Water Security Initiative
Program Overview and Available Products

EPA

United States
Environmental Protection
Agency

Program Overview

The Water Security (WS) initiative is a U.S. Environmental Protection Agency (EPA) program that addresses the risk of contamination of drinking water distribution systems. EPA established this initiative in response to Homeland Security Presidential Directive 9, under which the Agency must "*develop robust, comprehensive, and fully coordinated surveillance and monitoring systems, including international information, for… water quality that provides early detection and awareness of disease, pest, or poisonous agents.*"

EPA is implementing the WS initiative in three phases:

Phase I: Develop the conceptual design of a contamination warning system for timely detection and appropriate response to drinking water contamination incidents to mitigate public health and economic impacts;

Phase II: Test and demonstrate contamination warning systems through pilots at drinking water utilities and municipalities and make refinements to the design as needed based upon pilot results; and

Phase III: Develop practical guidance and outreach to promote voluntary national adoption of effective and sustainable drinking water contamination warning systems.

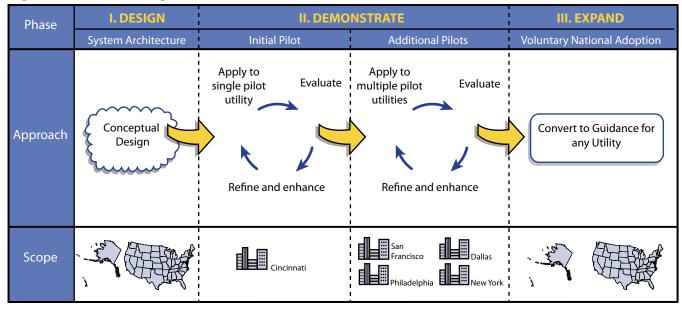Figure 1 below shows EPA's approach to developing the WS initiative.

Figure 1: WS Initiative Program Overview

Phase	I. DESIGN	II. DEMONSTRATE		III. EXPAND
	System Architecture	Initial Pilot	Additional Pilots	Voluntary National Adoption
Approach	Conceptual Design	Apply to single pilot utility → Evaluate / Refine and enhance	Apply to multiple pilot utilities → Evaluate / Refine and enhance	Convert to Guidance for any Utility
Scope	*(map of U.S.)*	Cincinnati	San Francisco, Dallas, Philadelphia, New York	*(map of U.S.)*

Phase I: Develop a Conceptual Design

A WS contamination warning system (CWS) involves the deployment of multiple monitoring and surveillance components to achieve timely detection of possible contamination in drinking water distribution systems.

The objectives for EPA's recommended CWS design include:
- Detect a broad spectrum of contaminant classes;
- Achieve spatial coverage of the entire distribution system;
- Detect contamination in sufficient time for effective response;
- Maintain operational reliability;
- Minimize the false positive rate; and
- Provide a sustainable architecture for day-to-day monitoring of distribution system water quality.

As illustrated in Figure 2, there are two major operational phases associated with a multi-component CWS: Routine Monitoring and Surveillance and Consequence Management. The day-to-day operation of the five monitoring and surveillance components of a CWS include:

- **Online water quality monitoring** comprises stations located throughout the distribution system that measure chlorine, total organic carbon, conductivity, and other parameters. Software analyzes the monitoring data to establish baseline parameter levels. Possible contamination is indicated when a significant deviation from a baseline occurs.

- **Public health surveillance** involves the analysis of health-related data to identify disease events that may stem from drinking water contamination. Public health data may include over the counter drug sales, hospital admission reports, infectious disease surveillance, Emergency Medical Services (EMS) reports, 911 calls, and poison control center calls.

- **Sampling and analysis** is the collection of distribution system samples that are analyzed for classes of contaminants, as well as specific contaminants. Sampling is both routine, to establish a baseline, and triggered, to respond to an indication of possible contamination from another component. Analyses are conducted for chemicals, radionuclides, pathogens, and toxins using a laboratory network.

- **Enhanced security monitoring** includes the equipment and procedures that detect and respond to security breaches at distribution system facilities. Security equipment may be cameras, motion sensing lights, door contacts, ladder and window motion detectors, and access hatch detectors.

- **Customer complaint surveillance** enhances the collection and automates the analysis of calls by customers for water quality problems indicative of possible contamination. Customers may detect contaminants with characteristics that impart an odor, taste, or visual change to the drinking water.

Routine monitoring and surveillance, along with event detection and initial trigger validation, determine if contamination is possible. Consequence management is the second major operational phase of a CWS and provides a decision-making framework used to establish credibility, implement response actions to minimize public health and economic impacts, and ultimately return the system to normal operations.
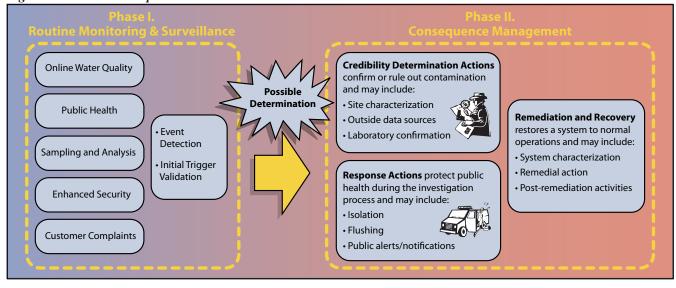
Figure 2: WS Initiative Operational Phases

Phase II: Test and Demonstrate

Greater Cincinnati Water Works Pilot Project
EPA deployed the first full-scale, comprehensive CWS pilot in partnership with the City of Cincinnati at the Greater Cincinnati Water Works (GCWW). Planning and pre-design activities for the pilot began in December 2005, were substantially completed in June 2009, and data collection concluded in June 2010. The drinking water CWS components are fully operational, with performance data continuing to be evaluated by EPA.

Elements of each Cincinnati CWS component, as installed, are noted below, and are described more fully in the report *Cincinnati Pilot Post-Implementation System Status*, (EPA-817-R-08-004), available at water.epa.gov/infrastructure/watersecurity/index.cfm.

Water Quality Monitoring
- Installed a network of 17 water quality monitoring stations with capability to measure a variety of water quality parameters;
- Installed a dedicated communication network and Supervisory Control and Data Acquisition (SCADA) system; and
- Deployed two water quality event detection systems.

Sampling and Analysis
- Established a local laboratory network to support analysis of routine and triggered samples for priority contaminant classes;
- Implemented a baseline monitoring program to characterize background contaminant occurrence; and
- Developed specialized field and laboratory procedures for incident response sampling and analysis.

Enhanced Security Monitoring
- Installed video cameras, motion sensors, and door contact switches at three large pump stations and ladder motion sensors at seven elevated storage tanks; and
- Leveraged existing partnerships with local law enforcement agencies to support the investigation of security breaches.

Customer Complaint Surveillance
- Enhanced the interactive voice response system that greets all callers to include a category for water quality issues; and
- Deployed event detection systems to continually analyze data from the interactive voice response and work order systems to detect anomalies that might be indicative of contamination.

Public Health Surveillance
- Deployed systems to capture new data streams, specifically 911 calls and emergency medical service data applicable to drinking water exposure;
- Established a Public Health User's Group with local partners and GCWW personnel; and
- Implemented automated email notification to notify all partners when a potential water-related health anomaly is detected.

Consequence Management
- Developed a Consequence Management Plan to serve as a response guide, and a Crisis Communication Plan to guide public notification and risk communication procedures during all phases of a potential contamination incident; and

- Coordinated a training and exercise program for utility staff and local response partner agencies to test, evaluate, and train participants on CWS plans and procedures.

The use of multiple monitoring and surveillance components is expected to provide broad contaminant coverage throughout the core GCWW retail service area, reduce the time for initial contaminant detection, and improve the reliability of information generated by the system. Further, the integration of monitoring and surveillance systems with routine operations provides many opportunities for dual-use benefits (e.g., improved water quality management and customer service).

Evaluation of the Cincinnati pilot will quantify system performance, derive lessons learned, and assess the cost/benefit of deploying CWSs at drinking water utilities. This information, along with data gathered from other pilots, will be critical in the development of effective and sustainable CWS guidance for drinking water utilities nationwide.

Additional Pilot Projects
EPA awarded funding for CWS pilots in New York City, San Francisco, Philadelphia, and Dallas. These four additional pilots were selected through a national competition and will conclude in 2012.

Phase III: Provide Guidance and Outreach

Interim Guidance on Planning for Contamination Warning System Deployment (EPA-817-R07-005)
Developing a CWS is a significant undertaking that impacts most departments and divisions of a utility at some phase of deployment.

> Deployment phases of a CWS include:
> - Planning and pre-design;
> - Design;
> - Implementation;
> - Preliminary testing;
> - Operation and maintenance; and
> - Evaluation and Refinement.

During planning and pre-design, the utility should define design objectives for their CWS and conduct an assessment and gap analysis to identify capabilities for each monitoring and surveillance component as well as consequence management. Utilities should also identify and engage local partners that may have a significant role in routine operations, such as local health departments and environmental laboratories. During implementation, enhancements are installed, operational procedures and response plans are reviewed, revised, and reconciled, and training for routine operation, maintenance, and consequence management should be conducted.

Baseline data will be collected during the preliminary testing phase of the project. Once a sufficient level of baseline testing has been completed, the utility will transition into full deployment, and the CWS will be fully operational.

Interim Guidance on Developing an Operational Strategy for Contamination Warning Systems (EPA-817-R-08-002)
A preliminary operational strategy developed during the design phase of the CWS can identify key users and their requirements for information access, procedures to guide system operation, information systems that may be leveraged, and requirements for notifications to key users and decision-makers.

The operational strategy should be developed with full participation of the project management team and front-line staff, including representatives from outside organizations involved in the design or operation of the system. This approach will build acceptance of responsibilities for system operation, as well as ensure that system operations are portrayed accurately.

> Steps to develop a preliminary operational strategy:
> - System-wide assessment of resources;
> - Component-specific analysis to develop standard operating procedures; and
> - System-wide integration of component-specific standard operating procedures into a comprehensive operational strategy for the CWS.

Interim Guidance on Developing Consequence Management Plans for Drinking Water Utilities (EPA-817-R-08-001)
A Consequence Management Plan serves as a guide for the utility that describes the actions that should be taken upon discovery of a possible contamination threat, as detected by one of the CWS monitoring and surveillance components. In the event of a confirmed contamination incident, the plan provides information on remediation and recovery steps to return the utility to normal operation.

This guidance document assists drinking water utilities with planning, designing, implementing, and maintaining an effective Consequence Management Plan as part of a CWS. It also provides a framework for the integration of the Consequence Management Plan with existing plans (such as an Emergency Response Plan), training scenarios, and outreach efforts to local, state, regional, and federal response partner agencies.

> ***Opportunities for Involvement***
> The following are opportunities for involvement in EPA's WS initiative program:
> - Review and comment on interim CWS guidance products;
> - Participate in technical studies, such as the Event Detection System Challenge.
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> To learn more about these and other opportunities for involvement in EPA's WS initiative, please send an e-mail to watersecurity@epa.gov or contact the WS initiative project coordinator, Dan Schmelling (202-564-5281).
>
> WS initiative products are available on the WS initiative website: water.epa.gov/infrastructure/watersecurity/lawsregs/initiative.cfm
>
> Comments on interim guidance documents are welcome and can be submitted to watersecurity@epa.gov (please include the document title in the subject line of your e-mail).
>
> **water.epa.gov/infrastructure/watersecurity/index.cfm**