

Homeland Security Research Improves the Nation’s Ability to Respond to Terrorism and Other Disasters

Introduction

EPA’s Office of Research and Development **Homeland Security (HS) Research** develops data, tools, and technologies to minimize the impact of accidents, natural disasters, terrorist attacks, and other incidents that can result in toxic chemical, biological or radiological (CBR) contamination. This contamination often results in sickness or death, disruption of drinking water and waste water services, and economic hardship in vulnerable communities.

Background

HS Research develops ways to detect contamination, sampling strategies, sampling and analytical methods, cleanup methods, waste management approaches, exposure assessment methods, and decision support tools (including water system models). These contributions improve EPA’s response to a broad range of environmental disasters including, for example:

- Anthrax attack on a subway system
- Nuclear power plant accident
- Chemical warfare agent attack, e.g., VX, sarin, in an entertainment venue
- Dirty bomb in an urban center
- Contamination of drinking water
- Disease outbreak
- Ricin in the mail

The research is designed to directly address incidents involving CBR agents while also accounting for unforeseen challenges such as the emergence of unanticipated pathogens or industrial accidents.

Legislation, presidential policy directives, and federal response plans give EPA specific responsibilities associated with disaster response, which includes being prepared to address wide area contamination, maintaining environmental laboratory capacity to analyze the large number of samples expected from a major incident, and protecting the Nation’s drinking water systems.



Demonstration of wash down methods for radiologically contaminated buildings Columbus, Ohio 2015

Research Impacts



Retrieving a sample from a railroad tie during a recent demonstration on decontaminating a subway tunnel

The success of HS Research is best shown by the use of its work and expertise in recent emergency responses, guidance and national-level disaster exercises, for example:

- Ebola Outbreak - U.S. cases (2014-15):** Provided technical support for using decontamination products and methods, decontaminating Personal Protective Equipment, managing wastes, and understanding fate in wastewater.
- NYC Environmental Response and Remediation Plan for Bio-incidents:** HS research and technical advice was used extensively by New York City in building this plan, which is the first of its kind to address how a large urban area would respond to a wide area biological incident during the remediation phase. Several other cities are now basing their plans on this document.
- Ricin contamination of Capital mail-handling facility, Maryland (2013):** HS Research on analytical methods and cleaning up sensitive equipment was applied to remediate contaminated mail sorting equipment and return it to service quickly. Contamination was caused when ricin-contaminated letters were mailed to the President and a Senator.
- Eagle Horizon National-Level Disaster Exercise (2016):** Created waste estimation decision support tools used by Federal Emergency Management Agency to estimate quantities and types of contaminated waste following detonation of an improvised nuclear device in Washington, DC.

Dangerous ricin

Ricin is one of the most poisonous naturally occurring substances known.

Ricin is derived from beans of castor oil plant, which is easily available worldwide

Castor oil Used in food products, medicine, industry

Ricin facts

- No vaccine available
- Very toxic to cells, damages all organs
- Can be fatal when inhaled, ingested or injected
- Per gram, it is 6,000 times more poisonous than cyanide

Symptoms

• Weakness	• Fever	• Seizures
• Cough	• Lung damage	• Heart failure
		• Upset stomach

Source: eMedicine, BBC, AFP

Ricinus communis

NOTE: Beans and plant are not to scale

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- Flint, MI drinking water crisis (2015-16):** Currently working on building an improved water distribution system hydraulic model to understand and improve operation of the City of Flint's drinking water system.
- Corpus Christi, TX (2016):** Provided information on

flushing and decontaminating drinking water systems following backflow contamination of a drinking water system with an asphalt emulsifier.

Why this Work is Important

Environmental contamination caused by disastrous events can kill, injure or displace people, cause severe economic loss, and potential abandonment of the affected area. For example, current estimates of the costs associated with the Fukushima, Japan nuclear accident include \$15B for cleanup and \$60B to manage an estimated 150,000 displaced people. The Anthrax-contaminated letters in 2001, a relatively modest terror incident, killed 6 people. Cleanup costs were estimated at \$450M in today's dollars. And the threats appear to be increasing. For example, ISIS has recently communicated the intent to use threat agents to further their terror mission; and, our recent experiences with unanticipated pathogens - Ebola and Zika viruses in humans, and highly pathogenic avian influenza H5 outbreak in poultry – may be just the start of more to come. The 2015 *Bipartisan Report of the Blue Ribbon Study Panel on Biodefense* concluded that “*despite significant progress on several fronts, the Nation is dangerously vulnerable to a biological event.*” Further, the report concluded that the U.S EPA should be explicitly assigned responsibility for decontamination and remediation.

HS Research's mission is to improve EPA's capabilities to carry out these responsibilities by filling critical scientific and technology gaps. HS researchers deliver key scientific products to the Agency aligned with its Strategic Research Action Plan (<https://www.epa.gov/research/homeland-security-strategic-research-action-plan-2016-2019>). The Program works closely with the EPA end-users of its work – specifically with EPA's Office of Water, Office of Land and Emergency Management, and Regions – to prioritize research, advise ongoing studies, and to transition research findings to these end users.

HS Research actively coordinates with other Departments/Agencies that carry out HS research. Although EPA and the Departments of Homeland Security and Defense each pursue distinct missions associated with CBR threats, under a Memorandum of Understanding, EPA coordinates with others' research portfolios to leverage information and resources resulting in several highly-successful, co-funded research and technology demonstration studies.

Moving Forward

HS Research addresses known vulnerabilities and anticipates others. Imminent challenges for EPA include emerging pathogens resulting from disease outbreaks or manufactured and released by terrorists, emerging chemical warfare agents, vulnerable water infrastructure, threats to agriculture that result in environmental disasters, and the capability to address a large-scale contamination incident such as a nuclear disaster or wide-spread anthrax attack. The capability to respond to such challenges requires significant research and development. There is much work to be done to ensure that the Nation is able to minimize the consequences of future homeland security incidents and environmental disasters.

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For more information, visit the EPA Web site at <http://www2.epa.gov/homeland-security-research>

U.S. EPA's Homeland Security Research Program (HSRP) develops products based on scientific research and technology evaluations. Our products and expertise are widely used in preventing, preparing for, and recovering from public health and environmental emergencies that arise from terrorist attacks or natural disasters. Our research and products address biological, radiological, or chemical contaminants that could affect indoor areas, outdoor areas, or water infrastructure. HSRP provides these products, technical assistance, and expertise to support EPA's roles and responsibilities under the National Response Framework, statutory requirements, and Homeland Security Presidential Directives.