quality of data allows for better management**

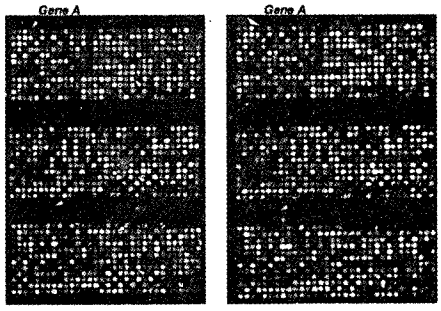
Microbial Contaminants Research

Microarrays

- An array of genetic probes can be prepared that will allow an environmental sample to be simultaneously probed for many types of microbes, including pathogens, indicator organisms and specific gene sequences such as toxin genes.
- Microarrays are a powerful tool that will provide a wealth of new information.

Microbial Genetic Response to Ecosystem Stress

Control **+++ Ammonia**



Water System Security

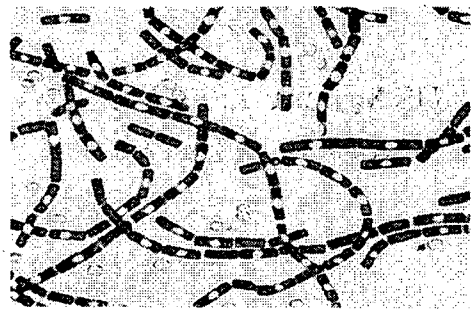
Homeland Security

- **Following 9/11/2001, the Centers for Disease Control and Prevention requested EPA collaboration on disinfection studies of surrogate organisms for specific agents**
- **Collaborating by conducting disinfection studies on the surrogates for the agents (bacteria only)**

Homeland Security

Priority given to work on surrogate for *Bacillus anthracis* because the information is needed advise water systems and consumers on what to do to respond in the event of water system contamination with this organism.

Bacillus anthracis



Kenneth Todar, Univ. of Wisconsin - Madison

Bioterrorism Agent Surrogate Research

BT Agent	Surrogate
Bacillus anthracis	*Bacillus cereus*
" "	*Bacillus thuringiensis*
" "	*Bacillus globigii*

Water Quality Research Priorities

Water Quality Research Emphasis

- Watershed Approach
- Total Maximum Daily Loads
- Management of residuals such as biosolids, animal manure

Watershed Approach

US Water Quality Problems Becoming Very Complex

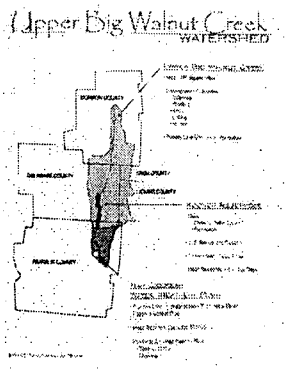
Watershed Approach

- Water Quality Management can best be accomplished by looking at entire drainage area
- Important to look at all potential sources of pollution within drainage area, holistically, point and non-point
- Can begin to integrate water quality and drinking water protection efforts

Case Study

Background

- Hoover Reservoir is central Ohio's largest source of drinking water providing water to 580,000 people in the Columbus area
- The Upper Big Walnut Creek watershed encompasses nearly 190 square miles of predominantly agricultural cropland that drains into Hoover Reservoir
- Infrequent occurrences of elevated Atrazine levels (4-12 mg/L) detected at treatment plant (MCL = 3 mg/L)



Background

- Downstream Atrazine Management
  - City of Columbus has spent $2 million for Powdered Activated Carbon (PAC) since 1997
  - Might have to install GAC
- Watershed Atrazine Management
  - City of Columbus and agricultural community developed a collaborative partnership to help reduce runoff
  - BMPs implemented on 23,000 acres at a cost of nearly a million dollars
  - Atrazine levels still elevated

Project Objectives

- Develop a methodology to determine the cost and effectiveness of non-point BMPs
- Qualify "cause and effect" relationships between land management and water quality

Results

- Preliminary modeling indicates that antecedent soil moisture content, timing of Atrazine application, and soil water holding capabilities seem to be more critical than total amount of atrazine applied

Total Maximum Daily Loads

Total Maximum Daily Loads

- Federal Clean Water Act requirement applied to water bodies that are reported by State/tribe to exceed their established water quality standards
- Once provision applies, a TMDL is required that apportions the amount of a pollutant that must be reduced in order to bring the water body back to its designated standard

Current and Future Research Issues

- Monitoring and Assessment Methods – biological endpoints increasingly used to determine health of waterbody
- Modeling/Decision Support/Cost
- Restoration methods on a watershed scale

Biosolids and Animal Waste

- Disposal of these waste materials are cause of concern among the public
- Amount of material has increased over the last 10 years
- Water quality problems related to these materials need to be addressed

Research Issues

- What does the material contain and how do we measure it – nutrients, pathogens, endocrine disrupting chemicals, pharmaceuticals
- What is appropriate application/ management of the material on land areas
- What are the human and ecological effects associated with these materials if they are released into the environment

Summary

- US developing methods to integrate drinking water and water quality related programs
- New tools hold promise to assist in making programs more effective
- Water System Security increasing in emphasis
- Remaining water quality problems in US will be more difficult to resolve than previous 20-30 years

Thank you for your attention

US EPA Office of Research and Development