



The Premier Energy Training Workshop
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A River of Energy Solutions

Protecting our Nation's Drinking Water from Threats and Attacks

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Presentation Outline

Introduction

Protection and Prevention

Detection and Analysis

Containment and Mitigation

Treatment and Decontamination

Innovative Approaches



OFFICE OF RESEARCH AND DEVELOPMENT

Homeland Security Research Program



**Advancing Our Nation's Security
Through Science**

Protecting Critical Infrastructure

- The Bioterrorism Act of 2002
- Homeland Security Presidential Directive (HSPD) 7 designates EPA the lead federal agency for water infrastructure safety and security
- HSPD 9 directs EPA to develop a surveillance and monitoring program for early detection of contamination
- HSPDs 10 and 22 deal with biological and chemical threats and contamination
- NHSRC supports the Office of Water and EPA's 10 Regional Offices in meeting these responsibilities

DRINKING WATER SECURITY
report suspicious activity

at reservoirs



at utilities



at water mains



WE'RE ALL IN THIS TOGETHER

FOR EMERGENCIES : _____

FOR MORE INFORMATION : _____

 United States Environmental Protection Agency

www.epa.gov/safewater/security

Office of Water (4606)
EPA 810-F-03-001
April 2003



EPA's Partners in Homeland Security Research

Department of Homeland Security

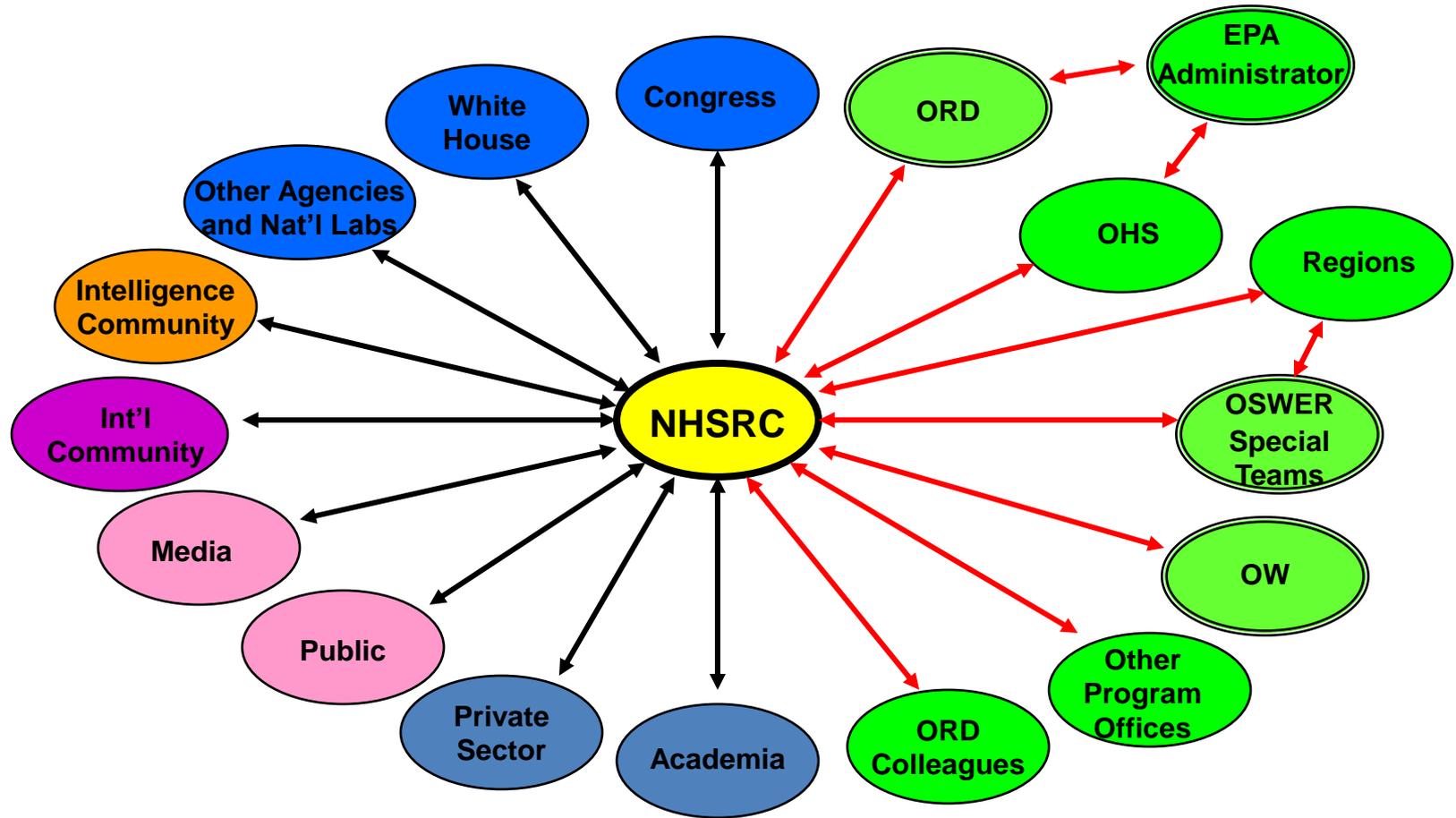
Department of Defense

Centers for Disease Control and Prevention

- Edgewood Chemical Biological Center (DoD)
- U. S. Army Corps of Engineers (DoD)
- Lawrence Livermore National Laboratories (DOE)
- Sandia National Laboratories (DOE)
- Argonne National Laboratory (DOE)
- Idaho National Laboratory (DOE)
- American Water Works Association
- University of Cincinnati



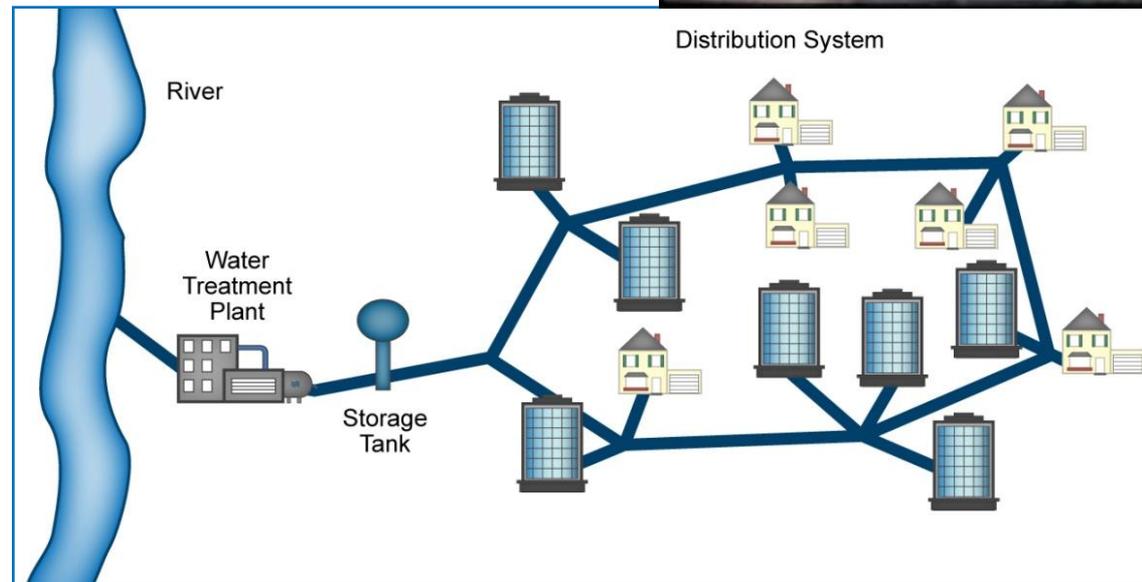
Organizations that Influence EPA's Homeland Security Research



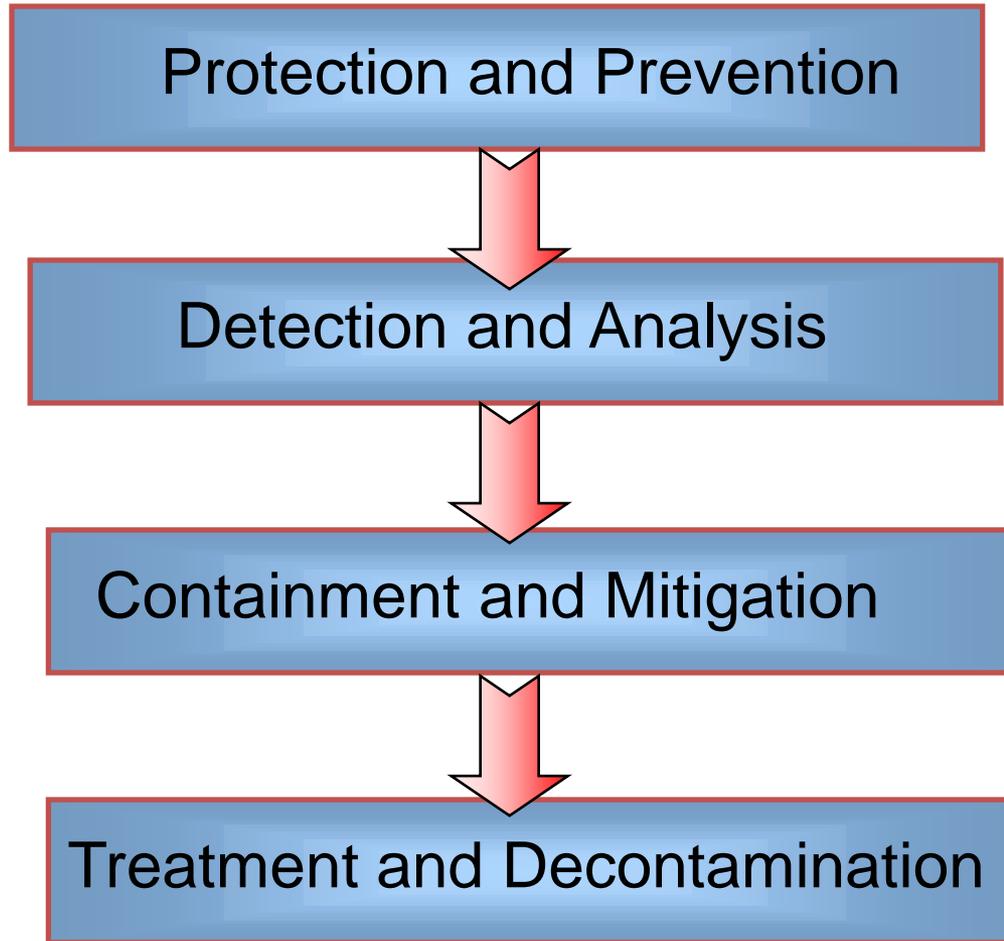
Water Security Threats

Water Distribution Networks

- Multiple points of access over thousands of miles of pipe
- Vulnerable to intentional or accidental contamination (e.g., injection at hydrant or cross-connection)
- Contamination might not be detected until people are sick or in the hospital
- Cost effective and rapid detection, mitigation and return to service



Approach to Manage Threats

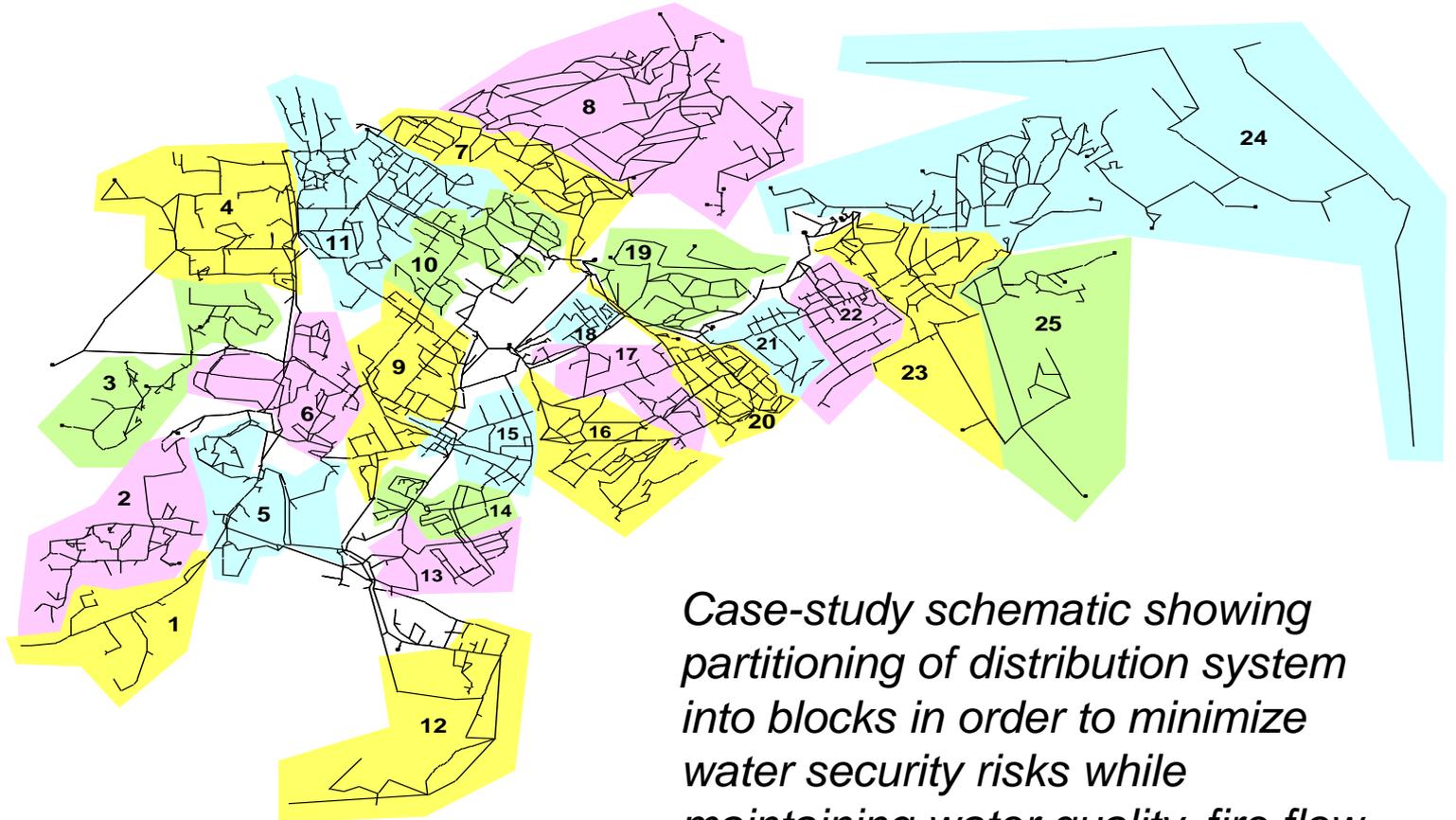


Enhancing existing approaches is essential.

But we also need new, cutting edge approaches that support rapid decision making and protect public health!

Preparedness and Prevention

Water system design or retrofit

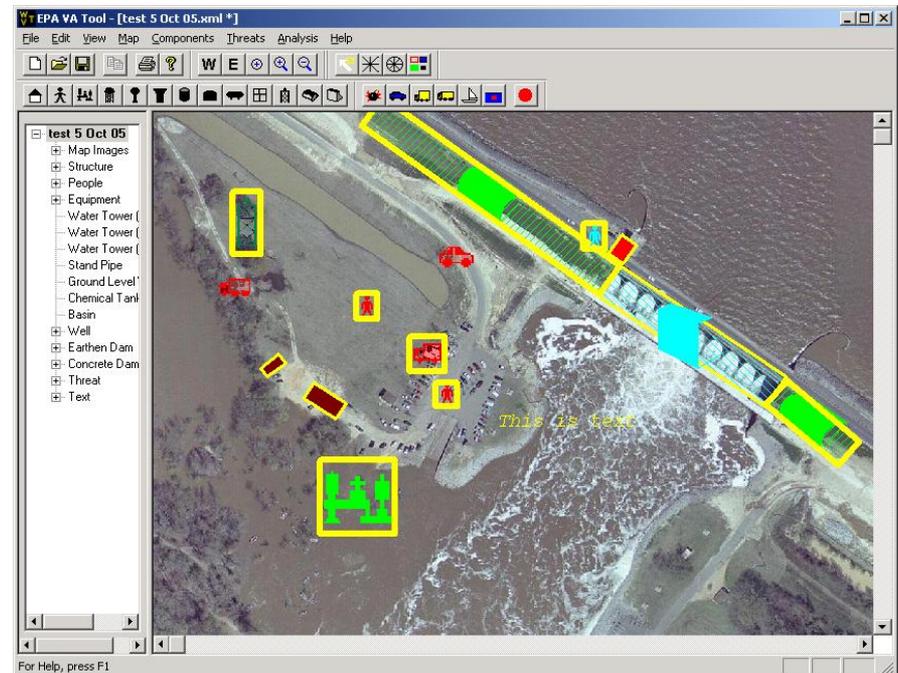


Case-study schematic showing partitioning of distribution system into blocks in order to minimize water security risks while maintaining water quality, fire flow, reliability, and pressure standards. ⁸

Accomplishments and Outcomes

Prevention

Protection of critical assets - Blast Vulnerability Assessment Tool



Detection and Analysis

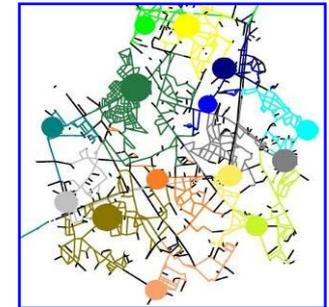
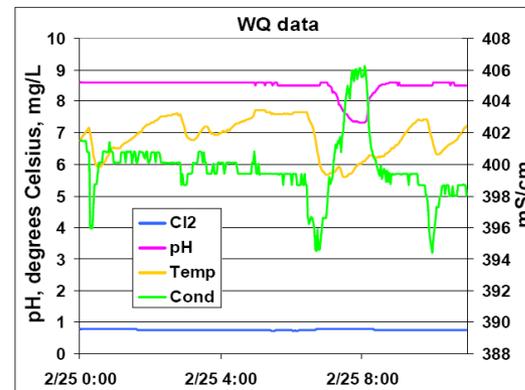
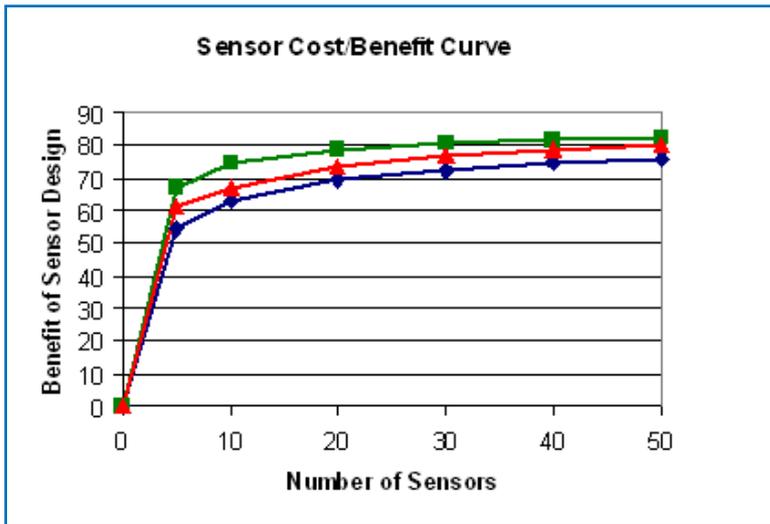
Developing, testing, and evaluating detection technologies to support contamination warning systems and improve sampling and analysis methods

- Testing commercially available water quality sensors
- Developing new, cheaper, more reliable detectors
- Improving sampling and analysis methods
- Using chemical systems modeling
- Developing software tools to enhance detection

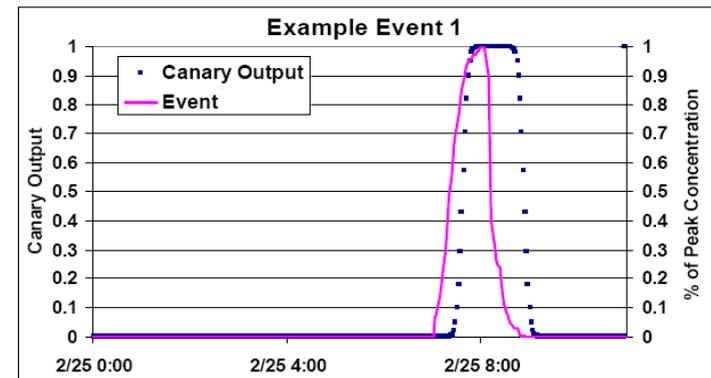


Detection and Analysis (Cont'd)

- Sensor placement optimization (**TEVA-SPOT**)



- Event detection tools



Accomplishments and Outcomes

Detection

Successful support for the Water Security initiative

- TEVA-SPOT deployed in all 5 pilot cities
- CANARY event detection system deployed in Cincinnati and Singapore – under consideration for other pilots
 - Workshops, webinars and conferences
- Sensor testing – 5 waters and 17 contaminants
- Total Organic Carbon on-line sensor (Lower O&M)
- Best practices report on sensors (& AWWA article)
- TTEP – Testing of UV and TOC sensors



Accomplishments and Outcomes

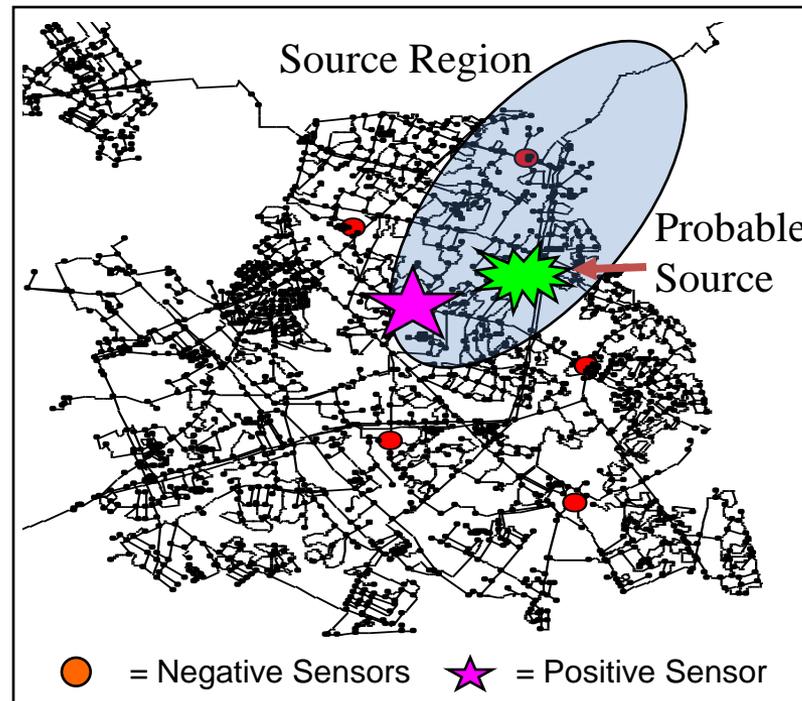
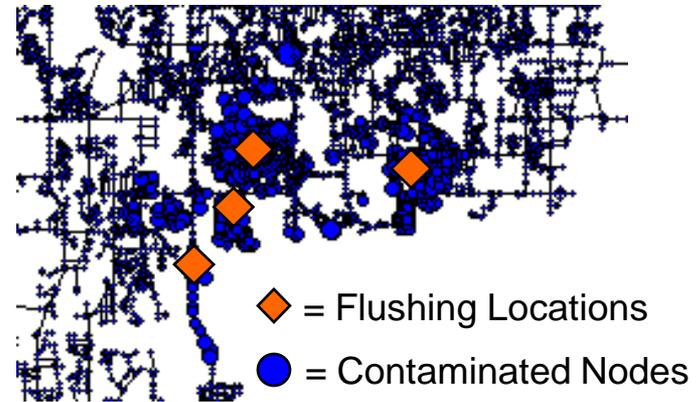
Sampling and Analysis

- Successful support for the Water Laboratory Alliance (+ ERLN)
Improve microbial detection
 - Water Concentrator
 - Successful performance testing (CDC)
 - Patent pending
 - Licensed to Teledyne Isco
 - Deployed during the full scale exercise in Region 9 and 10
- Stability of toxins in the presence of oxidants



Containment and Mitigation

- Real time modeling and response
- Emergency water supply
- Crisis communication
- Exposure factors for bio contaminants



Accomplishments and Outcomes

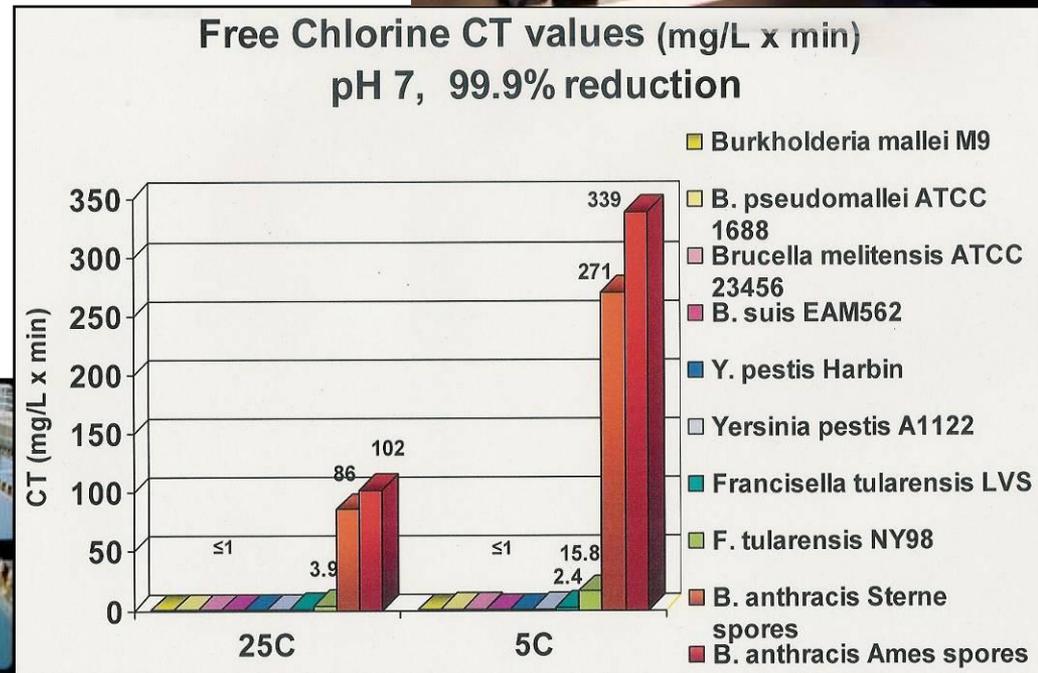
Containment and Mitigation

- Consequence management tools for the water sector
 - Advances in hydraulic response tools to optimize flushing and isolation (real-time models)
 - Recommendations for alternative water sources in *Planning for an Emergency Water Supply* (June 2011)



Treatment and Decontamination

- Microbial inactivation research
- Treatment of chemicals and biotoxins
- Washwater treatment + BOTE
 - Biological
 - Radiological



Treatment and Decontamination (Cont'd)

- Test and Evaluation Facility research
 - Agent fate and transport research
 - Persistence and adherence
 - Decontamination technologies
- Advanced water quality modeling

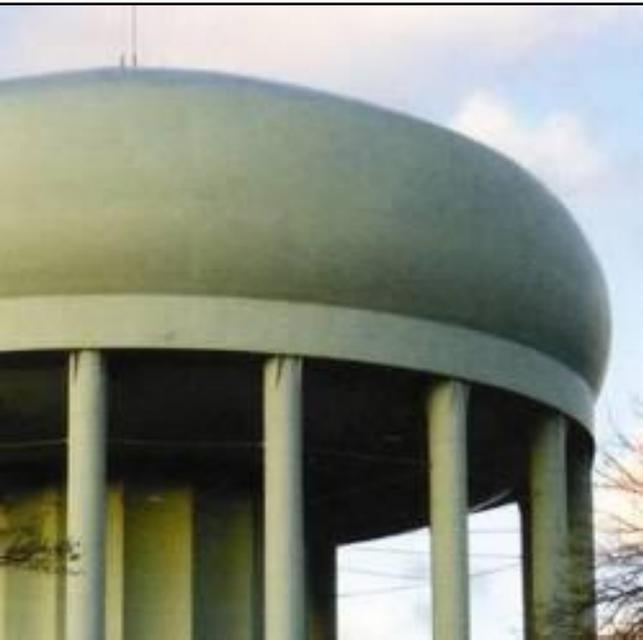


Accomplishments and Outcomes

Treatment and Decontamination

Successfully addressing Critical Infrastructure Protection Advisory Committee recommendations and providing data for Water Contamination Information Tool

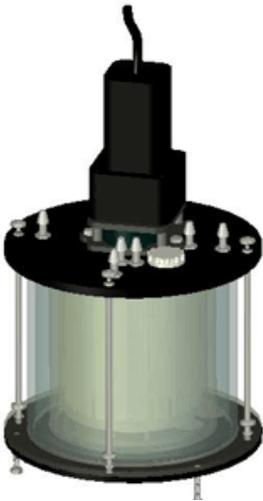
- Impact of strain variability on efficacy of inactivation *Burkholderia pseudomallei*
 - Successful use of bacteriophage as a surrogate for H5N1
 - Preliminary studies on inactivation of anthrax spores in wash water
 - Improved understanding of persistence / adherence and decontamination methods to inform recovery decisions
 - Spores
 - Cobalt and cesium (strontium) on corroded pipes
 - with and without biofilm



Accomplishments & Outcomes

Treatment and Decontamination (*Cont'd*)

- Development of a decontamination experimental protocol
- Experimental and modeling studies on arsenic adsorption



OUR RESEARCH FACILITIES

TEST AND EVALUATION FACILITY

The Test and Evaluation (T&E) Facility is located in Cincinnati, Ohio. T&E is a multipurpose, high bay research facility. Some experiments are performed under laboratory conditions (bench-scale), while others are conducted in large system simulators or in the field (pilot-scale).

Examples of interior pipe corrosion and sediment deposition, which can inhibit decontamination efforts.



Clear pipe loop water distribution system simulator.



“Once through” water distribution system simulator, with sampling points (right).



Various sensors being tested for their ability to detect contaminants.



Innovative Approaches

- Disinfection of *Bacillus* spores in water using plasma
- Microelectrodes to measure disinfectant profiles (bulk phase, biofilms)
- Quantitative Structural Property Relationships
- Water quality and real time modeling
- Data mining and data fusion techniques
- Cutting edge sustainable solutions



Questions???

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THANK YOU