Chemical, Biological, and Radiological Sensors for Early Warning Systems in Wastewater Utilities

Full Report (04CTS9S)/ Guidance Document (04CTS9Sa)

The purpose of this research was to compile the information necessary to develop clearly defined and broadly accepted criteria for installing and measuring the effectiveness of Early Warning System (EWS) sensors in wastewater systems. This Executive Summary is a synopsis of the work conducted in two separate research projects:

- Chemical, Biological, and Radiological Sensors for Early Warning Systems in Wastewater Utilities Phase I: Research Report – 04CTS9S
- Chemical, Biological, and Radiological Sensors for Early Warning Systems in Wastewater Utilities Phase II: Guidance Document – 04CTS9Sa

WERF's security-related research addresses emergency response and contingency planning, chemical/biological/radioactive contamination events (accidental or purposeful), cyber security of process control systems, and risk communications.

Numerous sensors were evaluated as part of this research and the results are specifically discussed in the reports. Phase I focused on the background information needed for the main components of an Early Warning System (EWS). A EWS is an integrated system for monitoring, analyzing, interpreting, and communicating monitoring data. It can be used to make decisions that protect public health and minimize unnecessary concern and inconvenience to the public.

Background information researched in Phase I included the identification of chemical, biological, and radiological (CBR) sensors, contaminants of concern, monitoring systems, and upset modalities. The information was found through:

- A literature survey
- Vendor interviews and presentations
- A web-based survey of wastewater utilities
- A state-of-the-art Early Warning System review for the drinking water sector and its applicability to wastewater

Phase II of the research produced a framework for development of EWS and the applicability of sensors to the wastewater matrix. The research identified a need for the development of a strategy and guidance that can help in the prevention and detection of a chemical, biological, and radiological contamination event on wastewater collection systems and treatment plants. Critical issues addressed included the development and deployment of EWS to protect wastewater utilities from CBR contamination events. This information is useful to utilities so that they can plan for and experiment with upset early warning protocols. It is also useful to manufacturers as they determine product performance needs. The EWS framework is applicable for utilities in a range of sizes.

BENEFITS

- Provides a state-of-the-art review of chemical, biological, and radiological (CBR) sensors for wastewater collection and treatment.
- Identifies CBR constituents of concern.
- Presents sensor selection and deployment criteria.
- Provides a comprehensive review of sample preparation and handling techniques.
- Provides emergency response procedures that can be employed in the event of a contamination event.
- Reviews data mining and anomaly detection methodologies.

RELATED PRODUCTS

A Workshop on Research Needs for Sensor Development for Wastewater System Security Operations (04CTS9SW)

These projects and others under WERF's Security Research Program cover different security thematic areas and are published as separate reports or tools. Some of these products are not available for public distribution because of security concerns and are available only through WaterISAC at http://www.waterisac.org.

AVAILABLE FORMAT

Online PDF posted on www.WaterISAC.org

Refer to: **STOCK NO. 04CTS9S/9SA**

For more information, log on to **www.werf.org**.

The first phase (review and compile existing information on EWS for wastewater systems) included:

- Identification of assessment criteria
- Development of a comprehensive list of entities that use, develop and manufacture sensors
- Development of a database for CBR contaminants of concern

A hierarchical system of selection was developed for sensor classification. This tiered approach aided in the analysis and made it easier to convey the current state of the technology.

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