Technical Support Working Group
Combating Terrorism Technology Support Office
Developmental Technical Brief

ICWater: Incident Command Tool for Protecting Drinking Water

Background Information:

The United States Department of Agriculture (USDA) Forest Service, Environmental Protection Agency (EPA), Federal Emergency Management Agency (FEMA), Technical Support Working Group (TSWG), and Defense Threat Reduction Agency (DTRA) have identified as a high priority, the need for protecting drinking water sources from terrorist attacks. Making key information rapidly available to incident commanders while an attack is underway will better enable them to evaluate the risks the attack poses to the public and to direct the actions of first responders to effectively reduce those risks.

The United States has approximately 180,000 water systems, serving over 250 million persons (Rycus et al, 2001). An estimated 16 trillion gallons of water is processed annually in the United States by these water utilities. All levels of government recognize that protecting the health and safety of all Americans requires safe drinking water and have invested heavily in public drinking water systems to achieve this goal. Despite strenuous efforts to protect public drinking water systems, however, they can still sometimes fail with tragic consequences. For example, in 1993, Milwaukee's drinking water was accidentally contaminated with the pathogen, *Cryptosporidium,* resulting in over 100 deaths. Recent acts of terrorism, including the attacks on the World Trade Center and Pentagon and the dispersal of *Anthrax* in the mails, illustrate the need to upgrade protection of drinking water to include defenses against deliberate terrorist acts as well as inadvertent water contamination.

The nation has two important ways to protect drinking water safety: (1) upgrade infrastructure to physically protect water supplies and (2) upgrade preparedness to take timely and effective action to minimize the consequences to the public should an attack occur. Physical protection will be expensive, may take years to accomplish, and at best provides only partial protection. Strengthening emergency response to attacks on drinking water can offer substantial and rapid gains in protection of public safety and civil order and can bolster security while infrastructure is being improved. Emergency response can be strengthened by (1) improving the speed and accuracy of detecting an attack and (2) promptly providing personnel who direct the emergency response ("Incident Commanders") with critical information to decide: who is at risk and what actions will most effectively reduce the risk. ICWater focuses on providing Incident Commanders with critical information they need in real time to protect the public during contamination attacks on drinking water sources.

Requirements Statement:

- Design, develop, and test a prototype ICWater (formerly known as "ICIT") for all 50 states of the United States
- Ensure the application meets the user requirements for an incident command tool.
- Develop the application to operate on the COBRA platform developed by Defense Group Inc. under a TSWG sponsored project and be compatible with the Defense Threat Reduction Agency's CATS, Environmental Protection Agency's Emergency Response Analyzer, and Federal Emergency Management Agency's HAZUS system.
- The contractor shall include the Real Time RiverSpill watershed and river-reach model as an integral part of ICWater.
- Ensure the RiverSpill tool is capable of operating at the highest resolution available through the United States Geological Survey (USGS) National Hydrology Dataset (NHD) and will at a minimum be at a 1:100,000 scale.

Technology Description:

This project involves the development an information tool that will give Incident Commanders the critical information that they need to make informed decisions regarding the consequences of threats to public water supplies. The tool will be designed to meet the specific needs of Incident Commanders with respect to its content, timing and spatial coverage and resolution. ICWater, being a multi-disciplinary application, will meet the following requirements:

- Integrate critical data needed to evaluate and respond to an incident into a GIS-referenced system.
- Predict dispersion of waterborne contaminants by integrating the EPA and TSWG RiverSpill system with the National Hydrography Dataset (NHD)
- Incorporate interfaces between field sensors and RiverSpill
- Develop an interface for input of field reports by first responders and mobile units.
- Incorporate an interface for inclusion of hospital admissions data
- Contain GIS layers and databases to display water threats in relation to: surface water contamination sensor locations; sensor outputs; the location of dams, reservoirs, and locks; the location of surface water bodies; all public drinking water intakes; roads and other terrestrial transportation networks; topography; and population
- Provide secure web-based access to local incident commanders, and to a centralized, regional or national command center.
- Provide the capability of tracking human pathogens, toxic chemicals, and radioactive substances that pose significant threat to public safety in case they were used to attack water sources.

ICWater's core component, RiverSpill, is a GIS-based system used to track and model the flow and concentration of contaminants in source water supplies. With RiverSpill, personnel can calculate, locate, and map the population that could be at risk from the contamination of a public water supply, by providing data through a variety of modules. In addition, the model calculates the travel time of a contaminant based upon stream flow, decay, and dispersion of the constituent introduced in surface waters.

The technical approach to develop an operational incident command system (as shown in Figure 1) is:

(1) Integrate existing components to interact seamlessly,
(2) Upgrade the supporting data bases to give the tool national coverage at the appropriate level of detail,
(3) Enable the tool to run on the web, and
(4) Maintain the tool ready to be available quickly in an emergency and for training.

As shown in figure 1, ICWater will integrate real-time flow data from USGS gages as well as contaminant detections from field sensors and reports with geographic information (NHD, GIS layers) and the RiverSpill model to provide up-to-date maps, reports and tables that enable emergency response personnel to make timely decisions about people at risk and what actions will most effectively reduce that risk. ICWater is based on three-tier system architecture. Each tier is described below:

- Tier 1: End user machine with an Internet browser, such as Netscape or Internet Explorer. The graphical user interface will allow the user to execute all ICWater functions as well as export maps, tables and reports to CATS, HAZUS, the EPA Emergency Response Analyzer and CoBRA.
- Tier 2: Web and Map Server, which houses the ICWater business logic including the RiverSpill model and the Internet Map Server
- Tier 3: Database Server, which houses the National Hydrography Dataset, and GIS layers

The system will also access external data from the USGS real-time stream gauging stations and contaminant detections from field sensors and reports

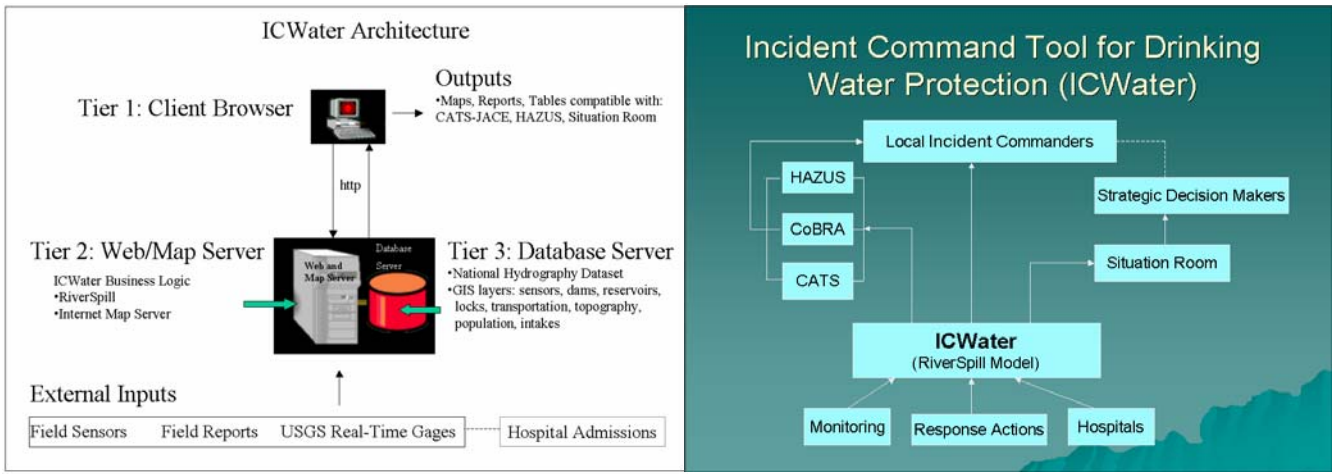

Figure 1. ICWater system architecture.

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