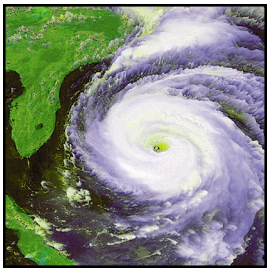
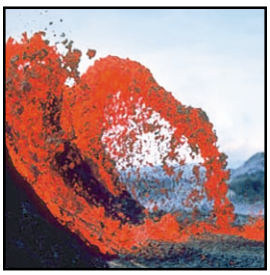






LESSONS FROM PPP2000

Living with

EARTH'S EXTREMES



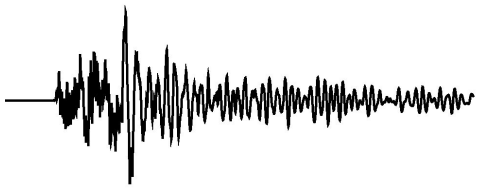
sndr
subcommittee on
natural disaster reduction

IBHS
Institute for Business
& Home Safety






Lessons from PPP2000:
Living with Earth's Extremes



Report from the PPP2000 Working Group

to the Office of Science and Technology Policy

Subcommittee on Natural Disaster Reduction

Edited by

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Captions for Cover Photographs

Center

Guam Memorial Hospital, shown here, lives with Earth's extremes. More than 25 typhoons have struck the island in the past 50 years, as well as a magnitude 8.3 earthquake in 1993. Because of the critical service it provides to 140,000 residents, and because of the high frequency of natural disasters, the hospital is very proactive in its preparedness and mitigation programs. The structure was designed to experience minimal or no damage from the next typhoon or earthquake and thus avoid repair or replacement costs. It has since been estimated that the benefit/cost ratio for this wind- and seismic-resistant construction is 20 to 1. FEMA.

Surrounding Images (Clockwise from Left)

- Hurricane Fran, September 1996. NASA RSD Image Library.
- Tornado, Alfalfa, OK, May 22, 1981. NOAA Photo Library.
- Flooded water treatment plant, Grand Forks, ND, April 1997. Photo courtesy of Advanced Engineering, Inc., Grand Forks.
- Wildfire near Sula, MT, August 2000. John McColgan, Bureau of Land Management, Alaska Fire Service.
- San Francisco's Marina District after Loma Prieta earthquake, October 1989. J.K. Nakata, U.S. Geological Survey.
- Damage due to waterborne debris from Hurricane Georges, Dauphin Island, AL, September 1998. FEMA PUB 338.
- Fire-resistant walls and roof of this house helped it survive a California wildfire. Photo courtesy of Decra Roofing Systems.
- Tornado Safe Room, Sioux City, IA. Dave Gatley, FEMA.
- Power system upgrades, St. Thomas, VI. A robust system limited power outages to only 15% of the island after Hurricane Georges struck in September 1998. FEMA.
- Shaded fuel break near residential property, Shingleton, CA, 1993. FEMA.
- A stainless-steel paddlewheel framing entrance to rebuilt Town Square, Grand Forks, ND. FEMA.
- Seismic improvement project protects critical aqueduct that carries water for 1.2 million people. Photo courtesy of East Bay Municipal Utility District, Oakland, CA.
- St. Croix students walk to undamaged gymnasium after Hurricane Georges, September 1998. Following Hurricane Marilyn in September 1995, most public buildings had been strengthened to withstand sustained winds of 110 mph. FEMA.
- Pumps and canals ensure adequate stormwater drainage in the context of tidal variation and level topography in Miami and Dade Counties, Florida. FEMA.
- Proper pile embedment and setback protected house during Hurricane Georges, Dauphin Island, AL, September 1998. Photo courtesy of American Red Cross.
- Arching lava fountain on East Rift Zone of Kilauea Volcano, HI, February 1983. J.D. Griggs, USGS.

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Overview

In the spring of 1997, the U.S. government and the U.S. insurance industry realized that they faced a common challenge: The conquest of natural disasters, which had once seemed nearly within reach, was proving more difficult than expected. Losses from natural disasters had been doubling or tripling each decade since 1960, and the century's steady progress in reducing deaths and injuries due to natural disasters had begun to level off. Furthermore, there was concern that a single disaster – for example, a catastrophic East Coast hurricane or a repeat of the 1906 San Francisco earthquake – could kill thousands, cost hundreds of billions of dollars, disrupt the national economy, and exhaust the reserves of the insurance industry.

The statistics were alarming. Seven of the ten costliest U.S. disasters had occurred since 1989, and the President's Office of Science and Technology Policy estimated that natural disasters were costing the United States on average a billion dollars each week and were consuming nearly one percent of GDP. This emerging pattern of disaster prompted Representative Bill Emerson and Senator Ted Stevens, in 1995, to note, "Hurricane Andrew and California's Northridge earthquake together cost more ($24 billion [of Federal outlays]) than what the government spends annually on running the Federal court system, aiding higher education and pollution control, combined." We are paying a high price for the way we live on our beautiful – but dangerous – planet.

One of the clear lessons of the 20th century's well-intentioned efforts to reduce the human and economic costs of natural disasters is that doing so is not as simple as it first appears. We have learned that structural solutions are often unsatisfactory; the human, environmental, and economic cost of attempting to engineer a society completely resistant to natural disaster is too high. The United States, for example, has spent billions of dollars on structural attempts to control flooding with dams, levees, and channelization. Although these techniques have often protected communities from flooding, they have also resulted in other costs including impairment of natural ecosystem functions and increased downstream flood peaks. In addition, they created new vulnerabilities connected with catastrophic failures of flood-control structures.

Note: This report results from a partnership between public and private entities and describes the content of the forum as recorded and interpreted by the sponsors assisted by the PPP2000 working group. The opinions and recommendations expressed in the report do not necessarily represent those of the Federal government, of the private partners, or of any particular individual.

Although the recurrence rate of earthquakes, volcanoes, and floods has not changed during the past century, the nature of associated disasters has mutated because of population growth and rapid changes in our society:

- More people live on marginal lands subject to floods, landslides, hurricanes, earthquakes, wildfire, wildlife disease, volcanoes and other hazards;
- We now stockpile large quantities of hazardous materials – petroleum products, animal wastes, etc. – in structures whose integrity can be breached by extreme events;
- Technological advances have paradoxically brought new vulnerabilities. For example, welded joints in steel-frame buildings, which were initially believed to lower building costs, cracked during the Northridge earthquake and will cost billions of dollars to repair or replace;
- Modern economies depend on large-scale infrastructure – networks of roads, pipelines, telecommunications, and computer systems – which have turned out to be both fragile and costly to repair when damaged by natural hazards.
- Natural disasters cause more than physical damage. They shut down businesses, many of which never re-open. Indirect societal costs associated with loss of jobs and business disruption often exceed the costs of repairing structures.
- Modern business practices, in particular just-in-time inventory management, have created new vulnerabilities. Taiwan's September 1999 earthquake directly affected the local economy but also echoed around the world; within days, Hewlett-Packard chief executive Carly Fiorina warned financial analysts that HP's current earnings would suffer because of "disruptions and delays in the PC supply chain" caused by the earthquake.
- Globalization of the world economy now makes all of us vulnerable to disasters wherever they occur.

Is There A Solution? In April 1997, Public Private Partnership 2000 was established to seek opportunities for government and private-sector organizations to work together to develop new strategies that will reduce our vulnerability to natural hazards. Its creation recognized that finding durable and comprehensive solutions will require continuing dialog among, and concerted action by, all sectors of our society. Past approaches to reducing the economic and social impacts of natural hazards have not fully solved the problem because it is too large and too complex to be handled by any one group.

PPP2000 is cosponsored by the Subcommittee on Natural Disaster Reduction (a subcommittee of the National Science and Technology Council's Committee on the Environment and Natural Resources and comprising 16 Federal agencies), the Institute for Business and Home Safety (a property/casualty insurance organization dedicated to reducing deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters), and more than 20 private-sector organizations.

The basic tool developed by the Partnership in its first phase, which lasted from September 1997 to October 1999, was the Public Private Partnership 2000 forum. Each forum was a one-day meeting that brought together around 100 technical experts and high-level policy officials to discuss a particular aspect of natural disaster reduction. The forums provided a safe environment where unconventional alternatives could be proposed and debated and new collaborations could be developed. Forums were held in the White House Conference Center, the Senate and House Office Buildings, the National Academy of Sciences, the World Bank, and headquarters of associations in and around Washington, D.C. Each forum was co-sponsored by one or more private-sector organizations.

Participants were drawn from the ranks of Federal, State, and local government, NGO's, academia, and the private sector, to ensure a diversity of perspectives. Each day consisted of one or two keynote talks plus three or four panel discussions. About half the time was reserved for general discussion among the participants.

Lessons Learned from the Forums. The forums confirmed that our society has made considerable progress in dealing with many specific aspects of natural hazards – for example, assessment of earthquake hazards, or safe construction of dams. Although progress in specific technical issues is important, the value of the forums lay in uncovering unexpected patterns and themes that emerged when experts in different areas shared their perspectives. The following general observations provide context for formulating policies to reduce natural disaster losses:

- Natural hazards, which the geologic record shows have been shaping the planet for millions of years, are not a problem to be solved but an essential part of how the earth functions. Ecosystems and individual species have evolved to coexist with them, and preventing their occurrence alters the natural system, often in undesirable ways. In 1996, the Department of the Interior was in the unusual position of creating an artificial flood on the Colorado River to mimic the natural spring floods in order to restore Grand Canyon streambanks. Similarly, the U.S. Army Corps of Engineers has recently begun to de-channelize the Kissimmee River in Florida, to restore the original flood-based ecosystem that it had altered 35 years earlier. Wildland fire and beach erosion are other examples of hazards for which the once-standard approach – control of natural processes – is now seen to be economically and environmentally unsound.
- Natural hazards become disasters only when they collide with people, structures, or other property. Natural hazards are a critical part of how the earth functions; they usually cannot – and mostly should not – be eliminated. Efforts to reduce losses should focus on human behavior, the real cause of natural disasters. FEMA's Associate Director of Mitigation, Mike Armstrong, articulated this concept when he noted: "We can't control Mother Nature; we can affect human nature."
- Natural disasters are neither acts of God nor simple technical problems. Rather, they result from human decisions about how we choose to live and build. As

Dennis Mileti has stated in *Disasters by Design*[†] natural disasters "are symptoms of broader and more basic problems. Losses from hazards – and the fact that the nation cannot seem to reduce them – result from short-sighted and narrow conceptions of the human relationship to the natural environment."

- Whether an extreme event becomes a natural disaster depends on our ability to predict, prepare, and mitigate, and better information about the natural environment and natural earth processes is a key to reducing losses. Improved technology for warning systems will yield immediate benefits; for example, lahar warning systems are being tested along the slopes of Mount Rainier in Washington State. Assessment of hazards across the Nation will allow for better land-use planning, building codes, and mitigation. Basic research leads to fundamental breakthroughs, like the theory of plate tectonics that greatly improved our knowledge of earthquake and volcano hazards. The recent experience with El Niño demonstrates the value of all three types of scientific and technical research. Long-term studies of coupled ocean-atmosphere oscillations enabled NOAA in 1997 to predict an unusually powerful El Niño during 1997-98. NOAA and USGS worked with the California Office of Emergency Services to prepare maps of landslide hazards, showing former landslide deposits, debris-flow source areas, and dangerous rainfall thresholds for the San Francisco Bay region. This prediction enabled individuals and emergency responders to prepare for this extreme event; no loss of life occurred from these landslides, compared to 25 killed in comparable storms in 1982.
- Communicating information about risk is not as simple as it seems, and many are unaware of even well- known dangers. For example, many people suffered carbon monoxide poisoning caused by gasoline generators operated indoors following the 1997 Northeast ice storm; the warning information on the generators was somehow inadequate during the crisis. Communication problems are exacerbated where language and cultural barriers exist, as is often the case in metropolitan areas.
- Natural disasters know no boundaries. Smoke from forest fires in Indonesia or Mexico can make air unbreathable in other nations. Ash plumes from Alaskan volcanoes can disrupt air traffic half a continent away. Emerging diseases and global warming impact the entire planet.
- Finally, it is now recognized that natural disasters, and how we choose to deal with them, have significant social and political implications. Many current approaches merely transfer risk to those who can't object effectively– less powerful groups or future generations. For example, tornadoes and floods disproportionately affect poorer segments of our society. Government at all levels has a responsibility for considering these issues of social equity in its policies.

Outcomes of PPP2000. One goal of PPP2000 was to form new collaborations, and several formed in response to an immediate issue:

[†]Mileti, D. R., Joseph Henry Press, Washington, 1999

- Following the first forum, NOAA, IBHS, and the University of Oklahoma held a two-day workshop for casualty insurers on the science and impacts behind the 1997-1998 El Niño event just then getting underway. In November, during the lull between the summer's forecasts and the impacts on the Western States that emerged in January 1998, insurers had the opportunity to hear from experts on the likely course of the event, and provide feedback to forecasters with respect to on-the-ground concerns.
- NOAA and IBHS held a second workshop a year later, to compare notes on the success of the El Niño forecast (as seen from the NOAA side) and the use of the forecast (as seen by industry). During the second workshop, NOAA scientists shared information on climate variability on time scales longer than ENSO (El Niño/Southern Oscillation), e.g., the Arctic Oscillation, the North Atlantic Oscillation, and the Pacific Decadal Oscillation. Observation and forecast of these fluctuations promise to provide useful planning information to agriculture, utilities, water resource managers, and insurers; dialog between NOAA and the industry continues.

In addition, several long-term collaborations resulted from the forum series:

- The World Bank, after participating in forum 3, co-sponsored forum 5 and thereafter continued to be a major partner in the dialog. From these endeavors, and given a sense of urgency following Hurricane Mitch, the World Bank has established a Disaster Management Facility, headed by Alcira Kreimer, that will ensure that future World Bank investments will more fully incorporate natural disaster reduction measures.
- The DMF has itself produced a new collaboration, called ProVention. At the opening conference, James D. Wolfensohn, President of the World Bank Group, announced that "the ProVention Consortium will help poor countries anticipate natural catastrophes so that when they do strike, as they inevitably will, there will be less suffering, destruction and disruption."
- A by-product of the PPP2000 Real-Time Hazards forum was the creation of a congressional Natural Hazards Caucus, co-chaired by Senators Ted Stevens and John Edwards. The caucus is supported by the American Geological Institute, the American Geophysical Union, and other non-governmental organizations. The caucus will serve as a clearinghouse for hazards information on Capitol Hill.

Where Do We Go From Here? CNN now brings images of devastation into millions of living rooms, almost as soon as a disaster strikes. Public awareness of the costs of natural disasters is growing. Because our society is still young, we have both the physical flexibility to decide where our development should take place and the behavioral flexibility to modify our ways – the rise in recycling rates and seat-belt use attests to our willingness to change once we understand and accept the need. How can this public interest and opportunity be combined with the impressive advances in science and technology to achieve a safer world?

We have an opportunity to prevent future natural disasters, rather than simply picking up the pieces after disaster strikes. Just as exercise and good diet – not faster ambulances and sharper scalpels – should be our first defense against heart disease, we as individuals need to develop good habits about how we live and build on this planet.

Government has several important roles, but it should cease indemnifying reckless decisions. First, it must foster partnerships between the public and private sectors and must specifically ensure that public-sector programs are coordinated both among government agencies and with private sector activities. It must consider the potential hazards implications in all its decisions, including siting of facilities, tax law, and compensation for "victims." As *de facto* insurer of last resort, government has an obligation to taxpayers to avoid creating incentives for reckless behavior. While it may be politically appealing to bail out individuals and businesses that have suffered after choosing to live in harm's way, the result is repetitive loss. Some properties have been damaged and rebuilt scores of times using insurance or taxpayer funds. Nonetheless, government will always have a responsibility for responding to disasters and assisting recovery.

Government has a clear responsibility for funding hazards research and collecting and maintaining hazards information. As government transfers responsibility for hazards to the public, it will have to provide clear and accurate information so that individuals and businesses can make sound decisions about how to live and build.

Gilbert White, the author of the first national assessment of natural hazards in 1975, recently wrote: "If the nation is to benefit fully from the growing and deepening knowledge of natural hazards, some effective method must be found to translate that understanding into operative public policy and private procedures." USGS Director Charles "Chip" Groat noted that "science by itself will not protect us. Federal, State and local governments, the private sector, volunteer and charitable organizations, and individual citizens must work together in applying the science to make our communities safer."

This book comprises reports summarizing the major discussions and recommendations that emerged at each forum. Additional information and links to public and private sector partners can be found on the web at:

http://www.usgs.gov/ppp2000.

CHAPTER 1

The Insurance Sector

Natural Disaster Reduction Initiatives of the Insurance Sector

Public Private Partnership 2000
Report on First Forum
10 September 1997

The history of efforts to reduce the economic, environmental and human costs of natural disasters is replete with unforeseen repercussions of well-intentioned policies. Early governmental efforts to control nature with concrete and steel, to create a society resistant to natural hazards, often proved costly, ineffective and environmentally unsound. More recent approaches have attempted to encourage accommodation with nature in an effort to develop a sustainable society resilient to natural disasters. However, we do not yet know how to do this.

Public Private Partnership 2000 (PPP2000) was established to address this situation. It seeks opportunities for government and nonprofit, private-sector organizations to work together to develop new strategies to reduce vulnerability to natural hazards in communities throughout the Nation. The creation of PPP2000 implicitly recognizes that past approaches to reducing the economic and social impacts of natural hazards have been unsuccessful and that the best hope for a solution is a continuing dialog involving all sectors of our society. The problem is too large and too complex to be handled by any one group.

On September 10, 1997, PPP2000 sponsored the first forum in a series dedicated to exploring new approaches to natural disaster mitigation. The forum focused on initiatives of the insurance sector and brought together representatives from federal, State and local governments, the private sector, and non-governmental organizations. The primary goals of the forum were to bring all of the stakeholders together and to break through traditional patterns of thinking. The forum included discussion of experiences with previous policies and programs related to reducing the impact of natural hazards. Despite efforts at mitigation, economic losses from natural disasters continue to grow exponentially, tripling every decade, causing an average of $1 billion

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in economic losses in the United States each week and threatening the safety of thousands of Americans.

Several forum speakers addressed the issue of "government failure" and "market failure" with respect to natural hazards. Economic theory would predict that a rational citizen, well informed and guided by the "invisible hand" of a free market, could be relied on to minimize net losses from natural disasters (floods, landslides, hurricanes, earthquakes, wildfires, volcanic eruptions, hail, tornadoes, etc.). However, this model does not adequately describe the situation. First, government policies and regulations have greatly distorted the free market. Several well-intentioned government programs have restricted market forces and in some cases have paradoxically encouraged development in hazard-prone areas. For example, some states require insurers to provide below-cost policies for homes built in flood-prone coastal regions; curiously, the law requiring such policies was originally intended to protect inner-city homeowners. Similarly, for humanitarian and political reasons governments choose to provide emergency disaster relief. This alleviates short-term suffering but arguably encourages further development in hazardous locations.

"Market failure" may also arise from a lack of information. Many in our society are uninformed about natural hazard risks, cannot accurately quantify their costs, or believe–often mistakenly–that government will somehow protect them. As a result, individuals discount hazard risks when making economic decisions.

Information failures occur at several levels. At the deepest level, important physical processes are not well understood; we simply do not know enough to adequately characterize and assess the risks from most hazards. This information failure can be addressed only through research in basic earth science. At the next level, monitoring data, warning systems, and actuarial information are not readily available. This lack of information is due to legal barriers (for example, insurance loss data needed to calibrate risk models are proprietary and protected by privacy laws), to the absence of standardized classifications and data formats, and to a shortage of funds needed to collect and disseminate information. Finally, the public has not chosen to educate itself about the true risks posed by natural hazards. For our society to significantly reduce the economic and human losses from natural disasters, it must first make natural disaster reduction a public value, an accepted part of the way we do business, in the same way that wearing seat belts has become an accepted part of riding in a car.

Forum participants observed that many seemingly unrelated actions and policies, both public and private, are developed without adequate consideration of their impact on natural hazard losses. For example, by permitting deduction of losses, the tax code in effect creates incentives for development in hazard-prone areas. Similarly, State laws that guarantee availability of insurance at subsidized rates, though well-intentioned, have removed a direct disincentive to development in harm's way. Even those policies directly concerning natural hazards have sometimes failed to consider long-term consequences. Conversely, the wetland protection provision of the Clean

Water Act, which was not directed at natural hazard reduction, may have effectively reduced flood losses by preventing development in hazardous areas.

Two patterns emerged from the discussion. First, issues surrounding natural hazards cannot be isolated from other public policy issues, such as welfare, climate change, and economic development. Second, decisions on how to address natural hazards will spill over into other aspects of our society. These patterns suggest that developing effective strategies for dealing with natural hazards will require a broad range of disciplines and participants, including business people, scientists, engineers and all levels of government.

Proposed Actions

The Forum stimulated broad discussion among the groups and led to the following proposals:

- Make natural disaster reduction a public value. This could involve use of "disaster impact statements" prior to significant public or private activities, analogous to the EIS (Environmental Impact Statement) requirements of NEPA;
- Emphasize structural and non-structural mitigation;
- Establish effective warning systems;
- Develop financing methods to pay for mitigation;
- Create an accessible data base containing disaster information using standardized classifications and formats;
- Expand consideration to include international partners and international issues.

Forum 1: Natural Disaster Reduction Initiatives of the Insurance Sector

Truman Room
The White House Conference Center
Washington, D.C.

September 10, 1997

9:00 WELCOME AND OPENING REMARKS

9:00 Dr. John H. Gibbons, Assistant to the President for Science and Technology, Office of Science and Technology Policy

9:15 Honorable William Daley, Secretary of Commerce

9:30 Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

9:45 General Wilson Cooney (ret.), Chairman of the Board, Institute for Business and Home Safety

10:00 OPENING PRESENTATIONS

10:00 *Overview of the PPP 2000 Forum on Public Policy Issues in Natural Disaster Reduction*
Dr. Walter Hays, U.S. Geological Survey, PPP 2000 Forum Working Group

10:10 *Keynote Presentation: FEMA's Role*
Honorable Kay Goss, Associate Director for Preparedness, Training, and Exercises, Federal Emergency Management Agency

10:25 *Keynote Presentation: Mitigating the Effects of Natural Disasters: The Insurance Sector in Partnership with Other Communities*
Harvey Ryland, President, Institute for Business and Home Safety

10:40 *Discussion and Focused "Why Are We Here?" summary*
Moderated by: Professor Henry Quarantelli, University of Delaware

10:55 Break

11:25 PUBLIC PRIVATE POLICY ISSUES: SPECIFIC OPPORTUNITIES TO CREATE A COMMON AGENDA TO WORK TOGETHER: A PERSPECTIVE BY THE PRIVATE INSURANCE SECTOR
Moderator: Professor Henry Quarantelli, University of Delaware

11:30 *Insurance: Policy Issues and Natural Hazards*
John Mulady, Director Industry Relations, USAA Insurance Company

11:45 *What the Insurance Industry is Doing Today*

D. Bryan Freeman, Assistant Vice President - Underwriting, State Farm Fire and Casualty Co.

12:00 *Where Potential Collaboration Exists*
Eldon Ziegler, Vice President Industry Affairs, Nationwide Insurance Company

12:15 *Discussion/Questions and Morning Wrap Up*
Moderator

12:30 Lunch (Provided)

12:30 *Social and Economic Considerations of the Insurance Sector*
Professor Dennis Mileti, University of Colorado Natural Hazards Center

1:30 THE INVOLUNTARY MARKET AND REGULATION: PUBLIC POLICY EFFECTS ON INSURANCE

1:30 *Public Policy Driving an Insurance Market*
Ronald Demerjian, President, Property Insurance Plans Services Office

1:45 *A State's Perspective*
Dottie Harris, Special Assistant to the Superintendent, New York State Insurance Department

2:00 *National Flood Insurance Program: A Public Private Interaction*
James Sadler, Assistant Vice President, Unisun Insurance Company

2:15 *The Buildings Initiative and Partnering with the Insurance Industry*
Henry Kelly, Acting Associate Director for Technology, Office of Science and Technology Policy

2:30 Break

3:00 DISCUSSION AND DEVELOPMENT OF AN ACTION PLAN
Moderator: William Hooke

Issues to be discussed:

Identification of the Primary Issues Associated with Creating Public Private Partnerships

Specific Opportunities to Create A Common Agenda to Work Together.

Where do we go from here: Barriers and Opportunities

4:20 *Final Wrap up*
Dr. William Hooke, Chairman, SNDR

4:30 CONCLUDING REMARKS

4:30 *Introduction to Second Forum*

4:45 *Closure*
Harvey Ryland and William Hooke

5:00 Adjourn

CHAPTER 2

Managing Catastrophic Risks

The Uncertainty of Managing Catastrophic Risks

Public Private Partnership 2000
Report on Second Forum
11 December 1997

On December 11, 1997, PPP2000 held its second forum on natural disaster reduction, "The Uncertainty of Managing Catastrophic Risks," which was cosponsored by the University of Pennsylvania's Wharton School. More than 100 participants from academia, Wall Street, non-governmental organizations, and Federal, State and local government discussed the interdependent roles of the private and public sectors in creating incentives and institutions to expand our capacity for managing natural disaster risk. Discussion focused on innovative approaches including new financing mechanisms of insurance, re-insurance and capital markets, as well as increased incentives for mitigation. This forum expanded on the theme developed in the first forum that the financial capacity of the insurance industry is inadequate to cope with a megadisaster such as a repeat of the 1906 San Francisco earthquake (estimated losses of $100 billion in current dollars) or even a major East Coast hurricane (estimated losses of $75 billion).

Mitigation: Modern modeling techniques allow us to identify cost-effective mitigation methods which can be expected to benefit property owners, improve the solvency of primary insurers and reinsurers, and reduce the need for costly post-disaster aid by government agencies. However, research on consumer decision making shows that the benefits of mitigation are not recognized by the vast majority of homeowners due to their misperception of the risk, their short-term outlook, and the upfront costs. Consequently, adoption of mitigation must be encouraged by the public and private sectors through education on true risks and benefits and through explicit incentives such as the following: (1) lowering insurance rates and deductibles for those who invest in effective measures and (2) linking lower insurance premiums to long-term

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loans for mitigation, which would reduce total cost to homeowners and make clear the benefit of investing in loss reduction measures.

The public sector can affect mitigation by creating and enforcing building codes and land use regulations. Governmental bodies can limit post-disaster assistance practices that perversely reward those who choose not to mitigate and who ignore insurance options.

Challenges emerged in the presentations and subsequent discussions. There was general agreement that current insurance regulation is not conducive to creating private sector incentives. Rate restrictions and artificial pooling of risks have created a situation where insurance premiums do not reflect the actuarial risk. As a result, insurers have little incentive to reduce prices or offer lower deductibles to those adopting mitigation. Several participants pointed out that these market distortions are poorly understood and called for further research to illuminate this important element of the public policy debate.

Insurance, Reinsurance, and Capital Market Instruments: A close look at the insurance and reinsurance industry reveals that its capacity to bear large catastrophic losses may be substantially less than aggregate figures suggest. Market and industry structure limits the extent to which reserves might be available to cover a specific mega-disaster. Furthermore, premium-derived capital reserves are currently limited by tax regulation. Reinsurance, while permitting pooling over a wide enough geographic area to create greater statistical independence of low-probability, high-severity events, inevitably carries with it incentive conflicts between primary and secondary insurers which result in increased auditing costs. These additional costs must eventually be borne by the consumer. In addition, the price of reinsurance is cyclical and volatile, making it difficult for insurers to consistently obtain coverage when they need it.

Researchers and practitioners are currently exploring how to bring into play large diversified pools of capital that might efficiently complement traditional insurance and reinsurance risk transfer mechanisms for catastrophic risk. The U.S. securities market is so large ($15-20 trillion) that capacity relative to natural disaster losses is not an issue. Therefore it is not surprising that using capital market instruments such as bonds to provide protection against losses from hurricanes and earthquakes is now beginning to take place. Inclusion of such securities in diversified portfolios can enhance portfolio efficiency because of attractive pricing and their lack of correlation with conventional asset classes. However, before such financial instruments can become an effective complement to insurance and reinsurance, they must be able to resolve the incentive conflicts between the primary and ultimate risk bearers. Emerging modeling technologies and objective indices will reduce information asymmetries between parties and facilitate this process. Several participants envision substantial progress towards a fully functioning market over the next five years.

The Need for Public Private Partnerships: Current regulation allows property owners in hazard–prone areas to transfer a significant part of their catastrophic losses

to the general taxpayer. Insurance regulation may give rise to cross subsidies and thereby impede insurers' attempts to efficiently diversify their risk. Furthermore, public expectations of Federal low-cost reconstruction loans for the uninsured, along with a history of subsequent forgiveness, have discouraged mitigation efforts and diminished the perceived need for insurance among property owners. Some speakers asserted outright that private market mechanisms have fared rather poorly in this area

The recent emergence of State catastrophe funds, such as the California Earthquake Authority and the Florida Hurricane Catastrophe Fund, has led to debate about their financial effectiveness and the need for them. A dominant theme throughout the forum was the need for new public policy to support market-driven behavior, such as immediate action by states to permit the use of sound actuarial estimates of catastrophe risk in the insurance rate setting process. At the same time, participants recognized that government has an important continuing role in ensuring that special financial consideration is given to the truly disadvantaged. Finally, it was also noted that for the very highest layers of catastrophe risk, the government (and consequently the taxpayer) is now, by default, the insurer of last resort.

Forum Themes

Several overarching themes emerged during the forum.

- What is the role of science and modeling in informing hazard policy? What standards are needed to properly evaluate models? Because efficient markets require equal access to information, there is a strong need for unbiased science and sound modeling. Models are also needed for assessing the benefits and costs of various mitigation strategies.
- How can the framework of funding sources available for catastrophe insurance be expanded and refined to cope with a potential megadisaster?
- Can rate regulation of insurance be justified? What regulations are needed to ensure solvency?
- Public-private partnerships should not be a gift to the private sector; such partnerships can only prosper when all parties share in the benefits and the risks. What are the best ways to ensure that benefits and risks are distributed equitably?
- There is an ongoing need for grassroots education to make the reduction of losses from natural disasters a public value. How can governments and the private sector best work together to develop the needed awareness among the public, the real estate and construction industries, and other significant audiences?

Forum 2: The Uncertainty of Managing Catastrophic Risks

Truman Room
The White House Conference Center
Washington, D.C.

December 11, 1997

Sponsored By:

The Wharton School of the University of Pennsylvania

9:00 WELCOME AND OPENING REMARKS

9:00 William H. Hooke, Chair, Subcommittee on Natural Disaster Reduction

9:10 Harvey G. Ryland, President, Institute for Business and Home Safety

9:20 Anthony Santomero, Professor of Finance and Director, Financial Institutions Center, The Wharton School of the University of Pennsylvania

9:25 Ellen Seidman, Director, Office of Thrift Supervision

9:40 PANEL 1: IMPACT OF UNCERTAINTY ON EVALUATING MITIGATION MEASURES

Moderator: Ellen Seidman

9:40 Howard Kunreuther, Professor of Decision Sciences and Public Policy and Management, The Wharton School of the University of Pennsylvania

9:55 Paul Kleindorfer, Professor of Decision Sciences, Economics, and Public Policy, The Wharton School of the University of Pennsylvania

10:10 Open Discussion

10:40 Break

11:00 PANEL 2: BUILDING CODES VS. FINANCIAL INCENTIVES POLICY PERSPECTIVES ON DEVELOPING MITIGATION STRATEGIES

Moderator: J. Robert Hunter, Director of Insurance, Consumer Federation of America

11:00 Craig Wingo, Deputy Associate Director for Mitigation, Federal Emergency Management Agency

11:10 Yacov Y. Haimes, Professor of Engineering, University of Virginia

11:20 James Ament, Assistant Vice President, State Farm Fire and Casualty

11:30 Open Discussion

12:00 Lunch (Provided)

1:00 PANEL 3: EVALUATING THE ROLE OF NEW FINANCIAL INSTRUMENTS IN CATASTROPHIC RISK MANAGEMENT

Moderator: Christopher Lewis, Senior Manager, Ernst & Young

1:00 J. David Cummins, Professor of Insurance and Risk Management, The Wharton School of the University of Pennsylvania

1:10 Neil Doherty, Professor of Insurance and Risk Management, The Wharton School of the University of Pennsylvania

1:20 Open Discussion

1:40 PANEL 4: STRATEGIES FOR UTILIZING FINANCIAL INSTRUMENTS WITH INSURANCE AND REINSURANCE

Moderator: Christopher Lewis

1:40 Robert Litzenberger, Director, Derivatives Research & Quantitative Modeling, Fixed Income Division, Goldman Sachs

1:50 Stephen Goldberg, Chief Actuary, USAA Property Casualty Insurance

2:00 Richard Zeckhauser, Professor, Kennedy School of Government, Harvard University

2:10 Open Discussion

2:30 Break

2:45 PANEL 5: THE ROLE OF THE PUBLIC AND PRIVATE SECTORS IN MANAGING CATASTROPHIC RISK FROM NATURAL DISASTERS

Moderator: Robert Klein, Associate Professor and Director, Center for Risk Management and Insurance Research, Georgia State University

2:45 Robert Litan, Director, Economic Studies Program, Brookings Institution

2:55 Edward Jobe, Director, American Reinsurance

3:05 Franklin Nutter, President, Reinsurance Association of America

3:15 Robert Irvan, Senior Vice President, CIGNA

3:25 Open Discussion

3:55 WRAP-UP

4:05 *Introduction to Next Forum*

4:15 Adjourn

CHAPTER 3

Megacities

Cities and Megacities at Risk from Natural Disaster

Public Private Partnership 2000
Report on Third Forum
21 January 1998

On January 21, 1998, PPP2000 held its third forum on natural disaster reduction, "Cities and Megacities at Risk from Natural Disaster." The event was cosponsored by the Stanford University John A. Blume Earthquake Engineering Center, the World Seismic Safety Initiative (WSSI), and the World Federation of Engineering Organizations (WFEO). More than 100 representatives from academia, the private sector, non-governmental organizations, and local, State, and Federal government participated, offering diverse perspectives on natural disasters and on the links between natural hazards and other urban issues.

The World's population has rapidly urbanized during this century, for technological, social and political reasons. While such urbanization yields diverse benefits – economies of scale and sharing of infrastructure resources – it also poses difficult challenges with respect to natural disaster risk and risk management. Cities now depend on the functioning and interaction of complex social, political and engineering systems, many of which are not well understood and all of which are subject to disruption by natural disaster. We are only beginning to comprehend these vulnerabilities and their implications for disaster mitigation, for emergency management, and for disaster recovery. One aspect of this problem is recognized, however: Our ability to respond effectively to urban natural hazards is closely linked to larger social issues and to the structure of our society. The fault lines in a city or a society become apparent under the stress of a natural disaster; true natural disaster reduction requires strengthening the social fabric.

The forum considered cities in the United States and abroad; concerns of both the private and public sectors; issues related to a variety of hazards, including earthquakes, hurricanes, coastal erosion and technological hazards; the interrelationships

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and specific responsibilities of individuals, neighborhoods, the business community, the insurance sector, private organizations, different levels of government, and the international community in addressing natural hazards; the need for reliable and easily available information about hazards; and mitigation, response, and recovery efforts at both the local and national levels.

Challenges of Natural Disaster Risk in Cities and Megacities

Today's cities and megacities are unlike any that existed in the past, and thus we cannot expect our experience with historical disasters to guide us in the future. Cities are larger than ever before and growing in size at an unprecedented rate. The average population of the world's 100 largest cities has swelled from 700,000 in 1900 to 5 million in 1990. As cities have grown, they have also become increasingly dependent on a large and complicated infrastructure that is vulnerable to natural disaster. Finally, cities have often expanded onto hazardous lands. For various reasons, people are choosing to live in harm's way.

New threats have arisen as the megacities have grown. In addition to the four horsemen (famine, war, disease, and death) recognized by the ancients, our megacities now face new perils: Climate change, sea level rise, civil unrest and terrorism, and emerging and reemerging diseases. The combination of natural and technological hazards creates an environment in which effects may be multiplied through cascading multi-disasters. For example, an earthquake can lead to a breakdown in the social order and infrastructure, resulting in rioting, the spread of disease through unsafe drinking water, and disruptions to the local economy. Because economic globalization has made the world's cities increasingly interconnected, events in Manila may affect Madrid, Mexico City and Milwaukee.

Global competition for jobs and the economic need to keep costs down are leading to deforestation, loss of biodiversity, marine pollution, and a decrease in cities' ability to protect themselves from environmental impacts and from the shock of a natural disaster. Societal vulnerabilities, such as increasing gaps in wealth and pre-existing health problems, exacerbate the havoc caused by a disaster. Mitigation and preparedness have not been high priorities in the competitive world economy; worldwide, the approach has been of responding to disasters rather than mitigating their effects. At the level of individual companies, the same is true; a focus on the bottom line and the quarterly earnings statement has reduced disaster preparedness efforts in many companies.

Reliable and accessible scientific information about risk is critical to making sound decisions about appropriate mitigation and response strategies. The speed and completeness of the transformation that cities have undergone in the past century complicate efforts to characterize and communicate natural disaster risk. The relative infrequency of natural disasters in some places has created a low level of awareness of the risk. Yet natural forces, such as coastal erosion and sea-level rise, are magnifying urban vulnerability to hazards. A primary challenge, therefore, is to expand

risk assessment efforts to better understand the nature and magnitude of the natural hazard risk that cities face.

A second challenge is to communicate the information about risk and mitigation to the many and diverse stakeholders in a form that is meaningful and useful to them. Most megacities contain a mix of peoples from varying ethnic, cultural and socio-economic backgrounds. Special issues arise when trying to communicate information – about hazards in particular – to such diverse audiences. Yet improved understanding of risk and mitigation is an essential part of any effort to provide effective mitigation, response, and recovery.

For mitigation to be truly effective, it must become connected with community priorities, especially in smaller cities, and must be shown to be a good investment. An expanded base of support, from utility companies, the news media, the insurance industry, property owners, and others, will help in developing coalitions and champions for mitigation. Cities and megacities have a unique concentration of economic and political power that can prevent – or encourage – mitigation.

The Role of Public-Private Partnerships

The forum highlighted the idea that, with a common interest in reducing the risk of natural disasters in cities, and with different resources at their disposal, both the public and private sectors could benefit from partnerships in which they work together to address the natural disaster risk of cities. In addition to describing the nature and magnitude of the risk that cities face, many forum participants offered examples of existing risk reduction and management efforts, particularly public-private partnerships, that can serve as models for future work. Mitigation plans need to exist and be coordinated at many levels, from a single company or building to a city or region.

Key Issues and Challenges

Several key issues were identified in the course of the discussion. Many of these issues echo concerns raised at previous forums, with a heightened intensity due to the size, complexity, and interconnections of today's cities.

- Partnerships are needed. Natural disasters are too large and costly to be handled by any one sector of the society.
- Mitigation is critical. Post-event response and recovery are necessary, but alone they are not an efficient or effective means to reduce cities' risk from natural and manmade disasters in the long term.
- Science and technology must be employed to help reduce the vulnerability of cities and megacities to natural disaster.
- Hazard mitigation should be integrated into the general urban development process. How sustainable are cities in their current form?
- In many regions, cities have grown and changed significantly since the last major disaster. Past experience alone, therefore, is not a reliable predictor

of the future. How have the changing size and nature of cities affected their vulnerability to natural disasters and their ability to manage risk?

- Local knowledge of populations and conditions is critical. How are different groups within cities affected differently? In what ways, and to what extent, do the poor and other marginalized groups suffer disproportionately? What could be done to reduce the vulnerability of these groups to natural hazards? Potential inequities need to be addressed in mitigation and disaster relief policies.
- Is there a post-event window of opportunity for reducing risk? If so, does it exist everywhere, or only in developed countries? How can it be exploited most effectively?
- Natural disaster reduction must be made a public value. Reaching out to the community and especially to children through the school systems is essential. Creative thinking at all levels and strong public-private partnerships are needed to accomplish this goal, which has been emphasized in all forums to date.

Forum 3: Cities and Megacities at Risk

Senate Hart Building, Room 902
Washington, DC

January 21, 1998

Sponsored By:

The Stanford University John A. Blume Earthquake Engineering Center
World Seismic Safety Initiative
World Federation of Engineering Organizations

9:00 WELCOME AND OPENING REMARKS

9:00 William Hooke, Chair, Subcommittee on Natural Disaster Reduction

9:10 Gloria C. Craven, USAA Insurance

David Verardo, Office of Senator Ron Wyden

9:15 John Beaulieu, Deputy State Geologist of Oregon

9:25 MORNING KEYNOTE ADDRESS

9:25 *Overview of Global and Domestic Issues and Risk in Cities and Megacities*
Ben Wisner, Cal State University, Long Beach

9:45 Discussion

10:00 Break

10:15 PANEL 1: MITIGATION AND PLANNING REDUCING RISK IN THE CITY

Moderator: Anne S. Kiremidjian, Stanford University, John Blume Earthquake Engineering Center

10:20 *Earth Observatory Issues Related to Risk in New York City - High Risk, Low Awareness*
Klaus Jacob, Columbia University Lamont-Doherty

10:30 *The Need for Science in Mitigating Hazards in Coastal Cities*
Jeff Williams, USGS

10:40 *Needs, Barriers, and Opportunities to Mitigation in Local Government*
Kendra Briechle, International City/County Management Association

10:50 *How Private Sector Deals With Planning for Disasters*
Bill Sherman, Total Spectrum (Formerly of Intel Corporation)

11:00 *Big City + Major Hurricane = Mega Disaster*
Jerry Jarrell, Acting Director, National Hurricane Center

11:10 Discussion

11:45 *Wrap-up and Summary*
Anne S. Kiremidjian

12:00 Lunch (Provided)

1:00 KEYNOTE ADDRESSES

1:00 *Large U.S. Cities at Risk and Project Impact*
Bob Volland, FEMA

1:20 *Megacities: Reducing Vulnerability to Natural Disasters*
Stuart Mustow, World Federation of Engineering Organizations

1:40 *Wrap-up and Summary*
William Hooke

1:50 Break

2:00 PANEL 2: POST-DISASTER RESPONSE AND RECOVERY IN CITIES AND MEGACITIES
Moderator: Haresh Shah, Professor Emeritus, Stanford University

2:05 *Insuring the Large City*
Mark Homan, The Hartford

2:15 International Project on Megacities
Fouad Bendimerad, Risk Management Solutions

2:25 *Policies With Respect to Disaster Management*
Mark Cackler, The World Bank

2:35 *Role of Financial Institutions in Response and Recovery*
Kawika Daguio, American Bankers Association

2:45 *Wrap-up and Summary*
Haresh Shah

3:40 FORUM WRAP-UP

3:55 *Introduction to Next Forum*
William Hooke

4:00 Adjourn

CHAPTER 4

Earthquakes

National Lessons from the Development and Implementation of the California Earthquake Loss Reduction Plan 1997-2001

Public Private Partnership 2000
Report on Fourth Forum
23 February 1998

California's huge earthquake risks have inspired its State government to develop and implement a series of earthquake loss reduction strategies. Its current strategic plan is described in The California Earthquake Loss Reduction Plan 1997-2001. The fourth PPP2000 forum, held on February 23, 1998, focused on what national lessons can be drawn from this State-led approach to reducing earthquake risks.

The Plan addresses all aspects of natural hazard reduction, from geosciences to emergency preparedness, response and recovery. It considers economic and social issues and the responsibilities and duties of the different segments of the society. Through a series of elements, strategies, objectives and initiatives, it explicitly recognizes the complex interaction between natural hazards and our society and defines the process through which California's earthquake hazards should be addressed. Individual implementation plans describe the actions required to accomplish the initiatives. Implementation policies are developed by the State administration in cooperation with the legislature and others responsible for earthquake safety and loss reduction.

The plan serves as the California Seismic Safety Commission's policy statement on reducing earthquake risk over the long term; it guides the executive branch of the State government in its priorities for seismic safety; and it serves as California's qualified and required mitigation plan for earthquakes, in compliance with the Federal Emergency Management Agency's National Hazards Mitigation Strategy.

The magnitude 6.4 earthquake that struck Northridge in 1994 revealed both the success and the failure of California's approach to earthquake loss reduction. On the one hand, the earthquake caused very few deaths, and thus the explicit goal of life safety was met. Paradoxically, while the human population fared well, California's

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engineered environment suffered serious structural damage. This resulted in huge losses to building owners, insurance companies and the regional economy.

In particular, unexpected weld failures were found in more than 200 steel-frame buildings, in some case requiring building evacuation and demolition. These failures show the dual need to develop nationally applicable standards and to implement them in local practice. Partnerships between the technical community and policy makers are essential for developing appropriate performance-based standards.

The Northridge experience has influenced public policy, engineering design, and building codes and has resulted in precedent-setting litigation. Unfortunately, in most cases this experience has not led to increased mitigation. For some owners, the benefits of retrofitting do not justify the cost and may create unanticipated civil liabilities.

The lessons from California's earthquake plan are directly relevant to other natural hazards and other States and can be used to suggest and clarify hazard mitigation programs. Forum participants agreed that the development of a national multi-hazard plan is inappropriate and that the goal is for State and local agencies to take primary responsibility. The Federal government's role should be to provide leadership and technical assistance and to acknowledge successes.

Forum Themes

Several critical elements of the California plan were also overarching themes of this and the three previous forums.

- California formally recognized that earthquake loss reduction is a public value. The State had already impaneled a Seismic Safety Commission that was influencing seismic safety legislation, codes, and research. Development of the California Earthquake Loss Reduction Plan was a natural outgrowth to formalize and provide a structure for its efforts.
- Input from stakeholders is important. California Seismic Safety Commission hearings are held monthly in locations throughout the State, often in cooperation with other State agencies and local governments. Through these formal meetings, committee meetings, and workshops, stakeholders are invited to present their experiences, their needs, and their aspirations for seismic safety. Because stakeholders – agencies, businesses, and citizens – implement the program, they must be full participants in its development. Public-private partnerships are encouraged.
- Reinforcing the built environment is only half of the equation. The California Seismic Safety Commissioners represent diverse interests and professions and recognize that mitigation activities need to be both structural and nonstructural. Social services, response, and recovery are an integral part of the California plan.
- The plan must be a living document. The California plan is evaluated continuously to refine its direction, measure its results, and consider new points of

view. It is revised annually and is reprinted in its entirety every five years. The plan and its updates are distributed to the California legislature, the executive office, State agencies, and local governments. It is available to anyone who requests it.

- Mitigation is cost effective. Multi-hazard mitigation is especially cost-effective. Stakeholder communities and the public and private sectors should work with regional disaster research centers where they exist to accelerate the pace of mitigation.
- Incentives are needed to encourage mitigation. As others have pointed out, many existing policies encourage the status quo. Incentives in the areas of land-use planning, legal liability, financing, insurance, taxes, loans, building permits, and interest rates, for example, would help encourage people to take hazard mitigation seriously. Conversely, insurance companies should consider increasing premiums for those who fail to mitigate.
- Ongoing education is needed to change behavior. More effective outreach techniques are needed to reach and involve individual citizens through varied partnerships involving Federal, State, and local governments, academia, and the private sector, such as are currently being developed for FEMA's Project Impact.
- Acceptable risk needs to be defined. An outgrowth of public education on disaster mitigation is the ability to consider what risks are acceptable. What level of safety are we willing to support? Performance-based engineering can then be applied; codes become secondary.
- Federal support is needed. Although California established its Seismic Safety Commission and developed a plan to reduce earthquake risk on its own, help from the Federal government is enabling other states to benefit from California's experience. For example, in 1996 FEMA funded a conference for States interested in forming their own seismic safety programs. This opportunity for one State to learn from the experiences of another resulted in many new organizations aimed at reducing earthquake losses in other States.

Forum 4: National Lessons from the Development and Implementation of the California Earthquake Loss Reduction Plan 1997-2001

Rayburn House Office Building, Room 2318
Washington, DC

February 23, 1998

Sponsored By:

California Seismic Safety Commission

9:00 WELCOME AND OPENING REMARKS

9:00 Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

9:05 Harvey G. Ryland, President, Institute for Business and Home Safety

9:10 The Honorable George E. Brown, Jr., U.S. House of Representatives, Ranking Member, Committee on Science

9:20 Lloyd S. Cluff, Forum Moderator, Utilities Commissioner, California Seismic Safety Commission, and former Commission Chairman

9:30 KEYNOTE PRESENTATIONS

9:30 *Dealing with Natural Disasters Some Fundamental Principals*
Dr. Wilfred D. Iwan, Chair, Board on Natural Disasters, National Research Council

9:40 The Honorable John Garamendi, Deputy Secretary, Department of the Interior

9:50 *Perspectives on the California Earthquake Loss Reduction Plan as Model for Other Natural Disasters*
John Clizbe, Vice President for Disaster Services, American Red Cross

10:00 Discussion

10:10 Break

10:25 PANEL 1: SAFETY POLICY ISSUES FOR THE BUILT ENVIRONMENT: A CASE HISTORY FROM THE NORTHRIDGE EARTHQUAKE

10:25 *Setting the Stage*
Lloyd S. Cluff, Utilities Commissioner, California Seismic Safety Commission, and former Commission Chairman

10:35 *Who Benefits and Who Pays?*
Fred Turner, Senior Structural Engineer, California Seismic Safety Commission

10:45 *What Went Wrong and How to Fix It*
Ronald O. Hamburger, Chairman SAC Project Joint Venture and Vice President, EQE International

10:55 *Engineering Challenges*
Chris Poland, President, Degenkolb Engineers

11:05 *Effects of the Northridge Earthquake on the California Residential Insurance Market*
Mark Leonard, Legislative & Public Affairs Director, California Earthquake Authority

11:15 *Discussion*

11:40 *Summary and Next Steps*
Lloyd Cluff

11:45 Lunch (Provided)

11:45 *LUNCHEON KEYNOTE*
Lloyd S. Cluff, Utilities Commissioner, California Seismic Safety Commission, and former Commission Chairman

12:45 PANEL 2: POLICY LESSONS FROM CALIFORNIA: CAN CALIFORNIA'S PLAN BE A MODEL FOR A NATIONWIDE NATURAL HAZARD LOSS REDUCTION PLAN?

12:45 *Setting the Stage*
Patricia Snyder, Social Services Commissioner, California Seismic Safety Commission Chairman, and Emergency Responder, American Red Cross

12:50 *Events Leading to the Creation of the California Plan*
Richard J. McCarthy, Executive Director, California Seismic Safety Commission

1:00 *Reflecting the Users' Views of the Plan*
James F. Davis, State Geologist, California Division of Mines and Geology

1:10 *Policy Issues and Implementing a Comprehensive Plan*
Stuart Posselt, Director, California Office of Seismic Safety Implementation

1:20 Discussion

1:40 *Summary and Next Steps*
Lloyd Cluff

1:50 Break

2:05 PANEL 3: TOWARD A NATIONWIDE MULTI-HAZARD LOSS REDUCTION PLAN

2:05 *Setting the Stage*
Lloyd S. Cluff

2:10 *A social Science Perspective on Loss Reduction: What Do We Need to Know, and How Can Social Science Help?*

Kathleen Tierney, Co-Director, University of Delaware Natural Disaster Research Center

2:20 *Opportunities to Improve Response and Recovery*
Don Manning, Fire Protection Commissioner, California Seismic Safety Commission, and former Fire Chief, City of Los Angeles

2:30 *From Earthquakes to Multiple Hazards in Mid-America*
Daniel Abrams, Hanson Engineers Professor of Civil Engineering, University of Illinois, and Director of the Mid-America Earthquake Center

2:40 *Federal Mitigation Plans*
Michael Armstrong, Associate Director for Mitigation, FEMA

2:50 Discussion

3:10 SUMMARY AND NEXT STEPS Lloyd Cluff

3:20 *Forum Wrap-Up*
Dr. William Hooke

3:55 *Introduction to Forum 5*

4:00 Adjourn

CHAPTER 5

A Global Perspective

A Global Perspective on Reducing Losses from Natural Disasters

Public Private Partnership 2000
Report on Fifth Forum
14 April 1998

Natural disasters are becoming more expensive and more threatening worldwide. This is in part because people are moving into regions at risk and because global infrastructure is becoming more complex and hence more vulnerable to natural hazards. The reduction of losses from natural disasters begins with information, and there is an urgent need to merge science and technology with local communities and with their capacity to respond to disasters. The mass media and the insurance industry have critical roles in building public awareness about vulnerability and in educating people and nations about the true, long- term cost of disasters.

On April 14, 1998, the World Bank, UNESCO, and the World Meteorological Organization co-hosted the fifth forum in the Public Private Partnership 2000 series, in cooperation with the Subcommittee on Natural Disaster Reduction and the Institute for Business and Home Safety. The forum, "A Global Perspective on Reducing Losses from Natural Disasters," provided the perspective of several international organizations on the policy issues of reducing the human and economic costs of natural disasters around the world. Participants from the U.S. and international insurance and financial communities, the U.S. Federal government, academia, and non-governmental organizations attended. The forum considered three topics: the international perspective on natural disasters; investing in mitigation; and fostering partnerships for disaster prevention. The discussions at the forum recognized the substantial demand for resources for relief and recovery after disasters in both developed and developing countries. However, as a percentage of GDP, the consequences in the less developed countries are particularly severe; relative losses from natural disasters are as much as 20 times greater in developing countries than in developed countries. Five issues were emphasized during the presentations and subsequent discussions.

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Forum Issues

- **Disaster Relief or Prevention and Mitigation?** Several speakers emphasized the need to shift from a "culture of relief" to a "culture of prevention" and, rather than focusing on immediate recovery, to emphasize the reduction of catastrophic losses. Emergency response must be supplemented, if not supplanted, by pre-event mitigation, and disaster mitigation must include both structural and non-structural aspects.

  Political will is a key requirement for disaster prevention and mitigation. Making the transition from emergency response to long-term sustainability requires appropriate government policies, an adequate insurance framework, and support from development bankers and people in the business of helping nations to develop sustainable economies.

  The World Bank's interest in disaster prevention and response is rooted in the Bank's mandate to reduce poverty. Although natural disasters threaten sustainable development everywhere, in developing countries the consequences are particularly severe. The Bank's existing process could be improved by inclusion of risk analysis in country strategies, by just-in-time proactive promotion of natural disaster mitigation, and by requiring a sound plan to address mitigation needs before lending for disaster response.
- **Information Needs and Development Networks.** Hydrometeorological events account for 70 percent of natural disasters worldwide. While much of the global infrastructure is in place to provide early warning systems, the frequency and severity of many hydrometeorological disasters has been increasing. The communication between decision makers and the scientific/technical communities that manage the information systems leaves much to be desired. A significant benefit of the International Decade for Natural Disaster Reduction (IDNDR) has been to raise the visibility of forecast and warning systems. Reducing losses from natural disasters requires contributions from many disciplines, and knowledge of the cultural aspects of communication is essential. The United States is currently exploring the feasibility of establishing a national information network, which is aimed at providing better information to emergency managers. The management structure includes an executive committee chaired by NOAA, an integrated program office hosted by USGS, and a public-private partnership with significant participation from stakeholders – defined as anyone who prepares for or responds to natural disasters, from company presidents and farmers to State emergency managers. The Internet is crucial to this disaster information network, but the increased decentralization that the Internet allows makes it harder to ensure integration, security, and reliability. Some countries have placed restrictions on the distribution of environmental data, and it was proposed that development banks consider making their loans conditional on unrestricted sharing of environmental infrastructure data for the benefit of all.

- **Insurance and Reinsurance.** In developing countries, few people insure adequately, and the premium volume for catastrophe exposure is negligible compared to the sums insured. There are four major reasons that people do not insure: Ignorance; a belief that "it won't happen to me"; true inability to pay; and lack of availability of insurance. Reinsurance supports insurers by reducing exposure and distributing the risk. Reinsurance reduces a potential imbalance in accounts of insurance companies.
- **Cost-Effectiveness and Other Financial Issues for Mitigation.** Measuring the cost-benefit ratio for various mitigation strategies has been an ongoing concern in the disaster reduction community. Techniques now used in environmental valuation could also be applied to measure the value of mitigation. The direct cost of damage to productive assets is relatively easy to derive, but many other costs are hard to value. Other possible quantitative measures are needed, possibly including land inundated, lives lost, or other physical data. Although NOAA's increasing ability to forecast climate for the next season or two clearly affects the business and insurance communities, there are still major research issues associated with weather and a need for better scientific understanding to make improved estimates for the future.

  International development agencies can encourage mitigation through their loan practices. For example, the Inter-American Development Bank has financed a number of mitigation strategies, including risk assessment and mapping, community-level landslide mitigation works, erosion control in coastal conservation programs, information and training materials, and outreach programs, to break from the traditional pattern of development leading to fragile societies and social structures. The new focus must be on the vulnerability of a society to natural disaster rather than on its total wealth.
- **Public-Private Sector Ventures.** Disaster prevention and mitigation require partnerships, and governments in particular need to do a better job of creating opportunities for such partnerships. Because natural disasters do not respect political boundaries, the partnerships to address disaster reduction must cross boundaries too; it is time to rethink old partnerships and to forge new ones, to create innovative partnerships like the Consultative Group on International Agricultural Research and the Global Water Partnership. One important challenge is to build up the technical capabilities of the developing world, a particularly fertile and appropriate area for public-private partnerships.

Forum Themes

Forum participants agreed that it is time to shift funding from recovery to prevention and to help developing countries increase their resilience to cope with disasters. As a development institution, the World Bank expressed its commitment to place a significant emphasis on prevention and mitigation in its portfolio. It also agreed to

promote awareness about disaster reduction and to actively participate in the planning of activities to follow the completion of the International Decade for Natural Disaster Reduction. In sum, the institution intends to promote activities to help build a safer world in the 21st century.

Forum 5: A Global Perspective on Reducing Losses from Natural Disasters

The World Bank Auditorium
2121 Pennsylvania Ave., NW, Washington, DC

April 14, 1998

Sponsored By:

The World Bank
The World Meteorological Organization
UNESCO

9:00 WELCOME AND OPENING REMARKS

Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

Harvey G. Ryland, President, Institute for Business and Home Safety

9:10 INTRODUCTIONS BY COSPONSORS

Robert C. Landis, World Meteorological Organization

Badaoui Rouhban, UNESCO

Alcira Kreimer, The World Bank

9:20 KEYNOTE PRESENTATIONS

Ismail Serageldin, Vice President, The World Bank

9:45 Break

10:00 PANEL 1: GLOBAL PERSPECTIVE ON NATURAL DISASTERS – WHERE ARE WE NOW?

Moderator: Robert M. Hamilton, National Research Council, Moderator

10:05 *A Reality Check: A View Toward the Future*

Phillipe Boullé, Director, Secretariate of the International Decade of Natural Disaster Reduction

10:20 *Developing a Global Disaster Information Network*

James F. Devine, U.S. Geological Survey

10:35 *Hydrometeorological Disaster Reduction*

Elbert W. Friday, National Oceanic & Atmospheric Administration

10:05 Open Discussion

11:20 *Wrap Up*
Robert M. Hamilton

11:25 Break

11:35 PRE-LUNCHEON SPEAKER Jerome Karter, President and CEO, SCOR Reinsurance

12:15 Lunch (Provided)

1:00 PANEL 2: INVESTING IN MITIGATION: WHAT'S THE PAYOFF?
Moderator: Frederick Krimgold, Virginia Polytechnic Institute and State University

1:05 *Economic and Policy Issues in Mitigation*
Mohan Munasinghe, The World Bank

1:20 *National Hazard Insurance and Development Investment*
David Pugh, International Finance Corporation

1:35 *Natural Disaster Risk: A View from a Development Bank*
Caroline Clarke, Inter-American Development Bank

1:50 *Building Regional Capacity*
Stephen O. Bender, Organization of American States

2:05 *Discussion and Wrap Up*
Frederick Krimgold, Virginia Polytechnic Institute and State University

2:15 Break

2:30 PANEL 3: DISASTER PREVENTION & PARTNERSHIPS: A VIEW TO THE 21ST CENTURY
Moderator: Robert T. Watson, The World Bank

Each panelist will answer two questions: 1) What are the constraints to successful disaster prevention in the international arena from your perspective?; and 2) what can be done to expand public-private partnerships with the global disaster reduction community?

2:35 Phillipe Boullé, International Decade of Natural Disaster Reduction

2:40 Robert C. Landis, World Meteorological Organization

2:45 Badaoui Rouhban, UNESCO

2:50 Maritta Koch-Weser, The World Bank

2:55 David Pugh, International Finance Corporation

3:00 Jerome Karter, SCOR Reinsurance

3:05 *Round Table Discussion/Open Discussion*
Robert Watson, Moderator

3:40 FORUM WRAP-UP AND ADJOURN

3:40 *Forum Synthesis and Action Items*
Maritta Koch-Weser and Alcira Kreimer, The World Bank

4:00 Adjourn

CHAPTER 6

Disaster Recovery Business Alliances

Disaster Recovery Business Alliances
Public Private Partnership 2000
Report on Sixth Forum
9 June 1998

Community Market Recovery

In the aftermath of a natural disaster, quick and coordinated recovery of basic commercial networks – utilities, food and water distribution, telecommunications, financial services, transportation and fuels, and broadcast media – is the key to timely recovery of other businesses, the viability of neighborhoods, and the continuity of government. Public sector emergency authorities, utility service providers, emergency medical teams and other primary responders have well-developed emergency response procedures, and they generally coordinate well with disaster relief organizations. However, the recovery of essential commerce and trade is traditionally left to chance, market forces, or ad hoc liaisons created in the chaotic aftermath of the event.

On June 9, 1998, PPP2000 sponsored "Disaster Recovery Business Alliances," the sixth forum in a series dedicated to exploring new approaches to natural disaster mitigation. The forum, cosponsored by the Electric Power Research Institute and the International Association of Contingency Planners in cooperation with the Subcommittee on Natural Disaster Reduction and the Institute for Business and Home Safety, brought together representatives from Federal, State and local governments, the private sector, and non-governmental organizations to discuss increasing the awareness of business recovery concerns in communities throughout the nation – a challenge involving the entire community. The forum provided an exchange of ideas on various ways to create disaster mitigation plans for businesses and communities. The presentations stressed the importance of developing networks with local businesses, identifying and implementing technological solutions to prepare for mitigation of and response to disasters, and sharing information to reduce financial losses and provide

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better services to communities before, during, and after disasters. Business preparedness, mitigation, and recovery programs are needed in every community and must be tailored to the community culture. Involvement must be at the grass roots to make the disaster recovery business plans sustainable, and education is critical to help grass-roots business leaders understand the value-added benefits of preparing for a disaster.

The welfare of the society depends critically on the resilience of its business community to natural disasters. If businesses do not survive a disaster, people are out of work, a community's revenue stream is disrupted, and the recovery process is prolonged. This aspect of community vulnerability to disaster is increasingly recognized, and many communities are examining the feasibility of establishing "business recovery alliances." The objective is to bring together the leadership and expertise of business, emergency preparedness, the engineering and scientific community, and others to develop a public/private partnership approach to reducing the vulnerability of businesses and the community's marketplace to flooding, tornadoes and severe weather, earthquakes and other hazards.

Both the Federal Emergency Management Agency Project Impact's Disaster Resistant Community Initiative and the Institute for Business and Home Safety's Showcase Community Program recognize the key role that businesses play in disaster mitigation and recovery. Another approach, a Disaster Recovery Business Alliance (DRBA), offers a tested model to assist interested local leaders from all sectors of the society in forming and facilitating a lifeline-based planning organization to serve a local community. It was established and funded by the Electric Power Research Institute (EPRI) and co-founded by the Department of Energy and the International Association of Contingency Planners, a non-profit organization of business professionals who have responsibility for or interest in contingency and business recovery planning.

Several examples of organizational models for business recovery were profiled during the forum, through analysis of projects in Evansville, Ind., Rye, N.Y., Memphis, Tenn. and Deerfield Beach, Fla. These successful programs have many similarities:

- They are community-based and community-driven;
- They involve a strong public/private sector collaboration;
- They are based upon a hazard and risk assessment;
- They recognize the importance of land use planning and building codes as mitigation tools;
- They recognize the role of incentives; and
- They integrate professional training opportunities, public awareness and education for all sectors of the community into the whole process.

Several forum speakers addressed the issue of the interdependence of the business community and the community at large with respect to natural hazards. The mission of FEMA's Project Impact is "to reduce the loss of life and property and protect our institutions from all hazards by leading and supporting the nation in a comprehensive

risk-based emergency management program of mitigation, preparedness, response and recovery." IBHS's Showcase Community program goal is to assist a community to help itself by reducing its vulnerability to hurricanes, earthquakes, tornadoes, wildfires, floods, or whatever natural disasters threaten it. The program works with the community to learn what works and what does not work to reduce the emotional and financial devastation caused by natural disasters.

EPRI is eager to catalyze and implement national and regional DRBA alliances of utilities, businesses, contingency planning professionals and community-based organizations to develop sharable regional mitigation and recovery plans. EPRI also is developing public and private disaster mitigation technologies, which are an important part of the DRBA planning process. DRBA has formed partnerships with public and private sector organizations including the American Red Cross, Central United States Earthquake Consortium, National Emergency Management Association, IBHS and many others.

The alliance of business discussed during the forum is a "natural alliance," with shared experience and shared goals of sustainability. It is perhaps the only mechanism likely to bring the entire community together in the ways necessary for mitigation and long-term recovery. Societal change is not easy to engineer. Leaders from the sponsors of this forum can certainly influence people to pursue challenging goals, but the people must want to get there in the first place for the influence to be effective. Leadership, through the use of champions, is often a process of facilitating the movement of people toward goals that they already hold, like economic recovery, but have not been able to articulate or make concrete and achievable. The participants at the forum pointed out that the goal of cooperation among community leaders for purposes of economic sustainability should be familiar and welcome to most people. However, many people continue to be unaware of the tremendous value in loss prevention strategies, or believe they lack the means to reach the goal.

Participation in public-private partnerships works to ensure that business organizations will continue to have customers and suppliers when natural disasters impact community life. Though the partnerships are not yet a common feature of the disaster response, recovery and mitigation landscape, events like this forum will help make them more common. Much work remains before disaster resistance and economic sustainability become public values. Developing a common language and conceptual understanding of mitigation, response and recovery will allow us to begin shaping the strategies for professional and community education and communication that will foster the necessary societal leadership. The forum participants noted that public and private sector lifeline organizations need to leverage their community leadership positions in support of these goals.

A consensus in the meeting identified a need to initiate team relationships across traditional private-public sector barriers. This includes considering how existing organizations, such as chambers of commerce and professional associations, can serve as natural "mitigation" connections among all sectors of the community.

Above all, it was highlighted during the forum that we need to take the action step of opening dialogues within each business community toward forming the necessary alliances. There is a lot being learned about what works in places such as Evansville, Rye, Memphis and Deerfield Beach. We need to pay attention and work to transfer that learning to other communities.

Forum 6: Disaster Recovery Business Alliances

Hart Senate Office Building, Room 902
Washington, DC

June 9, 1998

Sponsored By:

Electric Power Research Institute
International Association of Contingency Planners

9:00 WELCOME

9:00 Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

9:05 Harvey G. Ryland, President, Institute for Business and Home Safety

9:20 INTRODUCTORY REMARKS

Michael J. Armstrong, Mitigation Directorate, FEMA

James P. Oggerino, DRBA Project Manager, Electric Power Research Institute

Mary L. Carrido, Chairman & CEO, International Association of Contingency Planners

9:40 PANEL 1: CASE STUDIES IN CONTINGENCY PLANNING: PUBLIC-PRIVATE SECTOR PERSPECTIVES

Moderator: James W. Russell, Vice President for Outreach, Institute for Business & Home Safety

9:45 *The Evansville, Indiana Case Study*

Barbara Cunningham, Area Commissioner for Vandenburg County, Indiana

9:55 *Private Sector Mitigation Priorities*

Dale E. Olson, Chairman of the Board, Citizens Insurance

10:05 *The Deerfield Beach, Florida Case Study*

Terrence R. Moore, Assistant City Manager, Deerfield Beach, Florida

10:20 Break

10:40 *Discussion: What process underlies the development of community planning to reduce losses from natural disasters? How are relationships established between the public and private sectors? What is involved in bridging gaps in understanding to establish a dialog? What can be expected in the future?*

11:30 *Wrap Up*

James W. Russell

11:40 KEYNOTE SPEECH

Boeing's Mitigation Initiatives

David Freitag, Vice President, The Boeing Company

12:15 Lunch (Provided)

1:15 POINT/COUNTERPOINT DIALOGUE: EXPECTATIONS AND STRATEGIES FOR MITIGATION AND RECOVERY FROM NATURAL DISASTERS

Moderator: Mary L. Carrido, International Association of Contingency Planners

1:20 *Dialogue 1: Lifelines: Mitigation Technology and the Role of Public-Private Partnerships*

Donald Saracco, Vice President, MLC & Associates

John R. Powers, Commissioner, President's Commission on Critical Infrastructure Protection

Discussion

2:00 *Dialogue 2: Policy and Legislation: Supporting Public-Private Partnerships for Mitigation and Recovery*

Stephen B. Baruch, President, Stephen B. Baruch & Associates

Edward Kamerer, Director, Manhattan Energy Services, Consolidated Edison Co. of New York

Discussion

2:40 Break

3:00 *Dialogue 3 (Business): Creating Business Alliances for Mitigation and Recovery*

Robert L. Quick, President and CEO, Metropolitan Evansville Chamber of Commerce

Barry Scanlon, Director, Office of Corporate Affairs, FEMA

Discussion

3:40 WRAP UP (MARY CARRIDO)

3:50 *Wrap Up and Next Steps*

Harvey Ryland & William Hooke

4:00 *Introduction to PPP2000 Forum 7*

David Applegate, American Geological Institute

Adjourn

CHAPTER 7

Real-Time Hazards Monitoring

Real-Time Monitoring and Warning for Natural Hazards

Public Private Partnership 2000
Report on Seventh Forum
30 June 1998

Overview

The seventh forum in the Public Private Partnership (PPP) 2000 series on natural disaster reduction, entitled "Real-Time Monitoring and Warning for Natural Hazards," was held on June 30, 1998. The forum was co-sponsored by the American Geological Institute, American Geophysical Union, and Incorporated Research Institutions for Seismology in cooperation with the Subcommittee on Natural Disaster Reduction and the Institute for Business and Home Safety. More than 100 participants from the private sector, non-governmental organizations, academia, and local, State, and Federal government attended the event, held at the American Geophysical Union Building in Washington, D.C.

The purpose of the forum was to address policy issues related to communicating and applying real-time natural hazards data and information. For atmospheric, hydrologic, and geologic hazards, speakers representing both the providers and the users of real-time information addressed the following challenges:

- Effective presentation of scientific information on natural hazards to the public such that they can and, more importantly, will take appropriate action,
- Current state and emerging capabilities of real-time monitoring and warning capabilities,
- Existing ability of users to effectively apply real-time information and warnings,
- Public policy issues related to potential improvements in data and information transmission and applications, and

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- Obstacles facing implementation of real-time warning systems, including data transmission, limits on the openness of data exchange, politics, and legal liability.

Technology is radically changing how "real time" is defined for various hazards. In the broadest of terms, "real time" is the timescale in which a specific event can be forecast and a response to that event can be made. It varies from months to seconds depending on the hazard. In the case of seasonal to interannual climate variations, such as the El Niño effect, the National Weather Service now makes forecasts several months in advance. Such a forecast represents a "real-time" warning in that it provides specific information about how this season's storms will differ from long-term patterns. Accurate seasonal forecasts are important because months of lead time are required for response measures such as clearing out debris from flood control channels, training emergency managers and educating the public. In the case of hurricanes, floods and volcanoes, it is possible to provide several days' warning, allowing for evacuations, property protection, and response preparation. In the case of tornadoes and flash floods, the timescale may be minutes. For earthquakes it is seconds, but even in that narrow window of time it is now possible to implement computerized systems that can shut down gas lines, stop trains, secure hazardous materials, and power down generating stations.

Key Issues

Dissemination is the Critical Link. The forum made clear that it is not enough simply to provide real-time information; one must also ensure that it is understood and used. The data and interpretations made possible by rapid technological advances are only as good as the means of communicating them to policymakers, emergency managers, and the public who can use them.

Providing Information the End-User Will Use. The ultimate success of real-time information depends on whether people at the receiving end take action. The problem is one of psychology as much as technology, because the end-user has to understand and trust the warning in order to act on it. Overly broad warnings can result in a "chicken little" syndrome whereby people will ignore repeated warnings. Overcoming the non-response problem requires the ability to warn only the people directly at risk and in some way to personalize the warning enough that it will elicit a response. A tremendous opportunity exists to work with the designers of intelligent transportation systems, for example to develop the capacity to warn specific cars of flash floods using an on-board global positioning system (GPS). Such capabilities will only be developed, however, through partnerships between the natural hazard community and the private-sector vendors developing such systems.

Future warning systems will need to be more active. Current methods such as television, radio and the World Wide Web are passive, requiring the end-user to tune in to the warning. More active systems (such as pagers, for example) could reach people when they are outdoors and most vulnerable to meteorological and

hydrologic hazards, or sleeping and unaware that a warning has been issued. The next generation of systems also should allow people to see the hazard with their own eyes in some fashion. People respond better when they can see a storm coming, making the development of graphical products a priority.

Education Before the Event. The effective use of real-time information requires education before an event is imminent. For children, educational activities should be as participatory as possible, involving them in the collection or use of data. Students in grades 1-6 are believed to be the most receptive. For adults, education should be aimed at improving awareness of natural hazards and increasing responsiveness to real-time warnings. Education also entails training for specific user-groups, for example airline pilots who need to know how to react when they receive a warning of a volcanic ash cloud or severe weather.

Need for Reliable, Consistent Information. Social scientists note that response is enhanced when consistent information is derived from multiple sources. In a crisis situation, it is critical that everybody speak with the same voice. Thus, the many public and private data users need to operate off the same data, particularly images. Developing partnerships ahead of time will help ensure that when a crisis arrives, those groups disseminating warnings and information present a clear and consistent picture. The goal cannot be accomplished through policing by Federal agencies.

Reliability is another key attribute for real-time data. Because the data are being provided as they become available, the data may lack some internal quality assurance and review steps normally taken by the data producer. Consequently, it is important that users have a clear understanding of data limitations ahead of time. Since the information is being made directly available, alternative means need to be developed to allow for independent confirmation of the data in some form.

Maintenance of Existing Satellite Capabilities. Concern was raised at the forum that the next generation of GOES satellites will not have the channels necessary for ash cloud detection, which is needed because most active volcanoes are not monitored. Airline safety requires that this capability be maintained, and efforts need to be made to see that it is maintained. Decisions concerning issues such as satellite equipment and portions of the radio spectrum for expanded emergency broadcasts will continue to be made without consideration of natural hazards applications unless better communication is opened up with those agencies and companies that control these matters.

Importance of Full and Open Access to Data. It is essential to recognize that data are a public good; raw data should be openly available and proprietary value attached only to the interpretation. There has been a historical recognition of the need for full and open data exchange of weather, seismic, and other hazard-related data. Our future ability to develop and improve real-time capabilities demands a strong commitment to full and open access to data.

Liability Considerations. Most of the liability issues discussed at the forum affect only the private sector. Although Federal agencies may create some added liabilities as they provide more information directly to end-users without filtering, the law in general grants the Federal government broad discretionary judgment exemptions under the principle of sovereign immunity. The fast-growing private weather industry that provides products and services based on NWS data, however, lacks the same immunity and could be liable for harm caused by failure to issue warnings when there was a reliance on them by their clients. Even though the fear of litigation appears to be greater than the actual threat, it nonetheless has the potential to discourage the development of real-time capabilities. The legal experts at the forum agreed that liability issues should not stand in the way of improved warning and monitoring capabilities.

Incorporating Real-Time Rationales Into Funding Decisions. Several of the real-time capabilities discussed at the forum are being funded primarily for their utility in research, and there is a need to incorporate the value of monitoring and eventually warning into the funding rationale. For example, seismic networks have traditionally been operated by universities for research purposes but now serve many more applications. In the case of the U.S. Geological Survey's streamgaging network, individual stations are funded by many different partners for a variety of different purposes, but virtually the entire network provides valuable real-time analysis of flood hazards. Providing real-time monitoring and warning requires a substantial standing infrastructure, and all partners involved in reducing the impacts of natural hazards have a vested interest in maintaining and strengthening this basic structure.

Valuing Long-Term Data Collection. The accuracy of short-term warnings for virtually all natural hazards relies on long-term records of past events and conditions, often on a timescale of decades or centuries. For example, the accuracy of flood warnings depends on forecast models that in turn depend on long-term, continuous records of river discharge, climate variations, changes in hydrological response, irrigation, and pumping. Unfortunately, long-term records may not be critical to some streamgage partners, making continuity highly vulnerable to transitory funding. It is thus very important that agencies have long-term continuity of data collection as part of their central mission.

Need for Long-Term Partnerships. Another challenge discussed at the forum was that partnerships are often viewed from a political standpoint as an expediency measure in a time of shrinking budgets, a matter of political convenience, rather than as something of intrinsic value. Instead, the support for partnerships must be for the long haul, allowing relationships to develop.

Sound Policies Require Strong Partnerships. Just because a technology exists does not mean it can be implemented. Many other policy considerations factor into the decision. For example, if technology makes it possible to cut off power ahead of an earthquake to avoid faulting and burndown, who becomes responsible for ensuring that hospitals are not cut off? What is an acceptable level of risk? How broadly

should real-time data be disseminated? Who pays for these systems? Answering these questions requires inputs from the private sector, all levels of government, the scientific and technical community, and the public. Without standing partnerships and well-developed lines of communication, it is not possible to bring these diverse elements together and come up with socially acceptable solutions.

Translating Research Into Results. Only through a dialogue such as that set up by these forums can scientists understand user community needs and how best to meet those needs. In the process, new avenues for fundamental and applied research can be identified that will achieve the greater goal of translating research results into public policy that saves lives and reduces losses. Bridging the gap between research and implementation is a shared goal and is only possible through improved communication and partnerships.

Public-Private Partnership Opportunities. The overall goal of PPP2000 is to seek new and innovative opportunities for government, private sector organizations and individuals to work together to reduce vulnerability to and losses from natural hazards in communities throughout the Nation. In keeping with that goal, this forum identified a number of existing and potential partnerships.

- Data Dissemination Partnerships – Perhaps the most critical public-private partnership is in communications and dissemination, because regardless of where hazard information is created, increasingly the private sector creates the products that deliver the message. Future partners might include agencies and companies designing intelligent transportation systems, satellite platforms, radio spectrum distribution, and systems specifically to provide targeted hazard warnings.
- Partnerships with the News Media – Scientists need to develop closer relationships with the news media before a crisis happens so they can provide more useful information during a crisis–because the media deliver the message. Simultaneously, the media need to understand the limitations and constraints of real-time scientific data, so that they can communicate the information as accurately as possible.
- Congressional Natural Hazards Caucus* – A partnership opportunity exists between the private sector and Congress to develop a natural hazards caucus focused on long-term strategies for hazard mitigation. Hazards are broadly distributed in space, affecting all fifty states, but not in time. Public interest tends to be volatile, peaking just after major natural disasters and then dissipating rapidly. A bipartisan forum of interested senators and representatives could provide the needed continuity of message, direction and enthusiasm.
- Outreach to the Private Sector – Data producers at Federal and State agencies need to take part in informational sessions with the private sector, getting the message of how real-time data can be useful to the business community and providing needed backup for emergency managers within the companies. In

*The Natural Hazards Caucus, created in 2000, held its first meeting on June 21, 2000.

general, large companies with full-time staff are more aware of what is available to them than smaller companies, suggesting that one avenue of forging such partnerships is through an organization such as the U.S. Chamber of Commerce. Better awareness by employers can save lives and help to prepare infrastructure to handle natural hazards, for example reducing gridlock on highways. Outreach efforts to utilities, local government, and business entities are critical to building the relationships and trust that are the foundation of successful partnerships.

Forum 7: Real-Time Monitoring and Warning for Natural Hazards

American Geophysical Union
Washington, DC

June 30, 1998

Sponsored By:

American Geological Institute
American Geophysical Union
Incorporated Research Institutions for Seismology Consortium

9:00 WELCOME AND OPENING REMARKS

9:00 Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

9:05 Harvey G. Ryland, President, Institute for Business and Home Safety

9:10 INTRODUCTIONS BY COSPONSORS

Marcus Milling, Executive Director, American Geological Institute (AGI)

Sean Solomon, President, American Geophysical Union (AGU)

David Simpson, President, Incorporated Research Institutions for Seismology Consortium (IRIS)

9:25 PANEL 1: REAL-TIME MONITORING AND WARNING: ATMOSPHERIC AND HYDROLOGIC HAZARDS

9:25 *Introduction by Moderator*
Dan Carrigan, Catastrophe Consultant, State Farm Insurance

9:30 *Monitoring and Warning for Atmospheric Hazards*
John J. Kelly, Assistant Administrator for Weather Services, NOAA

9:40 *Real-time Capabilities for Flood Monitoring*
Bob Hirsch, Chief Hydrologist, U.S. Geological Survey

9:50 Break

10:00 KEYNOTE PRESENTATION: REAL-TIME WEATHER WARNINGS ... OPPORTUNITIES AND CHALLENGES Bob Ryan, Channel 4 News

10:40 (PANEL 1 CONTINUED)

Prevention & Mitigation on the Corporate Level
William Michael, Manager of Crisis Management, The Walt Disney Company

10:50 *Emergency Managers' Use of Real-Time Flood Data*
Kevin Stewart, Urban Drainage and Flood Control District, Denver, Colorado

11:00 *Discussion and Wrap Up*
Moderator

Are there technologies we have not implemented? Data not being applied?
How do real-time capabilities improve our understanding of hazards?
Are there applications for real-time data that we have not exploited?
What other types of real-time data would be valuable?

11:45 Lunch (Provided)

12:30 PANEL 2: REAL-TIME MONITORING AND WARNING: SEISMIC AND VOLCANIC HAZARDS
Moderator: Greg van der Vink, IRIS

12:35 *Implementing a Real-time Seismic Hazard Warning System*
Lucile Jones, U.S. Geological Survey

12:45 *Volcano Hazards–On the Ground and in the Air*
Terry Keith, Alaska Volcano Observatory

12:55 *Volcanic Ash Hazards for Aviation*
Edward Miller, Air Line Pilots Association

1:05 *Utilities and Real-Time Earthquake Data*
Ron Tognazzini, Los Angeles City Department of Water and Power

1:15 *Discussion and Wrap Up*
Moderator

Are there technologies we have not implemented?
Data not being applied?
How do real-time capabilities improve our understanding of hazards ?
Are there applications for real-time data that we have not exploited?
What other types of real-time data would be valuable?

2:00 Break

2:15 PANEL 3 OVERCOMING BARRIERS TO THE USE OF REAL-TIME DATA
Moderator: James F. Devine, U.S. Geological Survey

2:20 *New Opportunities for Transmitting Hazard Warnings*
Peter Ward, U.S. Geological Survey

2:30 *Promoting Data Exchange*
Richard Hallgren, American Meteorological Society

2:40 *Legislative Opportunities for Creating Incentives*
Ben Grumbles, House Transportation & Infrastructure Committee

2:50 *Overcoming Real-Time Data Liability Issues*
David V. Hutchinson, Department of Justice

3:00 *Liability Issues Related to Privatization*
Glenn E. Tallia, National Oceanic & Atmospheric Administration

3:10 *Discussion and Wrap-Up*

What are the bottlenecks to applying new technologies and how do we overcome them?
How do we create incentives and remove disincentives for the use of real-time data for mitigation?
Who pays for new technologies?
Define roles and responsibilities.

3:55 FORUM SYNTHESIS AND ACTION ITEMS

David Applegate, AGI

4:10 *Overview of Future Forums*
Bill Hooke

4:20 Adjourn

CHAPTER 8

Floods

Reducing Losses from Floods

Public Private Partnership 2000
Report on Eighth Forum
5 October 1998

Despite the billions of dollars that have been spent for structural flood control during this century, the real cost of floods has continued to rise, as has the number of major flood disasters. Currently 85% of Presidentially declared disasters in the United States are related to floods. Floods are also the deadliest natural disasters, killing 140 Americans each year.

Strategies for dealing with floods have changed significantly in the past 100 years. Prior to the 20th Century, flooding was largely the responsibility of the property owner, with charitable organizations or the community offering some help. In the first part of this century the Federal government led the charge to build a flood-resistant society, using structural approaches such as dams, levees, and channels to modify nature's flood hazard areas. Although these approaches often proved costly, ineffective and environmentally unsound, they received strong political support because they put people to work at a time of high national unemployment. Gilbert White's pioneering work in the 1940's showed that, instead of shaping nature to accommodate man, one could also adjust human behavior to accommodate nature. This approach promises to reduce the exposure to flood risk while creating a sustainable society.

However, moving from theory to practice presents many challenges. The 1973 National Flood Insurance Program (NFIP) attempted to shift more of the cost of flooding to those who build in flood-prone areas. In exchange for federally backed flood insurance, local and State governments agreed to regulate development in flood-plains in order to reduce the future vulnerability of the built environment. Although NFIP has had enormous impact on land use and development in flood-prone areas, it is not clear whether it has achieved its objectives.

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On October 5, 1998, PPP2000 sponsored its eighth forum on natural disaster reduction, "Reducing Losses From Flooding," which was co-sponsored by the Association of State Floodplain Managers (ASFPM). The forum focused on current national policy for reducing flood losses in the nation, exploring what is and is not working, policy impediments to effective reduction and changes that might improve current approaches.

Aggressive Federal policies related to flood hazards have created popular misperceptions about the role and responsibilities of the Federal government. Property owners, communities and states often feel floods and disasters are exclusively a Federal problem. This misunderstanding about who will pay for flood damage has the effect of reducing the number of property owners and communities who participate in the National Flood Insurance Program and follow its innovative flood loss reduction policies, including pre-disaster mitigation and non-structural approaches.

The forum noted a number of positive results of the NFIP. Nearly 20,000 flood-prone communities have flood hazard maps, and have agreed, through zoning and land-use planning, to regulate development in flood plains. NFIP has sold over 4 million flood insurance policies, which generate over $1.5 billion in yearly premiums to help offset disaster costs and NFIP operating costs. Many communities have passed local ordinances requiring elevation of new structures above the 1% flood elevation. And this process has increased public awareness of flooding issues.

Nonetheless, concerns remain about the NFIP. Approximately 2 out of 3 flood-prone structures are still not insured against floods. People continue to underestimate their vulnerability to floods and assume the 100-year flood will never happen–at least not again in their lifetimes. Although NFIP is no longer subsidized by taxpayers, there are substantial cross-subsidies among classes of policy holders. Finally, despite its huge impact on our society, no process has ever been established to evaluate the costs and benefits of NFIP.

Policy questions reviewed by the group during the discussion included the following:

- What is the appropriate role of government and the private sector in helping individuals and communities recover from floods, and who (Federal, State, local, private) should have primary responsibility?
- What types of and what degree of mitigation should individuals, communities and States be required or encouraged to undertake to reduce flood losses? What incentives can be used to facilitate mitigation?
- What is a fair and appropriate balance of flood recovery costs between individuals and society, and between different levels of government?
- What can be done by the State and Federal governments to encourage locally based comprehensive planning? Effective flood loss reduction can only occur in the context of the community's other problems and concerns. Durable solutions require partnerships between the private and public sectors, as well as assistance and incentives from State and Federal governments.

The group identified a number of counterproductive policies, including

- All States and communities receive the same disaster cost-share, no matter how good a job they do of preventing flood disasters. This lack of incentives explains why few States or communities choose to strengthen their mitigation programs. A number of States are backing off what were once strong flood reduction standards and programs, retreating to the minimum Federal standards.
- Communities not participating in the NFIP are still eligible to receive public assistance for replacing their infrastructure (roads, bridges, utilities, etc.), thereby encouraging development in flood-prone areas. Individuals, on the other hand, can get neither flood insurance nor disaster assistance unless their communities participate in the NFIP.
- Current national flood policy does not encourage or direct people to avoid flood-prone areas but instead tells them how to build in flood hazard areas. This sends the wrong message, suggesting that construction in the flood plain, if built according to code, is not at risk from floods.
- Past Federal policy for estimating the costs and benefits of alternative approaches to flood control ignored the costs to natural systems, instead focusing only on the built environment.
- The "100-year flood" terminology, though clear to the technical community, is misunderstood by most citizens and decision-makers. A better vocabulary for communicating flood risk to the public is needed.
- Past policy has considered only how to reduce flood losses, not how citizens and communities can deal with floods in the context of sustainable communities, and can benefit from the natural functions of river systems rather than alter them. Local mitigation actions should address the five basic principles of sustainability: (1) environmental quality, (2) quality of life, (3) disaster resiliency, (4) economic vitality, and (5) inter- and intra-generational equity.
- Governments have failed to maintain adequate funding for collecting and interpreting basic flood data. Good long-term streamgage data are needed by communities to develop effective mitigation programs and by Federal and State governments to develop rational and effective programs and policies. Real-time streamgage data are needed for flood forecasting and for emergency response and management. Flood loss data and up-to-date, accurate, readable flood maps are needed by property owners, zoning boards and developers.

Proposed Actions:

Develop an effective strategy for communicating flood risk. Such a strategy would include the definition of flood hazard areas, so property owners and communities can take actions to reduce that risk. Citizens, businesses, and local and State legislators need to understand that most floods do not become Presidentially declared disasters, and hence the Federal government does not bail them out in a flood; the risk is theirs.

Establish appropriate incentives for prevention and mitigation. The lack of broad incentives for more effective local or State standards encourages State legislatures to adopt minimum standards. Appropriate incentives will help State and local governments to assume their responsibility to prevent the disaster. Local and State preventive actions will reduce Federal disaster costs, offsetting the cost of Federal incentives.

Define the roles of Federal, State, and local government. The Federal government must provide leadership, using appropriate incentives and consequences to encourage individuals, communities, States and the private sector to assume their flood loss reduction roles and responsibilities. However, Federal agencies must see their role as facilitators to develop State and local capabilities, not as 'doing' the planning and implementation of projects. The Federal Government is also specifically responsible for collecting hydrologic data, issuing flood forecasts, producing flood insurance rate maps and operating the NFIP.

States should develop a broader approach independent of NFIP to help their communities incorporate floodplain management into other community processes. A key State role is to assist and monitor communities in implementing and enforcing mitigation, a task that can be effectively accomplished by State Hazard Mitigation Councils made up of essential State agencies and reporting to the governors.

Local governments must assume the primary responsibility for hazard mitigation efforts, using comprehensive plans that consider the entire watershed and address a range of community issues and concerns. With the appropriate tools and incentives, with ample involvement of their citizens, local businesses and non-governmental organizations – and without inappropriate interference from Federal and State regulations – local governments will be able to achieve the goal: sustainable communities resilient to natural disaster.

Forum 8: Reducing Losses from Floods

Rayburn House Office Building, Room 2167
Washington, DC

October 5, 1998

Sponsored By:

Association of State Floodplain Managers

9:00 WELCOME AND OPENING REMARKS

9:00 Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

9:05 Harvey G. Ryland, President, Institute for Business and Home Safety

9:10 INTRODUCTIONS BY COSPONSOR

Larry A. Larson, Association of State Floodplain Managers

9:25 BACKGROUND PRESENTATION ON FLOODS–HISTORY, TRENDS & OPTIONS IN THE U.S.

Mary Fran Myers, Co-Director, Natural Hazards Center, University of Colorado-Boulder

9:50 Break

10:00 PANEL 1: OPTIONS FOR REDUCING FLOOD DISASTERS–ARE CHANGES NEEDED?

Moderator: David Conrad, National Wildlife Federation

Patricia Stahlschmidt, Special Assistant to the Associate Director for Response and Recovery, Federal Emergency Management Agency

Michael L. Davis, Deputy Assistant Secretary of the Army for Civil Works

Lisa Holland, State Floodplain Manager, South Carolina Dept. of Natural Resources

Daniel P. Delich, Professional Staff Member, Senate Environment and Public Works Committee

11:15 KEYNOTE PRESENTATION

From a perspective of federal policy to reduce flood losses–what has and hasn't worked, future options

Jo Ann Howard, Administrator, Federal Insurance Administration, FEMA

12:00 Lunch (Provided)

12:45 PANEL 2: HOW CAN FEDERAL POLICY/PROGRAMS HELP COMMUNITIES REDUCE/PREVENT FLOOD LOSSES?

Moderator: Rebecca Quinn, Mitigation Program Manager, Michael Baker Jr., Inc.

W. David Canaan, Assistant Director, Mecklenburg County Engineering and Building Standards, N.C.

Daniel Fread, Director, Office of Hydrology, National Weather Service

French Wetmore, President, French and Associates, Ltd.

2:10 Break

2:25 PANEL 3: APPROPRIATE ROLES AND RESPONSIBILITIES OF GOVERNMENT, INDIVIDUALS AND THE PRIVATE SECTOR IN FLOOD LOSS MITIGATION (FROM THE PERSPECTIVE OF NATIONAL POLICY)

Moderator: Robert M. Hirsch, Chief Hydrologist, U.S. Geological Survey

Michael Armstrong, Associate Director for Mitigation, FEMA

Dayle Williamson, Director, Nebraska Natural Resources Committee

Douglas J. Plasencia, Kimley-Horn & Associates

3:55 FORUM SYNTHESIS AND ACTION ITEMS

Larry Larson, ASFPM

4:10 *Overview of Forum 9*

William H. Hooke, SNDR

4:15 Adjourn

CHAPTER 9

Critical Infrastructure

Protecting Our Critical Infrastructure

Public Private Partnership 2000
Report on Ninth Forum
17 November 1998

Our society has transformed itself during the past century from agricultural and rural, through industrial and urban, and now to information-based and global. This transition has greatly increased our national income, but it has simultaneously made us dependent on shared lifeline systems – water supplies, gas pipelines, transportation and communication links – which are vulnerable to natural disasters and to willful human acts. Most recently the emerging critical role of computer communications, and specifically supervisory control and data acquisition (SCADA) systems, have created additional poorly understood vulnerabilities. Our society and economy – from local businesses to global corporations – increasingly depend on infrastructures, and keeping those infrastructures functioning requires collaboration and collective solutions.

Since 1996 the President has issued two decision directives (PDD62 and PDD63) in response to concerns about the safety of our infrastructure. In 1997 the President's Commission on Critical Infrastructure Protection issued a report, "Critical Foundations: Protecting America's Infrastructure," which states: "Our national defense, economic prosperity, and quality of life have long depended on the essential services that underpin our society. These critical infrastructures – energy, banking and finance, transportation, vital human services, and telecommunications – must be viewed in a new context in the Information Age. The rapid proliferation and integration of telecommunications and computer systems have connected infrastructures to one another in a complex network of interdependence. This inter-linkage has created a new dimension of vulnerability, which, when combined with an emerging constellation of threats, poses unprecedented national risk."

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On November 17, 1998, PPP2000, a partnership between the Institute for Business and Home Safety and the Subcommittee on Natural Disaster Reduction, jointly sponsored its ninth forum on natural disaster reduction, "Protecting Our Critical Infrastructure." The forum was co-sponsored by the Center for Risk Management of Engineering Systems at the University of Virginia and the American Society of Civil Engineers. The forum focused on current national policy for reducing our Nation's vulnerabilities related to critical infrastructure but emphasized two perspectives that had not been addressed at previous forums: Our vulnerability to willful hazards (human acts of terrorism), including cyber threats, as well as to natural hazards. The discussion addressed what we know about these issues – surprisingly little – and how best to manage critical infrastructure in light of the extraordinary uncertainties that we face. It became apparent that significant changes in national policies may be needed, but it is not clear exactly what they are.

Panelists noted that strategies designed to deal with natural hazards often help reduce vulnerability to technological hazards, and that the reverse is also true. However, in many ways the two hazards are distinct. Natural disasters have always been with us; cyber terrorism and dependence on computer technology are new. Moreover, our knowledge of natural hazards has benefited greatly from events across the globe; our knowledge of cyber threats will come mostly from first-hand experience. Our attempts to address Y2K problems have shown that our society and economy are surprisingly vulnerable to fragile software and that software is remarkably hard to repair.

Our society has had little time to learn to live with and to rely on technology, and we have yet to develop appropriate legal and institutional frameworks to deal with cyber threats. Our legal systems, for example, are geographically based, but – as we have learned from efforts to apply existing laws to the World Wide Web – cyberspace does not respect geography. Similarly, accounting practices, which precisely quantify traditional business vulnerabilities, are only now beginning to consider vulnerability to fragile software, a surprising result given that Y2K conversions are expected to cost billions of dollars. It is also unclear how responsibility for dealing with cyber vulnerabilities should be divided among private companies, different levels of government, and individuals.

Terrorism presents different issues. Since the Gulf War, military planners in the United States and in nations across the globe have recognized that the United States and its Western allies are likely to have substantial superiority in a battle with conventional weapons. This has raised concern about emerging threats, and specifically terrorist threats to infrastructure. For example, a dam upstream from a population center could become a weapon of mass destruction; do we know how to protect such critical facilities?

Willful attacks present political and social issues that do not arise with natural hazards. Whether a physical infrastructure is disabled due to a natural cause, a disgruntled employee, or a terrorist act, the physical consequences may be similar.

However, the impacts – especially the psychological and political impacts – are likely to be significantly different.

Willful hazards also present a conflict between the open discussion that democracies require and the need for secrecy as a means of security. Public awareness – understanding our vulnerabilities so that we can act on them – may be the single most important factor in reducing our vulnerability to natural hazards. Paradoxically, the reverse may be true with respect to willful acts. Thus, one finds that public safety may require secrecy, which in itself can become political.

Nonetheless, forum panelists emphasized the need to educate the public about this emerging era of vulnerability to our critical infrastructure not only from natural hazards but also and especially from willful attacks. Enhancing the survivability and safety of our critical physical infrastructures should be viewed as a long-term process. This entails researching and developing new designs and extending broad educational efforts.

The current severe nationwide shortage of computer engineers can not be ignored when addressing the need to protect both our physical infrastructures and particularly our cyber and information infrastructures. An extensive body of literature documents system failures resulting from the occurrences of natural hazards, e.g., excessive precipitation, earthquakes, and hurricane force winds. In contrast, only a few terrorist threats have been directed against infrastructure systems, and those threats have not been widely publicized.

Forum participants emphasized that much remains to be learned, and that we are likely to struggle with these issues for years to come. Despite the urgency of eliminating the risks, it is not yet clear what actions and policies are needed, by whom, to reduce our vulnerability to cyber threats and willful acts. However, it seems likely that means to lessen the risks that natural hazards pose may, to varying degrees, harden the systems against willful hazards initiated by terrorists. Thus, considering natural hazards is appropriate to characterizing the need for and the alternative means to hardening such systems (i.e., making them less susceptible to becoming dysfunctional).

Our society's overall vulnerability to lifeline and cyber threats is unlikely to decline in coming decades. Threats will evolve; some will be reduced and new ones may emerge. At the same time, powerful economic forces are driving our society toward greater reliance on fragile technologies, toward economic deregulation with less societal control over lifeline resources, and toward more global interdependence. Assuming we continue on these paths, it is likely that our vulnerability to cyber and willful threats will increase faster than new policies and actions can address them.

Forum 9: Protecting Our Critical Infrastructure

ASCE World Headquarters
1801 Alexander Bell Drive
Reston, Virginia

November 17, 1998

Sponsored By:

American Society of Civil Engineers
Center for Risk Management of Engineering Systems at the University of Virginia

9:00 WELCOME AND OPENING REMARKS

Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

Harvey G. Ryland, President, Institute for Business and Home Safety

9:05 PANEL I: PROTECTION OF CYBER INFRASTRUCTURE PER SE

Moderator: Prof. Yacov Haimes, Center for Risk Management of Engineering Systems

Irv Pikus, Commissioner, President's Commission on Critical Infrastructure Protection

Sarah J. League, Critical Infrastructure Protection Directorate, Security & Information Operations, Department of Defense

Rich Pethia, Director, CERT Coordination Center, Carnegie Mellon University Software Engineering Institute

Anita Jones, Professor of Computer Science, University of Virginia

9:30 Moderator-directed discussion

9:50 Open discussion

10:30 Break

10:45 PANEL 2: PROTECTION OF PHYSICAL INFRASTRUCTURE, WITH ATTENTION TO NEW CHALLENGES POSED IN CONNECTION WITH SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEMS

Moderator: Richard N. Wright, Director, NIST Building and Fire Research Laboratory

Col. Rick Miller, Provost Marshall for Security, U.S. Army Corps of Engineers

Dr. William Stasiuk, Deputy Commissioner, New York City

Dr. Paula L. Scalingi, Director, Center for Critical Infrastructure Protection, Science Applications International Corporation (SAIC)

Prof. Daniel Alesch, Public and Environmental Affairs, University of Wisconsin at Green Bay

11:05 Moderator-directed discussion

11:25 Open discussion

12:05 Lunch (Provided)

1:00 FEMA Establishment of a Lifeline Executive Board

Doug Honegger, ASCE Technical Council on Lifeline Earthquake Engineering

1:15 Discussion

1:30 PANEL 3: THE EFFECT OF DEREGULATION ON THE RELIABILITY OF OUR NATION'S INFRASTRUCTURE SYSTEMS

Moderator: Ronald Eguchi, Vice President, EQE International Inc.

Dr. David Johnson, Science Director, Pickard, Lowe and Garrick

Dr. Stephen H. Shepherd, Consulting Engineer, Edison International

Dr. Ted Marston, Senior Vice President, EQE International.

1:50 Moderator-directed discussion

2:10 Open Discussion

2:50 Break

3:10 *Wrap Up Discussion*

Yacov Haimes

3:55 *Overview of Forum 10*

Kenneth Deutsch, American Red Cross

4:00 Adjourn

CHAPTER 10

Motivating People

Motivating People To Do Something About Natural Hazards

Public Private Partnership 2000
Report on Tenth Forum
15 December 1998

Over the past few decades, the science of forecasting natural hazard events such as hurricanes, floods, and volcanic eruptions has advanced significantly, as has the technology for disseminating warning information quickly. However, people at risk often fail to understand or act on the information in appropriate ways, suggesting that our ability to present the information has not kept pace with the technological advances.

Our approach to awareness and education about natural hazards reduction has in general been too simple. Therefore, we must approach the basic problem in a broader frame: disasters are one of many problems that undermine community sustainability when local communities are built in ways that do not interact appropriately with the land.

On December 15, 1998, PPP2000 sponsored "Motivating People To Do Something About Natural Hazards," the tenth forum in a series dedicated to exploring new approaches to natural disaster mitigation. The American Red Cross and the Institute for Business and Home Safety, in cooperation with the Subcommittee on Natural Disaster Reduction, jointly sponsored this forum that focused on communicating the mitigation message to the public. The forum was held in Washington, D.C., at the American Geophysical Union, which was also a co-sponsor of the event.

Forum presenters examined the effectiveness of existing grassroots mitigation initiatives with particular attention to how and what information needs to be communicated to motivate the public to protect themselves and their property from natural hazards. Many panelists discussed the importance of measuring the effects of mitigation, marketing mitigation success stories, and building partnerships as key elements to effectively reduce the human and economic costs of natural disasters.

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The starting point for grassroots mitigation requires an examination of both individual and societal behavior. Natural disaster reduction must become a public value. As a rule, the American public is unaware of its vulnerability to disaster and has not accepted that individuals, rather than the government or charitable organizations, are primarily responsible for ensuring their safety from natural hazards.

Americans are attracted to areas where disasters occur. More than 40 million people live in high-risk areas. Yet people have a low sense of personal risk from disaster, and their perception of risk does not correlate to what they do about their risk. Although scientists think in terms of statistics and probabilities and in the past have presented hazards information in this way, the public generally does not know how to connect probabilities with appropriate action. Scientists must learn how to translate research about hazards and risks into information that influences public action.

Communicating about hazards and risks is a dynamic, multi-faceted process, and effective public education is not simple. In the past twenty years, our ability to communicate with the public about disasters has improved significantly. We have based communication and public education on several assumptions:

- information should come from a number of different credible sources;
- the content should focus on risk;
- warnings should include specific information about who faces the risk;
- repetition is needed;
- communication is not a singular act but a process that can take months or years; and
- the public has a need to validate the information it hears.

However, we have not adequately validated these assumptions or assessed the effectiveness of public information campaigns to know whether or not our communication is eliciting the desired actions or behaviors.

It was proposed that the role of public education is to create uncertainty in people about the stability of their environment in order to get people to educate themselves, convince themselves that change is needed, and, ultimately, act to reduce their vulnerability. Awareness and education campaigns must recognize that people differ in their knowledge about the hazards they face, in their preferred way of receiving information, and in their ability to mitigate hazards. The public is not homogeneous, so education must be customized. The more local and targeted the approach, the more successful it is likely to be. Children make excellent messengers and have amazing ability to influence the adults in their lives. Additionally, the best time to influence a person's behavior is when they are young.

Our current approach to building awareness is hazard specific and is based on a linear model: that the public will understand hazards information if it is clearly presented and will act rationally to reduce its risk. In fact, we now realize that both businesses and individuals have little awareness of what can be done to protect homes and businesses. Future public education messages must be presented in many ways,

from many sources, and in many languages. The news media (print, television, radio) are an essential partner in the quest to motivate the public to take more responsibility to protect themselves and their property from natural hazards.

Diverse partnerships and coalitions among both grassroots and national groups are crucial to effective mitigation, yet no formal strategy currently exists to help develop these partnerships. Information and opportunities to influence grassroots mitigation exist but are not always shared; for example, design professionals and regulators must find ways to share technical information with insurers and lending institutions.

Mitigation actions too often have tended to shift the burden of risk onto the poor and other vulnerable populations. Future mitigation strategies need to enhance intra- and intergenerational equity as well as support long-term economic sustainability.

Recommendations

- Examine how public values about wearing seatbelts, historic preservation, and recycling have been changed, and use those tactics to change public values about disaster vulnerability.
- Establish a natural hazards coalition that will foster partnerships and information sharing among the diverse groups involved in mitigation.
- Expand incentives for grassroots mitigation action, and eliminate government disincentives to mitigation; for example, the current tax code does not allow deduction for retrofit, yet it does allow deductions for catastrophic losses.
- Publicize mitigation success stories to motivate similar actions.
- Target the message to the audience and engage all forms of the media to creatively expand education to the public about reducing vulnerability to natural hazards; for example, involve weathercasters in disseminating mitigation information.
- Maximize the effectiveness of public awareness and education efforts by urging collaborations among stakeholders.

Forum 10: Motivating People to Do Something About Natural Hazards

American Geophysical Union
Washington, DC

December 15, 1998

Sponsored By:

American Red Cross
American Geophysical Union

9:00 WELCOME AND OPENING REMARKS

Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

Harvey G. Ryland, President, Institute for Business and Home Safety

9:10 INTRODUCTIONS BY COSPONSORS

A. F. Spilhaus, Jr., Executive Director, American Geophysical Union (AGU)

9:15 GRASSROOTS MITIGATION: WHAT IS IT? DOES IT WORK?

Dennis Mileti, Professor of Sociology and Director, Natural Hazards Research and Applications Center, University of Colorado

9:45 OPEN DISCUSSION

How has research been incorporated into what organizations are doing to educate the public about how to prepare for disaster? Are those initiatives working? How do we know? How can we improve on motivating the public to take action, especially when a disaster does not seem to be likely?

10:00 Break

10:15 PANEL I: SHAPING THE MESSAGE

Moderator: Rocky Lopes, Senior Community Disaster Education Associate, American Red Cross National Headquarters

Sarah Nathe, Senior Program Planner, California Office of Emergency Services

Paula Gori, Community Planner, U.S. Geological Survey

Don Wernly, Chief, Customer Service, Office of Meteorology, National Weather Service

11:10 Open Discussion

What effect does consistency of message have upon public behavioral change?

How do messages need to be changed when disaster seems unlikely vs. when it is about to happen?

11:30 KEYNOTE ADDRESS: MAKING MITIGATION WORK

John Clizbe, Vice President, American Red Cross

12:00 **Lunch** (Provided)

1:00 PANEL II: COMMUNICATING THE MESSAGE

Moderator: David Bilbo, Associate Professor, Texas A&M University, Hazards Reduction and Recovery Center.

Raymond J. Ban, Senior Vice President, Meteorological Affairs Director, Broadcast Industry Council, National Association of Broadcasters

Dan Summers, Director, Emergency Management, New Hanover County, NC–a Project Impact Community

David Oliver, Director, Community Relations, Lowes Home Improvement Warehouse

2:05 OPEN DISCUSSION

What methods are most useful to disseminate disaster safety information?
How does the public respond?
What can be done to motivate public action through the communication process?
How can all communicators be more effective?

2:30 **Break**

2:45 PANEL III: HOW TO MAKE DISASTER MITIGATION A PUBLIC VALUE–SUCCESS STORIES AND THE IMPORTANCE OF MARKETING

Moderator: Val Bunting, Deputy Director, Federal Emergency Management Agency Region IX

Harriette Kinberg, Director, Marketing Division, Federal Insurance Administration

Dave Jones, Meteorologist, NBC 4 TV, Washington, DC

3:40 Open Discussion and Questions and Answers

4:00 WRAP-UP Dennis Mileti

4:10 *Overview of Forum 11*

Andrei Iatsenia, The World Bank

4:15 Adjourn

CHAPTER 11

Challenges for the Next Century

Natural Disaster Reduction: Challenges for the Next Century

Public Private Partnership 2000
Report on Eleventh Forum
27 January 1999

Twenty-five thousand Americans died and more than a hundred thousand were injured in natural disasters during the two decades following 1975, the year in which the First Assessment of the Nation's vulnerability to natural hazards was completed. The recently published Second Assessment* seeks to answer why society continues to suffer human and economic losses from natural hazards despite extensive efforts to curtail them during the past quarter century.

The Second Assessment suggests that past approaches, by focusing on the technical aspects of natural disasters, failed to recognize the more important human components. We have now learned that technological solutions alone are inadequate and in general simply redistribute the burden of future disasters. The Second Assessment, in contrast, advocates a shift to a policy of "sustainable hazard mitigation." This concept includes the sound management of natural resources, local economic and social resiliency, and the recognition that hazards and mitigation must be understood in the largest possible social and economic context.

On January 27, 1999, PPP2000 sponsored its eleventh forum on natural disaster reduction. Forum 11 was co-sponsored by the Natural Hazards Research and Applications Information Center at the University of Colorado and the World Bank. The purpose of the forum was to unveil and discuss the findings of the Second Assessment, a five year research project, involving more than one hundred experts, to assess the state of knowledge on natural hazards and propose policies to reduce future losses.

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*The Second Assessment Project was headed by Professor Dennis Mileti at the University of Colorado at Boulder and funded by the National Science Foundation, Federal Emergency Management Agency, U.S. Environmental Protection Agency, U.S. Geological Survey, and U.S. Forest Service. The complete report is published by the Joseph Henry Press under the title: *Disasters by Design: A Reassessment of Natural Hazards in the United States.*

Disaster losses result from the intersection of the natural system with constructed and human systems, which are becoming increasingly complex. The Second Assessment emphasizes the importance of fostering local sustainability as the foundation for reducing losses from natural disasters. Sustainability encompasses broad human objectives such as enhanced environmental quality, quality of life, local resiliency and responsibility, vibrant local economies, inter- and intra-generational equity, and local consensus building.

The following tools are considered critical to successful sustainable hazard mitigation:

- Land use planning,
- Warning systems,
- Engineering and building codes,
- Insurance, and
- New technology, such as geographic information systems (GIS) and remote sensing.

However, these tools by themselves are not enough. The shift to sustainable hazard mitigation requires that they be used in the context of seven essential actions:

- Build local networks, capability, and consensus;
- Establish a holistic government framework;
- Conduct local hazard and risk assessments across the Nation;
- Build national databases;
- Provide comprehensive education and training;
- Measure progress toward achieving a society resilient to natural disasters, and
- Share knowledge internationally.

These components of sustainable hazard mitigation form the basis for the Second Assessment's major recommendations.

The disaster community's challenge is to realize the goals of the Second Assessment. Forum speakers and participants discussed how the necessary "shift in culture" could occur and how the disaster community could work toward achieving some of these goals. Specifically, forum participants discussed the establishment of a national database of disaster losses in the United States. Currently, the Nation has no systematic accounting of natural disaster losses. As a result, *ad hoc* estimates and differing methodologies are used by a variety of government and private entities to collect data, thereby making it difficult to establish the current cost to the Nation of natural disasters, much less assess the benefits of mitigation. Panel discussions helped clarify the types of information that should be collected, including:

- Type of disaster,
- Types of losses,
- Disaster location (preferably in longitude/latitude), and
- Specific characteristics and causes of the disaster.

Developing this new data repository will require standards for geocoding, documentation, and on-line access. This effort must be coordinated with all stakeholders including government, professional societies, academia and the international community.

Forum participants recognized land-use planning as a critical tool for sustainable hazard mitigation. Effective land use planning can limit development in hazardous areas and has a proven record of success in reducing losses. For example, communities that enforce good land use plans have fewer damaged buildings in disasters. Unfortunately, most local governments do not have effective land use plans for hazard mitigation. One suggestion was that the Federal Government should offer substantial flood insurance rate incentives in exchange for land use planning. Forum participants also noted that the Federal Government is working towards integrating sustainability and mitigation, as can be seen in the Federal Emergency Management Agency's (FEMA) Project Impact program. Project Impact is also a good example of how private-public partnerships can succeed at the local level.

Many of the policies advocated by the Second Assessment will be difficult to implement given existing political institutions. However, Congressional staffers at the forum stated that they were interested in talking with members of the hazard community. In addition, the President's Assistant for Science and Technology expressed the Administration's concern over disaster losses and its commitment to sustainable mitigation. He noted the importance of the hazard community's work on this issue and underscored the need for a new paradigm. He endorsed the Second Assessment's recommendations and said that they are at the core of the Administration's goals. He mentioned the need for more resilient communities, better disaster warnings, public-private partnerships, and working on the goals of the Assessment at local levels.

While the Second Assessment addresses hazard issues in the United States, the forum expanded the discussion to include hazard issues worldwide and particularly in developing countries. Two major ideas emerged: Effective, sustainable development needs to include mitigation; and natural disasters are a symptom of failed development policies.

The World Bank, with its new Disaster Management Facility, is committed to reducing vulnerability by promoting sustainable projects that incorporate effective prevention and mitigation measures. The World Bank is now promoting the inclusion of risk analysis and disaster prevention mechanisms in its own operations and in its country assistance strategies. The Bank has also established the Market Incentives for Mitigation Investment (MIMI), which allows governments to shift funding from current emergency relief and reconstruction to longer-term projects for sustainable disaster mitigation. Agreeing with the recommendations of the Second Assessment, the World Bank voiced commitment to changing the paradigm and putting more resources toward sustainable hazard mitigation. This creates new opportunities for the U.S. hazard community, the World Bank, and other organizations to establish partnerships to reduce disaster losses worldwide.

Changing our way of thinking about natural hazards and disasters is clearly a challenge. Many forum participants wondered whether organizations that were set up to respond to disasters will succeed in promoting sustainable mitigation practices. Disaster managers need to become "players in the sustainable development game." Forum participants also recommended that a White House conference be held on the topic of sustainable hazard mitigation, and that disasters and hazards be recognized as critical components of economic and environmental sustainability. Everybody will benefit when sustainability experts consider natural disaster mitigation in their plans, and when the hazards community begins to incorporate all six essential objectives of sustainable hazard mitigation: environmental quality, quality of life, local resiliency, economic vitality, inter- and intra-generational equity, and stakeholder participation and consensus.

Forum 11: Natural Disaster Reduction: Challenges for the Next Century

The World Bank Building
1818 H Street NW, Washington, DC

January 27, 1999

Sponsored By:

The Natural Hazards Research and Applications Information Center, University of Colorado at Boulder
The World Bank

9:00 WELCOMING REMARKS

Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

James W. Russell, Vice President, Outreach, Institute for Business and Home Safety

Robert Watson, Director, Environment Department, The World Bank

9:20 KEYNOTE PRESENTATION

Dennis Mileti, Co-Director of the Natural Hazards Center, University of Colorado at Boulder

(Overview of the Approach, Methods, and Major Policy Recommendations of the Second Assessment)

9:45 Break

10:00 PANEL 1: NATURAL DISASTER LOSSES AND THEIR IMPACTS: DOMESTIC AND INTERNATIONAL IMPLICATIONS

Moderator: Mary Fran Myers, Co-Director, Natural Hazards Center, University of Colorado at Boulder

Robert Litan, Director, Economic Studies Program, The Brookings Institution

Alcira Kreimer, Manager, Disaster Management Facility, The World Bank

Susan Cutter, Chair, Department of Geography and Director, Hazards Research Lab, University of South Carolina

10:45 Moderator-directed discussion

11:15 KEYNOTE PRESENTATION: IMPLICATIONS OF THE ASSESSMENT'S MAJOR POLICY RECOMMENDATIONS FOR THE ADMINISTRATION AND THE INTERNATIONAL COMMUNITY

Neal Lane, Assistant to the President for Science and Technology

11:45 Lunch (Provided)

12:30 PANEL 2: IMPLICATIONS OF THE ASSESSMENT'S MAJOR POLICY RECOMMENDATIONS FOR THE CONGRESS

Moderator: William H. Hooke, Chair, Subcommittee on Natural Disaster Reduction

Mary Frances Repko, Legislative Assistant to Senator Russ Feingold (D-WI)

Bill Condit, Majority Staff Member, House Resources Committee

12:50 Moderator-directed discussion

1:10 PANEL 3: DOMESTIC AND INTERNATIONAL DISASTER LOSS REDUCTION OPPORTUNITIES

Moderator: Brent Woodworth, Director of Services, IBM Crisis Response Team Manager

Margaret Lawless, Division Director, Program Development & Coordination Division

Roy Williams, Director, Office of Foreign Disaster Assistance, U.S. Agency for International Development

Vijaysekar Kalavakonda, Financial Sector Consultant, Financial Sector Development Department, The World Bank

1:40 Moderator-directed discussion

2:10 Break

2:25 PANEL 4: CHANGING THE GLOBAL DISASTER MANAGEMENT CULTURE

Moderator: Andrei Iatsenia, Environmental Specialist for Latin America & the Caribbean Region, The World Bank

Raymond Burby, Professor of Urban and Public Affairs, University of New Orleans

Stephen Bender, Principal Specialist, Organization of American States

Rick Sylves, Professor of Political Science, University of Delaware

Neeraj Kak, Senior Associate, The Futures Group International

3:05 Moderator-directed discussion

3:35 FORUM SYNTHESIS AND ACTION ITEMS

Howard Kunreuther, Cecilia Yen Koo Professor of Decision Sciences and Public Policy, The Wharton School, University of Pennsylvania

4:00 *Preview of Future Forums and Adjournment*

William H. Hooke

4:05 Adjourn

CHAPTER 12

Public Health

Public Health in Natural Disasters

Public Private Partnership 2000
Report on Twelfth Forum
10 March 1999

Scientific understanding of natural hazards, technological advances in warning systems and structural engineering, and progress in related disciplines, are helping to minimize the consequences of natural disasters. Nonetheless, natural disasters, once they occur, quickly become a crisis in public health. In preparation for future disasters, public health specialists are using recent findings from epidemiological studies following disasters to establish strategies for decreasing injuries and deaths from such events.

On March 10, 1999, PPP2000 sponsored its twelfth forum on natural disaster reduction, "Public Health in Natural Disasters," which focused on the public health issues involved in emergency preparedness and response activities and the efforts to prevent or diminish adverse health effects from natural disasters. The forum was cosponsored by the UCLA Center for Public Health and Disaster Relief, University of Pittsburgh Safar Center for Resuscitation Research, World Association of Disaster Emergency Medicine, National Association of Medical Examiners, and the National Academy of Sciences Board on Natural Disasters. The forum was held at the National Academy of Sciences. Presentations and discussions by government representatives, the emergency management community, academia, and the private sector considered findings from epidemiologic studies following disasters and focused on successful strategies to respond to natural disasters and strengthen partnerships at the local, state, national,and international levels. One cannot eliminate natural disasters, but one can prevent some of their disastrous consequences. The Surgeon General set the stage for this forum by noting that "within any disaster is the opportunity to improve the basic system for prevention in the future."

Four questions form the basis for solving public health problems:

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- What is the problem?
- What is the cause?
- How and when can we intervene?
- What kinds of programs can we develop to prevent and control the problem?

A robust public health infrastructure is essential to protecting people's health by providing safe water and food, housing, sanitation, transportation, communication systems, and access to health care with trained personnel. The importance of public health infrastructure becomes paramount after a natural disaster and requires the contributions of all. Protecting the population requires more than government planning and policies. There must be not only cooperation among Federal agencies but also partnerships with private sector and non-governmental organizations.

The Surgeon General recognized four goals essential to reducing losses from natural disasters:

- *Developing a balanced community health system.* This would balance health promotion, early detection and universal access to health care. Today, 90% of the health budget is spent on treating disease and 10% on population-based prevention. We pay a terrible human and economic toll because of this imbalance. Our society's approach to dealing with natural disasters reflects a similar imbalance. Far too much is spent responding to individual events rather than preventing them through mitigation.
- *Promoting a healthy lifestyle and robust public health systems.* Just as we need to maintain our physical bodies, we need to maintain our society's public health infrastructure, so that as individuals and as a society we are resilient to disease and disaster.
- *Maintaining a global perspective on health.* We are tightly connected to the rest of the world. Any virus or bacteria can travel across the globe in 24 hours.
- *Eliminating disparities in health.* Our society's most vulnerable members are children, the elderly, the disabled and the poor, who suffer disproportionately following disasters.

An essential component of improving our society's response to natural disasters is the accurate characterization and clear understanding of the risks that we face. Analysis of past disasters provides the basis for better strategies and policies to address future events. Forum participants discussed case studies related to a variety of disasters (1995 Chicago heat wave, 1998 Maine ice storm, 1994 Northridge, CA, earthquake, and 1997 Jarrell, TX, tornado).

The panelists noted that only through disease and mortality surveillance after a disaster do we uncover the public health effects. The earlier we discover an outbreak, the less morbidity and mortality will result from the incident. Epidemiology is important to monitor trends, investigate concerns, and assist in science-based activities, but the findings must result in public health action and follow-up. To prevent morbidity and mortality, regardless of the type of potential hazard, we must educate the public and alert the affected population by providing information to news media (print,

television, and radio) about risks and ways to prevent exposure. Programs to educate consumers on proper use of equipment should also be implemented at the point of purchase for many items associated with disasters. For example, most people who used gas-powered generators and space heaters after the 1998 Maine ice storm bought them after the storm, had no operating experience, and did not notice any warning signs on the equipment. As a result, many people used them improperly, for example in basements or attached garages, and were poisoned by carbon monoxide. Awareness and education programs must recognize that people differ in their knowledge about the risks and hazards they face, in their preferred way of receiving information, and in their ability to mitigate hazards. The importance of social factors with respect to access to health care infrastructure following a natural disaster was stressed by all panelists.

Public health officials face a range of challenges in dealing with the national and international emergency preparedness and response activities while preparing for natural disasters. Following disaster, the loss of health care infrastructure adds new complexities to the challenge. After Hurricanes Georges and Mitch, for example, health officials faced major problems in providing an immediate assessment of needs, medical care, water and sanitation, psychological management, supplies management, and overall coordination. Immediately following a disaster, countries sometimes receive equipment with no training on its operation, so it is not useful. The work of the civilian and military agencies often is not well coordinated, and there is little sharing of information.

A number of possible solutions for these global problems were proposed. Broader adoption of prevention and mitigation measures is clearly essential and has been discussed repeatedly in these forums. Better and more timely dissemination of warnings would lower the human and economic costs of disasters; the scientific community generally has the information needed but getting the appropriate message to the people at risk has proved difficult. Contingency planning should coordinate all sectors, not just the health sector, before a disaster strikes. Finally, civilian institutions at all levels, from national to local, need support and strengthening. Panelists also discussed the need to address capacity building needs related to disasters. Institutions currently invest in education and training in the field, but with the rotation of staff there is a troubling loss of knowledge. Agencies have to accept the inevitable rotation of personnel and look at how their knowledge can be transferred to the new field staff. The public health profession's task is to develop programs and increase skills to (1) identify the cause of problems, (2) evaluate available options, (3) make information available, (4) prepare the work force to apply the learned skills, and(5) participate more fully in all phases of mitigation, response, and recovery. Since the early 1990's, several schools of public health have developed new curriculum programs related to emergency disaster management that are beginning to address these issues in a coherent way.

Research is an essential part of the broader public health response and is complemented by training, planning, and surveillance systems following a natural disaster. Basic tools of epidemiology do not differ. The difference with natural disasters is the situation. In the midst of the social destruction and public fear that follow a disaster, a scientific study does not seem important; people have much to do, and routine systems are no longer functioning. However, epidemiologic studies build the solid base for long-term studies. By conducting risk assessments, providing surveillance on mortality and disease trends, and collecting information on a variety of issues, scientists provide reliable information to decision makers who can then modify public health policies to better respond to future disasters. However, some disasters cannot be studied solely through historical data. For example, understanding the ramifications of global climate change, which some panelists asserted is the greatest long-term disaster we face, requires the use of models.

Panelists discussed strategies for translating research into prevention and mitigation, as well as effective methods for allocating response resources during disasters. Rapid needs assessment, a collection of techniques designed to provide information about an affected community's needs following a disaster, provides an essential tool. The objective is to collect and analyze the data quickly in order to provide information useful for decision making, such as delivering emergency supplies during response and recovery. A rapid needs assessment indicates the actual types of services and supplies needed, so that appropriate actions can be taken to respond to those identified needs. For example, findings from a rapid needs assessment after Hurricane Marilyn struck St. Thomas in the U.S. Virgin Islands in 1995 indicated that most affected households sustained minor injuries and regularly listened to a particular local radio station. In light of this information, emergency health officials amended plans to deliver health care services. Rather than focusing on individual household visits by public health and medical teams, they opted to broadcast by radio that health care services were available at a central point. Partnerships between governmental agencies, private groups, NGO's, and universities are crucial in the translation of rapid needs assessments and the transfer of technology.

Panelists also discussed the use of population-based surveys following natural disasters. The most familiar example is the use of random-digit dialing of telephones, where one gets the best response rate and can ask more complicated questions than in a mail-in questionnaire. Statistically valid survey data can help reduce the impact of future disasters by serving as a basis for developing reliable models and future interventions, by permitting evaluation of interventions over time, and by enabling priorities for minimizing loss and damage to be set.

In order to get the natural disaster message out to both the scientific and general community, we need (1) a common, universally accepted natural disaster language (current definitions of disaster terminology vary according to discipline and region), (2) improved access and communication across the involved disciplines, (3) consolidation of information sources, (4) concentration on practical, meaningful evaluation,

(5) interpretive editing and skill in translating scientific information to the public for generating press releases, and (6) incorporation of science into disaster planning. There is a growing need to translate our scientific information for publication on the Internet. We need to get active in disaster planning, which lags far behind current science and technology.

Final Recommendations

- Mapping after each disaster by all agencies that collect data. Map Red Cross data against FEMA's, NOAA's, CDC's, etc., to get a complete story of the actual vulnerabilities and to maximize public awareness and education opportunities through the collaboration among the stakeholders.
- Public health involvement in the formation of a congressional caucus to share the public health perspective in natural disaster reduction.
- Sharing of information and formation of strong partnerships to reduce the impact of natural disasters on the community. The involvement of the local community from the beginning is essential!

Forum 12: Public Health in Natural Disasters

The National Academy of Sciences Building
2101 Constitution Avenue NW, Washington, DC

March 10, 1999

Sponsored By:

UCLA Center for Public Health and Disaster Relief
University of Pittsburgh Safar Center for Resuscitation Research
World Association of Disaster Emergency Medicine
National Association of Medical Examiners
National Academy of Sciences Board on Natural Disasters

9:00 WELCOMING REMARKS

Dr. William Hooke, Chair, Subcommittee on Natural Disaster Reduction

Dr. Robert Hamilton, Executive Director, Commission on Geosciences, Environment and Resources, National Research Council, National Academy of Sciences

9:20 KEYNOTE PRESENTATION

David Satcher, M.D., Ph.D., U.S. Surgeon General, U.S. Department of Health and Human Services

9:50 PANEL I: CASE STUDIES : PUBLIC HEALTH EVENTS & IMPACTS

Moderator: Michael McGeehin Ph.D., M.S.P.H., National Center for Environmental Health, CDC

Edmund Donoghue, M.D., Cook County Medical Examiner, Illinois, and President, National Association of Medical Examiners (NAME)

Randolph Daley, D.V.M., M.P.H., National Center for Environmental Health, CDC

Rana Hajjeh, M.D., Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, CDC

David Zane, M.S., Director, Injury Epidemiology and Surveillance Program, Texas Department of Health

10:40 Moderator-directed discussion

10:45 Open discussion

11:05 Break

11:20 PANEL 2: EMERGENCY PREPAREDNESS & RESPONSE ACTIVITIES

Moderator: Steven Rottman, M.D., FACEP, UCLA Center for Public Health and Disaster Relief and President, World Association of Disaster Emergency Medicine (WADEM)

Hugo Prado, M.D., M.P.H., Emergency Preparedness and Disaster Relief Coordination Program, Pan American Health Organization

Roy Williams, Director, Office of Foreign Disaster Assistance, U.S. Agency for International Development

Henry Falk, M.D., M.P.H., Director, Division of Environmental Hazards and Health Effects, National Center for Environmental Health, CDC

Linda Landesman, Dr.P.H., M.S.W., Association of Schools of Public Health

12:10 Moderator-directed discussion

12:15 Open discussion

12:35 Lunch (Provided)

1:05 SECONDARY KEYNOTE PRESENTATION

Steven Rottman, M.D., FACEP, UCLA Center for Public Health and Disaster Relief and President, World Association of Disaster Emergency Medicine (WADEM)

1:25 Open discussion

1:35 PANEL 3: SCIENCE LEADING TO PREVENTION & MITIGATION

Moderator: Ernesto Pretto, M.D., M.P.H., Associate Director, Safar Center for Resuscitation Research, University of Pittsburgh

Josephine Malilay, Ph.D., National Center for Environmental Health, CDC

Kimberly Shoaf, Dr.P.H., Community Health Sciences, UCLA Center for Public Health and Disaster Relief

Marvin Birnbaum, M.D., Ph.D., Editor in Chief, *Prehospital and Disaster Medicine*

2:25 Moderator-directed discussion

2:30 Open discussion

2:50 Break

3:10 WRAP-UP SESSION

3:55 *Overview of Forum 13*
William Hooke, SNDR

4:00 Adjourn

CHAPTER 13

The Military

Mobilizing DOD Hazard Reduction Forces

Public Private Partnership 2000
Report on Thirteenth Forum
11 May 1999

The United States has a long history of looking to its military for help with natural hazards, both for responding to crises and for long-term technical support in protecting communities from floods and other hazards. There are several reasons for this: The military is trained and equipped to deal with chaotic and unexpected situations; it can quickly bring substantial resources to bear on a problem; it has the management structure needed to maintain order in the pandemonium surrounding a disaster. These capabilities are not widely available outside the military. On the other hand, there are substantial costs in relying on the military. First, employing the military in a non-combatant role diverts resources and attention from its primary mission; second, deploying the military tends to be expensive; third, relying on the military for response or recovery – essential activities though not solutions to the long-term threat of natural hazards – may come at the expense of true solutions to the Nation's underlying vulnerability to hazards.

On May 11, 1999, PPP2000 sponsored its 13th forum in a series dedicated to exploring new approaches to reducing the skyrocketing costs of natural disasters. The forum focused on the role of the military, including State National Guards as well as various components of the Department of Defense. The forum brought together representatives from Federal, State and local governments, the private sector, and non-governmental organizations – the major stakeholders – to explore and reassess the traditional patterns of thinking about natural disasters. Three major issues emerged from the discussion: The evolving role of the military in disaster response; its traditional role in structural hazard mitigation in light of our society's increasing demand for non-structural solutions; and some emerging threats that directly impact the ability of the military to protect the Nation from natural hazards.

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Determining the appropriate role for the military requires balancing issues of economic efficiency, civilian authority, and military readiness. However, for the foreseeable future it is clear that the military will continue to be involved. Economic losses from natural disasters continue to grow exponentially, tripling each decade, causing an average of billions of dollars in economic losses in the United States each year and threatening the safety of thousands of Americans.

Emergency Response: The Military Under Civilian Authority

Immediately following a natural disaster, local officials assess the damage to their communities and the extent of their needs. In many cases, a local jurisdiction can respond effectively and completely without any support from other governmental entities. For larger disasters, the local official can ask the State governor to mobilize State resources, including the National Guard; if more help is needed, the governor can request assistance from the Federal Government, generally the Federal Emergency Management Agency. The President can then implement the Federal Response Plan, which mobilizes Federal resources including the military.

Military involvement in natural disasters takes place only at the request, and under the control, of civilian authorities. The military is not in charge. Even at the Federal level, FEMA takes the lead. However, what makes the military particularly well suited to disaster response is:

- Speed: Capability for rapid mobilization
- Structure: Hierarchical command and discipline
- Smarts: Continual training and preparation
- Stuff: Materiel sufficient to fight two simultaneous wars

The military also has broad-reaching authority to hire contractors and procure materials from the private sector, which can be invaluable in emergency response and recovery.

The military is also well adapted to providing medical services where large numbers of casualties require treatment, which often occurs in natural disasters. Traditional medicine relies on multiple health professionals per patient; in disasters this ratio is turned on its head. Military medical personnel are trained to deal with this situation and with the kinds of injuries – trauma, burns, etc. – that natural disasters typically cause. The military also can provide the mobile logistical support that may be essential if local health facilities have been damaged by natural disaster or are overwhelmed by demand for services.

The use of the military for natural disaster response has both costs and benefits. Because the military is organized for war, it is highly effective, but not necessarily cost-efficient, in responding to natural disasters. However, accounting for the true costs is complicated. If the military is not immediately engaged in its primary mission, the marginal cost of disaster response can be relatively low. In addition, disaster response provides opportunities both for training and for serving the public, which can improve unit morale and public respect for the military. Because the public often judges its

government based on how quickly and effectively it responds to natural disasters, deployment of the military can provide political benefits. However, for various reasons military intervention should be temporary and local civilian responders should take over as quickly as possible.

The Military in Mitigation: The Army Corps of Engineers

In addition to its role in disaster response, the military plays an important part in hazard mitigation, particularly with respect to floods. The Army has a long tradition of expertise in civil engineering. The U.S. Military Academy at West Point, founded in 1802 by order of Thomas Jefferson, was the first engineering school in the Nation, and, during much of the 19th century, USMA graduates were involved in the construction of the bulk of the Nation's initial railway lines, bridges, harbors and roads. The Congress recognized this special expertise in the 1917 and 1936 Flood Control Acts, which gave authority to the Army Corps of Engineers for building and maintaining levees and dams for flood relief.

Historically, the Corps preferred structural solutions to floods and coastal erosion – dams, levees and groins. In recent years, the Nation and the Corps have recognized the environmental and economic cost of such solutions. The Corps now looks to non-structural solutions, working in cooperation with State and local governments, FEMA and other Federal agencies, to develop long-term, environmentally sound strategies.

Although the Corps lacks explicit authority to work overseas, it partners, when invited, with other Federal agencies and the private sector to assist in recovery and reconstruction efforts following disasters such as Hurricanes Mitch and Georges. This practice serves both humanitarian and strategic objectives.

Emerging Issues

The role of the military is changing in response to changes in our society, in the perceived role of the military, and because of the evolving nature of the threats that the military is expected to address. The downsizing of the Federal Government, and the military in particular, constrains the resources available to take on secondary missions such as disaster response. On the other hand, the emergence of new military threats, particularly weapons of mass destruction (chemical, nuclear and biological weapons) in the hands of terrorists, has forced the military to focus on Civil Defense in addition to ships and tanks.

The military has remote sensing capabilities that can help identify the extent of large-scale destruction and the disruption of critical infrastructure. Although remote sensing can reveal gross land movements and destruction, it is less effective at determining whether or not a facility remains functional, which is often the critical issue. Ground truthing is still needed. Finally, there is a potential conflict between disaster assistance, which calls for free release of information, and the need to avoid compromising national security by revealing significant details of our surveillance capabilities. These assets must be used with caution.

Perhaps the single largest challenge the military faces is maintaining necessary capabilities, including the ability to mobilize in response to disaster, in the context of downsizing. The end of the Cold War has been accompanied by declining budgets and reduced resources, reinforcing the trend toward a smaller Federal Government. As a result, the willingness of the military to assume increased responsibility for natural hazards will have to accommodate fiscal realities and the need to concentrate its resources on national defense.

Forum 13: Mobilizing DOD Hazard Reduction Forces

The National Guard Memorial Building
One Massachusetts Avenue, NW, Washington, DC

May 11, 1999

9:00 WELCOMING REMARKS

William H. Hooke, Chair, Subcommittee on Natural Disaster Reduction (SNDR)

James W. Russell, Vice President, Outreach, Institute for Business & Home Safety

Host Representative: BG J. Richard Capka, USA, Commander, U.S. Army Corps of Engineers (USACE), South Atlantic Division

9:20 *Keynote Presentation*
BG J. Richard Capka, USA

9:45 Break

10:00 PANEL 1: DOMESTIC MITIGATION AND RESPONSE
Moderator: Lacy Suiter, Executive Associate Director, Response and Recovery, Federal Emergency Management Agency

MG Ronald O. Harrison, USA, The Adjutant General State of Florida

Col. Robert A. Fitton, Chief, Military Support Division, Department of Defense

Capt. Vince Musashe, MSC, USN, Senior Medical Planner, U.S. Navy Bureau of Medicine

John P. D'Aniello, Deputy Director, Civil Works, USACE

11:00 Moderator-directed discussion

11:10 Open discussion

11:30 Lunch (Provided)

12:30 PANEL 2: INTERNATIONAL MITIGATION AND RESPONSE
Moderator: Maria C. Fernandez-Greczmiel, Deputy Assistant Secretary for International Affairs, Office of Public and Inter-Governmental Affairs, Department of Veterans Affairs

LTC Thomas E. Peck, Deputy District Engineer, USACE, South Atlantic Division Mobile District

Craig H. Llewellyn, M.D., MPH, COL, MC, USA (Ret), Professor and Chair, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences

John McMahon, Natural Resources Specialist, United States Agency for International Development, Latin-American Carribean Bureau

1:10 Moderator-directed discussion

1:15 Open discussion

1:30 PANEL 3: INNOVATIONS AND TECHNOLOGY TRANSFER

Moderator: James F. Devine, Senior Advisor, Science Applications, U.S. Geological Survey

Major Brent Anderson, USAF, Mission Commander, Defense Threat Reduction Agency, U.S. Air Force

Col. John. S. Silva, M.D., USAF, Program Manager, Defense Advanced Research Projects Agency, Defense Sciences Office

Maxwell Alston, Civil-Military Emergency Planning, Office of the Deputy Under-Secretary of the Army, International Affairs

Ed Link, Director of Research and Development, USACE

2:10 Moderator-directed discussion

2:15 Open discussion

2:30 Break

2:45 PANEL 4: EMERGING THREATS: WEAPONS OF MASS DESTRUCTION

Moderator: Robert F. Elliott, Deputy Director, Emergency Management Strategic Healthcare Group, Dept. of Veterans Affairs

MG John H. Fenimore V, USA, The Adjutant General, State of New York

Col. Jay S. Steinmetz, USAF, Program Director, Consequence Management Program Integration Office

Anthony G. Macintyre, M.D., Department of Emergency Medicine, George Washington University Medical Center

Connie J. Boatright, MSN, RN, Director, Training and Development, Emergency Management Strategic Healthcare Group, Department of Veterans Affairs

3:30 Moderator-directed discussion

3:35 Open discussion

3:55 Rose Mary Robert, Project Coordinator Loss Prevention & Safety Programs, USAA Property and Casualty Insurance Company

4:00 REVIEW OF FUTURE FORUMS AND COMMENTS
William Hooke, SNDR

4:05 Adjourn

CHAPTER 14

Combined Disasters

When Natural and Industrial Disasters Collide

Public Private Partnership 2000
Report on the Fourteenth Forum
13 October 1999

In the past few decades, natural disasters have been evolving rapidly and substantively in response to changes in our society. Disasters involve human beings; therefore almost all natural disasters now have a technological component. The floods caused by Hurricane Floyd in September 1999 were not just water and sediment but rather a slurry of animal-waste lagoon overflow, chemicals, animal carcasses, etc. However, U.S. policy and the actions of the public and private sectors fail to reflect these realities.

On October 13, 1999, PPP2000 held its 14th forum on natural disaster reduction, "When Natural and Industrial Disasters Collide," to examine some of these issues. The event was co-sponsored by The George Washington University Institute for Crisis, Disaster, and Risk Management, and the ACS Science and the Congress Program. The forum was held at the Hart Senate Office Building and was attended by over 100 representatives from academia, the private sector, non-governmental organizations, and Federal, State, and local government agencies.

A technological disaster occurring in the context of a natural disaster often involves complex interactions of many kinds. The responders to natural and technological events often come from different organizations and are governed by different plans and procedures. Yet, when the events occur concurrently, a high degree of coordination and information and resource sharing is required. The scale of the natural event may prevent an adequate response to the technological disaster, and an industrial disaster may greatly increase the impacts of a natural disaster. During the aftermath of the 17 August 1999 Kocaeli earthquake in Turkey, for example, responders were unable to mobilize the resources required to respond to a major oil spill. The agribusiness

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wastes released into North Carolina waterways by Hurricane Floyd may cause long-lasting environmental and public health consequences.

The National Contingency Plan establishes a response system coordinated by EPA and the Coast Guard for response to petrochemical releases. This system becomes part of the Federal Response Plan organization coordinated by FEMA during a natural disaster. The procedures, interactions, and communications required for effective coordination are seldom included in drills and exercises, and have not been tested in a catastrophic event. Furthermore, the Federal Response Plan is currently targeted only to governmental agencies; the private sector also has an important role in mitigating before a disaster, thus reducing the need for response, as well as providing people and equipment to respond when disaster strikes. Forum participants suggested that adding industry involvement to turn the FRP into a National Response Plan would significantly strengthen its ability to respond to a combined natural/technological disaster.

Floods, hurricanes, and earthquakes in industrial areas pose significant threats for toxic releases into densely populated areas. Our ability to anticipate the risks of such compound events has inhibited the introduction of measures that will minimize the probability and consequences of the events should they occur. We have not developed either the regulatory or financial incentives that will ensure that industry adequately minimizes the risk associated with an industrial disaster triggered by a natural hazard. As a society, we need to set the rules that determine acceptable levels of risk; in our free-market economy, it is then industry's responsibility to balance risks against profit.

A major goal of the forum was to discuss the threats we face, help establish priorities, discuss the adequacy of current plans, and anticipate the needs for the new century. Panelists discussed the current Federal/State planning and coordinating framework established by the Federal Response Plan, coordinated by FEMA and intended to respond to disasters that overwhelm local and State capabilities, and the National Contingency Plan, coordinated jointly by EPA and the U.S. Coast Guard and focused on industrial disasters. Although there is much common ground in the two plans, the organizational issues that arise when dealing concurrently with both a natural and industrial disaster have not been solved.

Many corporations are not prepared to deal with the crisis management aspects of an industrial disaster. Regulatory oversight, insurance industry requirements, and public and media interest serve to decrease risk and improve preparedness. Participants agreed, however, that this system was inherently reactive and had no clearly established goals for reducing the vulnerability of industry to natural disasters.

The emergence of national safety goals, improved sharing of comprehensive national data, and a more strategic approach to the problem of industrial and natural disasters are positive signs for the future. However, the lack of coordinated risk management, as the number and size of industrial facilities in high natural hazard zones throughout the world increase, suggests that we are likely to experience more and

bigger disasters. Forum participants agreed that the evaluation of risk, the education of the public, and the development of risk management strategies were shared public and private responsibilities.

Role of Public–Private Partnerships

A partnership consisting of key Federal agencies, insurance companies, industry associations, and individual companies could improve the current situation in the following areas:

- Estimate the potential probability and consequences of industrial disasters caused by natural disasters through improved event and loss estimation modeling. This will require extensive sharing of data between the public and private sectors.
- Educate the public as to the level of risks posed by industrial activities in high hazard areas and use the resulting awareness to improve the incentives for businesses to become more risk averse.
- Develop risk management goals and strategies.
- Create effective public-private response organizations and capability, building on the existing structure of the National Response Plan.

Key Issues and Challenges

Improving interagency coordination during response: People expect the Federal Response Plan and the National Contingency Plan to work well in all cases. This expectation demands a level of coordination and compatibility between FEMA, the EPA, the Coast Guard, and State and local response organizations that will be difficult to achieve.

Identifying, communicating, and preparing for threats: The existing risk management structure relating to industrial disasters caused by natural hazards is inherently reactive. Community risk perceptions in this area have not been significantly affected by right-to-know legislation. The scale of resources at risk and the inter-dependencies caused by infrastructure are increasing. A more strategic focus is required if we are to anticipate future threats.

Developing national safety/risk goals: Before meaningful goals can be established, one must develop metrics that connect safety performance with business objectives. Industry cannot be expected to design for worst case scenarios, particularly where doing so would be costly. However, if risk can be internalized into the economics of production, including decisions about location, design, and construction of facilities, natural disaster reduction will become a part of every business decision.

Improving incentives for industry: Creating market incentives for good behavior (risk reduction, preparation) can only be achieved through coordinated public/private actions. In particular, incentives that will enable small business to operate in a risk-averse manner are needed.

Increasing the understanding of the environmental and public health problem caused by technological/natural disasters: The potential impacts of combined industrial/natural disasters have not been adequately modeled.

Improving corporate crisis management: The crisis management capability of affected corporations is the key to the success of a combined public/private response.

Improving public-private partnerships: This is an area where public and NGO mitigation, planning and response will fail without the full partnership of the private sector.

Forum 14: When Natural and Industrial Disasters Collide

216 Hart Senate Office Building
Washington, DC

October 13, 1999

Sponsored By:

The George Washington University Institute for Crisis, Disaster and Risk Management
American Chemical Society Science and the Congress Program

9:00 WELCOMING REMARKS

William H. Hooke, Chair, Subcommittee on Natural Disaster Reduction (SNDR)

Sen. John Chafee, Senate Environment and Public Works Committee (invited)

Dr. John Sutter, U.S. Geological Survey Center for Earth Science Information Research

Prof. John Harrald, Director, George Washington University Institute for Crisis, Disaster, and Risk Management

9:20 KEYNOTE PRESENTATION

The Challenges We Face

Timothy Fields, Jr., Assistant Administrator for Office of Solid Waste and Emergency Response (OSWER), United States Environmental Protection Agency (USEPA)

10:00 Break

10:30 PANEL I: FEDERAL PLANS FOR DEALING WITH INDUSTRIAL DISASTERS CAUSED BY (OCCURRING DURING) NATURAL DISASTERS

Moderator: Prof. John Harrald, George Washington University

Special Briefing: The Disaster Time Line

Claire B. Rubin, Consultant, Claire B. Rubin & Associates

The National Contingency Plan

James L. Makris, Director, Chemical Emergency Preparedness and Prevention Office, USEPA

The Federal Response Plan

Lacy Suiter, Executive Associate Director, Response & Recovery Directorate, Federal Emergency Management Agency

Joseph Myers, Director, State Emergency Services, Florida

Marcus Peacock, Professional Staff Member, Water Resources & Environment Subcommittee

Capt. Larry Hereth, U.S. Coast Guard, Co-Chair, National Response Team

11:10 Moderator-directed discussion

11:30 Open discussion

12:00 Lunch (Provided)

Lunch Speaker: Corporate Responsibility for Crisis Management

Judge Stanley Sporkin, U.S. District Court, District of Columbia

1:00 PANEL 2: HOW CORPORATIONS RESPOND TO THE CHALLENGE

Moderator: Ernest Abbott, FEMA Office of General Counsel

Panelists:

Paul H. Hitch, President and Chairman, Hitch Enterprises, Inc.

Peter P. Howell, PE, President, Mark V, Inc.

Kent Jarrell, Vice President, WeberMcGinn Strategic Communications

Arthur G. Sapper, McDermott, Will, and Emory

1:30 Moderator-directed discussion

1:50 Open discussion

2:15 Break

2:45 PANEL 3: WHAT MIGHT THE FUTURE BRING?

Moderator: James L. Makris, Director, CEPPO Counsel

Panelists:

Prof. John Harrald, George Washington University

Dr. Sam Mannan, PE, CSP, Associate Professor and Director, Mary Kay O'Connor Process Safety Center, Chemical Engineering Department, Texas A&M University

Dr. Irv Rosenthal, Chemical Safety Board

Francis O'Connell, FM Global

3:15 Moderator-directed discussion

3:35 Open discussion

3:55 WRAP-UP AND CLOSING

4:10 Adjourn

CHAPTER 15

Conclusions

It is now widely recognized that the cost of natural disasters is skyrocketing. The goal of the forum series was to explore the causes and possible solutions to reduce the Nation's vulnerability and losses.

The most important finding of the PPP2000 series is that the challenge we face is rooted in our national history and psychology. Our vulnerability to natural extremes is inextricably linked to decisions and policies that drive our society – how and where we choose to live and work on our beautiful but dangerous planet – and must therefore be addressed in a comprehensive way. Disasters cannot be prevented through command-and-control approaches that address only one aspect of the problem, but they can be reduced by rational policies that foster societal resilience. Specific solutions can only be developed from an understanding of local circumstances in the context of thoughtful national policies rather than bureaucratic prescriptions.

Partnerships are essential to this effort. Governments, private enterprise, research universities, NGOs, and individuals must work together to make our communities safer. One achievement of PPP2000 was to frame proposals for a small number of general policy goals and to recognize that PPP2000 could not and should not develop an extensive set of specific actions. Other activities and organizations, such as FEMA's Project Impact, are better suited to addressing the implementation at an appropriate level.

The six goals for a safer world, outlined during the first forum and developed throughout the series, support these recommendations:

- **Make natural disaster reduction a public value.** The world will not be a safer place until its citizens understand and shoulder their personal responsibility for safety with respect to natural hazards, and at the same time understand that these individual actions must mesh with the actions of other individuals, businesses, governments and other institutions. The world will not be a safer place until individuals realize that they share responsibility for the safety of others because the decisions they make with respect to land use, building designs, codes, and construction practice impact their communities. The world will not be a safer place until the culture that insists on "rebuilding where

Note: This report results from a partnership between public and private entities and describes the content of the forum as recorded and interpreted by the sponsors assisted by the PPP2000 working group. The opinions and recommendations expressed in the report do not necessarily represent those of the Federal government, of the private partners, or of any particular individual.

grandpa built" is replaced by a culture that says "we can't let this tragedy happen again."

- **Emphasize pre-event mitigation.** The society has learned that faster ambulance service and better emergency room procedures are costly approaches to improving public health; lifestyle choices aimed at preventing disease or accident are both more effective and less expensive. We need to apply this lesson to reducing our vulnerability to natural disasters. The world will not be a safer place until the mindset of emergency response is replaced by one of disaster prevention.
- **Improve real-time warning systems.** Each improvement in forecast time horizon, in accuracy, or in reduced false alarm rate creates opportunities to reduce losses due to hazards. The United States is poised to build on dramatic technological improvements in real-time warning systems, including the Advanced National Seismic System, the National Space Weather Program, the National Streamgaging Program, and the U.S. Weather Research Program. These should be implemented quickly to make their benefits available to the Nation as soon as possible. The value of such real-time warnings – which enable people to get out of harm's way – goes beyond improved response. Better warnings, by reducing the apparent randomness of these events and the fatalism that sometimes accompanies the sense of helplessness, may also prompt a change in individual mindset – inspiring people to live out of harm's way.
- **Identify means for financing mitigation.** Mitigation adds relatively little to the cost of new structures, and often provides offsetting benefits. Experience with auto safety suggests that the public, once it understands the issues, is happy to pay for safety; in fact, safety can be a marketing tool. Efforts already underway to develop private-sector programs to underwrite catastrophic risk should be matched with efforts to minimize overall losses; it is not enough simply to shift the burden.
- **Improve information dissemination and access.** The above actions depend on access to information, not top-down, command-and-control regulation. Information brings opportunity – and, in some cases, responsibility – for avoiding disasters. The least expensive and most effective action that government and private enterprise can take is to improve the availability of information on the risks posed by natural hazards. Better information about vulnerability is needed at the community, the neighborhood, and even the individual structure level. Information must address vulnerability not just to structural failures – the traditional measure – but also to business disruption, which has become a costly component of disaster loss.
- **Recognize that natural disaster reduction is a global issue.** We must recognize that a natural disaster in Africa or Asia not only hurts us because of our shared humanity but also has the potential for disrupting our economy

because of myriad global economic interdependencies. Disasters also have political consequences, and global resilience to disasters will enhance political and social stability everywhere. More specifically, accurate knowledge of natural hazards risks are critical for sound investments by the World Bank and other development entities.

Participants at the PPP2000 forums received a comprehensive education from diverse perspectives. The challenge now is to share this understanding with the rest of the society. The next step involves expanding the circle of influence, by working with the news media, the legislative branch through the new Natural Hazards Caucus, and states and municipalities in the same way that the forums worked at the national level.

Over the past 50 years our society has changed dramatically in its approach to other safety issues – for example, auto safety and smoking – which required fundamental change in our cultural values. The time has come to make natural disaster reduction a national priority and a public value.

APPENDIX A

Forum Speakers

- Ernest B. Abbott, General Counsel, FEMA
- Daniel P. Abrams, Newmark Professor of Civil Engineering, University of Illinois, Central US Earthquake Engineering Center
- Daniel J. Alesch, Professor, Public and Environmental Affairs, University of Wisconsin at Green Bay
- Maxwell Alston, Civil-Military Emergency Planning, Office of the Deputy Under-Secretary of the Army, International Affairs
- James A. Ament, Vice President, Operations, State Farm Fire & Casualty Uompany
- Brent A. Anderson, Mission Commander, United States Air Force, Defense Threat Reduction Agency, Open Skies Division
- J. David Applegate, Director of Government Affairs, American Geological Institute
- Michael J. Armstrong, Associate Director, Mitigation, Federal Emergency Management Agency
- Raymond J. Ban, Senior Vice President, Meteorological Affairs and Operations, The Weather Channel
- Stephen B. Baruch, President, Stephen B. Baruch & Associates, LLC
- John Beaulieu, Deputy State Geologist, Oregon
- Stephen O. Bender, Principal Specialist, Organization of American States
- Fouad Bendimerad, Vice President, Engineering, Risk Management Solutions, Inc.
- David Bilbo, Coordinator of Extension, Hazard Reduction and Recovery Ctr, Texas A&M University
- Marvin Birnbaum, Editor in Chief, Prehospital and Diasaster Medicine, University of Wisconsin Clinical Sciences Center, E5/621 EMS Program
- Connie Boatright, Director, Training and Development, Emergency Management Strategic Healthcare Group, Department of Veterans Affairs
- Philippe L. Boullé, Director, International Decade for Natural Disaster Reduction
- Kendra J. Briechle, Senior Project Manager, Research & Development, International City/County Management Association
- George E. Brown, Jr., US House of Representatives
- Vallee Bunting, Deputy Director, Federal Emergency Management Agency

- Raymond J. Burby, Professor, Department of City and Regional Planning, University of North Carolina at Chapel Hill
- Mark Cackler, Sector Leader, The World Bank, Sustainable Development, Central America
- W. David Canaan, Director, Stormwater Services, Mecklenburg County Engineering & Building Standards Department
- J. Richard Capka, Commander, U.S. Army Corps of Engineers, South Atlantic Division
- Mary L. Carrido, President & Chief Executive Officer, MLC & Associates, Inc.
- Daniel Carrigan, Catastrophe Consultant, State Farm Insurance Company
- Caroline Clarke, Urban Specialist, Inter-American Development Bank
- John A. Clizbe, Vice President, Disaster Services, American Red Cross, National Headquarters
- Lloyd S. Cluff, Pacific Gas & Electric Company, Geoscience Department
- Bill Condit, Majority Staff Member, House Resources Committee
- David R. Conrad, National Wildlife Federation
- Wilson E. Cooney, Chairman of the Board, Institute for Business & Home Safety
- Gloria C. Craven, USAA Insurance
- J. David Cummins, Executive Director, S.S. Huebner Foundation
- Barbara L. Cunningham, Executive Director, Evansville-Vanderburgh County Area Plan Commission
- Susan Cutter, Director Hazards Research Laboratory and, Chair Department of Geography, University of South Carolina
- John P. D'Aniello, Deputy Director, Civil Works, U.S. Army Corps of Engineers
- Kawika Daguio, American Bankers Association
- Randolph Daley, Epidemic Intelligence Service Officer, Centers for Disease Control and Prevention
- William M. Daley, Secretary of Commerce, U.S. Department of Commerce
- James F. Davis, State Geologist, California Division of Mines and Geology, Dept of Conservation
- Michael L. Davis, Deputy Asst Secretary Army, U.S. Army Corps of Engineers
- Daniel P. Delich, Professional Staff Member, U.S. Senate Committee on Environment and Public Works
- Ronald W. Demerjian, President, Property Insurance Plans Service Office, Inc.
- Kenneth A. Deutsch, American Red Cross
- James F. Devine, Senior Advisor, Science Applications, U.S. Geological Survey

- Neil A. Doherty, Professor, Department of Insurance and Risk Management, University of Pennsylvania, The Wharton School
- Edmund R. Donoghue, Chief Medical Examiner, Office of the Medical Examiner-Cook County
- Ronald Tadashi Eguchi, EQE International, Inc.
- Robert F. Elliott, Deputy Director, Emergency Management Strategic Healthcare Group, Department of Veterans Affairs
- Henry Falk, Director, Division of Environmental Hazards and Health Effects, Centers for Disease Control
- John H. Fenimore, The Adjutant General, State of New York, Division of Military and Naval Affairs
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- David B. Freitag, Vice President, The Boeing Company
- Elbert W. Friday, Assistant Administrator, National Oceanic & Atmospheric Administration
- John Garamendi, Deputy Secretary, Department of the Interior
- John H. Gibbons, Assistant to the President for Science and Technology
- Steven Goldberg, Senior Vice President & Chief Actuary, USAA
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- Ben Grumbles, Senior Counsel, House Transportation & Infrastructure Committee
- Yacov Y. Haimes, Lawrence Quarles Professor of Systems Engineering & Civil Engineering and Founding Director, Center for Risk Management of Engineering Systems
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- Larry L. Hereth, Commandant (G-MOR), U.S. Coast Guard
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- Peter Paul Howell, President, Mark IV, Inc.
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- J. Robert Hunter, Director of Insurance, Consumer Federation of America
- David V. Hutchinson, Department of Justice
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- Robert P. Irvan, Senior Vice President, CIGNA Property & Casualty Company
- Wilfred D. Iwan, Pacific Earthquake Engineering Research Center, Caltech
- Klaus H. Jacob, Columbia University, Lamont-Doherty Earth Observatory
- Jerry Jarrell, Acting Director, National Hurricane Center
- Kent Jarrell, Senior Vice President, Crisis and Litigation Support, WeberMcGinn Strategic Communications
- Edward Jobe, Director, American Reinsurance
- David H. Johnson, Vice President & Chief Scientist, Pickard, Lowe, Garrick
- Anita Jones, Professor of Computer Sciences, University of Virginia
- Dave Jones, Meteorologist, NBC 4 WRC-TV
- Lucile M. Jones, U.S. Geological Survey
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- Vijaysekar Kalavakonda, Financial Sector Consultant, Financial Sector Development Dept, The World Bank
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- Terry Keith, Scientist in Charge, Alaska Volcano Observatory

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- Mark Leonard, Legislative & Public Affairs Coordinator, California Earthquake Authority
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- Richard L. Miller, Provost Marshal, U.S. Army Corps of Engineers, Office of Security, Plans and Operations
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- David Zane, Director, Injury Epidemiology and Surveillance Program, Texas Department of Health
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APPENDIX B

Forum Participants

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