AGENDA, 26 April 2007, 3 P.M. TO 5 P.M.
NATIONAL SCIENCE FOUNDATION
Room 580
CRITICAL INFRASTRUCTURE TASK GROUP
SUBCOMMITTEE ON DISASTER REDUCTION

Agenda

3:00 Welcome and Introductions .... Pauschke

3:05 Discuss Critical Infrastructure Definition .... All

3:45 Discuss Paper Outline .... All

4:40 Make Writing Assignments .... Pauschke; Wallace

5:00 Adjourn .... Pauschke

Meeting Minutes of the Subcommittee on Disaster Reduction Critical Infrastructure Task Group

February 21, 2007, NSF Headquarters, Arlington, VA Room 130

Critical Infrastructure Task Group Chair
Joy Pauschke, Chair

Attendees
Stephen Clark (EPA)
Sheila Duwadi (FHWA)
Ken Friedman (DOE)
Patricia Hoffman (DOE)*
Yazmin Seda-Sanabria (USACE)
Emily Wallace (Secretariat)

I. Call to Order

II. Summary of Discussion

A. Discuss CITG Reference Documents

Joy Pauschke welcomed members and began by discussing the CITG Reference Library. The Reference Library is no longer available online but the Secretariat has burned several CDs that are available to members. The Secretariat will continue to maintain and update the library offline. Several additions to the library were suggested, including:

- "Identifying, Understanding, and Analyzing Critical Infrastructure Interdependencies", by .M. Rinaldi, J.P. Peerenboom, T.K. Kelly
- The American Lifelines Alliance *Guidelines for Utility Performance Assessment*
- Information from the website of the National Infrastructure Simulation and Analysis Center (NISAC)
- The sector specific research and development plans issued by the Department of Homeland Security

B. Discuss CITG Mission Statement and White Paper

The group discussed the CITG mission statement included in the meeting materials, which was drafted after discussion at the previous meeting. Members suggested edits, which were noted by the Secretariat. Members are asked to provide any further edits or suggestions to the Secretariat following the meeting. The CITG will share their finished mission statement with the SDR at the next Subcommittee meeting on March 1st.

It was agreed that a clear definition for "critical infrastructure" needed to be developed for the white paper. It was agreed that critical infrastructure included:

- Transportation systems
- Water supply/waste water treatment
- Public health services
- Telecommunications systems
- Energy/nuclear facilities

- Emergency services

It was suggested that other components of the infrastructure likely to be effected by hazards, but not necessarily considered "critical infrastructure" should perhaps be addressed in the introduction to the white paper, including banking and finance, trash services and food supply.

III. Future Meetings
To be decided.

IV. Agenda Items and Other Communications with the Subcommittee
Please send proposed agenda items and any other items intended for distribution to the full Critical Infrastructure Task Group to the Secretariat, or to the CITG Chairs.

V. Contact Information CITG Leadership
Joy Pauschke, Chair, (703) 292-7024, jpauschk@nsf.gov

VI. Summary of January Actions

Action	Lead	By When
Continue to build and develop the CITG reference library based on member suggestions	Secretariat	Ongoing
Submit edits to the CITG mission statement to the Secretariat (ewwalce@grs-solutions.com)	Members	February 27
Finalize mission statement	Members	Next meeting

MISSION STATEMENT
CRITICAL INFRASTRUCTURE TASK GROUP
SUBCOMMITTEE ON DISASTER REDUCTION

The Subcommittee on Disaster Reduction's (SDR) Critical Infrastructure Task Group (CITG) is charged with articulating the need to protect critical infrastructure systems, or lifelines (e.g., communications, electricity, financial, gas, sewage, transportation, and water) before, during and after hazard events. The Task Group will develop a 6-8 page white paper on reducing critical infrastructure vulnerability to natural and technological hazards

By September 2007, the CITG will deliver a report for consideration by the SDR members. Topics addressed may include:

- Developing improved assessment methods for analyzing the vulnerability and interdependence of infrastructure systems.
- Develop innovative assessment models for emergency response procedures including addressing all threats to public health rapidly and effectively.
- Developing information acquisition systems that can be used to validate valuations of resilience and response.
- Identifying and deploying cost-effective technologies that ensure survivability of critical utilities and other infrastructures.
- Identifying and protecting critical nodes.

Draft Outline
White Paper
Disaster Reduction for Critical Infrastructure

I. INTRODUCTION

A. Background and Purpose of this Paper

B. Critical infrastructure

C. Interdependencies

D. The Grand Challenge for Disaster Reduction for Critical Infrastructures

II. CURRENT ACTIVITIES AND CAPABILITIES

A. Assessing the Impact of Hazards on Critical Infrastructures

B. Reducing the Impact of Hazards on Critical Infrastructures

C. Preparedness and Enhancing Community Resilience

III. GAPS

A. Assessing the Impact of Hazards on Critical Infrastructures

B. Reducing the Impact of Hazards on Critical Infrastructures

C. Preparedness and Enhancing Community Resilience

IV. RECOMMENDATIONS

Draft Outline
White Paper
Disaster Reduction for Critical Infrastructure

(with notes)

I. INTRODUCTION

A. Background and Purpose of this Paper

Infrastructures such as water and wastewater, energy generation and distribution, communications, transportation, agriculture and food, banking and finance, and public health networks are critical to our nation's welfare, security, and ability to compete in a global economy. Over the past century, these critical "backbone" infrastructures have evolved far beyond their original designs into a highly coupled, or interdependent, web of networked systems - through complex physical, natural resource, cyber, geographic, human, social, and logical connections. Large segments of these interdependent infrastructures consume a significant portion of the nation's nonrenewable energy and material production, face degradation, and are legacy systems coping with new technologies. In addition, the United States has witnessed significant cascading failures of these infrastructures, resulting in deaths, damage, and downtime, due to natural and technological disasters, e.g., 2001 California electric power disruptions, 2003 Northeast Blackout, and 2005 Hurricane Katrina. [Note: Add observed disaster examples from the four page implementation plans.]

Grand Challenge #4—Recognize and reduce vulnerability of interdependent critical infrastructure. Protecting critical infrastructure systems, or lifelines, is essential to developing disaster-resilient communities. To be successful, scientists and communities must identify and address the interdependencies of these lifelines at a systems level (e.g., communications, electricity, financial, gas, sewage, transportation, and water). Using integrated models of interdependent systems, additional vulnerabilities can be identified and then addressed. Protecting critical infrastructure provides a solid foundation from which the community can respond to hazards rapidly and effectively.

B. Critical infrastructure

Clear definition for "critical infrastructure" needed to be developed for the white paper. It was agreed that critical infrastructure included:

- Transportation systems
- Water supply/waste water treatment
- Public health services
- Telecommunications systems
- Energy/nuclear facilities
- Emergency services

It was suggested that other components of the infrastructure likely to be effected by hazards, but not necessarily considered "critical infrastructure" should perhaps be addressed in the introduction to the white paper, including banking and finance, trash services and food supply.

C. Interdependencies

See Rinaldi paper (2001) and subsequent papers

D. The Grand Challenge for Disaster Reduction for Critical Infrastructures

Protecting critical infrastructure systems, or lifelines (e.g., communications, electricity, financial, gas, sewage, transportation, and water), is essential to developing disaster-resilient communities. The interdependencies of these complex, coupled systems must be better understood and modeled to prevent cascading failures and protect public health before and after a hazard event.

What are other issues?

II. CURRENT ACTIVITIES AND CAPABILITIES

Activities at federal agencies
- Agencies listed under GC #4 on each four-page implementation plans
- Agencies involved in the National Infrastructure Protection Plan
- Interdependency modeling at Sandia National Labs
- National Infrastructure Protection Plan
- Other documents?

A. Assessing the Impact of Hazards on Critical Infrastructures
Science and technology for resilient critical infrastructure
Protection of public health before and after a hazard event.

B. Reducing the Impact of Hazards on Critical Infrastructures
Science and technology for resilient critical infrastructure
Protection of public health before and after a hazard event.

C. Preparedness and Enhancing Community Resilience
Science and technology for resilient critical infrastructure
Protection of public health before and after a hazard event.

III. GAPS

A. Assessing the Impact of Hazards on Critical Infrastructures
Science and technology for resilient critical infrastructure
Protection of public health before and after a hazard event.

B. Reducing the Impact of Hazards on Critical Infrastructures
Science and technology for resilient critical infrastructure
Protection of public health before and after a hazard event.

C. Preparedness and Enhancing Community Resilience
Science and technology for resilient critical infrastructure
Protection of public health before and after a hazard event.

Develop science and technology to prevent cascading failures in public infrastructure systems.

- *Interdependencies:* Develop tools and models to provide a more robust understanding of infrastructure interdependencies in order to protect the public infrastructure, to allow continuity of services, and to prevent cascading failures.
    - Current state of art in interdependency modeling (e.g., Sandia National Labs)
    - Infrastructures must be designed to protect people from secondary or cascading hazards.
- *Systems design: the four R's* (from MCEER white paper) – robustness, redundancy, resourcefulness, rapidity
    - Robust infrastructure systems should guard against damage from natural and technological hazards and feature redundant, rapidly resolving systems that allow any failures to be isolated and repaired with no disruption to other components.
- *New technologies needed* – physical, cyber, renewable…draw upon NIPP
- *Risk assessment tools:* Risk assessment tools should be used to determine the impacts of planned development so appropriate measures can be taken to mitigate threats to infrastructure.

Enhance the ability to protect public health before and after a hazard event.

- **Mitigation -** Increased understanding of hazard events and their impact on public health can help protect the public before and after a hazard event. Communities should be designed to maintain sanitary conditions and prevent contamination to water supplies during and after hazard events.
- **Response and Recovery** - Scientific knowledge of potential threats to public health should be used in the creation of emergency response plans. Delivery of emergency services must be uninterrupted by the hazard. Public health conditions must be rapidly and effectively addressed to minimize the impact on people, animals, and the environment.

IV. RECOMMENDATIONS

Note: Can the four-page implementation recommendations below that are hazard-specific be put into a generic framework?

Coastal Inundation

- Model the impacts of events affecting the infrastructure, including the effects of seismic activity and waves;

- Examine the interaction between wind and inundation to determine the impact on building foundations and critical infrastructure;
- Focus research on new mitigation technologies for purpose of avoidance, resistance, rapid repair and restoration of critical infrastructure and other essential facilities; and
- Provide the technical basis for revised codes and standards for critical infrastructure and essential facilities by using risk and vulnerability assessment tools.

Drought

- Investigate drought predictions and indicators to improve operational decision making for water supply, transportation, hydropower, and irrigation;
- Incorporate social science research into effective public communications calling for demand reduction during drought and improving demand-side efficiencies; and
- Develop improved information for water supply operation, transportation, hydropower, irrigation augmentation systems, and for the development of new supplies and estimation of demand-side efficiencies.

Earthquake

- Produce comprehensive seismic design guidelines for major specialized structural systems (e.g. ports and harbors);
- Develop performance criteria based on actual infrastructures, research, and other work for design and retrofit methods;
- Improve system reliability and survivability by applying newly emerging sensor technologies to control structural response in critical systems;
- Improve lifeline survivability through applying improved decision-making tools, redundancy, automated network assessment and shutoff systems, system hardening and network optimization technologies;
- Predict collateral damage and cascading failures based on models of infrastructure interdependencies;
- Research soil-structure interaction to prevent failures caused by liquefaction; and
- Develop automated early-warning systems capable of reducing impact to critical infrastructure in urban centers at a distance from the earthquake epicenter.

Flood

- Analyze the vulnerability of infrastructure systems to flood hazard, identify critical infrastructure vulnerable to flooding and propose mitigation strategies; and
- Conduct vulnerability analysis to reduce the risk of cascading failures and identify the potential impact of flooding on water supply and waste-water and fortify those structures and systems.

Heat Wave

- Provide a technical basis for revised standards and codes that integrate local climatological and meteorological knowledge to improve standards for the built environment, improve safety and increase power distribution infrastructure, railway, roadway and pipeline resistance to excessive heat.

Human and Ecosystem Health Hazards

- Assure that access to critical care facilities, emergency response and emergency management services is maintained following disasters;
- Assess what infrastructures are at risk during any detrimental event that can create a subsequent human or ecological disaster; and
- Repair adequately critical infrastructure immediately following a disaster.

Hurricane

- Examine the interaction between wind, storm surge, and shallow water waves to determine the impact on building foundations and critical infrastructure;
- Assess the vulnerability of critical communication, transportation infrastructure and essential facilities to hurricanes;
- Develop an improved loss estimation modeling tool (e.g. HAZUS); and
- Create robust and storm-ready communication systems, essential facilities and transportation infrastructure.

Landslide

- Inventory and assess the vulnerability of the Nation's most critical infrastructure to landslide hazards; and
- Provide the technical basis for codes and standards and local zoning decisions that will locate hospitals, schools, power plants and other essential facilities away from the risk area or retrofit to provide adequate protection from the assessed landslide risk.

Space Weather

- Incorporate the use of risk analysis techniques to guide loss-reduction efforts at the federal, state and local levels, and produce a power grid risk assessment throughout the United States; and
- Develop comprehensive preventive and pre-event recovery plans.

Technological

- 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; and
- Develop disaster resilient technologies to mitigate the effects of technical hazards on critical infrastructures.

Tornado

- Develop and deploy new technologies that aid in better design, rapid repair and restoration of critical infrastructure and other essential facilities; and,

- Measure the response of bridges and other highway structures to tornadoes, including stability, serviceability and functionality leading up to and through the tornado event; and
- Develop mitigation strategies with local authorities, such as burying power and communication cables.

Tsunami

- Develop risk assessments and inundation models to inform the location of lifelines, hospitals, schools, power plants and utilities, fire and police stations and equipment away from the risk area or harden those structures for adequate protection from the assessed tsunami risk.

Volcano

- Translate results from volcano hazard assessments into risk assessments based on up-to-date assessment of population, property and infrastructure at risk;
- Evaluate the potential long-term impact of increased sediment loads following eruptions on streams, rivers, wetlands, lakes and dams, near all high-threat volcanoes; and
- Develop plans for minimizing disruption to power grids, communication pathways, and transportation on the ground and in the air.

Wildland Fire

- Assess the fire-safe characteristics of community designs, including layout, landscaping, and structure design, and building materials, and make recommendations for improved fire safety. Improve information and tools for homeowners and planners on fire-safe construction, landscaping, and community planning;
- Develop data and validated models to assess how well different community and landscape designs and post-fire restoration activities mitigate fire risk and damage, including offsite effects such as flooding and erosion, and damage to transportation and energy infrastructure; and
- Develop improved approaches to increase the resistance of infrastructure and communities to damage from wildland fire and its aftereffects.

Winter Storm

- Educate individuals and emergency managers about the varying impacts of winter weather on critical infrastructure based on specific meteorological and sociological parameters (e.g., time of day, day of week, urban vs. rural, surface temperature);
- Develop protocols and standards for rapid repair and restoration of critical infrastructure and other essential facilities subjected to wind, snow, and ice loads;
- Model the potential effects of severe winter weather on critical infrastructure and essential facilities in advance of storms and immediately after to predict and reduce vulnerability in the short-term and long-term; and
- Develop improved engineering standards, smarter transportation systems, more resilient critical infrastructure and essential facilities in addition to cost-effective

technology to ensure that these facilities maintain robust operations during severe winter weather

IV. RECOMMENDATIONS