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Environmental Updates

Highlights of Battelle's International Environmental Leadership

Spring/Summer 2005



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Developing a National Program to Protect Our Nation's Water Systems

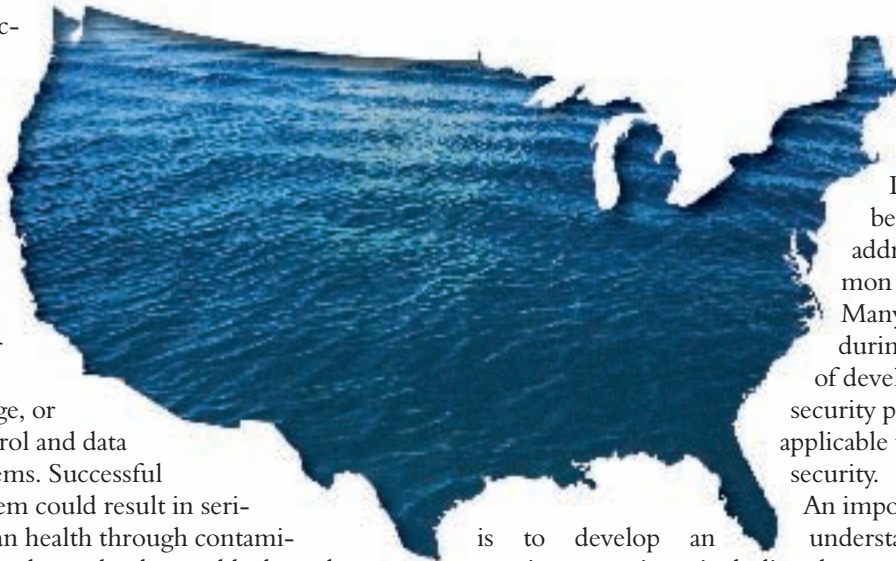
Threats to our water sector pose one of the more formidable risks to the safety and security of our Nation. Critical components of our water sector infrastructure are unprotected and thus represent attractive targets for attacks that could include chemical, biological and/or radiological (CBR) contamination, physical damage, or threats to supervisory control and data acquisition (SCADA) systems. Successful attacks against a water system could result in serious consequences to human health through contamination of drinking water. Such attacks also could adversely impact critical community capabilities including firefighting, healthcare, and wastewater conveyance or treatment capability.

The U.S. Environmental Protection Agency (EPA) has been given the important mission of protecting all critical infrastructures across the water sector. Much has already been accomplished, following directions established in the Agency's Strategic Plan for Homeland Security. As research programs called for in the *Water Security Research and Technical Support Action Plan* come to fruition, EPA's water security program likely will move in new directions as well. Immediate pressing programmatic challenges for EPA include:

- Refining a strategic plan that leads to an effective culture of security in the water sector and measurable security improvements
- Selecting an appropriate mix of voluntary and regulatory program measures and standards to motivate water utilities and publicly owned treatment works to improve security
- Developing technically sound recommendations for water sector monitoring, operations, and response.

In many ways, EPA is encountering a similar situation to that faced by the U.S. Department of Energy (DOE) several years ago. Battelle's experience in supporting DOE in developing its national security program for the nuclear weapons complex provides key insight to what may lie ahead for the water sector security program.

During the initial development of the DOE program, the critical importance of institutionalizing oversight in the development and implementation of the security program became quite evident. This allowed one organization to have the responsibility, authority, and resources to lead the program and institute the changes needed to ensure success. The adoption of a standardized



vulnerability assessment process ensured that all facilities approached security risk from the same perspective. This allowed DOE to make comparisons between facilities in order to address issues related to common strengths and weaknesses. Many lessons were learned during the evolutionary process of developing a comprehensive security program for DOE that are applicable to EPA's efforts in water security.

An important part of the process is to develop an understanding of the assets that require protection - including the consequences associated with the loss or compromise of those assets. The relative focus of asset protection efforts must be in proportion to the consequence of loss. By developing a design-basis threat and tailoring that threat accordingly to various facilities, one can determine the level of effort needed to overcome the postulated threats to various assets. Using a graded approach in the design of the security programs at the different facilities will help to ensure a cost-effective approach for developing a comprehensive overall security program.

Physical security design criteria and program elements need to be standardized and tailored to meet the needs of the different levels of security required for the types of facilities within the water sector. This ensures that resources are assigned on a priority basis (according to where the need is greatest). Performance testing should be conducted, where appropriate, to ensure that security programs have been designed and implemented effectively. The assumptions upon which the security programs are based should be regularly revisited in order to provide continuous improvement and risk reduction. Finally, by making every employee an integral part of the security program, a sense of ownership is achieved, which is necessary to ensure long-term success.

In summary, Battelle's experience with DOE has taught us that a successful security program is fully integrated into the design, maintenance, and operation of each and every facility. Through a graded process of continuous reassessment and incremental improvement, security, like any other quality assurance goal, is attainable by even the smallest water utility. Battelle has a long and distinguished history of supporting homeland security, many years before the events of September 11, 2001. We have included in this issue of *Environmental Updates* some examples of our relevant technical expertise and experience that contribute to the security of our Nation's water systems.

Laboratory Coordination and Data Quality: Integrating Key Issues for Responding to a *Water Security Breach*

“Ricin Scare Shuts Down Senate Buildings” appeared as the news headline on Tuesday, February 3, 2004. Hundreds of office workers were evacuated from the Dirksen Senate Office building in Washington, DC; building ventilation systems were closed and tours of the Capitol ceased that day. The threat of terrorist activities is real; preparedness is crucial to surviving such events.

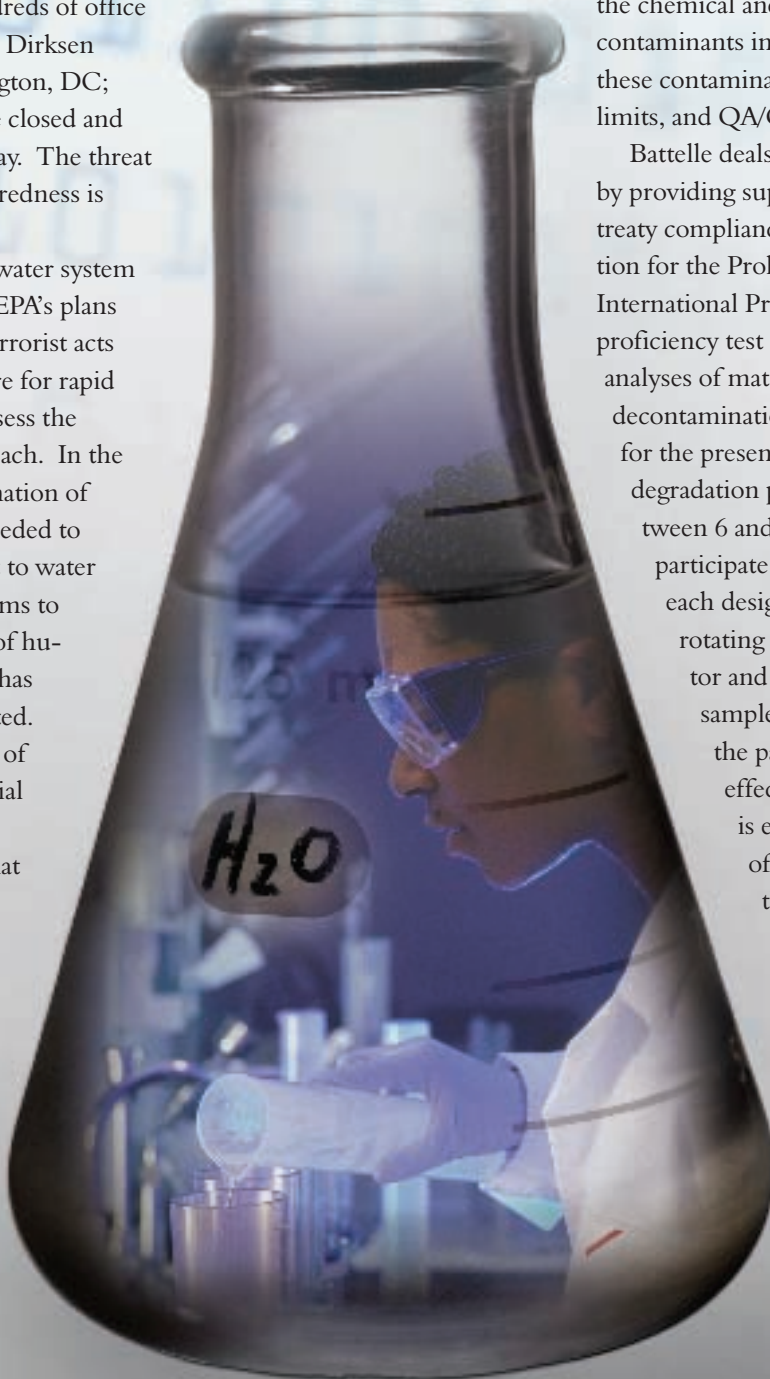
Our nation’s public drinking water system is a key potential terrorist target. EPA’s plans for counteracting water system terrorist acts include building the infrastructure for rapid coordination of laboratories to assess the nature and scope of a security breach. In the event of a terrorist attack, coordination of specialized laboratories will be needed to characterize the immediate threat to water safety, and to monitor water systems to determine, from the perspective of human health risk, when the threat has been contained and then eliminated. Integrity, consistency, and quality of data across laboratories are essential to ensuring accurate information and minimizing uncertainty so that public confidence with respect to safety is maintained during such an event.

Laboratory response must be led by specialists who have intimate knowledge of multi-laboratory coordination issues with particular expertise in implementing rigorous quality assurance and quality control (QA/QC) procedures. From sample collection protocols, to

analysis and interpretation approaches, these specialists must have a firm understanding of the chemical and biological properties of toxic contaminants involved, analysis methods for these contaminants, interferences, detection limits, and QA/QC sample design.

Battelle deals with these issues routinely by providing support to the U.S.-designated treaty compliance laboratory for the Organization for the Prohibition of Chemical Weapons International Proficiency Testing program. The proficiency test consists of rapid turn-around analyses of matrices such as water, sediment, decontamination solutions, and paint chips for the presence of chemical warfare agents, degradation products, and precursors. Between 6 and 25 international laboratories participate in the semi-annual test, and each designated laboratory serves on a rotating basis as either the coordinator and preparer of the proficiency samples, participant, or evaluator of the participants’ reports. To serve effectively in a coordination role, it is essential to have played the role of the participating laboratory so that the nuances of the methods and the QA/QC data are fully understood.

For more information on these programs, contact Dr. Bruce Alleman at (614) 424-5715, allemanb@battelle.org, or Dr. James Peterson at (410) 306-8632, peterstonj@battelle.org.



Drinking Water Vulnerability Assessments

Since the 2001 terrorist attacks, the United States has spent a considerable amount of time and resources examining the safety and security of assets associated with critical infrastructure systems across the country. Threats to potable water systems have been determined to pose a credible risk to the safety and security of the nation. Such attacks could result in very serious consequences to public health and the ability of certain critical components of society such as fire departments, hospitals, and military facilities to carry out their missions. As a result, the 2002 Bioterrorism Act amended the Safe Drinking Water Act (SDWA) to require all community public water systems serving 3,300 people or more to prepare vulnerability assessments (VAs) and emergency response plans (ERPs).

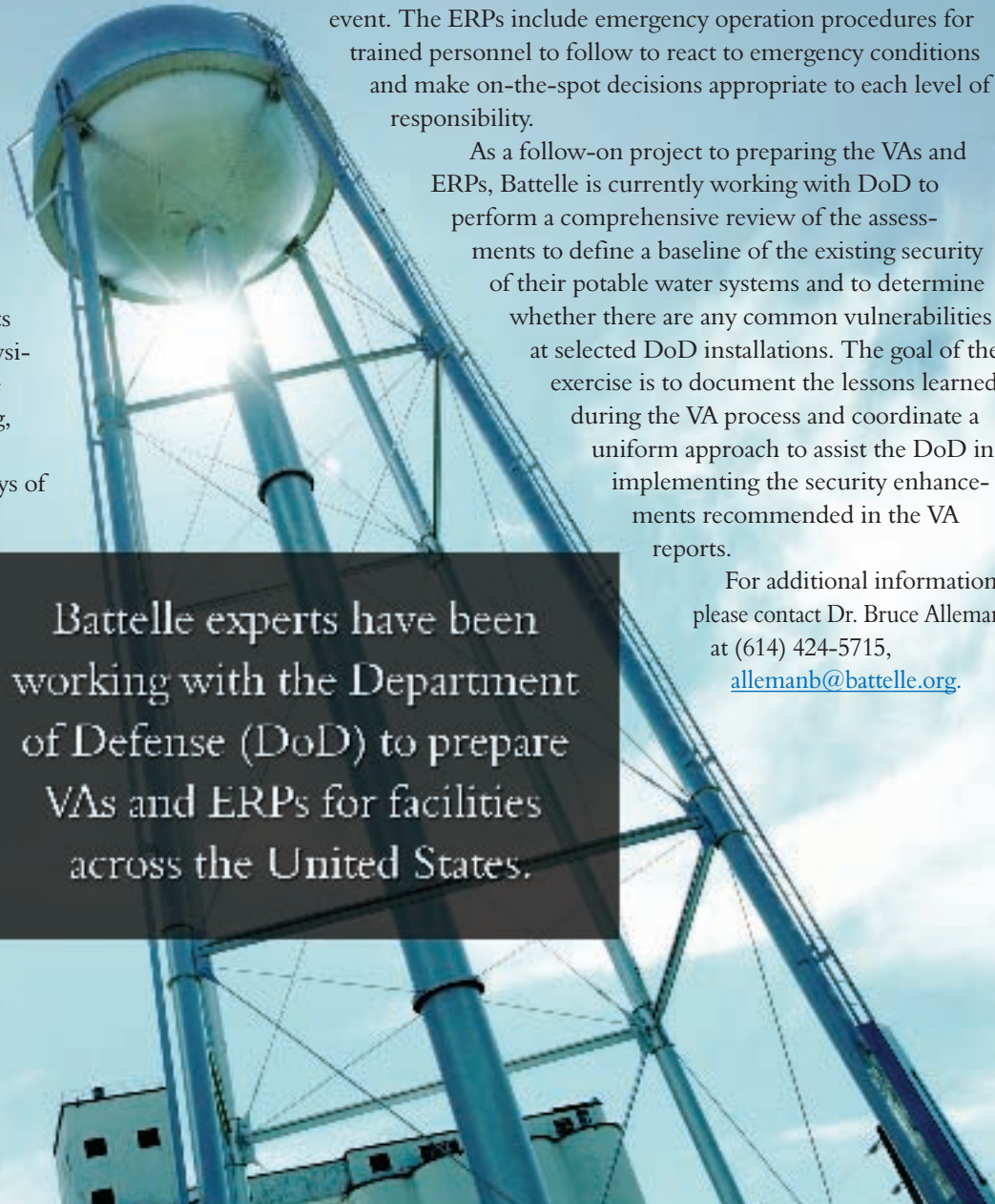
The VAs provide facility management personnel with a tool for understanding the risk of operations and pinpointing areas where security improvements might reasonably be expected to reduce risk. The assessments have focused on the effectiveness of physical barriers, access controls, surveillance and assessment systems, alarms, lighting, mitigation, and recovery capabilities.

Battelle's VA teams conducted surveys of critical installations/assets, reviewed security policy documents and assessments, and interviewed facility staff to obtain a thorough understanding of protection systems, security philosophy, threats, and

protection strategy. VA reports were then prepared according to a systematic approach where a detailed description of each drinking water system was followed by a prioritization of the critical facilities, a threat assessment, a consequence assessment, a thorough analysis of the existing physical protection system, and short- and long-term recommendations for protection enhancements to the system. The subsequent ERPs, which are based on EPA and military guidance documents, are designed to guide emergency response personnel through a series of steps to ensure public safety, minimize damages to the infrastructure, and regain control of the water system following any potable water emergency event. The ERPs include emergency operation procedures for trained personnel to follow to react to emergency conditions and make on-the-spot decisions appropriate to each level of responsibility.

As a follow-on project to preparing the VAs and ERPs, Battelle is currently working with DoD to perform a comprehensive review of the assessments to define a baseline of the existing security of their potable water systems and to determine whether there are any common vulnerabilities at selected DoD installations. The goal of the exercise is to document the lessons learned during the VA process and coordinate a uniform approach to assist the DoD in implementing the security enhancements recommended in the VA reports.

For additional information, please contact Dr. Bruce Alleman at (614) 424-5715, allemanb@battelle.org.



Battelle experts have been working with the Department of Defense (DoD) to prepare VAs and ERPs for facilities across the United States.

Water Security Testing and Evaluation

After September 11, 2001, various legislative and presidential directives enacted to protect drinking water consumers from chemical and biological attacks have required water utility companies to assess their vulnerability to terrorist attack, implement preventative measures, and develop emergency response plans to counteract terrorist acts. As a result, throughout the United States, water utility companies are considering how a terrorist could potentially access their water system and inflict lethal harm. Possible scenarios include attacks at the treatment plant, at large businesses or apartment complexes with localized water reservoirs, or at homes of consumers. Proper preventative measures against each possibility must be considered.

Water utilities and public safety groups (e.g., HAZMAT first responders, fire and police departments) need new technologies to help prevent, or at least minimize the impact of a possible terrorist attack. However, prospective technologies must first be identified and evaluated so that utilities and safety groups can make informed decisions regarding investments in the most effective technologies. Along with EPA, Battelle has been at the forefront of providing this sort of detailed information to water utility companies. Since 2002, Battelle has evaluated water security monitoring technologies under EPA's Environmental Technology Verification (ETV) Program. Testing involved the use of actual chemical and biological agents such as anthrax, botulinum toxin, ricin, plague, VX, and soman to ensure that test results reflect realistic terrorist scenarios. These tests are significant because many of these technologies have never been tested in the presence of live agents. Technology categories that have been tested include

portable cyanide analyzers (two rounds), rapid toxicity testing systems, immunoassay test kits for pathogens and biotoxins, rapid polymerase chain reaction (PCR) technologies, and multi-parameter water monitors for distribution systems.

In 2004, EPA took yet another step to address this need with the establishment of the Technology Testing and Evaluation Program (TTEP). As part of the first water security-related work under this contract, Battelle is performing a marketplace survey of commercially available water security technologies in technology areas such as detection and monitoring, distribution system decontamination, drinking water and wastewater treatment and decontamination, and software applications for modeling municipal water distribution systems. The results of this marketplace survey, including the key types of information that end users are interested in, are being compiled into a searchable technology tracking database. Battelle will be assisting EPA in evaluating this information by recommending specific products for immediate testing and evaluation and suggesting research and development projects that investigate general technology categories (rather than specific products) for applicability to the water security field. As part of TTEP, Battelle will support EPA by conducting commercial, off-the-shelf technology testing, designing a water testing pipe loop that can be used with live agents, and studying the application of technologies currently being used for other purposes, to problems associated with water security.

For more information, please contact Dr. Ryan James at (614) 424-7954, jamesr@battelle.org.



Providing Assistance to Our Nation's Marine and Coastal Security Programs

In 2004, the U.S. Ocean Commission published "An Ocean Blueprint for the 21st Century" to which President Bush responded with an "Ocean Action Plan." Both efforts focus on employing the best available scientific data so policymakers and 'on-the-ground' coastal and environmental managers can make informed, thoughtful decisions regarding the future of our coastal and marine ecosystems. This fact, combined with the post-9/11 culture committed to strengthening our nation's homeland security of U.S. ports and coastal infrastructure, and the need to understand potential threats to coastal communities, has resulted in a clear consensus. We are a nation in need of improved coastal and marine science guided by state-of-the-art technologies that require an integrated communication infrastructure and value-added interpretive tools. Emerging Integrated Ocean Observing System (IOOS) partnerships, which are created under the Ocean Blueprint, seek to fulfill this mission via three focus areas: field observation systems, data management methods and software to enable advanced data fusion, and analyses.

Battelle has active programs with dedicated responses to all three focus areas. In response to the marine and coastal security needs, in August 2004, Battelle staff at Pacific Northwest National Laboratory (PNNL) set up a new coastal security program to develop advanced sensors capable of providing early warning of biological, chemical, or nuclear material releases in marine and coastal environments. It is being instituted at PNNL's Marine Research Operations (MRO) in Sequim, Wash. (PNNL is operated for the U.S. Department of Energy by Battelle.) Battelle researchers at MRO will develop advanced sensors and technologies to meet needs of the intelligence, homeland security, defense and global security communities.

As part of its work in field observation systems, Battelle is conducting observing system studies for a government client to

evaluate Autonomous Unmanned Underwater Vehicles (AUV) for the collection and characterization of physical, biological, and chemical data of interest to the client. The studies include determining AUV navigational accuracy versus requirements for different types of sampling operations, integrating commercial off-the-shelf sensors into a payload, and creating preliminary designs of payloads for collecting water or pumping water through filtration systems.

In an effort to provide unparalleled support in this area, Battelle recently acquired Bluefin Robotics Corporation, a world leader in the development of autonomous underwater vehicles. Bluefin develops advanced underwater vehicles for such diverse applications as naval mine warfare and other battlespace missions; offshore oil and gas seafloor surveys, including those for deep-ocean installations; and scientific exploration, ecosystem investigations, and navigational surveys of the oceans.

Working together with Mass Insight Corporation, a public, non-profit policy consulting firm promoting economic development in Massachusetts, Battelle is also helping to develop the governance and agenda for a major new Ocean and Science Technology Initiative. The Initiative brings together a consortium of Massachusetts partners, including research institutions, (i.e., Woods Hole Oceanographic Institute, Navy Undersea Warfare Center), academic institutions (Massachusetts Institute of Technology, and the University of Massachusetts), and leaders in marine technology such as Battelle, Raytheon, and Lockheed Martin-Sippican. The group's immediate focus is to come together as a region to promote a unified approach to the IOOS implementation. Long-term goals include defining/developing a new, shared R&D center as a hub to integrate information from ocean observing systems and to develop IOOS applications.

For more information, contact Ms. Sally Yozell at (781) 952-5331, yozells@battelle.org.

Rapid Risk Assessment Tool Enhances Emergency Response

During emergencies, responders must rapidly assess risks and decide on the best course of action – all within seconds. Researchers at the Battelle-operated Pacific Northwest National Laboratory (PNNL) are blending existing modeling and decision support technology to develop new methods for transitioning science-based threat assessment to protective action recommendations. The rapid risk assessment tool will be both understandable and applicable to the emergency management community and would be a valuable tool during any water security-related incident.

PNNL is combining its FRAMES multi-thematic modeling capability with its EMAdvantage emergency planning and response tools to produce the rapid risk assessment tool. The new tool will provide a real-time, two-way information-sharing link between the science of threat assessment and emergency responders who need the most accurate, immediate information in order to take effective action. In terms of water systems, it can address the often non-contiguous environment of water pathways and processes.

FRAMES is a software platform that provides seamless and transparent communication between components. For the emergency responder applications, FRAMES uses a multi-thematic approach to provide a flexible and holistic understanding of how environmental releases potentially affect humans and the environment. It incorporates models that integrate across scientific disciplines, allowing for tailored solutions to specific activities. Combined with EMAdvantage, FRAMES provides meaningful, risk-based guidance to emergency response and technical managers.

EMAdvantage is an automated decision-support system that expands the operational awareness of emergency response managers during planning, daily operations, and response. During

planning, EMAdvantage helps managers pre-establish protective action recommendations and prepare emergency response plans. During daily operations, EMAdvantage provides information about community conditions and current activities that may affect a site's ability to respond to a potential event. During an incident, EMAdvantage combines incident characterization and protective action recommendations with

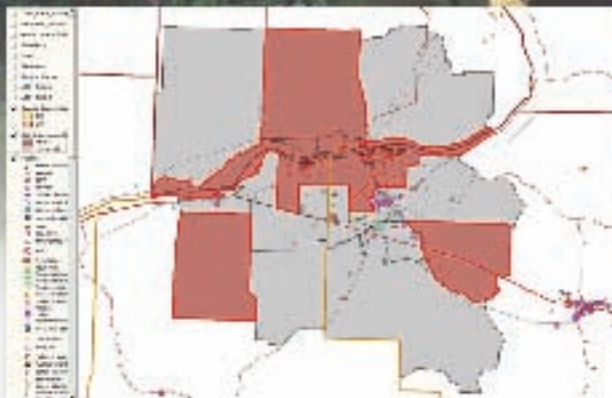
information about community conditions so that managers can select and execute the best response plan.

Because FRAMES supports multi-thematic modeling, it provides recommendations that are more holistic, identifying potential zones or facilities that are usually not

considered. This feature is useful in a water-related emergency where water processes and pathways are non-contiguous. EMAdvantage uses FRAMES' recommendations to help select and execute "best-fit" responses to meet the active guidance recommendations. Through map displays, status boards, checklists, and other user-oriented displays, EMAdvantage increases situational awareness for responders.

The rapid response analysis tool will provide a new and innovative prediction capability for emergency responders. It links command and control decision, action plan, and consequence characterization to state-of-the-art models for fate, transport, and effects assessment. The rapid nature of this approach and the availability of the feedback provide greater accountability for decisions made in the field – something emergency managers are constantly driving to achieve.

For further information, contact Dr. Gene Whelan at (509) 372-6098, gene.whelan@pnl.gov or Ms. Gariann Gelston at (509) 372-4480, gariann.gelston@pnl.gov.



The rapid risk assessment tool will help responders quickly view non-contiguous regions impacted by water process and pathways, which are often based on economic and community needs and rights rather than natural environmental patterns.

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