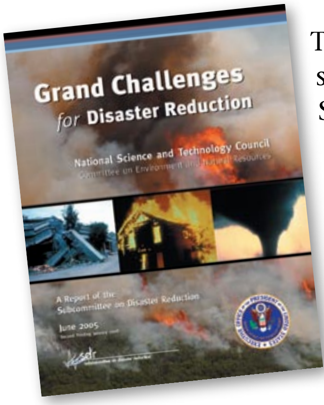

The *Grand Challenges for Disaster Reduction* outlines a ten-year strategy crafted by the National Science and Technology Council's Subcommittee on Disaster Reduction (SDR). It sets forth six Grand Challenges that, when addressed, will enhance community resilience to disasters and thus create a more disaster-resilient Nation. These Grand Challenges require sustained Federal investment as well as collaborations with state and local governments, professional societies and trade associations, the private sector, academia, and the international community to successfully transfer disaster reduction science and technology into common use.

To meet these Challenges, the SDR has identified priority science and technology interagency implementation actions by hazard that build upon ongoing efforts. Addressing these implementation actions will improve America's capacity to prevent and recover from disasters, thus fulfilling our Nation's commitment to reducing the impacts of all hazards and enhancing the safety and economic well-being of every individual and community. This is the technological disasters-specific implementation plan. See also **sdr.gov** for other hazard-specific implementation plans.

What is at Stake?

DEFINITION AND BACKGROUND. Technological hazards involve the release of hazardous substances that impact human health and safety, the environment, and/or the local economy. Hazardous substances are chemicals, toxic substances, gasoline and oil, nuclear and radiological material, and flammable and explosive materials, in the form of gases, liquids, or solids. Because such hazards exist during production, storage, transportation, use, or disposal, the impacts to our oceans, groundwater systems, streams, rivers, agriculture, air quality, and urban areas continue to be significant.

Criminal and terrorist threats to facilities that house technological hazards are additional concerns that must be considered when assessing risk and developing prevention and mitigation strategies. Failures in cyber-infrastructures, failures of upkeep, human error and accidents, and naturally occurring events such as hurricanes, floods, earthquakes, and fires also can cascade into a technological disaster.

IMPACTS. In July of 2001, a train traveling through the Howard Street Tunnel in Baltimore, Maryland was derailed, causing a major chemical spill.[1] Flames from the resulting chemical fire reached temperatures up to 1000°C (1800°F). The liquid fuel contained in the tanker cars sustained the fire for several hours causing significant damage to the tunnel and completely destroying all contents of the train. The event caused major disruption to the local infrastructure and necessitated the evacuation of several facilities, including Camden Yards.

TECHNOLOGICAL DISASTERS

A report of the Subcommittee on Disaster Reduction
www.sdr.gov

An element of the National Science and Technology Council

Grand Challenges for Disaster Reduction: Priority Interagency Technological Disasters Implementation Actions

GRAND CHALLENGE #1: Provide hazard and disaster information where and when it is needed.

- ➤ Improve and coordinate the databases of industrial hazard threats to communities with all Federal, state, and local response agencies;
- ➤ Improve GIS databases to map critical infrastructure, industry, public health services, and other facilities in order to identify locations of technological hazards and improve information sharing through common-format data collection and dissemination via interoperable systems;
- ➤ Enable sophisticated spatial modeling and dynamic population movement at local levels in all GIS databases;
- ➤ Develop a comprehensive toolkit of evaluation procedures, risk-assessment tools, and computational technologies that can be used in the field;
- ➤ Improve detection and assessment technologies and improve hazard prediction methodologies to enable risk reduction;
- ◆ Integrate science-based improvements into regulations;
- ◆ Develop new technologies to detect the presence of biological, chemical, and radiological contaminants in the air, water, or on surfaces in near-real time.

GRAND CHALLENGE #2: Understand the natural processes that produce hazards.

- ➤ Research the basic mechanisms behind contaminant fate and transport in air, water, and through the earth to improve understanding of commonly used hazardous chemicals and new materials as they are introduced; of situations that can lead to release; of dispersion rates in air, water, and soil; of immediate threat to the community including fires and explosions; and of short and long-term impacts on the environment, public health, and the economy.

GRAND CHALLENGE #3: Develop hazard mitigation strategies and technologies.

- ■ Establish an interagency committee for Technological Hazards coordinated through the SDR as a focal point for collaborative government, private sector, and academic research into the short-term and long-term effects of technological disasters;
- ■ Develop improved, security-based design standards for new facilities, transportation containers, and storage devices;
- ■ Develop improved design standards for environmentally sound and rapidly deployable clean-up technologies;
- ➤ Implement science-based improvements in regulatory guidance for local, state, and Federal zoning and mitigation plans;
- ◆ Develop new chemicals, materials, and industrial processes which are environmentally and physiologically benign and reduce consumer reliance on hazardous substances;
- ◆ Develop improved design standards for new facilities, infrastructure, transportation containers, and storage devices.

Key: ■ Short Term Action (1-2 years) ➤ Medium Term Action (2-5 years) ◆ Long Term Effort (5+ years)

GRAND CHALLENGE #4: Reduce the vulnerability of infrastructure.

- ➤ Create advanced computational models to assess the public health, economic, and environmental impacts of technological disasters on communities, and to assess the effectiveness of hazard identification, prediction, preparedness, and mitigation methods;
- ◆ Develop disaster-resilient technologies to mitigate the effects of technical hazards on critical infrastructures.

GRAND CHALLENGE #5: Assess disaster resilience.

- ■ Establish and communicate a consensus on acceptable risk levels and appropriate individual protective measures in places where individuals live, work, and play;
- ■ Develop new, more accurate technological hazard maps;
- ■ Develop community evacuation plans based on scientific research of likely hazard scenarios and public responses;
- ■ Incorporate lessons learned into a synthesis of risk assessment, prediction, mitigation, response, and recovery methodologies to assess and understand the impacts of technological disasters on interdependent infrastructure, public health, the environment, the economy, and the community as a whole;
- ◆ Assess how well local decision makers, emergency managers, and individuals understand the technological hazards that exist in their community, and the training of response personnel and individuals about appropriate responses to probable, local technological disasters.

GRAND CHALLENGE #6: Promote risk-wise behavior.

- ■ Develop a best practices guide for community warning systems;
- ■ Research and implement effective regulatory and enforcement approaches;
- ➤ Develop rapid risk assessment and risk communication strategies to inform decisions by individuals, state and local emergency managers, and response personnel;
- ➤ Offer increased incentives and methods for safer operation of hazardous facilities and materials transport;
- ➤ Cultivate a strong network of capable, communicative, and prepared local community leaders and emergency responders, educated about the technological hazards they face and the technical and communication skills needed to prevent, mitigate, and respond to such disasters;
- ◆ Develop and install new, more advanced detection and warning systems for all facilities and at-risk communities;
- ◆ Foster a ready-public, educated, prepared, and capable of receiving information and taking life-saving actions in the event of a technological disaster;
- ◆ Establish an effective nationwide and geographically specific warning system;
- ◆ Develop a strong network of capable, prepared Federal, state, and local authorities, emergency managers, and first responders, educated about the likelihood of technological disasters in the Nation, states, and local communities with technical and communication skills needed to prevent, mitigate, respond to and recover from such disasters.

Key: ■ Short Term Action (1-2 years) ➤ Medium Term Action (2-5 years) ◆ Long Term Effort (5+ years)

Expected Benefits: Creating a More Disaster-Resilient America

Fulfilling this technological disasters-specific implementation plan will create a more disaster-resilient America. Specifically:

Relevant hazards are recognized and understood. Owners and operators will adhere to guidelines and safely operate facilities. Individuals, decision makers, and emergency management personnel will understand the technological hazards that exist in their community and will have prepared appropriate responses to potential technological disasters.

Communities at risk know when a hazard event is imminent. Reliable information will be acquired in a common format and conveyed via interoperable systems, fostering information sharing and more rapid information dissemination. There will be faster, appropriate, safe responses from emergency responders and emergency management officials at all levels of government as well as more effective, timely warnings.

Individuals at risk are safe from hazards. Safer materials will exist, and there will be lower probability for release of hazardous materials. The consequences associated with different aspects of possible technological disasters will be predicted with certainty and conveyed to an educated, ready-public capable of implementing individual protective measures, developing evacuation plans, and taking life-saving actions.

Disaster-resilient communities experience minimum disruption to life and economy after a hazard event has passed. Prior consensus will be reached among all levels of government and industry-appropriate protective measures during response and recovery operations. New products, processes, and technologies will deliver value without threatening public safety or the environment. Improved technical basis for construction materials and design standards will reduce the consequences of technological disasters. Improved contamination and decontamination methods will reduce mortality/morbidity.

Reference

1. McGrattan, K.B., and Hamins, A., 2003: Numerical Simulation of the Howard Street Tunnel Fire, Baltimore, Maryland, July 2001. Available online at **http://fire.nist.gov/bfrlpubs/fire03/PDF/f03086.pdf**