AquaSentinel Technology and WaterSentry™ System: New Tools for Continuous Real-Time Water Monitoring

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Abstract

Two of the core program areas the Environmental Protection Agency has included in their latest Strategic Plan (2004-2008) are the protection of sources of drinking water from contamination and assurance that critical water infrastructure is secure from terrorist and other intentional acts. Currently, there is a very limited number of field-deployable continuous real-time water monitoring systems available to water professionals. As part of the Defense Advanced Research Projects Agency (DARPA) Tissue-Based Biosensor Program, Oak Ridge National Laboratory (ORNL) developed AquaSentinel; a technology which uses microscopic algae that live in sunlight-exposed source waters as fluorometric sensors. United Defense, L.P. (UD) has acquired an exclusive commercial license from ORNL for this technology in the United States of America and has designed a device called WaterSentry™. WaterSentry™ is a field-deployable continuous real-time system for stand-alone operation. It provides an alternative to conventional batch analytical methods which require dedicated personnel and expensive reagents among other things. WaterSentry™ uses very sensitive chlorophyll fluorometers to measure fluorescence induction curves as indicators of the health of the algae. We report photochemical yield analysis and toxins exposure sensitivity data for chlorophyll fluorescence experiments performed with water samples collected from the Clinch River in Oak Ridge, Tennessee. The Clinch River is the main source of water for the City of Oak Ridge. WaterSentry™ is fully compatible with SensorNet technology which has been developed at ORNL. SensorNet is a network system for the collection, management, processing and dissemination of threat-related information from real-time chemical, biological, radiological, and nuclear sensors deployed in different parts of the nation. Our results demonstrate that WaterSentry™ can be used by water facility managers to receive remote alerts for early detection of chemical toxins in primary-source water supplies. When combined with encrypted remote data telecommunication and a database-lookup library of the response of algae to chemical contaminants, WaterSentry™ provides a practical and effective approach for active monitoring of sunlight-exposed primary-source drinking water and application of water quality standards regulations.

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