Utilization of Public Health Surveillance Data for Early Detection of Drinking Water Contamination

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Objective

This paper summarizes the use and evaluation of various types of public health surveillance data for the early detection of chemical and biological contamination of drinking water.

Background

The United States Environmental Protection Agency (U.S. EPA) has developed a prototype contamination warning system (CWS) for drinking water in response to Homeland Security Presidential Directive 9 (HSPD9). The goal of HSPD9 and the CWS is to expedite contamination containment and emergency response, thereby minimizing public health and economic impacts.[1]

U.S. EPA's conceptual CWS system, named WaterSentinel, is currently being pilot tested by U.S. EPA and its research partners. WaterSentinel is a multi-faceted approach involving water quality monitoring at optimal locations throughout the drinking water distribution system, enhanced security monitoring at key water utility infrastructure assets, consumer complaint surveillance, and innovative uses of public health surveillance data streams.

Methods

Timelines for contamination incidents in real drinking water distribution systems were simulated, and subsequently evaluated to determine when contamination may be detected using the above monitoring and surveillance strategies. These analyses indicate that 911 calls and emergency medical service (EMS) run reports that are electronically captured and evaluated on a near real-time basis represent the strategy that most quickly detects chemical contamination within a drinking water distribution system. Over-the-counter drug sales and syndromic surveillance systems, such as RODS and ESSENCE, are the public health surveillance data streams most useful for a biological contamination event in drinking water. Poison control center reports are believed to be valuable for early detection of both chemical and biological contamination incidents.

U.S. EPA is currently working with pilot cities to capture the desired public health data, filter the data, analyze it for specified anomalies, and integrate the data related to suspected events with corresponding water quality data. EPA is also working to develop water modules within the RODS and ESSENCE systems for use by pubic health officials and possibly water utility emergency managers.

The components of the conceptual CWS will be evaluated through field use and testing with simulated data.

Results

Retrospective analysis of historical water quality and public health surveillance data have demonstrated that some correlations between these two data streams exist during normal operations and contamination events. Additionally, algorithms and event detection strategies utilized to identify anomalies in public health surveillance data also appear to have applicability to water quality data, thus providing a basis for integration of public health and water quality data into a single system.

Further results of the project are pending additional data gathering associated with the pilot study. These results will aid in enhancing future CWS programs.

Conclusions

A multi-faceted monitoring and surveillance approach is necessary for timely detection of water contamination events. Research currently being conducted by U.S. EPA indicates that certain public health surveillance data streams and water quality data are particularly useful for early identification of chemical and biological contamination in drinking water. Integration of these data streams and close coordination between drinking water utilities and public health departments is critical to implementation of early response actions that can contain and minimize the consequences of drinking water contamination events.

References

1. EPA. WaterSentinel System Architecture, 2005. http://www.epa.gov/safewater/watersecurity/pubs/watersentinel_system_architecture.pdf

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