Contamination Warning Systems & Consequence Management

Brian Pickard, P.E., BCEE, RS
U.S. EPA Office of Ground Water and Drinking Water
Water Security Division

Michigan Water Utility Security Summit
June 4, 2008; Lansing, MI
1. Water Security (WS) initiative Background
2. Contamination Warning System Design
3. Consequence Management Plan (CMP)
   a. Essential Elements
   b. CMP and Existing Response Plans
   c. Content: Outlining CMP Actions
   d. Constructing the CMP
   e. Communications
4. Training
5. Summary/Conclusions
Background

• Homeland Security Presidential Directive/HSPD-9
  – Establishes a national policy to defend the agriculture and food system against terrorist attacks, major disasters, and other emergencies.
  – Signed January 30, 2004

• HSPD-9 requires EPA to
  – “develop robust, comprehensive, and fully coordinated surveillance and monitoring systems . . . for . . . water quality that provide early detection and awareness of disease, pest, or poisonous agents”

• EPA’s Water Security initiative responds to the HSPD 9 charge
• Through studies, EPA has concluded that:
  – The distribution system is the most vulnerable component of a drinking water system
  – Contaminants are readily available that could produce staggering public health consequences
  – A contamination warning system has the potential to reduce public health and economic impacts from a contamination event
The WSi comprises work in three areas:

1. **Develop a conceptual design** for a system that achieves *timely detection* and *appropriate response* to drinking water contamination incidents to mitigate public health and economic impacts;

2. **Demonstrate**, test, and evaluate the conceptual design in contamination warning system **pilots** at drinking water utilities;

3. **Issue practical guidance** and conduct outreach to promote voluntary national adoption of effective and sustainable drinking water contamination warning systems.
# Pilot Demonstration Approach

## Design

<table>
<thead>
<tr>
<th>Phase</th>
<th>SYSTEM ARCHITECTURE</th>
<th>INITIAL PILOT</th>
<th>ADDITIONAL PILOTS</th>
<th>VOLUNTARY NATIONAL ADOPTION</th>
</tr>
</thead>
</table>

## Approach

- **Conceptual design**: Apply to *single* pilot utility. Evaluate. Refine and enhance.
- **Funding**: EPA Funds

## Scope

- **Not applicable**

## Design Specificity

- **Low**: Applies to pilot utility only
- **High**: Applies to each pilot
- **Medium**: Applies to range of utilities

## Funding

- **Utility Funds**
# Cincinnati Pilot Timeline

<table>
<thead>
<tr>
<th>FY 2006</th>
<th>FY 2007</th>
<th>FY 2008</th>
<th>FY 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>CRADA signed</td>
<td>Initial assessment</td>
<td>Work plan development</td>
<td>Implementation of enhancements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td>CRADA ends</td>
<td>Baseline development</td>
<td>Full deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaluation</td>
</tr>
</tbody>
</table>
CWS Design Objectives

1. Detection of a broad spectrum of contaminant classes
2. Spatial coverage of the entire distribution system
3. Detection of contamination in sufficient time for effective response
4. Reliable indication of a contamination incident with a minimum number of false-positives
5. Able to be implemented and sustained
CWS at a Glance

- Involves deployment and use of active monitoring and surveillance components for timely detection of possible contamination.
- Use of multiple components provides opportunity for faster detection of a broader range of potential contaminants and increased strength of signal.
- May also provide dual-use applications to utilities and local partners.

More than just **Water Quality Monitors**...!
• Consequence Management is a key aspect of the CWS design…
What is Consequence Management?

- **Consequence management** consists of actions taken to plan for and respond to potential drinking water contamination incidents.

- **Goal**: minimize response and recovery timelines through a pre-planned, coordinated effort

![Consequences diagram](image_url)
a. CMP Essential Elements

- **Credibility Determination actions** to investigate validated event triggers
  - Investigative actions (information gathering) to confirm or rule out contamination and inform response actions
  - Adopted Response Protocol Toolbox (RPTB) “Phases” of contamination: Possible-Credible-Confirmed
  - RPTB for *planners*; CMP for *decision-makers*

- **Response actions/Precautionary actions** to protect against potential effects of contamination while performing Credibility Determination
  - Operational responses
  - Notifications to partners/stakeholders
  - Assign Roles and Responsibilities for utility *and* response partner personnel

- **Remediation and Recovery** to return utility to normal operations
b. CMP and Existing Response Plans

- Great, *another* plan...

- The CMP should be a component of the overall emergency response plan; a incident-specific action plan for a drinking water contamination event in the distribution system
c. Content: Outlining CMP Actions

- Contamination Is “Possible”
  - Multiple Triggers Indicate Credible Threat
  - Perform Site Characterization

- Multiple Contamination Warning Trigger Monitoring
  - “Credible” Determination
    - Evaluation of Field Results and Additional Information
    - Contamination Is “Credible”
      - Perform Initial Operational Responses
    - Expanded Sampling Strategy

- “Confirmed” Determination
  - Evaluation of Laboratory Results and Additional Information
  - Contamination Is “Confirmed”
    - Remediation and Recovery
  - Perform Additional Operational Responses
    - Public Notification
c. Content: Outlining CMP Actions

Format: decision trees with supporting bulleted text

From "Possible" Contamination Threat

10.1. Notify Director and Superintendent; Consider activating Response Teams and ICS and notifying external agencies

Release Statement to employees; Coordinate with counterparts at external agencies.

10.2a. Implement operational responses

- Immediate operational response actions are intended to limit the potential for exposure of the public to the suspect water while site characterization activities are implemented. An example of an operational response action is hydraulic isolation of a tank by pumping water into the tank or closing influent and effluent valves to a tank. The procedures for performing initial operational responses are described in Tree 20.0.
- Initial operational responses to be performed by Response Teams, under the command of the Field Leader.
- Go to Tree 20.0—Operational Response Decision Tree: Credible Determination.

10.2b. Conduct Site Characterization

- Go to Tree 30.0—Site Characterization Decision Tree.
- Then proceed to Steps 10.3a and 10.3b.

0.1. Log information; close investigation; return to normal operations. END
### CM Tools: Expanded Sampling Field Kit

#### Zone of Impact

<table>
<thead>
<tr>
<th>Zone of Impact</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>…</th>
<th>…</th>
<th>…</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>12</td>
<td></td>
<td>12</td>
<td></td>
<td>24</td>
<td>24</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>24</td>
<td>24</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>1</td>
<td></td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>24</td>
<td>24</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>12</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

### Detection Location

- **Zone of Impact**: The table above represents the zone of impact, where numbers indicate the level of impact ranging from 1 to 24. Higher numbers indicate a more significant impact.
- **Detection Location**: The detection locations are marked on the map on the right, categorized by travel time (in hours) and sampling locations.

#### Sampling Locations
- **In**: Green dots indicate sampling locations within the area.
- **Out**: Blue dots mark sampling locations outside the area.

### Map Legend
- **Travel Time**
  - Red: Immediate<br>  - Orange: 2 Hours<br>  - Yellow: 4 Hours<br>  - Green: 12 Hours<br>  - Blue: 24 Hours
d. Constructing the CMP

• Self-assessment of existing plans
  – Integrate with other internal procedures and plans

• Develop internal utility plan framework first
  – Event typically unfolds from just utility to local agencies to state and federal - so should plan development
  – Obtain input from the divisions, departments and experts within the utility
d. Constructing the CMP (con’t)

• Use initial CMP draft to reach out to response partners and frame discussions
• Identify and engage key response partners and stakeholders to define roles and responsibilities
e. Communications

- General Communications
  - Internal (Utility) Equipment and Procedures
  - External (Response Partner)

- Risk/Crisis Communications
  - Plan Development for Roles/Responsibilities
  - Public Information Actions and Public Notification Requirements
  - Tools and Resources for Working with the Media
    > Coordination with other agencies/Unified message
    > Message Mapping: How to and what to communicate
Training

• To ensure an effective consequence management program, training should be conducted to:
  – Familiarize utility staff and response partners with the CMP and their corresponding roles
  – Test and evaluate CMP processes (e.g., credible, confirmed)
  – Test and evaluate participants’ ability to implement the guidance of the CMP
  – Identify opportunities for improving the plans
  – Increase response time efficiency and accuracy

• Include both internal and external exercise and drills involving partners at the local, state and federal levels

• Review, Revise, and Advise (alert staff to changes)
Training and Exercises (Cont)

- Full Scale Exercises
- Functional Exercises
  - Site Characterization
  - Triggered Sampling
  - Expanded Sampling
  - Mobilization of Staff/Equipment
- FEMA ICS Courses
  - Staff Orientation Training/Tabletops
  - Upper Management, familiarize director/chiefs
  - Site Characterization, familiarize field staff

Exercises
Drills
Classroom
CMP Training - Functional

Management Group

Response Partner Group

Field Response Group
CMP Training – Full Scale

- Management
- SIM CELL
- Field Response

- Response Partner On-scene Arrival
- Recovery of Water Sample
- Sample Analysis Coordination
Lessons Learned/Challenges

• Volunteer nature of the program = utility *culture* change
• Establish CMP *before* the CWS is online and running
• Matrixing with all local/state/federal agencies across jurisdictions
• Considerations in performing operational responses
  – Isolation of tank versus distribution system
  – Flushing and disinfectant dosages
• Law enforcement and Site characterization - access to possible crime scenes
• Identifying the extent of contamination
  – Use of distribution system models
• Remediation & Recovery
  – Who gives the “all clear”
  – How to rebuild public confidence
Summary & Conclusions

• The WS initiative CWS includes multiple monitoring and surveillance components for contaminant detection

• CMP is a blueprint to guide actions during a contamination event – it addresses the question “Now What?”

• The CMP outlines *credibility determination* actions to investigate alarms and *response actions* to protect against potential effects of contamination

• CMP Development: Planning and preparedness requires partnerships with other agencies, providing for “Dual use benefit”

• Training is essential to ensure effective CMP response
• Selected through a competition in 2007
  – Open to utilities serving at least 750,000 people

• Anticipate funding up to four additional pilots
  – Funding through a cooperative agreement

• Pilots will begin in Spring/Summer 2008
  – Three year project period

• Pilots must include:
  – All five WS monitoring and surveillance components
    > Water quality monitoring, consumer complaint surveillance, enhanced security monitoring, public health surveillance, and sampling and analysis
  – Consequence management plan
  – Evaluation plan
Additional Resources

- **Water Security Division**
  - http://www.epa.gov/safewater/security

- **Water Security Initiative**
  - http://cfpub.epa.gov/safewater/watersecurity/initiative.cfm


- *More guidance to come soon:*
  - Developing SOPs for contamination detection
  - Developing CMP for response
Questions?

Brian Pickard, P.E., BCEE, R.S.
Pickard.Brian@epa.gov; 202-564-0827