Surveillance and Response System
At Greater Cincinnati Water Works

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Water Quality & Treatment

Greater Cincinnati Water Works: System Overview

- 2 Treatment plants:
  - Surface: 220 MGD
  - Ground: 40 MGD
- 3100 miles of Water main
- 11 Pressure zones
- 28 Storage tanks
- Avg. day pumpage: 120 MGD
- Customers
  - Retail
  - Wholesale
## WaterSecurity Initiative Program

<table>
<thead>
<tr>
<th>Phase</th>
<th>Design</th>
<th>Initial Pilot</th>
<th>Expansion</th>
<th>National Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>Conceptual</td>
<td>Apply to single pilot utility</td>
<td>Evaluate</td>
<td>Convert to guidance for any utility</td>
</tr>
<tr>
<td></td>
<td>design</td>
<td>Refine and enhance</td>
<td>Evaluate</td>
<td></td>
</tr>
<tr>
<td>Scope</td>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Specificity</td>
<td>Low</td>
<td>High - Applies to pilot utility only</td>
<td>High – Applies to each pilot utility</td>
<td>Medium – Applies to range of utilities</td>
</tr>
</tbody>
</table>

### Contamination Warning System

- **Water quality monitoring**
- **Consumer complaint surveillance**
- **Sampling and analysis**
- **Enhanced security monitoring**
- **Syndromic surveillance**

#### Utility Data Management and Integration

#### Public Health Data Management and Integration

#### Utility Event Detection

#### Public Health Event Detection

#### Consequence Management Plan
Water Quality Monitoring (WQM)

- 17 Monitoring stations – 3 designs
- TOC, Cl₂, pH, Conductivity, Temperature, ORP, Turbidity
- Monitored through SCADA system
- Event detection system
  - CANARY – Sandia
Event Detection Alarms by Parameter

Consumer Complaint Surveillance (CCS)

- Capturing data from > 1 million sensors
- Filter funnel approach
- Triggers
  - IVR
  - Work Orders
- System monitors
  - 1 day
  - 2 day
Consumer Complaint Surveillance

- Work Order alert - e-mail with complaint details

ID: 09-038794-000
Datetime: 3/30/2009 1:39:41 PM EDT
Location: xxxx Carmel Ter & Everett Av (WESTWO)
Problem Description: cloudy water with black specks sample 3/31 10 am to 12

ID: 09-039533-000
Datetime: 3/31/2009 4:00:10 PM EDT
Location: xxxx Elkhorn Dr & Loralinda Dr (COLETP)
Problem Description: Customer says the water tastes like a garden hose. Please sample and flush on 4/1/09 between 12:00 and 4:00

CCS Alarm on GIS Map
Sampling and Analysis

- Field and lab program
- Additional parameters and methods
- Monitoring to establish baseline
- No detections out of ordinary
- Integrating with routine water quality sampling

Enhanced Security Monitoring

- 13 facilities
- Entry alarms, motion sensors and cameras
- Hatches and vents
- Alarms tied into SCADA system
Public Health Surveillance

Possible to Credible

Contamination Is 'Possible'

If Multiple Triggers Activated and Threat Deemed 'Credible' by WUERM

1.0. Multiple Contamination Warning Trigger Monitoring

2.0. Perform Initial Operational Responses

10.0. 'Credible' Determination

Evaluation of Field Results and Additional Info

If Necessary

400.0. Public Notification

Contamination Is 'Credible'

30.0. Perform Site Characterization; by utility if hazard level is LOW, otherwise by Hazmat

City and/or County
Fire Department
Near Real-Time
Fast-Acting Chemicals (Classes 1-9)

911
City and/or County
Fire Department
Near Real-Time
Fast-Acting Chemicals (Classes 1-9)

Poison
Regional
Poison Control Center
Near Real-Time
Fast-Acting Chemicals (Classes 1-9)

RX
City/County/ Regional
NRDM
Daily
Pathogens (Classes 10-11)

Hospitals
City/County/ Regional
LPH
Days or Weeks
Pathogens (Classes 10-11)
Total System Costs

- **Deployment Costs**: total cost to design and install the CWS
  - Total deployment cost: $11,951,805
    - Labor: $8,870,852
    - Equipment and services: $3,080,953

- **O&M Costs**: annual cost to operate and maintain the CWS
  - Total O&M cost per year: $308,328
    - Labor: $155,641
    - Consumables and services: $152,687

System Deployment Costs

Cost in Million Dollars

- WQM: $1.43
- ESM: $2.56
- CCS: $1.31
- PHS: $1.39
- S&A: $1.04
- CM: $4.23
**System O&M Costs**

- Costs of WQM Station: $7,600 per station per year ($4,800 for TOC) – O&M
- 3 hours per month per station – O&M
  - 50 hours/month typical for 17 stations
  - Includes significant travel time
- Plus investigation time
- EDDIES/Canary
  - Minimal maintenance cost
WQ Monitoring System Cost

- Deployment ($4.23 mil)
  - Equipment, Consumables and Services: $1,820,000 (43%)
  - Labor: $2,410,000 (57%)

- O&M ($172K)
  - Labor: $55,214 (32%)
  - Consumables and Services: $117,195 (68%)

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- **Equipment Replacement Costs**: total cost for equipment replacement every 7-10 years
  - Total replacement cost: $1,000,000 + ?
    - Hardware: $1,000,000
    - Software: $?
Benefits of CWS

- Reduced fatalities
- Reduced cost of medical treatment
- Reduced loss in wages and business revenue
- Reduced cost of remediation
- Reduced cost of bottled water
- Reduced loss in drinking water and wastewater revenue

Dual Use Benefits of SRS

- Improved knowledge of distribution system water quality
- Potential cost savings in operations and capital improvements
- Ability to detect and respond to a wide range of distribution system water quality issues
- Information to support activities related to regulatory compliance (GWR, SDWA, DBPR, AMR)
- Increased public confidence in the water supply
- Improved coordination and communication among agencies and within the drinking water utility
- “All emergencies” preparedness
Sustainable SRS

- Reduce O&M Cost using equipment with less field work
  - Optical sensors
  - Adaptive measurement frequency
  - Remote diagnosis

Remote Monitoring with Energy Harvest
Sustainable SRS

- Reduce O&M Cost using equipment with less field work
  - Optical sensors
  - Adaptive measurement frequency
  - Remote diagnosis
- Generate Revenue by selling services
  - Lab analysis
  - Monitoring equipment
  - Water quality data
- Utilize What is Available from others
  - Public health
  - Police video surveillance system
- Develop More Dual Uses
  - Site characterization tools like radios, drones

Additional Dual Uses
Sustainable SRS

- Reduce O&M Cost using equipment with less field work
  - Optical sensors
  - Adaptive measurement frequency
  - Remote diagnosis
- Generate Revenue by selling services
  - Lab analysis
  - Monitoring equipment
  - Water quality data
- Utilize What is Available from others
  - Public health
  - Police video surveillance system
- Develop More Dual Uses
  - Site characterization tools like radios, drones
  - UV/Vis probe
  - Real-time model calibration/validation

Questions?

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