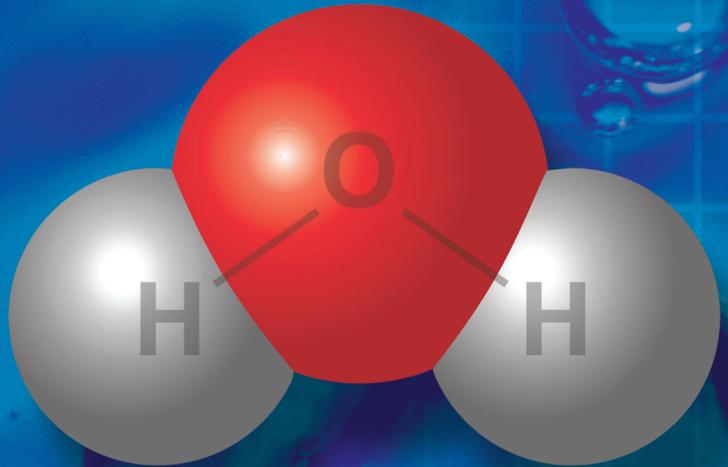




The Water Security Research and Technical Support Action Plan

Progress Report for 2005

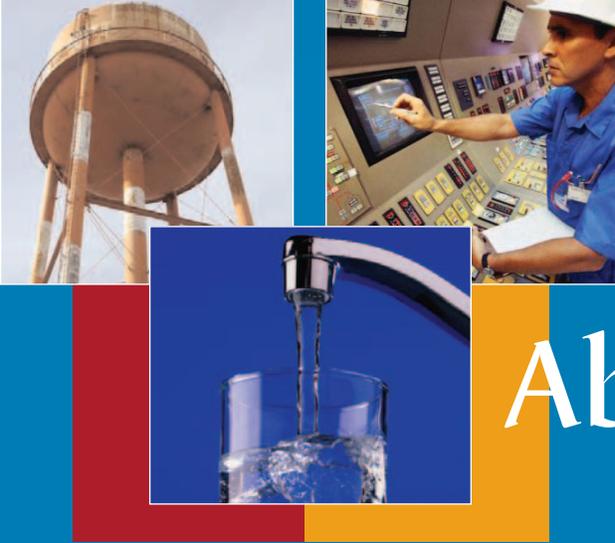


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About This Document

This report describes progress on issues set forth in the U.S. Environmental Protection Agency's (EPA's) *Water Security Research and Technical Support Action Plan* (Action Plan). EPA collaborated with many stakeholders in developing the Action Plan, which identifies research and technical support needs to ensure the security of the nation's water infrastructure. (It should be noted that, for the purposes of this document, the term "water," as it applies to the water infrastructure, encompasses both drinking water and wastewater.)

EPA has initiated more than 100 projects to meet the needs listed in the Action Plan. These projects will result in a number of important products—including voluntary guidelines, protocols, technologies, software, training, handbooks, and other scientific and technical tools—to improve the nation's capabilities in preventing and responding to a water security threat or incident.

This report is divided into the following sections:

- **Section I, Executive Summary**, provides an overview of the progress made to date.
- **Section II, Background**, describes EPA's role in water security and the development of the Action Plan.
- **Section III, Accomplishments to Date**, summarizes the technical support and research products currently completed.
- **Section IV, Products in Development**, describes the high-priority, "Tier 1" technical support and research products in development. Tier 1 products are the highest-priority research products identified in the Action Plan and are of interest to a diverse group of stakeholders.
- **Section V, Next Steps**, describes additional collaborative efforts under way to further address the needs identified in the Action Plan.
- **Appendices** to this report include tables that summarize the status of all technical support and research products. Appendix A addresses completed Tier 1 products, and Appendix B describes Tier 1 products still in development. Appendix C focuses on Tier 2 products, which are of interest to smaller, specialized groups of stakeholders and are not described in detail in this report. Appendix D lists acronyms used in this report.



Section I: Executive Summary

Since the events of September 11, 2001, improving the security of our nation's drinking water and wastewater infrastructure has become a top priority. The U.S. Environmental Protection Agency (EPA) plays a critical role in this effort as the federal agency lead for water security.

In March 2004, EPA released the peer-reviewed *Water Security Research and Technical Support Action Plan* (Action Plan), which identified important issues for the drinking water and wastewater industries, outlined research and technical support needs to address those issues, and presented a list of projects to be undertaken in response to the identified needs. This document describes the progress in addressing the issues identified in the Action Plan.

The National Homeland Security Research Center (NHSRC) in the Office of Research and Development (ORD) and the Water Security Division (WSD) in the Office of Water (OW) led the development of the Action Plan, which mobilized a wide range of partners (see sidebar, page 3). During the development of the Action Plan, these partners helped identify critical technical support and research projects needed to ensure the security of the nation's drinking water and wastewater systems. These needs form the core of the Action Plan. The various partnerships initiated by EPA will continue to be of critical importance as the Action Plan is implemented and updated.

The completion of the Action Plan marked a major step towards developing a comprehensive research strategy to protect the country's water infrastructure. Much has been accomplished since the release of the Action Plan. Partners have joined together to address the multiple concerns facing the nation's water sector. EPA has also put into place contracts, interagency agreements, and memoranda of understanding with organizations to conduct research studies, create standard operating procedures and protocols, and develop new technologies and tools to enhance water security (see Figure 1 on page 3 for the breakdown and status of EPA's Tier 1 and Tier 2 technical support and research projects).

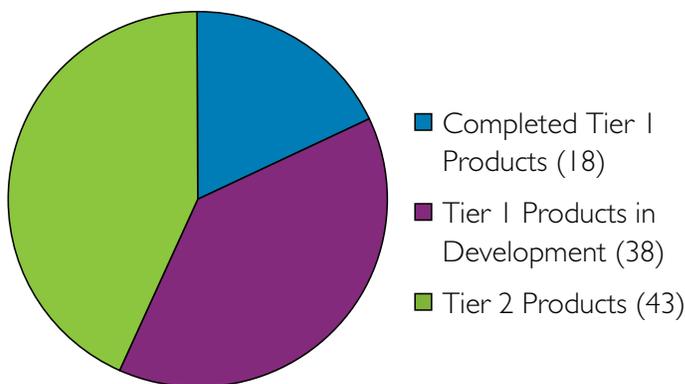
A number of key technical and research products have already been completed:

- Reports describing the most likely physical, electronic or cyber, and contamination threats to the nation's drinking water and wastewater systems.
- Updates of software tools and training to help water facilities conduct vulnerability assessments of their systems.
- Guidance, decision trees, protocols, and methodical approaches for responding to contamination threats and incidents.
- Procedures for handling and processing emergency water samples suspected of contamination with a known or unknown chemical or biological material.

- A series of guides that describe products available for enhancing communication, physical security, electronic security, and water monitoring.
- A compendium of environmental laboratories nationwide that could assist water utilities and government agencies respond to contamination threats, terrorist attacks, or natural disasters.
- Studies to determine the inactivation/removal capabilities of boiling and chlorination on pathogens.
- Evaluations and verifications of technologies related to contamination detection systems, point-of-use (POU) drinking water treatment, and wastewater treatment.

The completion of the remaining projects set forth in the Action Plan will result in the development of valuable tools in the areas of physical and cyber infrastructure protection; contamination identification; monitoring and analysis; treatment, decontamination, and disposal; contingency planning; infrastructure interdependencies; and risk assessment and communication.

Figure 1. Breakdown and Status of EPA’s Tier 1 and Tier 2 Technical Support and Research Projects Enhancing Drinking Water and Wastewater System Security

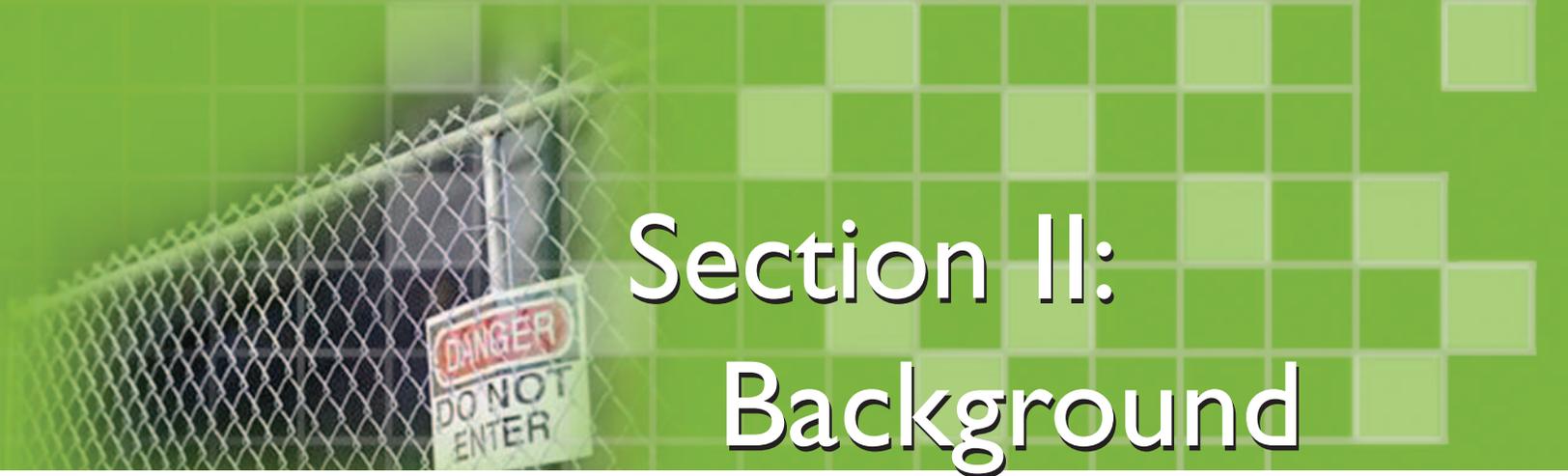


Collectively, these products will enhance the capabilities of the many parties involved in protecting the nation’s water assets, including drinking water and wastewater facility operators and managers; homeland security and law enforcement officials; public health officials and organizations; laboratories with water testing capabilities; state, regional, and local response organizations; federal agencies and departments; academia and consulting firms; vendors; and elected officials and the public.

Partnering for Water Security Research

From preparation of the Action Plan through the research, development, review, and distribution of water security projects and products, partnerships are critical to ensuring the safety of the nation’s water infrastructure. EPA has established relationships with many organizations in order to address the needs of the Action Plan. The following is a sampling of the many partners involved:

- American Society of Civil Engineers (ASCE)
- American Water Works Association (AWWA)
- American Water Works Association Research Foundation (AwwaRF)
- Association of Metropolitan Water Agencies (AMWA)
- Association of Public Health Laboratories (APHL)
- Association of State and Territorial Health Officials (ASTHO)
- Centers for Disease Control and Prevention (CDC)
- Department of Energy (DOE) National Laboratories
- Department of Homeland Security (DHS)
- Department of the Navy (NAVSEA)
- National Association of Clean Water Agencies (NACWA), formerly Association of Metropolitan Sewerage Agencies (AMSA)
- National Institute of Standards and Technology (NIST)
- National Research Council (NRC)
- U. S. Army Corps of Engineers (USACE)
- U.S. Army Edgewood Chemical Biological Center (ECBC)
- U.S. Geological Survey (USGS)
- Water Environment Federation (WEF)
- Water Environment Research Foundation (WERF)



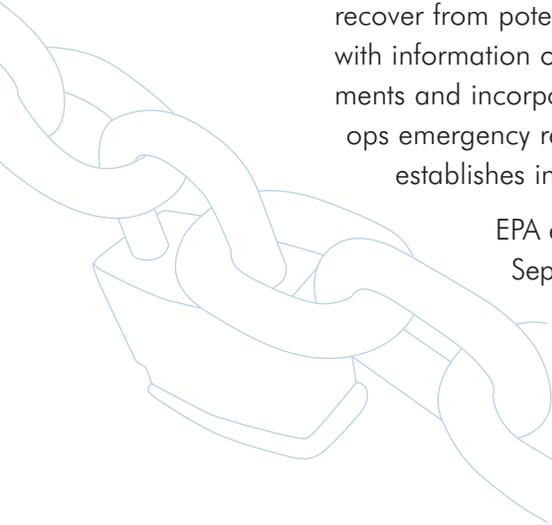
Section II: Background

The terrorist attacks on the Pentagon and World Trade Center and subsequent delivery of anthrax-contaminated letters in Washington, D.C., have changed the way the nation thinks about threats to national security. As the federal government reviewed its security priorities, the need to protect the country's critical infrastructures has come to the fore. The U.S. water system is widely recognized as one of the safest in the world, providing millions of Americans with clean, affordable water. As a critical infrastructure, however, water systems can be subject to threats and intentional attacks and must be protected.

EPA's Expanded Role

The U.S. Environmental Protection Agency's (EPA's) traditional mission of "protecting human health and the environment" has been broadened to include responsibility for protecting the United States against the environmental and health consequences of terrorist acts. The President's National Strategy for Homeland Security, published in July 2002, established priorities and direction for securing the nation's water infrastructure. In December 2003, Homeland Security Presidential Directive-7 (HSPD-7) designated EPA as the sector-specific lead agency for water infrastructure.

To address the Agency's water security mandate, EPA's Office of Water (OW) created the Water Protection Task Force, which was formally organized as the Water Security Division (WSD) in August 2003. WSD provides national leadership in developing and promoting security programs that enhance the water sector's ability to prevent, detect, respond to, and recover from potential terrorist or other intentional attacks. WSD provides the water industries with information on best security practices and assists them in developing vulnerability assessments and incorporating security enhancements into day-to-day operations. WSD also develops emergency response systems and tools, provides technical and financial support, and establishes information exchange mechanisms to assist members of the water industry.



EPA established the National Homeland Security Research Center (NHSRC) in September 2002. NHSRC became a permanent part of the Agency's Office of Research and Development (ORD) in December 2004. NHSRC is tasked with conducting research to provide information, tools, and guidelines that help decisionmakers adequately prepare for, detect, contain, and decontaminate chemical, biological, and radiological attacks on the United States. Within NHSRC, the Water Infrastructure Protection Division (WIPD) conducts research and reports on ways to protect the nation's water infrastructure. WIPD provides its products to water security stakeholders through

EPA's Statutory Authority

The Public Health Security and Bioterrorism Preparedness and Response Act (the Bioterrorism Act) of 2002 provides the legislative mandate for EPA's water security work.

EPA's responsibilities under the Bioterrorism Act include:

- **Section 1433: Terrorist and Other Intentional Acts.** Requires EPA to provide information on potential adversarial actions that could threaten water supply systems and provide strategies and responses that utilities could consider while conducting vulnerability assessments of their systems.
- **Section 1434: Contaminant Prevention, Detection, and Response.** Directs EPA to review methods to prevent, detect, and respond to the intentional contamination of water systems, including a review of equipment, early warning notification systems, awareness programs, distribution systems, treatment technologies, and biomedical research.
- **Section 1435: Supply Disruption Prevention, Detection, and Response.** Requires EPA to review methods by which the water system and all its parts could be intentionally disrupted or rendered ineffective or unsafe, including methods to interrupt the physical infrastructure, computer infrastructure, and treatment process.

Several Homeland Security Presidential Directives (HSPDs) have also helped define EPA's homeland security role:

- **HSPD-7, Critical Infrastructure Identification, Prioritization, and Protection,** designates EPA as the sector-specific lead agency for critical water infrastructure.
- **HSPD-9, Defense of United States Agriculture and Food,** directs EPA to develop a robust, comprehensive, and fully coordinated surveillance and monitoring program to provide early detection of biological, chemical, or radiological contaminants. HSPD-9 also requires EPA to develop a nationwide laboratory network to support the routine monitoring and response requirements of the surveillance program.
- **HSPD-10, Biodefense in the 21st Century,** currently a classified document, reaffirms EPA's responsibilities under HSPD-9 while adding a directive regarding the Agency's responsibilities during decontamination efforts.

close interaction with WSD, other Agency offices, and the 10 EPA regions.

The Action Plan

To better identify, understand, and address the potential threats facing water infrastructure in the United States, NHSRC and WSD developed the *Water Security Research and Technical Support Action Plan* (Action Plan). Released in March 2004, the Action Plan addresses drinking water supply, water treatment, finished water storage, and drinking water distribution infrastructure. It also addresses wastewater treatment and collection infrastructure, including sanitary and storm sewers and combined sanitary/storm sewer systems, wastewater treatment, and treated wastewater discharges.

The Action Plan identifies seven major needs:

1. Protecting physical and cyber infrastructure.

2. Identifying drinking water contaminants.
3. Improving analytical methodologies and monitoring systems for drinking water.
4. Containing, treating, decontaminating, and disposing of contaminated water and materials.
5. Planning for contingencies and addressing infrastructure interdependencies.
6. Targeting impacts on human health and informing the public about risks.
7. Protecting wastewater treatment and collection systems.

To ensure that all avenues were explored in identifying water security needs and potential projects, several EPA offices and a number of stakeholders collaborated in the development of the Action Plan. These stakeholders included drinking water and wastewater industry professionals, government agencies, homeland security experts, academics, and consultants.

Development of the Action Plan commenced in November 2002, when EPA convened a meeting of federal partners and water utility representatives in Cincinnati, Ohio, to discuss and refine water security issues and needs. Based on the results of that meeting, the Action Plan was drafted and presented for review at the Water Security Stakeholders Meeting, held in February 2003 in Washington, D.C.

Additional needs and projects proposed for inclusion at this meeting were added to the Peer Review Draft of the Action Plan. This draft was presented to an independent peer review panel in two meetings with the National Research Council (NRC) of the National Academies.

National Homeland Security Research Center

In September 2002, EPA announced the creation of a program for Homeland Security Research within the Agency's Office of Research and Development (ORD). The National Homeland Security Research Center (NHSRC) is headquartered at EPA's Andrew W.

Breidenbach Environmental Research Center in Cincinnati, Ohio, and also maintains offices at EPA headquarters in Washington, D.C., and in EPA's Research Triangle Park, North Carolina, facility.

NHSRC is now a permanent component of ORD, and is organized into three divisions, each of which focuses on a specific area of homeland security research. The three divisions are:

- Water Infrastructure Protection Division (WIPD)
- Threat and Consequence Assessment Division (TCAD)
- Decontamination and Consequence Management Division (DCMD)

WIPD is the primary driver of research efforts being conducted under the Action Plan. The division focuses on water supply, treatment, and distribution infrastructures in U.S. communities and conducts research concerning contaminant detection and characterization; emergency response and mitigation; and prevention and security. The division also addresses wastewater treatment and collection infrastructure, including collection (sanitary and storm sewers, or combined sanitary/storm sewer systems) and impacts on receiving waters such as rivers, estuaries, and lakes.



EPA reviewed the comments received from the review panel and incorporated the majority of them into the Action Plan. In addition to NRC review, EPA collaborated with the Water Environment Research Foundation (WERF) to conduct a wastewater security symposium in August 2003. Symposium participants identified needs and projects for inclusion in the Action Plan.

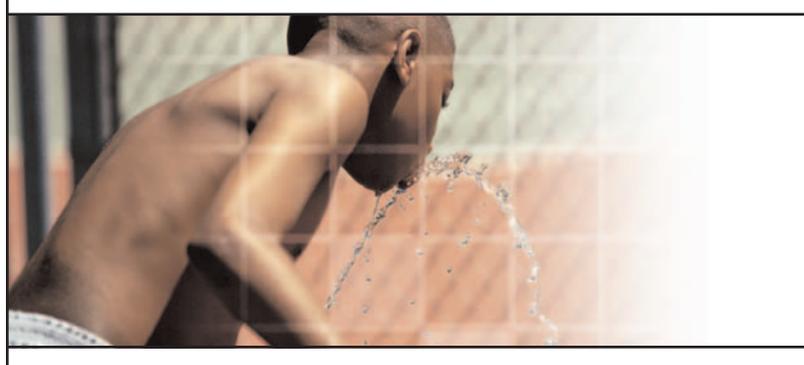
Product Use and Availability

More than 100 projects have been initiated to address the needs listed in the Action Plan. Various EPA offices, stakeholders, and federal organizations are leading different projects and assisting in the implementation of the Action Plan. Information and products resulting from these projects will be widely disseminated to interested stakeholder groups through documents; databases; Web sites; scientific and technical journals; and symposia, workshops, and conferences.

Stakeholders will be able to use the information gathered and products developed through the Action Plan to make more informed decisions regarding prevention, preparedness, response, and recovery in case of a threat or actual attack on the water sector. These users include water industry representatives; public health officials and organizations; laboratories with water testing capabilities; state, regional, and local response organizations; federal agencies and departments; state environmental agencies; academia and consulting firms; vendors; and elected officials and the public.

Certain products contain sensitive material and require distribution through secure or limited-access information exchanges. In November 2004, the National Association of Clean Water Agencies (NACWA) developed the Water Security Channel (WaterSC) for distributing sensitive material. For more information about WaterSC, visit <www.watersc.org>.

A listing of publicly available NHSRC research products is available through the NHSRC Web site at <www.epa.gov/nhsrc>; a catalogue of publicly available products from both WSD and NHSRC is provided on the WSD Web site at <www.epa.gov/safewater/security>.





Section III: Accomplishments to Date

In collaboration with the drinking water and wastewater community, federal partners, and other stakeholders, the U.S. Environmental Protection Agency (EPA) has made significant progress in addressing the needs identified in the Action Plan. The Agency has developed guidance and training, created new analytical tools, and conducted important research to improve the security of the nation's water infrastructure and emergency response capabilities. A number of high-priority technical support and research products have been completed, as described on the following pages. A summary of these projects and more information on accessing these products is presented in Appendix A.

Threat Scenarios for Water Systems Report (Classified)

EPA has developed a report ranking the most likely physical, cyber, and contamination threats to drinking water systems. This information, compiled in the Threat Scenarios for Water Systems Report, will inform a number of other projects in the Action Plan, and more generally, the federal homeland security community. To develop the report, EPA first created a list of potential threat scenarios relevant to drinking water and wastewater systems. Building from other EPA efforts to rank and prioritize threats to human health, EPA developed a risk-based methodology to screen out unlikely or low-impact scenarios. The methodology ranked threat scenarios according to their feasibility, availability of materials, public health, economic, and environmental impacts. The report was reviewed by all program offices in EPA before being finalized. The report has been classified.



Wastewater Baseline Threat Document (Classified)

Under this project, EPA worked with the Water Environment Federation (WEF) to identify and prioritize potential physical, cyber, and contamination (e.g. biological, chemical, radiological) threats and threat scenarios for the nation's wastewater treatment and collection infrastructure, including consequence analysis of adverse events. This document can help wastewater system managers:

- Understand potential vulnerabilities of their systems
- Understand potential threats to their systems
- Identify approaches for risk-based vulnerability assessments of their assets
- Understand the planning steps needed to perform a vulnerability assessment

Methodologies and Tools for Conducting Vulnerability Assessments

The 2002 Bioterrorism Act mandates that all community water systems serving more than 3,300 people conduct vulnerability assessments to evaluate their susceptibility to potential threats and identify risk reduction measures. The law also requires that EPA develop guidance for small systems serving less than 3,300 people. Under the Action Plan, EPA has supported the development of new methodologies and training for assessing vulnerabilities to drinking water, combined drinking water/wastewater, and wastewater systems. EPA and its project partners have performed modifications and enhancements to the following two tools:

Risk Assessment Methodology for Water Utilities (RAM-WSM)

(Publicly available at <www.epa.gov/safewater/watersecurity> under Vulnerability Assessments)

While a number of security risk assessment procedures and tools are now available, many utilities are using a tool known as the Risk Assessment Methodology for Water Utilities (RAM-WSM). With EPA support, the American Water Works Association Research Foundation (AwwaRF) and the Department of Energy's Sandia National Laboratories (SNL) developed RAM-WSM and conducted extensive training on the tool for thousands of water utility participants. RAM-WSM and other vulnerability assessment tools can help water utilities identify and prioritize threats, determine critical assets that could be subject to terrorism or other harmful acts, assess the likelihood of such an event occurring, evaluate countermeasures, and develop a plan for reducing risks. RAM-WSM is available only to relevant stakeholders in the water supply community, such as personnel at drinking water utilities; consulting engineers working for drinking water systems; state drinking water program regulatory personnel; and others providing security for drinking water utilities.

Vulnerability Self Assessment Tool (VSATTM) - Version 3.1

(Publicly available at <www.epa.gov/safewater/watersecurity> under Vulnerability Assessments)

With support from EPA, the National Association of Clean Water Agencies (NACWA) developed new software to help water utilities create, update, or revise their vulnerability assessments. The Vulnerability Self Assessment Tool (VSATTM) Version 3.1 enables users to assess a complete range of utility assets and offers significant upgrades, including new information on threats and countermeasures, an improved vulnerability evaluation method, and a new "expert mode" that makes the review and update of analysis easier. The Emergency Response Plan (ERP) module included in VSATTM Version 3.1 has been enhanced for both drinking water and combined drinking water/wastewater systems. NACWA is collaborating with the Water Environment Research Foundation (WERF) to make a similar ERP module available for wastewater utilities.

Interim Guidance and Voluntary Design Standards to Improve Security at Drinking Water and Wastewater and Stormwater Facilities

(Publicly available at <www.asce.org/static/1/wise.cfm>)

To improve security at the nation's water utilities, EPA established a cooperative agreement with the American Society of Civil Engineers (ASCE), the American Water Works Association (AWWA), and the Water Environment Federation (WEF) to develop guidance and voluntary design standards. To date, the project partners have completed three interim documents, as described as follows. EPA and its partners are continuing to develop additional guidance (see page 17).

Interim Voluntary Guidelines for Designing an Online Contaminant Monitoring System (OCMS)

Many water utility operators have identified timely contaminant monitoring as an important element in risk management. This document provides the water infrastructure community with important guidance for the design and implementation of an online contaminant monitoring system (OCMS). The report addresses numerous key issues concerning OCMS development:

- OCMS development rationale
- Detection, concentration, and identification of contaminants
- Instrument and platform selection and siting
- Data analysis and model use
- Communication system design
- Contamination event response
- Connection to existing surveillance systems
- System operations, maintenance, and upgrades

Interim Voluntary Security Guidance for Water Utilities

This document provides water utilities with guidance on designing new facilities and retrofitting existing ones to enhance security and reduce risks to the public water supply. The guidance emphasizes facility management, operations, and design considerations that can facilitate the installation and upgrade of physical security systems. The document also provides guidance on enhancing cyber security, selecting the optimal equipment, and developing an emergency response plan.

Interim Voluntary Security Guidance for Wastewater/Stormwater Utilities

This guidance document is intended for wastewater utilities that have completed a vulnerability assessment and are seeking methods for improving system security. While the guidance is primarily focused on design considerations for wastewater and stormwater systems, it also provides important information on management and operational practices that can be implemented without major capital investment. The report also provides initial guidance for enhancing cyber security, installing electronic security devices, and developing an emergency response plan.

Response Protocol Toolbox (RPTB)

(Publicly available at www.epa.gov/safewater/watersecurity under Emergency/Incident Planning)

The Response Protocol Toolbox (RPTB) is a comprehensive planning tool that includes decision trees, protocols, and analytical and methodical approaches to help drinking water utilities, laboratories, emergency responders, state drinking water programs, technical assistance providers, and public health and law enforcement officials effectively and appropriately plan for and respond to contamination threats and incidents.



The RPTB contains six interrelated modules:

1. **Water Utility Planning Guide.** Module 1 provides a brief discussion of the nature of the contamination threat to the public water safety. It also describes planning activities that utilities can take to effectively manage contamination threats and incidents.
2. **Contamination Threat Management Guide.** Module 2 provides a framework for evaluating a water contamination threat. It also describes information that could be useful for conducting a threat evaluation and describes actions that could be taken in response to a threat.
3. **Site Characterization and Sampling Guide.** Site characterization is defined as the process of collecting information from the site of a suspected contamination incident at a drinking water system. Module 3 presents protocols and procedures for site characterization activities.
4. **Analytical Guide.** Module 4 presents approaches and procedures for analysis of water samples that can be collected from the site of a suspected contamination incident. It also describes special laboratory considerations for handling and processing the samples.
5. **Public Health Response Guide.** Module 5 deals with public health response measures that could be used to minimize public exposure to potentially contaminated water. It examines the role of the water utility during a public health response action, as well as the interactions between the utility and other organizations and officials involved in making public health decisions. Public notification strategies and alternative water supply issues also are discussed.
6. **Remediation and Recovery Guide.** Following a confirmed water contamination incident, it will be necessary to remediate the system and demonstrate that the system has been successfully restored prior to resuming normal operation. Module 6 describes the planning and implementation of remediation and recovery activities.

A laboratory drill was conducted in 2003 to assess the responsiveness of laboratories to Module 4. Because each laboratory's approach is developed based on existing laboratory methodologies and infrastructure, the drill was designed to be a test of laboratory responsiveness, similar to that required in an emergency situation.

The toolbox will be updated periodically, and additional products will be added to the toolbox over time.

Security Product Guides

(Publicly available at www.epa.gov/safewater/watersecurity/guide/index.html)

EPA has developed a series of Security Product Guides to provide information on products that are available to enhance:

- **Communication/integration**, such as electronic sensors and Supervisory Control and Data Acquisition (SCADA) systems.
- **Physical security**, such as card identification and biometric security systems, fences, gates, and manhole locks, to prevent or delay unauthorized entry into buildings or pipe systems.
- **Electronic or cyber security**, such as computer firewalls, anti-virus software, and remote monitoring systems.
- **Water monitoring**, such as water quality sensors, biological sensors, chemical sensors, and radiation detection equipment, which can identify anomalies that pose a threat in raw water, process streams, finished water, and influent/effluent wastewater.

The products described in these guides are applicable to distribution systems, wastewater collection systems, pumping stations, treatment processes, main plant and remote sites, personnel entry, chemical delivery and storage, SCADA, and control systems for water and wastewater treatment systems. EPA will regularly update these guides, and develop additional guides as needed, to ensure the most recent information on security technologies is available. The inclusion of specific products in the guide does not signify endorsement by EPA.

Environmental Laboratory Compendium

(Restricted access available at www.epa.gov/compendium)

EPA developed a compendium of environmental laboratories nationwide that could assist water utilities and government agencies in responding to contamination threats, terrorist attacks, or natural disasters. The compendium is a live, secure, searchable database that contains each laboratory's specific capabilities to analyze chemical and biological analytes, radiochemical agents, and contaminants associated with chemical warfare and bioterrorism. Users must be registered in order to access the database.

One of the compendium's special features is a "water view," which allows users to directly access laboratories that possess water analysis capabilities. Specific information listed includes the laboratory's location, contact information, capabilities, and instrumentation. Gaps and vulnerabilities in the current laboratory analytical support area have also been identified, and recommendations for addressing these gaps will be integrated into existing and future projects.

Inactivation/Removal Capabilities of Treatment and Disinfection Technologies for Biological Contaminants

(Publicly available at <www.cdc.gov/ncidod/EID/vol10no10/04-0158.htm>)

EPA conducted a study to determine the capabilities of technologies for effectively inactivating various strains of anthrax (*Bacillus anthracis*). The study's results were published in the October 2004 edition of the Centers for Disease Control and Prevention's (CDC's) *Emerging Infectious Diseases*, a peer-reviewed journal that tracks and analyzes disease trends.

Effectiveness of Chlorination on Vegetative and Spore Forms of Bacterial Bioterrorist Agents

(Abstract is publicly available at <<http://aem.asm.org/cgi/content/abstract/71/1/566>>)

In a recently completed study, EPA and CDC determined that select bacterial bioterrorist agents can be effectively inactivated through exposure to free available chlorine (FAC). Researchers exposed both vegetative cells (*Brucella melitensis*, *Burkholderia mallei*, *Burkholderia pseudomallei*, *Francisella tularensis*, and *Yersinia pestis*) and spore forms (*Bacillus anthracis*) to varying concentrations of FAC. The team also varied exposure times and temperature to determine the most effective parameters for inactivation. A summary of the study and detailed results were published in the January 2005 edition of *Applied and Environmental Microbiology*, a peer-reviewed journal that highlights research findings applicable to the development of new processes or products. Additional ongoing research on inactivation and disinfection through chlorination is discussed on page 23.



Environmental Technology Verification (ETV) Program: Water Supply Systems, Point-of-Use (POU) Treatment, and Wastewater Treatment

(Publicly available at <www.epa.gov/etv/verifications/verification-index.html>)

EPA's Environmental Technology Verification (ETV) Program focuses on verifying effective technologies that can be used by water utility operators to monitor, detect, and treat chemical or biological contaminants introduced into a water system. ETV targets technologies related to three sections of the water usage cycle: water supply systems, point-of-use (POU) treatment, and wastewater treatment. ETV has evaluated and tested a number of technologies, as described as follows.

Immunoassay Test Kits for Pathogens and Biotoxins

Four immunoassay test kits for pathogens and biotoxins have been tested. These portable technologies allow water utility operators to conduct onsite testing for anthrax, botulinum toxin, and ricin contamination. Test results, which are available in a matter of minutes, are read using immunochromatographic or photometric devices.

Portable Cyanide Analyzers

Six monitoring technologies to rapidly detect the presence and concentration of cyanide in water have also been verified. One of the technologies is a colorimetric test that uses a photometer to measure cyanide contamination, while two others use portable colorimeters to generate results. The remaining three technologies rely on solid sensing elements.

Rapid Toxicity Testing Systems

ETV has verified the performance of eight rapid toxicity testing systems. Six of the tested technologies rely on luminescent microorganisms to measure toxicity. A seventh technology measures the respiration rates of small crustaceans to measure contamination, while the eighth system relies on chemiluminescence to quantitatively assess water samples.

Rapid Polymerase Chain Reaction (PCR) Technologies

Three rapid polymerase chain reaction (PCR) technologies have been recently evaluated. One technology is an integrated system that includes PCR chemistry, instrumentation, and data analysis software for the detection of *Escherichia coli* (*E. coli*). The provided software offers both a real-time and endpoint assay for PCR and data analysis. A second technology—also a three-part system—allows for the timely detection of *Francisella tularensis* (*F. tularensis*), *Yersinia pestis* (*Y. pestis*), *Bacillus anthracis* (*B. anthracis*), *Brucella suis* (*B. suis*), and *E. coli*, as well as a number of biowarfare agents, including plague, salmonella, and botulism. A third technology is a multiplex system capable of detecting *F. tularensis*, *Y. pestis*, *B. anthracis*, and smallpox in individual endpoint assays.

Reverse Osmosis Point-of-Use (POU) Devices

For POU treatment, investigators evaluated three processes that use combinations of reverse osmosis and filtration to remove sediments, contaminants, and tastes and odors from drinking water. During a three or five-phase process, depending on the technology selected, inlet water passes through a series of reverse-osmosis membranes and carbon blocks or filters.

Decontamination Wastewater Treatment Technologies

The ETV program has verified the performance of an easily portable, self-contained wastewater treatment system to decontaminate water and wastes generated during the cleanup of buildings and structures contaminated with biological or chemical agents.

EPA's Technology Testing Programs

In 1995, EPA launched the Environmental Technology Verification (ETV) Program to develop testing protocols and verify the performance of innovative technologies that have the potential to improve protection of human health and the environment. ETV was created to accelerate the entrance of new environmental technologies into the domestic and international marketplace. ETV operates through public/private testing partnerships and input is provided by the active involvement of stakeholder groups. All test/quality assurance plans and protocols are developed with the participation of technical experts, stakeholders, and vendors. In 2001, ETV's traditional role was expanded to test and verify homeland security technologies.

In 2004, NHSRC began a new program, the Technology Testing and Evaluation Program (TTEP), to provide reliable information regarding the performance of homeland security related technologies. TTEP is an offshoot of the ETV Program, but differs in that it is not based on voluntary vendor participation and that it compares the performance of similar technologies. TTEP is based on user needs, and the selection and prioritization of technologies evaluated is made with stakeholder input.

In 2003-2004, ETV verified 40 monitoring and treatment technologies relevant for water security. In 2005, an additional 20 homeland security verifications are expected. This will complete ETV verification of homeland security technologies, and further work will continue under TTEP.

Reports of testing performed under the ETV and TTEP programs can be found under the "Publications" section of the NHSRC Web site at <www.epa.gov/nhsrc> or at <www.epa/etv/homeland>. A fact sheet providing additional information on TTEP is also available under the "Publications" section of the NHSRC Web site.



Section IV: Products in Development

As described in Section III of this report, a significant amount of work has been accomplished in a short time, and many high-priority technical support and research products are complete. At the same time, a number of other activities outlined in the Action Plan are still in progress. Some products are nearing completion; others will require more time. The body of research currently under way will result in additional guidance, tools, and improvements to safeguard the nation's water infrastructure.

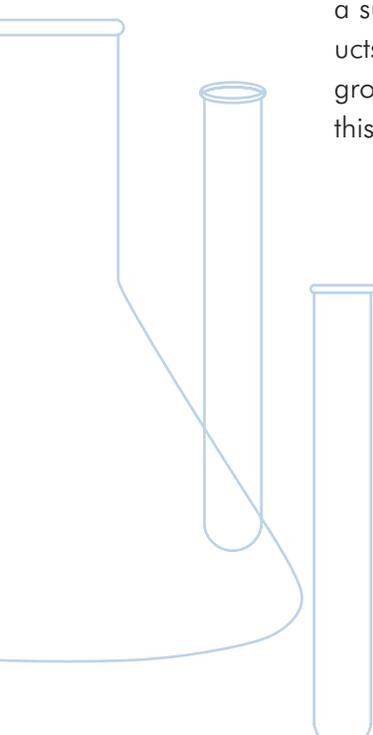
This section of the report describes "Tier 1 products," which are the products of the Action Plan's highest-priority research projects. These high-priority products, currently in development, are of interest to a diverse group of stakeholders. Appendix B provides a summary listing of these products. "Tier 2 products," which are of interest to smaller, specialized groups of stakeholders, are not described in detail in this report, but are summarized in Appendix C.

Addressing Stakeholder Needs

The Tier 1 products discussed in this section are organized by the following needs, which were outlined in the *2004 Water Security Research and Technical Support Action Plan*:

1. Protecting drinking water systems from physical and cyber threats.
2. Identifying drinking water threats, contaminants, and threat scenarios.
3. Improving analytical methodologies and monitoring systems for drinking water.
4. Containing, treating, decontaminating, and disposing of contaminated water and materials.
5. Planning for contingencies and addressing infrastructure interdependencies.
6. Targeting impacts on human health and informing the public about risks.
7. Protecting wastewater treatment and collection systems.

A final need, Implementing the Action Plan, is addressed on pages 32-33 of this report.



Protecting Drinking Water Systems from Physical and Cyber Threats

Water systems are vulnerable to physical attacks that can compromise the quantity and quality of a community's drinking water, as well as electronic or cyber attacks that can disrupt a system's computer operations. Physical threats include disruptions to water supply, treatment plants, storage facilities, and distribution systems. Cyber threats include attacks against computers, networks, and information stored in them, such as intrusion by hackers into a plant's system. Computer attacks could alter water quality or flow, disrupt plant operations, or release or prevent the release of chemicals that are stored, generated, or used on site.

Guidance and Voluntary Design Standards to Improve Security at Drinking Water and Wastewater and Stormwater Facilities

In partnership with the American Society of Civil Engineers (ASCE), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), the U.S. Environmental Protection Agency (EPA) is developing guidance and voluntary design standards for reducing risks to the drinking water, wastewater, and stormwater infrastructure arising from both malevolent and natural occurrences. Information on a full spectrum of potential solutions is being addressed, including retrofits, operational and management practices, and new design features. The standards are placing special emphasis on multiple benefits (in addition to security benefits) to increase the cost-effectiveness of design enhancements. The completion of these standards involves three phases:

- Phase I - Development of pre-standards guidance documents
- Phase II - Preparation of training materials
- Phase III - Development, vetting, and acceptance of appropriate standards

To date, Phase I has been completed for three different standards (see page 10 for a more detailed description of these products).

Guidance on Protecting Drinking Water and Wastewater Facilities from Blasts

EPA is working in collaboration with the U.S. Army Corps of Engineers (USACE) - Engineer Research and Development Center to develop a methodology for drinking water and wastewater utilities to assess their vulnerability to blasts from explosive devices that could severely damage their facilities and disrupt operations. The methodology, which will be compatible with existing vulnerability assessment approaches currently used by drinking water and wastewater utilities, would also identify measures that could be implemented by utilities to better protect their facilities from blasts.

Supervisory Control and Data Acquisition (SCADA) Systems

Many drinking water and wastewater facilities use Supervisory Control and Data Acquisition (SCADA) systems to integrate the monitoring of various facility operations into a central processing center. With the help of remote sensors and alarms located throughout a facility system (e.g., at pump houses, reservoirs, and water tanks), SCADA systems can help detect atypical or abnormal water quality conditions in real-time. These systems also can be programmed to respond to changes in system parameters, either by performing automated actions (such as adding chlorine to a drinking water system in response to low residual chlorine levels), or by sounding an alarm, which can alert operators and allow them to respond manually.

Guidance for Water and Wastewater Utility Computer Systems

EPA has funded a project to provide guidance to drinking water and wastewater utilities on securing and protecting their automated systems. The Water Environment Research Foundation (WERF) and the American Water Works Association Research Foundation (AwwaRF) are developing guidance for water infrastructure computer systems, including SCADA systems. The guidance will also document technology that is currently available (and being further developed) to sense and correct security breaches, as well as to alert the relevant authorities about the event.

Identifying Drinking Water Threats, Contaminants, and Threat Scenarios

Knowing the biological, chemical, and radiological contaminants of greatest concern to the nation's drinking water supplies and systems is critical to the Agency's research and technical support efforts. EPA has undertaken an extensive effort to identify these contaminants and the situations in which the contaminants could be used. The effort is an evolving one, and tools are being developed that will be updated and improved as more information becomes available.

Water Contaminant Information Tool (WCIT)

EPA is developing the Water Contaminant Information Tool (WCIT), a Web-accessible database that will manage current, peer-reviewed information on priority contaminants for both drinking water and wastewater. The tool will contain information on physical properties, fate and transport, medical information and toxicity properties, drinking water and wastewater treatment effectiveness, sampling and analysis, potential early warning indicators, and considerations for a utility's planning for and responding to an incident. WCIT users will include drinking water and wastewater utilities, emergency responders, public health officials, environmental laboratories, states, federal entities, and technical assistance providers.



WCIT will support the development of vulnerability assessments, emergency response plans, and site-specific response guidelines. WCIT will also inform response decisions and identify knowledge gaps for priority contaminants, which will, in turn, direct future research efforts. Users will be able to search on a variety of parameters, generate standard or customized reports, compare agent information, and perform simple contamination calculations. User training and guidance will be incorporated into WCIT through an online user's guide, help menus, and a glossary. A feedback module will also be available. As more research is conducted, WCIT will be updated and populated with more information.

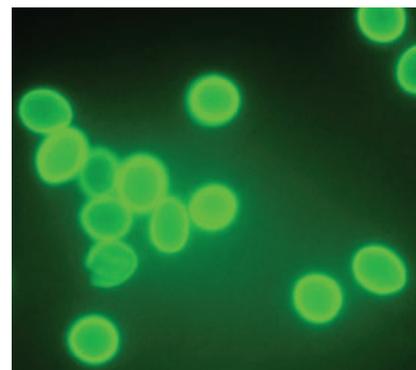
Water Contaminant Surrogates and Simulants Methods, Guidance, and Training

EPA has signed a memorandum of understanding with the U.S. Army Edgewood Chemical Biological Center (ECBC) to identify and validate surrogates or simulants for various agents. ECBC is also identifying or developing methods to detect the surrogates.

The surrogates will provide safer alternatives for use in testing, evaluation, and verification of technologies to protect drinking water supplies and systems. Validation studies will be conducted to ensure that the selected surrogates appropriately mimic their corresponding agent in response to various situations. ECBC will develop information describing the relationship between the surrogate and the contaminant of interest regarding a variety of biological, physiochemical, and toxicological properties. Guidance and training materials will also be developed for approved individuals and organizations.

Improving Analytical Methodologies and Monitoring Systems for Drinking Water

Correctly identifying contaminants after they have entered a drinking water system is of critical importance, particularly when they are not apparent through general observation or conventional testing. To safeguard the drinking water supply, treatment, and distribution infrastructure in U.S. communities, technologies need to be developed that can rapidly detect and identify unknown contaminants. EPA has formed several partnerships to help in this effort and to assist water utilities implement effective, new contamination warning systems. The water quality sensor technologies and software in these research agreements could potentially be incorporated into a system that will provide local drinking water quality officials with a timely alert of intentional or accidental drinking water contamination.



Development of Ultrafiltration Devices and a Water Filtering Protocol

While concentration techniques are essential to the sampling and analysis of biological contaminants, many of the currently available technologies are time-consuming and complex. EPA is working to enhance concentration technologies in cooperation with the Department of Defense's (DoD's) Joint Service Agent Water Monitor (JSAWM) Program, the Centers for Disease Control and Prevention (CDC), AwwaRF, and the Department of Energy's (DOE's) Idaho National Laboratory. Ultrafiltration has been identified as the most practical technology based on input from water utilities and response organizations. Two versions (automated and manual) of a new ultrafiltration concentration device are in development, along with a protocol for filtering water samples. EPA will solicit feedback from users to improve the technology and protocols for using the devices.

Sampling and Analytical Methods and Interim Protocol for Detecting Biological Contaminants in Water

Water utilities need improved analytical methods that can provide reliable information on contaminants. An initiative is under way to develop analytical methods for detecting biological contaminants, which will be integrated into a protocol to guide sampling and analysis. This protocol will become part of the Response Protocol Toolbox, described on page 11 of this report. A draft interim protocol will be developed for field and laboratory testing. Based on lessons learned from testing and real-world experiences, the protocol will be improved accordingly.

In the meantime, the National Environmental Methods Index (NEMI) is being updated to include analytical methods for biological, chemical, and radiological water contaminants. NEMI is an online database that allows users to search for and compare analytical methods. Upon completion of the protocol, NEMI-CBR (the version of NEMI that includes water security contaminants) will be further updated.

Reports on Biotoxins

This project is being conducted through an interagency agreement between EPA and the Naval Surface Warfare Center, Dahlgren Division. A literature review is under way to identify the properties of specific biotoxins or their role as intentional drinking water contaminants. Experimental laboratory work will follow the literature review and will be directed at developing methods for detecting and remediating biotoxins in water.

A number of products will result from this work:

- A report focusing on the state of knowledge on biotoxins as intentional contaminants for drinking water systems.
- A report detailing the use, performance, and suitability of immunoassay test kits in detecting biotoxins at concentrations of concern in drinking water.
- A report summarizing the data generated from using heat inactivation treatment and water treatment processes on biotoxins.

The information gleaned from this project will help inform the development of a protocol for analyzing unknown contaminants in drinking water supplies and systems. The protocol will be incorporated into the Response Protocol Toolbox.

Early Warning System (EWS) Technologies and Techniques to Monitor and Evaluate Drinking Water Quality: State-of-the-Art Review

EPA is developing a state-of-the-art document on technologies applicable to Early Warning Systems (EWSs) in drinking water. The document is for water utility operators, water organizations, monitoring technology and system developers and vendors. An EWS is an integrated system of monitoring sensors or devices linked in near real-time to provide immediate analysis and interpretation of a contamination event for a distribution system.

As promising technologies are brought into the commercial market, pilot testing will be conducted to observe the feasibility of EWSs. The results from the pilot-scale testing will be used to plan, organize, and conduct field-scale testing and evaluation. Through an interagency agreement with the U.S. Geological Survey (USGS), detectors and systems are being evaluated at an operating water utility. Upon successful completion of field-scale testing and evaluation, a report will be prepared that identifies qualifying protocols and technologies to apply tested EWSs to drinking water supply and distribution system protection. This document and additional reports on pilot testing will be made available over the next couple of years, and will play a role in meeting the requirements of HSPD-9.

Integrated Consortium of Laboratory Networks

In 2004, EPA and CDC developed a roadmap for integrating laboratories into an existing national network to meet emergency water analysis needs. The roadmap presents a phased strategy for aligning water laboratories with the CDC's Laboratory Response Network (LRN). EPA has joined the LRN Steering Committee and is working with the U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) to integrate this strategy with the Food Emergency Response Network (FERN), a system of laboratories for food and agriculture sample analysis. At the Agency level, EPA and CDC also developed a plan to address laboratory capability and capacity for handling environmental samples. This plan is being considered as EPA participates with CDC, USDA, FDA, the Department of Homeland Security (DHS), and other federal partners to address issues in laboratory preparedness for homeland security events.

Laboratory Response Tools

EPA is developing several tools, including training exercises and simulation modules, to prepare laboratories in responding to drinking water contamination events:

- A computer-assisted tool to increase effectiveness of laboratory strategies and decisionmaking in the process of identifying unknown contaminants in an emergency response situation.
- Additional laboratory drills to build on the lessons learned from the 2003 laboratory response (see Response Protocol Toolbox on page 11).



Containing, Treating, Decontaminating, and Disposing of Contaminated Water and Materials

To be prepared for a contamination event, water utilities, emergency responders, and others must have the knowledge and technology for containing and treating the nation's drinking water, decontaminating both water and equipment, and safely disposing of any residuals from response activities. EPA is developing modeling tools, reports, databases, and guidance to help water utilities and others better prepare and respond to a potential contamination event.

Distribution Systems Handbook

The Distribution Systems Handbook is a guide for drinking water utilities on how to hydraulically model distribution systems, conduct tracer studies for distribution system evaluation, calibrate hydraulic and water quality models, and integrate geospatial technology into data management and modeling. The document guides utility personnel on selecting the proper equipment and software needed to understand fate and transport in complex piping systems.

The study includes a series of case studies that illustrate the use of EPA products such as EPANET, PipeLineNet, and the Threat Ensemble Vulnerability Assessment (TEVA), as well as other

modeling tools. The case studies demonstrate how these tools can support epidemiological investigations, identify sources of drinking water contamination, support regulatory requirements, and identify the optimal number and placement of monitors to detect intentional contamination or reduce potential health effects. The study concludes with a discussion of future research needs in water quality management to address increasing concerns over water security.

Threat Ensemble Vulnerability Assessment (TEVA) Modeling Tool for Water Distribution Systems

The EPANET model (version 2.0), developed by EPA's National Risk Management Research Laboratory, performs extended period simulations of hydraulic and water quality behavior within pressurized pipe networks. The model provides the time-series concentration of a chemical as a single component; however, it does not consider bulk chemical reactions or pipe wall interactions. EPA is upgrading EPANET 2.0 to add the ability to perform modeling of multi-component reactions involving bulk water phase compounds, pipe surface compounds, and chemical and biochemical mechanisms. EPA is also developing improved methods for model calibration and data collection and identifying dual use benefits of these model improvements.

Through a collaborative interagency agreement with DOE's Argonne National Laboratory (ANL), EPA is developing the TEVA Modeling System. The TEVA system provides a suite of software tools for drinking water distribution system security that can be used in a distributed computing environment. This system enables high performance computing of multiple probabilistic simulations of complex behavior in large distribution systems, including chemical reactions, biological transformations, and interactions with the pipe wall. The TEVA computing framework makes large complex simulations tractable on small computing clusters.



By integrating software tools for drinking water security, the TEVA Modeling System will be useful in helping utilities to prepare for and respond to events to minimize their consequences. Based on the application of the TEVA Modeling System to several utility distribution systems, EPA will develop guidance on the use of models in mitigating and responding to contamination events. This guidance will include information on isolating affected portions of the network, locating the contamination source, identifying locations for confirmatory sampling, and developing decontamination strategies. Ultimately, the lessons learned from the TEVA Modeling System development and application will be used to assist those water distribution system networks not having detailed hydraulic models.

Threat Ensemble Vulnerability Assessment (TEVA) Contamination Warning System Data Analysis Tools

EPA and DOE's Sandia National Laboratories (SNL) are working in partnership to develop new software tools that will be incorporated in the TEVA Modeling System. EPA and SNL are developing tools to:

- Assess the vulnerability of distribution systems to contamination events.
- Estimate the public health impacts due to ingestion of contaminated water.

- Design, evaluate, and optimize sensor networks for contamination in a drinking water system.
- Identify contamination events from a stream of water quality online sensors.
- Locate the source of contamination from sensor data.

These tools will be contained within the TEVA Modeling System and will be available to water utilities, consultants, and researchers.

Resource Guide on the Aquatic Fate of Biological, Chemical, and Radiological Contaminants

Due to the threat of intentional attacks, there has been a significant increase in interest surrounding the fate of contaminants in natural waters. EPA is particularly interested in the hydrolysis rates and the formation of degradation byproducts resulting from interaction with dissolved humic materials (substances formed from the biological and chemical breakdown of animal and plant life).

To address this information need, EPA is developing a technical resource document on the fate of numerous biological, chemical, and radiological contaminants in source waters, drinking water treatment plants, and distribution systems. The document will incorporate the results of joint research with ECBC on the effect of humic material on these chemicals.

Research on the Inactivation of Biological Agents in Water

EPA has published two articles concerning its water treatment research, which has examined the effectiveness of: 1) boiling anthrax-contaminated water and 2) inactivating select bacterial agents through chlorination (see page 13). EPA is also researching the chlorination of *Francisella tularensis* and numerous surrogates for anthrax spores, as well as the resistance of *Bacillus* spores to chlorine dioxide when used as a disinfectant for drinking water treatment.

Drinking Water Treatability Database

To provide a more thorough understanding of effective treatment and decontamination processes for contaminated drinking water, EPA is developing a computerized database. The database will contain information on various drinking water contaminants, including those that are regulated, of particular interest to water security, or on the contaminant candidate list (CCL), as well as pesticides, endocrine disruptors, and pharmaceuticals. This online resource will also provide data on more than 30 different treatment processes. Information from this database will be added to WCIT as it becomes available (see page 18).

To help compile the database, EPA will use information gathered during numerous related research activities. This research covers the following areas:

- The ability of common water treatment methods to remove microbial and chemical contaminants.
- Identification of point-of-use/point-of-entry (POU/POE) technologies for treating contaminants.

- Chemical contaminants that could create hazardous byproducts during the decontamination process.

Municipal water system engineers and emergency responders will be able to use this database to identify the most appropriate and effective treatment processes or series of treatment processes in response to intentional (water security) and unintentional (spill) contamination events. Others (including regulators, researchers, design engineers, and academia) can use the data to identify best available technology (BAT), perform regulatory reviews, make CCL determinations, and identify research needs.

The Agency will update the database regularly to expand the number of contaminants included and to provide the most current information on treatment processes.

Resource Document and Guidance for Decontaminating Post-Service Connections

Through an interagency agreement, EPA and the National Institute of Standards and Technology (NIST) are developing a technical resource document that will provide critical information about tested decontamination technologies for post-service (post-distribution system) connection pipes, equipment, and appliances, including copper pipes, ice machines, and hot water heaters. Pipe towers at NIST will be used as part of the project field-testing. EPA will also use the information gathered through this testing to help draft guidance on decontaminating piping and equipment following an intentional attack on a water distribution system (see next product description).



Handbook for Decontaminating Piping and Equipment

Using information from research on decontaminated drinking water system components, EPA is developing a handbook for effectively decontaminating piping and equipment following an intentional attack on a water distribution system. This handbook, which will be included in EPA's Response Protocol Toolbox (see page 11), will help first responders, water utilities, and state and federal regulators prepare for and respond to an attack. This document will also provide important clean-up level criteria, helping utilities and regulators determine when a system is safe to use again.

Disposal Alternatives Tool

Following an attack on a water system, the immediate challenge that utilities and emergency responders face is the decontamination of the system and post-service connections so that the public can continue to receive safe drinking water. An additional challenge that must be addressed is the safe disposal of any contaminated waste, including contaminated piping, treatment residuals, and sludges generated during the decontamination process or the dismantling of a system. EPA is developing an online tool that will provide information about disposal options and associated regulations for decontamination-related waste. The tool will provide users with:

- Disposal regulations for various types of waste streams.

- Specific waste characteristics.
- Decontamination methods.
- Types of treatment and handling requirements necessary for safe disposal of waste streams.
- Lists of potential treatment options.

This effort is part of a larger undertaking to address disposal of all materials from intentional attacks.

Planning for Contingencies and Addressing Infrastructure Interdependencies

Following an intentional event or accidental disruption to water service, water utilities and municipalities must work as quickly as possible to address the root cause of the disruption. Prompt response is critical to decreasing the potential down time for a water distribution system. In some cases, a straightforward system repair might address the concern. In other cases, however, a primary water distribution system could be unavailable for an extended period of time. Under these circumstances, water utilities and municipalities must have effective contingency plans in place for supplying alternative sources of safe drinking water. EPA is developing tools to assist utilities plan for contingencies and provide alternative water supplies. The Agency is also examining interdependencies that water distribution and treatment systems have with other critical infrastructures, which could be disrupted or damaged by a water security breach.



Guidance for Drinking Water and Wastewater Utilities to Minimize Outages Due to Interdependencies with Other Critical Sectors

The operations of drinking water and wastewater facilities are dependent, to some degree, on the operations in 10 other critical sectors. Likewise, 13 sectors are dependent in some way on the supply of drinking water or wastewater services. EPA is working with Argonne National Laboratory (ANL) to provide tools to help drinking water and wastewater utilities minimize outages resulting from problems initiating within their own systems, as well as problems in other infrastructures (e.g., power supply, telecommunications) that critically affect the operations of water systems. Minimizing outages is important for not only maintaining continuity of drinking water and wastewater services, but also for reducing the possibility of cascading or escalating effects. Application of these tools will allow drinking water and wastewater utilities to assess their vulnerabilities with respect to interdependencies, take preventative measures reduce these vulnerabilities, and respond more effectively in the event that problems occur.

Report on Impacts to Water Systems Following Community-wide Radiological Events

EPA and ANL are evaluating the potential secondary impacts to water resources and infrastructure from a variety of possible incidents involving a radiological dispersal device (RDD) in urban areas. An RDD is any device that causes the intentional spreading of radioactive material across an area using conventional explosives. The research addresses different aspects of drinking water and wastewater system impacts following an RDD event. A report is being prepared to provide an estimate of the magnitude of the impacts that could potentially occur to drinking water and wastewater systems.

Guide on Deployment of Alternative Water

When drinking water systems are disrupted by an attack, it is essential for local utilities and municipalities to have contingency plans in place to provide customers with alternative sources of safe drinking water. EPA is working with the U.S. Army Corps of Engineers (USACE) to provide information on planning for alternative water supplies. The information will include a compendium of options for a variety of situations.

USACE is conducting a number of activities:

- 1) **Developing case studies.** These case studies examine contingency planning efforts under numerous situations (e.g., community water system size, population, geographic location, short-term versus long-term water needs) to help water utilities make the most technically feasible and cost-effective decisions.
- 2) **Assessing the deployment of portable water treatment facilities.** This project entails locating existing truck-mounted and otherwise portable water treatment units throughout the United States and within military installations and identifying a number of characteristics for each unit, including ownership, operating costs, type of treatment processes and capabilities, speed of deployment, and accessibility during domestic water emergencies.
- 3) **Assessing drinking water system redundancies.** This project identifies best practices for assessing and managing system redundancy based on technical feasibility and cost-effectiveness. Redundancies among a system can include backup diesel pumps, alternative storage, bypass delivery systems, and interconnections for rerouting water distribution.

Targeting Impacts on Human Health and Informing the Public About Risks

In the event of a water security threat or attack, responders will need to rapidly assess the risks and communicate information to the public in a clear, consistent, and accurate way. Research in this area focuses on adapting standard risk assessment methods for use during and immediately after a terrorist attack or other emergency. EPA is also developing a Web-based rapid risk assessment tool and a risk communication framework for emergency responders.

Health Effects Database

EPA is compiling a comprehensive, readily modified information system on the acute (one hour to less than one day), short-term (one day to 30 days), and chronic non-cancer health effects associated with the identified priority contaminants. Toxicity and infectivity information, risk assessment methods, dose-response, and health effects information is being compiled for chemicals (warfare agents, toxic industrial chemicals, and biotoxins) and microbiological agents of interest in both water and air.

As part of this project, EPA will evaluate nontraditional data sources for deriving acute and chronic toxicity values applied to water. The project will evaluate the use of lethal dose 50th percentile (LD_{50}) and QSAR (Quantitative Structure Activity Relationship) models to determine health and risk information for chemical agents that lack a complete set of toxicological data.

EPA will also compile and evaluate LD_{50} extrapolation methods for deriving acute and chronic toxicity values. This project is designed to develop and test methodologies to extrapolate across durations, to extrapolate from lethal doses to minimally toxic doses, and to interpret and apply summary toxicity properties of chemical groups to derive appropriate advisory levels.

The project will evaluate all possible routes by which people might be exposed to contaminated water. Although the traditional exposure route for contaminated drinking water is ingestion, some contaminants could result in exposures following inhalation, dermal, and ocular routes.

The information compiled will be made available through a secure and easy-to-update information portal on exposure routes and public health effects associated with various threat scenarios to water supplies and treated water. The compiled information also will be used as inputs into numerous activities and products such as fact sheets, derivation of toxicity values, and rapid risk tools. Collected data will also be incorporated into WCIT (see page 18).



Health Surveillance Network Linkages

EPA is collaborating with CDC, FDA, and state and local agencies to improve health surveillance networks and develop procedures for detecting water-related disease outbreaks. New and existing public health surveillance monitoring systems will be evaluated for their ability to track a disease or illness outbreak.

“Syndromic” systems are one type of network that could be useful in early disease detection. These systems include the reporting of increased cases of diseases by entities such as pharmacies and hospitals. The project will examine ways to improve input to such surveillance systems, link them with water utility data, and link the information electronically.

A technical guidance document will also be developed to help water utilities, public health officials, and other organizations institute a program for tracking disease outbreaks associated with water contamination events. This guidance will incorporate threat scenarios, detection methods, available technologies, distribution models, public health information, and other available data as appropriate.

Risk Assessment Decisionmaking Tools

Risk assessment and risk management need to be integrated into the decisionmaking process during all stages of a water security event, so that responders understand the options for minimizing exposures to the public. Using a holistic approach, this project will develop a decisionmaking framework for determining the actions needed to mitigate the health impacts of a water contamination event.

Using risk assessments and characterizations based on scenarios suggested by stakeholders (emergency response teams, regional response teams), this project will develop exercises that can be used by anyone looking to sharpen their risk assessment skills and to understand the nature of the potential risks within their communities. “Tabletop” exercises for group training and computer-based simulations for more individualized learning will be included.

Methods for Communicating Risks to Local Communities

EPA is developing a risk communication framework to help water utilities, health officials, emergency responders, and others communicate quickly and effectively with local communities when a threat or attack occurs. The Agency is reviewing existing risk communication resources and information-sharing strategies to help develop and refine the framework. Once the framework is established, tools will be developed to facilitate effective communication with a variety of audiences during a crisis. For example, EPA is currently developing a series of fact sheets that describe the risks of contaminants and/or toxicological information in multiple languages and for multiple uses. In addition, educational and training programs are being created on effective risk communication techniques.

Message Mapping for Decisionmakers

EPA is developing written and verbal message statements that water and wastewater utilities and elected officials can use to effectively communicate the potential risks arising from water emergencies. EPA anticipates that these communication tools will help communities establish local networks prior to the onset of crises and also enlist their cooperation with public agencies both before and during any such events.

Rapid Risk Assessment Tool

This project is developing a tool that uses readily available risk assessment techniques to rapidly assess the risks following a threat or intentional attack. The tool is envisioned to be a Web-based expert system, which can instantly calculate the health risks from multiple attack scenarios. Through a series of simple questions or queries, the system will provide step-by-step guidance through the risk assessment process and provide a numeric estimate of risk to human health. The system will be made available to users via secured access to EPA's Web site.

The system will be organized around data collection and evaluation, exposure assessment, toxicity assessment, and risk characterization. Data collection and evaluation will focus on identifying, measuring, and characterizing the toxic agents involved in the terrorist incident. Exposure assessment will focus on rapidly predicting and estimating the fate, transport, and transformation of the chemical or biological agent from its source to possible human receptors. Toxicity assessment will focus on the acute and sub-chronic effects and dose-response relationships of chemical and biological agents. Toxicologic information will be provided on a route-specific basis (e.g., ingestion, inhalation, dermal).

Crisis Communication Symposium

In May 2004, EPA conducted the National Water Security Risk Communication Symposium in San Francisco, California. The event featured presentations on the state-of-the-art of crisis communication and provided a forum for participants to share effective water security-related communication strategies, best practices, tools, and projects.

Approximately 100 individuals attended the event, including drinking water and wastewater utility managers, public health officials, state and local government representatives, local emergency response officials, elected officials, and the media. EPA is developing a comprehensive proceedings of the symposium on CD-ROM featuring PowerPoint presentations, video summaries of keynote topics, audio-recorded question and answer sessions, written summaries, photographs, and references.



Protecting Wastewater Treatment and Collection Systems

In addition to addressing threats against drinking water systems, EPA and its project partners are also conducting a multitude of projects to address the similar and more unique threats against wastewater treatment systems. To provide a more clear understanding of these threats, EPA is supporting research with the Water Environment Research Foundation (WERF) and others in a number of areas. These areas include identifying threats; assessing potential health and safety risks resulting from contaminated wastewater treatment facilities; developing intrusion prevention

technologies; and delivering appropriate response guidance and communication tools for wastewater treatment personnel.

Guidance on Managing Contamination Events

In collaboration with WERF, EPA is developing a guidance document to help wastewater utilities safely respond to, remediate, and recover from direct or secondary intentional contamination of wastewater collection and treatment systems. This report will emphasize risks associated with specific contaminants, detection methods, treatment and inactivation mechanisms, fate and transport, and emergency operating procedures. Its purpose is to protect public and employee health and safety, and prevent the spread of materials to other environmental media. More specifically, this report will:

- Identify biological, chemical, and radiological agents of concern for municipal wastewater treatment facilities. Each contaminant's impact on wastewater infrastructure, treatment processes, plant operators, public health, and the environment will be examined.
- Assess available treatment technologies and emergency operating procedures that detect, remove, degrade, inactivate, or minimize the effect of these agents on workers, the public, and the environment. These technologies or operating procedures would also be expected to prevent the spread of the agents to other environmental media, or determine that treatment is not necessary for specific agents.
- Provide information on the fate and transport and treatability of these agents in a typical municipal wastewater treatment plant. Contaminant volatility; uptake by biosolids; and degradation, inactivation, or disinfection will be explored.
- Address high-priority, critical areas of uncertainty through experimentation to develop guidance for emergency operating procedures, treatment process modifications, and potentially new treatment technologies.
- Compile available data to prioritize the critical areas of future research.

Information on Current Practices for Controlling Access to Wastewater Collection and Treatment Systems

To assist wastewater collection and treatment facilities around the country in better defending against system intrusion, EPA and WERF are developing a guidance document that contains comprehensive information on the use of a number of intrusion control methods and technologies. One such technology is a real-time sensing device that can detect and provide early warning of the presence of gases, toxins, and other contaminants that can result in process disruption. These sensors might be integrated with other emerging technologies to develop “smart pipes” and “intelligent infrastructure” with real-time monitoring capabilities. This guidance document will also incorporate research conducted by other agencies, including the American Society of Civil Engineers (ASCE) and the Federal Emergency Management Agency (FEMA).



Response Protocol Playbooks

In collaboration with WERF, EPA is developing a series of response protocol playbooks to help wastewater treatment system operators respond to moderate and severe chemical and biological contamination events. The playbooks will contain strategic decision support networks and guidance on how to avoid treatment process failures and most effectively decontaminate a treatment process while minimizing down time.

To develop the playbooks, EPA’s research team will first conduct field experiments analyzing the effects of various chemicals and toxins on water treatment processes (e.g., conventional aerobic activated sludge, nitrogen removal, biological phosphorous removal, and biofilm treatment). As part of these experiments, EPA will characterize the changes in key process model parameters that occur in response to the intrusion of contaminants.

EPA expects that the playbooks will help prevent or minimize permit violations, downstream ecological damage, and public health concerns that can arise from contaminant discharges or a malfunctioning biological treatment plant, especially in urban areas where the travel time and dilution effect between wastewater discharge and drinking water intake are minimal.



Section V: Next Steps

The U.S. Environmental Protection Agency (EPA) is implementing the Action Plan with the help of many partners and stakeholders. A number of collaborative technical, research, and information-sharing efforts are under way—both within the Agency and with federal agencies, research organizations, and water sector associations. Some examples of the collaborations in place are described below.

Collaborative Research

The U.S. Environmental Protection Agency (EPA) is establishing relationships with organizations that are critical to the execution of the Action Plan, including federal agency research laboratories, national science institutions, and water association research foundations.

- **Department of Homeland Security (DHS), <www.dhs.gov>**

EPA is working with the Science and Technology Directorate within DHS, which serves as the primary research and development arm of the department, to examine both internal and external threats to the nation's water systems. EPA and DHS are:

- Developing and implementing the National Infrastructure Protection Plan (NIPP) for water infrastructure.
- Jointly managing DHS-funded water security projects.
- Routinely meeting to exchange information on water infrastructure research.

- **Water Science and Technology Board (WSTB), <www7.nationalacademies.org/wstb>**

EPA has engaged the National Research Council's Water Science and Technology Board (WSTB) to provide consultation and peer review of the Agency's water security efforts. A peer panel, consisting of approximately 12 members supported by WSTB, has been established to gather information, deliberate on critical research issues, and discuss short- and long-term research needs related to securing the nation's water infrastructure. The panel will also highlight opportunities for EPA and help the Agency advance its research program on water security.

- **Distribution System Research Consortium**
EPA has formed the Distribution System Research Consortium (DSRC), an umbrella organization made up of 14 partnering organizations, to advance science, technology, and research in: 1) monitoring and detection, 2) contamination warning systems, 3) models and modeling of systems, 4) treatment waters in systems, and 5) decontamination of equipment and materials. The consortium is also working to identify challenges; prioritize solutions to expedite technology implementation; and transfer research results and guidance to users.

Information Sharing

Communication and information dissemination is of critical importance to all of EPA's homeland security activities. EPA is reviewing a variety of venues and media to disseminate technical information and research results to its stakeholders. Currently, all publicly available products are being placed on two main EPA Web sites at: <www.epa.gov/nhsrc> and <www.epa.gov/safewater/security>.

- **Water Sector Stakeholder Conferences, <www.epa.gov/nhsrc>**
EPA and the Water Environment Federation (WEF), in partnership with many other organization, hosted three regional water sector stakeholder conferences in 2005. The conference participants identified a list of trends and needs to enhance the overall security of the water infrastructure in the nation. Participants also developed recommendations on how to best meet the identified needs. The output from the workshops is a report on trends and utility needs.

The Path Forward

The *Water Security Research and Technical Support Action Plan* was released in March 2004. It was prepared with the help of federal partners and stakeholders and was reviewed by the NRC. The Action Plan is a comprehensive approach to addressing security issues and needs related to water infrastructure; however, it is only a snapshot in time. As work progresses on the projects identified in the Action Plan, efforts are also under way to update and revise the Action Plan based on EPA's current understanding of threats to, and vulnerabilities of, drinking water and wastewater systems.

Distribution System Research Consortium

To advance the science, technology, and research efforts underway to protect water distribution systems from terrorist attack, EPA formed the Distribution System Research Consortium (DSRC). Once a year, DSRC brings together 14 partnering federal and non-federal organizations, including EPA, the U.S. Army Edgewood Chemical Biological Center, the U.S. Army Corps of Engineers, the American Water Works Association Research Foundation, the Centers for Disease Control and Prevention, and the U.S. Geological Survey among others, to collaborate on issues including:

- Monitoring and detection.
- Early alert and warning systems.
- Models and modeling of systems.
- Treatment of waters in systems.
- Decontamination of equipment and materials.

DSRC also works to identify challenges and prioritize the development of short- and long-term solutions that expedite the implementation of useful and feasible distribution system technologies. The group disseminates information and provides assistance to drinking water utilities, states, researchers, policymakers, risk assessors, public health community members, and others in need of research results or guidance through EPA communication mechanisms and other routes.

Appendix A – Tier 1 Products for Enhanced Security of Drinking Water and Wastewater Systems (Completed)

Product Name*	Access Information	Product Type	Related Projects**	Primary Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.1 Protecting Physical and Cyber Infrastructure						
Threat Scenarios for Water Systems Report (August 2004)	Classified	Document	3.1.a.1 3.2.a.2	Federal agencies working on water security and threat analysis	N/A	
Methodologies and Tools for Conducting Vulnerability Assessments: 1) Risk Assessment Methodology for Water Utilities (RAM-W SM) 2) Vulnerability Self Assessment Tool (VSAT TM) - Version 3.1	www.epa.gov/safewater/watersecurity (under Vulnerability Assessments)	Tools	3.1.a.3 (combined with 3.1.a.2) 3.1.c.2 3.1.c.3 4.0.a.3	Water utilities State and local governments Threat analysts Federal policymakers	American Water Works Association Research Foundation (AwwaRF) Department of Energy's Sandia National Laboratories (SNL) National Association of Clean Water Agencies (NACWA)	Bioterrorism Act of 2002, Section 1434(a), 1435(a) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection
Interim Guidance and Voluntary Design Standards to Improve Security at Drinking Water and Wastewater and Stormwater Facilities	www.asce.org/static/1/wise.cfm	Guidance Documents	3.1.c.1 3.1.c.3 4.0.a.3	Drinking and wastewater utilities State water boards State and local health and environmental regulatory agencies Threat analysts Federal policymakers	American Society of Civil Engineers (ASCE) American Water Works Association (AWWA) Water Environment Federation (WEF)	Bioterrorism Act of 2002, Section 1435 (a) (1-4)

* Products are outcomes of projects enumerated in Action Plan.

** Project numbering corresponds to those used in Action Plan. Primary contributing projects appear first in bold.

Product Name*	Access Information	Product Type	Related Projects**	Primary Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.3 Improving Analytical Methodologies and Monitoring						
Response Protocol Toolbox	EPA Document #817-D-03-004 www.epa.gov/safewater/watersecurity (under Emergency/ Incident Planning)	Document; online resource	3.3.a.1 3.3.a.2 3.3.a.3 3.3.a.4 3.2.b.1 3.3.a.5 3.3.a.6 3.3.b.7 3.3.c.1 3.3.c.2 3.3.c.4	Chemical analysis laboratories Laboratory capacity and infrastructure planners Emergency responders Analytical method developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1) and (a) (3) HSPD-9 Defense of United States Agriculture and Food
Security Product Guides	www.epa.gov/safewater/watersecurity/guide/index.html	Online guide	3.3.c.1 3.3.c.2 3.3.c.3	Drinking water utilities Laboratory capacity and infrastructure planners Emergency responders Analytical method developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1) and (a) (3) HSPD-9 Defense of United States Agriculture and Food
Environmental Laboratory Compendium	www.epa.gov/compendium (Restricted access)	Online database	3.3.f.1 3.3.f.2 3.3.f.3	Water utilities Individuals responsible for planning for analytical response to contamination threats State officials Emergency responders Laboratories	N/A	HSPD-9 Defense of United States Agriculture and Food

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** Project numbering corresponds to those used in Action Plan. Primary contributing projects appear first in bold.

Product Name*	Access Information	Product Type	Related Projects**	Primary Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.4 Containing, Treating, Decontaminating, and Disposing of Contaminated Water and Materials						
1) Inactivation/Removal Capabilities of Treatment and Disinfection Technologies for Biological Contaminants	www.cdc.gov/ncidod/EID/vol10no10/04-0158.htm	Journal articles	3.4.c.3 3.4.c.5	Emergency responders State and local agencies Water utilities	Centers for Disease Control and Prevention (CDC)	Bioterrorism Act of 2002; Section 1434 (a) (1-6), Section 1435 (a)(1-4) HSPD-10 Biodefense for the 21st Century
2) Effectiveness of Chlorination on Vegetative and Spore Forms of Bacterial Bioterrorist Agents	http://aem.asm.org/cgi/content/abstract/71/1/566					
4.0 Wastewater Treatment and Collection Infrastructure Materials						
Wastewater Baseline Threat Document	Classified	Document	4.0.a.1 4.0.b.1 3.1.c.2 4.0.b.5	Wastewater utilities State and local health and environmental regulatory agencies	Water Environment Federation (WEF)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century

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Product Name*	Access Information	Product Type	Related Projects**	Primary Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
5.0 Providing the Means to Implement the Action Plan						
Environmental Technology Verification (ETV) Program Detection Technologies: - Immunoassay Test Kits for Pathogens and Biotoxins - Portable Cyanide Analyzers - Rapid Toxicity Testing Systems - Rapid Polymerase Chain Reaction (PCR) Technologies	www.epa.gov/etv/verifications/verification-index.html	Online verification reports	5.2.a.1	Water utilities State officials Emergency responders Technology developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-3) and (a) (5), Section 1435 (d) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Environmental Technology Verification (ETV) Program Point-of-Use (POU) Water Treatment Technology: - Reverse Osmosis Point-of-Use (POU) Devices	www.epa.gov/etv/verifications/verification-index.html	Online verification report	5.2.a.2	Water utilities State officials Emergency responders Technology developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-3) and (a) (5), Section 1435 (d) HSPD-10 Biodefense for the 21st Century
Environmental Technology Verification (ETV) Program Wastewater and Residuals Treatment Technology: - Decontamination Wastewater Treatment Technologies	www.epa.gov/etv/verifications/verification-index.html	Online verification report	5.2.a.3	Water utilities State officials Emergency responders Technology developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-3) and (a) (5), Section 1435 (d) HSPD-10 Biodefense for the 21st Century

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Appendix B: Tier 1 Products to Enhance the Security of Drinking Water and Wastewater Systems (In Development)

Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.1 Protecting Physical and Cyber Infrastructure					
Guidance and Voluntary Design Standards to Improve Security at Drinking Water and Wastewater and Stormwater Facilities	Guidance documents	3.1.c.1 3.1.c.3 4.0.a.3	Drinking and wastewater utilities State water boards State and local health and environmental regulatory agencies Threat analysts Federal policymakers	American Society of Civil Engineers (ASCE) American Water Works Association (AWWA) Water Environment Federation (WEF)	Bioterrorism Act of 2002, Section 1435 (a) (1-4) HSPD-7 Critical Infrastructure Identification, Prioritization and Protection
Guidance on Protecting Drinking Water and Wastewater Facilities from Blasts	Software	3.1.c.3 3.1.c.1	Drinking water systems State water boards State and local health and environmental regulatory agencies Threat analysts Federal agencies	U.S. Army Corps of Engineers (USACE)	Bioterrorism Act of 2002, Section 1435 (a) (1-4) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection
Guidance for Water and Wastewater Utility Computer Systems	Standards	3.1.c.2 4.0.c.6	Drinking water and wastewater utilities State and local health and environmental regulatory agencies	American Water Works Association Research Foundation (AwwaRF) Water Environment Research Foundation (WERF)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-7 Critical Infrastructure Identification, Prioritization and Protection

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** Project numbering corresponds to those used in Action Plan. Primary contributing projects appear first in bold.

Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.2 Identifying Drinking Water Contaminants					
Water Contaminant Information Tool (WCIT)	Tool (Web-based database)	3.2.a.1 (combined with 3.2.b.1) 3.2.b.2 3.2.b.3 3.3.a.2 3.3.c.3 3.4.b.1 3.4.c.1 3.4.c.8 3.6.a.1 4.0.f.1	Drinking water and wastewater utilities Emergency responders Public health officials State officials Federal agencies Technical assistance providers Environmental laboratories	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Food and Agriculture HSPD-10 Biodefense for the 21st Century
Training Modules Contained Within the WCIT	Training modules	3.2.b.2 3.2.b.1 3.2.b.3	Federal agencies State drinking water programs Drinking water and wastewater utilities Public health officials Environmental laboratories Emergency responders Technical assistance providers	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Improvements to the WCIT	Tool (Web-based database)	3.2.b.3 3.2.b.1	Federal agencies State drinking water programs Drinking water and wastewater utilities Public health officials Environmental laboratories Emergency responders Technical assistance providers	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.3 Improving Analytical Methodologies and Monitoring Systems for Drinking Water					
Water Contaminant Surrogates and Simulants Methods, Guidance, and Training	Document	3.2.c.1	Federal agencies involved in research Utilities Emergency responders Public health decisionmakers Scientific community at large	U.S. Army Edgewood Chemical Biological Center (ECBC)	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Development of Ultrafiltration Devices and a Water Filtering Protocol	Physical product	3.3.b.1 3.3.b.5	Laboratories Emergency responders Individuals responsible for planning for analytical responses to contamination threats	Department of the Defense Joint Service Agent Water Monitor (JSAWM) Centers for Disease Control and Prevention (CDC) American Water Works Association Research Foundation (AwwaRF) Department of Energy's Idaho National Laboratory	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Sampling and Analytical Methods for Detecting Biological Contaminants in Water	Documents	3.3.b.5 3.2.b.4 3.3.b.1 3.3.b.4 3.3.b.7	Drinking water utilities Environmental laboratories Emergency responders	U.S. Army Edgewood Chemical Biological Center (ECBC) Centers for Disease Control and Prevention (CDC) Metropolitan Water District of Southern California	Bioterrorism Act of 2002, Sections 1434 (a) (1) and (a) (3) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Interim Protocol for Detecting Biological Contaminants in Water	Document	3.3.b.7 3.2.b.4 3.3.b.4 3.3.b.5	Drinking water utilities Environmental laboratories Emergency responders	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1) and (a) (3) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Reports on Biotoxins	Documents	3.3.c.3 3.2.a.3 3.2.b.1 3.3.c.1 3.3.c.2 3.3.c.4	Rapid risk (threat) assessors Fate and transport modelers Analytical method developers Drinking water utilities Laboratory capacity and infrastructure planners Emergency response officials	Naval Surface Warfare Center, Dahlgren Division	Bioterrorism Act of 2002, Sections 1434 (a) (1) and (a) (3) HSPD-9 Defense of United States Agriculture and Food
Early Warning System Technologies and Techniques to Monitor and Evaluate Drinking Water Quality: State-of-the-Art Review	Document	3.3.e.4 3.3.e.1 3.3.e.2 3.3.e.3	Water utilities Water organizations Monitoring technology and system developers and vendors	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food
Integrated Consortium of Laboratory Networks	Document	3.3.f.4 3.3.f.2	Water utilities Laboratories Emergency responders Federal agencies	Centers for Disease Control and Prevention Laboratory Response Network (LRN) U.S. Food and Drug Administration (FDA) U.S. Department of Agriculture (USDA)	HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Laboratory Response Tools	Tools	3.3.g.1 3.3.a.3 3.3.f.3 3.3.f.6	Water utilities Laboratories Emergency responders Federal agencies Public in need of environmental testing laboratory support to contamination threats	N/A	HSPD-9 Defense of United States Agriculture and Food

Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.4 Containing, Treating, Decontaminating, and Disposing of Contaminated Water and Materials					
Distribution Systems Handbook	Document	3.4.a.1	Federal agencies State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5), Section 1435 (a) (1-4) HSPD-9 Defense of United States Agriculture and Food
Threat Ensemble Vulnerability Assessment (TEVA) Modeling Tool for Water Distribution Systems	Modeling tools	3.4.a.2 3.2.b.1 3.4.a.1 3.4.a.3 3.6.a.3	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	Department of Energy's Argonne National Laboratory (ANL)	Bioterrorism Act of 2002, Section 1434 (a) (5), Section 1435 (a) (1-4) HSPD-9 Defense of United States Agriculture and Food
Threat Ensemble Vulnerability Assessment (TEVA) Contamination Warning System Data Analysis Tools	Computer models/ software	3.4.a.3 3.2.b.1 3.4.a.1 3.4.a.2 3.6.a.3	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	Department of Energy's Sandia National Laboratories (SNL)	Bioterrorism Act of 2002, Section 1434 (a) (5), Section 1435 (a) (1-4) HSPD-9 Defense of United States Agriculture and Food
Resource Guide on the Aquatic Fate of Biological, Chemical, and Radiological Contaminants	Document	3.4.b.3 3.4.b.2 3.4.c.5 3.6.a.1	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-9 Defense of the United States Agriculture and Food
Research on the Inactivation of Biological Agents in Water	Ongoing research	3.4.c.3 3.4.c.5	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1-6), Section 1435 (a) (1-4) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Drinking Water Treatability Database	Database	3.4.c.5 3.2.b.1 3.4.c.3 3.4.c.4 3.4.c.6 3.4.c.8	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Resource Document and Guidance for Decontaminating Post-Service Connections	Document	3.4.d.7 3.4.d.8	State and local health and environmental regulatory agencies Building owners Water utilities	National Institute of Standards and Testing (NIST)	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Handbook for Decontaminating Piping and Equipment	Document	3.4.d.8 3.4.c.9 3.4.d.1 3.4.d.2 3.4.d.5 3.4.d.6 3.4.d.7 3.4.d.9	State and local health and environmental regulatory agencies Water utilities Federal agencies	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Disposal Alternatives Tool	Web-based tool (also on CD-ROM)	3.4.d.9 3.4.c.9 3.4.d.1 3.4.d.2 3.4.d.5 3.4.d.6 3.4.d.7 3.4.d.8	State and local health and environmental regulatory agencies Water utilities Federal agencies	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Report on Impacts to Water Systems Following Community-wide Radiological Events	Document	3.4.d.10	Federal agencies Water utilities Emergency responders Planners	Department of Energy's Argonne National Laboratory (ANL)	Bioterrorism Act of 2002, Section 1435 (a) (1-4) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection

Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.5 Planning for Contingencies and Addressing Infrastructure Interdependencies					
Guidance on Deployment of Alternative Water	Document	3.5.a.5 3.5.a.1 3.5.a.2 3.5.a.3 3.5.a.4	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	U.S. Army Corps of Engineers (USACE)	Bioterrorism Act of 2002, Section 1435 (b)
Guidance for Drinking Water and Wastewater Utilities to Minimize Outages Due to Interdependencies with Other Critical Sectors	Document	3.5.c.2 (incorporated into 3.1.b.1)	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	Department of Energy's Argonne National Laboratory (ANL)	Bioterrorism Act of 2002, Section 1435 (b) HSPD-7 Critical Infrastructure Identification, Prioritization and Protection
3.6 Targeting Impacts on Human Health and Informing the Public About Risks					
Health Effects Database	Database	3.6.a.1 (scope of project completed through Rapid Risk Project #1 [RR1]) 3.2.b.1 3.4.b.3 3.6.a.2 3.6.a.3 3.6.a.4 3.6.c.1 3.6.c.2	Risk assessors Detection limits scientists Decontamination planners	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Health Surveillance Network Linkages	Document	3.6.b.2 (scope of project encompassed by Rapid Risk Projects #22 [RR22] and #23 [RR23]) 3.6.b.1	Risk assessors Public health officials Scientists Water utility operators Planners Emergency responders	Centers for Disease Control and Prevention (CDC) U.S. Food and Drug Administration (FDA)	Bioterrorism Act of 2002, Sections 1434 (a)(2) and (a)(6) HSPD-9 Defense of United States Agriculture and Food
Risk Assessment Decisionmaking Tools	Tabletop and computer-based simulation exercises	3.6.d.2 3.6.d.3	Risk assessors Detection limits scientists Decontamination planners Water utilities Emergency responders	N/A	Bioterrorism Act of 2002, Sections 1434(a)(2)
Methods for Communicating Risks to Local Communities	Documents; training modules	3.6.e.1 3.6.d.3	Emergency responders Public officials	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6)
Message Mapping for Decisionmakers	Tools	4.0.e.3 (combined with 3.6.e.2)	Wastewater utilities State and local health and environmental regulatory agencies	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10: Biodefense for the 21st Century
Rapid Risk Assessment Tool	Tool (Web-based)	3.6.e.2 (scope of project completed through Rapid Risk Project #38 [RR38]) 3.6.e.3 3.6.e.4	Risk assessors Detection limits scientists Decontamination planners Emergency responders	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
4.0 Wastewater Treatment and Collection Infrastructure Projects					
Guidance on Managing Contamination Events	Document	4.0.b.4 3.1.c.2 4.0.b.1 4.0.b.2	Wastewater utilities Emergency responders Federal agencies State and local health and environmental regulatory agencies	Water Environment Research Foundation (WERF)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10 Biodefense for the 21st Century
Information on Current Practices for Controlling Access to Wastewater Collection and Treatment Systems	Documents	4.0.c.1	Wastewater utilities State and local health and environmental regulatory agencies	Water Environment Research Foundation (WERF)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10: Biodefense for the 21st Century
Response Protocol Playbooks	Document	4.0.e.1	Wastewater utilities State and local health and environmental regulatory agencies	Water Environment Research Foundation (WERF)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10: Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
5.0 Providing the Means to Implement the Action Plan					
Technology Testing and Evaluation Program (TTEP) Detection Technologies	Documents	5.2.a.1	Water utilities State officials Emergency responders Technology developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-3) and (a) (5), Section 1435 (d) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Technology Testing and Evaluation Program (TTEP) Point-of-Use (POU) Water Treatment Technology	Documents	5.2.a.2	Water utilities State officials Emergency responders Technology developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-3) and (a) (5), Section 1435 (d) HSPD-10 Biodefense for the 21st Century
Technology Testing and Evaluation Program (TTEP) Wastewater and Residuals Treatment Technology	Documents	5.2.a.3	Water utilities State officials Emergency responders Technology developers	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-3) and (a) (5), Section 1435 (d) HSPD-10 Biodefense for the 21st Century

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Appendix C—Tier 2 Products to Enhance the Security of Drinking Water and Wastewater Systems

Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.1 Protecting Physical and Cyber Infrastructure					
Guidance for Using Models to Analyze Terrorist Attack Consequences	Document	3.1.b.1 3.5.c.1 3.5.c.2	Drinking water systems State water boards State and local health and environmental regulatory agencies Threat analysts EPA and other federal policymakers	N/A	Bioterrorism Act of 2002, Section 1435 (a) (1-4) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection
Decision Tree for Alternatives to Chlorine Disinfection	Document	3.1.c.4	Wastewater utilities using chlorine gas for disinfection	Department of Homeland Security (DHS) National Association of Clean Water Agencies (NACWA)	HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection
3.2 Identifying Drinking Water Contaminants					
Documentation of Background Levels of Priority Biological Contaminants	Document	3.2.b.4 3.3.b.5	Federal agencies Water utilities Emergency responders State and local health and environmental regulatory agencies Scientific community at large	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.3 Improving Analytical Methodologies and Monitoring Systems for Drinking Water					
Revisions to the National Environmental Methods Index (NEMI) Database to Include Analytical Methods for Priority Water Contaminants	Database	3.3.b.2/ 3.3.b.6 3.3.b.5	Laboratories Individuals responsible for planning for analytical responses to contamination threats	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Report on the Water Industry's Position Regarding the Use of Ultrafiltration to Identify Contaminants in Water	Document	3.3.b.3 3.3.b.1 3.3.b.5	Laboratories Individuals responsible for planning for analytical responses to contamination threats	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Reports and Journal Articles Summarizing the Response of Sensors to the Introduction of Contaminants	Documents	3.3.d.1 3.4.a.1 3.3.d.2 3.3.d.6	Water utility operators Water organizations Monitoring technology and system developers and vendors	EPA's Water Awareness Technology Evaluation Research and Security (WATERS) Center U.S. Army Edgewood Chemical Biological Center (ECBC)	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Standard Operating Procedures and Quality Assurance and Control Practices to Guide the Evaluation of Monitoring Technologies	Documents	3.3.d.2 3.3.d.1 3.3.d.6 5.2.a.1	Water utility operators Water organizations Monitoring technology and system developers and vendors	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Identification of Sensors Used in Other Sectors That Might Be Applicable to Drinking Water Monitoring and Detection	Documents	3.3.d.3 3.3.d.6 3.4.a.2	Water utility operators Water organizations Monitoring technology and system developers and vendors	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Report on Biosensor Responses and the Development and Use of an Interpretive Algorithm	Document	3.3.d.4 3.3.d.6	Water utility operators Water organizations Monitoring technology and system developers and vendors	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Standard Operating Procedures for Evaluating Monitoring Technologies	Document	3.3.d.5 *updates 3.3.d.2	Water utility operators Water organizations Monitoring technology and system developers and vendors	N/A	Bioterrorism Act of 2002, Section 1434 (a) (1) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.4 Containing, Treating, Decontaminating, and Disposing of Contaminated Water and Materials					
Upgrade of the EPANET Model to Allow the Modeling of Multi-Component Reactions	Model	3.4.a.1 3.2.b.2 3.3.c.3 3.3.d.1 3.3.d.3 3.4.a.2 3.4.a.3 3.4.d.4 3.4.d.5 3.4.d.6 3.4.d.7 3.6.a.3	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5), and Sections 1435 (a) (1-4) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Guidance and Models for Performing Computational Contaminant Fate and Transport Studies	Document	3.4.a.2 3.2.b.1 3.4.a.1 3.4.a.3 3.6.a.3	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	Department of Energy's Argonne National Laboratory (ANL)	Bioterrorism Act of 2002, Section 1434 (a) (5), and Sections 1435 (a) (1-4) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Final Report on the Environment Fate of Selected Biological, Chemical, and Radiological Contaminants in Source Waters	Document	3.4.b.1 3.2.b.1 3.4.b.3	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	U.S. Army Edgewood Chemical Biological Center (ECBC)	Bioterrorism Act of 2002, Section 1434 (a) (5), and Sections 1435 (a) (1-4) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Report on the Treatability of Less Well Understood Water Contaminants and Recommendations for Additional Treatability Studies	Document	3.4.c.1 3.2.b.1 3.4.c.5	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-6) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Method for Evaluating Existing and Innovative Treatment Technologies	Document	3.4.c.2 (combined with 5.2.a.2)	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (1-6), and Sections 1435 (a) (1-4) HSPD-10 Biodefense for the 21st Century
Report on the Ability of Common Drinking Water Treatment Methods to Remove Microbial and Chemical Agents	Document	3.4.c.4 3.4.c.5	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	Department of the Navy (NAVSEA)	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Report Identifying Point-of-Use/Point-of-Entry (POU/POE) Devices, Uses, and Disposal Requirements	Document	3.4.c.6 3.4.c.5 5.2.a.3	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Report Describing Pretreatment Technologies and Effectiveness	Document	3.4.c.7	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Report Describing Decontamination Byproducts and Health Effects	Document	3.4.c.8 3.2.b.1 3.4.c.5	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Decontamination Residues Disposal Tool	Document	3.4.c.9 3.4.c.1 3.4.c.3 3.4.c.4 3.4.c.5 3.4.c.6 3.4.c.7 3.4.c.8	Federal agencies Emergency responders State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Standard Operating Procedures for the Decontamination of Drinking Water Infrastructure	Document	3.4.d.1 3.4.d.2 3.4.d.3 3.4.d.4 3.4.d.5 3.4.d.6 3.4.d.8	Federal agencies State and local health and environmental regulatory agencies Water utilities	American Water Works Association Research Foundation (AwwaRF)	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Report on the Relevant Physiochemical Properties of Contaminants That Are Difficult to Remove from Pipes and Equipment	Document	3.4.d.2 (combined with 3.4.b.2) 3.2.b.1 3.4.d.1 3.4.d.3 3.4.d.4 3.4.d.6 3.4.d.8	Federal agencies State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Reports Describing the Results of Fate and Transport Studies and Enzyme-Based Decontamination Methods	Documents	3.4.d.3 3.4.a 3.4.d.1 3.4.d.2 3.4.3.4 3.4.d.5 3.4.d.6 3.4.d.8	Federal agencies State and local health and environmental regulatory agencies Water utilities	U.S. Army Edgewood Chemical Biological Center (ECBC)	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century
Mirco-Scale Models to Evaluate Fate and Transport of Contaminants in a Pipe and Decontamination and Recovery Methods	Computer models	3.4.d.4 3.4.a .1 3.4.d.2 3.4.d.3 3.4.d.5 3.4.d.8	Federal agencies State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Report on the Use of EPANET to Design Decontamination Policies and Procedures for Drinking Water Distribution Systems	Document	3.4.d.5 3.4.a.2 3.4.d.1 3.4.d.3 3.4.d.4 3.4.d.6 3.4.d.8	Federal agencies State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-9 Defense of United States Agriculture and Food HSPD-10 Biodefense for the 21st Century
Report on Decontamination Efforts on <i>In Situ</i> Water Utility Pipes	Document	3.4.d.6 3.4.a .1 3.4.d.2 3.4.d.3 3.4.d.4 3.4.d.8	Federal agencies State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Report on the Preliminary Assessment of the Potential Impacts of Radiological Dispersion Devices on Water Systems	Document	3.4.d.10	Federal agencies State and local health and environmental regulatory agencies Water utilities	N/A	Bioterrorism Act of 2002, Section 1434 (a) (5) HSPD-9 Defense of United States Agriculture and Food
3.5 Planning for Contingencies and Addressing Infrastructure Interdependencies					
Case Studies on Technical and Cost Aspects of Existing Contingency Plans	Document	3.5.a.1 3.5.a.5 3.5.c.5	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	U.S. Army Corps of Engineers (USACE)	Bioterrorism Act of 2002, Section 1435 (b) HSPD-10 Biodefense for the 21st Century
Report Assessing the Feasibility of Deploying Portable Water Treatment Facilities	Document	3.5.a.2 3.5.a.5	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	U.S. Army Corps of Engineers (USACE)	Bioterrorism Act of 2002, Section 1435 (b) HSPD-10 Biodefense for the 21st Century
Report on Best Practices for Managing Drinking Water System Redundancies	Document	3.5.a.3 3.5.a.5	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	U.S. Army Corps of Engineers (USACE)	Bioterrorism Act of 2002, Section 1435 (b) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Database of Water Supply Sources	Database	3.5.a.4 3.5.a.5	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	U.S. Army Corps of Engineers (USACE)	Bioterrorism Act of 2002, Section 1435 (b) HSPD-10 Biodefense for the 21st Century
Feasibility Study on the Implementation of Innovative Drinking Water Technologies	Document	3.5.b.1 3.5.b.2	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	N/A	Bioterrorism Act of 2002, Section 1435 (b) HSPD-10 Biodefense for the 21st Century
Report Assessing the Performance of Innovative Drinking Water Technologies	Document	3.5.b.2 3.5.b.1	Federal agencies State health and environmental regulatory agencies Water utilities Consulting engineers	N/A	Bioterrorism Act of 2002, Section 1435 (b) HSPD-10 Biodefense for the 21st Century
Reports on a Variety of Water Interdependency Issues and a Water Version of the Critical Infrastructures Interdependencies Integrator Repair and Recovery Model	Document; model	3.5.c.1 (combined with 3.1.b.1, 4.0.a.4, and 4.0.a.5)	Federal agencies Drinking water and wastewater utilities State and local health and environmental regulatory agencies	Department of Energy's Argonne National Laboratory (ANL)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
3.6 Targeting Impacts on Human Health and Informing the Public About Risks					
Report on Bioaerosol Generation During Bathing and Screening Guidance for Evaluating Direct and Indirect Exposure Pathways	Documents	3.6.a.2 3.6.a.1	Federal agencies State and local health and environmental regulatory agencies Risk assessors Decontamination planners Water utilities Emergency responders	N/A	Bioterrorism Act of 2002, Section 1434 (a) (2) HSPD-10 Biodefense for the 21st Century
Report on Risk Assessment Methodology, Application, and Limitations	Document	3.6.a.4 3.6.a.1 3.6.c.2	Federal agencies State and local health and environmental regulatory agencies Risk assessors Decontamination planners Water utilities Emergency responders	N/A	Bioterrorism Act of 2002, Section 1434 (a) (2) HSPD-10 Biodefense for the 21st Century
Methods for Developing Short-Term Toxicity Data	Document	3.6.c.1 3.6.a.1 3.6.a.4	Federal agencies State and local health and environmental regulatory agencies Risk assessors Decontamination planners Water utilities Emergency responders	N/A	Bioterrorism Act of 2002, Section 1434 (a) (3) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
Report on the Uncertainty of the QSAR Model's Application to Chemicals Without Empirical Data	Document	3.6.c.2 3.6.a.1 3.6.a.4	Federal agencies State and local health and environmental regulatory agencies Risk assessors Decontamination planners Water utilities Emergency responders	N/A	Bioterrorism Act of 2002, Section 1434 (a) (3) HSPD-10 Biodefense for the 21st Century
Decision Trees for Contamination Event Response	Document	3.6.d.1 3.6.d.2	Federal agencies State and local health and environmental regulatory agencies Risk assessors Decontamination planners Water utilities Emergency responders	N/A	Bioterrorism Act of 2002, Section 1434 (a) (2) HSPD-10 Biodefense for the 21st Century
Consequence Management Protocol for Addressing Threats and Attacks on Drinking Water Supplies and Systems	Document	3.6.d.3 3.6.d.1	Federal agencies State and local health and environmental regulatory agencies Risk assessors Decontamination planners Water utilities Emergency responders	N/A	Bioterrorism Act of 2002, Section 1434 (a) (2) HSPD-10 Biodefense for the 21st Century

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Product Name*	Product Type	Related Projects**	Anticipated Users	Product Partner(s)	Statutory Authority/ Programmatic Basis
4.0 Wastewater Treatment and Collection Infrastructure Projects					
Resource Document on the Efficacy of Treatment Methods for a Variety of Contaminants	Document(s)	4.0.b.2 3.2.b.1 4.0.b.1	Federal agencies Drinking water and wastewater utilities State and local health and environmental regulatory agencies	Water Environment Research Foundation (WERF)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection HSPD-10 Biodefense for the 21st Century
Guidance Manual for Expert Detection System Software	Document	4.0.c.2 4.0.c.3	Federal agencies Wastewater utilities State and local health and environmental regulatory agencies	N/A	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-7 Critical Infrastructure Identification, Prioritization, and Protection HSPD-10 Biodefense for the 21st Century
Report Documenting the New SewerNet and PipelineNet Module Development Activities, Findings, and Recommendations	Document, model	4.0.c.4	Federal agencies Wastewater utilities State and local health and environmental regulatory agencies	Water Environment Research Foundation (WERF)	Bioterrorism Act of 2002, Sections 1434 (a) (3) and (a) (6) HSPD-10 Biodefense for the 21st Century

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Appendix D—Acronyms

AMWA	Association of Metropolitan Water Agencies
ANL	Argonne National Laboratory
APHL	Association of Public Health Laboratories
ASCE	American Society of Civil Engineers
ASTHO	Association of State and Territorial Health Officials
AWWA	American Water Works Association
AwwaRF	American Water Works Association Research Foundation
BAT	best available technology
CCL	contaminant candidate list
CDC	Centers for Disease Control and Prevention
DCMD	Decontamination and Consequence Management Division
DHS	Department of Homeland Security
DoD	Department of Defense
DOE	Department of Energy
DSRC	Distribution System Research Consortium
ECBC	U.S. Army Edgewood Chemical Biological Center
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
EWS	Emergency Warning System
ETV	Environmental Technology Verification
FAC	free available chlorine
FDA	U.S. Food and Drug Administration
FEMA	Federal Emergency Management Agency
FERN	Food Emergency Response Network
HSPD	Homeland Security Presidential Directive
JSAWM	Joint Service Agent Water Monitor
LD ₅₀	lethal dose 50 (dose causing death in 50 percent of exposed animals)
LRN	Laboratory Response Network
MOU	Memorandum of Understanding
NACWA	National Association of Clean Water Agencies, formerly Association of Metropolitan Sewerage Agencies (AMSA)
NAVSEA	Department of the Navy
NEMI	National Environmental Methods Index
NHSRC	National Homeland Security Research Center

NIPP	National Infrastructure Protection Plan
NIST	National Institute of Standards and Technology
NRC	National Research Council
OCMS	online contaminant monitoring system
ORD	EPA Office of Research and Development
OW	EPA Office of Water
PCR	polymerase chain reaction
POU/POE	point-of-use/point-of-entry
QSAR	Quantitative Structure Activity Relationship
RAM-W	Risk Assessment Methodology for Water Utilities
RDD	radiological dispersal device
RPTB	Response Protocol Toolbox
SCADA	Supervisory Control and Data Acquisition
SNL	Sandia National Laboratories
TCAD	Threat and Consequence Assessment Division
TEVA	Threat Ensemble Vulnerability Assessment
TTEP	Technology Testing and Evaluation Program
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VSAT™	Vulnerability Self Assessment Tool
WaterSC	Water Security Channel
WCIT	Water Contaminant Information Tool
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WIPD	Water Infrastructure Protection Division
WSD	Water Security Division
WSTB	Water Science and Technology Board



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Environmental Protection Agency
1200 Pennsylvania Avenue, NW
(MAIL CODE)
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