EPA SCIENCE MATTERS

Volume 1 | Number 8 | September 2011

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EPA's homeland security program is rooted in the traditional functions that decades of legislation have assigned to EPA. Among those are: response to oil and hazardous materials releases, spill prevention and control, waste management, air quality protection, drinking water and wastewater regulation, pesticide management, radiation protection, and of course, research and development to address the questions that we need to answer in order to better protect human health and the environment. Following the attacks of 9/11 and the subsequent anthrax incidents in 2001, these functions took on new importance and urgency as the Agency confronted a unique suite of threats and hazards.

EPA's roles and responsibilities in homeland security are complex and inter-connected. Today's efforts are shaped by the need to respond to multiple incidents with the potential for substantial environmental and public health impacts—whether they are acts of terrorism, large-scale accidents, or natural disasters. In order to prepare, researchers must understand the nature of these hazards and threats, and must devise, adapt and re-tool approaches, methods and technologies in order to characterize the extent and impacts of a different set of chemical, biological or radiological contaminants; ones that EPA has traditionally not had to deal with.

EPA's risk assessments must be based on relevant assumptions about civilian populations at risk, as well as the virulence or toxicity, nature, and length of exposure to these contaminants. Historically, EPA risk assessments dealt mostly with long-term exposures to low-level environmental pollutants.

In 2001, EPA was presented with a different set of analytical issues. Before the *Amerithrax* incident (when letters laced with anthrax spores began appearing in the mail in the worst biological attack in U.S. history), anthrax had been thought of as a military bio-weapon. Defense Department researchers based their assessments of anthrax exposures on a young and healthy military population. EPA and other health protection partners realized that in the event of a widespread anthrax attack, part of their responsibility would be to assure that all vulnerable segments of the U.S. population, including children, elderly, and immuno-compromised individuals were considered. If, for example, the residents of a contaminated area want to know whether it is safe for them to return home to retrieve their personal belongings before the area has been completely decontaminated, EPA needs to assess whether exposures to chemical, biological or radiological contaminants over a short-term period might be harmful.

Given the economic imperative to restore the use of water supplies, buildings, transportation, and public areas, as rapidly as possible, new approaches and tests were needed to find effective ways for them to be safely decontaminated. Once clean-up has been completed and facilities have been returned to their intended use, contaminated debris and waste must be safely disposed of and managed.

In addition to its role in emergency response, EPA plays an important role in the protection of drinking water and wastewater systems. The Agency's historical role in protecting drinking water led to EPA's designation as the federal lead for water infrastructure protection under the National Infrastructure Protection Plan. The Agency also received mandates under several statutes and Presidential directives over the years. For example, under the Bioterrorism Act of 2002, EPA's Office of Water works with utilities to implement prevention strategies and to prepare for potential attacks on both drinking water and wastewater systems.

Beginning in 2002, EPA's Homeland Security Research Program worked with the President's Office of Science and Technology Policy, other federal agencies and external stakeholders to advance the science of: detecting chemical, biological and radiological contaminants; characterizing the extent and nature of contamination; and assessing the risks to all Americans and the nation's water infrastructure. The program has tested and evaluated the effectiveness of early warning systems and decontamination technologies, developed tools to guide waste disposal decision making, and has helped to develop interim guidance for emergency response and recovery actions. Much has been accomplished over the past ten years, yet more work is needed in researching the remaining unknowns.

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> ***"EPA has a vital role in homeland security. The Agency has been called upon to respond to five major disasters and nationally significant incidents in the past seven years. In the coming years, EPA's homeland security roles and responsibilities will continue to be of the utmost importance as the Agency enhances its preparedness."***
> **~ Administrator Lisa P. Jackson, May 12, 2009**

In This Issue...

Advancing National Security Through Science

Executive message from Jonathan G. Herrmann, P.E., BCEE
Director, National Homeland Security Research Center, EPA Office of Research and Development

It has been ten years since the tragic events of September 11, 2001. When the World Trade Center collapsed, Flight 93 crashed, and the Pentagon was attacked, thousands of people were lost and the entire nation was shaken to its core. Later in 2001, an act of bioterrorism – the *Amerithrax* (or, *anthrax*) incident – killed five people, contaminated at least 17 buildings with anthrax spores, and required an immense characterization and cleanup effort by EPA and others.

Short term, we were faced with a set of unprecedented tragedies that required the U.S. Government— at all levels— to do what was necessary to respond and recover. Today, we are still actively engaged in important work to protect the American people and prevent the same kind of devastation from occurring again.

In 2001, EPA employees were deeply involved in responding to both the 9/11 and anthrax incidents. Today, they remain dedicated to meeting the Agency's homeland security responsibilities. While no chemical, biological or radiological-based terrorism has succeeded in the United States since 2001, EPA exercises continued vigilance and plays a critical role in ensuring the United States remain as prepared as possible to protect our homeland from the threat of terrorism.

Following the 2001 anthrax incident, there were significant scientific gaps related to sampling, decontaminating, and setting cleanup levels for anthrax and other chemical, biological, and radiological agents. To fill these scientific and technical gaps, the EPA's Homeland Security Research Program (HSRP) was created.

HSRP is based in EPA's Office of Research and Development. It is built upon systems-based approaches—involving aspects from preparation through recovery efforts—to address chemical, biological, and radiological threats and attacks. Its work is directly linked to EPA's legislated responsibilities and is interwoven with Agency priorities.

Directed by laws, Presidential Directives, the *National Response Framework*, and consistent with President Obama's 2010 *National Security Strategy*, EPA researchers provide guidance, tools and technical support to communities to ensure they are both sustainable and resilient. They also help enhance our national capability to prepare for, respond to, and recover from both man-made and natural disasters.

Events like Hurricanes Katrina and Rita (2005), the Deepwater Horizon oil spill (2010), and, more recently, the Fukushima nuclear power plant disaster in Japan (2011) tested our capabilities like never before. Along with Agency peers and colleagues from across the federal government, EPA scientists and researchers stepped up to these extraordinary challenges with their expertise, skills, time, energy, and dedication.

This special edition of *Science Matters* highlights many of the important accomplishments EPA researchers and their partners have made over the past decade in homeland security research. We have made advances in many areas, including: setting Provisional Advisory Levels for recovering from a chemical accident or incident, working with water utilities to protect water systems from attacks and other disasters, and developing innovative tools and technologies for cleaning up indoor and outdoor areas and water infrastructure.

I am proud of EPA's homeland security research efforts and the contributions our team has made in ensuring the nation's security. Our work will continue to address questions about chemical, biological, and radiological contamination; disaster recovery, and response. These efforts strengthen and sustain the nation; they help build resiliency and advance our mission of protecting the American people.

EPA and Homeland Security

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Scientific uncertainties will continue to challenge the EPA's ability to prepare for and respond to major emergency events. Agency scientists and engineers continue to ensure that decision makers and field responders have the best available science and tools to do their jobs. EPA seeks to advance and promote scientific research and technological innovation in order to enhance the Agency's and our federal, state, tribal, and local partners' abilities to protect public health and the environment, as well as strengthen community resilience. EPA will continue to address the knowledge and technology gaps for the threats that face us.

The Administrator's commitment to sound science serves as the basis for Agency decisions. That commitment is the foundation of EPA's homeland security program and is key to strengthening community resiliency.

About the Author: *Deborah Y. Dietrich currently serves as the Environmental Protection Agency Associate Administrator for Homeland Security. In that role, she coordinates homeland security policy across the agency for EPA's planning, prevention, preparedness and emergency response efforts. Ms. Dietrich advises the EPA Administrator and other senior EPA leaders on national security and intelligence issues, and her office serves as EPA's principal liaison to the U.S. intelligence community, the White House, the Department of Homeland Security and other federal agencies for matters of homeland security policy. Prior to this appointment, she was the Director of the Office of Emergency Management in the Office of Solid Waste and Emergency Response. From 1995 until 2002, Ms. Dietrich headed the Office of Resources Management and Administration in EPA's Office of Research and Development.*

Homeland Security Research Program: Directors' Roundtable

Research leaders talk about EPA's role and responsibilities in homeland security.

Science Matters (SM) sat down with program leaders from EPA's Homeland Security Research Program to talk about the Agency's scientific and technical roles and responsibilities supporting national security. Joining the conversation were Jonathan Herrmann, P.E., BCEE, Director, EPA National Homeland Security Research Center (NHSRC); Cynthia Sonich-Mullin, M.En., Deputy Director for Management; Peter Jutro, Ph.D., Deputy Director for Science and Policy; and Gregory Sayles, Ph.D., National Program Director.

SM: Greetings and thanks for joining us. Let's start with Director Jon Herrmann. Jon, can you tell us how EPA got involved in homeland security research?

JONATHAN HERRMANN: Following the attacks on September 11, 2001 and the *Amerithrax* incidents, EPA was asked to help address many challenging questions such as "what are the health impacts of being exposed to anthrax?", "how can we decontaminate and recover the use of the buildings that were attacked?", and "how can we detect harmful levels of chemical, biological or radiological contamination following an incident?" In 2002, the Agency created the National Homeland Security Research Center to address these and other homeland security issues. Since then we've responded to additional incidents involving mustard gas, ricin, and other homeland security threats.

SM: When we hear the words "homeland security" we think of the law enforcement and other government agencies such as the Department of Homeland Security, not EPA. What's EPA's research role in this area?

JONATHAN HERRMANN: Our primary responsibilities are to research ways to protect water infrastructure and to decontaminate buildings and public areas. This includes determining whether an attack has happened, characterizing the extent of its impacts, controlling contamination, assessing and communicating risks, getting useful information to first responders and safely disposing of clean-up materials.

Pictured, left to right: Peter Jutro, Cynthia Sonich-Mullin, Gregory Sayles, Jonathan Herrmann.

While we're not on the front lines like those agencies or EPA's own first responders, we do have a critical role to play. EPA's National Homeland Security Research Program conducts research covering chemical, biological and radiological contamination under laws such as the Safe Drinking Water Act, the 2002 Bioterrorism Act, Superfund Amendments and Reauthorization Act, and several Presidential Directives.

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Homeland Security Research Program: Directors' Roundtable

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SM: Can you describe some of the research?

JONATHAN HERRMANN: Our research covers a broad spectrum of activities along the risk assessment/risk management paradigm. Our researchers are involved in testing and evaluating contaminant detection, monitoring, threat assessment and treatment or decontamination technologies. We develop and evaluate computer models and warning systems for protecting drinking water infrastructure such as our award-winning CANARY software, developed to quickly analyze monitoring data and improve the security of drinking water systems. Our threat and consequence assessment team develops detection methods and conducts research on the risks associated with exposure to threat agents to inform decision-making.

Our decontamination and consequences management team have developed decision making tools to help incident managers find the best ways to manage the waste from decontaminating a building or public area.

SM: In last year's series, "Top Secret America," the *Washington Post* claimed that more than 1200 government organizations worked on counterterrorism, homeland security, and intelligence. Does EPA partner with other agencies and departments to accomplish its mission?

PETER JUTRO: Yes, absolutely. Many departments and agencies do have related responsibilities, but we realize that we can each be more effective and efficient if we cooperate. We participate in dozens of inter-agency, domestic and international committees, working groups and task forces where our expertise and the results of our research are used and significantly contribute to planning for emergency response, clean-up and risk communication following a chemical, biological or radiological incident. We also undertake research jointly with other government entities.

SM: Can you give some examples?

PETER JUTRO: Sure. We recently co-authored—together with the White House Office of Science and Technology Policy, the Department of Homeland Security and eight other departments and agencies—guidance for planning recovery following biological incidents. For many years now, we have worked with the State Department to have some of EPA's homeland security research conducted under our guidance in labs in the former Soviet Union. We also work closely with well protected labs on Department of Defense facilities to help us learn what we need to know in order to be ready to deal with dangerous pathogens. The Bio-response Operational Testing and Evaluation project [see page 8] is an example of direct research collaboration.

GREGORY SAYLES: Through our Tri-Agency Agreement with the Department of Defense (DOD) and Department of Homeland Security (DHS), we collaboratively plan and carry out research to fill knowledge and information gaps. This helps us build capacity in the nation's laboratories to respond to future incidents.

SM: Can you tell us where you do your research and what types of scientists are involved?

CYNTHIA SONICH-MULLIN: Our staff of nearly 60 personnel work in Cincinnati, Ohio, Research Triangle Park, North Carolina, Washington, D.C., and Las Vegas, Nevada. We are a strong multidisciplinary team that includes experts in the areas of chemistry, microbiology, health physics, engineering, toxicology, public health, environmental science, mathematics, risk assessment, quality assurance and quality control, and the social sciences. I attribute our success to the diverse nature of our scientific and technical staff in bringing different disciplines and perspectives to help us reach our goals and conduct our research. Each project is developed by an interdisciplinary team of experts that includes input from stakeholders and partners.

SM: Sounds like you have a lot of problems to tackle and many different types of scientists and engineers involved. How do you set priorities?

PETER JUTRO: We strategically target our research based on risk. Risk is determined by evaluating which agents are inherently the most dangerous and present the greatest problems in decontamination. This is then influenced by information we receive from the law enforcement and intelligence communities regarding adversarial intent and capability.

Not all of our work deals with terrorism; we also provide scientific assistance in recovering from natural disasters and accidents. We continually adjust our planning based on close consultation with our EPA program, regional, and state partners, federal collaborators, and other public and private sector customers to target those problems and opportunities where EPA research can make a contribution and/or fill an information gap.

SM: Are the risks associated with a homeland security incident different or worse than those associated with air and water pollution?

CYNTHIA SONICH-MULLIN: They are different in terms of the exposure duration and the amount of data available on the contaminants of concern. EPA has traditionally assessed the human health and environmental risks associated with long-term exposures to low levels of pollutants. The risks associated with a homeland security incident include not only risks of long-term exposures but also risks of being exposed to high concentrations of a chemical or biological agent for a short time. We

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Homeland Security Research Program: Directors' Roundtable

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are developing methods to assess risks based on available information to inform responders, residents or workers who are involved in the recovery and clean-up process.

SM: EPA's research office is focusing on sustainability. Can you explain the relationship between your work on homeland security threats and sustainability?

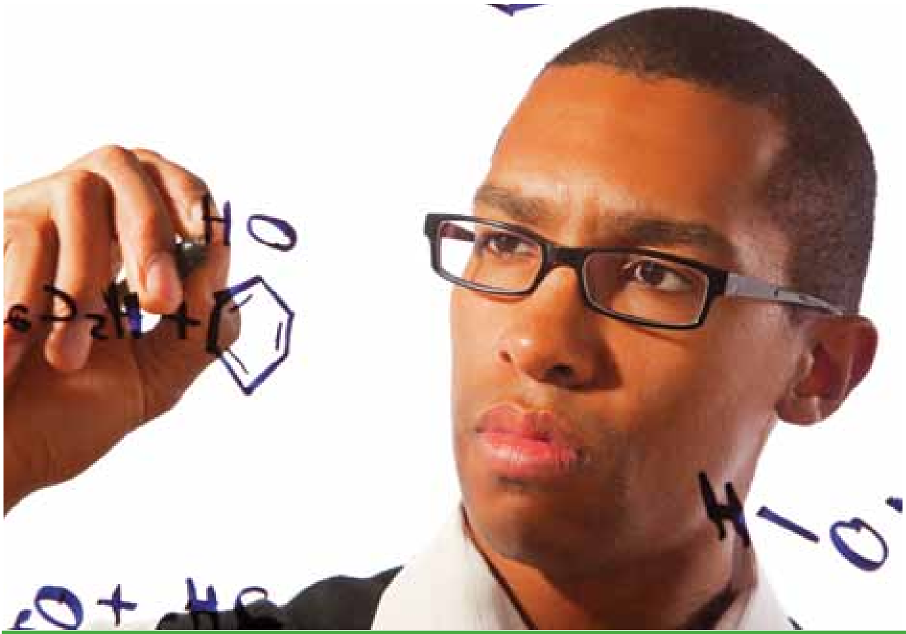
GREGORY SAYLES: An essential component of sustainability is the capability of communities to effectively bounce back from disasters such as natural catastrophes and terrorist attacks. This component of sustainability is often called, "community resilience."

EPA plays a crucial role in helping communities build resilience by providing guidance, tools, and technical support that will assist these communities in preparing for, responding to, and recovering from environmental disasters. Our research products fill critical science gaps thereby enabling the Agency to provide sound, technical information to communities of many sizes.

SM: Sounds like the EPA homeland security research has been really busy over the past few years. What are some emerging areas you see your research supporting?

JONATHAN HERRMANN: There are a few issues that immediately come to mind that are likely to influence our future strategic directions. These include:

- Provisions in the recently enacted *Food Safety Modernization Act* (2010), give EPA primary responsibility to "provide support for, and technical assistance to, state, local, and tribal governments in preparing for, assessing, decontaminating, and recovering from an agriculture or food emergency." Implementing these responsibilities will likely rely on research and technical support on disposing of food supplies that become contaminated with harmful pathogens, as just one example.
- The recent emergence of classes of chemical warfare agents not yet addressed by EPA is another issue. In addressing these agents, our scientists and engineers plan to work closely with our collaborators from DOD and DHS. This is an issue that we hope to work on as part of the Tri-Agency Agreement that Greg described.
- Increased attention to managing nuclear contamination in light of the Fukushima nuclear power plant disaster is a third issue that immediately comes to mind. EPA has an ongoing research project in the area of decontamination after the detonation of a radiological dispersion device—more commonly refered to as a "dirty bomb." We are particularly interested in how Japan is dealing with radioactive waste disposal. Ultimately, disposal of any biological, chemical, or radiological contaminated materials is an issue that needs attention.



S/M: I sense from this discussion that thanks to EPA science, the nation is more prepared than it was a decade ago.

PETER JUTRO: Yes we are, and I think we have become more realistic about threats as well. We now realize that the efforts of others can reduce the probability that something bad will happen, but our job is to be sure that if something does happen, we are as prepared to bounce back and move on. As someone who was involved in designing EPA's National Homeland Security Research Center following 9/11, I'm very proud of all that our scientists and engineers have accomplished since then. I know that our research program will continue to find new and innovative approaches and solutions to the challenges presented by both man-made and natural hazards. We will continue our efforts to pursue EPA's core mission to protect public health and the environment as well as strengthen communities' resiliency.

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Post *Amerithrax*: Advancing the Science and Engineering of Decontamination

EPA scientists are developing and evaluating decontamination technologies to inactivate lethal bacteria such as anthrax.

In 2001, while the nation was still stunned by the terrorist attacks of 9/11, a handful of anthrax-tainted letters were mailed to two U.S. Senators and several news media offices. While the letters never reached the Senators or the celebrity newscasters, 22 people who came into contact with the letters, primarily mail handlers were infected. Five of them died. At least 17 buildings were confirmed to have been contaminated with anthrax spores.

In addition to the human costs of these bio-terrorist attacks ("*Amerithrax*"), extensive clean-up efforts were needed to decontaminate affected offices and mailrooms. Because anthrax spores can persist for decades, finding effective, affordable techniques and protocols for cleaning up buildings contaminated with anthrax spores has become a priority for federal scientists, engineers and security experts. EPA scientists and engineers are helping lead the way.

EPA researchers have focused on finding methods that could be used to decontaminate indoor building surfaces and outdoor materials. Researchers are examining a wide range of issues, including: the efficacy of different decontamination methods (e.g., liquids, fumigants, fogging); agent and decontaminant containment; biological agent persistence; and waste management options. Laboratory and pilot-scale tests on more than 20 liquid and foam decontamination technologies have been conducted.

Dr. Shawn Ryan, Director of the Agency's Decontamination and Consequence Management Division, stresses that, "... full-scale field data, in addition to laboratory tests, are needed to determine which anthrax decontamination technologies work best under various conditions and with various types of building and outdoor materials. Field studies are then needed to ground-truth what we learned in the lab. Finally, we refine our understanding of how the whole system works."

In a current field-level study, three decontamination technologies are being field tested: hydrogen peroxide fumigation, pH-adjusted bleach, and chlorine dioxide fumigation. The tests Dr. Ryan and his colleagues are conducting are part of the Bio-response Operational Testing and Evaluation (BOTE) partnership program, which is an interagency project involving six federal agencies, including EPA. In addition to BOTE, EPA also has been an active participant in two interagency programs the *Interagency Biological Restoration Demonstration (IBRD)* led by the Department of Homeland Security (DHS) and Department of Defense and the *Wide Area Recovery & Resiliency Program (WARRP)* led by DHS. IBRD focused on how to address a hypothetical anthrax aerosol attack in the Seattle, Washington urban area and WARRP focuses on a similar scenario in Denver, Colorado. These collaborations also involve state and local agencies and numerous international observers.

Dr. Ryan notes that another important issue is learning how to decontaminate and properly dispose of waste materials contaminated with biological agents. EPA, along with DHS and other agencies, are implementing the *National Response Framework*, which guides federal response to domestic incidents. A suite of decision support tools has been developed to facilitate the safe disposal of waste and debris generated during a biological incident, as well as to quickly provide health and safety information critical to protect the public and recovery teams during cleanup.

The *Amerithrax* incidents sparked an increased awareness of the possibility of future bioterrorist attacks. While treating people potentially exposed to anthrax will always be the first order of business after such an event, emergency responders and recovery officials are also working to ensure that it can decontaminate affected buildings and mitigate possible, subsequent exposures. Since 2001, federal scientists, engineers and security experts have been researching methods for detecting, sampling and decontaminating anthrax from buildings and outdoor materials. EPA's Homeland Security Research Program is leading that effort.

Interagency Collaboration Tests Response to Anthrax Contamination

EPA partners with five other agencies and departments to conduct and evaluate various anthrax-decontamination technologies in real-world scenarios.

If millions of lethal and microscopic spores were released in a building, what would we do? How would we clean up such a dangerous mess?

A collaborative effort co-led by EPA's Homeland Security Research Program and the Department of Homeland Security (DHS) aims to uncover the best answer to that question. Through a two-phase research demonstration program called *Bio-response Operational Testing and Evaluation (BOTE)*, the agencies intend to provide information and data to guide decision making regarding biological threats to homeland security such as anthrax.

Up to now, homeland security research has made great advances in systematic decontamination techniques, but mainly this research has taken place on a small scale, in a laboratory. "To increase preparedness, we need to scale-up," explains Shawn Ryan, EPA's BOTE program manager. "We need to take this from the lab and get it into an operational environment and see what we can learn about implementing it in a real event, or as close to a real event as possible. That is the real importance of BOTE."

Phase I of BOTE evaluated three decontamination methods: fumigation with vaporized hydrogen peroxide, fumigation with chlorine dioxide, and a treatment process using a pH-adjusted bleach spraying technique.

Researchers released *Bacillus atropheus* spores (a nonpathanogenic surrogate for anthrax) in a two-floor test facility containing mockups of both commercial and residential rooms. Some rooms were designed to mimic business offices while others were laid out like small apartments, with appropriate materials such as carpet, fabric, and wood being used in each area. The variety of rooms and materials in the test facility allowed researchers to compare the efficacy of the different decontamination treatments under three different conditions.

"Each situation is different, in terms of environmental factors and the materials that are present inside the facility, so one approach may not work in every single case," says Shannon Serre, EPA researcher involved in the BOTE program. "This research allows the decision makers to look at their specific situation and compare it with the results that were obtained from our program."

In addition to comparing the success of each clean-up option, Phase I also examined the cost, damage to the facility, and potential re-contamination risk of each decontamination technique. The effectiveness of treating wastewater from the contamination site was also examined. Researchers are in the process of evaluating data from Phase I. Phase II is scheduled to begin in September, 2011.

Phase II will mirror a potential real-life scenario where government officials will be informed of an anthrax-like contamination of a building. The resulting contamination in the scenario is called a covert release.

"A covert release means we don't know what happened, we just know that there are spores there," explains Serre. "It's up to the FBI to try to figure out what happened…and eventually the building gets turned over to EPA to clean it up." This exercise will test the response of health officials, law enforcement officials, and environmental response teams to a biological incident.

Both phases of the project exemplify interagency cooperation. In addition to EPA and DHS, the BOTE project promotes partnerships among the Defense Threat Reduction Agency, the Centers for Disease Control and Prevention, the Federal Bureau of Investigation, and the Department of Energy. This interagency effort ensures that research results are widely shared throughout the homeland security community. It also leverages resources and expertise.

Participants say BOTE benefits from this extensive cooperation—intra-agency as well as interagency. "On the EPA side, it is great to have the researchers working with the operational staff in the field," reflects Ryan. "All sides have learned a lot about this very important homeland security subject."

From Disaster to Recovery: Waste Management Planning and Response

EPA scientists develop innovative tools to assist decision-makers manage wastes from natural and man-made disasters.

Stories of disaster and destruction regularly make headlines—tornadoes, terrorist attacks, oil spills, wild fires, nuclear accidents, and hurricanes. Most of us focus on the high-profile rescue efforts during and immediately following these crises. We seldom consider the longer-term cleanup efforts that follow—particularly managing waste and debris—which is a critical step toward preventing the spread of contamination and disease, protecting human health and the environment, and restoring the buildings and places affected by disasters.

That is where a new set of decision support and waste management tools developed by EPA researchers comes into play.

According to Dr. Shawn Ryan, Director of EPA's Decontamination and Consequence Management Division (DCMD), early waste disposal decisions can affect the safety and efficacy of cleanup and recovery following an incident (accidental or deliberate release of a hazardous substance) or disaster. He says that the anthrax attacks in 2001 demonstrated how "waste can drive a situation." For example, the largest cost of decontaminating the buildings targeted with anthrax mailings was waste disposal. As a result, the decontamination strategies used for subsequent anthrax incidents focused on minimizing waste and debris.

Recognizing the importance of waste and debris management in an emergency, EPA researchers developed the *Incident Waste Assessment System and Triage Estimator (I-Waste)* to help cleanup and recovery managers make crucial decisions about handling, transporting, treating, and disposing of waste and debris.

"I-WASTE is a powerful tool that helps emergency responders identify the types and quantities of waste from an incident, a critical first step in responding," says Ed Repa, Ph.D., Director, Environmental Programs, National Solid Wastes Management Association.

The suite of Decision Support Tools is designed to, "... get the best information out so that decisions are made in such a way that human health and the environment are protected. These tools are intended to provide one-stop access to the information and decision processes needed to safely manage waste and debris for a wide range of natural and man-made disasters, animal disease outbreaks, or terrorist attacks," according to Lemieux.

The idea for the tools emerged in 2003 during an EPA workshop attended by representatives from federal and state agencies, the waste management industry, academia, and chemical/biological experts from the U.S. Army. Workshop participants recommended storing information about the most current waste disposal strategies and technologies in a single location so that it could be accessed quickly during an emergency. This led to the creation of the first version of the tools in 2004.

Since that time, the tools have been updated using focus groups, workshops, and reviews with potential users to gather suggestions for additional features as well as ways to make the resource easier to use.

The latest version of I-WASTE supports waste disposal decisions related to:

- contaminated buildings;
- contaminated water and wastewater systems;
- the dispersal of radiation;
- natural disasters, and,
- agricultural events such as an outbreak of bird influenza.

The tools provide access to a wide range of information such as regulatory contacts at the local, state and federal levels; the amount and type of waste to expect in specific situations; contacts for handling, transporting, treating and disposing of waste and debris; and lessons learned from previous events. Some unique features of the tool include a waste materials estimator, links to treatment and disposal facility databases, and a template that allows users to create incident planning and response records.

The I-WASTE tools have been used for planning and developing response plans for airports in cases of chemical or biological attacks, and for cities in the event of a detonation of a radiological dispersal device. They were also used in response to recent wildfires in the San Diego, California area and during Hurricane Katrina. Even though these tools were used during these high-profile events, Lemieux believes that few potential users are aware of I-WASTE's availability. "We're trying to increase its visibility, along with the number of users," says Lemieux. "In the future, we would like to see I-WASTE used more widely so that waste management issues don't drag down the whole response and recovery process…that would be a major success."

EPA recently released the latest version (6.1) of I-WASTE. Comments from an external peer review conducted last month will be incorporated in finalizing this version of the tool later this fall. Managing wastes safely and efficiently is a critical element of responding to an incident and helping restore communities.

For access to the tool, please visit: http://www2.ergweb.com/bdrtool/login.asp.

Standing By: EPA Helps Nation's Laboratories Prepare for Emergency Response Operations

EPA researchers enhance nation's capabilities to analyze large numbers of samples.

Fast, accurate laboratory analysis can be critical. Determining the type and extent of contamination in the aftermath of a terrorist incident is essential for informing emergency response, recovery and remediation operations.

Ten years ago, such rapid analysis might not have been possible. In reviewing the responses following the terrorist and anthrax attacks in 2001, homeland security experts identified several areas where the nation could be better prepared by improving laboratories' ability to handle large quantities of environmental samples needing analysis following the intentional release of hazardous chemical, biological, and/or radiological substances.

A major step in that effort has been establishing the Environmental Response Laboratory Network (ERLN). The ERLN is a nationwide network of analytical laboratories that can quickly support large-scale responses, providing increased capacity, consistent analytical capability, and reliability in producing quality environmental data. The network integrates public sector laboratories' capabilities with accredited private sector laboratories to support responses for remediating contaminated indoor and outdoor areas and water infrastructure. The ERLN is coordinated by EPA's Office of Solid Waste and Emergency Response. The Water Laboratory Alliance --part of the ERLN--is led by EPA's Office of Water.

In support of the ERLN, EPA's homeland security researchers developed and compiled a compendium of methods to analyze environmental samples for chemical, biological, radiological, and biotoxin contamination http://www.epa.gov/sam/ to meet the needs of the response community and enhance laboratories' ability to handle large numbers of samples.

"SAM provides the response and laboratory communities with methods for analyzing a particular contaminant in a number of matrices (the material being tested such as soil, air, water, building debris, etc.)," says Hiba Ernst, Director of the Threat and Consequence Assessment Division of EPA's Homeland Security Research Program. "There will be increased consistency in measurements across the labs and more critically, labs will be able to look at the available methods in one location and select the best analytical method for a given contaminant and matrix," Ernst explains.

SAM lists the methods and approaches for characterizing and determining the nature and extent of contamination at a site. It also informs remediation and recovery decision-making.

SAM provides an on-line tool that laboratories can use to identify analytical methods for measuring chemical, biological and radiological analytes in environmental samples. The SAM web site provides a "methods query tool" that enables analysts to select a target contaminant, as well as the matrix of interest. Laboratory analysts can tailor methods to their own analytical and instrument capabilities. SAM also includes companion documents, sample analytical protocols, and sample collection procedures.

EPA, Centers for Disease Control and Prevention, Food and Drug Administration, Department of Agriculture, Department of Energy, Department of Defense, Geological Survey, state agencies, academia, and regional laboratories collaboratively evaluate and select the methods published in SAM. This partnership ensures that all available methods for each contaminant/matrix will be thoroughly evaluated and included. The result is a list of pre-selected, pre-evaluated, analytical methods that can be used by all laboratories when analyzing homeland security incident samples.

An earlier version of SAM, previously titled, "Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events" was published with methods for analyzing 82 chemical analytes in four matrices, such as drinking water, lake water, soil, clay, and other sources, and 27 biological analytes in three matrices. "We've come a long way from when we first started," says Ernst. The latest version, SAM 2010 (version 6.0), has 142 chemical analytes in five matrices, 25 radiological analytes in five matrices, and 18 biotoxin analytes in four matrices.

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Rapid Detection Methods Help Speed Recovery from Radiological Contamination

In 2010, EPA published a compendium of analytical methods for rapidly detecting selected radionuclides in drinking and surface water, *Rapid Radiochemical Methods for Selected Radionuclides in Water for Environmental Restoration Following Homeland Security Events*. The methods provide critical information to public and private laboratories called upon to support EPA's response and recovery actions following a radiological or nuclear incident such as a "dirty bomb" explosion.

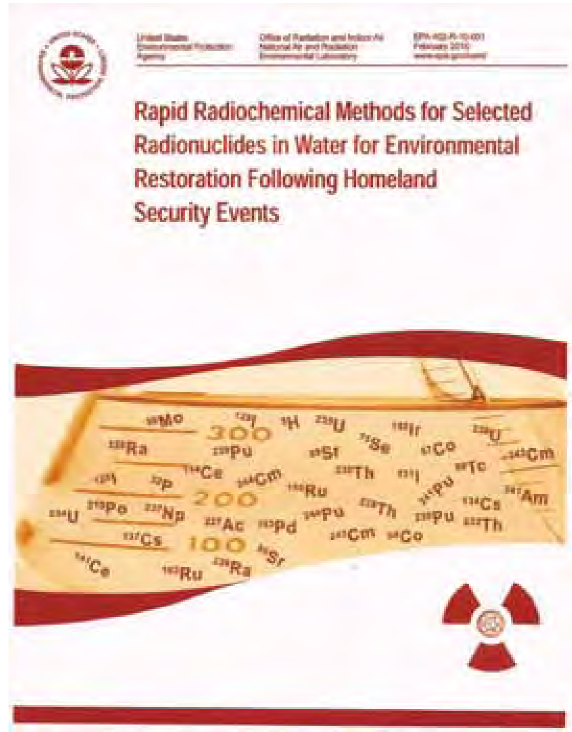
EPA homeland security researchers collaborated with the Agency's Office of Radiation and Indoor Air to develop these methods. They reduce sample processing time from days or weeks to just eight to 38 hours.

Researchers developed analytical methods for radionuclides associated with americium, plutonium, isotropic uranium, radiostrontium and radium. These substances could be used in a radiological dispersion device and are a challenge to detect in the field using handheld instruments.

In addition to expedited analysis, EPA researchers developed the new methods to provide quantitative results that meet measurement quality objectives for analyzing samples during the intermediate and recovery phases of responding to a nuclear or radiological incident.

Using these methods, partner laboratories can now provide results to field personnel more quickly, helping responders and decision makers develop site-specific clean-up strategies. In addition, after clean up has been completed, the new methods provide data that can help in determining when the site can be safely used again.

These new methods will be included in EPA's *Selected Analytical Methods (SAM) for Environmental Remediation and Recovery* in 2012.


Rapid Radiochemical Methods for Selected Radionuclides in Water for Environmental Restoration Following Homeland Security Events

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Enhancing Water Security: EPA Prepares for Intentional Contamination Incidents

EPA scientists make a variety of tools available to drinking water managers to help them keep water safe and secure.

While most people never give a second thought to turning on the faucet, public and private water utility managers remain vigilant to ensure the safety and security of the nation's water supply as it flows from source to sink. That commitment took on renewed urgency after the terrorist attacks of 2001.

Since 1998, EPA's mission has included protecting the nation's water supplies from terrorists who might use chemicals, biological agents, or radioactive materials as poisons. Following the events of September 11, 2001, EPA was also designated the primary federal agency responsible for decontamination in the event of such an attack. Agency scientists have continued piloting and developing new technologies to help water utilities prevent, detect, respond to, and recover from drinking water contamination in the event of such an attack.

A significant advance in protecting drinking water distribution systems has been the development of network based detection systems for use in complex drinking water systems. "One of the challenges is that there are so many contaminants of concern," says Regan Murray, Ph.D., of EPA's Water Infrastructure Protection Division. Typically, a utility monitors water quality by taking periodic samples and analyzing them in a laboratory for regulated contaminants such as lead and copper. Sampling intervals vary from once a day to, in some locations, once a month. Ideally, a utility would install automatic sensors that monitor water quality continuously. EPA is working to make that possible, starting with pilot projects in several cities.

Recognizing that any early warning system would need to cover large systems and be affordable to utilities, EPA focused its research on investigating effective, practical technologies for wide-spread use. Researchers evaluated a variety of commercially available sensors and instruments to identify technologies that could be used to detect changes in baseline water quality. These baseline changes, detected early through real-time monitoring, can alert water utility operators of potential contamination and the need for further sampling and analysis.

EPA researchers reviewed a variety of sensors that measure broad indicators of water quality, such as pH, total chlorine, and total organic carbon (TOC). They discovered that existing technologies could be used to measure total chlorine and total organic content (TOC) as a way of detecting other chemical and biological contaminants from both accidental and deliberate (such as sabotage) events.

"As you would expect, we have operations people - in our control center 24-hours a day, 365 days a year. They can feed data into a computer, and if contamination is detected, an audible alarm will sound," says Greater Cincinnati Water Works Assistant Superintendent, David Hartmann.

EPA's pilot projects are part of the Water Security Initiative, a new effort to bring technological solutions to the challenge of monitoring contamination in major cities such as Cincinnati, Ohio—site of a full-scale, comprehensive pilot in partnership with the City of Cincinnati at the Greater Cincinnati Water Works.

One of the early success stories of the research is CANARY Event Detection Software, a technology that serves as an early warning system for water utilities to quickly distinguish normal variations in water chemistry from a potential contamination event. Developed in partnership with Sandia National Laboratories, CANARY was recognized as one of the top 100 new technologies of 2010 by R&D Magazine. EPA makes the software available free of charge.

Even the least expensive, commercially-available, contaminant sensors are costly, typically costing $5,000 to $10,000. Therefore, to effeciently monitor their distribution systems, utility operators must carefully choose the best locations for placing sensors. To help, EPA researchers also developed the Threat Ensemble Vulnerability Assessment-Sensor Placement Optimization Tool, which offers a user-friendly interface

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EPA Examines Ways to Treat Biotoxins in Drinking Water

Agency researchers advance science to help protect the nation's drinking water.

Interior of drinking water facility

Since 1854, when Dr. Snow first traced a cholera epidemic to a public water supply in London, England health officials and researchers have been working to protect the quality and safety of drinking water. The U.S. Public Health Service set drinking water standards in 1914. Although biotoxins—toxic substances produced by living organisms—have long been a concern for drinking water, the concern that someone would maliciously introduce them into drinking water gained increased attention following attacks in 2001.

"As we continue to implement Safe Drinking Water Act and other homeland security protections, EPA has been identifying and filling data gaps regarding the impacts that biotoxins, such as ricin, SEB (staphylococcal enterotoxin B), botulinum toxin type A, and T-2 mycotoxin, might have on our drinking water," explains EPA research chemist Matthew Magnuson. Those particular biotoxins can cause fatalities or serious illness.

After conducting a literature review to identify data gaps, researchers tested the ability of off-the-shelf devices to detect biotoxin contamination, and investigated the potential of various technologies to treat water if it became contaminated. All of the detection devices tested used antibodies to detect the biotoxins. They were evaluated to see if they could detect biotoxins added in the laboratory to drinking water samples gathered from around the country.

Results of the testing suggest that some level of field testing may be possible; however, all of these devices detect only specific biotoxins and must be properly used in the context of a program to detect and identify water contaminants. While these off-the-shelf devices may be used as part of an initial threat evaluation, as the investigation of a threat or incident

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Enhancing Water Security: EPA Prepares for Intentional Contamination Events

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to guide water managers in optimally placing sensors across their distribution network.

EPA continues to innovate and develop other water security products, but these are "... still in the research stage," says Murray. One example is EPANET-MSX, a software program that water utility managers can use to model the physical and chemical changes a contaminant might undergo as it flows through a system: dilution, reacting with chlorine, or sticking to pipe walls. Understanding these processes helps to identify the best way to decontaminate a system following a contamination incident.

Much as the space program led the development of technologies, like satellite TV, that have broad uses in daily life, EPA's water security research has many benefits that address the everyday needs of water quality managers. The software Agency researchers are developing can be used to plan new infrastructure for expanded water service or respond to a water main break. For example, CANARY "is a useful tool because it doesn't just help detect a contamination incident that could be caused by a terrorist, but can also help detect other water quality problems that might occur during normal operations," Murray says.

EPA Examines Ways to Treat Biotoxins in Drinking Water

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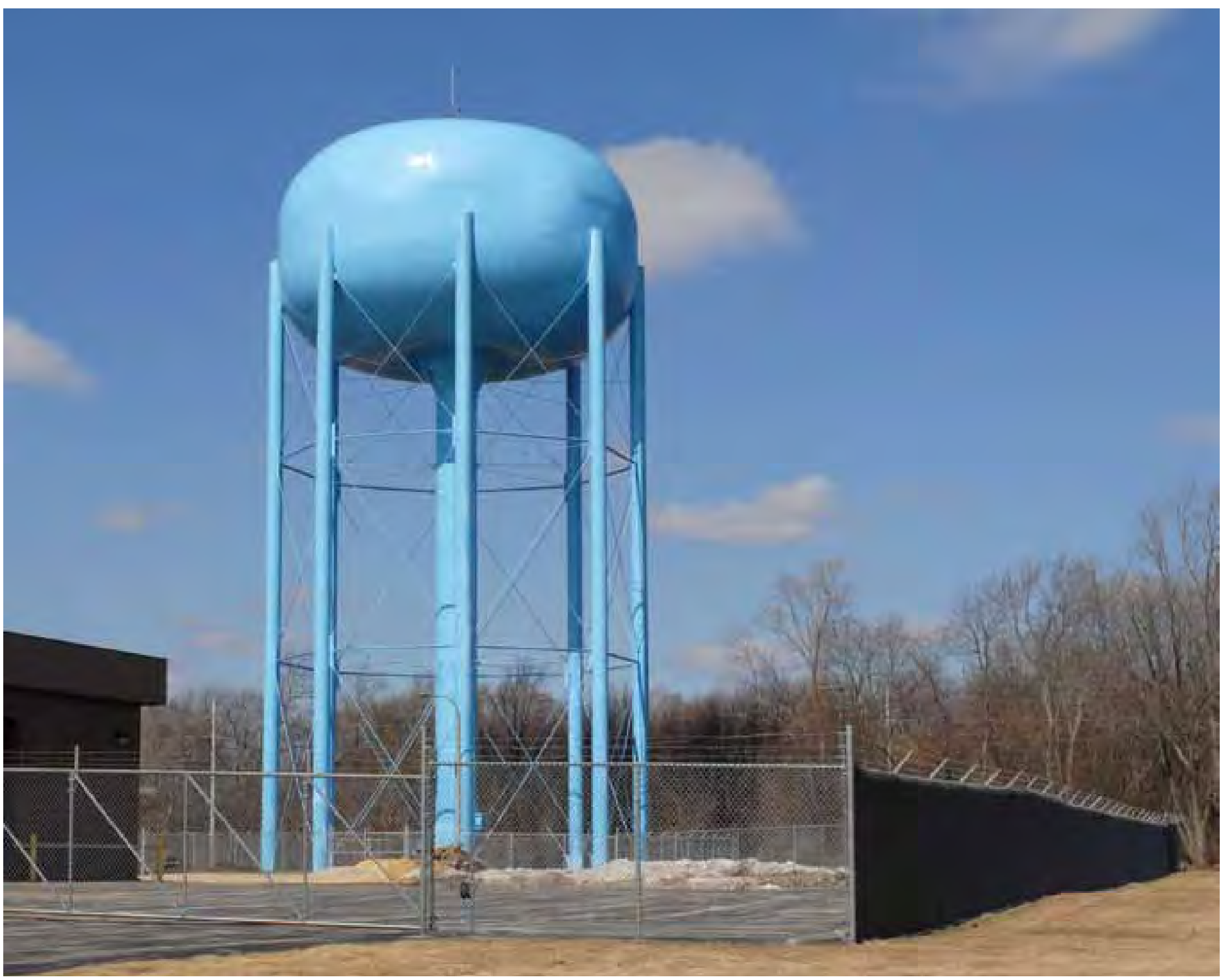
progresses, it is likely that additional laboratory analyses would be needed.

The study also evaluated the effect of several water treatment technologies, including boiling, coagulation, and chemical oxidation. The first two technologies are frequently employed at water treatment plants, and boiling is sometimes suggested for consumers to treat contaminated water. This part of the study concluded that there are notable variations in the effectiveness of treating the four biotoxins tested. For example, only one of four chemical oxidants evaluated was effective against T-2 mycotoxin, and one oxidant had only a limited effect against all of the biotoxins that were tested. High concentrations of coagulants might be useful in removing ricin, SEB, and botulinum type A. Boiling drinking water was effective for all biotoxins tested; however, the results suggest that boiling time must be increased from one minute to 10 minutes when treating T-2 mycotoxin contamination.

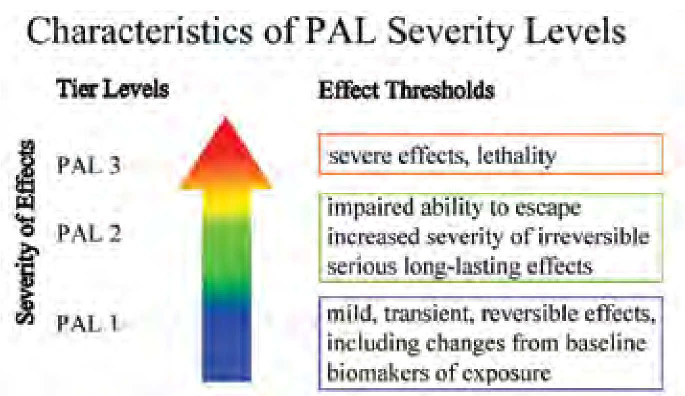
Water utilities, in conjunction with public health authorities, sometimes recommend that consumers boil their water for one to two minutes when the supply is potentially contaminated such as after a major water main break. The results of EPA testing provide important information for water utilities to consider, allowing them to more confidently recommend boiling water for longer periods of time if supplies have been contaminated with the biotoxins that were investigated.

Research results indicated that both detection and treatment technologies may help reduce the risk of public exposure to ingesting water contaminated with biotoxins. EPA is investigating these issues further and is committed to providing the necessary tools to protect drinking water resources.



Developing Provisional Advisory Levels for Interim Recovery Actions

EPA researchers are leading the development of health-based emergency exposure advisory levels to help inform and advise communities and emergency response professionals while they recover from a chemical incident or attack.



Following the terrorist attacks of September 11, 2001, national security and emergency response personnel immediately turned their attention to the need to be better prepared for future emergencies, especially those that might involve the deliberate or accidental release of hazardous chemicals.

To support that effort, EPA homeland security researchers have developed an approach to identify and communicate health-based emergency reference levels—Provisional Advisory Levels (PAL)—on the health dangers associated with exposures to high-priority hazardous chemicals and warfare agents.

"While a number of exposure limit reference values exist for some of the chemicals of concern, they do not address all of the exposure scenarios and durations in question to inform recovery operations," reports EPA researcher Dr. Femi Adeshina.

In the event of a deliberate or accidental discharge of hazardous chemicals, PALs will provide emergency responders and managers with critical information to support site-specific decisions and actions, such as how to address the nature and extent of clean-up operations, and to inform decision-making to allow re-entry into an area, such as a contaminated office building, to claim personal possessions.

PALs are threshold inhalation and oral exposure levels for the general public, derived for four exposure durations: an assumed continuous 24-hour, 30-day, 90-day, and 2-year exposure duration. The levels are based on extensive reviews of available scientific data on each hazardous substance.

To date, EPA has developed PALs for about 100 priority chemical agents. This translates to a total of about 2,400 PALs covering acute, short-term, and longer-term durations for potential ingestion and inhalation exposures.

For each exposure duration, three levels—PAL 1, PAL 2, and PAL 3—are developed as the data allow, to distinguish the degree of severity of toxic effects:

- PAL 1: are exposure levels expected to cause mild, transient, reversible effects
- PAL 2: are exposure levels expected to cause serious, possibly irreversible effects
- PAL 3: are exposure levels expected to cause severe, possibly fatal effects.

The longer-term (up to two year) exposure values are developed to inform responders involved in cleanup operations and the public regarding re-entry decisions.

EPA researchers developed and initiated a process to derive PALs that incorporates extensive peer review and collaboration across EPA and with other government agencies. A scientific workgroup including scientists in academia, state and federal agencies, industry, and the private sector meets quarterly to approve developed PALs. The workgroup provides comprehensive review of data available to derive PAL values.

By engaging a community of stakeholders and partners, EPA researchers developed PALs as scientifically-sound advisories to inform emergency planners and responders, to help the nation prepare for and respond to chemical releases.

Learn More!

To learn more about how EPA is advancing our nation's security through science, please visit: http://www.epa.gov/nhsrc/.

Volume 1 | Number 8 | September 2011
EPA 600/N-11/001

United States Environmental Protection Agency
Office of Research and Development (8101R)
Washington, DC 20460

"Tribute in Light" pays silent memorial to the former site of the Twin Towers at the World Trade Center in lower Manhattan. (Image: Shutterstock.com)

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