



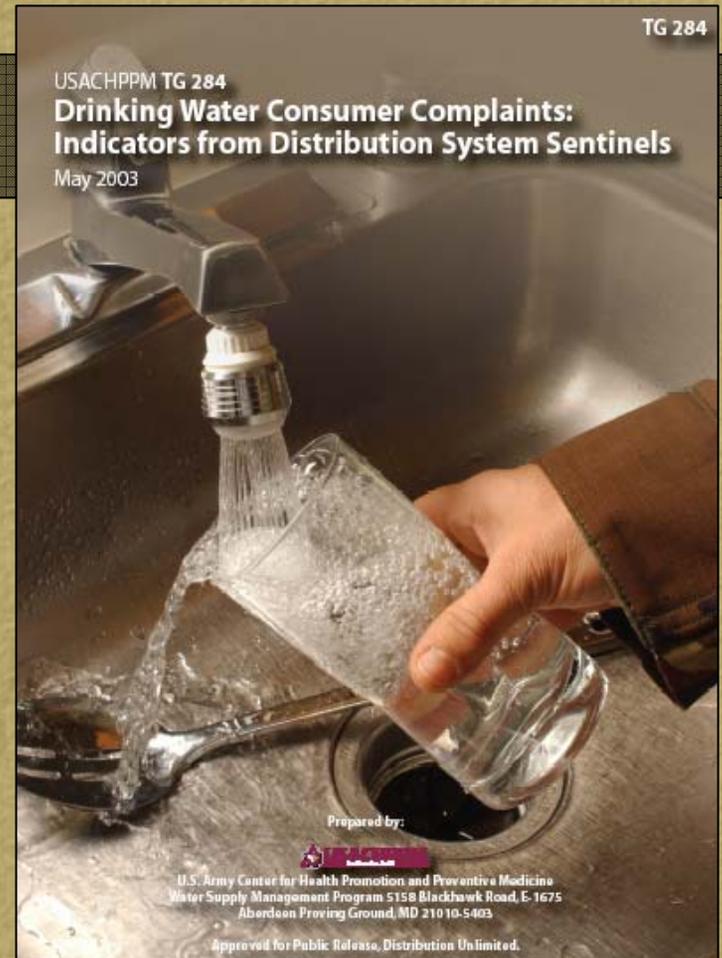
Customers as Distribution System Sentinels

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Andrew J. Whelton

**AWWA National Conference
and Exposition
Orlando, FL USA**

June 17, 2004





Presentation Outline

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C
H
P
P
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- 1. Early Warning Systems**
- 2. Syndromatic Surveillance**
- 3. Customers as Sentinels**
- 4. Effective Complaint System Components**
- 5. Conclusions & Recommendations**



The Early Warning System (EWS) should have Multiple Features

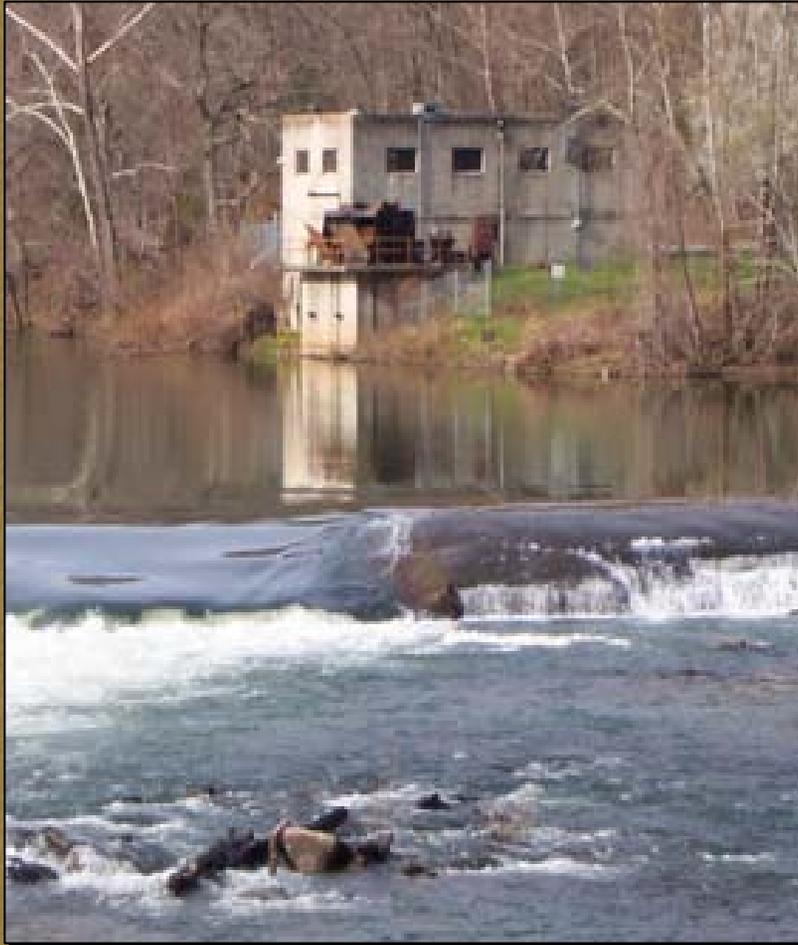


West Point, NY

- Inexpensive
- Fully automated and online
- Communicates and operates remotely
- Continuous sampling rate



EWSs should be Highly Reliable



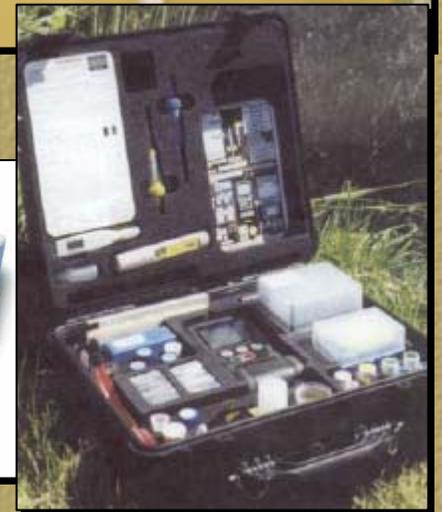
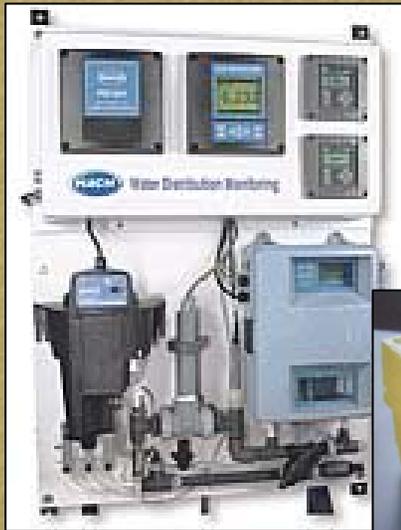
- Rapid response time
- Capable of detecting many contaminants at low levels
- Provides qualitative and quantitative results
- Low rate of false positives



Several Highly Publicized Water Monitoring Devices are in Use

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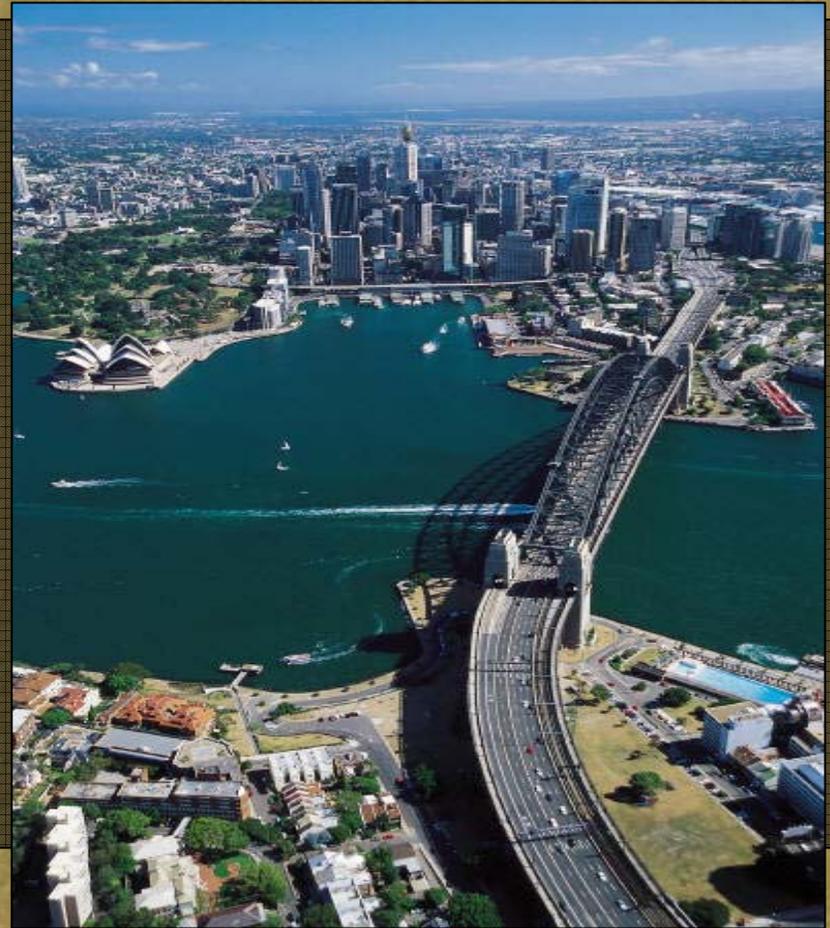
- Commercial off the shelf
- Continuous online
- Bio-sentinel monitors





Public Health Officials Speculate Terrorist Attacks will be First Detected by the Population

- First warnings of an attack will be
 - Emergency room admittances
 - Flu medicine purchases
 - School or work absences





Syndromatic Surveillance is Studied by the DoD and SNL

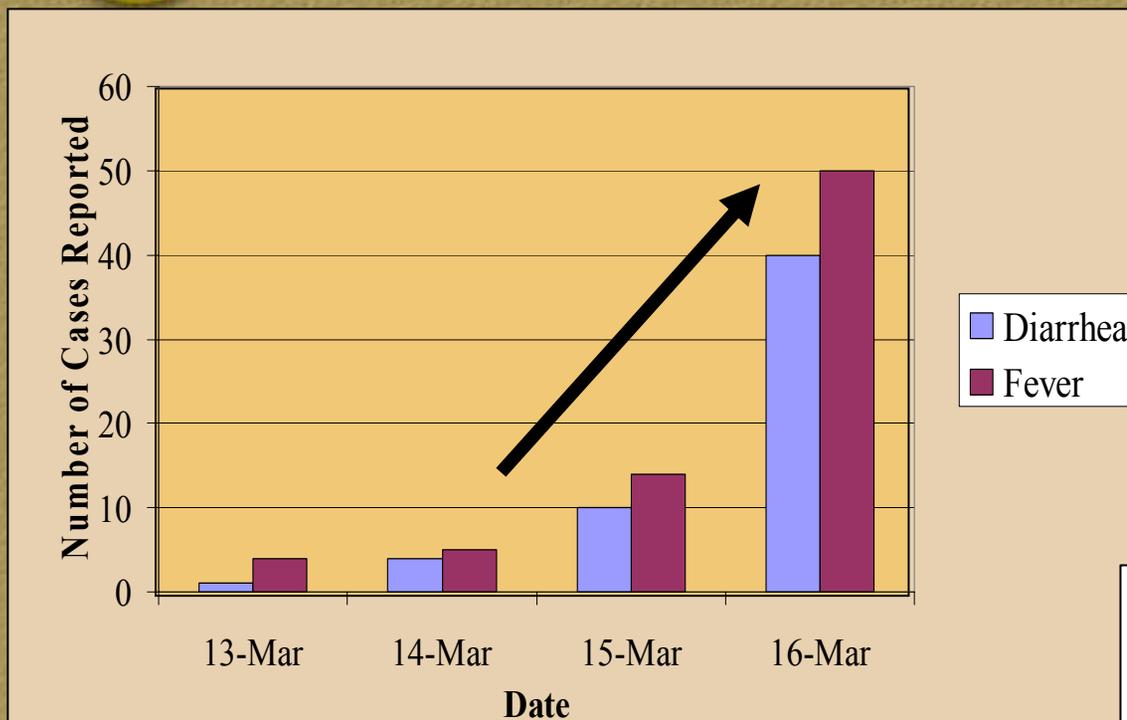
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C
H
P
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- Department of Defense uses “syndromatic surveillance” to detect terrorism
 - *American Forces Press Service*, Aug 02
 - *Washington Times*, Aug 02
- Sandia National Laboratories also develops program for public health surveillance (*San Francisco Chronicle*, Aug 02)



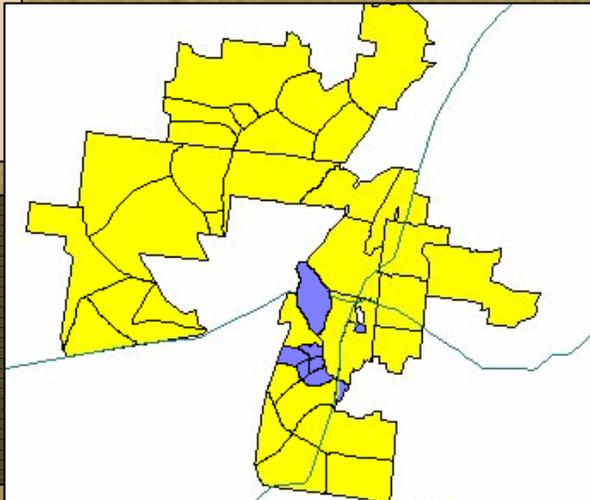


Syndromatic Surveillance Tracks Symptom Reports Temporally and Spatially



- Charts show trends

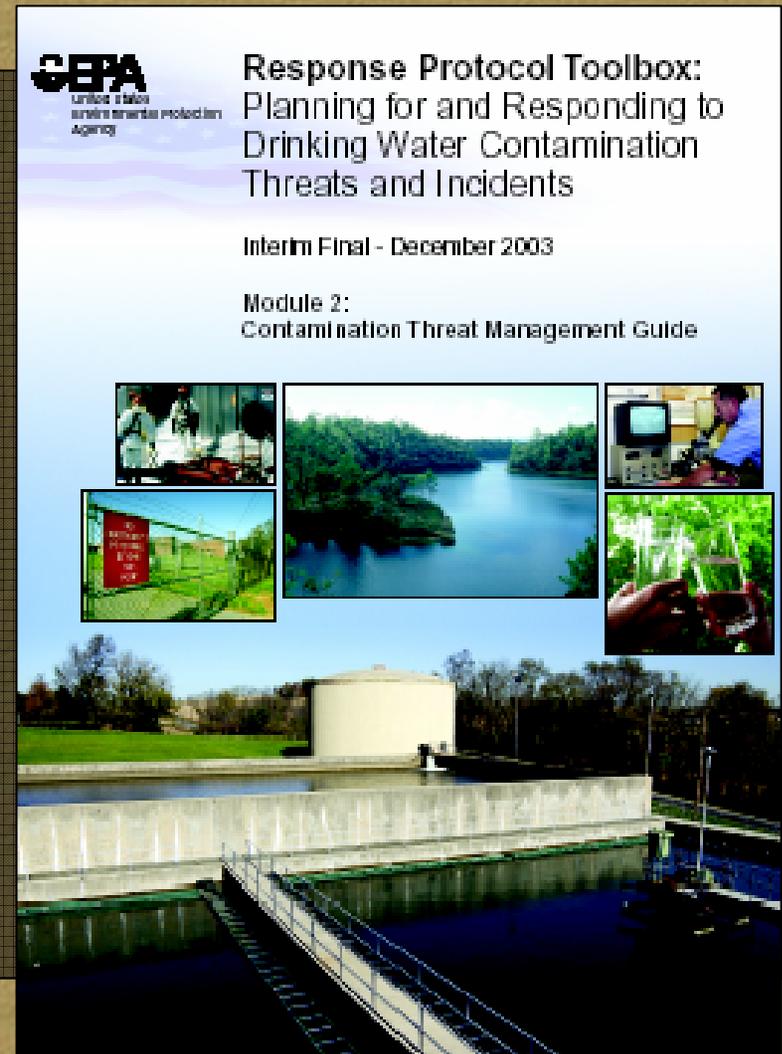
- Maps visually define problem areas
 - Location of people who are affected
 - Gives visual density of people affected





Drinking Water Customer Monitoring is Endorsed by the EPA and CDC

- EPA Contamination Threat Management Guide
- Expert CDC and EPA forum
 - Customer complaint databases highlighted as a frontline tool to be used to detect contaminated water
 - Considering how to integrate utility information into a larger surveillance tool





Customer Detection Capabilities are Comparable to those of an EWS

EWS Qualities	Customer Attributes
Continuous; Online; High sampling frequency; Inexpensive	Located at every point in the distribution system; Feedback is free
Real-time feedback; Rapid response time	Contacts the utility when a problem is noticed
Wide range of contaminant detection capabilities at very low concentrations	Notifies many contaminants at very low levels (10 ng/L or 0.000000001 g/L)
Pressure detection capability	Identifies pressure changes



Surveillance Benefits Unique to Customer Sentinels

- Monitoring capability extends to human health effects (i.e., symptoms and illness)
- Multi-sensory approach used (i.e., taste, odor, color, texture)
- Monitoring capability not limited to water quality (i.e., recognizes facility access)



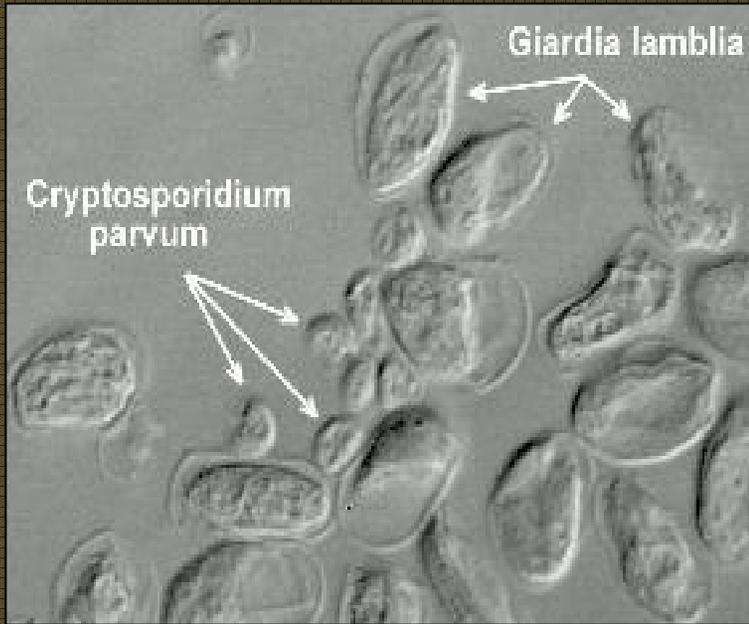


Chemicals in Water have Detectable Aesthetic Attributes

Compound Name	Taste Descriptor	Odor Descriptor	Color Descriptor	Turbidity Present
Cyanogen chloride	Sharp, metallic	Pepperish	Colorless	No
Diazinon (insecticide)	Not found	Faint ester-like	Colorless	No
Fluoride	Salty, soapy	Sharp, pungent, irritating	Colorless	No
Free chlorine	Astringent	Chlorinous	Colorless	No
Hydrogen cyanide*	Bitter, metallic	Almonds, peach kernels	Colorless	No
Malathion (insecticide)	Not found	Skunk, mercaptan, garlic	Yellow	No
Mercuric chloride	Bitter, metallic	Almonds, peach kernels	Colorless	No
Napthalene	Not found	Mothball-like	Colorless	Yes
Parathion (pesticide)	Not found	Rotten Onion, garlic	Colorless	Yes
Petroleum products	Not found	Pungent, hydrocarbon	Varies	Yes
Sewage	Salty	Septic	Gray, brown	Yes
Soman	Not reported	Fruity, camphor	Colorless	No
Sulfur mustard	Not reported	Garlic, mustard	Pale yellow	Yes



Ingestion of Biological Contaminants Causes Several Symptoms



Courtesy of H. Lindquist, U.S. EPA

Cryptosporidium parvum

(protozoan)

Nausea, diarrhea, and stomach cramps

Giardia lamblia

(protozoan)

Nausea, diarrhea, bloating, headache, stomach cramps, weight loss

Botulinum toxin

(toxin)

Paralysis but mentally alert

Smallpox

(virus)

Nausea, vomiting, fever, headache



Human Senses are Used to Evaluate Water Quality at Water Facilities



- Practiced *Standard Methods*
 - Threshold Odor Number Test (2150B) (TON)
 - Flavor Profile Analysis (2170B) (FPA)
 - Flavor Threshold Test (2160B) (FTT)

- Emerging Methods
 - 2-out-of-5 Test
 - Attribute Rating Test (ART)
 - Distribution Comparison Test

(Dietrich et al., 2003)



A Connecticut Water Utility Realized the Value of Customer Feedback in 1988

- 1988 Connecticut water utility fluoridation system malfunctions
- Concentrated fluoride pours into the distribution system (40x normal concentration; ~160 mg/L)
- Customers contacted water utility
 - Health effects: Illness included nausea, vomiting, diarrhea, cramps, skin irritation
 - Abnormal tastes
 - Water turned blue with contact with soap





Fort Knox Discovered the Value of Customer Complaints in the 1990s

- Contractor superchlorinated an offline storage tank after repairs were completed
- 100 ppm free chlorine concentration was in the storage tank
- Valves were not completely closed
- Superchlorinated water entered the distribution system

Customers field taste and odor complaints

4.0 mg/L FAC found at taps

1.0-2.0 mg/L FAC normal



In 2004 an Army Water System in Europe Discovered the Value of a *Single* Complaint

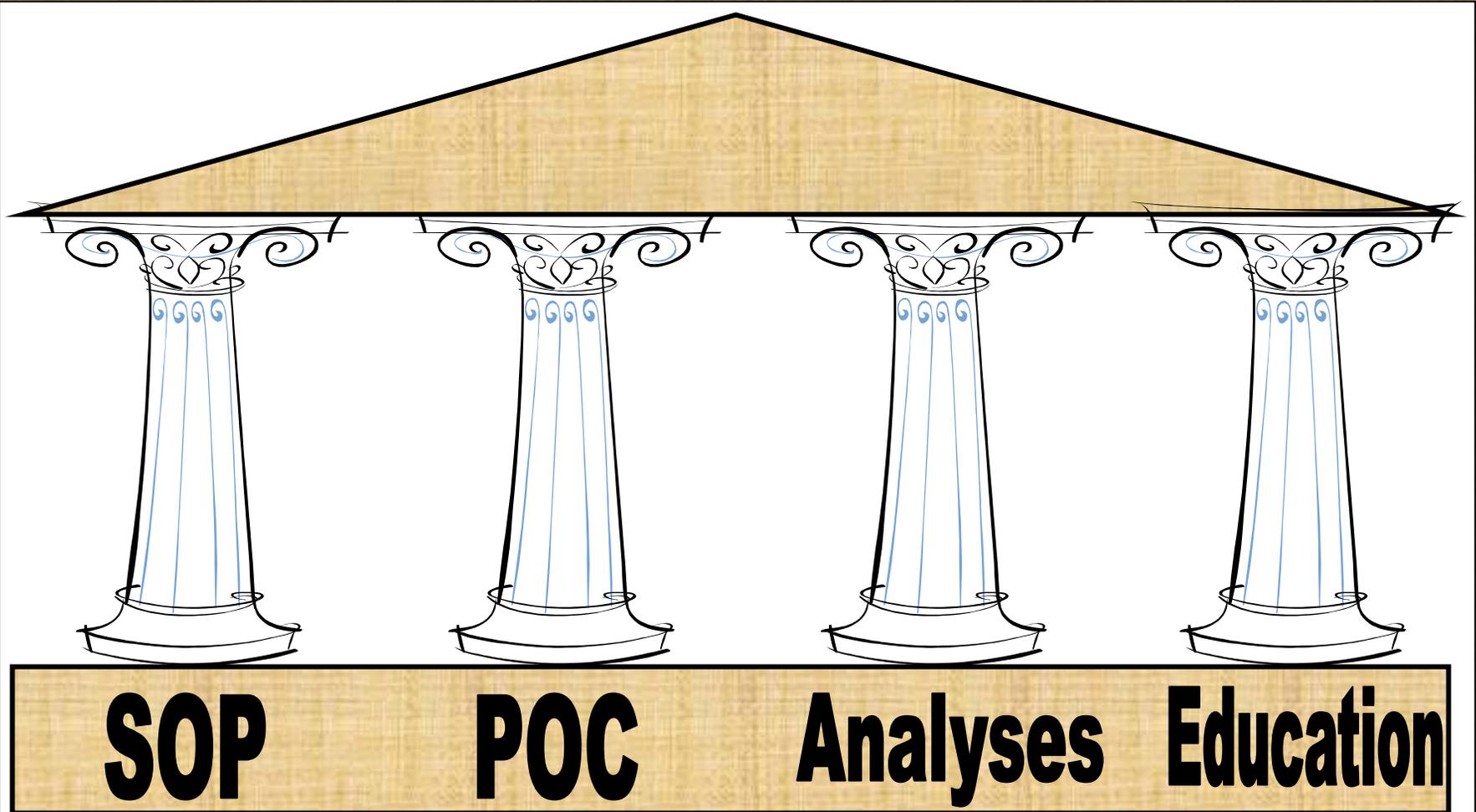


**Picture sent from the
Commanding General
to the Garrison Commander**

Photo courtesy of CHPPMEUR



Effective Utility Complaint Systems have Four Major Components





Executives and Managers Must Harness Information and Apply it to Operations

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A
C
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P
P
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CONCLUSIONS

- Public health officials suspect people will be the first to detect a terrorist attack
- Customers have EWS qualities that make them excellent sentinels of the distribution system
- Changes in distribution water quality are often noticed first by customers
- Utilities that capture and analyze customer complaint feedback will be in a better position to discover contaminated water quickly



When You Return to Your Utility Optimize Customer Complaint Procedures

U
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C
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P
P
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RECOMMENDATIONS

- Determine how complaints are currently handled
- Upgrade or develop a new complaint SOP to reflect the terrorist threat
- Confirm that the four major complaint system components are in place (SOP, POC, Analyses, Education)
- Consult the U.S. Army CHPPM TG 284

Acknowledgements



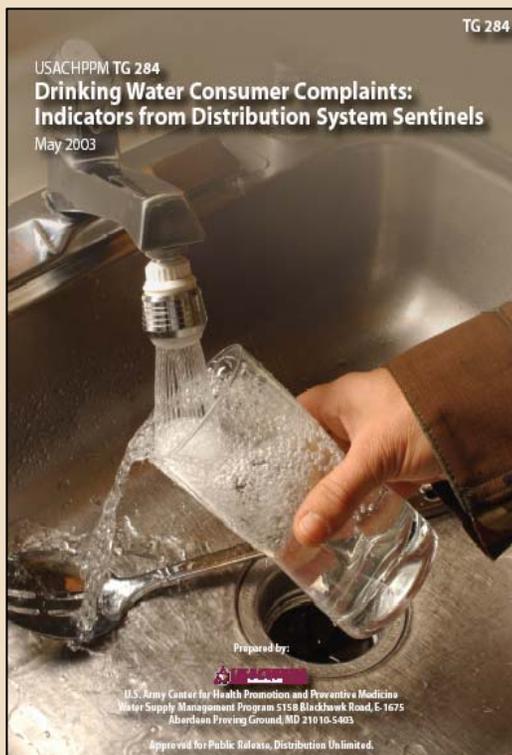
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- Oak Ridge Inst. for Science and Education
- Lauren Disano, EPA ORD/NHSRC
- Dr. Andrea Dietrich, Virginia Tech
- Gary Burlingame, Philadelphia Water Department
- Todd Richards, U.S. Army CHPPM
- Margaret Cooney, U.S. Army CHPPM
- Jerry Valcik, U.S. Army CHPPM



The Basis for this Presentation is U.S. Army TG 284

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Andrew J. Whelton

United States Army

CHPPM, APG, MD USA

COM: +1-410-436-8109

DSN: 312-584-8109

Andrew.Whelton@apg.amedd.army.mil

**Technical Guide 284, Drinking Water
Consumer Complaints: Indicators from
Distribution System Sentinels.**

United States Army Center for Health Promotion
and Preventive Medicine, APG, MD USA. 2002.

To obtain a copy:

Download at:

<http://chppm-www.apgea.army.mil/tg.htm>

Or send an e-request:

Water.Supply@apg.amedd.army.mil