

# Consequence Reduction: Response and Recovery

“THE PUBLIC WE ALL SERVE DOESN’T CARE ABOUT THE TRADITIONAL BOUNDARIES OF RESPONSIBILITY OR GEOGRAPHY. WHEN DISASTER STRIKES, THEY WANT AN EXPERT TEAM OPERATING SEAMLESSLY BETWEEN WHERE THEY WORK AND LIVE AND WHERE THEY NEED TO BE TO FEEL SAFE.” — JENNIFER L. DORN, U.S. DOT FEDERAL TRANSIT ADMINISTRATOR

**P**rotecting the nation from its infrastructure vulnerabilities is necessary to prepare for incidents and ensure the ability to react to and recover from them. Response and recovery take place during a disaster and after it occurs. When systems are in place for responding to a significant infrastructure attack while it is underway, the planned response phase activities will isolate and minimize damage, thus reducing consequences. Response involves those immediate activities that prevent loss of lives or property and provide emergency assistance. Recovery involves the short- and long-term activities that return all systems to normal or improved standards—and for transportation, it involves coor-

ordinated efforts to ensure rapid restoration of critical infrastructure facilities. Emergency response and recovery is not a linear process; decisions that are made during the emergency phase will impact the recovery process.

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## RESPONSE

**R**ecent catastrophic events have heightened awareness of the importance, as well as the vulnerability, of transportation systems and the need for improved emergency response planning.



RESPONDING TO CATASTROPHE: Baltimore firefighters get ready to enter the Howard Street Tunnel at Mount Royal Station to battle a smoky fire involving a CSX freight train, July 18, 2001. (Photo ©John Makely, The Baltimore Sun)

Activities that contribute to successful response include:

- Implementing emergency plans and procedures
- Issuing emergency warnings
- Mobilizing resources in response to emergency incidents
- Suppressing hazards (for example, fire containment)
- Providing immediate medical assistance and relief, and search and rescue

## Response to September 11

The Volpe Center demonstrated its ability to support the rapid response required in an emergency when Volpe staff members provided the Federal Emergency Management Agency (FEMA) with immediate assistance following the attacks of September 11, 2001. The FEMA staff greatly appreciated the Volpe staff's initiative in solving problems as they arose and the extensive professional networks they used to call on transportation specialists in other agencies as required. Examples of Volpe support included coordinating the movement of specialized response forces, the urban search and rescue teams, in both New York City and Washington, D.C.

## Impact of Catastrophic Events on Transportation Systems

Assessment of the successes and failures of efforts in the aftermath of major natural, accidental, and malicious disruptive events can offer valuable guidance in planning for the unknowable situations that might arise. The Volpe Center is supporting a comprehensive Federal Highway Administration (FHWA) effort to examine the impacts of catastrophic events on transportation systems and to understand what actions were taken by transportation agencies in response to these events. With the assistance of the Volpe Center, lessons learned from recent events are being incorporated into future emergency response planning across the country to share valuable new work practices or to warn others of adverse practices or experiences.

Volpe staff developed two case studies (the 2001 World Trade Center attack in New York and the Northridge, California earthquake of 1994) and oversaw the development of two others (the Pentagon attack in Washington, D.C. and the

Howard Street Tunnel fire in Baltimore, Maryland, both in 2001). The four case studies analyzed information from interviews and literature, and point to the value of advanced planning and disaster drills for crucial transportation response and recovery. The events studied occurred with no warning and resulted in substantial, immediate, and adverse impacts on transportation, and each has had varying degrees of influence on the longer-term operation of transportation facilities and services in its respective region. Each event revealed important information about the response of the transportation system to major stress and the ability of operating agencies and their public safety and emergency management partners to respond effectively to a crisis.

Each case study addressed the following questions:

- Were the key players prepared?
- What happened and who took action?
- What aspects of the emergency response worked well; what did not; and why?
- What role did technology play?
- What could be done differently, and what can be incorporated into response planning?

The results of the studies, summarized below, are being used in a series of regional workshops sponsored by FHWA that bring federal, state, local, and regional transportation officials and emergency response providers together to discuss emergency preparedness and the role that transportation plays in response and recovery. The studies emphasize the transportation aspects of the catastrophic events and lessons learned that could be incorporated into future emergency response planning.

### *Lessons for Future Response Planning*

After analyzing the information gathered in research and interviews, the Volpe team concluded that the following issues should be considered in future response planning.

1. *Pre-existing relationships among agencies and personnel are key to emergency management success.* Well-established relationships among the many transportation and emergency personnel in New York formed one of the most important success factors in managing the post-attack situation. The response to the Northridge earthquake was also greatly facilitated by pre-existing



**TRANSPORTATION SYSTEM CATASTROPHES:** Collapsed highway in Los Angeles caused by the Northridge earthquake. (Photo courtesy of the National Information Service for Earthquake Engineering, Univ. of California, Berkeley) **CENTER:** New York City subway on the morning of September 11, after the attack. (Photo ©AP/World Wide Photo) **RIGHT:** One of the primary transportation actions taken in Washington on September 11 was closing I-395 inside the Beltway to facilitate movement of emergency vehicles. (Photo courtesy of the Federal Emergency Management Administration)

interagency relationships. Such relationships help transcend the different response approaches used by transportation, military, and law enforcement agencies.

2. *Preparedness planning must include the development of an emergency response plan and training for all shifts of workers.* In Northridge, New York, and Washington, previous catastrophes had prompted regional agencies to develop plans, establish or upgrade operations centers, and participate in emergency drills. Planning helps establish relationships and define roles and responsibilities.

Training field personnel as well as managers is vital, for they often must make critical decisions with little or no input from senior staff. In New York, many key transportation personnel were missing or out of contact for the first few hours on September 11. Nevertheless, thanks to the quick decisions of field staff, agencies were responding within minutes of the attack.

3. *Redundancy must be built into institutions and physical systems, including personnel, communications, utilities, and control centers.* A new approach to redundancy is needed—a backup is not adequate if it is also exposed to failure in an emergency. The transportation infrastructure facilitates emergency response and evacuation, so an alternative network is critical, as are remote backup operations and emergency management facilities. New York's Office of Emergency Management had been located in the World Trade Center; a temporary office had to be relocated three times on September 11.

4. *Multiple technical communication methods help ensure proper institutional communication.* Redundancy and resiliency in communications is critical. Systems that depend on cell phones or landlines can be unreliable; an emergency response system

should include both alternative technologies and redundant network connectivity. Available communication modes can be dependent on the nature and location of a particular event. Immediately following the Northridge earthquake, cell phones and radio were the only means of communication for emergency personnel. However, service was unreliable in the canyon areas, where most of the damage occurred. Staff had to fill the gap with pagers, fax machines, and electronic data sharing via computers. In New York, cellular and radio towers were destroyed, and landlines were limited. Interagency communication was aided by other methods, such as e-mail, dedicated cell phones, two-way radios, and wireless e-mail.

5. *Advanced technologies play an important role in communications and decision making.* Traffic management centers, closed-circuit TV, sensor systems, dynamic message signs, advanced traffic control systems, Web sites, and geographic information systems were all identified as useful in aiding internal and external communication; the first six of these tools are associated with Intelligent Transportation Systems (ITS).

Timely decision making requires effective communication of accurate information. In the aftermath of disaster, ITS enabled facility managers to make informed decisions, improve regional transportation management, and enhance communication with the public. In the Washington area, traffic signal systems were adjusted to facilitate the rush of commuters from the District, and to enable access by emergency responders. In New York, TRANSCOM used traffic volume data to enable agencies to better distribute traffic, and the ITS package on the George Washington Bridge helped manage its closing and reopening. Highway advisory radio, dynamic message signs, and closed-circuit television provided public information.

### *Case Studies: Focus of Emergency Preparedness Workshops*

The four case studies have provided material for a series of regional Transportation Response and Recovery Workshops sponsored by the FHWA Office of Operations. These workshops are designed to enhance working relationships of personnel from different organizations in the region, and to identify areas for improvement in planning and readiness in the region. They also help determine next steps and provide input to emergency preparedness guidance being developed at the national level. Volpe's work on this important project was summarized in a crosscutting study published in January 2003. The study, "Effects of Catastrophic Events on Transportation Management and Operations," presents the findings of the four case studies for high-level decision makers.

### **Security-Related Workshops and Training**

The Volpe Center is constantly working to help its agency sponsors improve security awareness and training and has developed and conducted numerous courses, workshops, or forums. These include a course for first responders to chemical and biological incidents on public transit systems; a training course for first responders in the San Francisco Bay Area; courses on emergency response to other types of transit incidents; and guidelines for developing transit security procedures and programs. The Center has also assisted in training employees how to recognize and handle potentially dangerous packages in the mail and conducted needs assessments and training covering facility awareness, dock/platform transfers, processing and distribution, and flight assignment. Volpe works with the Research and Special Programs Administration and others to implement these courses throughout the country and also disseminates this guidance through Web sites, workshops, newsletters, a document clearinghouse, and training courses. Some examples of key workshops and training related to security response follow.

#### *Emergency Preparedness Forums: Connecting Communities*

Prior planning for operational alternatives and steps to facilitate implementation of those plans can make a dramatic difference in the total impact both during and after an emergency event. The Center has supported the Federal Transit Administration (FTA) in offering seminars on emergency preparedness and security. These "Connecting Communities" preparedness forums ensure that emergency training programs

include the latest safety and disaster preparation planning information.

Transit systems rely heavily on other emergency responders during emergencies. These forums help transportation and emergency response agencies work together to prepare and protect their community with coordination, communication, planning, and practice of safety and security measures. The forums have successfully brought together more than 1,900 transit, police, fire, medical response, and city/state emergency management communities around the nation. The program has helped create a network of participants for the facilitation of future drills and emergency plans, with the objective of enhancing the nation's ability to respond to emergencies more quickly and effectively.

Additional forums will focus on reaching out to the rural areas of the country.

#### *Bioterrorism in Transportation*

Bioterrorism involves the release of viruses, bacteria or other toxins through air, food or water, with the intention of killing or harming as many people as possible. Federal agencies have accelerated and expanded existing research and preparedness programs on bioterrorism since September 11, 2001. DOT staff will undoubtedly be required to respond appropriately to any major bioterror attack by shutting down the



**BIOTERRORISM IN TRANSPORTATION:** Human movement is responsible for how any biological agent wends its way into the general population. Upon discovery of an infectious threat, the transit system will have to be shut down or restricted. (Photo ©Kent Dayton/Harvard School of Public Health)

transportation system to limit and mitigate the damage from epidemics and diseases.

In order to anticipate and respond to the needs of the transportation community, the Volpe Center endeavors to keep its staff and others educated about cutting-edge issues. The Center initiated and co-hosted a workshop on “Bioterrorism in Transportation” with experts from the Harvard School of Public Health (HSPH) and the Kennedy School of Government, Harvard University, in February 2002. The workshop featured presentations from Volpe staff, Harvard University faculty members, and other distinguished guests. The goal was to cover a wide range of public health and policy topics related to bioterrorism that might affect transportation passengers, vehicles, and facilities.

Discussions covered four types of bioterrorism threats: airborne non-communicable threats such as anthrax, tularemia, and viral hemorrhagic fevers; airborne communicable threats such as smallpox, plague, and bioengineered influenza; vector-borne threats (i.e., by mosquitoes and rodents) such as encephalitis viruses, typhus, and yellow fever; and agro-terrorism such as foot and mouth disease, anthrax, and potato blight. Modes of transmission for biological agents—considering different space and time factors—were also discussed. Wind patterns in cities, for example, would make it difficult for a biological agent to be effective in an open-air release, but closed spaces in buildings and transport systems can be exploited. Scenarios of how a lethal attack might unfold were developed, as well as responses.

#### *Transportation Issues in Bioterrorism: Considerations for Evacuation and Quarantine*

In November 2002, Volpe Center personnel organized and facilitated the RSPA Office of Emergency Transportation’s (OET) workshop entitled, “Transportation Issues in Bioterrorism: Considerations for Evacuation and Quarantine.” The workshop was attended by participants from various transportation, emergency response, and public health agencies/organizations across the country.

In addition to addressing bioterrorism roles and risks in transportation, the workshop’s goal was to cultivate relationships among key agencies and associations at the local, state, regional, and national levels. Federal agencies represented included the Department of Homeland Security, Department of Agriculture, Department of State, Department of Health and Human Services, Centers for Disease Control and Prevention,

Transportation Security Administration, Federal Emergency Management Association, Federal Highway Administration, and the Federal Aviation Administration. National organizations represented included the National Emergency Managers Association, Association of American Railroads, National Defense Transportation Association, International Association of Fire Chiefs, National Association of Counties, and the Association of State and Territorial Health Officials.

The workshop used several hypothetical scenarios to stimulate broad-ranging discussion among the attendees regarding transportation as a response resource as well as a potential transmission tool.

#### Outcome of the Evacuation and Quarantine Workshop “Consensus Items”

- Develop a matrix of the impacts of human and animal diseases and the transportation options that would minimize their impacts
- Prepare a national transportation biological incident plan and supporting incident protocols
- Provide transportation operators with appropriate emergency response training
- Cultivate and maintain relationships with key agencies and associations at local, state, regional, and national levels
- Develop models for major transportation networks, to determine the possible spread of biological agents through transportation means
- Develop a public communication strategy and participate in a joint information center

#### *Transportation Executive Leadership Institute*

The Volpe Center, in conjunction with the Kennedy School of Government, has prepared case studies on current transportation topics to be used in training sessions for senior U.S. DOT officials under the Transportation Executive Leadership Institute (TELI). This joint effort provides an opportunity for current and future transportation executives to develop the prerequisites needed to continue meeting the challenges of future management and transportation issues and techniques.

These training sessions are designed to stimulate discussion among session participants on the high level of planning, coordination, and cooperation needed to successfully manage and recover from a bioterrorist attack, its impact on transportation, and the more general application of any “lessons learned” to other transportation situations.



**HAZMAT RECOGNITION AND MAIL SECURITY:** Anthrax in the mail has caused procedural changes in processing mail. The Volpe Center supports the Postal Service in ensuring the safety of employees as well as customers through training. (Photo ©Mario Tama/Getty Images)

One of the case studies, *The Roles and Responsibilities of Government Agencies in Responding to Incidents of Bioterrorism*, covers the discovery of anthrax-laced letters in the U.S. Postal Service (USPS) mail system in the fall of 2001. Specific emphasis is placed on how the USPS responded to these incidents, and the overlapping roles and responsibilities of the various other governmental organizations in addition to the USPS who were part of this response.

### *United States Postal Service Training*

The USPS delivers 680 million pieces of mail per day in the United States, and a single terrorist act has the potential to adversely impact the entire nation by compromising this vital transportation system. Volpe Center staff supports the Postal Service in evaluating and implementing process changes and training programs to ensure the enhanced safety of postal employees and customers.

*HAZMAT Recognition and Mail Security Training*—The events of the past two years have brought a new awareness of the vulnerability of many systems Americans enjoy for communication or convenience. The Volpe Center is supporting the USPS Hazardous Materials (HAZMAT) Program to fully develop and implement HAZMAT recognition and training for 600,000 postal employees, and develop training for Army Post Office/Fleet Post Office military postal personnel. One of the

greatest challenges facing the Postal Service is the control of hazardous materials, both declared and undeclared, in the mailstream. Many of these potentially hazardous or restricted materials regulated in the mailstream are common household items, including cosmetics, cleaning supplies, alcoholic beverages, and aerosols.

The Volpe Center is supporting the USPS on several endeavors developed to meet its strategic objectives and process-based initiatives, including prevention, detection, and identification of HAZMAT-related problems in the mail. In addition, the Center is involved in developing training materials, providing education, and developing management process improvement strategies. Postal Service employees are not only appreciative of the training provided by their management, but with the terrorist attacks and anthrax incidents as a backdrop, now also have a clearer understanding of the continued importance of recognizing potential HAZMAT or suspicious parcels, and knowing exactly what they should do.

*Air Mail Security*—The Volpe Center has a leadership role in developing HAZMAT background and course materials for the Postal Service’s air mail facilities; processing and distribution centers; retail, sales, marketing, and inspection services; rates, classification, and delivery personnel. As part of an educational outreach program, Volpe Center staff members have provided technical support in the presentation of “Hazardous Materials – What a Mailer Needs to Know” for targeted public and corporate organizations at USPS Postal Forums.

In addition, the Postal Service and the Volpe Center have embarked on a ‘Train the Trainer’ program where designated postal employees are trained in managing HAZMAT for all mail shipped through the postal surface, and through air and water transportation and distribution networks. These trainers will then train groups of employees until the goal of providing training for 600,000 postal employees is achieved.

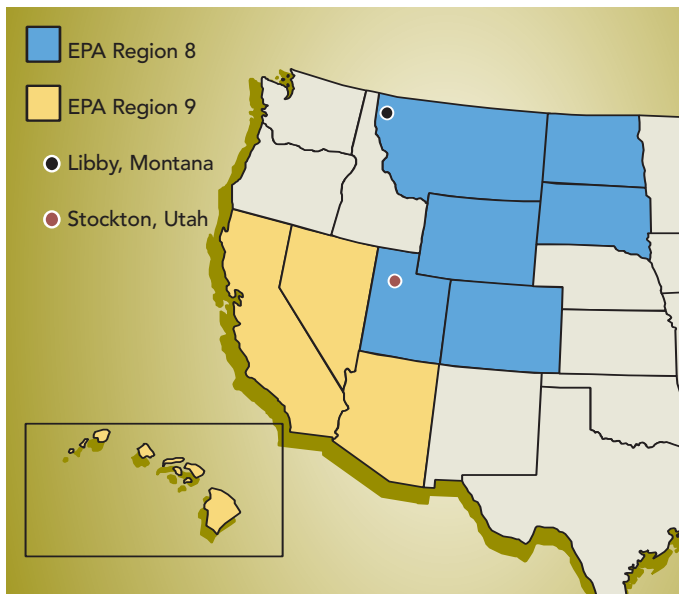
*Reducing Risks*—The safety of employees and customers, the security of the mail, and the confidence of the American public in the Postal Service were challenged by the events of 2001-2002. In an effort to reduce risk for both employees and customers (while at the same time maintaining current service levels), the Volpe Center was asked to assist in developing “management process improvement strategies” for the Postal Service. The goal is to develop a process-driven system that works as a series of interlocking repetitive activities, which can lead to streamlined postal activities and better customer service—so postal customers can safely and securely obtain products and services.

The Volpe Center is also supporting the development of internal and external communications plans. These will increase customer and Postal Service personnel awareness of the HAZMAT program by developing appropriate instruments that describe the basic elements of the program in easy-to-understand terms, pictures, and graphics.

This proactive role in reducing risk in the areas of aviation mail security and hazardous materials acceptance, handling, and transport have resulted in over 200,000 hours of training to Postal Service employees, supervisors, and managers throughout FY03. With assistance from the Volpe Center, these Postal Service programs are continually reviewed and modified to meet increased challenges through improved technology.

## LONG-TERM RECOVERY AND REMEDIATION

Recovery is the process by which an affected community is assisted in regaining a proper level of functioning following a disaster. It comprises initial recovery, which addresses personal and community needs and restores services to the level where local government and the normal responsible agencies can manage the continuing process. It also includes long-term recovery, reconstruction, and rehabilitation measures. Long-term recovery involves site analysis and damage assessment,



**ONGOING RECOVERY:** Processing plants located in EPA Region 8 and Region 9 received asbestos-contaminated vermiculite from Libby, Montana. Contaminated soil in Stockton, Utah posed a health threat. Volpe supports EPA's remediation efforts in these areas.

contaminant containment, and remediation. A recovery phase begins when the emergency ceases and the business of day-to-day living begins.

The Volpe Center has been involved in numerous efforts to assist agencies and others in long-term recovery and consequence management. In several Western states, past industries like mining and smelting have left a legacy of contamination or disease for current residents, who have turned to the Environmental Protection Agency (EPA) and other government agencies for help. They, in turn, have utilized Volpe's expertise and experience in community relations, site analysis, and remediation to assist them in addressing issues with the public, evaluating damage, containing contaminants, and cleaning up sites for future generations.

### Libby, Montana

Vermiculite is a nonmetallic mineral that occurs naturally in large deposits in the Libby, Montana area. It is used to manufacture building insulation, and as lightweight concrete aggregates and agricultural soil additives. Vermiculite was mined at the northwestern Montana site for more than 60 years until the mine's closure in 1990. Mined vermiculite was transported from Libby in bulk rail shipments to approximately 50 exfoliating plants throughout the United States.

Asbestos exposure resulting from vermiculite mining, processing, and transportation activities has been linked to over 200 deaths in Libby and over 400 additional cases of asbestos-related disease since 1961. Of those who have contracted asbestos-related diseases, some worked at the mines or were family members of miners. Others had no link to the mines other than living in Libby. Working in support of EPA, the Volpe Center initially conducted sampling of residential properties, schools, former mining sites, and other potentially impacted areas starting in 1999. Analysis of samples showed the presence of tremolite asbestos, a rare form of asbestos present within the mined vermiculite.

The Center is supporting the EPA by providing removal assessment support at Libby and additional sites in EPA Regions 8 and 9 (see map, this page). These sites either processed the Libby vermiculite or received the vermiculite for manufacturing. Volpe also provides the EPA with environmental engineering, remediation, and information-systems services.

Removal assessments were completed for sites in Arizona, California, and Hawaii. The purpose of these assessments was

to determine if a current potential existed for onsite asbestos exposure, or if past operations or conditions resulted in any of the asbestos or contaminated vermiculite being transported off site. Each assessment involved sampling of air, soil, dust, and other bulk/waste materials for asbestos, as well as gathering information regarding relevant past and current site operations. The results were used to determine the need for any additional investigative or corrective actions.

Volpe's ongoing removal assessment in support of the EPA is a direct result of EPA's requirement to determine the national extent of asbestos contamination associated with the mining operations in Libby, in line with DOT's strategic goal in the area of human and natural environment.

## Stockton, Utah

Other parts of the country suffer long-term consequences related to different contaminants. Over 100 years ago, Stockton was a booming mining town in the Oquirrh Mountains of Central Utah. Even though the silver ore smelters are long gone, remnants of the past remain with lingering lead and arsenic by-products in the soil.

When the EPA determined that the presence of lead and arsenic in Stockton's soil posed a health threat, the agency called on Volpe to conduct an emergency response action to remediate the most contaminated properties. Utilizing staff resources and existing relationships with commercial engineering firms, the Center assisted the EPA in managing the removal of over 40,000 tons of contaminated soil. Environmental engineers from the Center also implemented an innovative, cost-effective technology to remediate contaminated soil onsite. Volpe Center staff assisted the EPA with operations and provided an almost constant field presence to ensure that the work was done safely and efficiently.

## Applicable Experience in Response and Recovery

While the Volpe Center has traditionally focused on the unique environmental and security issues faced by the transportation community, its collaborations with different agencies have yielded lessons applicable in many other contexts. Lessons learned from long-term recovery activities could be put to good use in dealing with future disaster-related contamination and subsequent remediation, such as from chemical or biological attacks.

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## CONSEQUENCE REDUCTION LESSONS LEARNED

Ensuring our national security requires both comprehensive understanding and creative thinking to neutralize existing threats and to anticipate and address future threats. An important part of managing the outcomes of any disaster or attack is a careful review of the event and the responses to it, with an eye to preventing such disaster or mitigating deleterious effects in the future. Consequence management reviews the present and the past, in order to prepare for the future. The lessons learned help develop plans for emergency response, evacuation, and mitigation, and form the basis for training for security-related protection or prevention.

Key transportation-related lessons learned in the area of consequence reduction involve advanced preparations and planning, institutional coordination, communication, advanced technologies such as ITS, redundancy and resiliency, and operational decision making using multiple approaches to protect key assets and facilities. Although no one can predict the exact location or time of an earthquake or fire—or imagine the horrendous events that took place in September 2001—the cities, the states, even the regions involved were, to a great extent, more prepared for handling their respective disasters than they had been years earlier because of preparedness planning in response to previous disasters.

Long-term response and recovery lessons, such as in Libby and Stockton, involve maximizing the use of technology and managerial expertise to support site evaluations and onsite treatments, contaminant containment, and clean up. Long-term recovery efforts also engage citizens as part of the process so that residents are part of the solution.

Homeland security depends on prevention and protection, but should those barriers fail, emergency or disaster readiness is crucial. The Volpe Center stands at the forefront of expertise, ideas, and technology in consequence management and reduction—whether through disaster response research, technical support, onsite program management, training, or long-term recovery. The Center has made significant contributions to security and will continue its commitment to keeping the country's people, resources, and institutions secure and safe. 🌐