

Countermeasures to CW Attacks on Water Supplies

AquaSentinel

Homeland Security Issues and Technology Impact

Water supplies are vulnerable to attacks, rendering these supplies hazardous or deadly if consumed. Recent events have also increased concern about ensuring the safety of municipal water supplies. Current methods for testing water safety are cumbersome and often require several hours for test results. There is an urgent need for field-deployable continuous real-time water monitoring systems to quickly detect the presence of toxic agents in water supplies. The availability of such systems will ensure the safety of water supplies in the United States.

ORNL has developed a real-time detection technology for water testing in the field and for large-scale domestic primary drinking water supplies (such as reservoirs, rivers, and lakes). U.S. Patent No. 6,569,384 was released on May 27, 2003 for this invention.

AquaSentinel provides

- a field-deployable instrument;
- around-the-clock remote monitoring of drinking water; and
- early warning alert for toxic agents in water.

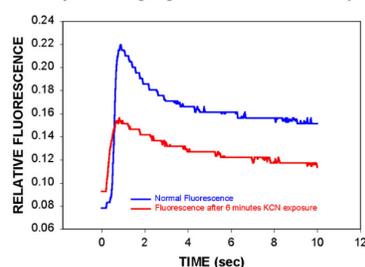
United Defense LP, has acquired an exclusive commercial license from ORNL for this technology in the U.S. United Defense (NYSE: UDI) is a leader in the design, development and production of combat vehicles, artillery, naval guns, missile launchers and precision munitions used by the U.S. Department of Defense and allies worldwide, and America's largest non-nuclear ship repair modernization, overhaul and conversion company. Beginning in January 2004, United Defense has marketed a commercial system based on this technology under the name WaterSentry™. This system is available for use in first alert homeland security, military and regulatory applications. WaterSentry™ is capable of testing results in as little as 3 minutes and can store data for up to 30 days.



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ORNL's Aqua Sentinel, using naturally occurring algae as biosensors, transfers information directly to analytical software for rapid analysis

Effect of 2 mM Potassium Cyanide (KCN) on Naturally Occurring Algae from Freshwater Samples



Technical Concept

ORNL's AquaSentinel is a revolutionary advance in the protection of military and municipal water supplies. It uses the fundamental principles of photosynthesis and state-of-the-art optoelectric instrumentation to provide continuous, unattended protection of all sunlight-exposed primary-source drinking water supplies. Algae grow in all water that is exposed to light. The detection system invented at ORNL measures characteristics of photosynthesis. Fluorescence induction curves are used as a real-time tool to detect exposure of these microscopic photosynthetic organisms to toxic agents.

The use of naturally occurring biosensors is practical and cost-effective. The actual opto-electronic fluorescence hardware used to collect data can be custom-designed instrumentation or a customized adaptation of commercially available instruments such as the Walz Flow-Through WATER-PAM fluorometer. Data from field instruments are transferred by encrypted wireless telecommunications to state-of-the-art analytical software and database libraries for quick analysis.

Research Strategy

ORNL researchers have successfully measured the effects of hazardous substances on photosynthesis of naturally occurring algae in the laboratory as well as in streams. The data gathered confirmed that these biosensors are accurate indicators of toxic agents in water. Methyl parathion, DCMU (Diuron), cyanide and Paraquat have been detected in freshwater samples. Dose-response studies have been performed that indicate the sensitivity of this system can equal or approach EPA guidelines for long-term exposure to these toxins. Further research and development of water quality tissue-based biosensors will expand the range of toxins that can be instantly identified.

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