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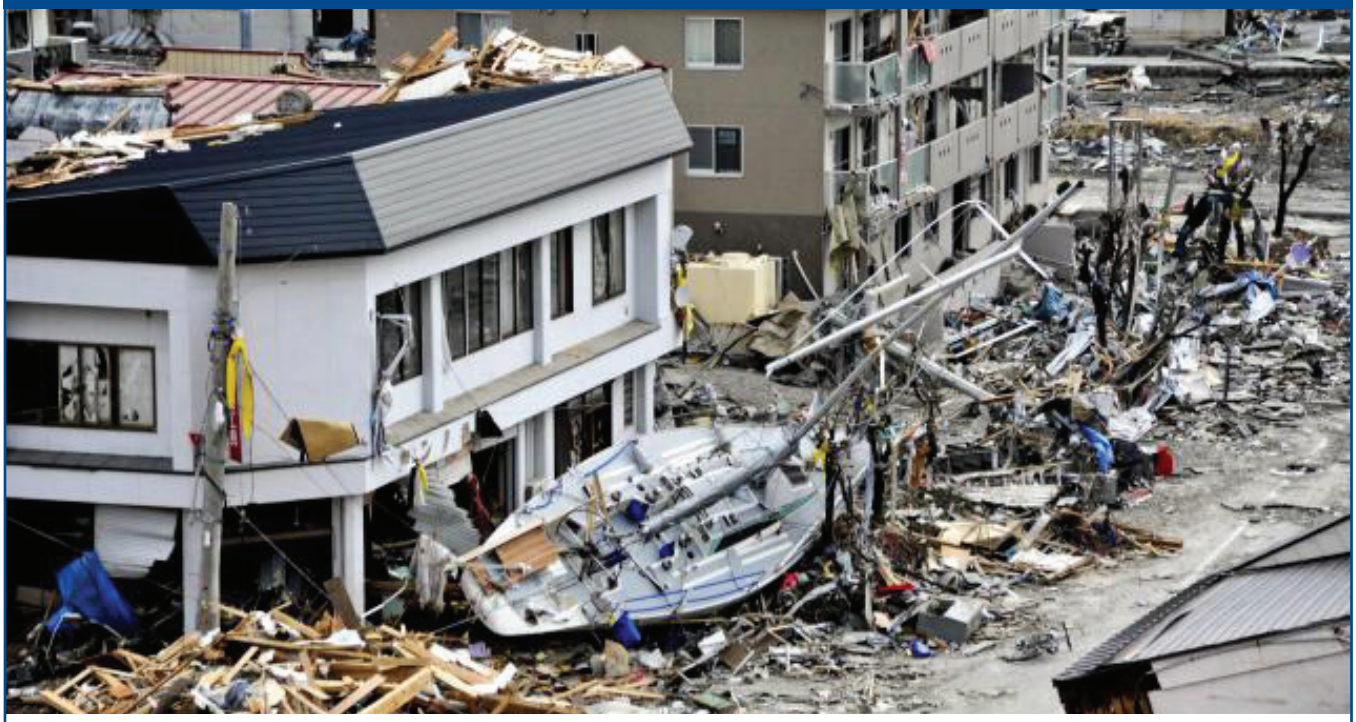

The Great Eastern Japan Earthquake

Assessing Disaster Response and Lessons for the United States

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The Great Eastern Japan Earthquake

Assessing Disaster Response and Lessons for the U.S.

By James Jay Carafano, Ph.D.

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Executive Summary

The massive earthquake and tsunami that struck Japan in March 2011, and the following release of radiation from the Fukushima Daiichi nuclear power station, represent one of the greatest disasters to strike the nation of Japan in recent memory. An initial assessment of the Japanese response in four critical areas suggests important lessons for the United States as it evaluates its own capacity to deal with catastrophes. These four critical areas are:

1. Preparedness and response
2. Communicating the risk
3. International assistance
4. Critical infrastructure

The Heritage Foundation's homeland security research team, in conjunction with a working group of outside experts, identified key observations, findings, and recommendations that have implications for short-term and long-term policies, and for preparing for catastrophic as well as routine disasters in the United States. The key findings and recommendations of this report are:

- Effective catastrophic planning, preparedness, and mitigation measures pay off. The federal government should focus on catastrophic disaster preparedness and response as well as decentralized plan execution.
- A culture of preparedness is a vital component of disaster response. The U.S. needs to foster a national culture of preparedness by focusing on building more self-reliant communities and individuals.
- Community awareness and effective risk communication may have played a more decisive role in saving lives than extensive technological protective measures, such as seawalls designed to resist flooding from tsunamis. The Department of Homeland Security should continue to focus on risk communication as part of its preparedness and response planning and exercise efforts.
- Communicating the risks of low-dose radiation exposure in the aftermath of a disaster is difficult; the U.S. should strengthen its communication of low-dose radiation exposure.
- Accepting foreign aid in the wake of a major disaster has proven to be a complex and difficult task for developed nations like the U.S. and Japan. While the U.S. has improved this process since Hurricane Katrina, it needs to further increase its capacity to accept and apply foreign aid efficiently in the event of a catastrophe.
- The resiliency and recovery of critical infrastructure significantly impacts the response to catastrophic disasters. It is therefore essential that the U.S. maintain its focus on the most "vital" critical infrastructure: the U.S.–Canadian electric grid.
- The United States has built a robust and multifaceted regulatory infrastructure after its own nuclear accident at Three Mile Island. It will be critical that both industry and federal regulators work together to determine lessons to be learned from Fukushima and how they can best be implemented.

The World Shook

According to the U.S. Geological Survey, at 2:46 p.m. on March 11, 2011, an earthquake occurred 80 miles off the coast of Honshu (Japan's most populous island), approximately 240 miles from Tokyo. The initial shock measured at a magnitude of 9.0 on the Richter scale (making it the fourth most intense quake in recorded history).[1] The quake was followed by powerful aftershocks, the first of which occurring only 30 minutes later at a magnitude of 7.4. Following the quake, a massive tsunami swept across the northeast coast of Japan, reportedly reaching several miles inland and flooding hundreds of square miles of land (including 42 municipalities in four prefectures).[2]

With destruction and damage to roads, bridges, ports, railroads, buildings, and other infrastructure, as well as more than 28,000 people dead or missing, the full disaster caused by the earthquakes and tsunami affected more than two dozen prefectures with a population estimated at over 15 million. The Miyagi, Fukushima, Iwate, Yamagata, Ibaraki, Chiba, Akita, and Aomori prefectures were affected the most, and current estimates of the cost of destruction are between $122 billion and $305 billion (between 2.2 percent and 4 percent of Japan's GDP). More than a month after the disaster more than 130,000 people were still housed in more than 2,500 shelters.[3]

In addition to this destruction and loss of life, facilities at the Fukushima Daiichi nuclear power station were severely damaged in the disaster. Electrical power that supports plant operations was lost as a result of the earthquake's damage to the electrical grid. Flooding resulting from the tsunami disabled generators that had powered the cooling systems in the reactors and the pools in which fuel rods were stored. The loss of coolant resulted in overheating, which caused the breech of the containment vessels and subsequently the release of radiation into the air, ground, and water, requiring officials to order mass evacuations of the local population. Some were ordered to shelter in place because of a lack of transportation and the risk of exposure to radiation.[4]

The massive earthquake and tsunami that struck Japan, followed by the release of radiation from the Fukushima Daiichi Nuclear Power Station, together represent one of the greatest disasters to strike the nation of Japan in modern memory.

Disaster in Context

For "normal" or "routine" disasters that have occurred in the United States, such as floods or snowstorms, a tiered response is employed. Local leaders turn to regional authorities when their capabilities are exhausted. In turn, when regional resources are exceeded, they turn to national and sometimes international support. For most disasters, local resources are capable of handling response measures in the first hours and days until national resources and international support can be requested. These resources normally take days if not weeks to arrive.

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1. Press release, "USGS Updates Magnitude of Japan's 2011 Tohoku Earthquake to 9.0," U.S. Geological Survey, March 14, 2011, at *http://www.usgs.gov/newsroom/article.asp?ID=2727* (May 17, 2011).
2. U.N. Office for the Coordination of Humanitarian Affairs (OCHA), "Japan: Earthquake & Tsunami," *Situation Report* No. 15, March 30, 2011, at *http://reliefweb.int/sites/reliefweb.int/files/resources/0286A99DA691B24CC125786300490AE5-Full_Report.pdf* (May 17, 2011).
3. OCHA, "Japan: Earthquake & Tsunami," *Situation Report* No. 14, March 28, 2011, at *http://reliefweb.int/node/393724* (May 17, 2011); Dick K. Nanto *et al.*, "Japan's 2011 Earthquake and Tsunami: Economic Effects and Implications for the United States," Congressional Research Service, April 6, 2011, p. 1, at *http://www.fas.org/sgp/crs/row/R41702.pdf* (May 17, 2011); The World Bank, "The Recent Earthquake and Tsunami in Japan: Implications for East Asia," *East Asia and Pacific Economic Update*, Vol. 1 (March 21, 2011), at *http://siteresources.worldbank.org/INTEAPHALFYEARLYUPDATE/Resources/550192-1300567391916/EAP_Update_March2011_japan.pdf* (May 17, 2011); and Center for Excellence in Disaster Management & Humanitarian Assistance, "Japan Earthquake and Tsunami Update," April 13, 2011, pp. 3–4, at *http://www.coe-dmha.org/Research/ResearchInfoMgmt/Japan/Japan04132011.pdf* (May 17, 2011).
4. Aliah D. Wright, "HR Professionals, Staffs in Japan Urged to Shelter in Place," Society for Human Resource Management, March 16, 2011, at *http://www.shrm.org/hrdisciplines/global/Articles/Pages/JapanShelter.aspx* (May 17, 2011).

Catastrophic disasters such as the recent earthquakes and tsunami in Japan represent a different kind of disaster,[5] in which tens or hundreds of thousands of lives are immediately at risk. Local resources may well be exhausted from the onset or crippled due to a loss of infrastructure. Government leaders are unable to determine or communicate their priority needs, often because there are too many needs to prioritize. First responders may themselves be victims of the disaster. There are few avenues to which these communities can turn for immediate help. Supporting resources must arrive in hours, not days, and in unprecedented amounts, regardless of the difficulties. Resources must be in place within 72 hours to prevent exposure, provide food and water, and ensure medical aid to deal with chronic illness, injury, and the spread of disease. Otherwise, people who could have been saved begin to suffer and die. Catastrophic disasters demand a different national response than do routine disasters.

It is always difficult to fully absorb the lessons from such wide-scale crises in the immediate wake of the catastrophe. Information is often incomplete or contradictory, or, as is the case in Japan, still evolving. The assessments offered in this report, therefore, are limited to issues that are both critical to understanding the character of the response and for which reliable appraisals could be made. To assist in the evaluation, The Heritage Foundation assembled a team of regional and functional experts to review the available material and offer analysis, insights and recommendations. The team focused on four key areas that are particularly critical to responding to large-scale crises: (1) preparedness and response, (2) communicating risks, (3) international assistance, and (4) critical infrastructure.

1. Preparedness and Response

Preparing to respond to, and mitigate the impact of, disasters as well as delivering assistance during and after the incident comprise the "preparedness and response" aspect of dealing with disasters. Activities included under this umbrella are the activities of government at all levels, as well as of the private sector, communities, individuals, volunteers, and non-governmental organizations.

Observation: *The nation of Japan organized a massive, speedy response.*

Immediately after the disaster in Japan, the government established an emergency response team headed by the prime minister. Within a day, the Ministry of Defense ordered deployment of all the available resources of the country's military, the Japan Self-Defense Forces (JSDF), which included 110,000 active and reserve troops. The government also dispatched nearly 28,000 members of the National Police Force and the Fire and Disaster Management Agency. In addition to "official" responders, the government moved quickly to organize and coordinate volunteer efforts, including the Japanese Red Cross, which serves as an auxiliary to the government for disaster relief. The Japan Civil Network for Disaster Relief in East Japan served as an overall coordinating body for over 300 organizations, including government offices, non-governmental agencies, and civil society organizations. Other prompt actions included allocation of almost $50 billion for critical tasks, such as debris removal, temporary housing, and restoring infrastructure. As a result, among other marks of progress within the days and weeks following the disasters, is that major transportation networks (not including those in proximity to the Fukushima nuclear plant) had been restored.[6]

This is not to say that preparedness and response were perfect. Continued concerns included the shortage of fuel and lack of sanitary conditions at some of the temporary housing centers. In some cases the most vulnerable populations—small children, the aged, the poor, and pets—suffered disproportionately because of the difficulty in evacuating or reaching them, largely due to impassable roads, evacuations and housing centers where pets were prohibited, and a general reluctance by elderly populations to abandon their homes. Furthermore, most of the infrastructure that provided care for vulnerable populations was eliminated by the quake or by the tsunami.

5. James Jay Carafano, "Improving the National Response to Catastrophic Disaster," testimony before the Committee on Government Reform, U.S. House of Representatives, September 15, 2005, at *http://www.heritage.org/research/testimony/improving-the-national-response-to-catastrophic-disaster* (May 17, 2011).
6. Center for Excellence in Disaster Management & Humanitarian Assistance, "Japan Earthquake and Tsunami Update," April 13, 2011, pp. 16–17, and OCHA, "Japan: Earthquake & Tsunami," *Situation Report* No. 15, p. 6.

Another issue that contributed to the hardship of vulnerable populations was the Japanese style of leadership, which often requires consensus-building or adherence to established procedures. This appears to have been problematic in some cases that required on-the-spot decisions about evacuation orders and other key preparedness and response activities.

Despite these shortfalls, it is clear that the Japanese government had learned lessons and made efforts to improve upon its experience in previous disasters, such as the 1995 Hyogo-ken Nambu earthquake near the city of Kobe.[7] After that quake, roads were packed with well-meaning citizens rushing to the affected areas to help those in need; however, the influx proved to hinder first responders trying to deliver aid. After the March 11, 2011, earthquake, officials warned volunteers not respond unless requested.

Finding: *Robust catastrophic planning, preparedness, and mitigation make a society more resilient to disaster.*

Developed nations, like Japan, have superior capacity to prepare for, mitigate, and respond to disasters. As one 2010 study notes, high-income nations respond better to catastrophic disasters than low-income or middle-income countries. In particular, affluent countries, although they have much more valuable infrastructure, incur far less damage to their infrastructure. Wealthy countries also recover more quickly.[8] Indeed, in some ways, the Japanese response is reminiscent of the U.S. response after Hurricane Katrina. While Katrina is mostly remembered for the criticism of the response shortfalls, what is often forgotten are the remarkable achievements in responding to a massive disaster that affected more than 90,000 square miles of the United States. In the wake of Katrina, tens of thousands were evacuated or rescued during and after the storm (including more than 33,000 by the U.S. Coast Guard).[9]

Investments in preparedness and response magnify the advantages of wealthy societies with vast resources at their disposal. These efforts result in making developed nations more resilient even though they may have much more life and property at risk in very big disasters. In many respects, the emphasis of the Japanese government on disaster preparedness paid off.

Since 1993, FEMA has been federalizing "routine" natural disasters—floods, fires, and storms—that have historically been handled entirely by state and local governments.

One limitation of the Japanese response is that it employs a "consolidated disaster management system for disaster response," which experienced "coordination and logistical challenges."[10] In essence, Japan's government can be bureaucratic in its response. This is a typical challenge faced when centralized action is used to meet large-scale, widespread disasters. During catastrophes, it is difficult for centralized systems to obtain and process all the information needed to make and execute deliberate decisions. The system becomes a "bottleneck" that delays the responsive and adaptive delivery of aid. The larger the scale of the disaster, the more the need for decentralized execution and the capacity and expertise of local leaders and community to act on their own.

The U.S. may increasingly face the same challenges encountered in Japan. Since 1993, the Federal Emergency Management Agency (FEMA) has been federalizing "routine" natural disasters—such as floods, fires, and storms—that have historically been handled entirely by state and local governments. Because of this over-federalization of disasters, two consequences have emerged. First, many state and local governments have cut funding to their own emergency management and first responder assets, thereby rendering themselves less prepared to handle natural disasters. Second, FEMA spends too much time preparing for and responding to routine natural disasters and not enough time preparing for catastrophic natural disasters—hurricanes, earthquakes, or volcanic eruptions, which

7. See, for example, EQE International, "The January 17, 1995 Kobe Earthquake, An EQE Summary Report," April 1995, at *http://www.absconsulting.com/resources/Catastrophe_Reports/Kobe,%20Japan%20EQ%201995.pdf* (May 17, 2011), and Kathleen J. Tierney and James D. Goltz, "Emergency Response: Lessons Learned from the Kobe Earthquake," University of Delaware Disaster Research Center *Preliminary Paper* No. 260 (1997), at *http://dspace.udel.edu:8080/dspace/handle/19716/202* (May 17, 2011).
8. *Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention* (Washington, DC: Global Facility for Disaster Reduction and Recovery, 2010).
9. Carafano, "Improving the National Response to Catastrophic Disaster."
10. OCHA, "Japan: Earthquake & Tsunami," *Situation Report* No. 14, p. 3.

could have a national impact—thereby increasing the likelihood that the federal response for the next catastrophic event will be insufficient.[11]

Recommendation: *The federal government should focus on catastrophic disaster preparedness and response and decentralized execution.*

Catastrophic disasters are a game-changer in terms of preparedness and response efforts. Routine disaster preparation is insufficient to accommodate the challenges of a catastrophic or "black swan" disaster. The federal government should focus on catastrophic disaster preparedness and response and decentralized execution:

- **Emphasize catastrophic disaster planning.** The federal government, particularly in coordination with states and major metropolitan areas, should emphasize catastrophic disaster planning, which has languished in recent years.[12] Furthermore, it should ensure that *ad hoc* efforts to plan for catastrophic disaster become more integrated.
- **Increase military preparedness.** The U.S. should also place added emphasis on ensuring that adequate military forces are available to support civil authorities. The Department of Defense has cut the number of specially trained and equipped forces for dealing with radiological, biological, and chemical threats. As the deployment of Japan's SDF demonstrated, military forces are a critical element of catastrophic disaster response.[13]
- **End "over-federalization."** Congress and the White House need to end the practice of placing too much emphasis on the federal government's role in dealing with "routine" disasters. Decentralized execution should be encouraged. The increasing use of presidential disaster declarations distracts federal agencies from preparing for catastrophic challenges and encourages states to supplant their own response capacity with federal aid.[14]

Observation: *The Japanese people demonstrated a "culture of preparedness."*

The Japanese government had, prior to the disaster, worked to ensure that "[a]ll of Japan's national territory is covered by early warning systems for storms, torrential rains, heavy snow, sediment disasters, tsunamis, tidal waves, high surf, inundation and floods…."[15] Generally, the Japanese population followed warnings issued before and during the alerts. For instance, 670,000 Japanese citizens participated in a national earthquake drill in September 2010.

Furthermore, in the aftermath of the disaster, the Japanese people demonstrated remarkable resilience and discipline with no reports of rioting or large-scale disruptions. While municipal authorities have been inundated with volunteers, for the most part the government has avoided the problem of "convergence," with citizens heeding government warnings not to rush to disaster scenes.[16]

The character and resolve demonstrated by the population generally served the nation well. The disciplined response did, however, also result in some shortfalls. In some coastal communities, residents were so confident in their response measures for tsunamis they had become complacent and were overwhelmed by the massive scale of destruction. Municipalities lacking the capacity to absorb volunteers found their existing ranks exhausted, meaning that while there were plenty of potential helpers, there was no one to lead or direct them.

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11. This section adapted from Matt Mayer and Mark DeBosier, "Federalizing Disasters Weakens FEMA—and Hurts Americans Hit by Catastrophes," Heritage Foundation *Backgrounder* No. 2398, April 13, 2010, at *http://www.heritage.org/Research/Reports/2010/04/Federalizing-Disasters-Weakens-FEMA-and-Hurts-Americans-Hit-by-Catastrophes*.
12. Matt Mayer and James Jay Carafano, "National Disaster Planning Slowed by Inadequate Interagency Process," Heritage Foundation *Backgrounder* No. 2079, October 24, 2007, at *http://www.policyarchive.org/handle/10207/bitstreams/13040.pdf* (April 29, 2011).
13. For useful recommendations, see The Advisory Panel on Department of Defense Capabilities for Support of Civil Authorities After Certain Incidents, "Before Disaster Strikes: Imperatives for Enhancing Defense Support of Civil Authorities," September 15, 2010, at *www.rand.org/content/dam/rand/www/external/nsrd/DoD-CBRNE-Panel/Executive-Summary-Advisory-Panel.pdf* (May 17, 2011).
14. Mayer and DeBosier, "Federalizing Disasters Weakens FEMA—and Hurts Americans Hit by Catastrophes."
15. Jonathan A. Lassa, "Japan's Resilience to Tsunamis and the Lessons for Japan and the World: An Early Observation," Ash Center, Harvard Kennedy School, at *http://www.zef.de/module/register/media/b4d0_Japantsunami%20resilience31mar2011.pdf* (May 17, 2011).
16. OCHA, "Japan: Earthquake & Tsunami," *Situation Report* No. 14.

Thus, a large number of volunteers sat idle because they had received no call to action.[17] Finally, because Japanese citizens were so well-prepared for known threats (earthquakes and tsunamis), they were incredibly *un*prepared for unforeseen disasters, such as the nuclear power plant's release of low-dose radiation.

Finding: *A culture of preparedness is a vital component of disaster response.*

As researchers at the Center for Strategic and International Studies pointed out, "[a]ny natural disaster of the scale experienced in Japan—involving sudden loss of life, traumatic destruction, relocation and homelessness, and deep uncertainty about the future—carries serious risk of short- and long-term psychological impacts." They note further that "With more than 20 percent of its population age 65 or older, Japan has one of the oldest populations in the world. In the coastal areas struck by the tsunami, that number rises to nearly 30 percent. The elderly are particularly vulnerable to disruptions in food, water, medical services, and disruptions to regular schedules of essential medication."[18] Yet, despite facing such hardships, the Japanese culture of cooperation facilitated the nation's ability to deal with the disaster.

As a nation, the U.S. lacks a consistent, uniform, and stable preparedness culture.

The Japanese culture of preparedness differs significantly from that in the United States. Japan is a much smaller country. While the recent Eastern Japan earthquake caused destruction largely in the northeastern part of the country, when disasters strike, they tend to impact the nation as a whole. The country has frequent disasters and they are generally uniform in character. Everyone in Japan worries about earthquakes. This uniformity makes establishing a common preparedness culture less challenging than in the U.S., which is much more diverse both in the disasters individual communities may experience and in the character and makeup of the U.S. population.

Research by emergency preparedness experts shows that individuals prepare for natural or technological disasters only if they have some experience that makes them believe such disasters might actually affect them. Thus, people in Oklahoma take the threat of tornados seriously, and people in Florida prepare for hurricane season. Yet as the event recedes in memory, preparedness levels decline. In California, preparedness levels have been dropping off commensurate with the increasing amount of time since the last earthquake.[19]

America's first responder community and other organizations and agencies upon whom the population relies for immediate, effective responses every day (not just fire, police, and medical personnel, but also electricity, communications, and transportation workers) are generally well trained and well prepared to respond to most significant casualties. They generally do so at some level of complexity and challenge every day, and do so regularly under the capable, seasoned, direct leadership of their chiefs, directors, and emergency managers when the events are more significant. When a catastrophe occurs, the public rightfully expects their elected officials and the most senior people from these organizations, agencies, and companies to take a direct substantive role in responding to the catastrophe and to restoring the affected region to a more normal status.

When a catastrophic event occurs, elected officials and other senior leadership must already know each other well, know the plans, and be comfortable with making critical decisions with limited and conflicting information. They must be comfortable making critical decisions under severe time limitations and be able to coordinate and collaborate with partner organizations and agencies in the midst of chaos. The elected officials and other senior leadership of the response organizations and agencies must know each other well enough that they can correctly anticipate the decisions of others, which may have to be made in isolation and without consultation.

Elected officials and other senior leadership need to be exposed to the stress of decision making during realistic simulations of catastrophic events that involve all of the principals. Although difficult to arrange and execute, there is no substitute for this level of preparation.

17. Lassa, "Japan's Resilience to Tsunamis and the Lessons for Japan and the World," and OCHA, "Japan: Earthquake & Tsunami," *Situation Report* No. 14.
18. Lisa Carty and Seth Gannon, "Health Outlook in Japan," Center for Strategic and International Studies, March 25, 2011, at *http://csis.org/publication/health-outlook-japan* (May 17, 2011).
19. See, for example, Naim Kapucu, "Culture of Preparedness: Household Disaster Preparedness," *Disaster Prevention and Management*, Vol. 17, No. 4(2008), pp. 526–535.

As a nation, the U.S. lacks a consistent, uniform, and stable preparedness culture. Developing that culture must be done in a manner consistent with the character of the nation.[20] Since the U.S. is really a composite of many diverse communities, it should develop a national preparedness culture from the bottom up, through community-based programs rather than top down, through Washington-based readiness campaigns.

One important note to consider is that, despite significant preparedness levels in Japan, the Japanese were unable to prevent the immediate death of thousands of people. One lesson is that there will always be limitations on a citizenry, no matter how well prepared, when a truly catastrophic event occurs. There has been insufficient public discussion that would set reasonable expectations for citizens as to what might happen during a large event and just how much their government will be able to do for them.

Recommendation: *Empower a national culture of preparedness by focusing on building more self-reliant communities and individuals.*[21]

- **Training the trainer.** The Department of Homeland Security can help state and local communities develop a culture of preparedness by helping them to establish training programs for state and local leaders.
- **Prepare the leadership of response organizations to respond together to catastrophic events.** Expose political leaders, public-sector senior leadership, and senior leadership of private-sector entities with major roles in maintaining and restoring services to situations requiring them to collaborate and coordinate responses to simulated catastrophes.
- **Employ "community-based planning."** Planning that includes input from the community produces not only higher quality plans, but also much higher levels of community approval and confidence in the plans.
- **Organize community needs assessments and situational awareness networks.** Community residents can often be the most important source for collecting and disseminating important information.
- **Getting down to business.** U.S. private-sector engagement has been dismal at best. While there has been some work done to effectively communicate and plan beforehand with large companies, small and medium-sized businesses are wholly unprepared for disasters. The right solution will be for the Department of Homeland Security to form relationships with these companies and encourage them to make preparations before the next disaster strikes. The government should support the Voluntary Private Sector Preparedness Accreditation and Certification Program (PS-Prep).
- **Establish community-based mental health responses.** One of the most significant and under-appreciated aspects of disaster response is responding to mental health issues caused by stress and trauma. The 1996 University of Delaware Disaster Research Center report "Disasters and Mental Health: Therapeutic Principles Drawn from Disaster Studies" found that when community ties "are strong, supportive, and responsive to the individual's physical and emotional needs, the capacity to withstand and overcome stress is heightened."

2. Communicating the Risk

Official communications that effectively identify risks to the public mitigate disasters by promoting measures and behaviors that avoid, minimize, prepare for, or respond to threats. For such "risk communication" to be effective it must understandable, credible, and actionable.

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20. James Jay Carafano, "Beyond Duct Tape: The Federal Government's Role in Public Preparedness," Heritage Foundation *Executive Memorandum* No. 971, June 3, 2005, at *http://www.heritage.org/research/reports/2005/06/beyond-duct-tape-the-federal-governments-role-in-public-preparedness*.
21. For a more comprehensive discussion of U.S. preparedness culture and recommendations, see David Heyman and James Jay Carafano, "Homeland Security 3.0: Building a National Enterprise to Keep America Safe, Free, and Prosperous," The Center for Strategic and International Studies and The Heritage Foundation, September 18, 2008, pp. 5–7, at *http://csis.org/files/media/csis/pubs/080918_homeland_sec_3dot0.pdf* (May 19, 2011).

Observation: *Japan relied heavily on formal early warning systems, evacuation plans, and alerts to limit loss of life.*

As noted, Japan has an extensive warning system for disasters like earthquakes. The government also employed a variety of mediums from traditional warning sirens to social media tools, such as Twitter.

These warning systems and alerts were not perfect. The government experienced difficulties in communicating in the aftermath of the crisis. As one observer noted, "the government has a tendency to want to have all the facts before making an announcement or a decision. Releasing information based on hunches or half-completed work can be seen as a failure to do a complete job. But in emergency cases, a timely decision based on some information, is better than a delayed decision with complete information."[22] The government's inability to provide satisfactory information regarding the conditions at the Fukushima nuclear plant exacerbated fear and uncertainty among Japanese citizens, and led to speculation and misinformation in news reports around the globe. Honesty and openness about the knowns and unknowns of the situation would have been desirable.

In general, it appears that when the government relied on established systems and scripted warnings, it proved fairly efficient. On the other hand, when faced with uncertain and unanticipated incidents, such as responding to the situation at Fukushima, the government's response was less effective.

Finding: *As one assessment of the disaster concluded, "soft measures," such as community awareness and effective risk communications, may have played a more decisive role in saving lives than extensive protective measures, such as seawalls designed to withstand flooding from tsunamis.*[23]

It is clear that no amount of hardening or protective measures can overcome the human quotient in a disaster situation. Without educating citizens about the risks they might face and the need to take certain actions to avoid death or injury, protective measures have a limited safety value. An example is that, despite warnings of an approaching tsunami, some Japanese citizens refused to leave their homes and even wanted to watch the disaster unfold. This is why it is essential to use "soft measures" to make citizens aware of the risk. The Japanese government used social networking fairly effectively, as did its citizens. According to reports, within an hour after the quake, "tweets" from Tokyo topped 1,200 per minute.[24]

Social media can spread rumors, perfidy, and faulty information with great speed.

The use of social media during a crisis can be problematic. One challenge is the constant question of information assurance—knowing whether the data are precise and reliable. During a large-scale crisis in particular, information can be spotty as communication systems are down and officials have difficulty collecting information and providing situational awareness. In addition, in a swiftly changing environment, first reports can later prove erroneous. Social media can compound this issue, as rumors, perfidy, and faulty information can be widely dispersed with great speed.

In addition to the challenge of vetting the accuracy and authenticity of government information, there is a similar concern about the private individuals and groups that can use the Internet to issue their own communications. These include street journalism, news, alerts, or opinion from people who are not professional journalists. This form of public journalism takes two forms. First, participatory journalists send reports, photos, videos, or information to news sites that are professionally edited. Second, citizen journalists develop their own news content and post their unedited products on individual Web sites. These sites might be managed by the user, or individuals can post information to sites hosted by others.

Social media relies on crowd-sourcing to filter the good information from the bad. No Web site better illustrates how the crowd has worked to organize online matters more than Wikipedia. This Web site maintains millions of

22. David S. Abraham, "How Bad Communication Is Undermining Japan's Crisis Response," *The Atlantic*, March 16, 2011, at *http://www.theatlantic.com/international/archive/2011/03/how-bad-communication-is-undermining-japans-crisis-response/72573* (May 17, 2011).

23. Lassa, "Japan's Resilience to Tsunamis and the Lessons for Japan and the World."

24. "Tweets from Tokyo Top 1,200 Per Minute," Silicon Republic, March 12, 2011, at *http://www.siliconrepublic.com/new-media/item/20872-tweets-from-tokyo-top-1-200* (May 17, 2011).

individual pages, all created, edited, and monitored by individual volunteers. Individuals can more readily challenge inaccurate information and offer corrections. Recent research finds that Wikipedia maintains a high level of accuracy even though editing is open to any individual.[25] While crowd-sourcing works well for sites like Wikipedia, it might serve less well in a time of crisis when accurate information could mean the difference between life and death.

Cyber attacks and hacking can also be used to purposefully mislead through official channels. In 2007, hackers used an SMS reporting system in Indonesia to issue a fake tsunami warning. In 2010, the Twitter account of the Indonesian president's disaster advisor was hacked, also to distribute a fake tsunami warning. Since the country was one of the nations devastated by the massive 2004 tsunami that swept over South Asia without warning, it was no surprise that the false alarms distressed more than a few people—who fled first and had to check facts later.

The Department of Homeland Security recently made great strides in improving its risk communication processes with its decision to scrap the deeply flawed Homeland Security Advisory System in favor of a new National Terrorism Advisory System, a series of "imminent" and "elevated" alerts that conform more closely with the principles of effective risk communication. Furthermore, the department plans to expand its use of social networking tools for communicating alerts.

Recommendation: *The Department of Homeland Security should continue to emphasize effective risk communication.*

- **Continue to develop the National Terrorism Advisory System** and expand the procedures and methods to create risk-communication frameworks for other homeland security-related activities, particularly for use in responding to unanticipated dangers.
- **Develop methods and capabilities to ensure the legitimacy of government communication through social networking.**
- **Integrate risk communication** in state and local "train the trainer" programs aimed at building community preparedness.

Observation: *Great confusion persists over the risks of low-dose radiation.*

No aspect of the response by the Japanese government was more troubling than its inability to effectively communicate the risks associated with low-dose radiation exposure as a result of damage at the Fukushima nuclear plant. Information was at times understated, inaccurate, and incomplete. Additionally, conflicting information came from Japanese ministries, TEPCO (the utility operating the plant), the International Atomic Energy Agency (IAEA), the U.S. Surgeon General, and the U.S. Nuclear Regulatory Commission. Many U.S. media outlets solicited commentary from a vast array of nuclear and homeland security experts; while some had experience with nuclear power and plant infrastructure and even critical infrastructure protection, others' expertise in nuclear weapons and nuclear proliferation had less relevance. Their assessment did more harm than good in terms of effectively communicating the risk of low-dose radiation to the public. Moreover, some analysts used the opportunity to comment on the disaster as an avenue by which to advocate for or against the efficacy of nuclear power rather than focus on providing effective risk communication.

No aspect of the response by the Japanese government was more troubling than its inability to effectively communicate the risks of low-dose radiation exposure.

The International Nuclear and Radiological Event Scale, which is maintained by the IAEA, also showed poor utility as a risk-communication tool. At one point, the Japanese government elevated the Fukushima plant to "seven," the level of a major accident. This placed the station on par with the rating given to the 1986 Chernobyl reactor disaster, though the release of radiation at Fukushima was far less substantial.

25. Besiki Stvilia *et al.*, "Information Quality Discussions in Wikipedia," Graduate School of Library and Information Science, University of Illinois at Urbana–Champaign, at *http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.84.3912&rep=rep1&type=pdf* (May 17, 2011).

Finding: *Communicating the risks of low-dose radiation exposure and other technical matters in the aftermath of a disaster is very difficult.*

Communicating information of a technical nature during a disaster is especially difficult, particularly when the responsibility for communicating information is shared by the government and private enterprise. In many respects, the troubles experienced by the government of Japan and TEPCO are reminiscent of similar challenges encountered by the U.S. government and BP in the aftermath of the Gulf oil spill last spring. Government and the private sector can have competing objectives, differing perspectives and levels of technical knowledge, even contrasting legal obligations in sharing information during a crisis.

Another factor that affected confusion in this particular situation is that the science of the effects of low-dose radiation is very controversial. The danger of low-dose exposure may be far less than is commonly assumed. The long-term effect of low-dose radiation is determined by the capacity of irradiated tissue to repair DNA damage. This is governed by a number of exposure, health, and genetic factors. There is some scientific evidence that current models may overestimate risks.[26] It is difficult during a crisis to explain the complexity and controversy surrounding the issue. Experts note, for example, that one of the greatest dangers of a "dirty bomb" is the panic that might be caused, not physical injuries.[27]

Recommendation: *The U.S. government should strengthen its capacity to communicate the risk of low-dose radiation exposure.*

- **Press the IAEA to reform the International Nuclear and Radiological Event Scale** to more effectively educate the public on the actual radiation risks associated with a particular number designation.
- **Develop more effective public–private partnerships** in critical risk communication, such as on low-dose radiation exposure, through the Department of Homeland Security's critical infrastructure partnership advisory council.

3. International Assistance

Other nations, international organizations, non-governmental agencies, and foreign philanthropists and volunteers routinely offer aid and assistance in the wake of disasters. However, it is less common for the most developed and wealthy nations to require or request foreign aid.

Observation: *The government of Japan has a mixed record in applying foreign aid.*

Within a month of the earthquake and tsunami, Japan had received offers of assistance from at least 134 countries and 33 international organizations. In coordination with the government, Japan Platform (an international emergency humanitarian aid organization) and the Japan non-governmental organization Center for International Cooperation (acting as part of the Japan Civil Network for Disaster Relief in East Asia) served as the key organizations coordinating support with international non-governmental organizations.[28] Accepted offers ranged from 2,000 blankets from Ukraine to special search and rescue disaster response teams from several countries to extensive

26. Health Physics Society, "Radiation Risk In Perspective: Position Statement of the Health Physics Society," March 2001, at *http://www.Hps.Org/Documents/Radiationrisk.pdf* (May 17, 2011); National Radiological Protection Board, "Risk of Radiation-Induced Cancer at Low Doses and Low Dose Rates for Radiation Protection Purposes," Documents of the NRPB, 6/11 (1995), pp. 1–7; and "Animal Studies of Residual Hematopoietic and Immune System Injury from Low Dose/Low Dose Rate Radiation and Heavy Metals," Armed Forces Radiobiology Research Institute *Contract Report* No. 98–3, September 1998, p. 1, at *http://www.usuhs.mil/afrri/outreach/pdf/CR98_3.pdf* (Mary 17, 2011). See also, Military Medical Operations Office, Armed Forces Radiobiology Research Institute, *Medical Management of Radiological Casualties Handbook* (December 1999), pp. 34–39.

27. James Jay Carafano and Jack Spencer, "Dealing with Dirty Bombs: Plain Facts, Practical Solutions," Heritage Foundation *Backgrounder* No. 1723, January 27, 2004, at *http://www.heritage.org/Research/Reports/2004/01/Dealing-with-Dirty-Bombs-Plain-Facts-Practical-Solutions* (May 1, 2011).

28. OCHA, "Japan: Earthquake & Tsunami," *Situation Report* No. 15, p. 6.

assistance provide by the U.S. military.[29] The government of Japan also encouraged support in the form of financial donations through the Red Cross. For the most part, as assessment by an evaluation team from the U.N. Office of Coordination of Humanitarian Affairs concluded, "the country can both produce and procure relief supplies domestically and has the capacity to deliver those supplies to the affected population."[30]

Military-to-military cooperation between the U.S. armed forces and the JSDF proved particularly effective. As one analyst noted, "Thanks to years of exercises and interoperability, the U.S. Pacific Command (PACOM) is highly equipped to work directly with the Japanese Self-Defense Forces. PACOM's support for the relief effort involves 17,000 personnel, 100 aircraft, and 14 ships, including the aircraft carrier *USS Ronald Reagan*, which was already in the area."[31]

There were also, on the other hand, anecdotal reports of delays and confusion in delivering assistance, complications that may, in part, have been attributable to the rigid Japanese style of disaster management.

Finding: *Accepting foreign aid in the wake of major disaster is a complex and difficult task.*

Foreign assistance can be important even to rich and developed nations such as Japan and the United States. In some cases, technical capacity such as urban search and rescue will always be in high demand—and nations should treat such offers of technical assistance separately, ensuring that they can get the right services on the ground. Even societies with extensive capacity may require donations and aid when faced with catastrophe if domestic resources cannot be quickly shifted to the disaster area.

The criticisms of the Japanese government's ability to accept and use aid mirror those made about the U.S. government after Hurricane Katrina and the Gulf oil spill. In part, the reluctance to accept aid resulted from practical limitations, such as logistical considerations and the mismatch between needs and the aid offered. On the other hand, the inability of the U.S. to effectively accept aid also reflected the limitations of disaster response systems that are more practiced at delivering aid than receiving it. As one observer of the Japanese response noted, "sharing information within bureaucratic organizations is often difficult in good times. But communication between many organizations and agencies is often stove-piped. And if information is not shared easily through clear pathways in normal times, when disaster strikes, it creates further obstacles to get details to decision makers."[32] This was often the case with management of foreign disaster assistance.

This particular challenge is one the U.S. has not mastered. After Hurricane Katrina and the BP oil spill, there was an outpouring of support and offers of aid—including proposed donations of supplies, expertise, and money—from countries around the world. After both disasters, however, U.S. officials declined the majority of the assistance offered, and were slow to accept the small amount they did. This inability to accept help rapidly from other nations during domestic disasters hurts American response and recovery. An unresponsive policy toward foreign offers of aid can also have negative diplomatic consequences, potentially alienating important allies whose assistance the United States needs on other issues. Despite the Bush Administration's efforts to improve the process after Hurricane Katrina, the U.S. government's response to the BP oil spill demonstrates that the U.S. government still needs a better structure to accept foreign assistance, and simultaneously foster better relationships with friends and allies on security and disaster response.[33]

Recommendation: *The U.S. should improve its capacity to accept foreign aid in the event of catastrophes.*

- **Implement the Government Accountability Office's (GAO) post-Katrina recommendations** for improving assessment of international aid. Some progress has been made in implementing the

29. Center for Excellence in Disaster Management & Humanitarian Assistance, "Japan Earthquake and Tsunami Update," April 13, 2011, pp. 2, 40, 41–43.
30. OCHA, "Japan: Earthquake & Tsunami," *Situation Report* No. 14, p. 3.
31. Carty and Gannon, "Health Outlook in Japan."
32. Abraham, "How Bad Communication Is Undermining Japan's Crisis Response."
33. Jena Baker McNeill *et al.,* "Accepting Disaster Relief from Other Nations: Lessons from Katrina and the Gulf Oil Spill," Heritage Foundation *Backgrounder* No. 2519, February 7, 2011, at *http://www.heritage.org/research/reports/2011/02/accepting-disaster-relief-from-other-nations-lessons-from-katrina-and-the-gulf-oil-spill*.

recommendations detailed in the GAO report. Some of the recommendations remain highly relevant today—and have not been implemented. Congress should revisit Katrina recommendations pertaining to international cooperation and assistance, and should work with the Department of Homeland Security to implement them.[34]

- **Consider international disaster exercises** to increase the ability of countries friendly with the United States to readily accept aid from one another when disaster strikes.
- **Establish an industry-led, multinational rapid-response capability**. Such a capability should be able to respond to major nuclear accidents worldwide. Nations with commercial nuclear plants could seamlessly integrate this capability into their response plans. This integration would minimize the hesitation that emerged in Japan to accept foreign technical assistance and give nuclear operators a better sense of available resources. Further, it could provide an effective mechanism to share best practices, integrate responses, and to ensure that all nations have access to the latest nuclear-response technology. This capability should be funded and controlled by the private sector using existing institutions like the Institute for Nuclear Power Operations, which has made similar recommendations, and the World Association of Nuclear Operators.

4. Critical Infrastructure

A nation's physical assets serve as the foundation for effective governance, economic vitality, and a resilient civil society. Agriculture, food, water, public health, emergency services, government, the industrial base, information and telecommunications, energy, transportation, banking and finance, and other key assets, such as nuclear power plants, dams, government buildings, and commercial facilities, are vital to everyday life. Ensuring their resilience and recovery in the face of catastrophic disaster is critical.

Observation: *Parts of Japan experienced loss of critical infrastructure on a catastrophic scale.*

The damage inflicted on the Miyagi prefecture is illustrative of the scale of catastrophic destruction wrought by the disaster. Of the 45,700 structures destroyed by the earthquake and tsunami 29,500 were in the Miyagi prefecture. Major urban areas were significantly affected. About half of Ishinomaki and Yamamoto were flooded. The prefecture estimated it will have to remove between 15 million and 18 million tons of debris.[35]

Exacerbating the physical destruction was the loss of electrical power, which both hampered the relief effort and limited the capacity of the prefecture to recover. This had cascading effects across all of Japan. Overall, across Japan, some 2.74 million households lost power after the earthquake. The Miyagi prefecture was particularly hard hit. A month after the disaster, almost 100,000 households in the prefecture still lacked power.[36]

The loss of the Fukushima power plant delivered a double blow to disaster recovery. An important power generation facility went offline. The response to the incident at the plant also complicated the overall response requiring evacuations, sheltering of evacuees, support for those sheltering in place, and disaster response assets that had to be dedicated to the incident.

In the aftermath of the disaster, the Japanese government and TEPCO came under intense criticism for not ensuring that the facilities at Fukushima were adequately prepared for the disaster. In particular, they have been

34. Government Accountability Office, "Hurricane Katrina: Comprehensive Policies and Procedures Are Needed to Ensure Appropriate Use of and Accountability for International Assistance," GAO 06-460, April 2006, at *http://www.gao.gov/new.items/d06460.pdf* (May 17, 2011).
35. Center for Excellence in Disaster Management & Humanitarian Assistance, "Japan Earthquake and Tsunami Update," April 1, 2011, at *http://reliefweb.int/sites/reliefweb.int/files/resources/B251B5D0A6C5AEA38525786600540D80-Full_Report.pdf* (May 17, 2011).
36. The Special Headquarters for Measures to Assist the Lives of Disaster Victims, "Conditions of Lifeline and Infrastructure in the Affected Areas (Mainly in Iwate, Miyagi and Fukushima Prefectures)," April 14, 2011, at *http://www.cao.go.jp/shien/en/0-infra/infra.pdf* (May 17, 2011).

faulted for not ensuring that safety precautions at the plant had been upgraded to global industry standards and that adequate plans were not in place to protect the back power systems during flooding.

Another problem which undoubtedly will increase the impacts of the disaster—especially in economic terms—was the lack of resilience in the supply chain. Multiple Japanese companies were forced to suspend operations, not just in areas hit by disaster, but in manufacturing plants around the globe. Companies such as Toyota and Sony were unable to get the parts they needed for production and were forced to simply shut down. This showed a lack of continuity and resilience in the supply chain that will have a cascading effect on consumers worldwide.

Finding: *The resilience and recovery of critical infrastructure significantly affects responses to catastrophic disasters.*

The destruction of infrastructure in prefectures like Miyagi is reminiscent of disasters in the U.S., such as Hurricane Katrina, where the loss of key services, particularly electrical power, had a significant and detrimental impact on the pace of response and recovery. All these challenges are magnified as the scale and scope of the disaster grows. Most of the destruction of the Great Eastern Japan Earthquake was confined to the northeast portion of the country. Thus, the rest of the nation, comparatively unaffected, could mount an effective response. If the effects of the disaster had been more widespread, the dramatic loss of infrastructure would have been calamitous.

In comparison to other international disasters, and even by U.S. standards, the Great Eastern Japan Earthquake is not unprecedented. In fact, recent disasters do offer insights into how to mitigate and respond to some aspects of this threat. Major urban blackouts, Hurricane Katrina, and the recent earthquake in Haiti illuminate the most daunting challenges. In each of these ensuring the resilience of the electrical grid was deemed vital.[37]

The loss of nuclear infrastructure is particularly significant. Industrialized societies are increasingly relying on nuclear power to facilitate their capacity to produce electricity. Furthermore, because of the dangers and concerns of a release of radioactive waste, the state of nuclear facilities during disasters is an enduring concern.

The U.S. system for ensuring the safety and effectiveness of nuclear power plants differs significantly from that implemented in Japan. The United States has multiple independent groups that have authority over nuclear infrastructure with the power to audit and direct compliance. In addition to the federal government's Nuclear Regulatory Commission and oversight from states, the independent Institute of Nuclear Power Operations (INPO) established guidelines for plant operations and conducts regular detailed evaluation of nuclear power plants.

When assessing the adequacy of plans, senior leadership should require playing out the analysis past the design basis threat along an alternative path, each time plans and readiness are tested. Working through the likely path of outcomes and challenges of a larger-than-planned earthquake could at least prepare decision makers to find creative responses to the potential loss of emergency generators and the resulting nuclear reactor problems. Thinking about potential "black swan" events when the catastrophe exceeds imagination, even if just as a separate assignment appended to a periodic exercise, preconditions the decision makers to realize their next set of potential shortfalls.

Recommendation: *The U.S. must maintain its focus on the most "vital" critical infrastructure, the resilience of the U.S.–Canadian electrical grid and the nuclear enterprise.*

- **Ensure resilience of the U.S.–electrical grid.** Measures must be adopted to ensure the resilience of the U.S.–Canadian electrical grid and telecommunications systems, including developing limited redundancy and identifying means for the timely replacement of essential damaged parts or their rapid substitution.
- **Rely on the current U.S. system for ensuring nuclear safety.** The United States has built a robust and multifaceted regulatory infrastructure after its own nuclear accident at Three Mile Island. The system relies on an empowered Nuclear Regulatory Commission and the private INPO working in tandem to promote safe operations and best practices. It is critical that both federal and industry regulators work together to recognize lessons from Fukushima and determine how they can best be implemented.

37. James Jay Carafano and Richard Weitz, "EMP Attacks—What the U.S. Must Do Now," Heritage Foundation *Backgrounder* No. 2491, November 17, 2010, at *http://www.heritage.org/research/reports/2010/11/emp-attacks-what-the-us-must-do-now*.

Lessons Relearned

In virtually every major respect, the lessons to be learned from the Great Eastern Japan Earthquake are ones that the United States should already know well. Many are reminiscent of the challenges the U.S. faced in recent large-scale disasters, such as Hurricane Katrina and the Gulf Oil spill.

Addressing the shortfalls of catastrophic disaster response is vital. Catastrophic disasters are one of the few challenges that can bring even the most rich and powerful nations to their knees. Yet, these shortfalls are avoidable calamities. This paper offers multiple recommendations for U.S. policymakers to address shortfalls in terms of preparedness and response, risk communication, international assistance, and critical infrastructure. Some of these next steps are:

- **Emphasize catastrophic disaster planning.** The federal government, particularly when coordinating with states and major metropolitan areas, should emphasize catastrophic disaster planning, which has languished in recent years.[38] Furthermore, it should ensure that *ad hoc* efforts to plan for catastrophic disaster are more integrated.
- **End "over-federalization."** Congress and the White House need to end the practice of placing too much emphasis on the federal government's role in dealing with routine disasters. Decentralized execution should be encouraged. The increasing use of presidential disaster declarations distracts federal agencies from preparing for catastrophic challenges and encourages states to supplant their own response capacity with federal aid.[39]
- **Increase understanding** and develop methods and capabilities to ensure the legitimacy of government communication through social networking.
- **Implement the GAO's post-Katrina recommendations** for improving evaluation of international aid. Some progress has been made in implementing the recommendations detailed in the GAO report after Hurricane Katrina. Some of the recommendations remain highly relevant today—and have not been implemented. Congress should revisit the recommendations pertaining to international cooperation and assistance, and should work with the Department of Homeland Security to implement them.[40]
- **Ensure resilience of the U.S.–Canada electrical grid.** Measures must be adopted to ensure the resilience of the U.S.–Canadian electrical grid and telecommunications systems, including developing limited redundancy and identifying means for the timely replacement of essential damaged parts or their rapid substitution.
- **Rely on the current U.S. system for ensuring nuclear safety.** The United States has built a robust and multifaceted regulatory infrastructure after its own nuclear accident at Three Mile Island. The system relies on an empowered Nuclear Regulatory Commission, and the private INPO working in tandem to promote safe operations and best practices. It is critical that both industry and federal regulators work together to agree on lessons learned from Fukushima and determine how they can best be implemented.

Developed societies such as Japan and the United States are the best resourced to deal with disasters. The more attention given to disaster preparedness before disaster strikes, the more efficiently resources can be applied to ensuring the resilience of the nation and rapid recovery after a disaster.

38 Mayer and Carafano, "National Disaster Planning Slowed by Inadequate Interagency Process."

39. Mayer and DeBosier, "Federalizing Disasters Weakens FEMA—and Hurts Americans Hit by Catastrophes."

40. Government Accountability Office, "Hurricane Katrina: Comprehensive Policies and Procedures Are Needed to Ensure Appropriate Use of and Accountability for International Assistance."

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