



# Online Water Quality Monitoring Systems

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Drinking Water Security & More

U.S. Army Center for Health Promotion  
and Preventive Medicine

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# Report Documentation Page

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# AGENDA

**PURPOSE:** Explain the usefulness and real-world considerations of using online water quality monitoring systems in DoD drinking water distribution systems

1. Introduction
2. How it works
3. Design
4. Implementation strategy
5. What else can be done



# Introduction

- Public health surveillance
  - 911 calls
  - Emergency room visits
  - Over-the-counter drug sales
  - RODS/ESSENCE databases





# Introduction

- Enhanced physical security
  - Intrusion/motion detection
  - Remote valve operation/isolation
  - Recording closed circuit TV





# Introduction

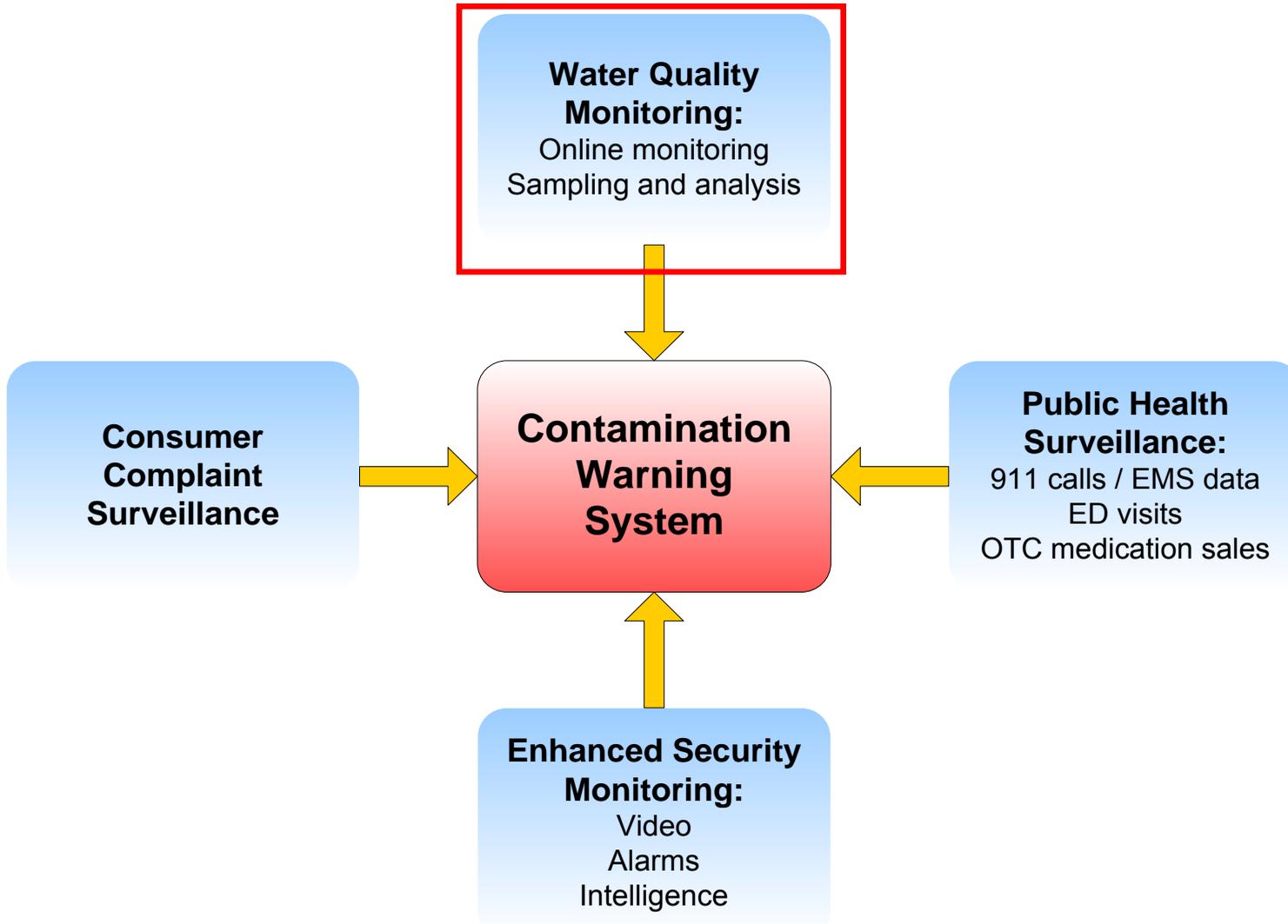
- Consumer complaint tracking
  - Centralized system
  - Analyze data
    - Spatial
    - Temporal
    - Water quality





# Introduction

- Security - EPA's Contamination Warning System





## How it Works

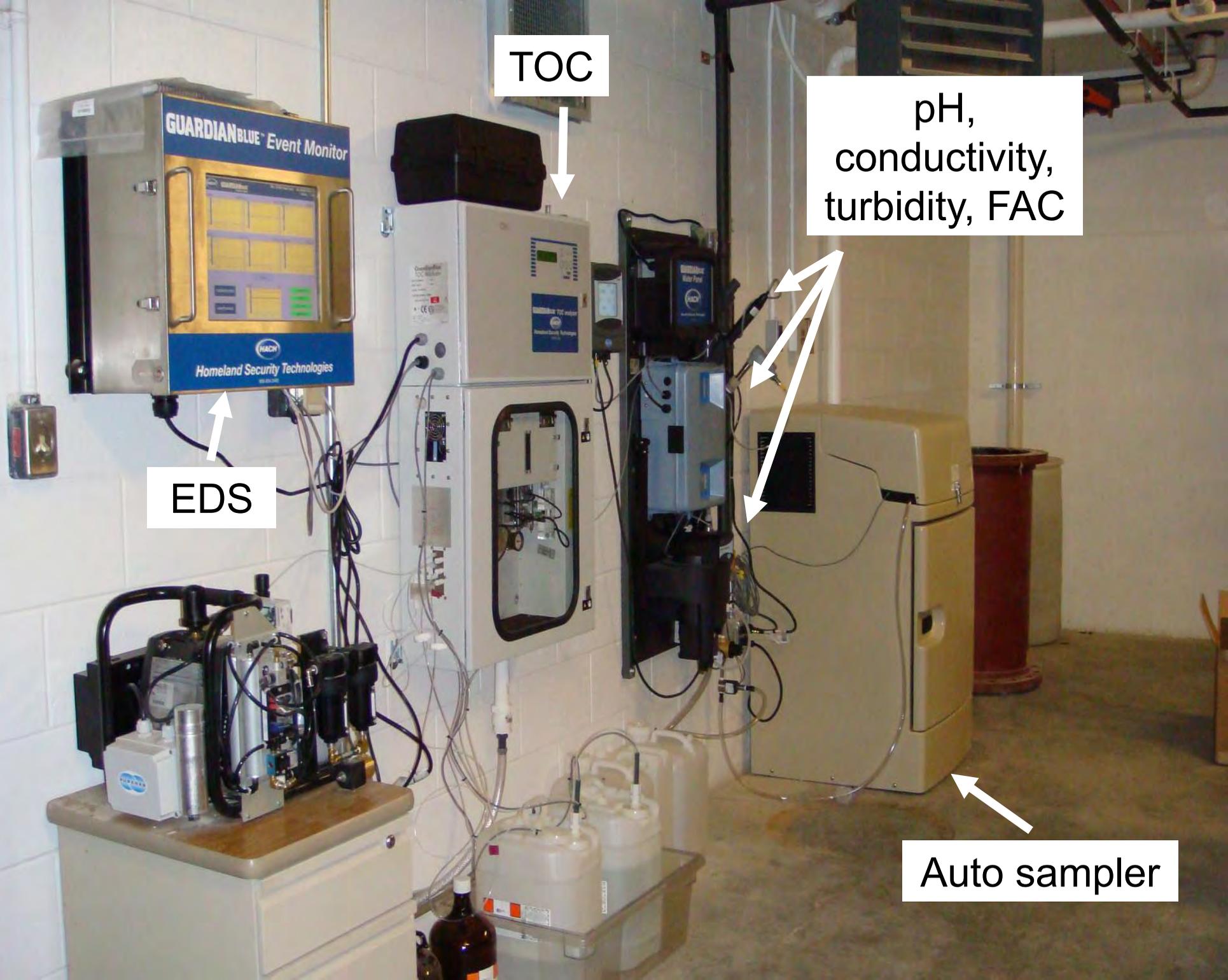
- A group of online water quality parameter monitors located at sites in the distribution system
  - Free Available Chlorine (FAC), conductivity
  - pH, Total Organic Carbon (TOC)
- Good indicators of contamination
- Software analyzes data to detect and identify abnormal water quality events
  - Event Detection System (EDS)

TOC

pH,  
conductivity,  
turbidity, FAC

EDS

Auto sampler



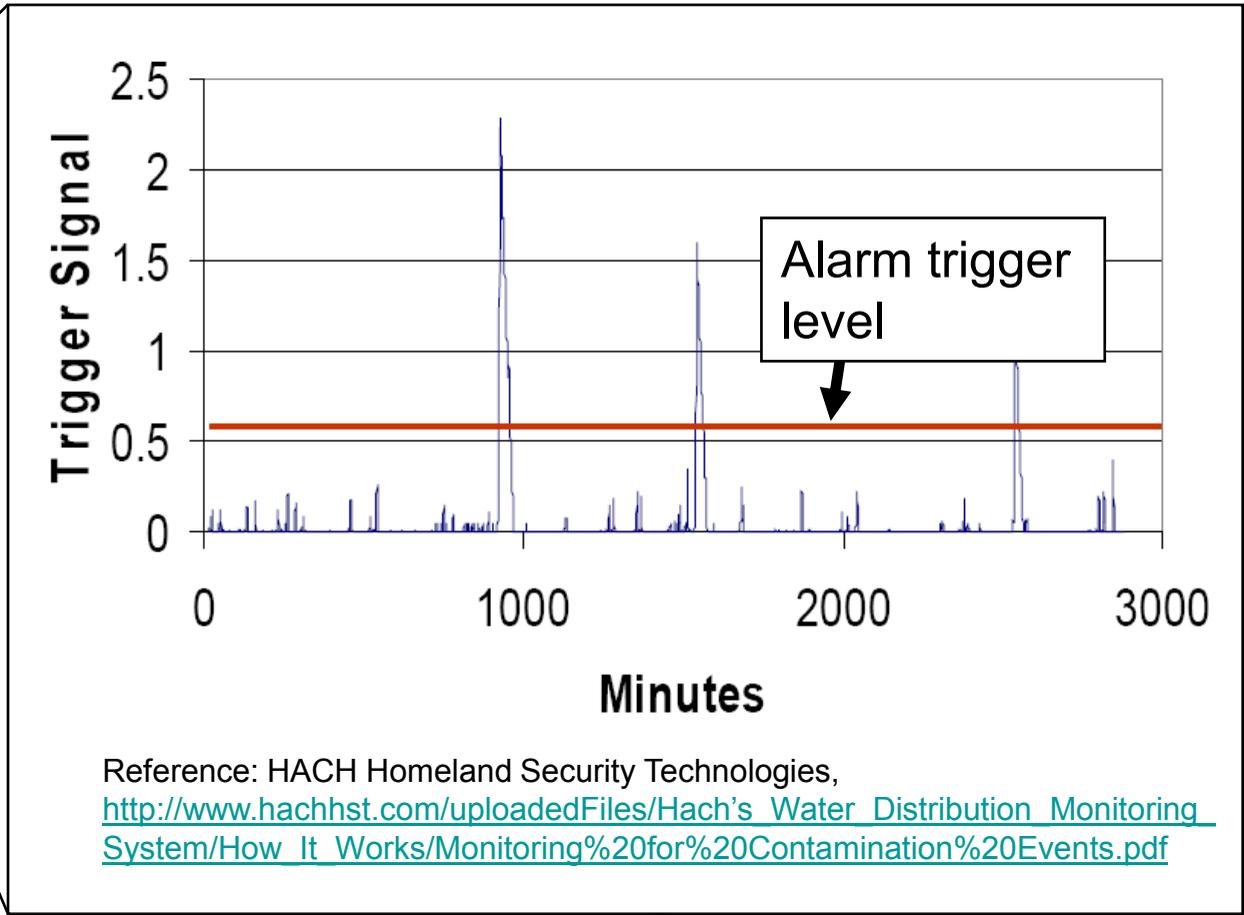




# How it Works

Online Water Quality monitors

EDS



Water Plant





## How it Works - Other Benefits

- Better understanding of distributed water quality
  - Replace or supplement existing monitoring locations
- Identify routine events degrading water quality
  - Treatment plant process procedures
  - Pump operation
- Identify non-routine events degrading water quality
  - Pipe breaks
- Improved relations & communication



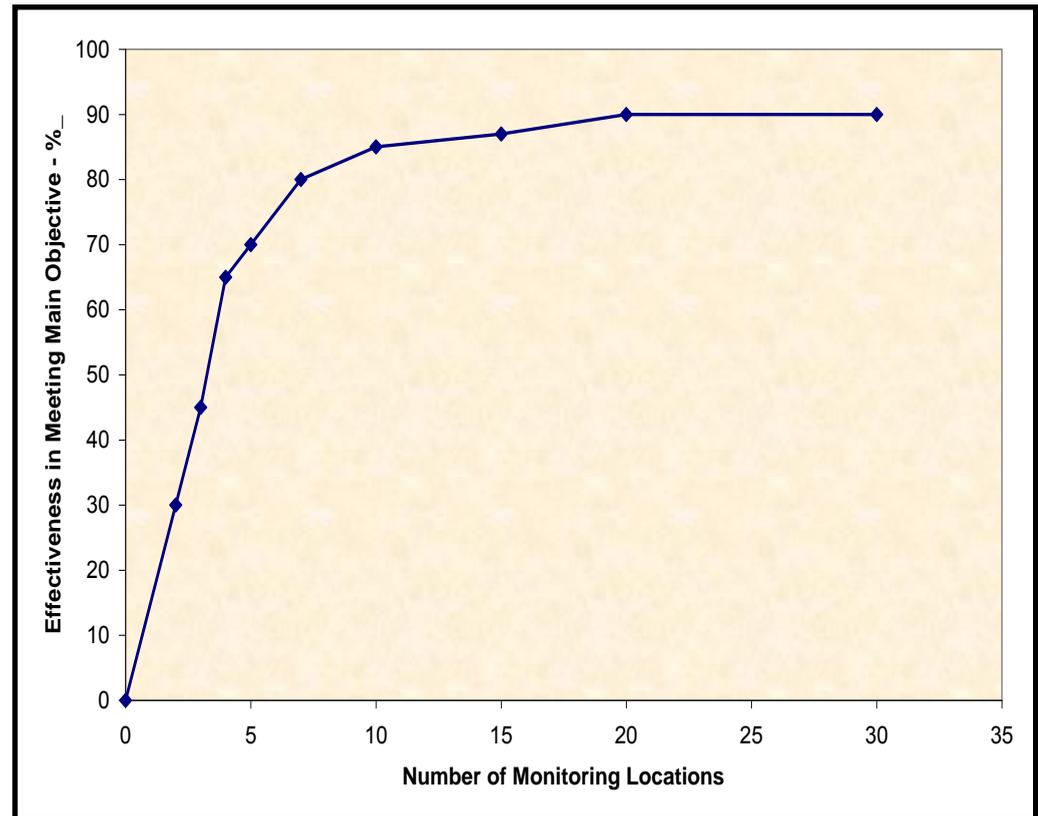
# Design

- Consider goal(s)
  - Increase protection of public health
  - Increase protection of mission-critical facilities
- Determine monitoring equipment & pilot test
  - Most promising parameters
    - Free available chlorine (FAC)
    - Total organic carbon (TOC) or UV<sub>254</sub>
    - Conductivity
  - Event detection system
  - Packaged systems vs. individual components
  - Look to 3<sup>rd</sup> party evaluations
    - Environmental Technology Verification (ETV)
    - Technology Testing & Evaluation Program (TTEP)



# Design

- Determine locations & number
  - Use optimization software
  - Need hydraulic model
  - Vetted by
    - Water system personnel
    - Force protection





# Implementation Strategy

- Ensure long-term funding available
- Develop hydraulic model & calibrate to simulate water quality
- Involve installation organizations early and often
- Determine design & installation issues (short-term)
  - Equipment & capital costs
  - Monitoring locations and number
  - Communication with existing IT infrastructure
- Startup & operation (long-term)
  - Responsibilities
  - Operation and maintenance
  - Consequence management plan



# Implementation - Hydraulic Model

- Must have accurate distribution model
  - Hydraulic & water quality
- Multiple benefits
  - Master planning
  - Fire flow analysis
  - Unidirectional flushing
  - Regulatory compliance
- Challenges
  - Lacking data
    - Infrastructure – outdated maps
    - Usage/demand - no metering, leak detection
  - Cost





# What Else Can be Done?

- Reduce risk of intentional contamination
  - Ensure effective distribution system programs
    - Cross-connection control
    - Valve exercising
    - Unidirectional flushing
    - Consumer complaint handling
  - Exercise your Emergency Response Plan (ERP)
  - Implement distribution system operational monitoring
    - Increase frequency & location with FPCON
  - Set system up for hydraulic model in future
    - Update maps
    - Install meters
    - Leak detection
  - Implement other components of CWS



# Additional Resources

- EPA Water Security Initiative

<http://cfpub.epa.gov/safewater/watersecurity/initiative.cfm>

- EPA Technology Testing & Verification program

<http://www.epa.gov/nhsrc/ttep.html>

- EPA Environmental Technology Verification program

<http://www.epa.gov/etv/>

# Questions?

