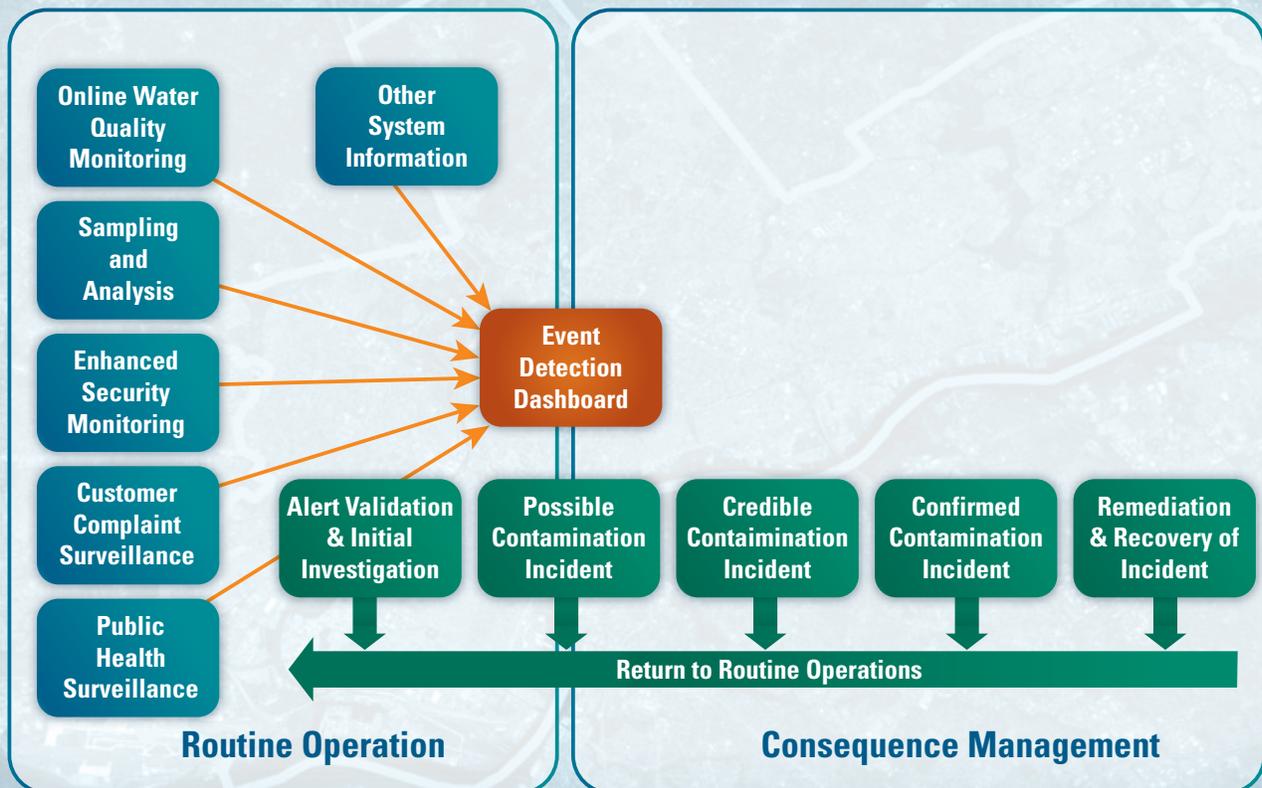


Philadelphia Water Department
 Contamination Warning System Demonstration Pilot Project:

Exercises and Lessons Learned Improve Response Preparedness for Site Characterization and Sampling



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This paper can also be downloaded from www.ch2mhill.com/iws.

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- Christopher Wiggins, CH2M HILL
- Stacey Black, CH2M HILL
- Timothy Maloney, CH2M HILL
- Yakir Hasit, PhD, PE, CH2M HILL

Questions concerning this document should be addressed to:

Gary Burlingame
Philadelphia Water Department
Bureau of Laboratory Services
1500 E Hunting Park Avenue
Philadelphia, PA 19124
Phone: 215-685-1402
E-mail: Gary.Burlingame@phila.gov

Yakir Hasit, PhD, PE
CH2M HILL
1717 Arch Street
Suite 4400
Philadelphia, PA 19103
Phone: 215-640-9027
E-mail: Yakir.Hasit@ch2m.com

Abstract

The Philadelphia Water Department (PWD) developed a comprehensive contamination warning system (CWS) for its drinking water system under a Water Security (WS) initiative grant from the U.S. Environmental Protection Agency (EPA). Sampling procedures associated with site characterization were developed and modified under the Sampling and Analysis (S&A) component. To facilitate operational implementation of site characterization and sampling procedures, a series of exercises were conducted. The exercises provided valuable opportunities for PWD staff to implement procedures and allowed collection of lessons learned to improve procedures and response preparedness. This paper summarizes consequence management and the incident command system, site characterization, the general process for exercise development, and lessons learned from the S&A exercises.

Project Background

The PWD developed a comprehensive CWS for its drinking water system under a WS initiative grant. The WS initiative is a program developed by the EPA in partnership with drinking water utilities and other key stakeholders in response to Homeland Security Presidential Directive 9. The WSI involves designing, deploying, and evaluating a model CWS for drinking water security. A CWS is a systematic approach to the collection of information from various sources, including monitoring and surveillance programs, to detect contamination events in drinking water early enough to reduce public health and economic consequences. The WS initiative goal is to develop water security CWS guidance that can be applied to drinking water utilities nationwide.

The project has six major components:

1. Online water quality monitoring
2. Sampling and analysis
3. Enhanced security monitoring
4. Consumer complaint surveillance
5. Public health surveillance
6. Consequence management (CM)

An integral part of the S&A component is response preparedness for sampling associated with site characterization. Site characterization is the process of collecting information from an investigation site for use in supporting the evaluation of a drinking water contamination threat. Site characterization activities include site evaluation, field safety screening, rapid field testing of the water, and sample collection. Site characterization results are critically important to the threat evaluation process. Exercises are designed to establish a learning environment for the utility and provide an opportunity to implement and evaluate response concepts, plans, and capabilities in response to a simulated contamination incident within the distribution system. The site characterization and sampling exercises capture lessons learned for use in improving response preparedness plans and capabilities.

CH2M HILL served as the project contractor and supported PWD in development of its CWS. CH2M HILL supported PWD in the design, implementation and evaluation of the S&A and CM components, including the planning and completion of the site characterization training and exercises.

Description of PWD and Routine Water Quality Monitoring

PWD is a municipal utility providing integrated water, wastewater, and stormwater services to the greater Philadelphia region. PWD delivers reliable and safe drinking water to more than 1.6 million people in Philadelphia and its suburbs. Source water is obtained from the Delaware and Schuylkill rivers.

PWD maintains 84 drinking water sampling stations for routine water quality monitoring and regulatory compliance purposes. The monitoring sites include PWD facilities and various other sites (such as police and fire stations) spread throughout the distribution system. PWD also conducts optimized corrosion sampling at 13 locations throughout the distribution system and at the entry points to the distribution system to comply with Pennsylvania Department of Environmental Protection permit requirements under EPA's Lead and Copper Rule.

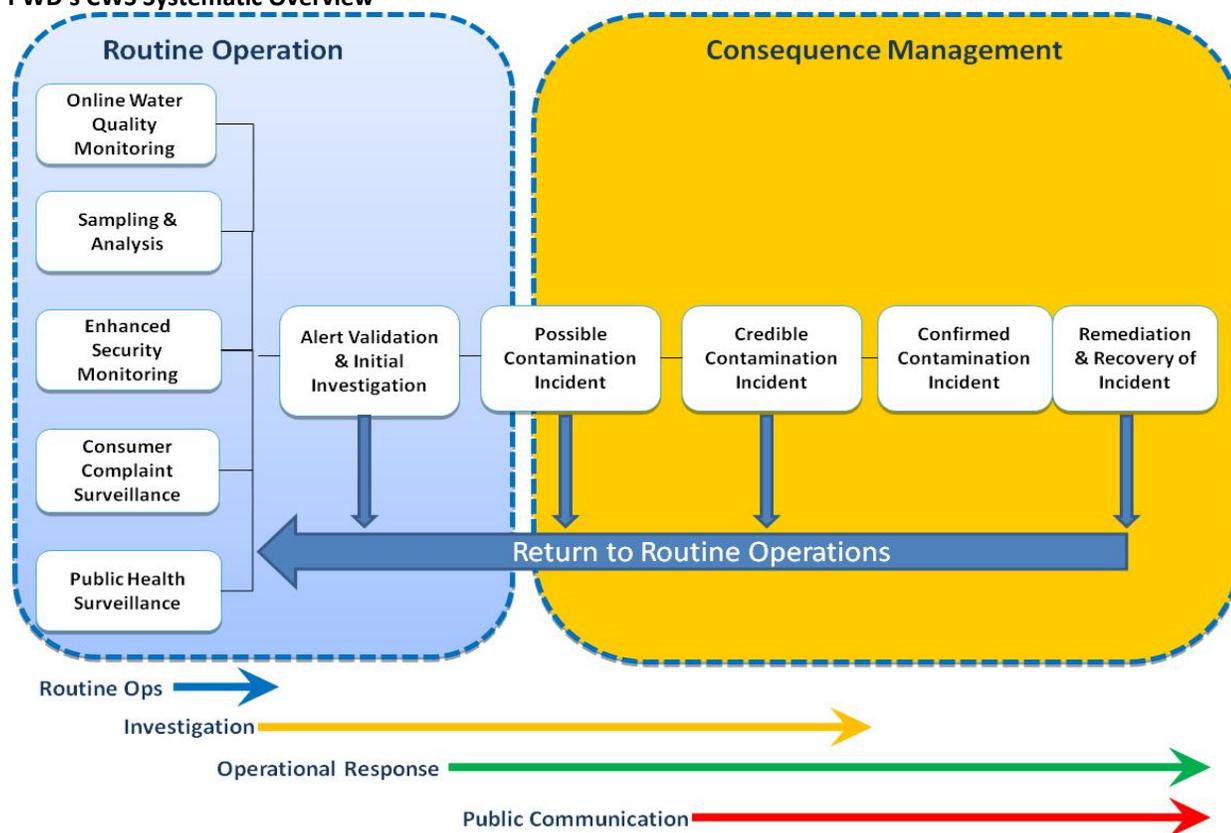
The 13 locations throughout the distribution system are monitored quarterly. Entry points to distribution are sampled weekly.

Samples are collected as frequently as daily. Each parameter has a designated monitoring schedule that may require analysis at the Bureau of Laboratory Services daily, weekly, monthly, quarterly, or annually. PWD routinely analyzes for general water quality, metals, and biologicals. Analysis for volatile and semivolatile organic compounds occurs quarterly.

Consequence Management and Incident Command System

As part of the CWS, a Consequence Management Plan (CMP) was developed by PWD to support response to indicators of potential water contamination relative to each of the other five CWS components. CWS components function as part of PWD’s routine operations while the CMP provides procedures to support the possible, credible, and confirmed contamination phases, as well as remediation and recovery (Figure 1).

FIGURE 1
PWD’s CWS Systematic Overview



The CMP includes provisions for implementation of the Incident Command System (ICS). A PWD-specific ICS structure was developed within the CMP for implementation during a possible contamination incident. Procedures for site characterization and sampling support both initial investigation as well as response once the CMP is activated.

Site Characterization Background

Site characterization is the process of collecting information regarding an investigation site in order to support the evaluation of a drinking water contamination threat. Characterization activities include site evaluation, field safety screening, rapid field testing of the water, and sample collection. Additional investigation sites may be identified due to the potential spread of a suspected contaminant. Site characterization results are critically important to

the threat evaluation process and also serve to identify safety procedures, protocols, and resources to be used to protect the health and safety of field responders.

Two broad phases of site characterization include planning and implementation. Within PWD, prior to CMP activation, the CWS Advisory Team is responsible for the planning phase, and the site characterization team is responsible for implementing the site characterization plan. Six steps are required to respond to a potential water contamination incident:

1. Develop a site characterization plan.
2. Prepare to approach the site.
3. Characterize actual site conditions.
4. Collect samples.
5. Prepare samples for transport.
6. Decontaminate equipment and personnel and exit the site.

Forms within the Site Characterization and Sampling Plan developed to support the process include the Water Quality Incident Site Characterization Plan, Water Quality Incident Site Characterization Report, and Incident Report (includes position assignments).

Training and Exercises

The Homeland Security Exercise and Evaluation Program (HSEEP) was used to develop and conduct a series of exercises to support operational implementation of site characterization and sampling procedures. The purpose of the HSEEP is to provide common exercise policy and program guidance that constitutes a national standard for homeland security exercises. HSEEP includes consistent terminology that can be used by all exercise planners, regardless of the nature and composition of their sponsoring agency or organization.

HSEEP reflects lessons learned and best practices of existing exercise programs and can be adapted to various scenarios and incidents (e.g., natural disasters, terrorism, and technological disasters). HSEEP synthesizes concepts from the National Response Framework, the National Incident Management System, the National Preparedness Goal, the Universal Task List, and the Target Capabilities List to facilitate a national framework for planning and conducting exercises.

The HSEEP continuum for training and exercises proved valuable in supporting implementation of site characterization and sampling procedures by ensuring that training and exercises are conducted in a logical, step-wise manner. Sixteen HSEEP exercises were conducted over 2 years, six of which included site characterization and sampling functions.

Exercise Lessons Learned

Through the conduct of six site characterization and sampling exercises, lessons learned were compiled. They fall into two general categories described below: (1) Designing, Deploying, and Evaluating the S&A Component; and (2) Site Characterization and Sampling.

Designing, Deploying, and Evaluating the S&A Component

With respect to the S&A Component, lessons learned are provided below:

- Not all instruments/methods proved practical for PWD use:
 - PWD evaluated methods and instruments to make investment decisions.
 - Hapsite ER and Ludlum were selected for use.
 - M272, ECLOX, and Microtox were not selected for use.
- Additional conversations and exercises with HazMat to define collaborative response procedures are necessary to support the CWS.

- Hazard awareness and safety training was not previously available for laboratory staff and field samplers. PWD developed its own training to meet this need.
- Site Characterization provides useful and functional tools to support field safety:
 - Safety procedures and precautions
 - Safety screening instruments
 - Systematic forms (Site Characterization Plan and Report)
 - Communication and organization protocols
 - Tools (including the CWS Dashboard) to support expedited response.
- Regular training is required. Training must be performed, evaluated, and continuously improved to prepare staff properly. Refresher training must occur to develop and maintain competency.
- Clear triggers for Site Characterization, moving from routine operations to consequence management, and characterization of the contamination phases (possible, credible, confirmed) are difficult to develop. Additional training is needed to support these decision-making processes.
- General control limits and triggers are identified in procedures; some managerial discretion should be built into the decision-making process.
- Succession planning is critical. Attrition forces the use of an ongoing training program.

Site Characterization and Sampling

The following specific lessons were learned regarding site characterization and sampling:

- Certain investigation procedures and resources require further training:
 - Training of field personnel regarding contact with customer complaints is necessary to support appropriate risk communication without causing panic.
 - Management must be trained to provide briefings to incoming personnel to allow them an appropriate level of situational awareness to support effective response.
 - Training regarding use the CWS Dashboard is important to allow users to take full advantage of the information provided by the five CWS monitoring components.
- General site characterization and sampling protocols require initial and ongoing training:
 - Team member roles and responsibilities during sampling.
 - Zone designation to support safe conduct of site characterization and sampling team members.
 - Site security procedures to support safe conduct of site characterization and sampling team members and the general public.
 - Decontamination procedures to support safe exit of site characterization and sampling team members from the site.
 - Procedures to maintain credibility of criminal evidence to support law enforcement investigation.
- Investigation to facilitate planning for site characterization and sampling activities should involve detailed consideration of various data sources, such as Customer Complaint and Online Water Quality Monitoring information, to identify safety concerns and to provide insight into sampling strategies. Assimilating data from each of the five monitoring components provides valuable information to support informed planning.
- When the ICS is activated, it is vital that the identity of the incident commander be communicated to all activated responders. Briefings to provide situational awareness must also be conducted.
- Preparing and using ready-to-go Water Quality Response Kits with supplies and equipment reduce mobilization and response times. Staff should be trained on the use and maintenance of these kits.

- Ongoing training is necessary to support operational use of field safety screening and rapid field testing equipment. Equipment competency supports effective, valid, and timely onsite investigation. Operational understanding of testing equipment ensures instrument readiness.
- Responders must know the capabilities of the Mutual Support Laboratories and contract laboratories, notification procedures, and sample delivery procedures. Relationships with the regional state and federal laboratories should be created and maintained to understand their sample processing, transport and shipping procedures. PWD held two workshops with agency support laboratories to discuss each laboratory's capability and capacity, notification procedures, inter-laboratory QA/QC procedures, sample delivery, data analysis, and management processes.
- Responders must understand the importance of site characterization, when it is necessary or unsafe to perform site characterization, the steps to perform site characterization, and communication required to support the ICS. For example, it is important to define the water utility's limitations in response, for example, when to call HazMat and relinquish control.
- Development and maintenance of decontamination procedures is vital to ensure field and laboratory staff safety. Working with HazMat teams can improve decontamination procedures.
- Clear guidelines are necessary as to when technical experts are to be notified and their role in supporting any response operation. PWD developed an awareness DVD on site characterization, sampling, and laboratory work following a contamination event and provided it to the police and fire departments and other external agencies.
- As an incident escalates, incoming response personnel should be briefed on the current situation to facilitate improved incident risk evaluation, site response planning, and deployment time.

Recommendations and Conclusions

The CWS provides critical early warning capabilities to support identification of a contamination incident; the CMP provides validated procedures to support incident response. As a vital component of the CWS, site characterization and sampling procedures are critical to support investigation of a possible water contamination incident and to perform tasks safely for the benefit of field responders and the general public. During development and implementation of site characterization and sampling procedures, training and exercises should be designed and conducted to evaluate the ability to activate the site characterization teams and perform the sampling. The HSEEP continuum for training and exercises proved valuable in supporting implementation of site characterization and sampling procedures by ensuring that training and exercises are conducted in a logical, stepwise manner. The exercises proved valuable in supporting an improved response posture and in providing a proper understanding of response procedures and capabilities among assigned utility responders and external response partners.

Abbreviations and Acronyms

CM	Consequence Management
CMP	Consequence Management Plan
CWS	Contamination Warning System
EPA	United States Environmental Protection Agency
HSEEP	Homeland Security Exercise and Evaluation Program
ICS	Incident Command System
PWD	Philadelphia Water Department
S&A	Sampling and Analysis
WS	Water Security

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