An All-of-Government Approach to Increase Resilience for International Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events

ISBN
978-0-309-30606-5

78 pages
8.5 x 11
PAPERBACK (2014)

Sherrie Forrest and Mark Lange, Rapporteurs; Steering Committee on An All-of-Government Approach to Increase Resilience for International Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events: A Workshop Summary; Division on Earth and Life Studies; National Research Council

An All-of-Government Approach to Increase Resilience for International Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events

A WORKSHOP SUMMARY

Sherrie Forrest and Mark Lange, Rapporteurs

Steering Committee on An All-of-Government Approach to Increase Resilience for International Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events

Division on Earth and Life Studies

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

THE NATIONAL ACADEMIES PRESS
Washington, D.C.
www.nap.edu

THE NATIONAL ACADEMIES PRESS 500 Fifth Street, NW Washington, DC 20001

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This study was supported by Contract/Grant No. 60NANB12D293 between the National Academy of Sciences and the National Institute of Standards and Technology. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the organizations or agencies that provided support for the project.

International Standard Book Number-13: 978-0-309-30606-5
International Standard Book Number-10: 0-309-30606-X

Additional copies of this report are available from the National Academies Press, 500 Fifth Street, NW, Keck 360, Washington, DC 20001; (800) 624-6242 or (202) 334-3313; http://www.nap.edu.

Printed in the United States of America

Suggested citation: National Research Council. (2014). An All-of-Government Approach to Increase Resilience for International Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events: A Workshop Summary. Sherrie Forrest and Mark Lange, Rapporteurs. Steering Committee on An All-of-Government Approach to Increase Resilience for International Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) Events, Division on Earth and Life Studies. Washington, DC: The National Academies Press.

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. C.D. Mote, Jr., is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Victor J. Dzau is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. C.D. Mote, Jr. are chair and vice chair, respectively, of the National Research Council.

www.national-academies.org

Steering Committee on An All-of-Government Approach to Increase Resilience for International Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) Events

Dr. Gerry E. Galloway Jr. (NAE), Chair, Glenn L. Martin Institute Professor of Engineering, University of Maryland, College Park
Dr. John Carrano, President, Carrano Consulting
Dr. Bert Coursey, Program Manager, Coordinated National Security Standards Program (Retired), National Institute of Standards and Technology
Hon. Sherri W. Goodman, Senior Vice President, General Counsel, and Corporate Secretary, CNA Analysis & Solutions
Ms. Ann Lesperance, Deputy Director Regional Programs, Northwest Regional Technology Center for Homeland Security, Pacific Northwest National Laboratory
Dr. Randall S. Murch, Associate Director, Research Program Development, Office of the Vice President for Research, National Capital Region Operations, VA Polytechnic Institute and State University
Hon. Andrew Natsios, Executive Professor and Scowcroft Institute Fellow, Texas A&M University
Dr. Gregory S. Parnell, Professor of Systems Engineering, U.S. Military Academy, West Point
Mr. Brent H. Woodworth, President/CEO, Los Angeles Emergency Preparedness Foundation

Staff
Lauren Alexander Augustine, Director, Program on Risk, Resilience, and Extreme Events, and Associate Executive Director, Division on Earth and Life Studies
Micah Lowenthal, Director, Committee on International Security and Arms Control
Sherrie Forrest, Program Officer, Program on Risk, Resilience, and Extreme Events, National Research Council
John H. Brown, Jr., Program and Administrative Manager, Program on Risk, Resilience, and Extreme Events, National Research Council

Preface

Chemical, Biological, Radiological, Nuclear, and high-yield Explosive (CBRNE) events have the potential to destabilize governments, create conditions that exacerbate violence, or promote terrorism. This can trigger global repercussions. These events can quickly overwhelm the infrastructure and capability of the responders, especially in countries that do not have specialized resources for response. Effective response to CBRNE events is a U.S. national security priority as outlined in the National Security Strategy (White House, 2010) and National Strategy for Counterterrorism (White House, 2011). When a CBRNE incident occurs in a partner nation or other foreign country, the United States will likely be called upon to provide assistance. The United States wants to help save lives and alleviate suffering through its humanitarian efforts. In terms of national security, more efficient response to CBRNE attacks may ultimately reduce the incentive for those who would initiate them.

Interoperability—the ability to work together—among U.S. agencies, foreign governments, and responders involved in the effort is key to an efficient response. The effectiveness of the U.S. response and approach to CBRNE events in partner nations depends on (1) the capability of the U.S. government to provide timely and appropriate assistance, (2) the resilience of the partner nation to a CBRNE event, and (3) the ability of the partner nation to absorb external assistance.

At the request of the National Institute of Standards and Technology (NIST), the National Research Council of the National Academy of Sciences formed a steering committee (see Appendix C) tasked with organizing and conducting a workshop to discuss ways to strengthen the United States ability to prepare for and respond to CBRNE events that occur in U.S. partner nations. The statement of task (Appendix B) directs the steering committee to explore approaches to understanding or determining baseline conditions of resilience to CBRNE events, and common metrics or other measures of resilience to CBRNE events, in an effort to increase interoperability across U.S. agencies and other entities. After careful consideration, the steering committee concluded that it could only partially address two of the items from the original statement of task at this workshop. First, the steering committee did not specifically address explosives (the "E" in CBRNE) because it determined that issues associated with explosives were distinct from those associated with CBRN events and that there was not adequate time to address all of these events in one workshop. Second, the steering committee concluded that

addressing the task of articulating some common measures or reference points to assess a country's resilience required a more thorough understanding of the key capabilities and best practices for an all of U.S. government response to CBRNE events in foreign nations. As this workshop was envisioned as the first activity in a series of activities that focus on response to international CBRNE incidents, the steering committee determined that the workshop should initially focus on the following topics as a first step toward further examination of developing metrics and measures of resilience. The workshop brought together diverse experts and stakeholders to:

1. Identify capabilities that are necessary for responding to an international CBRN event.
2. Discuss best practices and resources needed for improved interoperability of the United States and partner nations during response to a CBRN event.
3. Identify key questions that need to be addressed in follow-up activities to this workshop that focus on improving U.S. CBRN response in partner nations.

The committee met in person and over the phone to define and organize a high-level workshop that was held at the National Academy of Sciences building in Washington, DC on June 20-21, 2013 (see Appendix A for the workshop agenda). The first day of the workshop consisted of two keynote lectures followed by a panel discussion. Audio and video of the proceedings were broadcast online and questions were taken from both the in-house and remote audience. The afternoon consisted of four concurrent breakout sessions with each group asked to address the following three questions:

1. What capabilities are needed for effective CBRN response in a partner nation?
2. What are the gaps in capabilities?
3. What is needed to improve U.S. efforts for coordinated response to CBRN events in partner nations?

Each group presented its key points to the larger group, and Dr. Gerry Galloway, chair of the workshop steering committee, provided an initial synthesis of the overarching themes. The second day of the workshop was organized around small workgroups consisting of a subset of the first day's participants. The small workgroups further refined and prioritized the key issues and questions identified the previous day.

As an initial step to explore ways to improve an all of U.S. government approach to international CBRN response, the goal of the workshop was to start the important work of documenting CBRN response capabilities and gaps that need to be addressed to improve U.S. coordination.

ABOUT THIS WORKSHOP SUMMARY

The workshop presentations and discussions are summarized in three chapters. Chapters 1 and 2 present information in keynote addresses and panel discussions regarding the capabilities and best practices needed for an effective and coordinated response to international CBRN

events. Chapter 3 recaps the discussions from breakout sessions, including a synthesis of the key issues that arose during the workshop. This workshop summary was prepared by independent rapporteurs and is confined to the material presented and discussed at the workshop. The workshop was not designed to generate recommendations or conclusions nor does this summary contain recommendations or conclusions by the steering committee, which was responsible only for the selection of speakers and organization of the agenda. This summary is not a comprehensive review of all facets of response to international CBRN events and the range of views expressed at the workshop were limited by the time available for discussion. The workshop captures the current thinking regarding international CBRN events as expressed by the workshop participants.

References

White House. 2010. *National Security Strategy*. Available at http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf.

White House. 2011. *Strategy for Counterterrorism*. Available at http://www.whitehouse.gov/sites/default/files/counterterrorism_strategy.pdf.

Acknowledgements

This workshop summary reflects discussions at a workshop convened by the Division on Earth and Life Studies of the National Research Council (NRC) on June 21 and June 22, 2013. We would like to thank the individuals who served on the steering committee, each of whom brought deep and varied expertise to the process of developing and organizing the event. We gratefully acknowledge their time and assistance in planning an informative and engaging program. We thank: Gerry E. Galloway Jr. (chair), John Carrano, Bert Coursey, the Honorable Sherri W. Goodman, Ann Lesperance, Randall S. Murch, the Honorable Andrew Natsios, Gregory S. Parnell, and Brent H. Woodworth. We also thank the National Institute of Standards and Technology, who generously supported this effort.

The program's success was due to the many speakers, panelists, and other participants who donated their time and expertise to inform salient discussion on these important issues. The speakers and panelists were highlights of the workshop and deserve credit and our gratitude. We thank Major General Julie Bentz, Daniel Blumenthal, Martin Cetron, Charles Donnell, Chad Gorman, Kiyoshi Kurokawa, Brian Lewis, the Honorable Paul Stockton, Colonel Patrick Terrell, and Brent Woodworth for their insightful presentations and discussion. We also thank the moderators and other speakers, Gerry Galloway and Ann Lesperence, and National Research Council staff, John Boright, Executive Director of International Affairs.

The success of this workshop would not have been possible without the invaluable contributions from Micah Lowenthal, Director of the NAS Committee on International Security and Arms Control, whose collaboration and guidance was essential in developing and directing this activity. We also gratefully thank NRC staff members for their time and attention to supporting all of the activities throughout the day: John Brown, Jr., Sherrie Forrest, Eric Edkin Jo Husbands, Mark Lange, Orin Luke, Ben Rusek, and Thao Tran.

This workshop summary has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the Report Review Committee of the National Research Council. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published summary as sound as possible and to ensure that the summary meets institutional standards for objectivity, evidence, and responsiveness to the charge. The review comments and draft manuscript remain confidential to protect the integrity of the process. I would like to thank the following individuals for their review of this workshop summary: John F. Ahearne, Sigma

Xi, The Scientific Research Society; Mark Bartolini, former Director, U.S. AID Office of U.S. Foreign Disaster Assistance; Gerald Epstein, U.S. Department of Homeland Security; Ann Lesperance, Pacific Northwest National Laboratory; and Brian Lewis, U.S. Department of State.

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the content of the summary nor did they see the final draft of the summary before its release. The review of this summary was overseen by John R. Harrald of Virginia Polytechnic Institute and State University. Appointed by the National Research Council, he was responsible for making certain that an independent examination of this workshop summary was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this summary rests entirely with the authors and the institution.

Lauren Alexander Augustine

Director, Program on Risk, Resilience, and
Extreme Events, and Associate Executive
Director, Division on Earth and Life Studies

Contents

CHAPTERS

APPENDICES

Chapter 1

Capabilities for Effective Response to an International CBRN Event

The opening speakers outlined the core capabilities required to mount an effective response to international chemical, biological, radiological, or nuclear (CBRN) events. The comments reflected their experiences and lessons learned from past CBRN and other disruptive events. Major General Julie Bentz, Director of Strategic Capabilities Policy on the National Security Staff in the Executive Office of the President, provided the opening remarks. Bentz helped coordinate the U.S. response to the March 11, 2011 Tōhoku Earthquake (Great East Japan Earthquake) and tsunami in Japan. She currently directs a sub-Interagency Policy Committee (sub-IPC) on the U.S. government response to international CBRN events. The Honorable Paul Stockton, President of Cloud Peak Analytics and Managing Director at Sonecon, LLC, gave the morning keynote presentation. Stockton previously served as the Assistant Secretary of Defense for Homeland Defense and Americas' Security Affairs.

U.S. LESSONS LEARNED FROM FUKUSHIMA

When an earthquake and tsunami hit northern Japan on March 11, 2011, and subsequently disabled the Fukushima Daiichi nuclear power plant, Major General Bentz and her colleagues organized the U.S. response, Operation Tomodachi, based on historic examples of U.S. response to similar events. Bentz requested after-action reports from the 1979 nuclear accident at Three Mile Island Unit-2 reactor in Pennsylvania from the Jimmy Carter Library and Museum, and the 1986 accident at Chernobyl nuclear power plant in the Ukraine from the Ronald Reagan Presidential Library. The lessons learned from these events improved the U.S. government response to Fukushima; an after-action report was also prepared for Operation Tomodachi. Bentz highlighted four key lessons learned from the response to the Fukushima accident (Box 1.1).

Mechanisms for Intra-government Coordination

The first lesson Bentz highlighted was the need to develop a mechanism for intra-government coordination for low-probability, high-impact events; Traditional mechanisms of coordination are not sufficient when additional layers of government are added to the normal processes. The U.S. Department of State (DOS) and U.S. Agency for International Development (USAID) are very adept at responding to day-to-day crises and typical natural disasters. However, Bentz offered, with complex events such as the Fukushima nuclear accident, the additional involvement of the White House National Security Council tends to complicate or slow normal processes. Following the Fukushima nuclear accident, the National Security Staff gathered representatives from several agencies to identify ways to improve decision making for CBRN events because these types of extreme events transcend normal channels.

Bentz noted a distinction regarding the legal framework for a domestic response versus an international response. In a domestic response, funding for response to a disaster is made available through the Stafford Act,[1] which applies to major disasters and emergencies declared by the President of the United States. Under the Stafford Act, decision makers have the legal authority and access to resources to save human lives and mitigate suffering, and to protect property and the environment. In an international event, Bentz noted, U.S. funding and authority provide for humanitarian assistance to save lives and mitigate suffering; property and the environment are not part of the legal structures. For example, with the response to the Fukushima accident, material to shield the core and pumps to cool the core were not considered humanitarian assistance. Bentz noted that contamination or contagion could be an additional complication that is also outside normal humanitarian response. To address this situation, Bentz proposed a framework or annex be developed that identifies the pieces not covered under current legal or statutory authorities for response to an international CBRN event. She suggested one potential solution is to build bilateral agreements with other capable nations that map out the sequence and roles in responding to a CBRN event in a particular region.

Improved Ways of Sharing Technical Data

Bentz's second message was that the United States needs an improved mechanism for sharing technical data that is useful, timely, and meets the needs of all responding entities. Bentz noted that the Department of Energy (DOE) tackled the question of how to share very technical data within the interagency and with international counterparts through a bilateral or multilateral engagement. DOE developed a Best Practices document (internal interagency document), which outlined six broad best-practice categories:

1. Strategic CBRN Consequence Management Priorities. For example, how to set goals, establish objectives, and allocate response capabilities.
2. Data Management and Policies. This allows for data accuracy and standardization, which is a serious complication in the midst of a crisis.

[1] Stafford Act: https://www.fema.gov/media-library/assets/documents/15271?fromSearch=fromsearch&id=3564.

3. Data Analysis and Presentation. Good analysis and presentation allows senior decision makers to quickly understand what the data are telling them.
4. Data Integration and Predictive Modeling. This allows scenario building so that decision makers can anticipate future conditions.
5. Sharing, Releasing, Accessing, and Distributing Data. This includes inter-government and intra-government sharing as well as unclassified, classified, or law enforcement sensitive data types.
6. Treaties, International Agreements, and Legal Obligations. This concerns moving information between and among countries while still following existing bilateral and multilateral frameworks and agreements.

Defining Metrics

Bentz's third lesson highlights a need to define metrics for success and consequence management. Bentz posed several typical questions that are raised following a CBRN event: How safe is safe? How clean is clean? What do we do with the waste? Lessons learned from the Fukushima accident informed the U.S. Environmental Protection Agency (EPA) effort to update and improve 1992 radiation contamination protective action guides, particularly in the area of late phase recovery or late phase cleanup (Environmental Protection Agency, 2013). The updated version includes re-entry and waste disposal guidelines and provides scientifically credible, well-defined drinking water guidance to advise early phase decisions relative to short-term exposure to radionuclides in response to the emergency.

Evacuations of U.S. Personnel and Citizens

Bentz concluded with a fourth lesson learned and the United States' most difficult challenge: how to evacuate American personnel and citizens from a region that has been hit by a CBRN event. The DOS and Department of Defense (DOD) worked together to define 'trip wires' that trigger the evacuation of U.S. personnel, whether through authorized or ordered departures. These trip wires were inserted early in the process so that all parties involved understand when and how they are to act. Bentz noted that DOS and DOD put together a document that outlines consequences of particular drawdown, departure, and evacuation decisions; guidelines for how to conduct an evacuation; and at what point military assistance should become part of the process. As part of this collaboration, a simple checklist was developed with questions that should be considered immediately following an event.

BOX 1.1
Key Lessons Learned from the U.S. Response to Fukushima

1. Improve intra-government coordination for unusual events
2. Improve ways of sharing information and technical data
3. Define metrics for success and consequence management
4. Pre-define decision points that trigger drawdowns of overseas personnel and citizens

KEYNOTE ADDRESS

An All-of-Nation Approach to International CBRN Preparedness and Response

The U.S. government is making terrific progress with regards to international CBRN preparedness and response in building federal capabilities to support partner nations when they request our assistance following an event, began the Honorable Paul Stockton. However, U.S. state capabilities have not been fully brought to bear to provide similar support. Stockton explained that a large portion of DOD capabilities to conduct life-saving operations in the United States or in support of partner nations is in state National Guard[2] organizations ordinarily under the command and control of state governors, rather than the President of the United States.

One reason why state capabilities have not been tapped is the challenge of federalism regarding command and control, explained Stockton, adding that these challenges are eminently solvable. More difficult to overcome is the "tyranny of time and distance" in deploying supplies and people to an international location, which impacts how we mobilize state forces and then deploy them effectively abroad. Stockton suggested that one way forward is to support capacity building within foreign nations instead of relying exclusively on the U.S. ability to send assistance. From his perspective, the United States is not doing enough to bring to bear the potentially invaluable capabilities of the private sector in CBRN preparedness and response.

Stockton noted a paradox in how the U.S. government is improving national CBRN capabilities versus its ability to provide these same capabilities outside U.S. borders. Under the Obama administration, the federal government has made solid progress in building CBRN response capabilities. Since 2009, DOD has radically changed and strengthened the ability of troops, soldiers, and airmen to provide life-saving capabilities by distributing response capabilities across the nation; for example, every state has a civil support team to rapidly detect and characterize a CBRN event. Each of the ten Federal Emergency Management Agency (FEMA) regions has a homeland response force that can arrive at an event within six to twelve hours of occurrence. In addition to distributing CBRN response capabilities geographically, he continued, the United States has strengthened its focus on life saving within the different C-B-RN areas, such as in building the capacity for decontamination and search and rescue capabilities

[2] The National Guard is referenced throughout this report. More information can be found at their website: http://www.ngaus.org/ and a summary of their roles and responsibilities can be found at: http://www.ngaus.org/sites/default/files/pdf/primer%20fin.pdf.

in a contaminated environment. However, Stockton cautioned, the distribution of capabilities and reliance on state National Guard forces could create challenges for gathering these capabilities together at the request of a foreign nation.

Stockton explained that public safety is the responsibility of the governors of the United States under our Constitution, not the President. This means that, although governors take this responsibility very seriously and partner with DOD to coordinate capabilities, homeland response forces are under the command and control of governors on a day-to-day basis. Within a given region, governors will often offer assistance to neighboring states, but a request from a foreign government through the DOS may not be as readily granted. Stockton posed several questions to illustrate the complications that can arise with a foreign request for assistance to a CBRN event. What if requested forces would reach their maximum lifetime radiological exposure limits during a deployment in a foreign country? What is the risk that their equipment will be contaminated and could not be returned to the United States? Stockton offered that there are likely solutions to these command and control questions if imaginative people work their way through these challenges to reach consensus.

A more difficult issue to solve, Stockton reiterated, is the tyranny of time and distance. The window to engage in serious life-saving activities following a large CBRN event is 72-96 hours. Domestically, the U.S. government has the capabilities to deploy response forces within the time frame needed to save lives on a large scale, and to provide search and rescue in a contaminated urban environment. Deploying those forces abroad, however, runs up against that 72-96 hour window. Stockton offered that there are valuable niche capabilities that can be rapidly deployed. In support of Operation Tomodachi in Japan, the U.S. government quickly sent teams to assist with characterizing the event and modeling the fallout plume. But in terms of life-saving capabilities, Stockton cautioned, there are limits to what a U.S. based force can accomplish internationally. A potential solution is to partner with foreign nations to build their capabilities and capacities.

Stockton recalled a recent statement by U.S. Defense Secretary Chuck Hagel that the U.S. military will retain vital capabilities, but at the same time the most sustainable and wisest approach to our security in the 21st century will be to help allies do more to contribute to their own security and our common interest. Stockton emphasized that this is especially true in the realm of CBRN response and preparedness, and suggested that the National Guard state partner program could be leveraged for this purpose; personnel from a given state could work with an international partner to help build that country's capacity. Several states, such as Colorado, already engage in capacity building activities for CBRN response through their state partner programs. From Stockton's perspective, these activities need to expand to more states and countries.

A second opportunity is training, Stockton continued. U.S. training and exercise activities could support partner nations who want to take advantage of U.S. expertise. Stockton underscored that joint training activities between foreign and U.S. forces would help meet the challenges of interoperability by providing a shared understanding of how the response to CBRN events can be successfully executed. An additional component to improve interoperability, he continued, is the development of common international decontamination and exposure standards.

Stockton stated that the open frontier in terms of CBRN response capability is developing partnerships with the private sector. The private sector in many cases has excellent preparation against natural hazards, he explained. Every big company and many medium and small-sized companies have plans for continuity of operations; for example, to protect critical infrastructure

and supply chains against earthquakes and other natural hazards. Many large companies maintain emergency operation centers. However, Stockton acknowledged, the private sector's resilience to the emerging CBRN-type hazards needs strengthening. He added that adversaries that would launch a CBRN attack on the United States want to kill Americans, but their objectives are political and this means inflicting economic damage. Helping the private sector strengthen its continuity-of-operations plans for a CBRN event helps mitigate economic damage and makes launching an attack less attractive.

Stockton proposed that an additional opportunity to build private sector resilience to CBRN events is through the insurance industry. A properly structured insurance environment would allow policies to be made available to those companies that had taken the required steps to prepare for CBRN events. Stockton suggested that different premiums might depend on a company's level of preparedness. Insurance for chemical, biological, radiological, and nuclear events does not currently exist, with rare exceptions and with good reason, he added. The difficulty in assessing the frequency and magnitude of the impacts from these events makes it nearly impossible to price insurance using the traditional actuarial approach. Stockton referred to the insurance market for explosive events, and suggested that it could be used as an example of how to provide insurance for CBRN events. He cited the Terrorism Risk Insurance Act (TRIA)[3] that passed after the terrorist attacks on September 11, 2001. The enormous costs incurred following the 9/11 attacks caused insurance companies to be hesitant to offer coverage for a future event. Through TRIA legislation, the federal government ensured a backstop for coverage of losses under circumstances related to a terrorist act that allowed for the creation of an insurance market. Stockton envisioned that TRIA legislation, which expires in 2014, could be reauthorized and expanded to include all CBRN-related events.

Question and Answers

Lauren Alexander Augustine of the National Research Council asked why addressing CBRN events was important. Stockton advised that the CBRN threat was growing and required a better understanding of how to address the potential consequences. He cited the example of a long-term power outage on a power or nuclear facility, pointing to the cascading effects that would result on the nation and noting that current plans are targeted only for short and mid-length power outages. Long-term outages, whether due to a natural event such as the New Madrid Earthquake or a manmade threat such as a cyber attack on U.S. power infrastructure, would create a seriously disrupted environment for weeks or months. To be ready requires planning in advance.

A participant from the Oak Ridge National Laboratory suggested expanding partnerships beyond the private sector to include non-profits, non-governmental organizations (NGOs), and the community. Stockton agreed and pointed to an objective that FEMA Administrator Craig Fugate has often cited, to treat citizens not simply as passive victims of disasters, but as active contributors to their own resiliency. Stockton raised the recent Fukushima nuclear accident as an example, noting that the absence of information on whether to flee or shelter in place led to fear

[3] Terrorism Risk Insurance Act of 2002: http://www.gpo.gov/fdsys/pkg/PLAW-107publ297/html/PLAW-107publ297.htm.

and confusion among Japanese citizens. Clear communication lines with the public help dissipate that fear, particularly for nuclear and radiological events. He added that working with partner nations to build that type of community resilience would be extremely valuable.

A question was asked about metrics for measuring success and the perception of what the United States can do in response to an international CBRN event compared to what the United States is actually able to accomplish. Stockton responded that, given limited resources, the federal government could only do so much in terms of building federal capacity, and pointed to the importance of the sub-IPC interagency process that is being directed by Major General Bentz. Stockton proposed that engaging more partners like the American and International Red Cross, United Way, and faith-based organizations is the best way to expand the resource base. For example, the U.S. government needs to support these types of organizations ability to operate in a contaminated environment, as CBRN disasters are very different events from which they traditionally prepare. A participant suggested leveraging connections with regional security organizations such as the African Union, Organization of American States, or the Organization for Security and Co-operation in Europe to further the conversation with private organizations in those regions. Another participant referred to a recent DOS workshop on corporate volunteerism that involved large corporations such as IBM, HP, and Citibank, suggesting that as another type of venue for expanding private partnerships in the CBRN arena.

A participant from the Israeli Home Front Command pointed out that because DOS is the lead agency on international CBRN event response, DOD has limited authority to engage in pre-event planning to assist foreign partners in foreign consequence management. He asked if, given the tyranny of time and distance, there is a way forward that would give DOD and the National Guard enhanced authority to engage in activities that improve their ability to assist. Stockton responded that DOD has been comfortable supporting FEMA, the DOS, and other federal agencies in responding to a particular event. He acknowledged that, with international incidents, combatant commanders face additional concerns with requests for assistance, such as force protection issues. Although command and control might be better aligned with a request for assistance, Stockton advised that improved coordination efforts should be built into the current system.

A question was raised about the possibility of stockpiling antibiotics and other materials needed to respond to a large-scale biological attack in other countries so that the United States would not have to use its domestic supply to support foreign responses. Stockton replied that progress was being made to build a partnership approach to pandemics. Major General Bentz added that the White House is undertaking a big effort to apply lessons learned from the H1N1 outbreak to the current H7N9 coronavirus. A member of the steering committee offered that there is already an established system run by the United Nations Office for the Coordination of Humanitarian Affairs[4] (UNOCHA) that addresses natural and manmade disasters, including biological events. It is highly developed, includes infrastructure in developing countries, and has been used hundreds of times in the past 25 years. He added that it is worth distinguishing nuclear and radiological events from biological events, but did not advise establishing parallel response systems. Instead, the existing system for responding to biological events, including decision-making processes and organizational structures could be expanded to include nuclear and radiological incidents. He cited a successful program run by USAID that trains first

[4]United Nations Office for the Coordination of Humanitarian Affairs, http://www.unocha.org/.

responders in Latin America to bolster their effectiveness in responding to large disasters. As a result, USAID now only needs to provide assistance for very large disasters in Latin America.

A participant from the National Institute of Standards and Technology (NIST) asked what preparedness might look like in the future in terms of basic capabilities of a system overseas, whether it is a knowledge base, equipment base, or other. Stockton suggested that it would likely be an information base, pointing out that an established, carefully planned strategic communication agenda is necessary to provide reliable information during and after a CBRN event, and the only way to counter misinformation in the age of social media.

There are certain types of events that, while rooted in biology, do not fit the traditional pandemic model, posed another participant; for example, a massive area denial due to an anthrax incident would require the ability to operate in a contaminated environment. These are unique characteristics that put a biological event into a similar category as nuclear or radiological incidents. Stockton reiterated that standards are essential to determine an acceptable level of decontamination.

PANEL DISCUSSION

Capabilities Needed for Effective Response to an International CBRN Event

Moderator, Dr. Gerry Galloway, chair of the workshop steering committee, indicated that the panel would focus on capabilities needed for an effective response to an international CBRN event. The panel was framed around the following questions: (a) what capabilities are needed for effective response to a CBRN event? How are these different from responding to all hazards?, (b) from the U.S. government perspective, what capabilities are unique to responding to a CBRN event in a partner nation?, and (c) what are gaps in capabilities for coordinating CBRN response with partner nations? The panelists were Mr. Brian Lewis of the U.S. Department of State, Dr. Martin Cetron from the Centers for Disease Control and Prevention, and Mr. Chad Gorman from the Federal Emergency Management Agency.

Desired End States for an Effective CBRN Response Overseas

Brian Lewis, Deputy Director of Technical Programs at the Bureau of Counterterrorism for the U.S. Department of State (DOS) provided a strategic level perspective on outreach and preparation for responding to international CBRN events. He began with three components of an effective CBRN response. First, the local government needs the technical capability to rapidly identify a CBRN event has occurred, and then quickly communicate accurate information about the incident to the United States and other international partners; the faster the communication, the more lives can be saved. While natural hazards such as an earthquake, tsunami, or volcanic eruption are self evident, there may be no visual evidence of a CBRN event. If the local government does not declare an event has occurred, the United States may not detect it. The second component, Lewis indicated, is clear communication of needs by the local government; in the midst of a crisis, this can present a challenge. This means more than simply saying "send help" because it is difficult for outside governments to know how to respond. In the absence of clear communication, the U.S. government and other allies can only speculate on what is needed. Lastly, Lewis noted the importance of pre-identifying interagency CBRN response leadership

and subject matter experts. These three components or end states provide the foundation for an effective international CBRN response.

Lewis highlighted several unique attributes of a CBRN event as compared to a natural hazard. First, they are highly unlikely events and it is difficult to convince foreign nations to invest in preparation for a hazard they have never experienced. Second, it takes technical skill to identify a CBRN event. Third, characterizing the extent of a CBRN event, how far along a biological hazard has progressed or over how wide an area radiation has spread, is difficult for any government. The fourth difference, Lewis offered, is that CBRN events can linger. Natural hazards, such as an earthquake, have a definite end time, but it is much more difficult to know when, for example, anthrax deposition is done. Finally, fear and misunderstanding are common with CBRN events and it is difficult to reduce complex technical data into simple and effective messages that the layperson can understand. Lewis underscored that the singular nature of a C-B-RN event means that a foreign government must be willing to receive technical expertise, equipment, and unique medical treatments as part of a response. From an organizational perspective, resources for CBRN response may not be located in the ministry or agency typically responsible for disasters.

Lewis offered that gaps remain in U.S. government coordination and decision making in regards to CBRN response; improving U.S. capabilities is an ongoing effort. Pre-determining CBRN technical expertise goes a long ways toward shortening U.S. response time, and DOS is constantly working to understand the distribution of expertise throughout U.S. embassies so that resources can be quickly mobilized when necessary. Finally, Lewis added, developing cohesive partnerships that support partner governments' ability to prepare for different types of incidents needs to be improved. For example, the United States may practice decontamination activities with a given government, but lack training programs with that government for hazard detection. While the goal of engaging government partners throughout a region is a good one, he noted, to date the most effective relationships have been bi-lateral. Multi-lateral partnerships take more time to gain consensus, and tend to focus on the requirements of the least capable partner.

Global Challenges of Responding to CBRN Events

Dr. Martin Cetron, Director of Global Migration and Quarantine at the Centers for Disease Control (CDC), drew from over 20 years of experience in working with global health and infectious diseases to illustrate the capabilities needed for international response to biological incidents. He echoed earlier comments by Major General Bentz that the U.S. government response to biological threats has been improving due to experience gained in addressing infectious diseases and other health threats that initiate through natural processes. However, he cautioned that significant gaps in capabilities remain, particularly in the global arena.

Cetron pointed out that biological threats have unique factors that require a different set of considerations than a chemical or radiological event. First, he offered, the high speed and high volume of global air traffic is a game changer for the spread of communicable disease. People move around the world in 24-72 hours, which is faster than the incubation period for most infectious diseases. To illustrate this point, Cetron showed an image of the civil aviation traffic among the 500 largest international airports in over 100 countries (Figure 1.1). In terms of connectivity, he said, this is the world we live in. The second unique attribute is the progression

of a biological event through time. Cetron explained that unlike a chemical or radiological event, at ground zero a biological incident might not be immediately detected. If lucky, health providers will discover an epidemic before it starts to spread, as many biological threats grow exponentially with time. Considering the global interconnectedness of today's world, he added, the designation of a global versus a local event quickly becomes meaningless; significant health threats can spread to multiple locations. Cetron cited the most recent major health threat, the Middle Eastern Respiratory Syndrome, a novel coronavirus that emerged in the Arabian Peninsula with the potential to become a global issue. He noted that the threat of spread was significantly heightened by the Hajj pilgrimage en masse in the region.

Figure 1.1: A geographical representation of the civil aviation traffic among the 500 largest international airports in more than 100 different countries. SOURCE: Modified and reprinted with permission from Hufnagel, L., D. Brockmann, and T. Geisel. et al. Copyright (2004). *Forecast and control of epidemics in a globalized world.* Proceedings of the National Academy of Sciences, U.S.A 101(42):15124-15129.

Cetron stated that emerging infectious diseases are on the rise with approximately 30 new epidemics in the past 30 years. The convergence of biologic, physical, and environmental, and social, political, and economic factors all play a role in the spread of disease. He added that health threats emerge under different circumstances, which is why Mother Nature is so successful in creating new diseases; the element of human intent poses additional challenges. Cetron identified several challenges and gaps that fall under the guise of the ability to 'detect, respond, and prevent'. With detection, the major challenge is the predictability and detection of an unknown emergence. He indicated that it is not enough to have the capability to match an incident against biological threat agents that are known. In both clinical and environmental settings, diagnostic capacity and tools are required to diagnose a health threat that has not been previously observed, for example a disease that has mutated or been genetically modified to have

resistance to normal countermeasures. Another issue is the ability to determine thresholds for contamination and safety.

With response, the primary challenge is to define a problem quickly so that steps can be implemented to reduce risk factors and determine the pattern of transmission, for example, whether the threat is airborne, transferred via contact, or spread through the environment. Cetron cited the need to identify medical and non-medical countermeasures to contain an epidemic, as well as the need to develop global stockpiles of necessary medicines, which he said had improved but was not adequate. Within prevention, he indicated the need to mitigate the impact of an epidemic, to reduce the number of infections, the severity of the threat and number of deaths, and to protect new populations from exposure. Cetron said that technical capabilities and expertise are expanding around the world but also emphasized that much more is needed to improve global expertise.

Cetron turned to system-wide capabilities necessary for effective response. He cited the importance of infrastructure, expanding capability through training, and the need for multi-disciplinary engagement to promote a whole of society response when an event occurs. He suggested a need to educate and engage the media as a source of support rather than as a source that expands the uncertainties around an event. He also pointed to the importance of establishing an international governance framework that promotes international health regulations and treaties; helps define government and intergovernmental norms around detection and reporting; and promotes collaboration during health investigations, for example with global specimen sharing and detection, and laboratory support. Cetron raised the concern countries have in regards to intellectual property and national pride around diagnosing and detecting threats in regional laboratories. Developing countries have raised the issue of specimen sharing and the need to reap the benefits from that information, for example if a vaccine is developed. Lastly, he revisited the need to stockpile countermeasures in multiple countries, not solely developed ones.

Cetron referred to the anthrax incidents that occurred after 9/11 (also called Amerithrax) to illustrate the challenges posed by a health threat that initiates through a nefarious act. The intentional use of anthrax changed how public health experts understood the implications of an infectious disease and altered the approach to the response. In these incidents, the disease presented itself differently than was previously known, causing meningitis, a poorly understood neurologic condition, and a different distribution of cutaneous lesions. He stressed how important it was to rapidly characterize the disease. Questions arose about whether the organism had been engineered for drug resistance and whether the usual antibiotics would successfully counter the symptoms. Cetron also cited the importance of effective communication. For example, during the Amerithrax incidents, misunderstanding about treatment approaches became an issue when exposed members of Congress and postal workers were treated with different drugs, even though the decision was based on sound biological reasons. Poor communication led one group to think they were being treated with second-class antibiotics. Another profound issue is the amount of disruption, uncertainty, and fear that a bio-event can generate; how can health infrastructure handle an epidemic where the amount of people infected is not clear and there is significant fear throughout a population. Clinicians need training to distinguish patients with common respiratory illness from those that show similar symptoms but have been infected by a potentially fatal disease. Lastly, Cetron cautioned against thinking we are more prepared to handle an incident than we are; health professionals cannot rely exclusively on their past experience but must be open to the uncertainty that can come with a biological incident.

Cetron highlighted the successes and challenges in addressing the 2003 SARS event, indicating that the global infrastructure for preparedness was significantly improved from lessons learned during the response. The disease was quickly characterized through effective global governance and laboratory collection. However, large economic losses, damage, and fear still resulted across the globe. Cetron reiterated several needs: (a) to communicate effectively, (b) to quickly understand how the epidemic is spreading, (c) to come together as a global health community to characterize the disease and develop diagnostics, and (d) to cooperate in developing and implementing medical countermeasures to the disease. Protection is also a major issue with a biological event Cetron indicated. During SARS, questions arose around protection of responders and people in infected zones, protective equipment, and how to adapt standards for personal protection from one environment to another. Lastly, he echoed earlier comments around issues of decontamination, and standards for "how clean is clean".

Cetron noted that responding to certain types of epidemics may require difficult means for control and containment of the disease; SARS reintroduced the word quarantine to a 21st century public. He recalled his earlier discussion about the global air transportation network; with SARS this translated into strict measures enacted in various countries to try and protect their borders from incoming travelers. For example, thermal imaging was used at airports to identify people who had a fever. He cautioned that diagnosis through technology is susceptible to false negatives that can create additional problems, but countries such as China employ these types of techniques when new potential threats emerge. Cetron said that new evidence was emerging that point to screening for health conditions at the source of an epidemic as more effective than trying to control the illness at arrival points.

As part of the solution for filling in gaps in detection and response to biological threats, Cetron cited a new CDC project, BioMosaic that layers multiple types of data systems, including demographic, migration, health, and transportation patterns, to facilitate the movement of the health community from a reactive response to biohazards to more predictive capabilities. He envisions that these tools will help global health workers to visualize patterns of biothreats and provide more anticipatory capability to respond to fast moving pandemics.

A Domestic Perspective of CBRN Response Capabilities

Chad Gorman, Director of the Chemical, Biological, Radiological, Nuclear, and Explosives Office in the Response Directorate of the Federal Emergency Management Agency (FEMA) outlined how FEMA approaches CBRN preparedness and response from a domestic perspective, focusing on past efforts, the current approach, and the way forward. Gorman noted that examples of best practices learned in the United States could provide a helpful lens for response to international events; to illustrate this point he highlighted some domestic response approaches and activities.

Pre-2008, FEMA's approach to planning and preparedness for a CBRN event was captured in the national planning scenarios defined in Homeland Security Presidential Directive 8 (HSPD-8) (White House and U.S. Department of Homeland Security, 2003). This outline provided 15 worst-case scenarios that would guide their response following a CBRN incident (Box 1.2). Gorman stated that from a planning perspective these scenarios presented several challenges that eventually led to a new approach: the scenarios did not offer the analytic depth to identify priorities over the time phase of an incident or provide information on how to make the

most effective use of limited resources to address those priorities. The use of one plan applied to one specific incident limited responders flexibility in dealing with a real event, and in creating one plan for each scenario it became apparent that many of the initial steps for response were the same for each hazard. What resulted, Gorman offered, was a de facto creation of an all hazards approach to planning.

BOX 1.2
FEMA National Planning Scenarios[5]

1. Nuclear Detonation – 10kT IND
2. Biological Attack – Aerosol Anthrax
3. Biological Disease Outbreak – Pandemic Influenza
4. Biological Attack – Plague
5. Chemical Attack – Blister Agent
6. Chemical Attack – Toxic Industrial Chemicals
7. Chemical Attack – Nerve Agent
8. Chemical Attack – Chlorine Tank Explosion
9. Natural Disaster – Major Earthquake
10. Natural Disaster – Major Hurricane
11. Radiological Attack – RDD
12. Explosives Attack – Bombing Using IED
13. Biological Attack – Food Contamination
14. Biological Attack – FMD
15. Cyber Attack

In 2011, Presidential Policy Directive-8 (White House and U.S. Department of Homeland Security) defined an all hazards approach to preparedness from the level of capabilities down to planning, with the further direction that the needed capabilities should fit into a whole of community approach. Gorman recalled statements by FEMA Administrator Craig Fugate that people need to move away from the idea that governments are always in the lead following a disaster. Response efforts should not solely involve first responders. Federal and other responders should consider non-governmental organizations and people who live in the affected communities as a resource for response and recovery rather than a liability. Gorman cited the response to Hurricane Sandy in which the "first responders" were often neighbors, community members, and faith-based organizations. Using a whole of community mindset, FEMA's current operation plans for all hazards are designed to address how to deliver core capabilities against perceived needs in many, if not all, scenarios. In considering the unique set of capabilities that a CBRN event may require, FEMA builds off the same all hazards approach, which provides 65-70 percent of the core capabilities. Annexes are then developed to address specific challenges

[5] FEMA National Planning Scenarios: http://emilms.fema.gov/IS800B/lesson5/NRF0105060.htm.

inherent to a C-B-RN incident, always with the goal of maximizing life-saving capabilities, and stabilizing infrastructure and ultimately the affected population.

In drilling down into capabilities specific to CBRN incidents, Gorman began by considering an act of nuclear terrorism. FEMA's approach was to address the question of how to successfully respond following a nuclear attack or detonation. The *DHS Strategy for Improving the National Response and Recovery from an IND Attack* (Box 1.3) (U.S. Department of Homeland Security, 2010) was developed to outline high level capabilities required for response to an act of nuclear terrorism, such as managing a large, complex event; rapidly characterizing the incident; and using information about the hazard and the expected consequences of the event to inform decision making on priorities, incident objectives, and application of resources across the spectrum of emergency management. Gorman highlighted the ability to inform responders to make better decisions about mass evacuation, sheltering populations, enacting protective measures, medical triage and casualty care, controlling and stabilizing the affected area, and how to move from response into recovery operations. The document laid out the problem and identified what the delivery of capabilities might look like; what it did not do was offer a way to apply these capabilities in an actual emergency.

BOX 1.3
DHS Strategy for Improving the National Response and Recovery from an IND Attack

Capability 1 – Manage the Response
Capability 2 – Characterize the Incident
Capability 3 – Mass Evacuation and In-Place Protection
Capability 4 – Medical Triage
Capability 5 – Provide Casualty/Evacuee Care
Capability 6 – Stabilize and Control the Impacted Area
Capability 7 – Perform Site Cleanup and Recovery and Restore Essential Functions

To address issues of implementation from the perspective of a local decision maker, emergency managers, and other responders, an earlier version of the *Planning Guidance for Response to a Nuclear Detonation (v.2)* (U.S. Department of Homeland Security, 2010) was revised. Gorman indicated that this document used the guidance on capabilities from the strategy report and framed it at the level of an actual event. The planning guidance sets priorities and describes ways to approach the application of the capabilities in the environment that exists following a nuclear event. Gorman added that this document was a huge milestone in addressing the response to a nuclear accident in that it took the view that, although catastrophic, an incident could be survivable. This was an important change in the discussion with local, state, and tribal partners, whose normal stance is that they do not possess the capacity to respond to a nuclear event and therefore all of the responsibility lies with the federal government. Through a sound basis in science and analysis of the evidence, the guidance demonstrated that employing preparedness efforts in advance could provide invaluable protection for the affected population such as communicating with the community to stay inside, facilitating better coordination with federal partners, and having a plan for allocating limited resources in a productive way.

Gorman added that the primary change in the revised version of the guidance was discussion that emerged around addressing risk communication to better prepare the public to respond to a nuclear event, and to facilitate a better understanding of what messages need to be quickly disseminated to help people save their own lives. Gorman noted that preparedness of the public was very important in the two terrorist attacks on the World Trade Center, 1993 and 2001. The 9/11 Commission Report (National Commission on Terrorist Attacks, 2004) analyzed how measures put in place by the Port Authority following the 1993 bombing affected how people in the Twin Towers responded on 9/11; measures included training and drills with the building population for preparedness and evacuation. They found that close to 95 percent of occupants below the impacted zone were able to save their own lives through knowing information about the location of exits, how to follow lighted arrow strips, and where to locate flashlights. Gorman stressed that this lesson learned was critical in developing new guidance.

This process led to a new document, *IND Response and Recovery: Communicating in the Immediate Aftermath* (Federal Emergency Management Agency, 2013), which provides guidance for public affairs professionals on how to communicate with the public following a nuclear incident. Risk communication experts were asked to draft likely questions that the public would have in the face of this type of event. The questions were matched with subject matter experts in the scientific community, national labs, and interagency partners to craft scientifically informed messages that could be used to fill an information gap very rapidly. These messages were tested in a focus group in Atlanta, Gorman explained, through a partnership between FEMA and the CDC. The focus group resulted in some interesting lessons learned; for instance, the wording of messages is important. Telling people to "shelter in place" did not resonate and the message was changed to "get inside". Gorman posed a question of how all this information and data is integrated into building capabilities for planning, and identified a major gap in the ability to manage an incident as large as a nuclear event. A basic premise is that there needs to be a plan in place; he reiterated that FEMA's new approach moves away from specific planning scenarios. Currently, FEMA is working with regions and states to develop a comprehensive approach for response, which includes matching science and analyzing capabilities to a city or region's unique population densities, building types, weather patterns, and geography, i.e., challenges that could occur with a nuclear incident in a particular place. The first plan to be developed is in FEMA region V in the State of Illinois and City of Chicago.

Gorman concluded with suggestions of how the capabilities identified for nuclear events could be applied to chemical or biological incidents. In taking a high level approach, many of the same challenges and questions may characterize chemical and biological events. First, responders need to be able to manage the complexity of the challenges that are unique to the incident. Gorman highlighted the following questions as essential to the process a) what capabilities are needed and how are those capabilities delivered to meet specific needs; b) how is an incident characterized–what are you dealing with and where; c) what communication is needed with the public so they know what to do; and d) when to move on to recovery efforts. A framework designed to address these challenges could provide a useful approach to other CBRN events.

Question & Answers

Session moderator Galloway began with a question from an online participant who asked about how capabilities of U.S. federal agencies other than the military are leveraged during an international response. Lewis responded that DOS works across many agencies, including Health and Human Services (HHS), EPA, DOE, and DHS, in addition to DOD. They have identified resources and subject matter experts that would help to characterize the issues in the aftermath of an event and the U.S. support required to best meet those needs. Resources and support could come from DOD, but DOS works across the interagency landscape to find the best solution. Cetron offered the pandemic influenza as a good model for an intergovernmental preparedness initiative in the international arena. Difficult issues were raised in approaching the response to the pandemic, such as whether citizens should be repatriated versus stay in the affected country, and questions around the maintenance and use of global stockpiles of medicine. He noted that response frameworks already address infectious disease threats that occur from natural processes and globalize quickly, such as the Global and Response Network under the umbrella of the World Health Organization, which bring together international support based on capabilities to do rapid intervention and response. Lewis explained that coordination between counterparts in different countries, under bilateral or multilateral agreements, could be very effective, but that issues often arise when working between different ministries or agencies within the same country. These synergies are just now being coordinated within U.S. agencies and pose more challenges across international governance. Gorman agreed that an effective approach includes leveraging U.S. capabilities for domestic response to assist foreign partners. Lessons learned about how to coordinate the response to an incident in the United States from the local level through national structures, and how to move resources quickly to the incident command and location, could be applied internationally. Lewis added that the private sector could provide critical support in a local response overseas and domestically, but had not yet been effectively tapped into.

A workshop steering committee member commented that issues raised by Lewis would provide an excellent outline to scope future CBRN activities that might be undertaken by the National Academies, specifically:

- Lack of preparation for "unlikely" events
- Technical skills and equipment for detection and identification of the hazard
- Characterizing the extent of the problem
- "Lingering" and invisible hazards
- Fear/misunderstanding by the populace

In response, Lewis raised the challenge of managing expectations and narrowing the scope to what can realistically be done, adding that support from the academic community and private sector could provide invaluable assistance in improving U.S. response efforts.

Another participant asked how decision making in these situations could be streamlined. Lewis replied that the initial challenge is always to identify the problem, and then reach out to appropriate experts. The Fukushima accident was considered a nuclear problem that required a nuclear expert to coordinate the response. However, the solution went beyond nuclear experts, who fill one niche, and required assistance from the EPA, health communities, and many others. Lewis offered that the painful lessons learned through that experience helped to identify the

issues needed to improve decision making. He added that the interagency group being led by Major General Bentz is grappling with questions of which agency has the best capability, which agency is prepared to deploy to the location of the incident, and how to ensure that the appropriate resources are quickly dispensed to the site. This should help to avoid a knee jerk reaction, Lewis stated, which can result in the U.S. government sending every capability they have to offer, rather then focusing on what is essential. Cetron reiterated the need for federal agency partners to prepare and coordinate before an incident, particularly one that presents cross-sectoral challenges, so that required assets can be located quickly and deployed. He added that part of what is needed to improve decision making is to alter the mindset from whole of government to whole of society and work with people outside traditional silos. Gorman added that how we translate technical data to decision makers who are not experts in fields related to CBRN is critical, how we package information, describe information, and push information. An essential capability in supporting decision making is providing decision support, particularly in a high-paced, complex environment such as CBRN response.

Is the U.S. government preparation for domestic response to a chemical event robust enough that we are in a position to help another country, asked an online participant? Gorman drew upon FEMA's strategy for nuclear response, explaining that FEMA is currently engaging in similar efforts to address the unique issues around chemical threats. Chemical incidents are fast paced, and first responders and HAZMAT teams are often the first to the scene. FEMA is analyzing what capabilities are needed from the federal agencies in support of a chemical incident, as well as the responsibility of the whole community. It is still a work in progress, he indicated, but appropriate steps are being taken to improve U.S. government response capabilities. Lewis added that, from an international perspective, preparation of partner nations is key to a chemical incident because of the rapid nature of a chemical event. The United States should work with partner nations before an incident to develop their capabilities for first response and help them empower their communities to take action.

Another participant offered that the grand challenge in CBRN events is a psychosocial one, challenging the panelists to think about the trusted messengers, both domestically and internationally, that could help the public get past the fears and trepidation of accepting messages like "stay inside" when they want to flee. The participant suggested that communicators should be identified across faith-based communities, media, and non-profit organizations in advance. Cetron agreed that the importance of communication could not be overemphasized, particularly with a whole of society approach, adding that it takes a unique skill set to garner the public trust and to be able to convey information succinctly and clearly. Cetron stressed that it takes different trusted opinion leaders to reach different communities. To promote outreach, the CDC started an education program for medical journalists focused on ways they could more effectively communicate important messages during a crisis. Lewis expressed two additional points, the importance of communication between the interagency counterparts and the challenge of translating information to partner governments. He indicated that some foreign governments are better at delivering messages rapidly to their populations using different media, while others have difficulty in identifying a credible spokesperson. As an example of effective communication using non-traditional messengers, Gorman drew on a major highway construction project that took place in Los Angeles, CA. To avoid a traffic disaster, the city enlisted celebrities with regular Twitter feeds to dispense the message to avoid the I-5 freeway at the day and time of the work; it resulted in complete success.

A question was asked about cultural capabilities necessary for international CBRN events that occur in complex societies, considering different gender roles, language, family structures, expectations of government, and values and risk perception regarding science. All of these attributes influence people's behavior and ability to be resilient during and after an event. Cetron responded that this is a huge gap area that needs more attention, adding that even within the United States many different cultural communities are represented. CDC is working to design outreach that works over the vast cultural landscape of the United States; internationally, political structures can complicate the issue. For example some government leaders do not communicate information but rather tell their population "this is the way it is going to be". There is also the challenge of countering misinformation; for example, during polio vaccination campaigns in some countries, certain groups spread misinformation that vaccination programs were a conspiracy to sterilize kids. Cetron suggested that the CDC's bottom up approach to refugee resettlement represents a good model for communication. This approach identifies effective communicators within different communities and cultures, and creates an exchange of information between the CDC, who provides training on the message, and the community representative, who ensures that the message is delivered in a culturally appropriate way. Lewis agreed that local people have the understanding and knowledge of local requirements, adding that many response organizations link with local people to support their work in the field. He noted that it is often challenging to transfer messages and training designed for a particular place to another location, for example training for an incident in South Sudan may not apply in Southeast Asia.

Lewis was asked if there was a way to leverage the National Guard State Partnership Program, which has developed relationships with 65 countries, to address the need to connect subject matter experts in the United States with foreign partners. DOS and the National Guard Bureau work together at the headquarter level, responded Lewis. Partnerships between the U.S. National Guard and partner states tend to develop across military counterparts, which consider CBRN response as one niche capability. However, Lewis stated, these are military experts and they bring military capability and rule of law. From his perspective, the State Guard Bureaus have developed long-term partnerships between experts that have been successful in building capabilities and capacity, such as in the preparation for the Eurocup and the Illinois National Guard's work with Poland. However, a challenge still exists of whether the receiving government has the leadership and organization to employ these capabilities.

A steering committee member asked about the U.S. government capabilities for modeling and simulation of an incident to provide partner countries and U.S. responders the necessary information to develop effective messages. Lewis re-emphasized that an affected country is responsible for determining the extent of the hazard and managing the response in their nation. If U.S. government response entities and the foreign government are sending different messages, there is a communication credibility issue. Many countries have the ability to model a situation or have detectors in place to measure the contaminant, which helps them to understand where the problem has spread and not just make predictions. He added that the United States would likely support a country's effort to define the extent of the problem and work with the local government to verify or bolster their capacity to characterize the hazard. Cetron pointed out that asking the right questions could help a country understand whether they have determined the extent of the incident. International frameworks for response and governance, such as the International Health Regulations, have annexes designed to help countries determine their capacity to assess and respond. Normative standards can also be set out as part of a global governance process. Lewis

added that countries do not have to come to the United States but can receive assistance with predictive modeling through organizations such as NATO, ASEAN, or a bilateral agreement with a neighbor.

A participant from the FBI asked if the response would be different if an incident was caused by an intentional act. And, if so, what would be done in an international incident to determine the attribution? Cetron cited examples from the intentional anthrax incidents and indicated that there were many differences in the response. A lesson learned was that the FBI and law enforcement and the CDC both had an investigative role but with different purposes. This led to questions of how to coordinate an inquiry when there are overlapping needs that can impact each other's investigation, such as both agencies needing to talk to the same people and communicate with the public. Since then, much has been done to strengthen the relationship between the FBI and CDC. Cetron posed that issues arise around the different chain of custody for evidence, moving specimens, and the ability to prosecute perpetrators and find attribution. Internationally, it is even more complicated due to politics, rules, and laws in different countries. Another difference is that when there is intent to do harm there is often a need to be ready for the unexpected. Cetron revisited unknowns associated with an intentional act, such as whether a strain of anthrax was bioengineered to be resistant or to evade detection and diagnostics. Intent also raises the level of fear and anxiety because that uncertainty creates more public panic. Gorman agreed, adding that FEMA's perspective domestically is to always respond to the requirements of the incident and put capabilities against those requirements, be they naturally occurring, accidental, or manmade. For a CBRN threat, he added there is an opportunity within the Presidential Policy Directive-8 (White House and U.S. Department of Homeland Security, 2011) preparedness goal in the mission area for prevention (other mission areas are protection, mitigation, response, and recovery) to leverage intelligence indicators or information for terrorist acts. In the event that prevention fails, consequence management analysis could also be used to inform key decisions that buy down risk. Lewis stated that information from the intelligence community could be applied to an international CBRN event. The U.S. government is well organized to coordinate the response to an international terrorist act, including the delivery of health support, consequence management, and characterization of a site. The FBI and other intelligence agencies are key in identifying and ensuring proper collection of evidence, working with local government to investigate a crime against Americans or American interests abroad, and provide follow-on support for forensics and crime scene investigation. FBI attachés could work through an embassy to provide support for a local investigative authority. Lewis turned to the question of attribution, stating that identifying the perpetrator is likely a longer-term issue rather then part of the immediate response. The attribution piece requires detailed analysis and coordination within the U.S. government.

References

Environmental Protection Agency (EPA). 2013. *PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents*. Draft for Interim Use and Public Comment, March 2013.

Federal Emergency Management Agency. 2013. *IND Response and Recovery: Communicating in the Immediate Aftermath.*

Hufnagel, L., D. Brockmann and T. Geisel, et al. 2004. *Forecast and control of epidemics in a globalized world.* Proceedings of the National Academy of Sciences. 101(42): 15124-15129.

National Commission on Terrorist Attacks upon the United States. (Philip Zelikow, Executive Director; Bonnie D. Jenkins, Counsel; Ernest R. May, Senior Advisor). 2004. *The 9/11 Commission Report*. New York. Available at http://www.9-11commission.gov.

U.S. Department of Homeland Security. (DHS). 2010. *DHS Strategy for Improving the National Response and Recovery from an IND Attack.*

White House and Department of Homeland Security (DHS). 2003. *Homeland Security Presidential Directive 8 (HSPD-8):* National Preparedness. Available at: http://www.fas.org/irp/offdocs/nspd/hspd-8.html.

White House and Department of Homeland Security (DHS). 2011. *Presidential Policy Directive-8*. Available at http://www.dhs.gov/xlibrary/assets/presidential-policy-directive-8-national-preparedness.pdf.

Chapter 2

Best Practices for Coordinated Response to an International CBRN Event

On March 11, 2011, the Tōhoku Earthquake (Great East Japan Earthquake) and subsequent tsunami caused a nuclear disaster at the Fukushima Daiichi power plant in Japan. In the wake of the disaster, Dr. Kiyoshi Kurokawa of the National Graduate Institute for Policy in Japan led an independent commission, The Fukushima Nuclear Accident Independent Investigation Commission, charged with investigating the Fukushima accident and providing recommendations to prevent future incidents. In the afternoon keynote presentation, Kurokawa reflected on his experience with the Daiichi commission, a first of its kind for Japan, and shared his perspective on the role and response of the Japanese government and other entities in the aftermath of the devastating disaster.

KEYNOTE ADDRESS

Opportunities and Challenges in Coordinating the Response to CBRN Events: Fukushima Daiichi, a Case Study

The speed and strength of the destruction from the Tōhoku Earthquake and subsequent tsunami provided a shock to the global community, offered Dr. Kiyoshi Kurokawa. Not only was the earthquake at 9.0 on the Richter scale, and resulting tsunami a record-breaking disaster, the event unfolded on television while the world watched. Kurokawa noted that people who witnessed the disaster first hand were able to disseminate information through social networks, which allowed for real-time reports of the disaster and its aftermath. This rapid information exchange also resulted in more direct scrutiny of the Japanese government's response to the accident by the Japanese people and the world. In reaction to some miscommunication and mistrust that resulted during the response, an independent commission was formed and released a report, *The Fukushima Nuclear Accident Independent Investigation Commission* (2012). The primary mission of the commission was to investigate:

- Direct and indirect causes of the accident independent from political influences;

- Responses, damages, sequence of events, and actions taken and their effectiveness;
- History of decisions and approval processes regarding nuclear energy policies; and
- Recommend measures to prevent future nuclear accidents.

The investigation included the history of decision making and the approval process for nuclear power and policies going back to the 1950s, all with the goal of preventing future nuclear accidents (see Box 2.1 for the complete commission charge). The Commission did not address issues around future energy policy, damage compensation, decommissioning processes/ technology, and disposition of spent nuclear fuel rods.

BOX 2.1
Charge to The Fukushima Nuclear Accident Independent Investigation Commission

The Commission was charged by the Speaker and the President of the National Diet of Japan (Japanese government) to do the following:

1. To investigate the direct and indirect causes of the Tokyo Electric Power Company Fukushima nuclear power plant accident that occurred on March 11, 2011 in conjunction with the Great East Japan Earthquake.
2. To investigate the direct and indirect causes of the damage sustained from the above accident.
3. To investigate and verify the emergency response to both the accident and the consequential damage; to verify the sequence of events and actions taken; and to assess the effectiveness of the emergency response.
4. To investigate the history of decisions and approval processes regarding existing nuclear policies and other related matters.
5. To recommend measures to prevent nuclear accidents and any consequential damage based on the finding of the above investigations. The recommendations shall include assessments of essential nuclear policies and the structure of related administrative organizations.
6. To conduct the necessary administrative functions necessary for carrying out the above activities.

Kurokawa explained that the Commission's work was structured around 20 meetings with 38 key people in attendance, including the Prime Minister, Chief Cabinet Secretary, the Minister of Economy, Trade and Industry, and three former and current Heads of the Nuclear Safety Agency in Japan. The investigation included site visits to nine nuclear power plants that included the Fukushima Daiichi, Fukushima Daini, Tohoku Electric Power Company Onagawa Nuclear Power Plant, and The Japan Atomic Power Company Tokai Daini Power Plant. The Commission also visited Washington D.C., the GE Nuclear Headquarters in North Carolina, and the Nuclear Regulatory Commission Technical Training Center in Tennessee. In collecting evidence for the report, Kurokawa indicated that the commission held 900 hours of hearings with

over 1,000 people; conducted an evacuee's survey with over 10,000 people participating, an on-site worker's survey with over 2,000 participants, and town meetings with over 400 attendees. Kurokawa highlighted that key to the investigation was that all Commission meetings were broadcast live and available online with simultaneous English translation.

The report, The Fukushima Nuclear Accident Independent Investigation Commission (2012), resulted in nine conclusions and seven specific recommendations[6] made to the legislative arm of the Japanese government. Kurokawa stressed that three key features of the investigation were very important to the final report; the process was transparent, secure, and open to the Japanese public and the world. Of the nine conclusions, Dr. Kurokawa emphasized the importance of number nine in which the Commission concluded a need to reform Japanese laws and regulations so that they are compatible with global standards, which had not previously been implemented in Japan. The seven recommendations by the Commission[7] included:

1. Monitoring of the nuclear regulatory body by the National Diet
2. Reform the crisis management system
3. Government responsibility for public health and welfare
4. Monitoring the operators
5. Criteria for the new regulatory body
6. Reforming laws related to nuclear energy
7. Develop a system of independent investigation commissions

Of these recommendations, Dr. Kurokawa pointed to the importance of the first recommendation, which focused on monitoring by the National Diet and the need to establish "a permanent committee to deal with issues regarding nuclear power… in order to supervise the regulators to secure the safety of the public" (The Fukushima Nuclear Accident Independent Investigation Commission, 2012).

Kurokawa shifted the discussion to the lessons learned from his work with the Commission. He emphasized the importance of not forgetting the devastation that occurs in the wake of a "black swan" event,[8] and stressed that transparency in preparing for and responding to an event like Fukushima is the foundation for public trust. Kurokowa offered that the increasing interconnectivity of the world leads to more global risks, and noted the importance of working across siloes and building resilience through "anticipatory strategy" based on shared knowledge.

Kurokawa concluded by addressing the need to increase resilience between partner nations and to harness the power of new technologies and individuals who are working to solve the complex issues that arise with catastrophic events. He raised the need for a "global exchange

[6] For detailed information on the nine conclusions made by the Fukushima Nuclear Accident Independent Investigation Commission, please see pages 16–21 in the Executive Summary of the official report at http://www.nirs.org/fukushimawarp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/09/NAIIC_report_lo_res10.pdf.

[7] For the complete versions of the seven recommendations of the Fukushima Nuclear Accident Independent Investigation Commission, please see pages 22–23 in the Executive Summary of the official report at http://www.nirs.org/fukushima/naiic_report.pdf; http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/09/NAIIC_report_lo_res10.pdf.

[8] A black swan event is one that is characterized by being rare and unpredictable, with massive consequences. Most recently, this term was explored in two books by Nassim Nicholas Taleb, *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets* (2001), and a more in depth examination in his follow-up book, *The Black Swan Theory: The Impact of the Highly Improbable* (2007).

program" between nuclear regulators and operators that promote information sharing based on actual experience, similar to how scientists facilitate research and information exchange through peer reviewed journals. He also emphasized the need to develop global nuclear standards and licensing, along with common lines of communicating that information, so that every nation has a common resource that can help increase national security and safety. Finally, Kurokawa proposed that the Japanese government should invite continued comment, analysis, and input from world experts as they continue to recover from the Fukushima accident, and to keep the input and decision-making processes transparent as part of good governance; it is very important to share all of this information because "something similar could happen next week" anywhere in the world.

PANEL DISCUSSION

Best Practices for Coordinated Response to International CBRN Events

Moderator, Ann Lesperance of the Pacific Northwest National Laboratory indicated that the panel would focus on best practices for coordinating international response efforts by showcasing actual events, such as the Fukushima accident. The panel was framed around two questions; a) what are best practices for effective response to CBRN events in partner nations, and b) what are examples of successful coordinated response efforts? What are the challenges? Panelists included Dan Blumenthal of the Department of Energy, Charles Donnell of the American Red Cross, Colonel Patrick Terrell from the Department of Defense, and Brent Woodworth of the Los Angeles Emergency Preparedness Foundation.

The Role of the National Nuclear Security Administration of the Department of Energy in an International CBRN Event

The primary role of the National Nuclear Security Administration (NNSA) of the Department of Energy (DOE) in a radiological disaster is to provide technical response for radiological and nuclear incidents, whether they occur domestically or internationally. Dr. Dan Blumenthal, NNSA Consequence Management Program Manager for the Office of Emergency Response at the Department of Energy, drew upon his experience in the response to the Fukushima accident in Japan to illustrate how NNSA capabilities are applied following a radiological event. Blumenthal stated that coordination and execution of response activities could be very different if an incident takes place in the United States versus another country. He framed the discussion around two main themes, the technical response to the incident and the importance of coordination and building relationships between all responding entities.

NNSA consequence management provides three primary technical capabilities for response after a radiological event, noted Blumenthal: monitoring, modeling, and medical management. Radiological monitoring is a central DOE capability and the service can be deployed in several ways; as standard ground-based monitoring, people carrying meters in the field, or specialized equipment outfitted for military and other aircraft. Modeling helps responders understand the likely spread of radiological material based on conditions at the time of an incident. Medical management experts advise and train responders on how to deal with

radiological injuries, exposure, and contamination. Teams collect raw data from the field, analyze the results, and translate the information in a way that supports critical decision making to help save lives and stabilize an area as quickly as possible. Blumenthal explained that small, interdisciplinary field teams work with DOE headquarters and laboratories to determine which course of action is the most appropriate for the reality on the ground; the tools used at the site are specific to the unique situation. During the response to the Fukushima accident very little modeling was done due to the many unknowns. Teams relied heavily on monitoring and aerial capabilities, which proved to be the only way to collect timely information over large areas of complicated and inaccessible terrain without putting responders in harms way.

Blumenthal addressed technical challenges that often emerge with response to international events; such as how U.S. capabilities "plug in" to a foreign government's response capabilities. In the United States, DOE's technical response activities fit with existing frameworks, such as the National Response Framework (Federal Emergency Management Agency, 2013), and response organizations. He cited Presidential Policy Directive 8 (White House and U.S. Department of Homeland Security, 2011), explaining that NNSA's work spans the space of 'prevent, protect, and respond'. In terms of FEMA's core capabilities, the work supports situational assessment and environmental response, and health and safety. With international response, clear frameworks for partnering with other U.S. agencies and with international governments and organizations are rarely in place, and therefore it is critical to be able to adapt and coordinate on site. In Japan, DOE teams were part of multiple efforts, including the USAID's Disaster Assistance and Response Team and the U.S. military's Operation Tomodachi, in which they worked together to conduct field monitoring for U.S. interests and the embassy; the DOE team also partnered directly with the Japanese government. Blumenthal cited another technical challenge as how to translate raw data collected from monitoring activities into actionable products for decision makers. The type of units used in providing information may come into question depending on who is requesting that information, for example, the U.S. military versus the Japanese government. These were the types of issues that came about on the scene.

From the first day in Japan, DOE teams flew equipment with the U.S. military with the objective of mapping the radiation footprint that resulted from the Fukushima accident. Blumenthal noted that after three days, the scope of the incident was much better known (Figure 2.1). Although significant, teams discovered that the response did not require mass evacuations across Japan or that DOD personnel leave the area. Aerial surveys also collected information about areas that were not affected by the radiation plume. Compiling the data provided critical information for decision makers, and supporting communication for the public. Due to success of the monitoring program, the Japanese government continued aerial flights to map the plume after U.S. assistance was completed.

The importance of building relationships and respecting cultural differences and processes are also key capabilities for responding to an international CBRN event. Blumenthal noted that many federal agencies engage in outreach activities and capacity building with other nations, but cautioned there is a limit to what can be accomplished in advance of an event. Blumenthal explained that once a crisis occurs there is often a need to balance U.S. capabilities to provide assistance to a foreign nation with protecting U.S. citizens and interests in the region. In Japan, the U.S. response proved to be a combination of both.

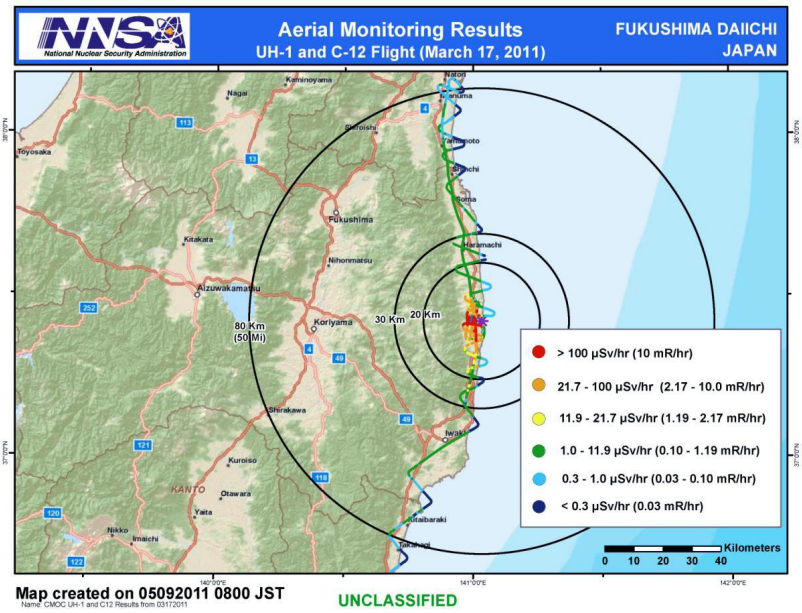

Figure 2.1: Results of the initial aerial radiological survey to measure the exposure rate at ground level resulting from radioactive material deposited on the ground following the Fukushima accident. Source: U.S. Department of Energy/National Nuclear Security Administration (2011).

Upon arrival in Japan, building relationships became the most important process for working with the Japanese government on the response, Blumenthal said. What made the relationships work was transparency in how missions were conducted, and scientific integrity. Equally as important was respecting cultural differences and processes (see Box 2.2). In partnership with the military, DOE provided both the technical capability and the military infrastructure to assist their Japanese counterparts with logistics and aerial support. Over time, relationships developed between U.S. and Japanese technical teams at the Ministry of Education, Science, Culture, and Technology (MEXT). Blumenthal described how U.S. teams shared information with Japanese counterparts during high-level, formal meetings set up between the Department of State (DOS) and the Japanese Ministry of Foreign Affairs. The "icebreaker" came through the exchange of technical information, Blumenthal offered, specifically as U.S. teams shared a map of the radiation footprint. DOE/military teams helped the Japanese to form equivalent partnerships between Japanese civilian technical experts and their military counterparts, and Japanese teams began to conduct their own aerial surveys to map the radiation. This was significant in that civilian/military partnerships rarely exist in Japan. Blumenthal stated that the lesson learned was not to assume normal diplomatic procedures or political barriers will be in effect during a time of crisis.

Blumenthal highlighted best practices that emerged out of the response to the Fukushima accident. It is essential to balance U.S. and host country needs. Transparency and scientific integrity are also critical to building relationships; NNSA teams remained focused on the technical work, were transparent about their plans, shared data, and framed results in basic physical units. In closing, Blumenthal reemphasized two important components of international response: 1) the U.S. government has the technical capabilities—information, scientific integrity,

transparency, and adaptability—but can be limited in its ability to plug into the response efforts of different countries; and 2) be prepared to encounter cultural and procedural differences.

BOX 2.2
Respecting Cultural Differences

After three weeks of joint aerial surveys, U.S. and Japanese teams mapped the radiation footprint that resulted from the Fukushima accident. Blumenthal described how building the joint team was a lesson learned in respecting the Japanese culture and operational processes. U.S. and Japanese teams met in advance of the surveys to outline a plan of action. At the end of the meeting, Blumenthal was not sure if there had been agreement to move forward with the joint operation. In a follow-up meeting, his counterparts from MEXT showed a hand-drawn map with several circles that represented how DOE and MEXT would work together. The Japanese process was not to make decisions in real time at formal meetings, but to take time to deliberate. Once determined, Blumenthal explained, the decision was put into action. The U.S. team learned to respect that process.

Challenges of Response Efforts to Disasters

Chuck Donnell, Vice President of Disaster Services Planning and Doctrine at The American Red Cross, noted that whether a disaster is predictable or considered a "black swan" event, it could have unimaginable consequences around the globe. He added that there are few incident management challenges more difficult for the U.S. government than facilitating an efficient, integrated, well-coordinated response to a CBRN event with an international partner; as one example, he cited the challenge that response efforts in other countries must ensure the safety of American citizens in the affected region.

Donnell identified three foundational principles for every disaster response regardless of hazard: preparedness, readiness, and nurturing the development of resilient communities capable of responding to myriad disasters. Preparation is the hallmark of effective response to large-scale disasters, he added; successful response is not accidental, organic or self-organized, whether domestic or international. Responding to major events and particularly a CBRN incident requires an inordinate amount of coordination in advance to build capabilities, including development, training, and testing of those capabilities within a known framework. In an international response effort, U.S. assistance should build upon existing local capabilities, commitments, and relationships, and efficient decision making should be facilitated at the lowest operational levels to be effective and timely. Donnell concluded by emphasizing the speed and availability of U.S. capabilities should be equal to the urgency of the need for the response.

U.S. Response to International Disasters

Colonel Patrick Terrell, WMD Military Advisor and Deputy Director for CBRN Defense Policy in the Office of the Deputy Assistant Secretary of Defense for Combating WMD at the

Department of Defense, outlined four fundamental reasons the U.S. government responds to international disasters; 1) we stand by people in need—provide humanitarian assistance; 2) we take care of American citizens wherever they are; 3) we protect our forces overseas; and 4) we defend our homeland. In Japan, U.S. assistance was tied to some, if not all, of these principles, and the U.S government had a commitment to Japan as its ally. Terrell framed his comments using the Fukushima accident as an example, referring to important questions about effective U.S. response that were raised by this incident. How do we take care of American citizens in a foreign region? How do we evacuate people from a country when there is not an existing plan for noncombatant evacuation operations? How do we share information with vital allies and partners as quickly as possible? These are the types of questions being addressed by the U.S. government to improve our nation's response capabilities in the future.

Terrell characterized areas where U.S. capabilities are very effective in international response and challenges that are faced once an event has happened. He emphasized that information is vital for an effective response, and posed that the United States is very good at collecting information but not as successful at sharing that information, whether within the U.S. government or with external partners. In the response to Fukushima, 17 federal departments and agencies were communicating multiple times a day within 24 hours. The challenge was ensuring that the right information was communicated to decision makers who needed to make strategic and tactical decisions quickly.

Relationships play a key role in effective international response, he added; it is important to have open lines of communication in place in advance of an event, both among federal agencies and between the U.S. government and their foreign counterparts. Terrell noted that because of his work with foreign consequence management policy, he and his counterpart at DOS had an established relationship built on trust and confidence. In Japan, where the U.S. government has military headquarters, U.S. military officers had established relationships with the Japanese Ministry of Defense and the Japanese Joint Staff. However, Terrell cautioned, relationships do not ensure that information will reach the appropriate parties. Following the earthquake and Fukushima accident, the United States received requests for assistance from multiple channels at multiple federal agencies; for example DOD received the same request for assistance as DOE. He emphasized that it is critical that the country team at the embassy provide the interface for all communication with a foreign government. Equally important, the U.S. government must be coordinated at home to avoid duplication of effort and to deliver resources and capabilities on the ground as quickly as possible. These factors are critical for saving lives.

Terrell cited current DOD activities focused on fostering better coordination and communication, which address questions such as how can DOD posture forces with key capabilities in effected regions quickly? How can DOD support countries so that they can respond on their own, particularly in the first few hours? How can DOD align army forces and combatant commands to promote building partner capacity and capabilities? Terrell stated that a current effort expands consequence management training to foreign civilian responders rather than solely military to military interactions. He noted that connecting with foreign civilians requires additional coordination between DOD and DOS, as they are the nexus of activity in the foreign nation.

Terrell concluded with two final points. The first underscored the need to consider how the U.S. government can foster interaction with international organizations and NGO's in the face of a nuclear event since they are often the ones on the ground providing humanitarian assistance. And finally he noted that foreign partners may be overwhelmed by an event but not

realize it until it is too late, posing the question, how can the U.S. government help foreign governments understand an event clearly to promote more seamless coordination between all responding parties?

Private Sector and Non-governmental Organization Response to International Disasters

Brent Woodworth, President and CEO of the Los Angeles Emergency Preparedness Foundation, outlined issues that can arise in international response to disasters from the perspective of the private sector and NGO's, and introduced some emerging technologies that can support the response to CBRN events. For over 30 years, Woodworth worked at IBM where he founded and managed a program called the Crisis Response Team (CRT), a group of experts who respond to disasters throughout the world. During his work with CRT, they responded to over 70 major events in 50 countries. Woodworth drew from specific cases to highlight lessons learned and challenges that occur when assisting in international response efforts.

In the aftermath of a large earthquake in Turkey, CRT faced the challenge that "people will ship anything" following a disaster. Woodworth described the situation in which the Turkish government was overwhelmed with the amount of medical supplies received from foreign donors. At the request of the minister of health, the CRT assisted with setting up seven warehouse operations and managed the receipt and distribution of medical goods and services. To complicate the process, not all incoming supplies were useable; for example, half used tubes of toothpaste and opened bottles of aspirin. Woodworth recalled that sorting and organizing these goods took an incredible amount of time, and added an additional layer to the logistical challenge of creating efficient systems for the Turkish government. Woodworth stressed that this is a common challenge following a disaster; large shipments of non-useable goods are sent to an affected country that will then have to be disposed, e.g., expired medicine or vast amounts of used clothes. To avoid this problem in the aftermath of the 2005 earthquake in the Kashmir region of Pakistan, Woodworth advised Prime Minister Aziz to ask the international community for a list of specific items needed for the response, such as winterized tents, blankets, and propane heaters. Pakistan received exactly what they needed based on that request.

Another important lesson learned is the need to match disaster assistance to the cultural and social structures of the country or region being assisted. Woodworth cited his work with the response to a large earthquake in Gujarat, India, which affected over 16 million people and caused complete devastation in some areas. During this response, the CRT faced local political and cultural sensitivities that needed to be addressed. Gujarat is a vegetarian state and food donations had to be carefully sorted. With the distribution of goods, response teams had to ensure that certain villages were not passed up based on political affiliations; this was accomplished by working with local government officials and other community leaders. Essential items that had been donated were held up because of customs fees; eventually fees were waived. Woodworth also highlighted how traumatic these events are to impacted families, and emphasized that meeting the needs of affected people requires specialized experts and programs that are customized to the unique cultural and social elements of the region.

Woodworth identified several additional challenges that can emerge in international disaster response. After a volcanic eruption near the capitol of Quito, the Ecuadorian government needed assistance with determining whether to evacuate the city or advise its citizens to shelter in place. During the response to the Indian Ocean Tsunami in Banda Aceh, the

massive devastation included a high number of fatalities, resulting in a large number of sanitation and health issues. Communication was critical, particularly because many affected people lived in remote, inaccessible areas. He also cautioned about working in areas of ongoing war and military action. Lastly, he stressed the importance of gathering and disseminating information, which is critical to making timely and appropriate decisions.

Woodworth cited operational questions, such as how do you find missing people? How can multiple organizations, agencies, governments, and others coordinate their efforts? Who is doing what? Are hospitals and other medical facilities capable of handling the influx of casualties? Woodworth offered that innovative technologies could address these questions and help foster coordination of response teams. He noted the open source software program Sahana,[9] which was designed to provide information management solutions to assist disaster stakeholders better prepare for and respond to disasters. This software, which grew out of response activities in Sri Lanka following the 2004 Indian Ocean tsunami, is widely used by emergency managers, NGO's such as International Red Cross/Red Crescent (IFRC), local decision makers and government, among others. Following the Japanese earthquake and tsunami, Sahana was used to map the location of shelters, camps, hospitals, and other resources, as well as plot sources of contaminated water. The American Red Cross developed a standardized resource management system on Sahana to manage their volunteers, members, warehouses, and assets. Sahana also has tools to help locate and reunite families and manage shelters. Finally, Woodworth highlighted a new program, the Community Stakeholder Network, a network for business, government, non-profit organizations, faith-based groups, and other community stakeholders where groups can share data and information with the goal of improving situational awareness before and after a disaster. The network can be customized for different sectors, so that different users can collect and display data in a way best suited to their needs. For example, maps of an area can be created with different overlays of information, such as population census, inventory, and infrastructure data.

Woodworth concluded by identifying several areas critical for international response. Most important, the U.S. government and other organizations must be invited by the host country. External governments and organizations must respect the government and be aware of and respectful toward cultural and societal issues and norms in the region. Honest communication with the public is a key component of response to a disaster. Woodworth underscored the need to define procedures, have a plan, and use sensible systems to implement the plan, break down silos, avoid redundancy of effort, and document everything. He closed by urging responding organizations not to be afraid to ask for help, saying that the most successful responders are the ones that admit they need assistance; ones that isolate themselves are doomed to failure.

Question and Answers

Lesperance, moderator of the session, opened with a simple question for each of the panelists, what are the top two priorities for response following an international CBRN event? Woodworth highlighted the importance of open and honest communication and building the trust of the country's government and population. He added that it is critical to get information right

[9] http://sahanafoundation.org.

the first time. Following a large-scale disaster, Donnell observed, affected countries often cannot articulate their needs. To provide assistance and bring capabilities requires advance preparation and a line of communication with a responsible person in the center of the response. Often a country needs to be told what capabilities are available to assist them. Blumenthal said that from the technical side, it is important to respond quickly using well-practiced methods, and emphasized the need to be sensitive to cultural sensitivities and not surprise your partner. He added that decisions should be made based on the technical data that is available. Terrell drew on previous answers to sum up; a shared understanding of the situation on the ground is required as quickly as possible to employ the appropriate capabilities to address the incident. This happens with open, honest communication.

One participant asked if an independent government organization was needed to address standards, and roles and responsibilities of different responders, and to synchronize and coordinate response efforts. If so, should the effort have a domestic or international focus and work with the United Nations? On the international side, Woodworth responded, there is a need for coordination to address issues around resource allocation and to reduce redundancy of efforts. Donnell pointed out that successful mechanisms exist to coordinate the federal government with other response entities after a U.S. incident, and noted that the authority for making decisions following a domestic disaster lies with state and local governments. He re-emphasized the importance of preparation for international disaster deployments, indicating that responding to a situation becomes increasingly complex when requests are made through the country's ambassador up to the President of the United States. Donnell also noted that NGO's and private sector partners might already be on the ground when U.S. teams arrive. Donnell added that with CBRN events, there are only so many countries and organizations with the technical capability and capacity for response, e.g., following a nuclear accident. This helps to narrow the scope of coordination and planning that needs to occur in advance to build up robust capabilities.

A question was asked about how the United States can help other countries put systems and capabilities in place that are appropriate to their situation, rather than providing a one size fits all approach based on how the United States responds to a domestic CBRN incident. Terrell suggested that the country should state the problem directly and then work with the U.S. government to solve the problem specific to the situation, rather than the U.S. government presenting an "answer" to the problem. Woodworth added, "simpler is better"; don't start with the newest, most innovative solutions that will not be sustainable over time. Blumenthal echoed Terrell and Woodworth, saying that in technical exchanges, he frames assistance in terms of the constraints of the issue rather than a right way to do things. Another participant pointed to an existing manual of emergency response standards, known as the Sphere Standards, used by the Red Cross, agencies, NGO's, and United Nations (UN) responders, and asked if this system would be relevant for a CBRN event. Donnell stated that in his experience working through international disaster mechanisms, such as IFRC, the NGO community and UN cluster system, successful coordination is dependent on the individuals establishing the network at the time of the response. Woodworth suggested that the general relief capabilities outlined in the Sphere Standards could provide a useful model for a framework to address CBRN events. He added that the IFRC is adapting new systems to foster better coordination among NGO's responding in foreign countries.

Another participant asked Blumenthal and Terrell if they could characterize the value of existing relationships in a moment of crisis and ways that emergency response capabilities could be built into existing relationships. Blumenthal explained that developing bilateral agreements at

the operational level is very helpful so that work can begin immediately following an incident. Additionally, continuing working relationships once they have been established is important; for example, he still works on data analysis with his counterparts in Japan. Setting the groundwork in advance is essential to having success, Terrell echoed. When a crisis comes, relationships will help to identify the issue and work out appropriate solutions. Moderator Lesperance directed a question to Terrell about how much capacity partner nations have with respect to a chemical event. Terrell responded that chemical events happen very quickly and that the focus may rapidly shift to caring for casualties from saving lives when a request is made for assistance. Building partner capacity to respond to a chemical event in advance is important so that the country can assess what has occurred and take action, for instance, to limit the spread of contamination and to know what types of assistance is required, for example, a request for additional respirators. Terrell added that it is vital to maintain relationships with NGO's in other countries, as they may be the ones providing the bulk of the humanitarian assistance.

A question was posed to each panelist about whether there is an optimal blend of coordination and empowerment of responders who are operational on the ground. Can these capabilities be built into a system or are they based on the situation? Donnell used his experience in Haiti to frame his answer, indicating that there are multiple layers of coordination that have to be organized following large-scale disasters. Donnell observed that in the international community, organizations tend to gravitate toward a coordination mechanism based on the function they are performing, be it military, NGO's, or the private sector. Oftentimes, the biggest challenge is to stitch those services into the leadership of the country in a way that the local government can organize and manage the operations. In Haiti, a fairly concise decision-making body was organized to assist the prime minister in addressing strategic issues. A second layer of coordination was set at the operational and tactical levels where the World Food Program was setting up different sites to distribute food. Donnell re-emphasized the importance of multiple layers of coordination and facilitating decision making at the lowest levels possible. What is often missing in responding to major disasters is the coordination mechanism for multiple stakeholders with multiple functions to come together and think holistically about the situation. From a technical response perspective Blumenthal identified three different situations that require different approaches, a) whether a large U.S. presence exists in a host country and the country provides a lot of support for the response, e.g., Japan; b) whether a large U.S. presence does not exist but the host country can provide support; or c) a situation where there is no U.S. presence and the host country is not equipped to respond. Woodworth emphasized that coordination between NGO's and the private sector is critical, and that mapping and triage tools are used to help simplify decision making and improve situational awareness. Donnell pointed out that these issues are often the same in responding to international and domestic incidents.

References

Federal Emergency Management Agency (FEMA). 2013. *The National Response Framework* (2nd ed.). Available at http://www.fema.gov/national-response-framework.

National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission (Chairman: Kiyoshi Kurokawa). 2012. *The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission: Executive Summary*
Available at http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/en/report/.

White House and U.S. Department of Homeland Security (DHS). 2011. *Presidential Policy Directive-8*. Available at http://www.dhs.gov/xlibrary/assets/presidential-policy-directive-8-national-preparedness.pdf.

Chapter 3

Increasing Coordination for the Response to an International CBRN Event: Break Out Groups and Next Steps

Break out groups—June 20, 2013

Four breakout groups were held during the afternoon of June 20, 2013. Each group was asked to address three primary questions:

1. What capabilities are needed for effective CBRN response in a partner nation?
2. What are the gaps in capabilities?
3. What is needed to improve U.S. government efforts for coordinated response to CBRN events in partner nations?

Groups consisted of approximately 20-25 participants composed of the workshop attendees, panelists, and steering committee members. Workshop steering committee members moderated the discussion and NRC staff members acted as rapporteurs to document the key points and questions. At the conclusion of the individual break out groups, all of the participants returned to a plenary session. Moderators from each group reported back, highlighting the major take-aways that emerged during the discussion.

Group One

Dr. Greg Parnell, U.S. Military Academy at West Point, highlighted a quote from a participant of his group, "CBRN does not respect country boundaries." In addressing the capabilities needed for effective response, his group suggested that the U.S. government should work to establish agreements and coordinate efforts with various organizations and networks rather than rely solely on bilateral capacities, as that will not work in all regions. Participants in Group One agreed that U.S. agencies and other organizations should work to improve their understanding of cultural factors in partner nations. In addition, it is important to understand how other countries view the CBRN threat and help them make investments to build capabilities that are relevant to the country's needs. Parnell stated that Group One participants emphasized the importance of practices and exercises to build both proficiency and trust; one participant

suggested the establishment of a joint CBRN response coordination center that can assess a CBRN event and help affected countries collect data and information.

Some of the gaps identified by Group One participants included the need for better communication and to overcome "language" barriers when both translating technical information between countries, and in understanding different cultural values. It was suggested that regular channels of communication among the government and NGO or private sector stakeholders is lacking, and that common international standards and understanding of how to assess and measure CBRN response capabilities are needed. To improve U.S. government coordination, Group One participants suggested the need to focus on increased interoperability between U.S. agencies and other U.S. entities, and between the U.S. government and foreign countries and other international entities; a participant pointed out that combatant commands have security assistance programs that could provide a useful foundation to build upon. Strategic rather than opportunistic partnerships were emphasized, as was more advanced planning with partners where CBRN threats are recognized and relationships permit.

Group Two

A large part of Group Two's discussion focused on standards, reported John Carrano, Carrano Consulting, adding that a useful contribution to this work would be to improve ways to understand how to communicate technical information for CBRN, and how to format data and present it to decision makers. Carrano suggested that the World Health Organization's global harmonization task forces could provide a useful model to organize CBRN communities. In addressing the capabilities necessary to improve the U.S. government response to international events, participants from Group Two raised issues such as the need for better information management and situational awareness; assessing and characterizing problems in advance; and harnessing disaster relief capabilities outside the CBRN spectrum. This group also suggested that more practice on how to respond to international emergencies was required, as was consideration of who will pay for international response before a disaster happens. Group Two participants echoed the need to address gaps in standards, particularly in reference to communicating technical information with other countries. Carrano also noted that problems could develop with implementing experimental technology during a CBRN incident. Carrano summarized the discussion by citing the importance of advance training and best practices workshops and exchanges; science and technology solutions; and finding common understanding of standards.

Group Three

Dr. Randall Murch, Virginia Tech, stated that a dominant theme that emerged from their discussion was U.S planning and preparation in advance of an event, both internally and externally. Murch offered that sometimes establishing an 80 percent solution may be sufficient for the response, citing the statement that "perfect is enemy of the good." Murch said that Group Three participants echoed many of the key capabilities and gaps in response identified by other groups, citing the importance of working toward a common language to increase communication and understanding the culture of different countries. He also acknowledged that there is a great diversity of capabilities in different countries. The U.S. government should work to better

understand countries capabilities, as well as manage the expectations of what the United States can provide during an international response. Murch emphasized the importance of building trust and credibility to work in international areas. Participants in Group Three identified the potential for supporting trust between nations through partnerships between academia; for example, through the National Academies and their scientific counterparts in another country or region.

Murch said that his group identified gaps in current capabilities as the need to define a metric to help understand the desired end state of U.S. government participation in an international response, the need to leverage ally's capabilities in an impacted region, and to assess countries capabilities for CBRN response in advance. They added that multi-lateral regional agreements could foster coordination, as would development and sharing of international standards. Murch pointed out that CBRN events bridge disaster response and national security, which poses a need for all sides to coordinate and understand their roles in advance of an incident. It is important that command and control of the response is clear before an event occurs.

Group Four

Ann Lesperance, Pacific Northwest National Laboratory, noted that many of the issues identified by other groups were raised in her session. Participants from Group Four felt that a key point was the need to conduct assessments of different country's CBRN capabilities. Participants suggested that transparency and truthfulness was paramount to any response effort. Some people proposed development of a "plug and play" system, a template that the U.S. government could use with partner nations following an event. Lesperence said that this led to a group discussion about how CBRN subject matter experts could support response efforts led by Disaster Assistance Response Teams (DART) within USAID whose primary mission is humanitarian assistance, considering the complications that arise with CBRN events. Group Four participants felt that there were multiple issues with communication. Not only must U.S. response teams communicate to stakeholders in the country but also address how to provide appropriate outreach to U.S. citizens in the region. Participants emphasized the need to address questions around locating and communicating with U.S. citizens in an affected region, including appropriate technologies to convey messages. Group Four also highlighted issues around managing expectations, as well as the question of whether a foreign government actually wants U.S. assistance. They echoed the importance of training, and one participant suggested that NNSA training programs could be beneficial as a model for CBRN training programs. Other participants pointed to the difficulty with addressing the breadth of CBRN events and asked if a "catalog" of training opportunities could be developed. Lastly, Lesperance said Group Four identified issues around when response ends and recovery begins, and whether U.S. authorities are in place to address these issues.

Working Groups—June 21, 2013

A subset of participants from the June 20, 2013 workshop was invited to participate in small working groups on the morning of June 21, 2013. During a plenary session, participants prioritized issues identified over the course of the previous day into three dominant themes:

- Frameworks to Integrate CBRN and All Hazards Response Capabilities
- Data and Information Sharing
- Standards for International CBRN Response

Groups consisted of approximately 5-10 participants; workshop steering committee members acted as moderators and NRC staff served as rapporteurs. Major themes and issues were documented to help inform future NRC activities aimed at improving U.S. response to international CBRN events.

Working Group One – Frameworks for Integrating CBRN and All Hazard Response Capabilities

Participants addressed questions of how to facilitate the integration of response efforts for all hazards with the specific needs of CBRN events. Questions considered included: Are there existing frameworks or scenarios that can provide appropriate models for improving CBRN response, and what are the gaps and unique attributes that need to be considered for each C-B-RN event type? Participants emphasized that the trigger for the United States to assist in an international response effort should include an acknowledgement by the affected country that they have experienced a disaster, followed by a request for assistance from that country. Some of the key issues that emerged from the discussion included: consideration of the differences between an all hazards response and the unique requirements of a CBRN event; a need to examine existing overseas response frameworks to ensure that development of a new framework would not duplicate current efforts, the need to identify where gaps exist in existing frameworks, and the need for a better understanding of who will be responsible on the U.S. side for assessing requests for assistance from a foreign country, i.e., are appropriate people making decisions about what resources to mobilize in a C-B-RN situation.

Participants suggested that one useful mechanism for coordinating response could be to plug into existing incident command structures that already include standards for response. Building from this, other participants emphasized the need for standards that could help facilitate interoperability between different agencies and international response entities. One participant stated the need for a framework that supports development of transnational CBRN response capabilities. A last suggestion was to include a business model in existing DART team protocols that would support their capabilities to act quickly to minimize damage following an incident.

Working Group Two – Data and Information Sharing

The second working group focused on ways to improve the facilitation of information and data sharing between the U.S. government and decision makers in other countries, including government, the private sector, and non-governmental organizations (NGO's). Participants identified the need to inventory capabilities in advance, both within the United States and in foreign countries, as key to supporting response efforts following a CBRN event. It was acknowledged that the work being done by Major General Julie Bentz is vastly improving how interagency groups coordinate the U.S. government's capabilities. However, participants also

said that more efforts are needed to identify sources of data for U.S. agencies, and to build linkages and structures that promote coordination of effort. Participants suggested the development of a database that could be plugged into by NGO's, the private sector, and international entities, in addition to the federal government, pointing out that currently there is no central place for the U.S. government to share information or lessons learned from past response efforts to CBRN or other major hazards.

Several participants brought up the need for more outreach to NGO's by federal agencies, as they are often the first ones at the scene and could potentially provide the quickest response in a given situation. Participants also raised questions around how to create systems that increase our ability to build situational awareness and promote exchange of cross-sectoral information between the government, private sector, NGO's, and faith-based organizations; what are the best practices to improve sharing of information? Having this type of information, they suggested, would increase response entities ability to leverage efforts and resources. One participant pointed to the Department of Defense's All Partners Access Network (APAN) as a potentially useful platform for this type of exchange.

Participants raised key questions that need to be addressed in advance of an incident to facilitate a successful international response to a CBRN event. What information should the host nation provide? What information does the responding nation need to provide? What are the mechanisms to share that information? Who needs to have access to that information to support timely and appropriate decision making? One participant cautioned that collecting data in a foreign country could pose an issue, particularly if there are adverse political or social conditions in the country where the incident occurs. Another participant pointed out that requests that originate from different sources may require different responses depending on who is asking for that assistance.

Working Group Three – Standards for International CBRN Response

The third working group focused on opportunities for developing a body of international guidelines, standard operating procedures, and other standards for response to catastrophic events, such as a CBRN event. Participants suggested that standards and common guidelines could enhance the effectiveness of response efforts by the United States and its partner nations, both domestically and internationally. This group defined a standard as "what a set group of people agree to abide by" and noted that to succeed, a standard needs to be relevant, validated, tested, and accepted by the community. Participants noted that a complete body of standards does not currently exist to support the U.S. government and partner nations' ability to better coordinate a response to an international CBRN event, adding that current standards were not developed by the people who need to use them. They proposed that joint development of standards will help to establish an agreed upon lexicon and mode of operation, and build personal and institutional partnerships that increase the likelihood of successful implementation. Participants suggested that standards need to adaptively but effectively address preparedness, detection, identification, characterization, response, and resolution to accommodate different societal values, approaches to decision making, investment and capacity building, and available resources. Measuring a country's capabilities against standards should inform effective response by the international community, and fit into the larger mission of addressing the end-to-end range of countering CBRN events.

The working group considered the primary classes of standards that need to be developed for response to catastrophic events such as CBRN. They identified terminology and nomenclature; command, control, communication, and information sharing and access; threat detection, identification, characterization, and reporting; technical standards (e.g., metric vs. imperial, reference materials, type, and quality of information); capacity and capability; and standards of practice and training. Participants also determined existing examples of guidelines or standards could serve as useful models for successful CBRN response. These included:

- Current standards for humanitarian assistance.
- International Health Regulations (IHRs),[10] which are in the process of establishing a common baseline against which countries can compare and assess their own systems.
- The process of creation and adoption of human forensic DNA standards.
- ISO standards that are related to these topics.

Participants thought that this type of effort would take approximately 3-5 years. They also suggested that involvement from National Science Academies (and similar institutions) in various countries could provide a successful venue for convening work on developing standards; providing a neutral environment committed to scientific rigor and developing conclusions and recommendations based on research and evidence. Science academies and associated institutions could also build broad constituencies that include the senior, in-country experts who are often well connected to their respective governments, and simultaneously tap pools of young in-country scientists that would carry these efforts forward into the future.

[10] International Health Regulations, World Health Organization http://www.who.int/topics/international_health_regulations/en/

Appendix A

An All-of-Government Approach to Increase Resilience for International CBRNE Events: Workshop Agenda

Thursday, June 20
National Academy of Sciences Building
2101 Constitution Avenue, NW, Washington, DC 20418

The effectiveness of the U.S. Government (USG) response and approach to chemical, biological, radiological, nuclear, and high-yield explosives (CBRNE) events in partner nations depends on (1) the capability of the USG to provide timely and appropriate assistance; and (2) the resilience of the partner nation to a CBRNE event. The National Research Council of the National Academy of Sciences is hosting a workshop sponsored by the National Institute of Standards and Technology to discuss ways to strengthen the coordination and interoperability between USG and partner nations to prepare for and respond to CBRNE events. The workshop will bring together diverse experts and stakeholders to:

1. Identify capabilities that are necessary for responding to an international CBRNE event.
2. Discuss best practices and resources needed for improved interoperability of the USG and partner nation during response to a CBRNE event.
3. Identify key questions that need to be addressed in follow-up activities focused on improving USG CBRNE response in partner nations.

8:45 – 9:00 am	**Welcome** *Dr. Gerald Galloway, Chair, Steering Committee, Workshop on an All-Government Approach to Increase Resilience for International CBRNE Events*
9:00 – 9:30	**Opening Remarks** Introduction: *Micah Lowenthal, National Research Council* *Major General Julie Bentz, Director of Strategic Capabilities Policy, National Security Staff, Office of the President*

9:30– 10:15	**Keynote: An All of Nation Approach to International CBRNE Preparedness and Response** Introduction: *Lauren Alexander Augustine, National Research Council* *The Honorable Paul Stockton, President, Cloud Peak Analytics and Scholar in Residence, Homeland Security Policy Institute/George Washington University*
10:15 – 10:30	**Break**
10:30 – 12:00 pm	**Panel 1: Capabilities Needed for Effective Response to an International CBRNE Event** Moderator: *Dr. Gerry Galloway, Glenn L. Martin Professor of Engineering, University of Maryland, College Park* *Mr. Brian Lewis, Deputy Director, Technical Programs, Bureau of Counterterrorism, U.S. Department of State* *Dr. Martin Cetron, Director, Division of Global Migration and Quarantine, Centers for Disease Control and Prevention* *Mr. Chad Gorman, Director, Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Office, Response Directorate, Federal Emergency Management Agency* • What capabilities do we need for effective response to a CBRNE event? How are these different from responding to all hazards? • From the USG perspective, what capabilities are unique to responding to a CBRNE event in a partner nation? • What are the gaps in capabilities for coordinating CBRNE response with partner nations?
12:00 – 1:00	**Lunch**
1:00 – 1:45	**Keynote: Opportunities and Challenges in Coordinating the Response to CBRNE Events: Fukushima Daiichi, A Case Study** Introduction: *Dr. John Boright, Executive Director, International Affairs, National Academy of Sciences* *Dr. Kiyoshi Kurokawa, Professor, National Graduate Institute for Policy, Japan*
1:45 – 3:00	**Panel 2: Best Practices for Coordinated Response to International CBRNE Events** Moderator: *Ms. Ann Lesperance, Deputy Director Regional Programs, Northwest Regional Technology Center for Homeland Security, Pacific Northwest National Laboratory*

Dr. Daniel Blumenthal, NNSA Consequence Management Program Manager, Office of Emergency Response, Department of Energy
Mr. Charles Donnell, Vice President, Disaster Services Planning and Doctrine, The American Red Cross
Colonel Patrick Terrell, WMD Military Advisor and Deputy Director for CBRN Defense Policy in the Office of the Deputy Assistant Secretary of Defense for Combating WMD
Mr. Brent Woodworth, President/CEO, Los Angeles Emergency Preparedness Foundation

- What are best practices for effective response to CBRNE events in partner nations?
- What are examples of successful coordinated response efforts? What are the challenges?

3:00 – 3:15	**Break**
3:15 – 4:15	**Breakout Groups with Workshop Participants** • What capabilities are needed for effective CBRNE response in a partner nation? • What are the gaps in capabilities? • What is needed to improve USG efforts for coordinated response to CBRNE events in partner nations?
4:15 – 4:45	**Synthesis of Key Themes & Next Steps**
4:45 – 5:00	**Closing Remarks**
5:00	**Adjourn**

Appendix B

Statement of Task

STATEMENT OF TASK

An ad hoc committee will plan and conduct a public workshop on the subject of an all-government approach to increase resilience in the face of international chemical, biological, radiological, nuclear, and explosive (CBRNE) events. The committee will develop the agenda for the workshop, select and invite speakers and discussants, and moderate the discussions. An individually authored summary of the workshop will be prepared by a designated rapporteur in accordance with institutional policy and procedures. With reference to international CBRNE events, this workshop aims to bring together experts to (1) articulate some common measures or reference points to better assess the resilience or baseline conditions of an impacted country or a region and (2) strengthen communications and improve inter-operability among relevant U.S. government agencies involved in international disasters. Overarching issues include: fostering interagency cooperation and coordination in times of CBRNE disasters; obtaining, documenting, and integrating consequence management information; improving USG agency inter-operability and disaster event planning; and facilitating USG interagency information exchange and sharing across relevant agency USG programs. The workshop will establish a neutral venue for USG inter-agency exchange and discussion on issues related to resilience to CBRNE consequence management. Specific topics discussed at the workshop may include:

- initial means or approaches to understand or determine baseline conditions of resilience to CBRNE events;
- metrics or other measures of resilience to CBRNE events that may include human/social dimensions, economic-political considerations, and constructed and natural infrastructure integrity; and
- paths or platforms to document and share best practices, current research, seminal documents, and other approaches to increase interoperability across USG agencies and other entities.

Appendix C

Workshop Steering Committee Biographies

WORKSHOP STEERING COMMITTEE BIOGRAPHIES

Gerald E. Galloway Jr. (NAE), ***Chair*****,** is a Glenn L. Martin Institute Professor of Engineering and an affiliate professor of public policy at the University of Maryland, College Park. During his 38-year career in the military, he held positions as commander of the Army Corps of Engineers District in Vicksburg, Mississippi, professor and founding head of the Department of Geography and Environmental Engineering and dean of the Academic Board at the U.S. Military Academy. He was promoted to Brigadier General in 1990 and retired from active duty in 1995. A civil engineer, public administrator, and geographer, Dr. Galloway's current research focuses on the development of U.S. national water policy and national floodplain management policy. Prior to joining the University of Maryland, he was vice president, Geospatial Strategies, for the ES3 Sector of the Titan Corporation. He is a member of the National Research Council's Water Science and Technology Board and he served on the Committee to Review the JSOST U.S. Ocean Research Priorities Plan. He is a member of the National Academy of Engineering. Dr. Galloway earned his M.S.E. at Princeton and his Ph.D. in geography (specializing in water resources) from the University of North Carolina at Chapel Hill.

John C. Carrano is currently the president and founder of Carrano Consulting, a firm specializing in serving the *in vitro* diagnostics and homeland security industries. He is also the president and CEO of Paratus Diagnostics, LLC an early-stage company focused on developing sample preparation technologies and devices specifically suited for point-of-care clinical diagnostic testing. He has co-authored over 60 scholarly publications and has one patent issued and two patents pending. Dr. Carrano has served as the chairman of several international conferences and symposia, and is a fellow of SPIE and member of Phi Kappa Phi and Eta Kappa Nu honor societies. Prior to starting his own businesses, Dr. Carrano was vice president, Research & Development, corporate executive officer, and chairman of the Scientific Advisory Board at Luminex Corporation (LMNX:NASDAQ). Dr. Carrano was a program manager at DARPA for nearly 5 years, where he initiated and led several major Defense Department programs related to biological and chemical sensing. Prior to joining DARPA, he was an assistant professor of Electrical Engineering, Department of Electrical Engineering and Computer Science (EECS), United States Military Academy. Dr. Carrano retired from the

military as a Lieutenant Colonel in June 2005, after over 24 years of service. During his service he held several command and staff positions worldwide, and received numerous decorations and awards including the Defense Superior Service Medal awarded by the Secretary of Defense. He was also a member of the Board of Directors for Xagenic, Inc. from 2011-2012. Dr. Carrano was recently personally appointed by U.S. Secretary of Homeland Security Janet Napolitano to serve on the Homeland Security Science and Technology Advisory Committee. Dr. Carrano earned his B.S. from the United States Military Academy, West Point, in 1981, and earned his M.S. and Ph.D. in electrical engineering, from the University of Texas at Austin.

Bert M. Coursey served as an officer in the Army Nuclear Power Program and came to the National Institute of Standards and Technology (formerly the National Bureau of Standards) in 1972. He worked with the White House on the Transition Planning team for the Office of Homeland Security in 2002, and served for nine years on detail to the Department of Homeland Security as the standards executive and the director of the Office of Standards. He was co-chair of the Office of Science Technology and Policy's Subcommittee on Standards that produced the National Strategy on CBRNE Standards. Dr. Coursey led the development of standards for radiological, nuclear, and microbiological detection, and funded efforts for chemical and explosives detection. He led federal writing groups on planning for decontamination following terrorists' attacks with chemical, biological, and radiological/nuclear agents. He is presently the chair of the Strategic Advisory Group on Security of the ISO and collaborates with the European Union Joint Research Centres on harmonization of standards for CBRNE countermeasures. He has a B.S. and Ph.D. in physical chemistry from the University of Georgia.

The Honorable Sherri W. Goodman is senior vice president, general counsel, and corporate secretary of CNA. Known as an innovative and multidisciplinary leader, Ms. Goodman has been recognized for her work creating and overseeing a landmark project in her role as executive director of the CNA Military Advisory Board for projects on *National Security and the Threat of Climate Change* (2007), *Powering America's Defense: Energy & the Risks to National Security* (2009), *Powering America's Economy: Energy Innovation at the Crossroads of National Security Challenges* (2010), and *Ensuring America's Freedom of Movement: A National Security Imperative to Reduce US Oil Dependence* (2011). From 1993 to 2001, she served as deputy undersecretary of Defense (Environmental Security). As the chief environmental, safety, and occupational health officer for the Department of Defense (DOD), she oversaw an annual budget of over $5 billion. She established the first environmental, safety, and health performance metrics for the department and, as the nation's largest energy user, led its energy, environmental, and natural resource conservation programs. Overseeing the President's plan for revitalizing base closure communities, she ensured that 80 percent of base closure property became available for transfer and reuse. Ms. Goodman has twice received the DOD medal for Distinguished Public Service, the Gold Medal from the National Defense Industrial Association, and the EPA's Climate Change Award. She served on the staff of the Senate Armed Services Committee for Committee Chairman Senator Sam Nunn, practiced law at the Goodwin Procter, serving as both a litigator and environmental attorney, and has worked at RAND and SAIC. Ms. Goodman serves on the boards of the Atlantic Council of the U.S., including its Executive Committee, Blue Star Families, Committee on Conscience of the U.S. Holocaust Museum, Marshall Legacy Institute, National Academy of Sciences' Board on Energy and Environmental Systems, and the Woods Hole Oceanographic Institution. She is a life member of the Council on Foreign

Relations, and serves on the Board of its Center for Preventive Action. She also serves on the Alliance Commission on National Energy Efficiency Policy, the Joint Ocean Commission Leadership Council, and the Responsibility to Protect Working Group co-chaired by former Secretary of State Madeleine Albright. In 2010, she served on the Quadrennial Defense Review Independent Panel co-chaired by former National Security Advisor Stephen Hadley and former Secretary of Defense Bill Perry. She has testified before numerous committees of the U.S. Congress, and conducted interviews with print, television, radio, and online media, and has published widely in various media and in legal and scholarly journals. She has been an adjunct lecturer in International Affairs and Security at the Kennedy School of Government and an adjunct research fellow at the Kennedy School's Center for Science and International Affairs. Ms. Goodman has a J.D. from Harvard Law School, a M.A. in public policy from Harvard's John F. Kennedy School of Government, and a B.A. from Amherst College.

Ann Lesperance has been with the Pacific Northwest National Laboratory since 1990. In her current capacity she is the director of Regional Programs Northwest Regional Technology Center for Homeland Security located in Seattle, Washington. Her primary focus is developing regional programs to accelerate the demonstration and deployment of new Homeland Security technologies. To accomplish this, Ms. Lesperance works with state and local emergency responders and public safety officials to understand and help prioritize their operational needs and requirements. She also builds regional coalitions of emergency management professionals to partner with the Department of Homeland Security Science and Technology Directorate, the Department of Defense, and other federal agencies and manages program implementation in the field. Ms. Lesperance has over 20 years of experience in domestic and international environmental and public health analysis, project management, and program development. In the international arena she has managed water sustainability projects in Mexico City, worked with Russian managers on the cleanup of radioactive waste sites, and explored drug discovery and conservation strategies in Peru and Chile. Prior to joining PNNL, she worked for a private consulting firm in Los Angeles, CA and USDA in Atlanta, GA and Los Angeles. She served as a U.S. Peace Corps volunteer in the Andes Mountain in Ecuador where she initiated community development, energy and environmental programs with USAID, and the United Nations. She is also on the Advisory Board at the University of Washington School of Business Center, for International Business Education and Research and is a former Fellow at the World Affairs Council in Seattle. Ms. Lesperance has a B.A. from the University of Wisconsin in Environmental Science and Latin American Studies and a M.S. from UCLA's School of Public Health, Environmental Science and Engineering Program in Public Health.

Randall S. Murch is a Professor in Practice, School of Public and International Affairs, Virginia Tech - National Capital Region, where he has been since December 2004. At Virginia Tech, he conducts research and program development activities in biosecurity, microbial forensics, advanced forensic science, and science and security. He teaches graduate courses in three programs and advises Ph.D. students in five programs. Prior to Virginia Tech, for two years he was a research staff member at the Institute for Defense Analyses (IDA), a leading Federally Funded Research and Development Center where he led studies for the U.S. national security community. Prior to IDA, he was a special agent, Federal Bureau of Investigation (FBI) for nearly 23 years, retiring in November 2002. During his FBI career, he was assigned to investigative and technical support duties in three field offices, served in several assignments at

the FBI Laboratory including forensic practitioner, research scientist, department head, and deputy director and also served as a mid-level manager and deputy director in the technical operations (engineering) division. He has extensive experience in counterterrorism, Weapons of Mass Destruction and catastrophic terrorism, crisis response and major, complex national and international terrorism investigations. During his last two FBI Laboratory assignments, he created the U.S. national WMD forensic investigative program, the first-ever of its kind and worked with a number of Federal departments and agencies to establish strong relationships and coordinated response to these threats. He has served or is serving on several standing boards and committees at the National Research Council (NRC), and has served on five NRC study committees including that which produced *Determining Core Capabilities for Defense Chemical and Biological Defense Science and Technology*, which was published in 2012. He also has served or is serving on several advisory committees for the U.S. national security community. He has published in several fields, presented extensively to public and government audiences, testified in U.S. courts of law approximately 110 times and testified before Congress on several occasions. He holds a B.S. from the University of Puget Sound, a M.S. from the University of Hawaii, Manoa and a Ph.D. from the University of Illinois at Urbana-Champaign, all in the Life Sciences.

The Honorable Andrew S. Natsios is executive professor at the George H.W. Bush School of Government and Public Service at Texas A&M University, and previously taught at the Walsh School of Foreign Service at Georgetown University from January 2006 to May 2012. Natsios served as administrator of the U.S. Agency for International Development from 2001 to January 2006. In addition to teaching he served as President Bush's Special Envoy to Sudan from October 2006 to December 2007. From 1993 to 1998, Natsios was vice president of World Vision U.S., the largest faith-based NGO in the world. Natsios was a member of the U.S. Army Reserves for 23 years, served in the Gulf War in 1991 on active duty and was a Lt. Colonel when he retired in the 1990s. Natsios served as secretary of Administration and Finance for the Commonwealth of Massachusetts and was a member of the Massachusetts House of Representatives for six terms, and was named in 2000 by Governor Paul Cellucci as the chief executive officer for Boston's Big Dig which he took over after a cost over-run scandal. Natsios is the author of three books, *U.S. Foreign Policy and the Four Horsemen of the Apocalypse* (1997), *The Great North Korean Famine* (2001), *Sudan, South Sudan, and Darfur: What Everyone Needs to Know* (2012) and collaborated on 13 other books, and numerous articles. He is a graduate of Georgetown University and has a MPA from Harvard University's Kennedy School of Government.

Gregory S. Parnell is a professor of systems engineering at the U.S. Military Academy at West Point. His research focuses on decision analysis, risk analysis, resource allocation, and systems engineering for defense; intelligence; homeland security; research and development; and environmental applications. Dr. Parnell is a former president of the Decision Analysis Society of the Institute for Operations Research and Management Science (INFORMS) and of the Military Operations Research Society (MORS). He has served as editor of Journal of Military Operations Research. Dr. Parnell has published more than 100 papers and book chapters and has co-edited *Decision Making for Systems Engineering and Management*, Wiley Series in Systems Engineering (2nd Ed, Wiley & Sons, 2011) and co-wrote the *Handbook of Decision Analysis* (Wiley & Sons, 2013). He has served on three National Academy of Sciences Studies, including

the Committee on Evaluating the Performance Measures and Metrics for the Global Nuclear Detection Architecture. He is a fellow of MORS, INFORMS, the International Committee for Systems Engineering, Society for Decision Professionals, and the Lean Systems Society. He received a Ph.D. from Stanford University in Engineering-Economic Systems. Dr. Parnell is a retired Air Force Colonel and a graduate of the Industrial College of the Armed Forces.

Brent H. Woodworth is the president and CEO of the Los Angeles Emergency Preparedness Foundation and chairman of the Sahana Software Foundation. He also serves as a member of the national Advisory Committee on Earthquake Hazards Reduction (ACEHR/NEHRP) and on the American Red Cross advisory board for the Southern California region. In addition, he is the project manager for the national DHS/FEMA Community Innovations Resilience Award Program being supported by the Los Angeles Emergency Preparedness Foundation. Mr. Woodworth is a well-known leader in global risk and crisis management, and has worked and consulted with governments, private sector companies, and non-profit organizations to help them more effectively prepare, mitigate, respond, and recover from significant risk exposures and crisis events. In December 2007, he retired from IBM after 32 years of service that included the development and management of all worldwide crisis response team operations. He is the founder and manager of "The Crisis Response Team"—a team of individual international specialists who have responded on-site to over 70 major crisis events in 49 countries, and is responsible for the concept creation, initial design and roll-out of the open source international emergency management software system "Sahana," considered a global standard for nationwide crisis management (www.sahanafoundation.org). Mr. Woodworth has developed innovative business enterprise risk management procedures for early identification and mitigation of potential exposures for large private sector corporations. He was chairman of the Multihazard Mitigation Council's congressionally mandated study on the benefits of government and private sector investment in pre-disaster mitigation, and he testified to Congress on the need for additional investment in mitigation. Mr. Woodworth is certified in business continuity planning, incident management, disaster communications, search and rescue, and emergency medical services. He is a regularly featured speaker on radio and television broadcasts along with industry conferences, government sessions, and senior executive board meetings. Mr. Woodworth has written multiple articles on disaster management and has been a guest lecturer at colleges and universities including Caltech, Stanford, Wharton, USC, US Naval Post Graduate Academy, Harvard, and Yale Law Schools. Mr. Woodworth and his team have worked for many years in cooperation with international United Nations relief agencies and NGO's including WHO, WFP, OCHA, World Bank, UNHCR, World Vision International, Red Cross, and USAID. He has a B.S. from the University of Southern California in Marketing Management.

NRC Staff Biographies

Dr. Lauren Alexander Augustine is the director of the Program on Risk, Resilience, and Extreme Events in the Office of Special Projects at the NAS. She serves on the World Economic Forum's Global Agenda Council on Catastrophic Risks, and as an advisor for the American Geophysical Union's Thriving Earth Exchange program. In her tenure at the Academies, Lauren started as a study director for water science policy issues on the Water Science and Technology Board; since 2007, she has been the Country Director in the African Science Academy

Development Initiative (ASADI), a 10-year program that builds scientific capacity in national academies of science in eight African countries. Her most recent positions at the Academy entail her developing a portfolio on natural disasters and ways that science can inform policy to reduce the risk and elevate society's resilience to them. Dr. Augustine earned her B.S. in applied mathematics and systems engineering and her Master's degree in environmental planning and policy from the University of Virginia; she completed her Ph.D. in an interdisciplinary program that combined hydrology, geomorphology, and landscape ecology from Harvard University.

Sherrie Forrest is the program officer for the Resilience Roundtable. Previously, she was program officer for the Disasters Roundtable. She joined the full time staff of the National Research Council (NRC) in the summer of 2010 following a Christine Mirzayan Science & Technology Graduate Fellowship in the fall of 2009. While at the NRC, she has worked with the Ocean Studies Board and the Board on Science Education on projects that include the Roundtable on Climate Change Education, the Conceptual Framework for New Science Education Standards, and the Effects of the Deepwater Horizon Mississippi Canyon-252 Oil Spill on Ecosystem Services in the Gulf of Mexico. She obtained her M.S. in biological oceanography from the Institute of Marine and Coastal Sciences at Rutgers University and a B.A. in english from Pepperdine University.

John H. Brown Jr. is the program and administrative manager for the Resilience Roundtable. Since 2002, he has worked with the Disasters Roundtable and served on numerous project teams in conjunction with National Research Council studies, including toxicity pathway-based risk assessment, the hidden costs of energy, a research and restoration plan for Western Alaska salmon, endangered species in the Klamath and Platte River Basins, risk reduction and economic benefits from controlling ozone air pollution, and environmental impacts of wind energy projects. Prior to joining the National Academies staff, he worked with the Smithsonian Institution and the Kennedy Center. He received his bachelor's and master's degrees from Boston University.

Appendix D

Workshop Presenter Biographies

WORKSHOP PRESENTER BIOGRAPHIES

Major General Julie A. Bentz is the director, Strategic Capabilities Policy on the National Security Staff within the Executive Office of the President. She is responsible for writing presidential policy, coordinating interagency dialogue, informing presidential budgetary decisions and building consensus on interagency initiatives in programs that develop United States strategic capabilities to meet 21st century requirements. General Bentz has served in a variety of active, reserve, and National Guard assignments revolving around nuclear defense, homeland security, health physics, environmental sciences and traditional nuclear, biological, and chemical officer assignments. She served as the principal deputy for Nuclear Defense within the Office of the Deputy Assistant to the Secretary for Nuclear Matters. Previously, General Bentz worked with the Homeland Security Council where she helped to establish a joint domestic nuclear detection office within the Department of Homeland Security. She played a key role in developing a whole of government approach to nuclear forensics including the creation of the National Technical Nuclear Forensics Center. General Bentz also performed within the Joint Capabilities Integration and Development System process as the combat developer for the National Guard Bureau.

Dr. Daniel Blumenthal manages the Consequence Management programs in the Office of Emergency Response at the National Nuclear Security Administration (NNSA) within the Department of Energy (DOE). In 2009, he transferred from the Department of Homeland Security's Domestic Nuclear Detection Office where he was the chief test scientist. Prior to joining the Federal government he was a senior scientist at the Department of Energy's Remote Sensing Laboratory from 1996 to 2006 where he managed or provided scientific support to several DOE emergency response teams. Most recently Dr. Blumenthal led the initial DOE response team to Japan where he spent a total of 7 weeks following the Fukushima Daiichi nuclear power plant accident in March 2011. Dr. Blumenthal's background is in nuclear physics and he is also a Certified Health Physicist (CHP).

Dr. Martin Cetron, MD, is the director for the Division of Global Migration and Quarantine (DGMQ) at the U.S. Centers for Disease Control and Prevention (CDC). Dr. Cetron holds faculty appointments in the Division of Infectious Disease at the Emory University School of Medicine and the Department of Epidemiology at Rollins School of Public Health. He trained in Internal Medicine at the University of Virginia and Infectious Diseases at the University of Washington before joining the CDC's Epidemic Intelligence Service and becoming a commissioned officer in the U.S. Public Health Service (PHS) in 1992. His primary research interests are international health and global migration with a focus on emerging infections, tropical diseases, and vaccine-preventable diseases in mobile populations. DGMQ regularly publishes the textbook *Health Information for International Travel*, known widely as the CDC Yellow Book, providing health promotion and disease prevention guidance to travelers globally. Dr. Cetron has also been a leader in public health emergency preparedness and response activities at CDC and is a graduate of the Harvard School of Public Health & Kennedy School of Government's National Preparedness Leadership Institute. Since 1992, he has led several domestic and international outbreak investigations, conducted epidemiologic research, and been involved in domestic and international emergency responses. He has played a leadership role in CDC responses to intentional and naturally-acquired emerging infectious disease outbreaks including the 2001 anthrax bio-terrorism incident, the 2003 global SARS epidemic, the 2003 U.S. *Monkeypox* outbreak and recent 2009 H1N1 influenza pandemic. Dr. Cetron is part of the CDC pandemic influenza planning, preparedness, and response team. He leads CDC's preparedness for international border responses and community mitigation strategies; most recently, he headed the CM Task Force response to 2009 H1N1 pandemic influenza. Dr. Cetron is also part of the WHO Influenza Pandemic Task Force. Dr. Cetron has authored or co-authored more than 100 publications and received numerous awards for his work since joining CDC in 1992. He received his B.A. from Dartmouth College in 1981, and his M.D. from Tufts University in 1985.

Mr. Chuck Donnell is vice president of Disaster Services Planning and Doctrine at The American Red Cross. He joined the American Red Cross in May 2013 with significant international and domestic disaster response experience. In his previous role at the White House, he was the special assistant to the President and Senior Director for Resilience Policy on the National Security Staff. While at the National Security Staff he managed several portfolios including National Preparedness Policy, National Response Policy, Medical Preparedness Policy, National Security Communications Policy, Homeland Security Grants, National Exercises, Continuity, and Presidential Emergency Declarations under the Robert T. Stafford Act. Mr. Donnell served 25 years in the U.S. Army achieving the rank of Colonel before his retirement in 2012. He was commissioned through the Central Michigan University Reserve Officers Training Corps (ROTC) program in 1987 and served in a variety of Infantry and Civil Affairs assignments including disaster relief operations for the 2004 Southeast Asia Tsunami and 2010 earthquake in Haiti. He also served as the chief, Joint Directorate of Military Support (JDOMS) on the Joint Staff where he coordinated Defense Support to Civil Authority (DSCA) activities and as the organizational integrator for Special Operations Forces on the Army Staff. Mr. Donnell holds a Bachelor of Science Degree from Central Michigan University and a Master's in strategic studies from the Army War College. Chuck has been married for 25 years and he and his wife Janice have two daughters.

Mr. Chad Gorman is currently the Chemical, Biological, Radiological, Nuclear, and High Explosives (CBRNE) office director within the Response Directorate at Federal Emergency Management Agency (FEMA) Headquarters. He is responsible for overseeing the specialized CBRNE teams and programs maintained by FEMA and for working throughout the agency to enhance FEMA's ability to respond and recover from all-hazards events. Mr. Gorman is a trained intelligence officer and extensive experience dealing with National Security and Counterterrorism issues. Before joining FEMA, Mr. Gorman was a member of the DHS Incident Management Planning Team (IMPT) and led several sensitive DHS planning efforts focused on providing Departmental assets to support forward deployed military units. These plans directly supported senior military commanders in both Afghanistan and Iraq. He worked for the DHS Office of Intelligence and Analysis as a senior intelligence analyst and senior warning officer responsible for providing indications and warning intelligence analysis to DHS senior leadership and federal, state, local and tribal officials. Prior to working for DHS, Mr. Gorman provided intelligence support to the Joint Staff as a member of the Defense Intelligence Agency's Joint Intelligence Task Force for Combating Terrorism. Mr. Gorman has a Bachelors of Arts in criminology and criminal justice, with a citation in science and technology in society, from University of Maryland, College Park and received his Masters in security studies (Homeland Security) at the Naval Post Graduate School-Center for Homeland Defense and Security in March 2012. He resides in Manassas, Virginia with his wife Jessica and their two children.

Dr. Kiyoshi Kurokawa is professor of the National Graduate Institute for Policy Studies and is science advisor to the Cabinet of Japan. He is also member of President Council of the University of Tokyo; professor emeritus of the University of Tokyo; senior scientist of the Earth Institute, Columbia University; governor of Japan Chapter of American College of Physicians; and chairman of Health Policy Institute, Japan. Dr. Kurokawa is the former president of the Science Council of Japan (2003-2006) and Pacific Science Association (2003-2007). He has also served in many ministerial committees in Japan including science advisor for the Ministry of Education, Sciences, and Culture; member and chair of several Special Committees of the Ministry of Health and Welfare; and member of the National Health Policy Council of the Ministry of Health and Welfare. He was professor of Medicine at Departments of Medicine UCLA School of Medicine (1979-1984), University of Tokyo Faculty of Medicine (1989-1996), dean of Tokai University School of Medicine (1996-2002), and Research Center of Advanced Science and Technology of the University of Tokyo (2003-2006). Dr. Kurokawa is a recipient of Order of Purple from the Government of Japan for Excellence in Academic Achievements in 1999.

The Honorable Paul N. Stockton is president of Cloud Peak Analytics and managing director at Sonecon, LLC. Previously, he served as the assistant secretary of defense for Homeland Defense and Americas' Security Affairs from May 2009 until January 2013. In that position, he was responsible for DOD initiatives to strengthen security in the Western Hemisphere and help partner nations build their capacities to meet emerging security challenges. Dr. Stockton created the Department's first-ever Mission Assurance Strategy, and launched a range of initiatives with the private sector, the Department of Energy, and the Department of Homeland Security to help ensure the availability of energy to DOD facilities. He also guided the Defense Critical Infrastructure Protection program, served as DOD's Domestic Crisis Manager, and helped lead the Department's response to Superstorm Sandy, Deepwater Horizon, and other disasters. In

addition, Dr. Stockton was responsible for DOD policy on domestic antiterrorism, maritime domain awareness, air sovereignty, and preparedness for chemical, biological, radiological, and nuclear events. Dr. Stockton was twice awarded the Department of Defense Medal for Distinguished Public Service, DOD's highest civilian award. The Department of Homeland Security awarded Dr. Stockton its Distinguished Public Service Medal. From 2010 until January 2013, Dr. Stockton served as executive director of the Council of Governors, where he helped Governors, the National Guard, DOD, DHS, and FEMA adopt initiatives to strengthen Federal-State collaboration and unity of effort. In addition, from 2009 to 2012, Dr. Stockton served as the acting U.S. co-chair of the Canada-U.S. Permanent Joint Board of Defense, the premier organization for defense policy coordination between the two Nations. Dr. Stockton currently serves as scholar in Residence at George Washington University's Homeland Security Policy Institute. Prior to being confirmed as assistant secretary, Dr. Stockton served as a senior research scholar at Stanford University's Center for International Security and Cooperation, and as associate provost of the Naval Postgraduate School (NPS). While at NPS, Dr. Stockton also founded and led its School of International Graduate Studies, the Center for Homeland Defense and Security, and the Center for Civil-Military Relations. Prior to joining NPS, Dr. Stockton served as research associate for the International Institute for Strategic Studies and as legislative assistant for defense, foreign relations, and intelligence for Senator Daniel Patrick Moynihan. Dr. Stockton holds a Ph.D. from Harvard University and a BA *Summa Cum Laude* from Dartmouth College. He is lead co-author of "Prosecuting Cyberterrorists: Applying Traditional Jurisdictional Frameworks to a Modern Threat," *Stanford Law & Policy Review* (forthcoming June 2014), and has published in *International Security*, *Political Science Quarterly, Homeland Security Affairs* (which he helped found in 2005), and other peer-reviewed journals and edited volumes. Dr. Stockton holds a current TS/SCI clearance.

Colonel Patrick Terrell is currently serving as the WMD Military Advisor and deputy director for CBRN Defense Policy in the Office of the Deputy Assistant Secretary of Defense for Combating WMD. He was commissioned through ROTC at New Mexico Military Institute and has spent 25 years on active duty in the U.S. Army as a chemical officer. During that time he has served in tactical chemical defense staff assignments with the 1st Battalion, 27th Field Artillery; the Headquarters, 41st Field Artillery Brigade; Headquarters, 2nd Armored Division; Headquarters, 2nd Armored Division Artillery; and Headquarters, 1st Cavalry Division. He served as the operations officer for the 9th Battalion, 1st Field Artillery and the 2nd Chemical Battalion. His commands include the 44th Chemical Company, 2nd Armored Division (reflagged to the 31st Chemical Company, 4th Infantry Division) and the 22nd Chemical Battalion (Technical Escort). Other assignments have included Political-Military planner, Joint Staff; chemical Organizational and Systems Integrator, Army Staff; chemical assignment officer, branch chief, and executive officer to the Director, Officer Personal Management, U.S. Army Human Resources Command; Chief Operational and Strategic Concepts, Maneuver Support Center; and most recently Stability Transition Team Leader, 2nd Brigade Combat Team, 10th Mountain Division in Operation Iraqi Freedom. Colonel Terrell has a Bachelor's Degree in business administration from New Mexico State University, Masters of Science in administration from Central Michigan University, and a Masters in strategic studies from the U.S. Army War College.

Mr. Brent H. Woodworth is the president and CEO of the Los Angeles Emergency Preparedness Foundation and chairman of the Sahana Software Foundation. He also serves as a member of the national Advisory Committee on Earthquake Hazards Reduction (ACEHR/NEHRP) and on the American Red Cross advisory board for the Southern California region. In addition, he is the project manager for the national DHS/FEMA Community Innovations Resilience Award Program being supported by the Los Angeles Emergency Preparedness Foundation. Mr. Woodworth is a well-known leader in global risk and crisis management, and has worked and consulted with governments, private sector companies, and non-profit organizations to help them more effectively prepare, mitigate, respond, and recover from significant risk exposures and crisis events. In December 2007, he retired from IBM after 32 years of service that included the development and management of all worldwide crisis response team operations. He is the founder and manager of "The Crisis Response Team"—a team of individual international specialists who have responded on-site to over 70 major crisis events in 49 countries, and is responsible for the concept creation, initial design and roll-out of the open source international emergency management software system "Sahana," considered a global standard for nationwide crisis management (www.sahanafoundation.org). Mr. Woodworth has developed innovative business enterprise risk management procedures for early identification and mitigation of potential exposures for large private sector corporations. He was chairman of the Multihazard Mitigation Council's congressionally mandated study on the benefits of government and private sector investment in pre-disaster mitigation, and he testified to Congress on the need for additional investment in mitigation. Brent is certified in business continuity planning, incident management, disaster communications, search and rescue, and emergency medical services. He is a regularly featured speaker on radio and television broadcasts along with industry conferences, government sessions, and senior executive board meetings. Brent has written multiple articles on disaster management and has been a guest lecturer at colleges and universities including Caltech, Stanford, Wharton, USC, U.S. Naval Post Graduate Academy, Harvard, and Yale Law Schools. Mr. Woodworth and his team have worked for many years in cooperation with international United Nations relief agencies and NGO's including WHO, WFP, OCHA, World Bank, UNHCR, World Vision International, Red Cross, and USAID. He has a B.S. from the University of Southern California in marketing management.

Appendix E

Workshop Participant List

WORKSHOP PARTICIPANTS – IN PERSON AND ONLINE

Lauren Alexander Augustine, National Research Council

Kevin Anderson, U.S. Department of Homeland Security

Valerie Antsiferova, CRDF Global

Jessica Appler, AAAS/Department of Homeland Security

Thomas Austin, The Boeing Company

Judith Bader, U.S. Department of Health and Human Services

Michael Balog, Baltimore County Police Department

Don Bansleben, Department of Homeland Security

Lauren Bell, Gryphon Scientific

Major General Julie Bentz, National Security Council

Adam Bernier, Gryphon Scientific

Aditya Bhattacharji, Eurasia Group

William Billotte, National Institute of Standards and Technology

Daniel Blumenthal, U.S. Department of Energy

Paul Boren, Defense Threat Reduction Agency

Malerie Briseno, Federation of American Scientists

Brenda Brooks, U.S. Food and Drug Administration

John Brooks, Department of Defense

John Brown, National Research Council

Anne Busher, Dynamac Corporation

Mel Caprarie, Vancouver Police Department

Julia Capri, CSS-Dynamac

John Carrano, Carrano Consulting

Eleanor Celeste, AAAS

Martin Cetron, Centers for Disease Control and Prevention

Pamela Chamberlain, Food and Drug Administration

Heather Chen-Mayer, National Institute of Standards and Technology

Vincent Chiew, ATCO Electric

Allen Egon Cholakian, IRDF Project Harvard/Columbia

Neil Cohen, Defense Group Inc.

Eric Cole, USSTRATCOM

Carlos Corredor, U.S. Department of Energy

Sean Crawford, Federal Emergency Management Agency

Katie Crockett, Cubic Applications

Jessica Cummins, DHL DGF Industrial Projects

George Cunningham, DIA

Candida D'Avanzo, Center for Domestic Preparedness

Sameera Daniels, Ramsey Decision Theoretics

Kevin Dennison, U.S. Department of Agriculture

Ira Deutsch, Israel Home Front Command

Teresa Dillon, Battelle/DOD Contractor

Vincent Doherty, Adelphi University

Chuck Donnell, American Red Cross

John Drake, U.S. Environmental Protection Agency

Eelco Dykstra, CEN TC 391 - WG2 CBRNE

Gerald Epstein, U.S. Department of Homeland Security

Kelley Evans, U.S. Army

Matthew Fargo, CRDF Global

Jeffrey Faszcza, Catalyst Partners

Sherrie Forrest, National Research Council

Susan Francisco, New York Police Department

Doug Friedman, National Research Council

Gerry Galloway, University of Maryland

Holly Gilbert, Security Management/ASIS International

Al Goodwyn, Savannah River National Laboratory

Chad Gorman, Federal Emergency Management Agency

Michael Gresalfi, Federal Bureau of Investigation

Rita Guenther, National Research Council

Heidi Hamling, Pacific Northwest National Laboratories

Dan Hanfling, Inova Health System

Randall Hanifen, Hanifen & Associates

Sherry Harowitz, ASIS

Randall Hecht, Federal Emergency Management Agency

Emily Hicks, U.S. Department of State

Carrie Hiser Sivley, KD Analytical

Steve Hoffman, Defense Threat Reduction Agency

Blake Holub, Downtown DC Business Improvement District

India Hook-Barnard, National Research Council

Jeffrey Horlick, National Institute of Standards and Technology

Gerad House, John Hopkins Applied Physics Laboratory

Regina Hsu, Embassy of Japan

Kathryn Hughes, National Research Council

Robert Hull, Los Alamos Technical Associates Inc.

Jo Husbands, National Research Council

Aamer Ikram, Armed Forces Institute of Pathology

Satoshi Ishibashi, The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission

Jed Ivory, Bethesda-Chevy Chase Rescue Squad

Selwyn Jamison, Federal Bureau of Investigation

Stephen Johnson, Cranfield University

Steve Johnson, CBRNE World

Peter Jutro, U.S. Environmental Protection Agency

Jordan Kanter, Office of Science and Technology Policy

Rebecca Katz, U.S. Department of State

Nicholas Kelley, University of Minnesota Center for Infectious Disease Research and Policy

Maxine Kellman, U.S. Department of Health and Human Services

Beth Kennedy, U.S. Department of Defense

Allison King, Institute for Defense Analyses

Kristin Korte, FLIR

Akhila Kosaraju, SIGA Technologies

Andrew Kuepper, U.S. Department of Defense

Gail Kulisch, BTG Ventures LLC

Kiyoshi Kurokawa, National Graduate Institute for Policy

Andrew Kurzrok, Pacific Northwest National Laboratory

Carl Lachenmayer, U.S. Military

Marc Lafontaine, Health Canada

Mary Lancaster, Pacific Northwest National Laboratories

Cindy Landgren, U.S. Army Medical Research & Materiel Command

Ann Lesperance, Pacific Northwest National Laboratories

Astrid Lewis, U.S. Department of State

Brian Lewis, U.S. Department of State

William Lorenzen, Boston's Children Hospital

Zachary Louder, Public Safety, Quebec

Micah Lowenthal, National Research Council

Gavin Macgregor-Skinner, The Pennsylvania State University

Fadia Maki, AAAS

James Martiney

Keely Maxwell, U.S. Environmental Protection Agency

Dave McClimans, U.S. Department of Health and Human Services

Josephine McCourt, European Commission

Dan McElhinney, Federal Emergency Management Agency

Ron McGonigle, Analytic Services, Inc.

Marilyn McKenzie, TASC, Inc.

Katharine McLellan, U.S. Department of Energy

Doreen Melling, Anser Analytic Services

Jose Mendez, Inova Fairfax Medical Campus

Jayne Michaud, U.S. Environmental Protection Agency

Georgeann Morekas, Dynamac Corporation

Mark Morgan, Defense Threat Reduction Agency

Joseph Morris, U.S. Department of Homeland Security

Randall Murch, VA Polytechnic Institute and State University

James Murphy, Garrett Consulting

Stephen Myers, U.S. Air Force

Andrew Natsios, Texas A&M University

Fridman Oleksii

Greg Parnall, U.S. Military Academy, West Point

Brooke Pearson, Cubic App. Inc.

Nichole Pease, Contractor, Federal Emergency Management Agency

John Pennella, U.S. Department of Homeland Security

Dana Perkins, 7th Civil Support Command, USAREUR

Arthur Petrou, Defentect Group, Inc.

Ian Pleet, Battelle

Robert Prins, U.S. Military Academy, West Point

Moises Ramirez, National Research Council

Jacqueline Rams, Southern Research Institute

Glen Reeves, Applied Research Associates, Inc.

Juan Reyes, U.S. Environmental Protection Agency

Jennifer Roderick, AAAS

Lucie Andree Roy, Public Health Department, Montreal

Christina Rudzinski, MIT Lincoln Laboratory

Ben Rusek, National Research Council

Hollie Ryan, Veritas Alchemy LLC

David Rykken, U.S. Department of Health and Human Services

Hillary Sadoff, BVTI

Donald Sanders, Collaborative Business Solutions

Bret Schothorst, NSTC Subcommittee on Disaster Reduction

Robert Segal, Discovery Laboratories.com

Dana Shea, Congressional Research Service

Indu Singh, LATA-World Institute for Security Enhancement

Peter Smalley, Federal Emergency Management Agency

Glenn Snow, Defense Threat Reduction Agency

Ricardo Soto-Acevedo, Chemical Materials Activity

Tim Stephens, Emergency Services Coalition for Medical Preparedness

Robert Stevens, Federal Emergency Management Agency

Bill Stevenson, Federal Emergency Management Agency

Timothy Stickler, KD Analytical Consulting, Inc.

Honorable Paul Stockton, Cloud Peak Analytics

Jarrett Stoltzfus, U.S. Department of Transportation

Joyce Stout, Pima County Health Department

Daniela Stricklin, Applied Research Associates

Patrick Terrell, Department of Defense

Paul Thorpe, Australian Capital Territory Fire and Rescue

Robert Trau-Massey, U.S. Army Africa

Shirley Tseng, IGI

Akira Tsugita, Embassy of Japan

Joseph Tuggle, AAAS/Department of Defense

Edward Van Oeveren, U.S. Army

Jolien Van Zetten, NEN

Francis Veasey, Analytic Services, Inc.

Mike Visotsky, Department of Defense

Richard Ward, U.S. Army, Civilian

Ricky Ward, USSTRATCOM

Tracy Wilson, Pacific Northwest National Laboratory

Wayne Wilie, U.S. Department of Health and Human Services

Brent Woodworth, Los Angeles Emergency Preparedness Foundation

Dorothy Zolandz, National Research Council