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**LESSONS FROM FUKUSHIMA:
RELOCATION AND RECOVERY FROM NUCLEAR
CATASTROPHE**

by

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June 2015

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**LESSONS FROM FUKUSHIMA:
RELOCATION AND RECOVERY FROM NUCLEAR CATASTROPHE**

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ABSTRACT

The Fukushima nuclear plant meltdown offers an unusual opportunity to examine and learn from Japan's experience managing the forced, extended relocation of over 100,000 people. The objective of this study was to assess lessons the United States can incorporate into its disaster management plans from Japan's experience managing the relocation of communities due to the widespread contamination from the Fukushima Daiichi nuclear plant. Four years after the catastrophe, Fukushima Prefecture estimates 119,000 residents are still living in temporary accommodations while remediation work continues in 11 municipalities.

This comparative analysis of the Fukushima case approached the challenge of planning for recovery after a nuclear/radiological disaster from the perspective of managers with limited radiation management expertise. It examined the progress of recovery in the first four years and the management practices related to the relocation and resettlement of the most contaminated Fukushima communities. The primary recommendation is that states and communities require guidance and tools to use both to prepare for major radiological incidents and as post-incident job aids for managing disaster recovery. Leaders and planners will be able to apply the study's detailed recommendations to enhance efforts to prepare for the intermediate and late-phase recovery from radiological disasters.

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
CDC	Center for Disease Control
CORE	a pilot research project supported by the European Commission after Chernobyl
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
ETHOS	a pilot research project supported by the European Commission after Chernobyl
FEMA	Federal Emergency Management Agency
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IRPA	International Radiation Protection Association
Km	kilometer
LDP	Liberal Democratic Party of Japan
MD	medical doctor
METI	Japan Ministry of Economy, Trade, and Industry
MEXT	Japan Ministry of Education, Culture, Sports, Science and Technology
MOE	Japan Ministry of Environment
mSv/y	Milisievert per year
NA	not applicable
NAS	National Academies of Science
NCRP	National Council on Radiation Protection and Measurements
PAG	Protective Action Guides
PM	prime minister
REP	radiological emergency preparedness
TEPCO	Tokyo Electric Power Company
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UPMC	University of Pittsburgh Medical Center

U.S.
WHO

United States
World Health Organization

EXECUTIVE SUMMARY

Nana korobi ya oki—Fall seven times, stand up eight.

—Japanese proverb

A. INTRODUCTION

Four years later, Japan is still struggling to recover from the triple disaster of earthquake, tsunami, and nuclear plant meltdown that struck March 11, 2011. Any one of these disasters would have challenged seasoned leaders with a well-designed disaster management system. The disruption and uncertainty unleashed by the widespread releases of significant radiological contamination from the Fukushima Daiichi plant has added layers of complexity few leaders are prepared to navigate. Fukushima Prefecture estimates nearly 46,000 residents are still living in other prefectures and at least 73,000 are in temporary accommodations elsewhere in Fukushima. The villages of Okuma, Futaba, and Namie stand virtually empty and may remain off limits for a decade or more.

The United States is home to 100 licensed nuclear power plants and numerous active fault lines. What if there were a major accident at one of those plants with significant offsite impacts? What if there were a terrorist attack using an improvised nuclear device or a radiological dispersal device that resulted in widespread contamination? Are we prepared to manage the abrupt displacement of hundreds of thousands of people who will not be able to return for years or decades?

U.S. plans and exercises for nuclear/radiological disasters are all based on theoretical scenarios with very little recent practical experience to support them. The potential lessons for the U.S. in examining Japan's progress of ensuring the health and livelihoods of its residents, cleaning up the contamination, reversing the blow to its already dragging economy, rebuilding, and resettling are innumerable. Most scholarly articles and books published thus far about Japan's nuclear disaster focus primarily on early decision making, noting the difficulties the government had reacting to the extreme challenges of the situation, but not yet assessing decisions and outcomes beyond the first year—the recovery.

This study examines the progress of recovery in the first four years and the management practices and decisions related to the relocation and resettlement of the most contaminated Fukushima communities.

B. RESEARCH QUESTION

The objective of this thesis is to address the following primary research question: what lessons can the U.S. incorporate into its disaster management plans from Japan's experience managing the relocation of communities due to the widespread contamination from the Fukushima Daiichi nuclear plant? The Fukushima disaster offers an unusual opportunity to examine and learn from the experience of Japan, Fukushima Prefecture, and the affected municipalities. The Japan disaster is a useful comparative study since Japan is similar to the U.S. in key ways: it is a modern, developed country; it has a sophisticated building code and disaster management system; and its governmental structure is democratic and includes executive and legislative branches (parliamentary) with responsibilities divided between national, prefectural, and municipal levels.

C. METHOD

This comparative analysis of the Fukushima case approaches the challenge of planning for recovery after a nuclear/radiological disaster from the perspective of managers with limited if any health physics or other radiation management expertise. It synthesizes aspects of nuclear/radiological preparedness and disaster recovery planning and management that are typically addressed separately.

To compile the case, the author collected and reviewed over 400 source documents available from the Japanese central government, Fukushima Prefecture, the affected municipalities, Tokyo Electric Power Company (TEPCO), nongovernmental organizations, and the media. In addition, the author reviewed numerous scholarly articles and books published regarding the 2011 disaster as well as the Three Mile Island and Chernobyl nuclear accidents. The author compared lessons derived from the case to the disaster management policies, plans, and experience in the United States in order to assess potential effectiveness and applicability and to make recommendations.

D. FINDINGS AND RECOMMENDATIONS

A surprising finding is that although an official recommendation to financially assist property owners to permanently move out of “difficult to return” zones was made in early 2012, it took over a year before implementation began and even longer for the central government to fully and publicly embrace such a policy. It is clear that local and state officials in the U.S. will also not be eager to assist taxpaying residents move elsewhere and give up on the community’s future. This is a heart wrenching situation for which there are no easy solutions.

The study concludes with a set of planning recommendations for U.S. nuclear/radiological disaster recovery managers and five topics to highlight for future research. Leaders and planners will be able to apply the recommendations in the final chapter to enhance efforts to prepare for the intermediate and late phase recovery from radiological disasters.

The primary recommendation is that guidance and tools for states and communities to use both to prepare for and as post incident job aids for managing disaster recovery after major radiological incidents is lacking and necessary. Managing public information and stakeholder involvement is the most critical capability to develop because it affects all other aspects of recovery and is the best tool for empowering survivors. Guidance and job aids for the intermediate and late phase (recovery) are all the more critical since community preparedness in advance is likely to be limited. Local and state governments will be at the center of the maelstrom if a significant radiological disaster happens here. They will be managing the recovery—and they will need help.

Additionally, the federal government and Congress should review the mechanisms available to support communities, individuals, and businesses in such a situation. Particularly for nuclear power plant accidents governed by the Price-Anderson Act, the compensation system, which requires first court intervention and then congressional intervention almost guarantees delayed assistance and aggravation for survivors.

Now is the moment for us to stand up the eighth time.

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I. INTRODUCTION

Cherry blossoms in Namie fall without being loved

—from a poem by Minoru Ikeda,
retired letter carrier and decontamination worker¹

Despite the devastating toll of lives lost to the tsunami that followed the Great East Japan Earthquake, the defining element of the catastrophe is the cascading failure of the Fukushima Daiichi nuclear plant and subsequent release of high levels of radiation throughout the Prefecture and beyond. Four years later, after initial worldwide headlines and footage of boats and helicopters spraying water at the smoldering plant have faded, just under 119,000 Fukushima residents are still evacuated and living in temporary accommodations.² The villages of Okuma, Futaba, and Namie stand virtually empty and may remain off limits for a decade or more.

Community leaders managing the aftermath of a complex disaster like the Fukushima meltdown can be overwhelmed. The best antidote to this is planning and preparedness, not just for the emergency response, but for managing the recovery and reconstruction. Large disasters frequently involve extended temporary relocations of residents and businesses. A disaster involving radiological contamination adds a new dimension of complexity to the ability of communities to manage the recovery. People will be fearful and skeptical. Surrounding jurisdictions will be inundated with displaced residents seeking housing and work, putting a strain on local infrastructure and public services that will last years. The usual procedures and systems for clearing and disposing of disaster debris will be completely inadequate.

What if a nuclear plant accident or a terrorist attack using nuclear materials caused widespread contamination here in the U.S.? Are we prepared to manage the

¹ Kentaro Isomura, “Decontamination Worker Moved by What He Saw Writes Poetry in Fukushima,” *The Asahi Shimbun*, May 28, 2014, <http://ajw.asahi.com/article/0311disaster/recovery/AJ201405280003>

² “No. of Fukushima Nuclear Disaster Evacuees Drops below 120,000,” *Fukushima Minpo News*, February 13, 2015. <http://www.fukushimaminponews.com/news.html?id=469>

abrupt relocations and recovery after an event that may displace whole communities for years, possibly a decade or more?

A. RESEARCH QUESTIONS

This objective of this thesis is to address the following primary research question: what lessons can the U.S. incorporate into its disaster management plans from Japan's experience managing the relocation of communities due to the widespread contamination from the Fukushima Daiichi nuclear plant? In order to fully explore the main research question, the thesis applies a qualitative, comparative analysis of the following ancillary questions:

1. What were the timelines of decision making related to managing the relocation of communities due to the contamination from the Fukushima Daiichi plant?
2. What were the situational, political, geographical, or cultural contexts that affected how decisions were made?
3. Are there examples of policies and actions undertaken by the Japanese that were successful? Are there examples with poor outcomes or side effects?
4. What cultural and political differences between the U.S. and Japan might impact how well the identified lessons might apply in the U.S. disaster management context?

B. PROBLEM SPACE

In 2015, Japan is still struggling to recover from the triple disaster of earthquake, tsunami, and nuclear plant meltdown that struck March 11, 2011. Fukushima Prefecture estimates nearly 46,000 residents are living in other prefectures and at least 73,000 are in temporary accommodations elsewhere in Fukushima.³ Reviewing Japan's progress in ensuring the health of its residents, cleaning up the contamination, reversing the blow to its already dragging economy, rebuilding, and resettling, the potential lessons in catastrophic disaster recovery management are innumerable.

The Japan disaster has garnered lots of attention from the media, academic researchers, and interested organizations. The Fukushima recovery is still unfolding and

³ Ibid.

thus far the scholarly literature focuses primarily on early response decision making, noting the difficulties the government had reacting to the extreme challenges of the emergency situation, but not yet assessing decisions and outcomes beyond the first few months—the recovery.

The U.S. is home to 100 licensed nuclear power plants and numerous active fault lines. What if there were a major accident at one of those plants with significant offsite impacts? The Nuclear Regulatory Commission, as part of its post-Fukushima lessons learned initiative, required nuclear power plant operators to conduct re-evaluations of their integrated plans to include beyond design based external events, as well as flood and seismic vulnerabilities. These efforts will serve to reduce risk but cannot eliminate it. What if there were a terrorist attack using an improvised nuclear device or a radiological dispersal device that resulted in widespread contamination? U.S. plans and exercises for nuclear/radiological disasters are all based on theoretical scenarios, with very little recent practical experience to support them.

The Fukushima disaster offers an unusual opportunity to examine and learn from the experience of Japan, Fukushima Prefecture, and the affected municipalities. The Japan experience offers the opportunity to sketch out realistic expected situational factors for recovery scenarios for planners and leaders to work through the complex issues, uncertainties, and decision points they may one day face after a radiological disaster.

The Japan disaster is a useful comparative study since Japan is similar to the U.S. in key ways: it is a modern, developed country; it has a sophisticated building code and disaster management system; and its governmental structure is democratic and includes executive and legislative branches (parliamentary) with responsibilities divided between national, prefectural, and municipal levels. Unfolding during the Internet age, the technological tools and forms of public media employed during the Fukushima recovery are current and relevant for today's disaster managers.

The focus for this study is to evaluate the decision making regarding management of the relocation and resettlement of communities (residents, businesses, municipal services) due to the radiological contamination. Some of the major recovery management

factors include: public messaging regarding potential health impacts, relocation logistics, and available assistance; preparing host communities to receive and support displaced residents; assisting residents to maintain or re-establish livelihoods; ensuring physical and mental health of residents; ensuring continuity of critical infrastructure and other key community services; and orchestrating decontamination and waste disposal work.

The initial hypothesis of this study is that the original overarching policy direction in Japan would not be a workable solution in the U.S., though a number of individual Japanese disaster management practices will provide useful models. It appears that Japan has chosen to extend the temporary relocation period, undertake aggressive decontamination, and eventually resettle residents in even the most contaminated areas. The study considers the implications of a policy option to facilitate permanent relocation of residents and businesses out of the most severely contaminated zones at an earlier point, even if it may be possible to reclaim the area years later. The U.S. has more land suitable for redevelopment for permanent relocation sites than Japan. Culturally, U.S. residents may tend to be more transient and less tied to specific geographic locations than the Japanese people.

C. SUMMARY OF METHOD

This comparative analysis of the Fukushima case approaches the challenge of planning for recovery after a nuclear/radiological disaster from the perspective of managers with limited if any health physics or other radiation management expertise. Community leaders and disaster recovery managers and planners tend not to be radiation experts. As with response plans, the expectation is generally that one of the many functions radiation experts will provide when plugged into the larger disaster management organizational structure, is provide technical advice to the overall disaster leadership team. Knowing that expertise will be there is a comfort to disaster managers, but ideally their training and preparedness should include basic understanding of the unique impacts and challenges a nuclear/radiological disaster would pose.

To compile the case, the author collected and reviewed over 400 source documents available from the Japanese central government, Fukushima Prefecture, the

affected municipalities, the Tokyo Electric Power Company (TEPCO), nongovernmental organizations, and the media. In addition, the author reviewed scholarly articles and books published regarding the 2011 disaster. The author compared lessons derived from the case to the disaster management policies, plans, and experience in the United States in order to assess effectiveness and applicability and to make recommendations.

Recovery management after a catastrophic disaster involves many facets and complexities. This study touches on a wide range of issues, but focuses on communication with and assistance to residents and management of the community relocations.

D. SIGNIFICANCE TO THE FIELD

Most scholarly articles and books published thus far about Japan's nuclear disaster focus primarily on early decision making, noting the difficulties the government had reacting to the extreme challenges of the situation, but not yet assessing decisions and outcomes beyond the first year. This thesis synthesizes aspects of nuclear/radiological preparedness and disaster recovery planning and management that are typically addressed separately. The Fukushima recovery is still unfolding and much more will be written about this disaster in years to come. This research provides an early analysis of the progress of supporting displaced populations, reestablishing relocated communities, and the effectiveness of recovery assistance efforts.

The product of this research is intended to be practical—carefully considered lessons that will serve as a foundation for future support and guidance for states and communities to prepare for recovery after major radiological disasters.

E. OVERVIEW OF CHAPTERS

Following the Introduction, this thesis includes five additional chapters. Chapter II reviews the major literature related to management of radiological disaster recovery, the Chernobyl nuclear disaster recovery as a reference point, and risk communication related to radiation hazards. The third chapter describes the study methodology in more detail. The Fukushima disaster case is organized in thematic sections in Chapter IV. The

fifth chapter identifies and assesses key practices and lessons derived from the Fukushima case, and then compares them to the U.S. situation for applicability. A surprising finding is that although an official recommendation to financially assist property owners to permanently move out of “difficult to return” zones was made in early 2012, it took over a year before implementation began and even longer for the central government to fully and publicly embrace such a policy.

The author’s recommendations for adopting lessons for U.S. disaster recovery planning efforts as well as areas for future study are outlined in Chapter VI. The primary recommendation is that guidance and tools for states and communities to use both to prepare for and as post incident job aids for managing disaster recovery after major radiological incidents is lacking and necessary. Managing public information and stakeholder involvement is the most critical capability to develop because it affects all other aspects of recovery and is the best tool for empowering survivors.

II. LITERATURE REVIEW

The literature related to the recovery phase of managing nuclear/radiological disaster impacts is, not surprisingly, heavily influenced by the Chernobyl experience. Over the 29 years since the Chernobyl disaster, a robust literature tracing its impacts and legacy has developed. Scientists have taken advantage of the opportunity to monitor and assess the long term health impacts of radiation exposure, the psychological effects to the surrounding population, the nature of the radioactive decay over time, and many other technical aspects pertinent to managing radiological contamination. To assess the need for further research related to managing recovery after radiological disasters, this review concentrates on three major categories of relevant literature. The first section directs readers to recent literature providing comprehensive treatment of recovery phase radiological disaster management. The next section discusses the recovery after Chernobyl, in particular the long term implications of the population relocations as a protective action. Because public information is a critical core capability for managers implementing relocations to protect the population, the final section examines the applicable risk communication literature.

A. NUCLEAR/RADIOLOGICAL RECOVERY PLANNING AND MANAGEMENT

The national and international associations and organizations devoted to research, education, and information sharing related to radiation management and protection are an invaluable source for reports and articles documenting impacts and results of protective actions, as well as recommendations for improving standards, programs, and disaster management. Those frequently cited in radiological incident management literature include the Health Physics Society, which publishes the peer reviewed journal *Health Physics*; the International Atomic Energy Agency (IAEA), an independent intergovernmental scientific and technical organization of the United Nations that publishes reports and standards; the International Commission on Radiological Protection (ICRP), an independent nonprofit that publishes reports and recommendations focusing on protection from ionizing radiation; the International Radiation Protection Association

(IRPA), a professional society that promotes radiation protection through education and publications; the National Council on Radiation Protection and Measurements (NCRP), a congressionally chartered nonprofit corporation, which publishes a series of reports and commentaries; and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Through collaborative committees and workgroups of scientific, technical, and professional members, the publications of these organizations are typically regarded as the most comprehensive and credible sources for radiation management information and advice.

In December 2014, the NCRP published its long awaited report No. 175, *Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents*. The committee had begun its work on recovery after radiological terrorism prior to the Fukushima disaster and afterwards added nuclear accidents to its agenda. This advisory report emphasizes the importance of local, state, and national plans addressing late phase issues and decision making processes in concert with emergency response requirements. Radiation professionals typically divide radiation incident management actions into three phases. The early or emergency phase lasts from the onset of an incident throughout the plume passage. During this time, actual environmental radiation measurements will be limited and incident management is focused on shelter in place or evacuation, rescue, and life saving medical response. The intermediate phase is characterized by the stabilization of radioactive releases and the ability to characterize the release and monitor radiation levels. Depending on the environmental readings, protective action guides may call for additional measures such as food restrictions and temporary relocations to reduce dose through contaminated food or water and external exposure. When the situation allows for remediation and other restoration actions, the late phase is underway and may continue for years or decades.⁴

The NCRP committee discusses and promotes the concept of “optimization” rather than a flat, set standard for radiation contamination clean up after a radiological

⁴ National Council on Radiation Protection and Measurements, *Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents* (Bethesda, MD: National Council on Radiation Protection and Measurements, 2014), 17.

disaster. As NCRP describes it, optimization builds on the “as low as reasonably achievable (ALARA) principle” to guide decisions through a stakeholder engagement process that weighs the costs, benefits, and tradeoffs involved with the various methods of reducing dose exposure. It discusses existing ICRP and Department of Homeland Security (DHS) guidance and the importance of stakeholder involvement in decision making related to cleanup standards and planning.⁵

The “how clean is clean” issue has plagued radiological disaster planning for decades. These concepts build on evaluations of the merits and drawbacks to various population protection measures in the late phase. For example, in their 1995 article drawing heavily on interviews and studies conducted after the Chernobyl accident, Lochard and Pretre emphasize the concept of the acceptability of countermeasures in relation to the perception of risk for the involved population, which will naturally vary with circumstances. They conclude that the most difficult decisions relate to those areas of more moderate risk that require significant changes in daily routine over long periods—as opposed the highest risk areas where drastic measures are more obviously necessary.⁶

Report No. 175 stands out among radiation protection publications for its attention to harmonizing general disaster resilience and recovery planning with traditional emergency and technical radiation management guidance. Throughout, it intertwines detailed radiation management methodologies with general resilience and recovery preparedness guidance points from sources such as: the *National Disaster Recovery Framework*; the Federal Emergency Management Agency’s (FEMA) *A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action*; FEMA’s *Long Term Community Recovery Planning Process: A Self-Help Guide*;

⁵ Ibid., 18–20.

⁶ Jacques Lochard, and Serge Prêtre, “Return to Normality after a Radiological Emergency,” *Health Physics* 68, no. 1 (1995): 21–26.

and the work of the Community and Regional Resilience Institute, among others.⁷ The report includes detailed appendices describing the long term impacts, protective actions, and late phase measures for the major nuclear/radiological incidents around the world, including Fukushima and Chernobyl.

B. CHERNOBYL RECOVERY

Perhaps the easiest way to put the first four years of community recovery after the Fukushima disaster in context is to read about the fate of villages and residents surrounding the Chernobyl plant. The accident was spurred by an ill-conceived safety test that led to an explosion and a raging graphite fire in the unit 4 reactor in the early morning hours of April 26, 1986.⁸ Authorities evacuated the 45,000 residents of the town of Pripyat, two miles away, beginning the afternoon of April 27 and an additional 90,000 people from surrounding villages by May 31.⁹ Former Soviet official Grigori Medvedev describes an almost surreal scene of a slow onset evacuation, with poorly informed residents continuing to spend time outdoors right up until the buses arrived. Yet since naïve officials assumed the evacuation would be of short duration, they told residents to bring little and simply close windows and doors and turn off the gas. Within days, radioactive particles passed through cracks and covered all surfaces.¹⁰

Later, officials relocated additional villages in Ukraine and Belarus, resulting in hundreds of thousands of people displaced permanently. The catastrophe resulted in

⁷ National Council on Radiation Protection and Measurements, *Decision Making for Late-Phase Recovery*; Federal Emergency Management Agency, *National Disaster Recovery Framework* (Washington, DC: Federal Emergency Management Agency 2011), <http://www.fema.gov/national-disaster-recovery-framework>; Federal Emergency Management Agency, *A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action* (Washington, DC: Federal Emergency Management Agency, 2011), <https://www.fema.gov/media-library/assets/documents/23781>; Federal Emergency Management Agency, *Long Term Community Recovery Planning Process: A Self-Help Guide* (Washington, DC: Federal Emergency Management Agency, 2005), <https://www.fema.gov/media-library/assets/documents/6337>; Community and Regional Resilience Institute, “Resilient Communities,” accessed January 22, 2015, <http://www.resilientus.org/>

⁸ Grigori Medvedev, *The Truth about Chernobyl*, trans. Evelyn Rossiter (New York: Basic Books, Inc., 1991), 46–77.

⁹ David R. Marples, “The Chernobyl Disaster: Its Effect on Belarus and Ukraine,” in *Long Road to Recovery: Community Responses to Industrial Disaster*, ed. James K. Mitchell (United Nations University Press, 1996), 190.

¹⁰ Medvedev, *The Truth about Chernobyl*, 181–188.

widespread, enduring psychological distress, 6,000 documented cases of thyroid cancer in children, extensive environmental contamination, and profound economic disruption throughout the region.¹¹ Nearly thirty years later, the disaster is not fully resolved. The sunken, molten reactor core continues to be a threat to the water table that supplies the city of Kiev. The hastily built sarcophagus from 1986 is deteriorating, so an international consortium of donors is paying for a multi-billion dollar dome cover to replace it.¹²

It is difficult to compare the Soviet information management efforts after Chernobyl to public information expectations in the U.S. or Japan. Soviet officials waited two full days before publicly acknowledging the accident had happened at all. Children attended school and played in the streets the next day. Five days after the accident, the May Day parade continued as scheduled in nearby Kiev. Public statements continually reassured residents that radiation levels were improving though specific numbers were rarely offered. Official maps of the estimated fallout were first released years later. The official number of deaths stands at 31, but this number is disputed and later deaths are difficult to attribute.¹³

David R. Marples, historian and Ukraine/Belarus specialist at the University of Alberta, has written extensively about the impacts of the Chernobyl disaster. He published *The Social Impact of the Chernobyl Disaster* in 1988 and later contributed a chapter about the effect of the Chernobyl disaster on Belarus and Ukraine in James K. Mitchell's *The Long Road to Recovery: Community Responses to Industrial Disaster* in 1996.¹⁴ Marples describes the gradual rise of local victim action groups and involvement of international organizations to assist the survivors and the governments of the Ukraine,

¹¹ United Nations Development Programme, *The Human Consequences of the Chernobyl Nuclear Accident: A Strategy for Recovery* (New York: United Nations, 2002), <http://www.un.org/ha/chernobyl/docs/report.pdf>, 28–32; Vladimir A. Kirichenko, Alexander V. Kirichenko, and Day E. Werts, “Consequences and Countermeasures in a Nuclear Power Accident: Chernobyl Experience,” *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 10, no. 3 (2012): 317.

¹² Henry Fountain, “Chernobyl: Capping a Catastrophe,” *New York Times*, April 27, 2014, <http://www.nytimes.com/interactive/2014/04/27/science/chernobyl-capping-a-catastrophe.html>

¹³ Marples, “The Chernobyl Disaster,” 189–193.

¹⁴ David R. Marples, *The Social Impact of the Chernobyl Disaster* (London: Macmillan Press, 1988); Marples, “The Chernobyl Disaster,” 183–230.

Russia, and Belarus. Though clearly wary of the IAEA as an organization devoted both to nuclear safety and the advancement of nuclear power, he outlines the invaluable assistance the organization provided as it delicately managed a tentative relationship with Soviet officials.¹⁵ His recommendations for improved response and early recovery actions for nuclear accidents are consistent with current preparedness protocols for nuclear plants and surrounding jurisdictions.¹⁶

One example of the continuous flow of international support is the Chernobyl Forum. IAEA initiated the Forum in 2002 in cooperation with several United Nations subcomponents, the World Bank, and the governments of Belarus, the Russian Federation, and Ukraine. The Forum published its report in 2006: *Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine*. The report reviews the long-term health, social, and economic impacts from Chernobyl and the countermeasures enacted afterwards. Because of successful countermeasures, the primary health impacts to the general population have been limited to a significant increase in thyroid cancer among exposed children and widespread psychological distress.¹⁷

Drawing heavily from a 2002 report of the United Nations Development Programme, the Chernobyl Forum team estimates more than 350,000 people relocated from the most contaminated areas of Ukraine, Belarus, and Russia. Most of those were forced to move several years after the accident. The relocations have had significant, rippling and lasting social impacts on the villagers involved. Though the government paid compensation and provided free housing, many people remain deeply unhappy about being compelled to move and the loss of control over their lives. Studies indicate those who stayed or went back despite official bans have coped better psychologically than those forced to move. The populations in the affected areas are disproportionately aged

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ David Kinley III, ed., *Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine*, 2nd ed. (Vienna, Austria: International Atomic Energy Agency, 2006), 7.

since many younger people moved away voluntarily. With a limited workforce, it has been difficult to retain adequate services to support communities.¹⁸

The financial strain on the governments was still acute at the time of the Chernobyl Forum report in 2006. Ukraine, Belarus, and Russia were still providing compensation related to the Chernobyl impacts for approximately seven million people at that time. The governments were not able to sustain the plans to develop resettlement communities, leaving unfinished homes and empty public facilities in some locations. The team describes a “dependency culture” that grew among the inflated rolls of people used to receiving the Chernobyl compensation benefits. Stuck in an environment with few other economic prospects, the reliance on the government payments has stymied the natural capacity of the population to lead its own recovery.¹⁹

The Chernobyl Forum report recommends refocusing limited resources to provide targeted assistance to those who suffered true health impacts due to Chernobyl, redesigning social and economic programs to address the broader community needs, and helping those able to manage on their own to do so. The report also recommends returning areas with reduced contamination levels to occupational use.²⁰ At the time, discussions were considering the potential for redeveloping portions of the Exclusion Zone in Ukraine, though it may be most suitable for industrial use such as supporting the construction efforts for the new reactor cover.²¹

Shortly before the Chernobyl Forum published its final report, a team led by Jim T. Smith and Nicholas A. Beresford, ecologists from the United Kingdom edited a book assessing the long term impacts of Chernobyl. The book’s primary contribution is detailed explanations of the far-reaching environmental damages, protections and remediation applied, as well as prospects for recovery. Smith and Beresford summarize a wide range of research related to the radioactive depositions and subsequent effects on wildlife and

¹⁸ Kinley, *Chernobyl’s Legacy*, 35–6; United Nations Development Programme, *The Human Consequences of the Chernobyl*.

¹⁹ Kinley, *Chernobyl’s Legacy*, 33–38.

²⁰ *Ibid.*, 42–3.

²¹ *Ibid.*, 31.

the terrestrial and aquatic systems of rural Ukraine, Belarus, and Russia. They describe the various types and effectiveness of countermeasures applied to reduce the spread of contamination and reduce internal uptake through the food chain. Other direct human ramifications fill two chapters detailing the health consequences and the long term social and economic effects.²²

One issue that remains controversial after Chernobyl is whether the full regime of permanent relocations undertaken was necessary. An official at the Russian Ministry of Public Health's Institute of Biophysics argues that many of the long term radiation protection measures were excessive and unnecessary, resulting in increased detrimental economic and social impacts. Discussing the decision to relocate hundreds of thousands of people in the journal *Health Physics* in 1996, I.V. Filyushkin states, "this measure was obviously groundless, both medically and socially." He points to the decision making in the political aftermath of Chernobyl as it coincided with the breakup of the Soviet Union which he believes was more influenced by emotionally charged rhetoric and politics than science.²³ The Chernobyl Forum alludes to this controversy as well, noting that the benefits of the majority of relocations are unclear because they occurred years after the incident.²⁴

C. COMPARING FUKUSHIMA TO CHERNOBYL

The Fukushima accident is frequently compared to the Chernobyl disaster in the media and a number of scholarly articles compare the radiological contamination levels and potential health impacts between the two incidents. However, few if any scholarly articles yet compare the lessons of Chernobyl to Japanese efforts to manage relocation and recovery of communities. NCRP Report No. 175 catalogues the broad impacts and countermeasures for all the major international nuclear/radiological incidents in its appendices, including Chernobyl and Fukushima.

²² Jim T. Smith, and Nicholas A. Beresford, *Chernobyl: Catastrophe and Consequences* (Chichester, UK: Springer, 2005).

²³ I. V. Filyushkin, "The Chernobyl Accident and the Resultant Long-Term Relocation of People," *Health Physics* 71, no. 1 (July 1996): 4–8.

²⁴ Kinley, *Chernobyl's Legacy*, 35.

One recent report includes both disasters in its examination of the implications of mass population displacement for improvised nuclear device planning in the U.S. In 2013, Monica Schoch-Spana and colleagues from the Center for Biosecurity at the University of Pittsburgh Medical Center (UPMC) completed a comparative case study of eight disasters, including Fukushima and Chernobyl. Though it is not a direct comparison between the two nuclear disasters, the report synthesizes lessons from all eight disasters to derive a list of general recommendations for planning for population displacement.²⁵

Ann Norwood, an MD, contributed the Chernobyl chapter to the UPMC report. She describes how authorities lost credibility early on and never regained it due to delayed announcements of the accident and downplaying the magnitude of the risk, a pattern repeated to a lesser extent in Japan. After Chernobyl, rural villagers were moved to city apartments and a number chose to sneak back to their contaminated homes rather than stay. Later surveys demonstrate that towns that were relocated together suffered less mental stress overall. Another concern she notes is that the types and relative liberality of assistance provided to evacuees spurred envy among new neighbors and validated residents' health fears. She also discusses the later success of the European ETHOS and CORE programs, which established community-based, self-managed, protective measures to reduce exposure and consumption of contaminated food and drink for those still living in areas with low dose contamination.²⁶

Ryan Morhard's chapter describing the impact of the Fukushima disaster focuses primarily on the hardships faced by families and individuals living in evacuation centers for extended periods. He notes the discomforts and difficulties finding suitable work for rural villagers moving to urban locations, an issue that had arisen after Chernobyl. He describes the TEPCO and governmental compensation to evacuees and some of the negative side effects. He recommends careful balancing of the actual health risk versus the disruptive impacts of relocations.²⁷

²⁵ Monica Schoch-Spana et al., *Mass Population Displacement After a Nuclear Terrorist Attack: How to Hasten and Strengthen the Recovery of Uprooted Communities* (Baltimore, MD: UPMC Center for Health Security, 2013).

²⁶ *Ibid.*, 32–45.

²⁷ *Ibid.*, 20–31.

Schoch-Spana's overall recommendations based on the eight case studies of displacement in the report include: avoid relocation when possible; rebuild livelihoods; prepare for supporting vulnerable populations; respect self-determination; preserve family and community ties; fight stigmatization; bolster mental health; and support host communities.²⁸

Thus, far, the literature relating to the 2011 Japan disaster recovery is more focused on the larger earthquake/tsunami disaster, with limited references to management of the radiological disaster specifically. The articles that do focus on the radiological impacts tend to focus on technical data about radiation depositions and/or health monitoring. Few assess the disaster management decision making based on that data, particularly as relates to decisions beyond year one. The most comprehensive coverage in the scholarly literature of the management of the radiation aspects of the disaster appear to relate to health implications and risk communication.

D. RISK COMMUNICATION

One of the most prevalent themes across the Chernobyl and other radiological disaster management literature is communication with the public and other stakeholders. In order to help the public make informed decisions quickly, it is critical for the government agencies to work out differences and provide unified, or at least consistent, public messaging. For the intermediate and late phase, the public will seek straightforward avenues to provide input into the restoration decisions that will have vital impacts on their livelihood. Amidst all this, public officials routinely face the challenge of outside experts providing contradictory information and advice.

The commonly accepted definition of risk communication, as provided by the National Academies of Science (NAS), is

an interactive process of exchange of information and opinion among individuals, groups, and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, that express

²⁸ Ibid., 112-3.

concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management.²⁹

The NAS definition was a deliberate departure from widespread understanding at the time (1989) because the committee had identified a need to emphasize the multi-directional nature of communications between the public and risk managers in government and industry.

1. Public Trust

Regarding risk communication as an interactive process with the public, in other words a stakeholder engagement, is an important factor in establishing and maintaining trust between members of the public and government and industry officials. Dr. Paul Slovic, of the University of Oregon Department of Psychology, summarized in *Risk Analysis* in the early 1990s a spate of recent studies showing that a growing dearth of trust was a primary factor in controversial political disputes about environmental and technological regulation.³⁰ For the nuclear industry, this is not surprising in the wake of the Three Mile Island meltdown in 1979 and the Chernobyl explosion in 1986. Though Slovic's article seems somewhat sympathetic to the nuclear industry, it is often cited in the risk management literature relating to public trust. He describes research showing that we tend to casually accept certain technological risks, such as medical procedures involving radiation, but have less confidence in industrial hazards such as chemical and nuclear plants. This can be related to polling that ranks the industries and their government regulators consistently low on trustworthiness.³¹

It is probably not surprising to anyone that from a psychological standpoint trust is more difficult to gain than it is to lose. Also, the trust relationship is very susceptible to breakage by a negative event. Once broken, regaining the trust relationship is extremely difficult and sometimes irretrievable. Slovic describes research confirming and elaborating on the factors that underlie the phenomenon. Negative incidents that damage

²⁹ National Research Council, *Improving Risk Communication* (Washington, DC: National Academy Press, 1989), 21.

³⁰ Paul Slovic, "Perceived Risk, Trust, and Democracy," *Risk Analysis* 13, no. 6 (1993): 675–682.

³¹ *Ibid.*

trust are more noticeable and carry more weight than positive actions and events. People tend to give more credibility and the news media more air time to a negative source of information than positive ones. This was shown in a study where two stories, one positive and one negative on a similar risk, were published in an academic journal at the same time. The negative story got more media attention. One reason distrust is difficult to reverse is that we are likely to avoid constructive interaction with people and organizations we do not trust, thereby limiting any possibility to change our perceptions.³²

The factors that make one group seem more trustworthy to us depend on what type of group we are according to survey conducted by Peters, Covello, and McCallum in 1997. They find that for industry, actions demonstrating caring and compassion will improve our perceptions of a company's credibility, perhaps because we expect the opposite. For government agencies, commitment is the most important factor for the public to trust spokespersons and the agency they represent. The team also asked what makes citizen advocacy groups trustworthy. For these groups it is important they exhibit knowledge and expertise.³³

Dr. Steven M. Becker, of the College of Health Sciences at Old Dominion University, has written several articles evaluating practical applications of the trust research underpinning the risk communication discipline. He describes key results from the Center for Disease Control (CDC) funded "Pre-Event Message Development Project," for which he served as principal investigator. One finding that has important implications for disaster response and recovery is that the public trusts television meteorologists as messengers during disasters.³⁴ Television meteorologists may not be radiation experts but they could be helpful in referring the public to trusted sources of radiation safety information. Becker also points out that health is a primary concern

³² Ibid.

³³ Richard G. Peters, Vincent T. Covello, and David B. McCallum, "The Determinants of Trust and Credibility in Environmental Risk Communication: An Empirical Study," *Risk Analysis* 17, no. 1 (1997), 43-54.

³⁴ Steven M. Becker, "Risk Communication and Radiological/Nuclear Terrorism: A Strategic View," *Health Physics* 101, no. 5 (2011): 553.

people have about radiation hazards and suggests further investment in developing medical professionals and health agencies as trusted sources of information in post-disaster settings.³⁵ This corresponds with Slovic's earlier point that the public is more trusting of radiation management by the medical profession than government officials and industry representatives.

2. Individual Perception of Risk

At a basic level, one element of risk communication is about infusing factual, scientific information into the public's natural rational thinking process to quickly assess and react to danger in the environment. In a more recent, post-9/11 article, a team led by Slovic explores the nature of humans' automatic, nearly subconscious, "experiential system" as it relates to fear and decision making. They describe how the experiential system is both naturally well suited to help us make risk decisions and at other times fails us. The system seems to work well to protect us from imminent dangers in our immediate environment. When judging risks of future loss or danger, we are more likely to give higher value to emotional attachments within our current surroundings. So, for example, people will pay more to insure an item that has sentimental value.³⁶

The experiential system can fail when savvy advertisers or malevolent dictators manipulate it by playing on our natural impulses. Our systems are also naturally pre-dispositioned to pay more attention to our body's basic needs such as hunger, warmth, or addiction than to future risks. Research has also shown that the system is calibrated to give more weight to small threat indicators in our near environment compared to large numbers that are harder to fathom, particularly if remote to us.³⁷

The Slovic team suggests risk managers pay attention to a few key factors: first that the job of analytical and scientific risk information is to assist people to balance their reactive emotions in decision making; careful incorporation of affect into the presentation

³⁵ Ibid.

³⁶ Paul Slovic et al., "Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality," *Risk Analysis* 24, no. 2 (2004): 319.

³⁷ Ibid.

of analytical information can improve how it is perceived; and risk managers must take into account the value of people's emotions and concerns, including how feelings of dread and lack of control impact them.³⁸ The second point on this list warrants a note of caution about professional responsibility. Risk managers must recognize they are in effect always influencing public perceptions and consider the potential consequences of their communication efforts, both intended and unintended.

Dr. Elaine Peters led a team that describes one method humans have to evaluate risk in the context of radiological hazards as "stigma susceptibility." They find that our judgments are influenced not just by stimuli in our environment such as nearby and world events, but also by negative emotions (such as fear and anger) derived from our past experiences. Thus, cultural and geographic differences will affect our reaction to potential dangers. Peters' team notes that previous research characterized stigma as a moral response and their findings that it can be tied to emotion suggest different mitigation strategies. One option they suggest, education programs, would have fewer potential ethical implications since it would not be a direct manipulation of a person's emotional response.³⁹

3. Risk Communication in Disaster Management Practice

Becker discusses the importance and progress of the field of risk communication relating research to practical application for radiological/nuclear terrorism. He defines four phases of advancement and asserts that the U.S. is currently in phase three, "development of improved messages and materials" and transitioning to phase four, "moving beyond better messages and materials." He notes that development of messaging for the recovery phase is a necessary area of further attention. Though Becker does not make the distinction, it may be fair to infer that recovery phase risk communication is still hovering between phase one "awareness of the importance of

³⁸ Ibid.

³⁹ Ellen M. Peters, Burt Burraston, and C. K. Mertz, "An Emotion-Based Model of Risk Perception and Stigma Susceptibility: Cognitive Appraisals of Emotion, Affective Reactivity, Worldviews, and Risk Perceptions in the Generation of Technological Stigma," *Risk Analysis* 24, no. 5 (2004), 1363

communication” and phase two “research initiatives to understand public needs and preferences.”⁴⁰

Dr. Vincent Covello, founder and Director of the Center for Risk Communication, is known for helping organizations to apply risk communication research to practical application, including for disaster management planning. His 2011 *Health Physics* article reads like a bible for risk communicators dealing with radiological emergency planning. It includes basic rules and standard models for effective risk communication in general. The article outlines the primary challenges to effective risk communication and recommends strategies to address them. Over half the article is devoted to practical appendices of strategies and tools specific to radiological emergencies that include message templates and anticipated media and public questions. The questions are organized by topics such as potential health impacts, sheltering in place, evacuation, decontamination of persons, radiation monitoring and data, radiological cleanup, economic impacts, environmental and agricultural impacts, etc. Much of the guidance included in this article is incorporated into NCRP Report No. 175, Appendix E.⁴¹ This list covers some of the late phase recovery issues (e.g., What is being done to combat stigmatization of the community? Can residents get jobs helping with cleanup?) that are rarely found in governmental public information guidance.⁴²

As the NAS definition makes clear and the NCRP Report No. 175 emphasizes, risk communication is not just about sharing information with the public in a transparent way, but also involving stakeholders in decision making. The IRPA’s 2009 publication of Guiding Principles for Radiation Protection Professionals on Stakeholder Engagement provides a commonly accepted foundation. The Health Physics Society endorsed the Guiding Principles in 2010 and NCRP Report No. 175 refers to them throughout and

⁴⁰ Becker, “Risk Communication and Radiological/Nuclear Terrorism,” 551.

⁴¹ National Council on Radiation Protection and Measurements, *Decision Making for Late-Phase Recovery*, 307–48.

⁴² Vincent T. Covello, “Risk Communication, Radiation, and Radiological Emergencies: Strategies, Tools, and Techniques,” *Health Physics* 101, no. 5 (2011): 511–530.

particularly in Section 5.6 *Making Decisions*.⁴³ The IRPA document emphasizes the need for systematic efforts to involve interested parties in decisions and the recognition that not all participants begin with shared understanding of the language and concepts of radiation protection and risk. The ten principles (listed below) may apply to pre-incident decisions such as siting a nuclear power plant or waste storage locations or post-incident decisions about planning for remediation and reoccupancy.⁴⁴

1. Identify opportunities for engagement and ensure the level of engagement is proportionate to the nature of the radiation protection issues and their context.
2. Initiate the process as early as possible, and develop a sustainable implementation plan.
3. Enable an open, inclusive and transparent stakeholder engagement process.
4. Seek out and involve relevant stakeholders and experts.
5. Ensure that the roles and responsibilities of all participants, and the rules for cooperation are clearly defined.
6. Collectively develop objectives for the stakeholder engagement process, based on a shared understanding of issues and boundaries.
7. Develop a culture which values a shared language and understanding, and favours collective learning.
8. Respect and value the expression of different perspectives.
9. Ensure a regular feedback mechanism is in place to inform and improve current and future stakeholder engagement processes.
10. Apply the IRPA Code of Ethics in their actions within these processes to the best of their knowledge.

Experiences after the 2010 Gulf Coast oil spill offer another perspective in applying risk communications concepts in practice after a disaster. With support from the National Science Foundation, George Washington University sociologist Sabrina McCormick assesses the emerging impact of crowd sourced data as a form of citizen

⁴³ Health Physics Society, *Position Statement of the Health Physics Society: Stakeholder Engagement*, 2010, http://hps.org/documents/stakeholder_engagement_ps024-0.pdf; National Council on Radiation Protection and Measurements, *Decision Making for Late-Phase Recovery*, 108–11.

⁴⁴ International Radiation Protection Association, *Guiding Principles for Radiation Protection Professionals on Stakeholder Engagement*, 2008, report no. IRPA 08/08, <http://www.irpa.net/members/54494/%7B86D953FC-5B32-4BF9-91CE-739C8F615F4B%7D/Stakeholder-Engagement-Guiding-Principles.pdf>

science on risk assessment and disaster recovery policy. She outlines the interplay between official governmental and “responsible party” risk assessment reports, those provided by independent experts, and data gathered by laypersons, specifically crowd sourced collections. McCormick promotes the idea that crowd sourcing is shifting the established model of citizen science and potentially lends new legitimacy to the efforts of environmental and social groups to influence policy.⁴⁵

Crowd sourced data issues have already begun to play out in Japan. Volunteers in Japan and around the world have begun building a radiation detection sensor network using off the shelf and custom built or modified Geiger counters. The Safecast network’s objectives are primarily to put more information into the hands of Japanese residents and to ensure a detailed record of radiation levels is created showing how the radiation levels change over time for future research purposes.⁴⁶ The rise of the Internet has completely changed the playing field for risk communication, making the public less dependent on “official” information sources. Planners and policymakers now must factor the pervasive use of widespread radiation detection and crowd sourced posting and mapping of measurements into public information planning for radiological emergencies.

E. SUMMARY AND NEED FOR FURTHER RESEARCH

The literature associated with managing the intermediate and late phase recovery of a radiological disaster has much to benefit from the ongoing experience of managers in Japan. The bulk of the scholarly literature is based on lessons from managing the impacts of Chernobyl. Technical findings about the effectiveness of protective action countermeasures or remediation techniques continue to be transferable and will advance from new technologies and innovations being tested in Japan. The unique political situation of the Soviet Union at the time of the Chernobyl disaster makes it difficult to evaluate and relate observations about many of the overarching disaster recovery management decisions and practices. The context of the population relocations in Japan is much more similar to what U.S. managers would face after a radiological disaster—an

⁴⁵ Sabrina McCormick, “After the Cap: Risk Assessment, Citizen Science and Disaster Recovery,” *Ecology & Society* 17, no. 4 (2012). <http://www.ecologyandsociety.org/vol17/iss4/art31/>

⁴⁶ Safecast, “About Safecast,” accessed January 6, 2014, <http://blog.safecast.org/about/>

active, questioning media; citizens armed with high expectations and easily accessible and conflicting information; a land use system based on private property rights; and a stable national government in place to coordinate recovery support.

With few exceptions, the majority of articles and books related to radiological disaster management focus narrowly on either the immediate response or the technical or health implications of the recovery. Few tackle the broader and intricate issues of supporting relocated populations and businesses while juggling remediation, hazardous waste management, and infrastructure restoration. The Fukushima disaster is still in its infancy; as is the literature developing out of the experience. Additional research reviewing the decision making and outcomes related to managing the relocations and resettlements in areas affected by radiological contamination will be beneficial to ensure lessons from this tragic experience are captured.

III. METHOD

This thesis is designed to answer the primary research question, “what lessons can the U.S. incorporate into its disaster management plans from Japan’s experience managing the relocation of communities due to the contamination from the Fukushima Daiichi nuclear plant?” This study applies a basic comparative analytical approach, with the objective of identifying practical lessons that can be applied in the U.S. for planning for future disaster recovery management. The case reviews events, decisions, and outcomes after the Fukushima disaster and identifies key practices and potential lessons that may be useful for U.S. nuclear disaster recovery planners.

To derive and assess potential lessons, the author collected and reviewed over 400 source documents available from the Japanese central government, Fukushima Prefecture, the affected municipalities, TEPCO, nongovernmental organizations, and the media. In addition, the author reviewed scholarly articles and books published regarding the 2011 disaster. The recommendations are based on a comparative analysis of lessons derived from the case for applicability to disaster management policies, plans, and experience in the United States.

A. UNIT OF ANALYSIS

This is a single social science case study to evaluate and derive lessons from the national and regional/local level governmental decision making regarding management of the relocation and resettlement of communities due to widespread radiological contamination. The case selected is the disaster recovery after the Fukushima Daiichi accident of 2011. The unit of analysis is individual decisions and key practices made by governmental organizations at all levels responsible for disaster management. The study reviews management practices of the Japanese municipalities assisting residents and businesses, as well as those of the Fukushima Prefectural government and the Japanese central government, primarily the executive and legislative branches.

B. CASE SELECTION

During the design phase of this research, the researcher considered a multi-case study design to provide a more full comparison between the Chernobyl case and the Fukushima case. Ultimately, based on the literature review, the researcher adopted the single case design. The primary criterion for selecting the Fukushima case is that it is a recent, unique disaster incident that involves extended displacement of communities due to radiological contamination. Before Fukushima, the most significant international nuclear power plant incident was the 1986 explosions at Chernobyl, Ukraine (Soviet Union). The most significant U.S. incident was the partial core meltdown at Three Mile Island, Pennsylvania in 1979.

The Chernobyl explosions resulted in widespread, significant radioactive releases, the abandonment of a number of surrounding villages, and relocation of over 350,000 people.⁴⁷ The communist regime of the Soviet Union managed the accident aftermath, with very different standards for transparency and inclusiveness from the U.S. Since 1986, technologies for monitoring and managing contamination and tools for communication between disaster managers and with the public have transformed dramatically. This means that some recovery management practices from the Chernobyl incident are simply no longer relevant compared to the Japan case. The primary utility of the Chernobyl example is the time that has elapsed since the accident, which allows for examination of the enduring impacts of recovery policy decisions.

The Three Mile Island nuclear power plant accident in 1979 caused the Governor to recommend people within a ten mile radius stay indoors and to order the evacuation of children and pregnant women within a five mile radius for a brief 10 days. Many more people voluntarily evacuated during the emergency period. A very small amount of radiation was released beyond the plant site.⁴⁸ Despite the minimal radioactive release, the accident resulted in \$1.3 million in American Nuclear Insurers' payouts to evacuees and over \$81 million in estimated economic losses to businesses within a 20 mile

⁴⁷ United Nations Development Programme, *The Human Consequences of the Chernobyl*, 32.

⁴⁸ U.S. Nuclear Regulatory Commission, "Backgrounder on the Three Mile Island Accident," accessed September 12, 2014, <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html>

radius.⁴⁹ Recovery phase lessons from Three Mile Island are of limited value for this inquiry because of the lack of offsite impacts and the communications and other technology changes since 1979.

Despite significant cultural differences with the U.S., Japan is a modern, developed country, with high-tech buildings and infrastructure, and some of the most advanced disaster resistant technologies and building codes in the world.⁵⁰ Japan has a western-style, democratic, parliamentary system of government with a prime minister and a Diet with two houses, which have been controlled by different parties since 2007.⁵¹ Japan does lack a comprehensive disaster management law and central agency with corresponding responsibility such as the Federal Emergency Management Agency.⁵² Still, disaster management lessons from Japan will be more transferable than nearly any other large international calamity over the last decade because of these important similarities to the U.S. Additionally, being a recent event, the technological tools and forms of public media employed during recovery management are contemporary for planning purposes.

The Japanese government had the benefit of information and outcomes from the Chernobyl and Three Mile Island experiences, and Japanese policies and actions would have attempted to incorporate many of these lessons. As such, Chapter II, Literature Review, summarizes the rich body of literature from the Chernobyl accident as a reference point for this analysis.

⁴⁹ Peter S. Houts, Paul D. Cleary, and Teh-Wei Hu, *Three Mile Island Crisis: Psychological, Social, and Economic Impacts on the Surrounding Population* (University Park, PA: Pennsylvania State University Press, 1988), 7, 45.

⁵⁰ K. Crowley, and John R. Elliott, "Earthquake Disasters and Resilience in the Global North: Lessons from New Zealand and Japan," *The Geographical Journal* 178, no. 3 (2012): 208.

⁵¹ Jeff Kingston, ed., *Natural Disaster and Nuclear Crisis in Japan: Response and Recovery after Japan's 3/11* (New York: Routledge, 2012), 189.

⁵² Alex Greer, "Earthquake Preparedness and Response: Comparison of the United States and Japan," *Leadership and Management in Engineering* 12, no. 3 (2012): 111–125.

C. LIMITATIONS OF THE STUDY

This study is specifically focused on decision making related to management of the relocation and resettlement of communities (residents, businesses, municipal services) due to the radiological contamination. Some of the major recovery management factors include: public messaging regarding potential health impacts, relocation logistics, and available assistance; preparing host communities to receive and support temporarily displaced residents; assisting residents to maintain or re-establish livelihoods; ensuring physical and mental health of residents; ensuring continuity of critical infrastructure and other key community services; and orchestrating decontamination and waste disposal work.

Each of these factors alone is complex and multi-layered. This thesis necessarily touches lightly on some factors due in part to scope limitations, but also in order to retain attention on the research questions. For example, psycho-social support and infrastructure restoration are both significant capabilities for recovery management and are essential to the re-establishment of communities displaced by disaster. Given resource and information availability limitations, this study includes references to psycho-social support and infrastructure restoration efforts in the larger context without examining them individually in-depth.

The study does not focus on the causes of the disasters themselves or other immediate response efforts other than evacuation. Similarly, the disaster management efforts that relate solely to the earthquake and tsunami impacts in Japan are beyond the scope of this effort. The case description will provide brief summary accounts to provide context. To the extent that management and decisions relate to the overall disaster including the radiological impacts, they may be included.

A wealth of information and official documents related to this disaster are available and easily accessible in English. In some cases, documents or websites of interest are not yet available with official English translations. The study utilized informal translations when necessary to identify source existence and locations. For example, some municipalities offer English versions of their websites and some

documents and plans related to the recovery are posted in English translation versions. If a municipality's website is only available in Japanese, the researcher may have used informal translations to determine that a revitalization plan was posted and the date in order to establish a more complete chronology. The plan content is only used as a primary source when an official translation is available. The major findings of the study are based on official translations (frequently labeled provisional) and original English source materials.

D. DATA SOURCES

To compile the case, the author collected and reviewed over 400 source documents in four categories: 1) government reports, plans, press releases, survey results, website postings, etc.; 2) Japanese and international media reports about the incident, impacts, and ongoing recovery; 3) publications of interested organizations (international advisory bodies, advocacy groups, professional associations, etc.) about the disaster; and 4) scholarly literature about the event and aftermath.

Based on the best practices outlined by Robert K. Yin in *Case Study Research, Design and Methods*, this research examines decisions and practices from more than one perspective to the extent possible using documents from different sources for triangulation and comparison.⁵³ For example, if the central government published a plan, the plan itself as well as media accounts and third party critiques regarding the plan are included and evaluated against the case study questions.

E. TYPE AND MODE OF ANALYSIS

This research followed a case study protocol designed to explore the selected research questions. The protocol includes the following steps:

1. Develop a case study database to organize the source documents and notes from document review relative to the research questions.
2. Collect, categorize by event date and keyword, and organize in the database, documents from the sources described in section III.D. The

⁵³ Robert K. Yin, *Case Study Research: Design and Methods*, vol. 5, 3rd ed. (Thousand Oaks, CA: Sage Publications, 2003), 97.

assigned keywords relate each document to the following policy themes/management capabilities:

- a. evacuation and sheltering
 - b. public information/risk communication
 - c. recovery planning and stakeholder involvement
 - d. temporary housing
 - e. decontamination
 - f. resettlement
3. Review documents to identify the chain of events, decisions/key practices, influencing variables, and potential outcomes.
 4. Compare decisions/key practices and outcomes to assess how well the identified lessons might apply in the U.S. disaster management context.
 5. Report findings.

F. OUTPUT

The results of this research and analysis are summarized in Chapters IV–VI. Chapter IV, *Relocation and Recovery after the Fukushima Nuclear Accident*, which describes the onset of the Fukushima Daiichi meltdown through the present day ongoing recovery and resettlement, serves as the focal point of the report. The structure of Chapter IV is a hybrid of chronological and thematic description. Each section in the case narrative explores a core recovery management capability or policy theme and examines the events, actions, decisions, key practices, and reactions related to that theme.

To the extent possible, the sequence of the themed sections follows the general chronology of events and the descriptions within each section are organized to follow the chronology as well. Because activities occur simultaneously that influence multiple themes, the resulting narrative gives precedence to the themes over pure chronology when necessary.

Chapter V summarizes in tables the evaluation of effectiveness of key practices and how applicable the lessons derived from the Fukushima experience would be in the U.S. policy environment. This analysis compares the decisions and events in Japan to the political/organizational, geographical, and cultural environment in the U.S.

The study concludes with a set of planning recommendations for U.S. nuclear/radiological disaster recovery managers based on the analysis results. Chapter VI also highlights five potential topics for future research that would benefit U.S. radiological disaster recovery planning efforts. Leaders and planners will be able to apply the recommendations in the final chapter to enhance efforts to prepare for the intermediate and late phase recovery from radiological disasters.

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IV. RELOCATION AND RECOVERY AFTER THE FUKUSHIMA NUCLEAR ACCIDENT

Wrecked fishing boats still lie stranded miles inland and there are vast piles of scrap metal, smashed cars, bits of concrete bridges and broken wooden house frames where once a thriving village stood. An abandoned elementary school, 500m from the sea, looks as though it has been bombed.

—Simon Tisdall, *Guardian*, describes Namie, Japan in January 2014⁵⁴

A. INTRODUCTION

The core of this case study is to fully understand the decision making related to management of the relocation and resettlement of communities due to the radiological contamination in Fukushima. This account includes a brief summary of the disaster management context in Japan as well as an overall disaster event description.

It is important when examining the decision making of officials in Japan to remember they are managing the impacts of three nearly simultaneous disasters, any one of which would challenge the most seasoned professionals. Nonetheless, in order to focus the case description on the underlying research questions of this study, the narrative includes only minimal references to the disaster management efforts that relate solely to the earthquake and tsunami impacts. To the extent that management and decisions relate to the overall disaster including the radiological impacts, they are included. Likewise, the narrative incorporates only limited references to the causes of the nuclear meltdown itself or other immediate response efforts. The case description focuses on the concerns and recovery management efforts related to the sudden, forced relocation of people and communities, beginning with the evacuation.

Chapter IV is divided up by thematic sections in order to explore the issues and key recovery support practices relevant to the research questions. This case does not

⁵⁴ Simon Tisdall, "Fukushima Ghost Towns Struggle to Recover Amid High Radiation Levels," *The Guardian*, January 1, 2014, <http://www.theguardian.com/environment/2014/jan/01/fukushima-ghost-towns-high-radiation-levels-tsunami>

attempt an exhaustive accounting of the innumerable impacts, issues, and decisions involved in managing recovery after a nuclear disaster. The timeline of events related to each theme are grouped together in the relevant section.

B. JAPAN'S DISASTER MANAGEMENT SYSTEM

It is hard to imagine there is a more disaster-prone nation in the world. Between the years 2004–2014, 302 earthquakes of a magnitude 6.0 or higher struck Japan. Despite its relatively small size, the 302 comprised 18.5 percent of all such earthquakes worldwide. Japan also has seven percent of the world's active volcanoes and is subject to typhoons, flooding, heavy snow, and landslides.⁵⁵

The overarching law that governs national disaster related authorities, systems, and plans in Japan is the Disaster Countermeasures Basic Act. Under the Act, a Central Disaster Management Council is responsible for advising the prime minister and ensuring a national Basic Disaster Management Plan is in place that encompasses the full preparedness cycle. The Plan was overhauled after the Great Hanshin-Awaji Earthquake of 1995 and includes a substantial section on recovery and rehabilitation. Each prefecture and municipality also must have a disaster management council and local disaster management plan.⁵⁶

Under the national Plan, a team of the directors general from each ministry gather in the Crisis Management Center within the prime minister's office during an incident to coordinate and advise the prime minister. If necessary, the government may establish a Headquarters for Disaster Management, which would be led by the Minister of State for Disaster Management, or in extreme events, the prime minister.⁵⁷ After a 1978 earthquake and again after the 1995 earthquake which killed 6,400 people, Japan has continually strengthened its policy framework to invest in codes and structural hazard

⁵⁵ Cabinet Office, Government of Japan, "Disaster Management in Japan," 2014, http://www.bousai.go.jp/1info/pdf/saigaipamphlet_je.pdf, 1.

⁵⁶ Ibid., 8–9.

⁵⁷ Ibid., 10.

mitigation of buildings and infrastructure to reduce loss of life and damages from earthquakes.⁵⁸

Japan's disaster management system includes a comprehensive program of "Recovery and Rehabilitation Measures" in the form of subsidies, loans, insurance, tax breaks, or direct payments by the central government to support rebuilding of public facilities and infrastructure, agriculture, small businesses, and livelihoods. Another enhancement enacted after the 1995 earthquake is the Act on Support for Livelihood Recovery of Disaster Victims passed in 1998. The act provides for payments of up to three million yen (approximately \$25,074) after certain larger disasters to households when the home is destroyed.⁵⁹ However, Japanese policy generally provides little support for individuals to reconstruct their own homes.⁶⁰

1. Nuclear Power Regulation and Emergency Preparedness

The primary governing authorities for regulation of nuclear power and emergency preparedness prior to the 2011 disaster are the Atomic Energy Basic Act, the Reactor Regulation Act, the Electricity Business Act, the Act on Special Measures for Nuclear Disasters. The Atomic Energy Basic Act, enacted in 1955 established the foundational philosophy that nuclear energy development in Japan would be for peaceful purposes and conducted safely.⁶¹

Under the Electricity Business Act and the Reactor Regulation Act, the Ministry of Economy, Trade, and Industry (METI) licensed nuclear reactor operations and its subcomponent, the Nuclear and Industrial Safety Agency, conducted safety inspections.

⁵⁸ Ibid., 15.

⁵⁹ Ibid., 38.

⁶⁰ Yoshimitsu Shiozaki, "Housing Reconstruction and Community Development," in *The Great East Japan Earthquake 2011 Case Studies* (Kobe, Japan: United Nations International Recovery Platform, 2013), http://www.recoveryplatform.org/outfile.php?id=1026&href=http://www.recoveryplatform.org/assets/irp_case_studies/ENGLISH_RECOVERY%20STATUS%20REPORT%20JAPAN_revised%202014.3.27.pdf, 64-71.

⁶¹ Nuclear Emergency Response Headquarters, *Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety-the Accident at TEPCO's Fukushima Nuclear Power Stations* (Tokyo, Japan: Cabinet Office, Government of Japan, 2011), http://japan.kantei.go.jp/kan/topics/201106/iaea_houkokusho_e.html, II-1

The Radiation Review Council within the Ministry of Education, Culture, Sports, Science and Technology (MEXT) was responsible for oversight of dose limits for radiation workers. MEXT also had responsibility for assisting the prefectures and municipalities with radiation monitoring and measurement.⁶²

The Nuclear Safety Commission, an independent organization under the Cabinet Office, established guidelines to implement the legislative authorities governing the operation of nuclear plants. The commission was also responsible for auditing the safety regulation activities of METI and MEXT, as well as advising the prime minister during emergencies.⁶³

In 1999, Japan had amended the Act on Special Measures for Nuclear Disasters after a criticality accident at a small nuclear fuel preparation plant in Tokaimura. The criticality incident killed two operators and resulted in a one day evacuation of 161 people and indoor precautionary sheltering of 310,000 in the surrounding area.⁶⁴ The new law established provisions for emergency response actions, a declaration of nuclear emergency, convening of a Nuclear Emergency Response Headquarters, and restoration measures.⁶⁵

The Fukushima meltdown caused a new review of the nuclear power regulatory structure in 2011 and 2012. The Nuclear Regulation Authority Establishment Act of June 2012 established a more fully independent Nuclear Regulation Authority that replaced the Nuclear Safety Commission in September of that year.⁶⁶

⁶² Ibid., II-4.

⁶³ Ibid.

⁶⁴ International Atomic Energy Agency, *Report on the Preliminary Fact Finding Mission Following the Accident at the Nuclear Fuel Processing Facility in Tokaimura, Japan* (Vienna, Austria: International Atomic Energy Agency, 1999), 1.

⁶⁵ Nuclear Emergency Response Headquarters, *Report of Japanese Government to the IAEA*, II-8.

⁶⁶ Sayuri Umeda, *Japan: Legal Responses to the Great East Japan Earthquake of 2011*, Law Library of Congress, 2013, <http://www.loc.gov/law/help/japan-earthquake/>, 35–6.

2. Concept of Operations for Nuclear Emergencies

The *Nuclear Emergency Response Manual* was designed to provide a unified concept of response for all the involved authorities and players during radiological emergencies. The operator of a nuclear plant is responsible for managing the incident on-site at the plant and reporting it as soon as possible to METI's Emergency Response Center, which would then notify the Cabinet Office. The Cabinet Office would then establish a Nuclear Emergency Response Headquarters in Tokyo and an off-site Local Nuclear Emergency Response Headquarters near the accident. Senior officials from each ministry deploy to assist with resource and information coordination at the Crisis Management Center within the Cabinet Office, while cabinet ministers would gather with the prime minister.⁶⁷ METI would be responsible for advising the prime minister when pre-determined safety levels warrant designation of a nuclear emergency.⁶⁸ Figure 1 depicts the planned nuclear response organizational structure.

⁶⁷ Investigation Committee on the Accident at the Fukushima Nuclear Power Stations, *Interim Report* (Tokyo, Japan: 2011), <http://www.cas.go.jp/jp/seisaku/icanps/eng/>, 5.

⁶⁸ Nuclear Emergency Response Headquarters, *Report of Japanese Government to the IAEA*, II-9.

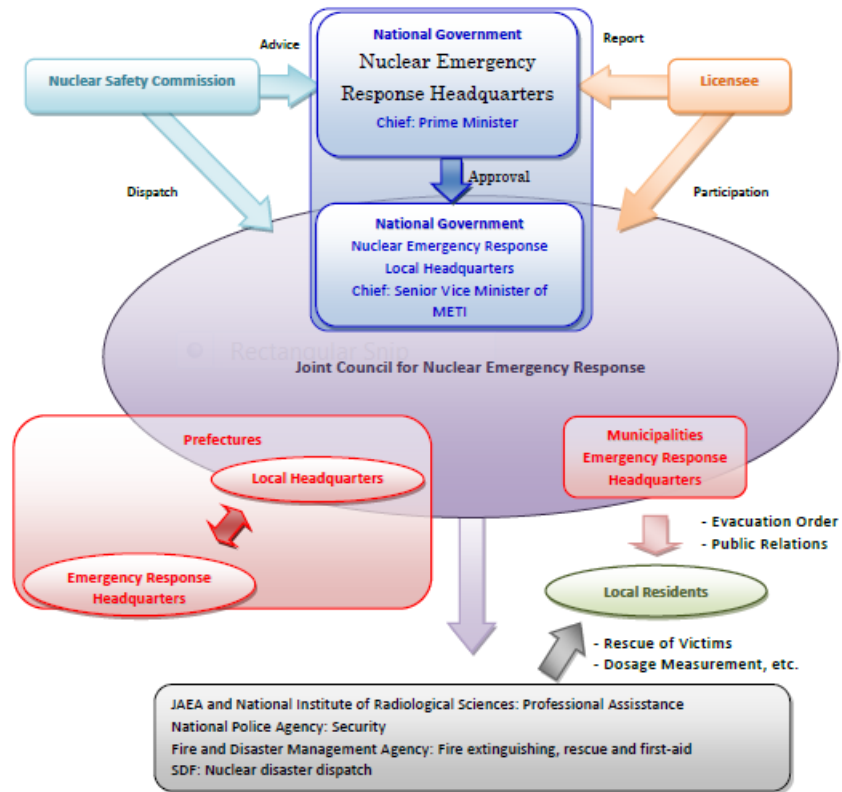


Figure 1. Outline of nuclear emergency response related organizations⁶⁹

C. OVERVIEW OF INCIDENT, IMMEDIATE RESPONSE AND EVACUATIONS

Though triggered by a massive earthquake and tsunami, forces of nature all too familiar to the island nation of Japan, the National Diet’s Nuclear Accident Investigation Commission declared the Fukushima meltdown a “manmade” catastrophe. The Diet Commission’s judgment referred to the inadequate protection of the plant and backup power systems against known hazards as well as poor preparedness of employees, managers, regulators, national and local officials, and the public to respond to such an emergency.

⁶⁹ Ibid., II-12.

1. Cascading Catastrophe

The Great East Japan Earthquake struck at 2:46 pm on March 11, 2011 and registered a 9.0 magnitude on the Richter scale, the largest ever observed in Japan's history.⁷⁰ Fukushima Daiichi units 1, 2, and 3 went into emergency shut down immediately with the onset of seismic tremors. Units 4, 5, and 6 were already offline for routine inspection. Seismic damage also resulted in a total loss of off-site power to the plant.

When the 14–15 meter tsunami waves hit the plant approximately 45 minutes later, all but one (at unit 6) of the 12 backup diesel generators were destroyed. The worst case scenario for nuclear plant safety, a “station blackout” had occurred. Critical emergency cooling systems activated after the earthquake were now lost. The inundation and debris, loss of instrumentation and light, as well as continuing aftershocks severely hampered emergency response efforts by TEPCO employees.⁷¹ Despite efforts to inject freshwater and vent the units, the loss of cooling caused spent fuel rod exposures at reactor 4 and catastrophic core meltdowns in reactors 1 thru 3. Overheating of the core required pressure relief that released radioactive elements as well as gaseous hydrogen into the secondary containment building. The first of three hydrogen explosions occurred the following afternoon in Unit 1. When the hydrogen exploded, it started fires that created large plumes that carried radioactive elements downwind over a large area of the Prefecture.

In its October, 2013 report on the accident, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) estimates the environmental releases of radioactive Iodine 131 to be 10 percent and Cesium 137 to be 50 percent compared to Chernobyl discharges.⁷² The World Health Organization (WHO) estimates that the effective radiation dose for the general population in the most affected areas of

⁷⁰ Investigation Committee on the Accident at the Fukushima Nuclear Power Stations, *Interim Report*, 18.

⁷¹ James M. Acton, and Mark Hibbs, *Why Fukushima was Preventable* (Washington, DC: Carnegie Endowment for International Peace, 2012), 5–8.

⁷² United Nations, *Report of the United Nations Scientific Committee on the Effects of Atomic Radiation: Sixtieth Session*, 2013, http://www.unscear.org/docs/GAreports/A-68-46_e_V1385727.pdf

Fukushima Prefecture outside the 20 km evacuation zone was between 10–50 mSv. The average annual background effective radiation dose worldwide is 2.4 mSv. The WHO report assesses that no appreciable increase of cancer risk will result in the general population from this level of exposure. The report attributes the low level of risk in part to the protective actions including evacuations and food safety measures taken by the central and local governments.⁷³

2. The Evacuation

Evacuations did protect residents, but the evacuation process was improvised, chaotic, and extremely distressing for residents. Unlike the earthquake and tsunami hazards, very little planning and exercise had occurred to prepare local Japanese officials and residents for evacuation due to a radiation leak at the power plant, leading to an ad hoc, confused process fraught with poor communication.⁷⁴ To better understand the evacuee's experiences and prior understanding of risk, the Diet Commission conducted a postal survey of evacuated residents in March 2012. Over 50 percent (10,633 of 21,000) randomly selected households from twelve Fukushima municipalities replied. Fewer than 15 percent of evacuees indicated they had participated in an evacuation drill or been informed of the possibility of a nuclear accident at the plant prior to the earthquake.⁷⁵

The Diet Commission also documents the fractured communications within and between the central, prefectural, and local levels of government. The commission report is particularly critical of the confusion and paralysis within the central government between the prime minister's office, various cabinet ministers, the Nuclear and Industrial

⁷³ The sievert is the international unit to measure radiation dose; mSv stands for millisieverts; μ Sv stands for microsieverts. World Health Organization, *Health Risk Assessment from the Nuclear Accident after the 2011 Great East Japan Earthquake and Tsunami, Based on a Preliminary Dose Estimation* (Geneva, Switzerland: World Health Organization, 2013), http://www.who.int/ionizing_radiation/pub_meet/fukushima_risk_assessment_2013/en/, 37–39.

⁷⁴ Reiko Hasegawa, *Disaster Evacuation from Japan's 2011 Tsunami Disaster and the Fukushima Nuclear Accident* (Paris, France: Institut du développement durable et des relations internationales, 2013), http://www.iddri.org/Publications/Collections/Analyses/STUDY0513_RH_DEVAST%20report.pdf, 6; Pablo M. Figueroa, "Risk Communication Surrounding the Fukushima Nuclear Disaster: An Anthropological Approach," *Asia Europe Journal* 11, no. 1 (2013): 61.

⁷⁵ Fukushima Nuclear Accident Independent Investigation Commission [Fukushima Nuclear Accident Commission], *Official Report Executive Summary* (Tokyo, Japan: The National Diet of Japan, 2012), 58.

Safety Agency, the Nuclear Safety Commission, the Emergency Operations Team within the Crisis Management Center at the prime minister's office, and senior TEPCO officials. With little information coming from the central government, Fukushima Prefecture issued the first official evacuation order for a 2 km zone around the plant on the evening of March 11. Unfortunately unaware of Fukushima's action, the central government issued an order 30 minutes later for a 3 km zone evacuation and shelter in place for 10 km.⁷⁶

However, these conflicting messages apparently reached only a small portion of the at risk population. Despite the prime minister's Declaration of a Nuclear Emergency Situation at 7:03 pm and multiple evacuation orders on March 11, a staggering 80 percent of Fukushima residents first learned of the accident at the plant on March 12 or later.⁷⁷ In a single day (March 12), the central government increased the evacuation zone first from 3 km to 10 km, then to 20 km with no details about the severity of the situation or anticipated duration.⁷⁸ This caused many to bring few necessities, leave pets behind, and some to move multiple times as the zone expanded.⁷⁹

Communications failures resulted in some residents moving into areas with higher radiation concentrations. Radiation monitoring equipment near the plant was damaged in the tsunami, contributing to delays in accurate environmental readings. In the absence of official plume projections, several local officials ordered evacuations that moved residents into the path of higher levels of radiation. Ultimately, it took the government over a month to assemble and analyze the environmental radiation data in order to fully establish all evacuation zones.⁸⁰ It was not until April that some residents who moved into areas of higher concentrations were then instructed to move again.⁸¹

⁷⁶ Ibid., 36.

⁷⁷ Ibid., 50–52.

⁷⁸ Nuclear Emergency Response Headquarters, *Report of Japanese Government to the IAEA*, V-7.

⁷⁹ Fukushima Nuclear Accident Commission, *Official Report Executive Summary*, 38.

⁸⁰ Steven M. Becker, "The Fukushima Dai-Ichi Accident: Additional Lessons from a Radiological Emergency Assistance Mission," *Health Physics* 105, no. 5 (2013): 455–461.

⁸¹ Fukushima Nuclear Accident Commission, *Official Report Executive Summary*, 19.

The evacuation of elderly nursing home residents out of the 20 km zone around the nuclear plant was harrowing and disastrous in and of itself. Fifty patients were confirmed to have died during the hurried and muddled evacuation.⁸² Fukushima Medical University reports that mortalities for elderly evacuees increased overall 2.4 times the 2010 rate for senior Fukushima residents, with even higher rates in the first 3 months. Contributing factors include poor planning for evacuation of institutions housing elderly residents, inadequate supplies of warm blankets and food to support evacuees, multiple moves over a short period, and refusals to accept elderly evacuees from radiation zones at relocation sites. Given the high mortality rates for elderly evacuees, a number of researchers have recommended that serious consideration be given to limiting or staggering evacuations of nursing homes during radiological disasters, depending on the situation.⁸³

While the planned evacuations in villages like Iitate were undertaken in an orderly manner over a month after the initial disaster, mixed messages and uncertainty of the situation during the intervening period may have been detrimental for residents. From March 15 to April 22, a shelter indoors order applied to the rest of the 20–30 km zone around the plant. Many residents confined themselves to more sedentary lifestyles during this time, potentially exacerbating chronic health conditions, especially for the elderly.⁸⁴

Ultimately, 154,000 Fukushima residents evacuated, 107,000 of whom were from the evacuation order areas. Most (97,000) found temporary housing elsewhere in the Prefecture, and 57,000 were living in other prefectures as of May, 2013.⁸⁵ With whole towns empty, government officials have faced significant challenges just maintaining

⁸² Koichi Tanigawa et al., “Loss of Life After Evacuation: Lessons Learned from the Fukushima Accident,” *The Lancet* 379, no. 9819 (2012): 889–891, DOI:10.1016/S0140-6736(12)60384-5.

⁸³ Shuhei Nomura et al., “Mortality Risk amongst Nursing Home Residents Evacuated after the Fukushima Nuclear Accident: A Retrospective Cohort Study,” *PloS One* 8, no. 3 e60192 (2013).

⁸⁴ Fukushima Nuclear Accident Commission, *Official Report Executive Summary*, 38; Amina Sugimoto et al., “The Voice of the Most Vulnerable: Lessons from the Nuclear Crisis in Fukushima, Japan,” *Bulletin of the World Health Organization* 90, no. 8 (August, 2012): 629–630, <http://www.who.int/bulletin/volumes/90/8/11-094474.pdf?ua=1>

⁸⁵ Reconstruction Agency, Government of Japan, *Current Status and Path toward Reconstruction* (Tokyo, Japan: Cabinet Office, 2013), http://www.reconstruction.go.jp/english/130528_CurrentStatus_PathToward_FINAL.pdf, 15.

security for large areas with multiple access points. Large numbers of security personnel are required who are trained and equipped to work in and near radioactive contamination sites. Towns formed neighborhood watch teams to patrol the deserted streets and ward off criminals.⁸⁶ Once roads began reopening near restricted areas, looting at abandoned homes and businesses increased. Towns began installing security cameras as further deterrence.⁸⁷ For evacuees, worrying about the security of the home or business they left behind adds to their stress and anxiety.⁸⁸

D. PUBLIC INFORMATION/RISK COMMUNICATION

Many of the issues that arose during the evacuation process related to the management of public information by the central and local governments. Public information management is a critical aspect of disaster response and recovery. During the immediate crisis, public warnings are a matter of life and death. Effective evacuation relies on clear messaging to convey the urgency and specific parameters the government is establishing to guide the process, i.e., which areas are to be evacuated and when, where it is safe to go and shelters are open, what public transportation resources are available and how to access them, how long the evacuation is likely to last, what special measures people should take to protect themselves while in transit, etc.

The importance of well managed public information does not diminish as the urgent threats recede, particularly after a radiation disaster. Coordinated messaging regarding available shelter and assistance and the status of their home community reduces confusion and anxiety for evacuees. Managing public information to assist residents and

⁸⁶ Town of Okuma, "History of after the Earthquake," accessed November 24, 2014, http://www.town.okuma.fukushima.jp/fukkou/?page_id=10 ; "Fukushima Village to Reopen, but Will Residents Return?" *The Asahi Shimbun*, February 1, 2012, http://ajw.asahi.com/article/0311disaster/life_and_death/AJ201202010049

⁸⁷ Takuro Negishi, and Naoyuki Takahashi, "Fukushima Towns use Cameras to Halt Surge in Thefts at Evacuees' Homes," *The Asahi Shimbun*, July 16, 2014, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201407160050>

⁸⁸ Steven M. Becker, "Learning from the 2011 Great East Japan Disaster: Insights from a Special Radiological Emergency Assistance Mission," *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 9, no. 4 (2011): 402.

communities as they navigate their way through a potentially protracted recovery process helps to knit all of the complex variables together cohesively.

1. Public Information for Dispersed Residents

For evacuees living in shelters or temporary housing during the early stages, access to official public information about services and recovery progress was often inadequate. For example, the shelters set up specifically to support persons with disabilities were not all pre-planned and therefore were not included in supply and information distribution systems that supported the general population shelters. Once residents moved out of shelters into temporary housing, their access to information and services dropped even more. The housing sites were located further from distribution sites, suitable transportation was often not available, and initially no systems were in place to track evacuees to ensure continuity of support by aid groups. Volunteer organizations struggled to find evacuees in need of support and were generally unable to get information from local communities due to privacy concerns.⁸⁹

As the situation stabilized, both the central and local (prefectural and municipal) governments leveraged their websites as a key tool for sharing recovery information. Japan's Cabinet Office, the Ministry of Economy, Trade, and Industry, and the Ministry of Education, Culture, Sports, Science and Technology established linking websites early after the event. They post information for residents, including maps of the most recent restricted zones and roadmaps describing strategies and systems in place to assist residents, conduct decontamination work, and secure the plant itself.⁹⁰

Since 2012, Fukushima Prefecture includes videos on its website under the heading, "Future from Fukushima Broadcasting Channel," in addition to its disaster recovery information pages. The channel includes tourism promotion and explanations of

⁸⁹ Rochelle Brittingham, and Tricia Wachtendorf, "The Effect of Situated Access on People with Disabilities: An Examination of Sheltering and Temporary Housing After the 2011 Japan Earthquake and Tsunami," *Earthquake Spectra* 29, no. s1 (2013), S433–S455.

⁹⁰ Ministry of Economy, Trade and Industry, Government of Japan, "Assistance of Residents Affected by the Nuclear Incidents: Evacuation Areas," accessed September 12, 2014, http://www.meti.go.jp/english/earthquake/nuclear/roadmap/index.html#evacuation_areas

the cares growers and manufactures are taking to ensure food, bottled water, and sake are safe for consumption.⁹¹

The mayor of Kawauchi had an active blog prior to the disaster that he restarted in mid-April 2011 to share disaster relief information. The mayor has continued to blog on at least a weekly basis to communicate with displaced residents and discuss efforts to prepare Kawauchi for repopulation.⁹² The town of Okuma, one of two communities that host the plant, notes in its official major event timeline that it launched its disaster information website on March 24. Recognizing that varied means of communication are necessary to reach all populations, Okuma also began disseminating a bi-weekly newsletter in June.

2. Public Trust

Professionals agree that early missteps by the government and TEPCO officials during the initial crisis at the Fukushima Daiichi plant severely eroded trust in official public information; a condition that has unfortunately endured throughout the recovery. Experts attribute the loss of trust primarily to official lack of transparency. Driven by an apprehension of inciting fear and panic, officials downplayed the severity of the accident and refused to speculate openly about potential problems and impacts.⁹³ Lacking coordinated plans and prepared messages for a plant meltdown scenario, officials struggled to communicate effectively with residents. Delays of official information may have allowed misinformation to fill the void and certainly added to residents' anxiety.⁹⁴

The ruling party has made numerous efforts at public contrition for the failures in communication and transparency. The cabinet's own investigation committee devoted

⁹¹ Fukushima Prefectural Government, "Future from Fukushima Broadcasting Channel," accessed September 12, 2014, <http://www.pref.fukushima.lg.jp/site/english/fff-channel.html>

⁹² Yuko Endo, "Weblog, Mayor of Kawauchi Village," *Kawauchi* [blog], April 23, 2011, accessed December 20, 2014, <http://kawauchi.exblog.jp/m2011-04-01/>

⁹³ Figueroa, "Risk Communication Surrounding the Fukushima Nuclear Disaster," 53–64; "The Futurist Interviews Crisis Communications Expert Peter Sandman on the Fukushima Daiichi Nuclear Meltdown in Japan," The World Future Society, accessed April 25, 2014, <http://www.wfs.org/content/futurist-interviews-crisis-communications-expert-peter-sandman-fukushima-daiichi-nuclear-mel>

⁹⁴ Amina Sugimoto et al., "The Relationship between Media Consumption and Health-Related Anxieties after the Fukushima Daiichi Nuclear Disaster," *PloS ONE* 8, no. 8 (2013).

significant space in its report to document the instances of delayed and deliberate misinformation that occurred during the early crisis phase.⁹⁵ However, the principle described by risk communication expert Slovic has held true for Japan. It takes many times longer and far more effort to rebuild public trust once it is lost.⁹⁶

The efforts government officials are taking to regain trust are full of potential pitfalls and may appear to observers as one step forward, two steps back. Some local leaders earned praise for taking extra measures to keep their communities together by setting up offices inside shelters and maintaining communications with residents.⁹⁷ Over time, however, perceptions have grown that some local leaders have pushed the community cohesion case too far in pressing for residents to return to areas with lifted evacuation orders. This has led to some individuals and families feeling disenfranchised because they remain concerned about contamination levels despite official assurances.⁹⁸

For residents of the restricted areas, their patience wears thin at promises they will be able to move home eventually. They wonder if leaders have known all along the cleanup will take much longer than predicted and are suppressing the information in order to gain acceptance for restarting other nuclear plants idled after the accident.⁹⁹ Residents also suspect preparations for the 2020 Tokyo Olympics are taking precedence and funneling resources and attention away from the cleanup and restoration in Fukushima. Fukushima evacuees remain concerned that the rest of the country is not fully supporting the recovery and average Japanese people are losing awareness of their plight.¹⁰⁰

⁹⁵ Investigation Committee on the Accident at the Fukushima Nuclear Power Stations, *Interim Report*, 12.

⁹⁶ Slovic, "Perceived Risk, Trust, and Democracy," 677–80.

⁹⁷ Becker, "Learning from the 2011 Great East Japan Disaster," 399; Schoch-Spana et al., *Mass Population Displacement*, 25.

⁹⁸ Hasegawa, *Disaster Evacuation from Japan's 2011 Tsunami Disaster*, 44.

⁹⁹ Martin Fackler, "Japan's Nuclear Refugees, Still Stuck in Limbo," *New York Times*, October 1, 2013, http://www.nytimes.com/2013/10/02/world/asia/japans-nuclear-refugees-still-stuck-in-limbo.html?pagewanted=all&_r=1&

¹⁰⁰ Tisdall, "Fukushima Ghost Towns Struggle to Recover;" "Three Years After: Frustration Remains High Over Fukushima Cleanup, but Radiation Fears Easing," *The Asahi Shimbun*, March 4, 2014, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201403040053>

Even discussing the potential for abandoning any of the restricted areas has been considered a taboo among Japanese officials at all levels of government. An LDP (ruling party) official incited angry reactions from various local village officials, including those from Futaba and Iitate, when he stated during a speech in Sapporo in November 2013, “The time will come when someone must say, ‘You cannot live here anymore, but we will make up for it.’”¹⁰¹ At least one local official, Koichi Miyamoto, mayor of Tomioka appreciated the candor, noting that frustrated residents frequently insist they would rather be told now if they would not be allowed to return.¹⁰² Anger in the public erupted again when LDP Party and coalition members issued a public report frankly admitting that some areas may never be reoccupied and calling for government assistance to help residents permanently relocate.¹⁰³

3. Environmental Radiation Standards

Though its beginnings predate the disaster with cozy relationships between government leaders and regulators promoting the nuclear industry, the heart of the current public trust crisis for Fukushima is the fear of radiation.¹⁰⁴ As mentioned in the discussion of risk communication literature above, radiation exposure and health risk is a technical matter that can be challenging to communicate to people during nonemergency situations, let alone during a crisis. An issue that hampered clear communication for the Japanese public was that officials initially relied on dose standards for normal plant operations that did not account for the emergency state, forcing them to relax protection standards as the situation continued. These changes contributed to mistrust in official government information about radiation safety. Furthermore, the central and local

¹⁰¹ “Debate Begins for Governments over Ishiba’s no-Return Remark,” *The Asahi Shimbun*, November 4, 2013, <http://ajw.asahi.com/article/0311disaster/recovery/AJ201311040066>

¹⁰² Ibid.

¹⁰³ Justin McCurry, “Fukushima Residents May Never Go Home, Say Japanese Officials,” *The Guardian*, November 12, 2013, <http://www.theguardian.com/environment/2013/nov/12/fukushima-daiichu-residents-radiation-japan-nuclear-power>

¹⁰⁴ Fukushima Nuclear Accident Commission, *Official Report Executive Summary*, 9.

governments disagreed about safety levels and appropriate protection measures, had poor information sharing mechanisms, and provided inconsistent messaging.¹⁰⁵

By the end of July 2011, the Nuclear Safety Commission of Japan announced its intent to manage exposure levels to below 20 mSv/year in the near term with the long term goal of reducing exposures to 1 mSv/year.¹⁰⁶ The concept that evolved over the next five months through the deliberations of the Cabinet's *Working Group for Risk Management of Low-Dose Radiation* was to first ensure the stability of the plant itself, then begin lifting restrictions in areas with estimated doses of 20 mSv/year or less. For each such area, they would set a reference target, such as 10 mSv/year within the next two years and 5 mSv/year within the following year until the ultimate target of 1 mSv/year is reached. Children's living environments (schools, daycares, parks, etc.) have the stricter target of 1 mSv/year from the outset. In order to achieve the reductions, the governments would undertake aggressive, prioritized decontamination measures to remove radiation from the environment as quickly as possible. The plan also includes provisions for public deliberations and education campaigns, including cultivation of local experts on the safety of low dose radiation exposure, information transparency, radiation measurement instruments throughout repopulated areas, and health monitoring and support.¹⁰⁷

The evacuation and restricted zones that the Nuclear Emergency Response Headquarters established as of the end of April remained mostly intact until September 30, 2011. See Figure 2. At that time, the Headquarters announced that certain areas that

¹⁰⁵ Takehiko Murayama, *Social Impacts Induced by Radiation Risk in Fukushima* (Porto, Portugal: International Association for Impact Assessment, 2012), <http://www.iaia.org/conferences/iaia12/uploadpapers/Final%20papers%20review%20process/Murayama,%20Takehiko.%20%20Social%20impacts%20induced%20by%20radiation%20risk%20in%20Fukushima.pdf>; Abel J. González, "The Recommendations of the ICRP Vis-Á-Vis the Fukushima Dai-Ichi NPP Accident Aftermath," *Journal of Radiological Protection* 32, no. 1 (2012): 1–7, http://iopscience.iop.org/0952-4746/32/1/N1/pdf/0952-4746_32_1_N1.pdf; Geoff Brumfiel, and Ichiko Fuyuno, "Fukushima's Legacy of Fear," *Nature* 483, no. 7388 (2012): 138–140.

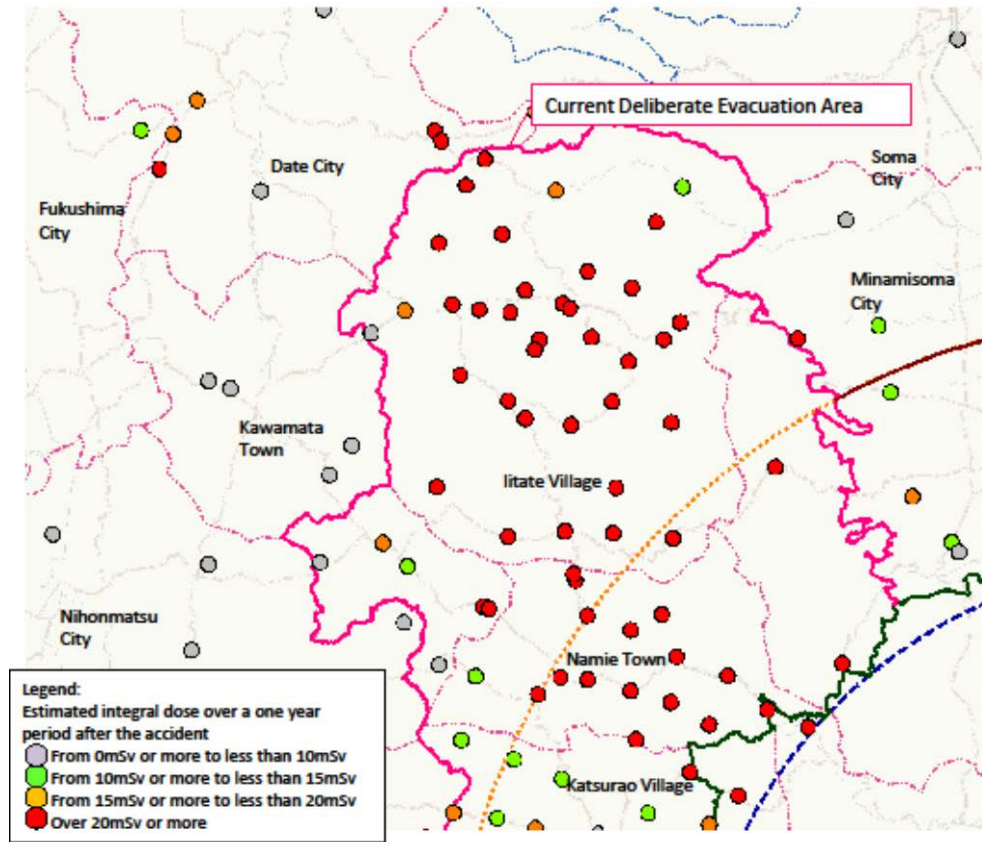
¹⁰⁶ Nuclear Safety Commission of Japan, *Basic Policy of the Nuclear Safety Commission of Japan on Radiation Protection for Termination of Evacuation and Reconstruction*, 2011, http://www.nsr.go.jp/archive/nsc/NSCenglish/geje/20110719suggest_4.pdf, 3.

¹⁰⁷ Nuclear Emergency Response Headquarters, *Basic Concept and Issues to be Challenged for Rearranging the Restricted Areas and Areas to which Evacuation Orders have been Issued Where Step 2 has been Completed* (Tokyo, Japan: Cabinet Office, Government of Japan, 2011), 3–5.

had been evacuated primarily as a precaution due to the instability at the plant, as opposed to actual contamination, were ready to be lifted based on restoration plans that the five affected municipalities had been preparing since August. These zones, the “evacuation-prepared area in case of emergency” includes portions of Hirono town, Naraha town, Kawauchi village, Tamura city and Minamisoma city. Prior to lifting the orders, the governments (national, prefectural, and municipal) conducted monitoring in the areas, particularly at schools, playgrounds and daycare centers, to verify environmental radiation levels were within their designated standards.¹⁰⁸

¹⁰⁸ Ministry of Economy, Trade and Industry, Government of Japan, “Lifting the Evacuation-Prepared Area in Case of Emergency Designation,” 2011, http://www.meti.go.jp/english/press/2011/0930_09.html

Deliberate Evacuation Area and Specific Spots Recommended for Evacuation



Based on the material published by the Ministry of Education, Culture, Sports, Science and Technology on 3 June

	Deliberate Evacuation Area	Specific Spots Recommended for Evacuation
Applicable Area	Spots with an integral dose over a one year period after the accident exceeding 20mSv are wide spread within the area.	Spots exist in some areas where an integral dose over a one year period after the accident exceeds 20mSv (Exist per residence that is not easy to decontaminate).
Safety Viewpoint	There is a risk of exceeding 20mSv through daily life in general.	The dose decreases by moving away from high dose spots, so a risk of exceeding 20mSv through daily life in general is low.
Governmental Response	Deliberate evacuation (The Government requires across-the-board evacuation.)	Call for attention, provision of information, evacuation assistance, etc. (The Government does not require across-the-board evacuation.)

Figure 2. Deliberate Evacuation Area and Specific Spots Recommended for Evacuation as of June 2011 from Ministry of Economy, Trade, and Industry, Japan.¹⁰⁹

¹⁰⁹ Ministry of Economy, Trade and Industry, Government of Japan, “Deliberate Evacuation Area and Specific Spots Recommended for Evacuation,” 2011, http://www.meti.go.jp/english/earthquake/nuclear/roadmap/pdf/evacuation_map_b.pdf

Ten weeks later, the headquarters announced that the reactors had progressed to “a condition equivalent to cold shutdown.” This means the government anticipates minimal risk of further explosions or major releases that would affect the public provided careful protective measures are adhered to during the continuing decommission process.¹¹⁰ It also triggered the further reconfiguring of the evacuation zones in April 2012 and reoccupation for portions of Kawauchi village, Tamura city, and Minamisoma city.¹¹¹

The effect of disagreements and communications failures between the central and local governmental officials on public perceptions is exemplified by the delays in reclassification of Namie’s evacuation zones. Namie Mayor Tamotsu Baba suspended discussions on the reclassification with the central government for months because of disagreement over damage compensation and payment for the town health monitoring program.¹¹²

The IAEA highlights the central and local governments’ extensive stakeholder engagement efforts in its January 2014 report on its mission to assess progress of the decontamination of offsite areas. This finding indicates that Japan is learning and improving risk communication procedures as the recovery progresses. Especially of note is that “key local community figures have been motivated to lead on engagement issues, gaining the trust of their communities. The national government is encouraging local authorities to conduct extensive consultations with local communities, and is respecting their outcome.” The IAEA team also specifically praised the outreach efforts linked with the Decontamination Information Plaza in Fukushima City as a best practice for

¹¹⁰ Nuclear Emergency Response Headquarters, *Basic Concept and Issues*, 6.

¹¹¹ Ministry of Economy, Trade and Industry, Government of Japan, “Rearranging Restricted Areas and Areas to which Evacuation Orders Have Been Issued, etc.,” March 2012, http://www.meti.go.jp/english/earthquake/nuclear/roadmap/pdf/20120330_01a.pdf

¹¹² “Namie Mayor to Accept Govt’s Proposal to Reclassify into 3 Areas by Year-End,” *Fukushima Minpo News*, August 19, 2012, <http://www.fukushimaminponews.com/news.html?id=76>

stakeholder engagement related to setting and managing environmental radiation standards during the recovery.¹¹³

Despite these improvements, the central government came under fire as recently as March 2014 for withholding environmental radiation level data from the public while the data was reviewed and recalibrated due to accuracy concerns. The data was collected from newly placed dosimeters in three municipalities (Iitate, Tamura, and Kawauchi) in areas where evacuation orders were expected soon to be lifted. According to the Japan Daily Press, the readings from the newer dosimeters were higher than expected, so officials feared residents would be frightened about returning.

This story demonstrates the hazard of changing official standards midstream. The story claims the central government planned to adjust the assumptions of average indoor versus outdoor time that would be used to determine re-occupancy safety in order to fit the new readings within published safe exposure levels.¹¹⁴ In April, the Minister of Industry apologized for the delay in publicly releasing the report and cabinet staff indicated it was due to the need to fully consult with all involved officials.¹¹⁵

At the time of the release of the report involving dosimeter readings in Tamura, Kawauchi, and Iitate, the central government indicated a panel was considering the value of using individual dosimeter readings as the basis for setting decontamination levels rather than estimating dose based on environmental readings. IAEA encouraged the study and the direction of individual dose measurement in its January 2014 decontamination mission report.¹¹⁶ In June, 2014 the Ministry of Environment unveiled its plan in a meeting with municipal officials. Officials from the city of Date had participated in

¹¹³ International Atomic Energy Agency, *Final Report: The Follow-up IAEA International Mission on Remediation of Large Contaminated Areas Off-Site the Fukushima Daiichi Nuclear Power Plant* (Vienna, Austria: International Atomic Energy Agency, 2014), 9.

¹¹⁴ Maan Pamintuan-Lamorena, "Government Team Keeps High Radiation Data on Three Fukushima Municipalities from the Public," *Japan Daily Press*, March 26, 2014, <http://japandailynews.com/government-team-keeps-high-radiation-data-on-three-fukushima-municipalities-from-the-public-2646381/>

¹¹⁵ "Minister Sorry for Delay in Releasing Survey Results on Radiation Exposure," *The Asahi Shimbun*, April 19, 2014, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201404190048>

¹¹⁶ International Atomic Energy Agency, *Final Report: The Follow-up IAEA*, 12.

testing the plan and welcomed the proposal, as it would likely result in less decontamination work to meet the standards. The city of Tamura reacted with concern that the change would only increase anxiety for residents. Some outside experts agreed that the new policy would reduce unnecessary decontamination work. Others noted that the low individual dosimeter levels in tests reflect increased actual indoor time due to residents' fear of exposure outdoors.¹¹⁷ Thus, the results would not accurately reflect residents' desired future daily habits.

Many radiation and health experts believe the actual health risk in Japan is far lower than public perceptions. Some, such as Dr. Geraldine Thomas at the Chernobyl Tissue Bank at the Imperial College London, say this is primarily due to poor public information efforts.¹¹⁸ As described earlier, the WHO report assessed that the Fukushima accident exposure will result in no appreciable increase of cancer risk in the general population, in part due to the protective measures undertaken in Japan.¹¹⁹ The IAEA's January 2014 decontamination mission report and other experts recommend more open and direct communication with people in the affected communities to help them understand the relative risk—relative to background radiation and relative to Chernobyl and similar human-caused releases. Specifically, IAEA emphasizes Japanese officials could do a better job helping the public understand that dose levels below 20 mSv/year with a long term goal to get below 1 mSv are within international standards.¹²⁰

4. Discrimination and Stigma

Once evacuated, Fukushima residents faced various difficulties, including bias based on fear that they carried contamination with them on their bodies or cars.¹²¹

¹¹⁷“New Radiation Measurement Method Spreads Confusion,” *Fukushima Minpo News*, June 22, 2014, <http://www.fukushimaminponews.com/news.html?id=376>

¹¹⁸ Rowan Hooper, “Fukushima: Health Disaster or PR Fail?” *The Japan Times*, September 7, 2013, http://www.japantimes.co.jp/news/2013/09/07/national/science-health/fukushima-health-disaster-or-pr-fail/#.U_AmAsVdWSo

¹¹⁹ World Health Organization, *Health Risk Assessment from the Nuclear Accident*, 8.

¹²⁰ International Atomic Energy Agency, *Final Report: The Follow-Up IAEA*, 11; Hooper, “Fukushima: Health Disaster or PR Fail?”

¹²¹ Hasegawa, *Disaster Evacuation from Japan's 2011 Tsunami Disaster*, 35.

Evacuees describe being banned from using public baths or giving blood, cars being vandalized, and children getting taunted and shunned at school.¹²² Despite a national policy against issuing radiation screening certificates to evacuees, local governments reluctantly began to provide them in response to the overwhelming demand from residents who faced discrimination without them.¹²³ Most parents are nervous about raising children in an environment with low dose radiation levels. Parents of young girls worry about their future marriage prospects due to the taint of radiation exposure.¹²⁴

Official public statements and government documents frequently note that the government will work to counteract “harmful rumors” that are negatively affecting Fukushima citizens and businesses. Some of the supplemental central government subsidies provided to communities specify this type of public information initiative as one of the intended uses.¹²⁵ Fukushima Prefecture has invested in its Future From Fukushima marketing campaign and a highly visible food safety monitoring system to rebuild the reputation of local goods. Japan imposed stricter standards for radiation content of food samples in April 2012.¹²⁶

Overcoming negative perceptions about radiation danger in Fukushima products continues to be a battle. Consumer Affairs Agency surveys show that public confidence in the safety of food products from Fukushima within Japan had been rising but dipped again in late 2014, even though Japan’s standards are more strict than the U.S. and Europe.¹²⁷ Some government officials believe the lower polls are due to widespread

¹²² Michael Okwu, Aaron Ernst, and Azmat Khan, “Inside Fukushima’s Ghost Towns,” *Al Jazeera*, January 6, 2014, <http://america.aljazeera.com/watch/shows/america-tonight/america-tonight-blog/2014/1/6/fukushima-decontaminationghosttowns.html>; Abigail Haworth, “After Fukushima: Families on the Edge of Meltdown,” *The Guardian*, February 23, 2013, <http://www.theguardian.com/environment/2013/feb/24/divorce-after-fukushima-nuclear-disaster>

¹²³ Becker, “Learning from the 2011 Great East Japan Disaster,” 402.

¹²⁴ Fackler, “Japan’s Nuclear Refugees, Still Stuck in Limbo.”

¹²⁵ “Gov’t Offers Fukushima 301 Bil. Yen for 30-Year Interim Nuclear Waste Storage,” *Fukushima Minpo News*, August 9, 2014, <http://www.fukushimaminponews.com/news.html?id=388>

¹²⁶ “Survey: 1 Percent of Food Samples Exceeded Radioactive Limit,” *The Asahi Shimbun*, September 30, 2012, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201209300031>.

¹²⁷ Jun Hongo, “One in Five Japanese Cautious about Fukushima Food,” *The Asahi Shimbun*, October 2, 2014, <http://blogs.wsj.com/japanrealtime/2014/10/02/one-in-five-japanese-cautious-about-fukushima-food/?KEYWORDS=fukushima>

media exposure of a popular graphic novel storyline that involved visitors to the nuclear plant getting nosebleeds.¹²⁸

E. RECOVERY PLANNING AND MANAGEMENT STRUCTURE

You get depressed when you can't see your future.

—Chairman, temporary housing residents' association in Japan¹²⁹

After a disaster that results in a large number of displaced families and businesses, indeed whole communities, as the Japan disaster has, outreach with residents and businesses during the temporary relocation period is a critical community function. Closely related to public information management is ensuring stakeholder involvement during the recovery planning process. Post disaster recovery planning is a useful tool for governments to organize how they will manage the recovery, involve citizens in the decision making for the community's future, and convey to them important information about the recovery process.

1. National Planning and Legal Frameworks For Recovery

At the national level, this process had its roots with the appointment of the Reconstruction Design Council by the Cabinet one month after the disaster. The Design Council established seven basic principles for the reconstruction that guided its June 25 report, *Hope beyond the Disaster*. The council and supporting study group were populated primarily by academics (urban planning, architecture, engineering, economics, social sciences, etc.) but also included three governors of heavily impacted prefectures, a mayor, a nongovernmental disaster support organization, several corporate leaders, a Buddhist clergy, and a news columnist.¹³⁰

¹²⁸ Kenjiro Takahashi, "Consumers Suddenly More Wary of Produce from Fukushima," *The Asahi Shimbun*, October 2, 2014, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201410020033>

¹²⁹ NHK, "Return Or Relocate: The Dilemma of Fukushima Evacuees," February 28, 2014, <http://www.nhk.or.jp/japan311/kuro-return.html>

¹³⁰ Reconstruction Design Council, *Towards Reconstruction "Hope Beyond the Disaster"*, 2011, http://japan.kantei.go.jp/kan/actions/201106/25KAIGI_fukkou_e.html

The Design Council report includes a chapter devoted to the nuclear disaster. It calls for swift resolution of the ongoing emergency at the plant itself; assistance and health monitoring and management for residents; removal of all contamination from Fukushima; and establishment of a technology center for renewable energy, decontamination and environmental restoration, and medical support, particularly for radiation exposure.¹³¹

Overall, several researchers credit the government of Japan for acting quickly to make legislative changes, authorize supplemental budgets, set up new organizational structures to manage recovery and reconstruction, and promote participatory planning.¹³² By May 2011, the central government's organizational structure for planning and managing the recovery and reconstruction after the Great East Japan Earthquake and the Fukushima nuclear disaster was taking shape. See Figure 3.

¹³¹ Ibid., 37.

¹³² William Siembieda, "Multi Location Disaster in Three Countries: Comparing the Recovery Process in Japan, Chile and New Zealand," *Focus: Journal of the City and Regional Planning Department* 9, no. 1 (2012): 49; Itoko Suzuki, and Yuko Kaneko, *Japan's Disaster Governance: How Was the 3.11 Crisis Managed?* vol. 4 (New York: Springer Science & Business Media, 2013), 81–101; Yasuo Tanaka et al., *Reconstruction Policy and Planning* (Washington, DC: World Bank, 2013).

Outline of Government Headquarters in response to the Great East Japan Earthquake

(As of 9th May 2011)

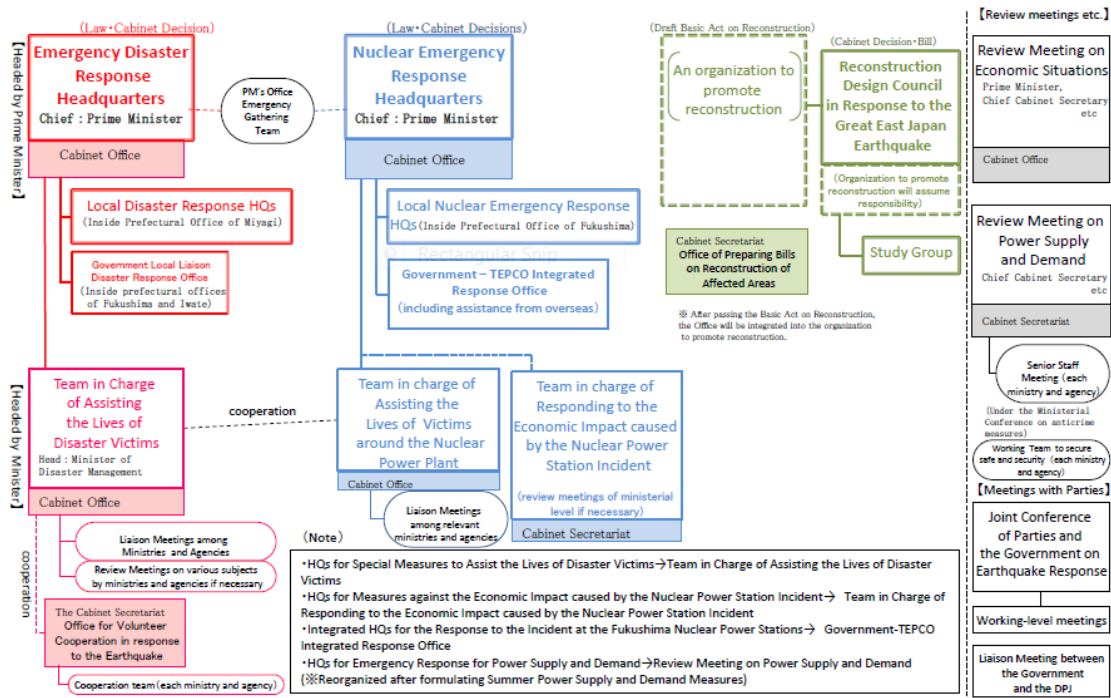


Figure 3. Japan Central Government Disaster Management Structure as of May 09, 2011¹³³

The *Basic Act on Reconstruction in response to the Great East Japan Earthquake*, passed by the Diet June 20, 2011, acknowledged the Design Council and established the Reconstruction Headquarters constituted of cabinet ministers and support staff. It authorized a standalone Reconstruction Agency that would replace the headquarters once fully instituted.¹³⁴

By July 29, 2011, the Reconstruction Headquarters published the *Basic Guidelines for Reconstruction*, based on the Design Council’s report, which promoted prefectural and village recovery planning and outlined provisions for national support and

¹³³ Cabinet Office, Government of Japan, “Outline of Government Headquarters for Great East Japan Earthquake,” 2011, http://japan.kantei.go.jp/incident/road_to_recovery.html

¹³⁴ Basic Act on Reconstruction in Response to the Great East Japan Earthquake (2011).

financial assistance.¹³⁵ The *Basic Guidelines* set the goal of reconstruction completion within ten years.

The *Basic Act on Reconstruction* also established a framework for a system of special zones for reconstruction. The zone system would provide tax breaks and lending incentives, ease eligibility for public housing, special procedures for business permits, and simplify land-use restructuring to stimulate investment and rebuilding in the impacted areas.

To address recovery of the areas impacted by the nuclear accident specifically, the Diet enacted the *Act on Special Measures for Fukushima Reconstruction and Revitalization* on March 30, 2012. Key provisions included in the act are declarations that the national government pay for remediation and reconstruction of infrastructure in Fukushima, planning and assistance for revitalization of industry, support for the prefecture to conduct a health survey of residents, monitoring of radiation in agricultural and fisheries products, tax benefits for residents and businesses, and reaffirmation of local control for municipalities. Notably, the Diet stated clearly that the policies for reconstruction would respect local community autonomy and support sustaining local communities.¹³⁶ Even at this early point, it is not surprising that there were discussions about whether the vacated communities would survive at all. The act also tasked the Cabinet to develop *Basic Guidelines for Fukushima Reconstruction and Revitalization* in consultation with the governor of Fukushima and the affected municipalities, which they completed in July 2012.

2. Prefectural and Municipal Planning

The Fukushima Prefecture published two editions of its revitalization plan, the first in December 2011 and an update in June 2012. The plan's goals are simultaneously lofty and poignantly realistic. Three of the twelve priorities involve revitalizing industry and promoting new sector hubs for renewable energy and health and medical production.

¹³⁵ Reconstruction Agency, Government of Japan, "About Us," Cabinet Office, accessed March 11, 2014, http://www.reconstruction.go.jp/english/Agency_G/topics/2013/03/about-us-senior-officials.html

¹³⁶ "Act on Special Measures for Fukushima Reconstruction and Revitalization," Japanese Law Translation, 2012, <http://www.japaneselawtranslation.go.jp/law/detail/?id=2282&vm=04&re=02>

At the same time, the performance target for restoring the prefecture population by 2020 (down to 40,900 in 2012 from 146,400 pre-disaster) is listed simply as “to be increased.” One of the key recovery measures listed for Prefecture-wide emphasis is to ensure community health through monitoring surveys and public radiation education campaigns. The plan emphasizes throughout consultation with returned and evacuated residents to identify and address requirements for everyday activities.¹³⁷

A number of towns, including Namie and Minamisoma established citizen and expert committees to inform the vision setting and planning process. In addition to its outreach to adults, Minamisoma city sent teams to schools to seek the views of children on the city’s future. To facilitate local planning, the prefecture and towns affected by the radiological contamination have been conducting surveys of evacuated residents either on their own or with university assistance to track where they are living and gauge their desire to return to their hometown. Some surveys also ask additional questions about how residents are coping physically and mentally, their current economic status, whether they are working, etc.¹³⁸

With each iteration, fewer say they hold out hope for returning and most of those are older without young children.¹³⁹ The town of Okuma saw an increase from nine percent to 30 percent saying they would not return in the first four months from June to October 2011.¹⁴⁰ Whereas in January 2012, 64 percent of residents from the town of Namie said they hoped to return, the latest results in August 2014 indicate almost 50

¹³⁷ Fukushima Prefectural Government, *Plan for Revitalization in Fukushima Prefecture* (Version 2), 2012, http://www.pref.fukushima.lg.jp/download/1/plan_for_revitalization2_outline.pdf, 4.

¹³⁸ Yuzuru Isoda, “Refuge Life of Evacuees from the Fukushima Nuclear Accident Analysis of Okuma Town Survey Based on Human Capital Theory,” *The 2011 East Japan Earthquake Bulletin of the Tohoku Geographical Association* (October 31, 2011), <http://tohokugeo.jp/articles/e-contents26.html>

¹³⁹ Bob Stilger, “Fukushima’s Future,” *Open Democracy*, February 3, 2014, <https://www.opendemocracy.net/transformation/bob-stilger/fukushima%E2%80%99s-future>

¹⁴⁰ Town of Okuma, “Road to Recovery from the Nuclear Accident-Current Situation of Okuma Town and Issues to be Resolved,” 2012, <http://www.town.okuma.fukushima.jp/fukkou/wp-content/uploads/files/Road%20To%20Recovery%20From%20The%20Nuclear%20Accident.pdf>, 31.

percent have decided not to come back, up over ten points from the year prior. An additional 24.6 percent are undecided.¹⁴¹

The town of Okuma's experience demonstrates the necessarily iterative recovery planning process that the uncertainties of the Fukushima situation require. The town held its first recovery planning meeting June 3 and a public meeting to discuss the town's future July 29. By March 30, 2012, the town circulated a first draft recovery plan for public comment and published the first iteration in September. The town also undertook specific planning for decontamination, temporary housing, managing reconstruction grants, and temporary storage for contaminated materials. It published an updated reconstruction plan in March 2014.

Prior to the disaster, the town of Okuma could boast that its population of 11,500 had increased slightly in recent years, contrary to Fukushima Prefecture's overall downward trend. The town economy is based on agriculture and the nuclear plant it co-hosts. The earthquake and tsunami destroyed 30 houses in Okuma and caused significant infrastructure damage. The largest group of Okuma evacuees to move together (3,700) found shelter and later temporary housing in Aizu Wakamatsu City, Fukushima Prefecture.¹⁴² The town began cooperating by April with the municipal government in Aizu Wakamatsu City. They established schools for the Okuma students in elementary through high school levels within just over a month. Okuma later established coordination with Iwaki City and Koriyama as host communities for temporary housing for Okuma residents.¹⁴³

By its March 2012 plan draft, the town had established four initial priorities for focusing its recovery efforts. 1) Decontamination of the whole town within 10 years; 2) Due to its initially lower radiation levels, prioritize the Okawara area for decontamination within two years to serve as a base for decommissioning and decontamination work; 3)

¹⁴¹ Yoichiro Kodera, "One-Third of Namie Evacuees Expect to Never Return Home," *The Asahi Shimbun*, January 14, 2012, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201201140042>; Town of Namie, "Namie Recovery and Reconstruction," press release, accessed 11/24, 2014, <http://www.town.namie.fukushima.jp/site/shinsai/press-release20141021.html>

¹⁴² Town of Okuma, "Road to Recovery from the Nuclear Accident-Current Situation," 25.

¹⁴³ Town of Okuma, "History of After the Earthquake."

Within five years, develop municipal and educational facilities in Iwaki City as the base of a temporary town near Okuma; and 4) In the near-term improve temporary facilities in the Aizu Wakamatsu host community.¹⁴⁴

Decontamination work in Okawara subsequently began in December 2012. Although earlier town documents acknowledged a 10-year target to decontaminate Okuma, the local assembly adopted a five year no return policy in late 2012.¹⁴⁵ The Mayor of Okuma admitted to an Asahi Shimbun survey of municipal officials that it would be 11 to 15 years before his community could be resettled.¹⁴⁶ These fluctuations in recovery goals are confusing and exasperating for residents trying to map out their own plan for recovery. In its April 2013 status summary, the town highlighted its frustrating predicament of attempting to plan for the future amidst a lack of consensus on safe exposure levels and uncertain timeframes by stating, “The final decision to return to the town rests on individual residents, but there should be objective and scientific basis that they can refer to in making their decision (especially for women and children).”¹⁴⁷

Okuma’s updated reconstruction plan of March 2014 represents more certainty and planning detail. It is organized in five year increments to 2033, a long-term jump to 2053 for full decommissioning of the plant and decontamination in all restricted areas. It includes appealing site sketches for the base town in Okawara. Improving the current living conditions of evacuees is a central theme of the plan.¹⁴⁸

F. FINANCIAL ASSISTANCE

If one could describe it as an advantage, the households and businesses affected by the nuclear disaster do receive more financial assistance than those whose losses were only related to the earthquake and/or tsunami.

¹⁴⁴ Town of Okuma, “Road to Recovery from the Nuclear Accident-Current Situation,” 32–3.

¹⁴⁵ Town of Okuma, “Recovering from Nuclear Disaster-Issues Facing Okuma Town Today,” 2013, http://www.jaif.or.jp/ja/annual/46th/46-s3_toshitsuna-watanabe_e.pdf, 11.

¹⁴⁶ “Survey: Half of Disaster-Hit Communities Need 6 to 10 More Years to Rebuild,” *The Asahi Shimbun*, March 1, 2013, <http://ajw.asahi.com/article/0311disaster/recovery/AJ201303010087>

¹⁴⁷ Town of Okuma, “Recovering from Nuclear Disaster-Issues Facing Okuma Town Today,” 17.

¹⁴⁸ Town of Okuma, “The Okuma Reconstruction Plan: An Interim Report.”

1. Governmental Disaster Assistance

As described earlier under Japan's disaster management system, the *Act on Support for Livelihood Recovery of Disaster Victims* provides for payments of up to 3 million yen (approximately \$25,500) after certain larger disasters to households when the home is destroyed.¹⁴⁹ By November 2014, the central government had issued 115,000 such grants for livelihood rebuilding and completed construction on 14 percent of the estimated 21,895 planned public housing units to address the wider disaster. The government also has invested 17.5 trillion yen into loans, subsidies, and temporary buildings for business operators impacted by the overall disaster.¹⁵⁰

News reports indicate Japan is struggling to expend the grants made and meet planned reconstruction timelines for the overall disaster. Reuters reported in October 2014 that approximately 60 percent of the \$50 billion the central government has paid for infrastructure and public housing construction to local governments in the three hardest hit prefectures, including Fukushima, remains unspent. Factors contributing to the delays include labor shortages, increased costs for building materials, difficulty in acquiring land for relocations, and resource diversions for the Tokyo 2020 Olympics infrastructure development.¹⁵¹ The reality after very large disasters is that planning the reconstruction and rebuilding take time, not just money.

2. TEPCO Compensation

TEPCO began making provisional lump sum compensation payments to evacuees April 16, 2011. The first payments ranged from 750,000 to 1 million yen (\$7,500–\$10,000) per household. TEPCO distributed additional payments to individuals of up to 300,000 yen each by the end of 2011.¹⁵² Agricultural and fishery cooperatives provided

¹⁴⁹ Cabinet Office, Government of Japan, "Disaster Management in Japan," 23.

¹⁵⁰ Reconstruction Agency, Government of Japan, "The Process and Prospects for Reconstruction," 2014, http://www.reconstruction.go.jp/english/topics/Progress_to_date/pdf/2014_pd.pdf, 2.

¹⁵¹ Taiga Uranaka, and Antoni Slodkowski, "Special Report: Tsunami Evacuees Caught in \$30 Billion Japan Money Trap," Reuters, October 31, 2014, <http://www.trust.org/item/20141031005413-ux955/?source=jtOtherNews1>

¹⁵² Umeda, *Japan: Legal Responses to the Great East Japan Earthquake of 2011*, 32–4.

bridge loans to members out of their own reserves and also distributed payments to members on TEPCO's behalf starting in May 2011.¹⁵³

Initially, the 1961 *Act on Compensation for Nuclear Damage* governed the compensation framework, including the establishment of a Dispute Reconciliation Committee for Nuclear Damage Compensation April 11, 2011. The Reconciliation Committee has passed a series of guidelines since 2011 to clarify or expand compensation schemes as the situation has progressed. The Reconciliation Committee's initial priorities were to ensure assistance for those with obvious damages: the evacuees and businesses subject to shipping and sales restrictions. The Reconciliation Committee set up the Center for Dispute Resolution for Compensating Damages in August 2011 to address disagreements on compensation outside of court.¹⁵⁴

The Diet enacted the *Act on Emergency Measures against Damage from the 2011 Nuclear Accident* on August 5, 2011 to allow the government to make partial compensation payments directly to facilitate timely assistance. Under the new act, the government provided provisional payments to tourism operators negatively affected by the stigma of radiation contamination in late 2011. The government is authorized to seek reimbursement from TEPCO for the provisional compensation.¹⁵⁵ TEPCO later began compensation for tourism operators directly in October 2012.¹⁵⁶

The compensation system includes a consolation payment to families of 2.5–5 million yen (approximately \$20,700–\$41,400) for deaths attributed to the effects of the accident, including the mandatory evacuation. A local panel of medical doctors and lawyers reviews the circumstances to determine whether the death can be attributed to health deterioration due to the extended displacement caused by the accident. As of June

¹⁵³ Ministry of Economy, Trade and Industry, "Assistance of Residents," 17.

¹⁵⁴ Ministry of Economy, Trade and Industry, Government of Japan, Progress of the "Roadmap," 22; Umeda, *Japan: Legal Responses to the Great East Japan Earthquake of 2011*, 32–4.

¹⁵⁵ *Ibid.*, 34.

¹⁵⁶ Tokyo Electric Power Company, "Addition of Areas Subject to Compensation for Damages to the Tourism Industries Caused by Harmful Rumors," 2012, http://www.tepco.co.jp/en/press/corp-com/release/2012/1222066_1870.html

2014, the panels certified 1,729 deaths of Fukushima residents as related to the accident.¹⁵⁷

The second supplement to the Reconciliation Committee guidelines in March 2012 directed a lump sum payment of six million yen (approximately \$60,000) for psychological suffering for each person who cannot return to a home located in the “difficult to return” zone earlier than five years. It also recommended TEPCO develop a scheme to compensate property owners in that zone for the full value of their land and home “in order to provide prompt relief for the victims.”¹⁵⁸ TEPCO announced in April it was working with national and local officials to determine the best method for meeting this requirement. The deliberations included public meetings with evacuees and lasted a full year.¹⁵⁹ TEPCO began accepting applications to pay real estate value compensation to residents and business owners in March 2013.¹⁶⁰

The Science Ministry estimated that as of the end of September 2013, TEPCO had paid to a family of four on average 90 million yen (approximately \$745,000) in total compensation payments. The Reconciliation Committee announced in October 2013 some flexibility in the guideline that the 100,000 yen per month payments for psychological suffering would end one year after evacuation orders are lifted. As of October 2013, 84,000 residents continued to receive the monthly payments for psychological distress. The committee determined that payments would be made

¹⁵⁷ “Fukushima Pref. Eyes Uniform Standards for Recognizing Deaths as Related to Nuke Accident,” *Fukushima Minpo News*, June 26, 2014, <http://www.fukushimaminponews.com/news.html?id=368>; Tokyo Electric Power Company, “Permanent Compensation for Nuclear Damages by the Accident at Fukushima Daiichi Nuclear Power Station and Fukushima,” 2011, <http://www.tepco.co.jp/en/press/corp-com/release/11083007-e.html>.

¹⁵⁸ Nuclear Energy Agency, *Japan’s Compensation System for Nuclear Damage* (Issy-les-Moulineaux, France: Organization for Economic Co-operation and Development, 2012), <https://www.oecd-neo.org/law/fukushima/7089-fukushima-compensation-system-pp.pdf>, 181; Umeda, *Japan: Legal Responses to the Great East Japan Earthquake of 2011*, 32–4; Kazumasa Takenaka and Kaname Ohira, “TEPCO to Seek Billions More for Fukushima Compensation,” *The Asahi Shimbun*, March 21, 2012, <https://ajw.asahi.com/article/0311disaster/fukushima/AJ201203210049>

¹⁵⁹ Town of Okuma, “Movement of the Town,” accessed September 13, 2014, <http://www.town.okuma.fukushima.jp/fukkou/?cat=3>

¹⁶⁰ Tokyo Electric Power Company, “Start of Application Procedure Concerning Compensation for Housing Lands, Buildings, Land Lease Rights, etc.,” 2013, http://www.tepco.co.jp/en/press/corp-com/release/2013/1226929_5130.html

regardless if residents return to their hometown and individual circumstances could result in continued payments beyond one year.¹⁶¹

In December 2013, the Nuclear Emergency Response Headquarters announced a profound shift in policy: a cabinet decision to enhance support for evacuees to either return home or restart their lives in a new location. The announcement referenced a December 26 Reconciliation Committee decision to provide additional compensation to evacuees for building new housing to return to their home community or to purchase a new home elsewhere. These announcements followed a November 2013, Reconciliation Committee recommendation that TEPCO compensate those evacuees who purchased a new home in another place, 50–100 percent of the difference of the land value.¹⁶² Per NHK, the new policy allows for payment of 75 percent of the difference in value for those who buy homes elsewhere.¹⁶³

In order to ensure TEPCO would be able to meet its responsibilities for the massive compensation payments, the government created the Nuclear Damage Compensation Facilitation Corporation under a new act. The Corporation has the power to issue government-guaranteed bonds or take out loans from existing financial institutions in order to provide loans or other forms of financial support to a nuclear operator that needs assistance to make required compensation payments. The Corporation began providing such support to TEPCO in November 2011.¹⁶⁴

TEPCO reports that as of February 13, 2015 it has made compensation payments to individuals and businesses totaling over 4,675 billion yen (approximately \$39.4 billion). That includes almost equal amounts of just over 2,000 billion yen each for forcibly evacuated households and business entities, and over 353 billion yen for

¹⁶¹ “Panel Willing to Extend Compensation Period for Fukushima Evacuees,” *The Asahi Shimbun*, October 26, 2013, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201310260046>

¹⁶² “Panel Decides to Pay Additional Damages to Long-Term Fukushima Evacuees,” *The Asahi Shimbun*, November 23, 2013, http://ajw.asahi.com/article/0311disaster/life_and_death/AJ201311230054

¹⁶³ NHK, “Return Or Relocate: The Dilemma of Fukushima Evacuees;” Ministry of Economy, Trade and Industry, Government of Japan, “For Accelerating the Reconstruction of Fukushima from the Nuclear Disaster-Major Points,” 2013, <http://www.meti.go.jp/english/earthquake/nuclear/roadmap/>

¹⁶⁴ Umeda, *Japan: Legal Responses to the Great East Japan Earthquake of 2011*, 33.

voluntary evacuees whose homes have not been or no longer were in restricted zones.¹⁶⁵ These payments do not include TEPCO's costs to decommission the plant or contributions toward decontamination of the environment.

Compensation support for voluntary evacuees remains controversial. The term "voluntary evacuees" includes those who choose not to return after their neighborhood is removed from the occupancy restrictions. TEPCO began providing compensation at the behest of the Reconciliation Committee for voluntary evacuees from certain communities beginning in June 2012. This amount is a flat rate encompassing both psychological distress and evacuation costs, of 400,000 yen for children and pregnant women and 80,000 yen for all other people in the designated eligible areas.¹⁶⁶ A local paper estimates there were still as many as 35,000 voluntary evacuees as of January 2014. A large group of 16,000 evacuees living in Tokyo sent a petition to the central government in April 2014 seeking more long term assistance.¹⁶⁷

Recognizing the bureaucratic complexities facing disaster survivors, Japan expanded legal assistance with the *Act Concerning Special Legal Aid by the Japan Legal Support Center to Assist Victims of the Great East Japan Earthquake* in March 2012. For Fukushima evacuees, the *Special Act* established a special procedure for making damage claims directly to TEPCO. It also includes alternative dispute resolution procedures for nuclear disaster claims. The *Special Act* removes for 2011 disaster survivors income and asset thresholds that normally determine who may receive legal fee loans from the Japan Legal Support Center.¹⁶⁸ In addition to providing mobile support consultations in areas

¹⁶⁵ Tokyo Electric Power Company, "Records of Applications and Payouts for Indemnification of Nuclear Damage as of 02/13/15, 2015, <http://www.tepco.co.jp/en/comp/images/jisseki-e.pdf>

¹⁶⁶ Nuclear Energy Agency, *Japan's Compensation System for Nuclear Damage*, 163–8; Tokyo Electric Power Company, "(Comment) in Response to the Decision on the 'Supplement of the Interim Guidelines on Criteria for Determining Nuclear Damage Indemnification Coverage (Losses due to Voluntary Evacuation)," 2011, <http://www.tepco.co.jp/en/press/corp-com/release/11120613-e.html>; Tokyo Electric Power Company, "Start of Compensation Payouts for the Voluntary Evacuees from Southern Fukushima Prefecture," 2012, http://www.tepco.co.jp/en/press/corp-com/release/2012/1205326_1870.html; Tokyo Electric Power Company, "Additional Compensation for the Voluntary Evacuees," 2012, http://www.tepco.co.jp/en/press/corp-com/release/2012/1223487_1870.html

¹⁶⁷ Mami Maruko, "Fukushima Evacuees Seek End to Limbo," *The Japan Times*, June 19, 2014, http://www.japantimes.co.jp/news/2014/06/19/national/fukushima-evacuees-seek-end-limbo/#.VFw0_TTF-So

¹⁶⁸ Umeda, *Japan: Legal Responses to the Great East Japan Earthquake of 2011*, 43.

where evacuees are currently living, the Center’s website provides phone and email contacts for not only legal support but other social service providers such as mental and physical health, housing, financial counseling, and insurance.¹⁶⁹ The new Nuclear Damage Compensation Facilitation Corporation is also providing consultations, seminars, and information to survivors about how to apply to TEPCO and how to use the alternative dispute resolution system.¹⁷⁰

G. TEMPORARY HOUSING

Japan has implemented a number of policy changes to improve disaster housing in the wake of the Kobe earthquake of 1995. The large, multi-family disaster public housing buildings relied upon after the Kobe earthquake tended to scatter former communities and isolate the elderly. One improvement after the 2011 disaster is the expansion of housing options offered, such as sublets of vacant rental housing (a longstanding practice in the U.S.), as well as construction of small, wood frame temporary units using local materials and construction firms. The magnitude of the housing need elevated the importance of multiple options for housing support.¹⁷¹ Traditionally, Japanese policy provides little support for individuals to reconstruct their own homes.¹⁷²

Japanese disaster housing experts have encouraged policies that preserve communities and support livelihood reconstruction, such as support for municipalities to develop community consensus and manage housing recovery efforts.¹⁷³ Some experts have also recommended a re-distribution of housing and recovery responsibilities such

¹⁶⁹ Japan Legal Support Center, “The Consultation List on the Great East Japan Earthquake,” accessed January 14, 2015, <http://www.houterasu.or.jp/eastjapaneq/madoguchi.html#madoguchi08>

¹⁷⁰ Nuclear Energy Agency, *Japan’s Compensation System for Nuclear Damage*, 37.

¹⁷¹ Elizabeth Maly, and Yoshimitsu Shiozaki, “Towards a Policy that Supports People-Centered Housing Recovery—Learning from Housing Reconstruction after the Hanshin-Awaji Earthquake in Kobe, Japan,” *International Journal of Disaster Risk Science* 3, no. 1 (2012): 64.

¹⁷² Shiozaki, “Housing Reconstruction and Community Development,” 68.

¹⁷³ Tamiyo Kondo, and E. Maly, *Housing Recovery by Type of Resident Involvement: Providing Housing Vs. Mobilizing Residents* (Shanghai: International Society of Habitat Engineering and Design, 2012).

that prefectures take away some of the burdens of struggling local governments.¹⁷⁴ In addition to 10,000 pre-planned and contracted housing units provided by the Japan Prefabricated Construction Suppliers and Manufacturers Association, Fukushima Prefecture solicited local builders to build wooden and log units. With planning, architectural, and engineering assistance from universities and associations, the Prefecture developed 6,000 additional units through this novel initiative. Fukushima purchased rather than leased the units, which allowed for more flexibility in duration of use and reuse of materials.¹⁷⁵

Despite lessons after the Kobe earthquake, local governments in the Tohoku region have employed lottery systems to distribute permanent housing to elderly and disabled residents without concern for co-locating neighbors or relations close together.¹⁷⁶ The new sublet framework provides higher quality housing but results in residents being dispersed within host cities far away from home rather than grouped together with former neighbors.¹⁷⁷ More recent reports indicate officials are making an effort to facilitate the preservation of close ties among neighbors as they move from temporary housing to newly constructed, permanent public housing.¹⁷⁸

Local officials have made significant efforts to create a mini-municipality away from home by siting temporary offices and schools near the largest groups of their own residents' temporary housing.¹⁷⁹ Towns have set up community centers and senior centers for their residents.¹⁸⁰

¹⁷⁴ Yuka Kaneko, "Livelihood Support for the Early Recovery in the Great East Japan Earthquake and Tsunami: Lessons for Developing Countries," *Journal of International Cooperation Studies* 20, no. 2/3 (2013): 101. http://www.research.kobe-u.ac.jp/gsics-publication/jics/kaneko_20-2&3.pdf

¹⁷⁵ Tomoyoshi Urabe, "Wooden Temporary Housing in Fukushima Prefecture: Focusing on Log Construction," in *The Great East Japan Earthquake 2011 Case Studies* (Kobe, Japan: United Nations International Recovery Platform, 2013), 75–79.

¹⁷⁶ Daniel P. Aldrich, *Building Resilience: Social Capital in Post-Disaster Recovery* (Chicago: University of Chicago Press, 2012), 156.

¹⁷⁷ Shiozaki, "Housing Reconstruction and Community Development," 66.

¹⁷⁸ "Lack of Bids Threatens to Keep Fukushima Evacuees in Temporary Lodgings," *Fukushima Minpo News*, February 17, 2014, <http://www.fukushimaminponews.com/news.html?id=308>

¹⁷⁹ "Futaba Municipal Gov'T to Relocate its Functions to Iwaki's Nakoso Area," *Fukushima Minpo News*, October 16, 2012, <http://www.fukushimaminponews.com/news.html?id=101>

¹⁸⁰ Town of Okuma, "History of After the Earthquake."

Regardless, surveys show that many evacuee families are separated from family they lived with pre-disaster. The cramped housing units limit the ability of extended families to stay together. Also, some families live apart for work. The phrase “atomic divorce” has emerged to describe couples splitting over disagreements about living in Fukushima and their children’s health, or simply due to the stresses of being displaced.¹⁸¹ One of the limitations of some of the temporary housing units is their unsuitability for long term occupation. Residents complain of moldy ceilings, crumbling walls, and rotting steps. Fukushima Prefecture conducts inspections on the units annually but must address over 300 repair requests each month.¹⁸²

The prefecture’s plans to build 4,890 permanent public housing units in 15 locations have hit a number of delays. One project for a 16-unit apartment complex in Aizu Wakamatsu could not attract any bidders for construction within the established budget. In some cases, land acquisition negotiations drag on or site clearance of wooded areas and farmland are taking longer than expected.¹⁸³

H. OFFSITE REMEDIATION

When considering the progress of recovery planning and the decontamination process, it’s illustrative to review the timeline of the stabilization and decommissioning of the Fukushima Daiichi plant itself. TEPCO and the government estimate the decommissioning process will take 40 years to complete. As described in Section D, from March until mid-December 2011, the plant was still in an unstable state. The Nuclear Emergency Response Headquarters announced first in late December 2011 that cold shutdown finally had been achieved.¹⁸⁴ The insecurity during this period had a ripple

¹⁸¹ Justin McCurry, “Fukushima Nuclear Disaster: Three Years on 120,000 Evacuees Remain Uprooted,” *The Guardian*, September 10, 2014, <http://www.theguardian.com/world/2014/sep/10/fukushima-nuclear-disaster-japan-three-years-families-uprooted>

¹⁸² “Fukushima Evacuees’ Housing Units Crumbling,” *Fukushima Minpo News*, November 01, 2013, <http://www.fukushimaminponews.com/news.html?id=269>.

¹⁸³ “Lack of Bids Threatens to Keep Fukushima Evacuees in Temporary Lodgings,” *Fukushima Minpo News*; “First Tranche of Public Housing for Fukushima Evacuees Hit by Delays,” *Fukushima Minpo News*, August 5, 2014, <http://www.fukushimaminponews.com/news.html?id=389>

¹⁸⁴ Nuclear Emergency Response Headquarters, *Basic Concept and Issues*, 2.

effect on all recovery efforts for Fukushima Prefecture because of the ongoing potential for additional releases and re-contamination. In the years since, radiation discharges during plant debris removal operations and leaks of contaminated water stored onsite have continued to try public confidence.¹⁸⁵

Within this environment of uncertainty, the government established its initial framework for managing remediation of contamination in the neighboring communities and prefectures with the *Act on Special Measures Concerning the Handling of Radioactive Pollution*, in August 2011. The act delineates two categories of areas to be remediated: the Special Decontamination Area, inclusive of the 20 km radius from the plant and areas with environmental radiation levels above 20 mSv/year; and the Intensive Contamination Survey Area encompassing those areas with levels between 1 and 20 mSv/year.¹⁸⁶ The central government (Ministry of Environment) is responsible for developing decontamination and waste management plans and directly managing work in the Special Decontamination Area. The prefectures and municipalities are responsible for developing plans and managing the work in the Intensive Contamination Survey Areas with technical support from the central government. TEPCO is liable for compensating the respective governments for the remediation costs.¹⁸⁷

Based on the act, the Ministry of Environment's January 2012 *Decontamination Roadmap for the Special Decontamination Areas* prioritized remediation work in the areas with less than 20 mSv/y and between 20 to 50 mSv/y.¹⁸⁸ The strategy is to facilitate return of evacuees more quickly by reopening the least affected areas first.

¹⁸⁵ Miki Aoki, "Study: Cesium from Fukushima Debris Removal Likely Spread 50 Km," *The Asahi Shimbun*, July 16, 2014, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201407160064>; Miki Aoki, "Radioactive Dust Released during Fukushima Cleanup Reaches as Far as Miyagi Prefecture," *The Asahi Shimbun*, July 31, 2014, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201407310044>; Ian Sample, "Fukushima Two Years On: A Dirty Job with no End in Sight," *The Guardian*, December 3, 2013, <http://www.theguardian.com/environment/2013/dec/03/fukushima-daiichi-tsunami-nuclear-cleanup-japan>

¹⁸⁶ International Atomic Energy Agency, *Final Report: The Follow-Up IAEA*, 5.

¹⁸⁷ *Act on Special Measures Concerning the Handling of Environment Pollution by Radioactive Materials Discharged by the NPS Accident Associated with the Tohoku District—Off the Pacific Ocean Earthquake that Occurred on March 11, 2011* (2011), 25, http://josen.env.go.jp/en/framework/pdf/special_act.pdf?20130118.

¹⁸⁸ Ministry of Environment, Government of Japan, "'Decontamination Roadmap' for the Special Decontamination Areas (Outline)," 2012, <http://josen.env.go.jp/en/roadmap/>

Decontamination of essential public facilities such as town halls, roads, and water infrastructure would be completed earliest in these areas. The central government would undertake initially only demonstration projects in the areas with levels higher than 50 mSv/y.

The remediation program has faced sharp criticism due to missed completion targets in communities like Namie, extended from the original estimate of March 2014 to 2017.¹⁸⁹ Heavy snows over the 2012/2013 winter limited access, but many believe the Ministry of Environment's original roadmap was overly optimistic given the enormity of the undertaking.¹⁹⁰ The process is painstaking. Once the essential infrastructure and municipal building are cleaned, government sponsored decontamination teams tackle the residential areas. Homeowners clean out the inside of their homes on daytrips after the teams complete a 10 to 14 day process of cleaning roofs and gutters, then removing surface grass, dirt, and shrubs.¹⁹¹ In addition to the sheer vastness of the task, recontamination occurs in areas near hilly terrain when rainfall carries contaminants back down into the cleaned areas.¹⁹²

Delays are in part due to planning and preparing safe temporary and interim storage for contaminated materials. Managing the disaster debris contaminated with radiation as well as the large volumes of polluted topsoil, shrubbery, and other materials generated by the remediation efforts has been an iterative process for both the central and local governments. To the extent possible, they sort, recycle, and burn some waste to reduce the volume. Workers moved most disaster related contaminated debris from coastal areas, with the exception of larger items like ships, to interim storage locations by the end of 2012.¹⁹³ Larger intact items like boats and vehicles require tracking down

¹⁸⁹ NHK, "Return Or Relocate: The Dilemma of Fukushima Evacuees;" Sample, "Fukushima Two Years On: A Dirty Job with no End in Sight."

¹⁹⁰ "Ministry Angers Residents by Pushing Back Fukushima Cleanup," *The Asahi Shimbun*, September 11, 2013, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201309110052>

¹⁹¹ Tisdall, "Fukushima Ghost Towns Struggle to Recover."

¹⁹² McCurry, *Fukushima Nuclear Disaster: Three Years on 120,000 Evacuees Remain Uprooted*; Okwu, Ernst, and Khan, "Inside Fukushima's Ghost Towns."

¹⁹³ Umeda, *Japan: Legal Responses to the Great East Japan Earthquake of 2011*, 28.

owners and permission for removal. Approximately, 70 fishing boats cast ashore by the tsunami still litter the Fukushima coast as of the end of 2014.¹⁹⁴

The central and local governmental authorities have struggled to identify viable interim storage locations in or near the 11 hardest hit communities. Residents and local officials are wary that temporary sites will become permanent over time leaving their communities with the stigma of radiation forever.¹⁹⁵

It was a major breakthrough in late August 2014 when Fukushima Prefecture and the towns of Okuma and Futaba finally agreed after lengthy negotiations to accept the construction of interim storage facilities in the two towns. The Prefecture insists that the central government identify long term storage solutions outside of Fukushima to take effect after 30 years. The central government also offered additional subsidies for various economic and social revitalization initiatives in the Prefecture and two communities.¹⁹⁶

In October 2013, the IAEA conducted a follow up mission to its 2011 review of Japan's strategy and organizational mechanisms for offsite remediation and published a report noting progress, best practices, and areas for continued improvement in January 2014. Some key practices the IAEA team highlights as positive progress that relate to community relocations include:¹⁹⁷

1. The overall investment in financial resources, technical assistance, and coordination of multiple supporting organizations to minimize exposure and enable people and communities to return;
2. Central and local efforts to foster local leadership to engage stakeholders meaningfully in the decision making process;
3. Comprehensive, systematic information development to support decision making and provide progress reporting;

¹⁹⁴ "Shipwreck Dismantled in Fukushima no-Go Zone," *News On Japan*, November 22, 2014, <http://newsonjapan.com/html/newsdesk/article/110357.php>.

¹⁹⁵ Miki Aoki, "Residents Failed by Fitful Rebuilding," *Japan Times*, March 11, 2013, <http://www.japantimes.co.jp/news/2013/03/11/national/residents-failed-by-fitful-rebuilding/#.VM4JldLF-So>

¹⁹⁶ "Fukushima Prefecture, Two Towns Give Nod to Temporary Storage of Nuke Waste," *Fukushima Minpo News*, August 31, 2014, <http://www.fukushimaminponews.com/news.html?id=398>; "PM Abe Pledges Effort to Meet Conditions for Temporary Storage of Nuke Waste in Fukushima," *Fukushima Minpo News*, September 3, 2014, <http://www.fukushimaminponews.com/news.html?id=399>

¹⁹⁷ International Atomic Energy Agency, *Final Report: The Follow-Up IAEA*, 9–10.

4. Assessment and comparison of the effectiveness and efficiency of different remediation methods;
5. Monitoring, progress, and successful alternative methods for agricultural land remediation;
6. Practical buffer remediation (20 meters) of forestland contiguous to residential, agricultural, and other occupied spaces;
7. Advancement of temporary and interim storage facility solutions, including application of incineration techniques to decrease volume that also minimizes emissions exposure for the public;

IAEA also offers suggestions to Japan to continue to improve remediation programs and increase public support for the efforts. The recommendations include a more prominent role for the Nuclear Regulation Authority in remediation oversight as well as access for independent assessments of safety related to storage facility development. The team urges continued balancing of the risk to decontamination workers versus benefits to people and ecosystems for forestland and similar areas. Several recommendations focus on communication with the public to improve understanding of the long term nature of the 1 m/Sv per year goal and the tradeoffs involved with a single target reference level standard for environmental radiation. Tradeoffs mentioned include increased waste production and storage requirements, and the diversion of resources away from infrastructure reestablishment. The team also suggests it may increase public confidence in decisions if the risk communication and stakeholder engagement efforts were planned more strategically.¹⁹⁸

¹⁹⁸ Ibid., 11–12.

I. COMMUNITY RESETTLEMENT

Those of us who belong to the older generation feel that we received this town from our ancestors, and we feel great pain that we cannot pass it down to our children.

—Tamotsu Baba, Mayor of Namie, Japan¹⁹⁹

How do you know when a community has recovered from a disaster? What does the “new normal” look like and who decides when it is achieved? The answers to these nagging questions are unique to the affected community—its leaders, its residents, and businesses. For a community that completely relocates temporarily due to radiological contamination, it is not enough to just clean up and rebuild. The real hard work is bringing people and businesses back.

Based on the advance notices after the December stabilization of the nuclear plant, the government lifted evacuation restrictions in portions of Tamura city, Kawauchi, and Minamisoma in April 2012. Portions of Iitate followed three months later. However, it has taken time for people and businesses to move back and in March 2015 all are still struggling to rebound. For the 11 communities in the Special Decontamination Area, the key to resettlement is completing the decontamination work and building public confidence that not only will they be safe, but they will be able to work, buy necessities, get medical assistance, and send their kids to school or daycare nearby.

The mayor of Kawauchi, Yuko Endo, has been a prominent champion of resettling the village as quickly as possible to ensure the community does not remain a ghost town. The village reopened municipal offices and schools immediately in April 2012 as soon as the evacuation restrictions were lifted even though much of the community lies within the 20 km zone that was still off limits and few residents were returning at the time. The mayor pushed hard to reopen the village, but acknowledged it would be a slow process for residents to get comfortable with the idea: “Villagers who

¹⁹⁹ Justin McCurry, “Fukushima Town Revealed in Google Street View Two Years after Tsunami,” *The Guardian*, March 27, 2013, <http://www.theguardian.com/environment/2013/mar/27/fukushima-google-street-view-meltdown-tsunami>

are concerned about radiation can wait and see before they decide...We want to start rebuilding the village with those who can come back.”²⁰⁰

A year later in March 2013, Kawauchi’s returned population stood at 420 out of the 3,000 displaced in 2011. Most returned residents, approximately 65 percent, were over the age of 65, a significant rise from Kawauchi’s overall 34 percent senior population. The elementary school enrolled only 16 students in its first year after reopening. However, with a few restaurants and gas stations open, new apartments ready to accept residents, and several major employers committing to open as of March 2013, Kawauchi’s progress was arguably among the best of the 11 municipalities.²⁰¹

It was in this same month that the Ministry of Environment announced that the decontamination work was behind schedule in almost all of the 11 municipalities, including Kawauchi. It took another full year, until April 2014 for the village to grant short term overnight stays so that people could prepare their homes and businesses for permanent return. Kawauchi’s was the second portion of the 20 km zone to reopen in October 2014. Tamura city’s Miyakoji district had opened in April. About half of Kawauchi’s original population had returned by the time the restrictions were lifted. The government and TEPCO have agreed that the 100,000-yen monthly compensation for psychological distress will continue for one year after evacuation restrictions are lifted whether residents return or not.²⁰²

Fukushima Prefecture overall is experiencing some other emerging bright spots in its recovery progress. The Fukushima Association of Obstetricians and Gynecologists announced in October 2014 that over 1,000 pregnant women chose to follow traditional practice and give birth in their parents’ hometown in Fukushima in fiscal year 2013. The number had dropped to below 600 in 2011 after the disaster.²⁰³ Fukushima’s birthrate has

200 “Fukushima Village to Reopen, but Will Residents Return?” *The Asahi Shimbun*.

201 Aoki, “Residents Failed by Fitful Rebuilding.”

202 “Gov’t to Lift Evacuation Order for Fukushima Village, but Residents Wary,” *The Mainichi*, September 30, 2014, <http://mainichi.jp/english/english/newsselect/news/20140930p2a00m0na005000c.html>

203 “No. of Women Visiting Parents’ Homes for Childbirth Rising in Fukushima Pref.,” *Fukushima Minpo News*, October 16, 2014, <http://www.fukushimaminponews.com/news.html?id=420>

also returned to pre-disaster levels overall.²⁰⁴ Authorities were able to open two major roadways in late 2014, the Joban Expressway and Route 6, which connect communities in the restricted zones to other prefectures. Officials hope the improved access will facilitate reconstruction and make it more convenient for residents and businesses to return.²⁰⁵ Additionally, in August 2014 the National Federation of Agricultural Cooperative Associations resumed Fukushima rice exports to Singapore for the first time.²⁰⁶

Unfortunately, resettlement remains a far off goal for the communities such as Namie and Futaba that lie primarily within the zone designated as “difficult to return for a long time” (see areas marked in pink on Figure 4). The central government’s Cabinet Office updated its estimates in June 2014 to predict they will be able to resettle those areas first in 2021.²⁰⁷

²⁰⁴ “Birthrate in Fukushima Pref. Recovers to Pre-Disaster Levels in 2013, Logs Nation’s Biggest Rise,” *Fukushima Minpo News*, June 5, 2014, <http://www.fukushimaminponews.com/news.html?id=357>

²⁰⁵ “Gov’T Reopens Highway Section Closed by Fukushima Nuclear Crisis,” *Fukushima Minpo News*, September 13, 2014, <http://www.fukushimaminponews.com/news.html?id=404;> “2 Sections of Joban Expressway to Open to Traffic on Dec. 6,” *Fukushima Minpo News*, September 18, 2014, <http://www.fukushimaminponews.com/news.html?id=407>

²⁰⁶ “Fukushima Rice Exports to Resume, First Batch Going to Singapore,” *Fukushima Minpo News*, August 19, 2014, <http://www.fukushimaminponews.com/news.html?id=393>

²⁰⁷ Noriyoshi Otsuki and Yuri Oiwa, “Government Estimates all Fukushima Areas Safe for Living by 2021,” *The Asahi Shimbun*, June 24, 2014, <http://ajw.asahi.com/article/0311disaster/fukushima/AJ201406240055>

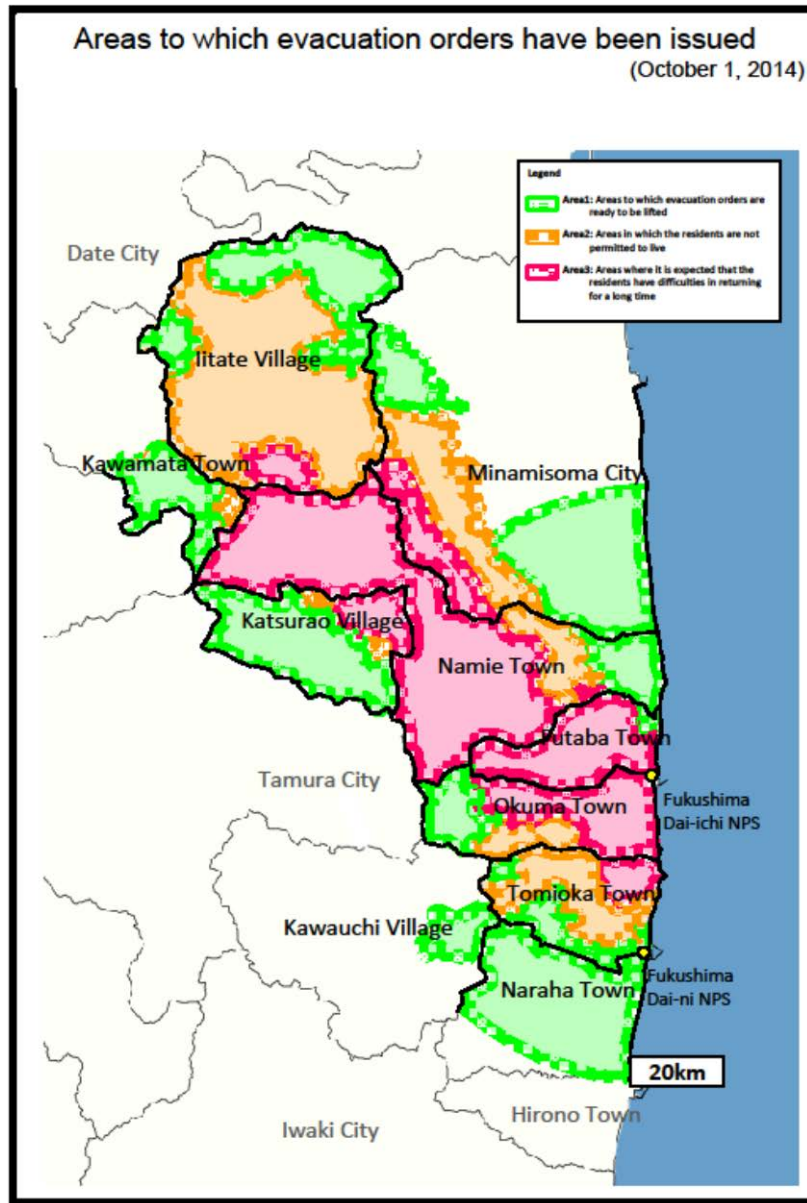


Figure 4. Nuclear Evacuation Areas as of October 2014²⁰⁸

²⁰⁸ Ministry of Economy, Trade and Industry, Government of Japan, “Areas to Which Evacuation Orders Have Been Issued,” 2014, <http://www.meti.go.jp/english/earthquake/nuclear/roadmap/pdf/141001MapOfAreas.pdf>

J. SUMMARY OF FUKUSHIMA CASE DESCRIPTION

Imagine the perspective of disaster survivors struggling to keep life together over the last four years. Surrounded by the horrifying death and destruction of the tsunami, they left behind a home and a business, a farm, or a job for what was expected to be a few days. After weeks or months in a group shelter, they moved to hastily built temporary housing and may or may not be near former neighbors. They are allowed to return for short visits to retrieve items and maintain their house. Some people do not return at all due to health fears or because they cannot bear to look. Depending how far away they are, the visits may be infrequent and the house is showing signs of neglect. They apply to TEPCO and receive compensation payments once a month covering the initial evacuation and lodging costs, emotional distress, lost wages, etc. They endure snide comments from residents in their adopted town about not needing to work even though they may have only been able to find a part time job that pays lower wages. The projections they hear about how long it will be before they are allowed home seems to change every six months. Information about the progress of recovery at home in general is spotty and they do not always know what to believe.

It is actually more difficult to imagine what those four years have been like for the town mayors struggling to retain a sense of community among evacuees and manage the planning and cleanup work from a temporary office in a neighboring jurisdiction. In the first year, they waited for the nuclear plant situation to stabilize, so it was impossible to estimate a return timeframe. They set up newsletters, webpages, and town hall meetings to attempt to keep residents informed and involved. They negotiated agreements with two or three host jurisdictions to bring together clusters of former residents in areas that could absorb the additional school children and offer adequate housing. Following the lead of national recovery planning initiatives, they invited residents and experts to craft revitalization strategies, temporary waste storage plans, and remediation roadmaps. They face a constant barrage of complaints about the missed targets for remediation goals, which they pass on to the central government agencies managing the tedious cleanup. They work the phones and email trying to attract large companies to return or new ones to move in using the central government revitalization zone incentives. Among their

many worries is whether enough medical and other service providers will return to support the rapidly aging population willing to come back. When the restricted area designation is lifted for a small part of town, they beg residents to return but struggle to enroll enough kids to fill a classroom, let alone a school.

At the four year mark, restrictions are lifted for portions of four towns and remediation planning and work continues for the other seven hardest hit municipalities. Decontamination and repairs permitted the late 2014 reopening of two major sections of highway that connect the restricted areas to neighboring jurisdictions. The return of residents to the reopened areas of villages such as Tamura and Kawauchi is proceeding very slowly, with the higher percentage being elderly. While the number of residents who still hope to return continues to decline, it is too early to evaluate what impact the December 2013 policy shift to financially support people who decide to buy new homes elsewhere is having on population returns. See Figure 5, next page, for an overview timeline of major events related to the nuclear disaster recovery.

The next chapter will distill the key recovery management practices of central, prefectural, and municipal leaders described in the policy themed sections of this chapter. The comparative analysis in Chapter V will assess the potential effectiveness of the identified key practices and compare them to the U.S. policy environment for potential applicability here.

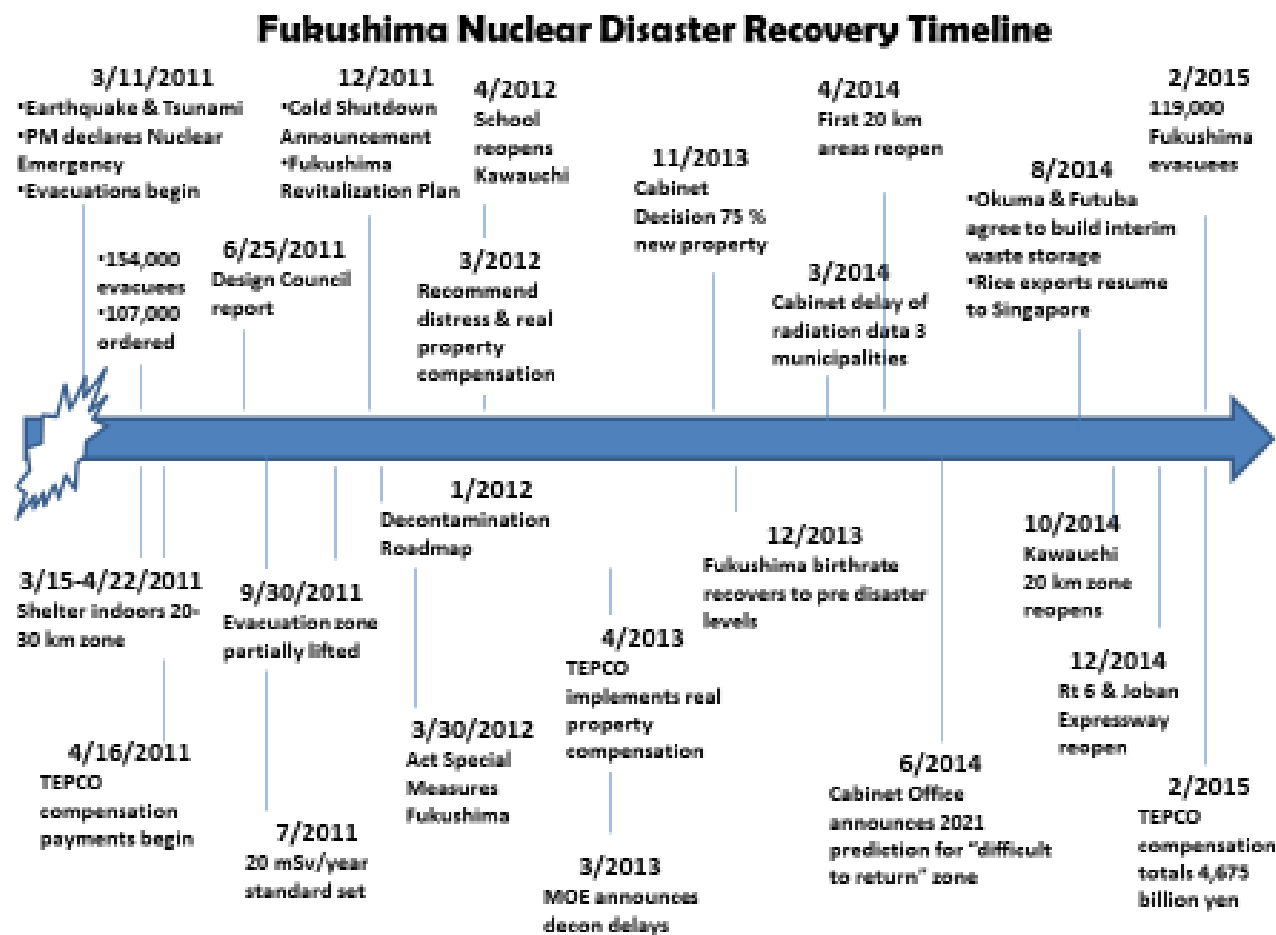


Figure 5. Fukushima Nuclear Disaster Major Recovery Events Timeline

V. COMPARATIVE ANALYSIS

Chapter IV describes the events and decisions related to the forced relocation of Fukushima communities after the March 2011 disaster as well as reactions from citizens, the media, other officials, and observers with academic or professional expertise.

Following the same policy themes from Chapter IV, this chapter reviews notable disaster recovery management decisions and key practices from the case description and summarizes their potential for effectiveness based on known reactions and observations. Note, public reactions and perceptions of outcomes related to complicated recovery issues are multi-faceted. This summary necessarily simplifies the case study findings based on available observations. Section G discusses how the most promising practices might apply in the U.S based on the political/organizational, geographical, cultural, and public relations environment.

A. KEY PRACTICES—PUBLIC INFORMATION/RISK COMMUNICATION

On the one hand, public information/risk communication seems to be a capability with which government officials in Japan have struggled. Japan's Fukushima experience demonstrates how critical early transparency and coordinated agreement on standards and related messaging are to establish and maintain public trust in official information and actions. Early faltering with public information during extreme crisis situations can sow mistrust that may not be recoverable.

On the other hand, officials clearly exploited the latest technology and communications trends, quickly employing social media, websites, and blogs for outreach and posting maps and other technical impact information. The municipalities also leveraged traditional public engagement techniques such as newsletters, citizen committees, and town hall meetings to stay in touch with residents and develop recovery plans.

It is not clear from the case study what mechanisms were most useful for the Prefecture and municipalities to establish and maintain contact with relocated residents. The case does indicate that regular contact between the community and dispersed

residents has been beneficial for promoting community cohesiveness and ensuring residents are aware of temporary re-entry opportunities, security arrangements, and available assistance. Setting up and testing the means for this tracking and communication in advance in the absence of time pressures and the stress of disruption would be easier than ad hoc arrangements post incident.

The stories of evacuated residents encountering prejudice and stigma in host communities and officials reversing procedure to issue decontamination certificates to reduce discrimination indicates that public information efforts were not adequate in those areas. The ability of officials to be flexible and adjust policy to meet emerging needs is commendable. However, prior planning and strategic public information to educate people in host communities about radiation to ensure evacuees were welcomed rather than ostracized is a tool that could have alleviated some of these issues.²⁰⁹

The effectiveness of efforts to educate the affected public about the potential health effects of radiation, self-protection measures, and the implications of offsite remediation decision making is a mixed bag. When the central government set an overall target to reduce dose to under 20 mSv/y for reoccupancy and a long term goal of 1 mSv/y, it paved the way for more consistent messaging and coordinated remediation planning across the affected jurisdictions. As noted earlier, the IAEA decontamination mission team praised a number of risk communication practices including the personal leadership of several local officials and an information plaza set up in Fukushima City.²¹⁰ The University of Tokyo partnered with Fukushima Prefecture to test in person seminars as a means of radiation education and found they were relatively effective to ease anxiety and combat rumors and misinformation.²¹¹ The public continues to be mistrustful, in part due to the early precedents of lack of transparency and poor communications coordination.

²⁰⁹ Schoch-Spana et al., *Mass Population Displacement*, 7.

²¹⁰ International Atomic Energy Agency, *Final Report*, 9.

²¹¹ Sugimoto et al., "The Relationship between Media Consumption and Health-Related Anxieties," 6.

Table 1. Public Information/Risk Communication Key Practices Summary

Key Practice	Government Level	Observations
Establish and maintain trust	Central	Early missteps; difficult to regain
Use multiple means of outreach	Central, Prefectural, Municipal	Improved after early stage
Ensure direct contact between community and relocated residents	Municipal	Community cohesion; flow of information to residents about home community; participation in recovery planning
Combat stigma in host communities	Central, Prefectural, Municipal	Limited efforts resulted in discrimination and demands for decontamination certificates
Local leader engagement	Prefectural, Municipal	Improved public trust
In person radiation education seminars and stations	Prefectural, Municipal	Assisted residents to understand risk and manage dose; earlier identification of those needing more assistance
Set national, flexible dose limit range for the incident	Central	Improved earlier confusion due to fluctuating/relaxed standards; likely facilitated earlier reoccupancy in some areas

B. KEY PRACTICES—RECOVERY PLANNING AND MANAGEMENT STRUCTURE

The case study indicates that the practice of planning for recovery after disasters and involving the community and other stakeholders in the process was actively applied after the Great East Japan Earthquake disaster. From the Reconstruction Design Council and the Working Group on Risk Management of Low-dose Radiation Exposure at the national level to the citizen and expert committees employed by the municipalities, examples of these practices abound. This impression is tempered with criticisms of the

Design Council membership, its lofty visions short on practical implementation, and the frustrating pettiness of inter-ministerial infighting typical of Japanese politics.²¹²

At the national level, Japan established a new, separate Reconstruction Agency to manage the rebuilding process. Despite the nod to local leadership in the Design Council report, Japan's governmental system remains primarily centralized in nature, requiring a focused central mechanism to manage the rebuilding.²¹³ The Reconstruction Agency has not stemmed criticisms of slow rebuilding in the face of the massive undertaking of planning and managing reconstruction after the tsunami's devastation.

One successful technique that is not commonly used in the U.S. after disasters is the population surveys the Fukushima prefecture and towns have regularly conducted since 2011. The surveys have provided residents an opportunity to anonymously voice opinions about returning and the standards they expect before they will come back. The towns have gleaned useful demographic information to incorporate into their recovery plans.

It is unclear from the case whether any of the relationships between the impact communities and host communities were pre-planned or if all were hastily agreed to after the evacuation. The Okuma town disaster timeline indicates that cooperation with the Aizu Wakamatsu municipal government began April 6, 2011. Once established, the arrangements promote community cohesiveness by facilitating placement of Okuma's residents in temporary lodging near the temporary municipal offices, schools, and senior centers. The host communities serve as central locations for recovery planning and other informational meetings.

All plans reviewed for this case study include vision statements prioritizing the re-establishment of the communities in Fukushima. National special legislation and plans also emphasize the desire to bring back communities. The prerogative of residents and business owners to set the direction of their recovery gets far less attention in official documents. A Tohoku University assessment of all 3/11 disaster impacted municipality

²¹² Kingston, *Natural Disaster and Nuclear Crisis in Japan*, 10, 232, 193.

²¹³ *Ibid.*, 30, 202.

planning indicates that some level of citizen involvement occurred in all community planning, but due to municipal inexperience was only perfunctory or represented only small population segments in a number of cases.²¹⁴ Balancing a desire for retaining community cohesiveness with residents’ self-determination has proven not to be an easy task in Fukushima or the other tsunami-struck communities.

Table 2. Recovery Planning and Management Structure Key Practices Summary

Key Practice	Government Level	Observations
Participatory recovery planning	Central, Prefectural, Municipal	Recovery visions and priorities nationally and for each locality; stakeholder involvement
Separate, new Reconstruction Agency	Central	Centralized recovery management; criticism of slow bureaucracy continues
Surveys of relocated residents	Prefectural, Municipal	Improved information flow between residents and communities for planning
Arrangements with host communities	Municipal	Keeps community members together; gathering place for community meetings
Balance community cohesiveness vs. individual self determination	Central, Prefectural, Municipal	Official support for both retaining communities and support of livelihoods; some residents feel pressured to return

C. KEY PRACTICES—FINANCIAL SUPPORT

On the whole, TEPCO’s compensation system appears to be functioning efficiently. The Dispute Reconciliation Committee has provided a third party check and balance system for compensation decisions. The Organization for Economic Cooperation and Development’s Nuclear Energy Agency issued a report in 2012 which praised the Reconciliation Committee’s role in facilitating smooth payment through its guidelines

²¹⁴ Michio Ubaura, “Reconstruction Urban Planning: Current Status and Future Challenges,” in *The Great East Japan Earthquake 2011 Case Studies* (Kobe, Japan: United Nations International Recovery Platform, 2013), 43.

and Center for Dispute Resolution.²¹⁵ A few disputed cases have landed in the courts with substantial awards. The media has reported several cases of dissatisfied claimants.²¹⁶ The media has also reported perceptions that compensation recipients have less incentive to seek work and choose to frequent gambling establishments instead.²¹⁷

The concern that compensation payments create a disincentive for evacuees to find new work harkens back to descriptions of a “dependency culture” developing after Chernobyl.²¹⁸ The extended displacements have an enormous impact on residents’ ability to continue working or find new work and maintain an independent livelihood. Research based on surveys of Fukushima evacuees indicates that “location specific investments” prior to the disaster, such as a job that is tied to a particular location, have proved to be a disadvantage for evacuees during displacement. Those with more mobile jobs (e.g., salaried employees of a larger company with multiple sites) and lifestyles (e.g., renters versus homeowners) have found it easier to reestablish a stable livelihood elsewhere. Many previously full time workers have only found part-time work in their relocation community.²¹⁹ Despite a robust subsidy system, those dependent on local small businesses have been stymied by the delays in rebuilding while local governments determine new land use policies and develop recovery plans.²²⁰

TEPCO’s financial compensation framework is supported through a government chartered corporation. The arrangement facilitates government bonds and bank financing to ensure TEPCO has adequate funding to support compensation, remediation, and decommissioning costs. By July 2012, the Nuclear Damage Compensation Facilitation Corporation owned over 50 percent of TEPCO shares, “effectively nationalizing” the

²¹⁵ Nuclear Energy Agency, *Japan’s Compensation System for Nuclear Damage*, 38.

²¹⁶ Chico Harlan, “Japan’s Nuclear Victims Seek Compensation, but Not a Day in Court,” *The Washington Post*, June 25, 2012, http://www.washingtonpost.com/world/japans-nuclear-victims-seek-compensation-but-not-a-day-in-court/2012/06/25/gJQAe8GO1V_story.html

²¹⁷ Mari Saito, and Lisa Twaronite, “Fukushima Farmer Takes on Nuclear Plant Operator over Wife’s Suicide,” Reuters, July 9, 2014, <http://www.trust.org/item/20140709205521-oxacp/?source=search>

²¹⁸ Kinley, *Chernobyl’s Legacy*, 33–8.

²¹⁹ Isoda, “Refuge Life of Evacuees from the Fukushima Nuclear Accident.”

²²⁰ Kaneko, *Livelihood Support for the Early Recovery*, 75–104.

company.²²¹ The government has provided additional interest free loans as the accident related costs have increased.

Though the Reconciliation Committee recommended compensation in March 2012 for lost real estate value in the affected areas, TEPCO’s process to discuss implementation schemes with affected municipalities and residents lasted a full year. The Reconciliation Committee and the central government announced a significant expansion in November 2013 that signaled a major shift in policy to provide substantial support for residents to relocate permanently. Large natural disasters can result in displacement of homes and businesses for several years, and many tsunami survivors are still living in temporary housing while communities rebuild outside the tsunami zones. The difference for the residents in areas like Namie and Futaba is the uncertainty that their community will ever be safe for reoccupancy. The uncertainty is a major source of distress and a hindrance for people to re-establish livelihoods.

Table 3. Financial Support Key Practices Summary

Key Practice	Government Level	Observations
Dispute Reconciliation Committee	Central	Buffer between affected parties and TEPCO; Detailed Guidelines; Compensation for psychological distress and evacuation costs early; Reduced court actions
Central government financial backing for TEPCO	Central	Ensures financial support for TEPCO compensation; Government/taxpayers bearing costs at least for near term
Payment for real estate loss to facilitate permanent relocation	Central, Prefectural, Municipal	Recommended March 2012, implemented March 2013, expanded December 2013; negotiations with local governments may have slowed implementation

²²¹ Tsuyoshi Inajima, and Yuji Okada, “Tepco Under State Control as Government Gets Shares for Cash,” *Bloomberg*, July 31, 2012, <http://www.bloomberg.com/news/articles/2012-07-31/tepcu-under-state-control-as-government-gets-shares-for-cash>

D. KEY PRACTICES—TEMPORARY HOUSING

Japan has applied many lessons learned after the 1995 Kobe earthquake, particularly related to providing temporary housing for displaced residents. In addition to the more typical disaster public housing and prefabricated units, the prefectures provide sublets of rental units and locally built wooden structures using central government funding. With 330,000 people displaced nationwide, the additional options were critically needed. By November 2011, over 17,000 people were still staying with family or friends, but the vast majority (over 310,000) were in some form of temporary housing.²²²

Every form of temporary housing has drawbacks to be considered. While sublets tend to be nicer units, they are dispersed and mostly in cities. Many temporary units were not built to last longer than two years in the surrounding climate and pose substantial repair requirements after three plus years of use and weather exposure. Disaster public housing complexes are often not desirable for residents from rural villages and create a permanent management burden for local governments.²²³

What if Japan and Fukushima Prefecture had taken a more radical approach and not focused on providing temporary housing for the residents from the “difficult to return zone”? By concentrating scarce resources and attention on providing temporary housing, officials made a deliberate policy choice not to focus on facilitating permanent relocations for those who face a minimum of five years out of their homes. No doubt this policy direction is in deference to municipal leaders from the restricted zones and consistent with the Design Council’s original principles to maintain communities. This exposes a fundamental tension between what a community needs to stay together and rebuild, and what an individual might prefer to accelerate his or her own recovery.

²²² Reconstruction Agency, Government of Japan, *Current Situations of Evacuees in the Aftermath of the Earthquake (by Prefectures and by Facilities)*, 2011, http://www.reconstruction.go.jp/english/topics/current_situation_of_evacuees.pdf

²²³ Shiozaki, “Housing Reconstruction and Community Development,” 64–71

Table 4. Temporary Housing Key Practices Summary

Key Practice	Government Level	Observations
Expanded housing options	Central, Prefectural, Municipal	Faster transition from shelters to temporary housing; small units separate extended families
Long term use of temporary structures	Prefectural, Municipal	Unit deterioration and significant maintenance requirements.
Policy emphasis on provision of temporary housing	Central, Prefectural	Resources not directed to facilitate permanent relocation for those desiring to move.

E. KEY PRACTICES—OFFSITE REMEDIATION

For the purposes of the identified scope, this study focuses on the key practices related to overall remediation decision making that affects the community relocations and less on technical issues and methods. Risk communication and stakeholder involvement, an essential element of offsite remediation strategy, is discussed in Section A.

The central government’s decision to divide remediation responsibilities with the municipal governments has minimized the burden on the local governments that likely have limited technical expertise. The central government is providing technical advisory support and funding to the prefectures and municipalities managing the remediation in the Intensive Contamination Survey Areas. This has allowed the central government to focus its efforts to oversee the work in the 11 municipalities of the Special Decontamination Area.

To an outsider it may seem counter intuitive to focus disaster recovery efforts in the less affected areas. Particularly after a disaster involving contamination, but also after large natural disasters, this strategy enables leaders to prioritize resources to accomplish the most good in the shortest time. It takes fewer resources to return more people to an area that had lower radiation readings at the outset. This strategy also takes advantage of natural decay to reduce levels in the areas with highest concentrations. Additionally, remediation workers would accumulate maximum radiation dose more quickly in areas with higher radiation levels.

One of the potential benefits of a zoned prioritization of recovery work in the less affected areas is the opportunity to support residents and businesses who choose to relocate permanently once fully informed of the situation. Though the Dispute Reconciliation Committee made recommendations in March 2012 in this direction, it appears that stance may not have been fully embraced by the central and local governments. As would be expected, municipal leaders are motivated to keep their communities together and likely pushed back on suggestions to facilitate independent relocation for residents. Until late 2013, it was unthinkable for public officials to speak publicly of permanent relocations.²²⁴

Some local officials and outside experts view the central government's original *Decontamination Roadmap* as unrealistic. The schedule delays have resulted in disappointment and frustration for community leaders, residents, and businesses. The planners may have not accounted adequately for the identification and preparation of temporary storage sites for the contaminated materials generated during cleanup operations.

Storage sites for contaminated materials are inevitably controversial. Communities and residents are wary that the temporary leases will be extended due to difficulties identifying and preparing new permanent disposal locations. For communities trying to lure residents and businesses back to the area, a temporary storage site diminishes the vision of the community they hope to project. The Japanese central government ultimately offered subsidies to convince Fukushima Prefecture and the towns of Okuma and Futaba to accept temporary storage sites in the areas closest to the plant.

As noted by the IAEA decontamination mission team, Japanese efforts to conduct demonstration projects to test and compare remediation and dose management methods are yielding benefits. One example resulted in a simpler, less expensive method for decontaminating agricultural land. Also, IAEA recommended further study of the use of personal dosimeter measurement versus estimated dose based on environmental readings alone to support late-phase decision making.

²²⁴ "Debate Begins for Governments over Ishiba's no-Return Remark," *The Asahi Shimbun*.

Table 5. Offsite Remediation Key Practices Summary

Key Practice	Government Level	Observations
Divided responsibilities central and local governments based on severity of contamination	Central, Prefectural, Municipal	Reduced burden on local governments
Prioritized decontamination of areas with lower radiation levels	Central	Focused effort in lower level areas to support earlier reoccupancy; missed opportunity to facilitate early permanent relocations from most contaminated areas
Central government subsidies for municipalities providing temporary storage sites	Central, Prefectural, Municipal	Provided after lengthy negotiations; temporary site identification delayed remediation
Demonstration projects to assess and compare methods	Central, Prefectural, Municipal	Prioritizes resources for proven methods; lower cost methods identified for some purposes
Study to assess use of personal dosimeter measurements to support late phase decision making	Central, Prefectural, Municipal	Mixed reactions from local officials, experts, and media; study ongoing

F. KEY PRACTICES—COMMUNITY RESETTLEMENT

The zoned approach to remediation has enabled communities to phase their reoccupancy by initially reestablishing portions of the evacuated communities as base settlements to support remediation and decommissioning work. New hotels, restaurants, and hardware stores have either opened or reopened to support the needs of decontamination workers moving into the area.²²⁵ The benefit of this approach is that communities can retain an active core to build upon as the radiation levels are reduced and restrictions are lifted. It provides some small businesses from the community a location to re-establish themselves near their original customer base. Time will tell if these temporary economies are sustainable. It will be useful to monitor how well the

²²⁵ Sam Harnett, “Not Everyone Wants the Clean-Up in Fukushima to be Over,” *Public Radio International*, October 15, 2014, <http://www.pri.org/stories/2014-10-15/not-everyone-wants-clean-fukushima-be-over>

communities are able to transition to a traditional economy and society after decontamination and decommissioning work reduces and ends.

Table 6. Community Resettlement Key Practices Summary

Key Practice	Government Level	Observations
Staged reoccupancy to support remediation and decommissioning	Municipal	Capitalizes on localized, disaster-based economic boom; some businesses able to reopen and/or change model for new customer base; keeps community active and functioning

G. APPLICABILITY TO THE U.S. POLICY ENVIRONMENT

How well would the key practices from Japan’s experience managing relocation and recovery work in the U.S.? Are there modifications that would make the practices work better in the U.S. compared to Japan? Are similar practices already adequately included in U.S. guidance, plans, and exercises? The sections below discuss how the types of key practices identified in the Japan case might be impacted by differences in the U.S., based on: 1) political and governmental structure, including existing plans and guidance; and 2) geographical and cultural considerations.

1. Political and Governmental Structure

The U.S. federal structure is similar to Japan’s, though the state roles and authorities are much stronger and broader than the Japanese prefectures. Under the U.S. federal system of government, offsite impacts would be managed primarily by the local and state governments with significant advice and support from federal agencies. Because of the technical expertise and equipment requirements, a radiological disaster would involve more federal teams and support than a natural disaster would. Most of the practices discussed above could be applied within the U.S. federal system with minimal modifications.

a. Nuclear Liability and Compensation in the U.S.

In the U.S., compensation for bodily injury and property damage or loss caused by a nuclear power plant accident is governed by the Price Anderson Act. The Act limits liability for nuclear plant operators and associated suppliers and transporters while ensuring that a large pool of insurance funds are available to pay offsite costs (survivor compensation, decontamination, etc.) in the event of an accident.²²⁶ The tiered insurance pool under the Act currently totals just under \$13 billion coverage per event.

The American Nuclear Insurers is the organization that manages the insurance pool for nuclear power plant operators. Their *Frequently Asked Questions* brochure published in June 2014 lists typical costs that may be covered if warranted for the situation based on official evacuation orders, such as: transportation, lodging, emergency medical treatment, property damage, and lost wages for individuals; loss of revenue, contaminated agricultural products, and property loss for businesses; and the additional costs of state and local governments for police services, transportation, shelter due to imminent risk to public safety from a nuclear plant accident. The brochure lists the following specific exclusions: evacuation costs of persons living outside the designated evacuation area; loss of business revenue outside a reasonable area based on the evacuation zones; losses due to theft or looting; transportation accidents during evacuation; and losses due to acts of war (though terrorist acts are covered).²²⁷

If the full pool is depleted, Congress would determine whether additional disaster assistance is required to pay excess costs. As of February 2015, TEPCO has paid out three times the \$13 billion limit just for compensation to individuals and businesses.²²⁸ Unlike Japanese law which specifies unlimited liability for the plant operator, the operator is not liable above this limit in the U.S. This means that if a Fukushima scale accident occurred in the U.S., compensation and cleanup costs above \$13 billion would

²²⁶ U.S. Nuclear Regulatory Commission regulations also require operators to retain insurance for onsite cleanup costs.

²²⁷ American Nuclear Insurers, *Emergency Response: Some Answers to Frequently Asked Questions*, 2014, http://nuclearinsurance.com/library/ANI_FAQ_Brochure.pdf

²²⁸ Tokyo Electric Power Company, "Records of Applications and Payouts for Indemnification."

not be paid by the plant operator or their insurer and Congress would be expected to step in.

Though the Act does not include a dispute reconciliation committee system similar to Japan's, it does require federal district court prioritization and management of compensation after 15 percent of the available pool has been expended.²²⁹ The uncertainties built in to the Price Anderson Act system almost guarantee assistance delays and frustration for survivors. Disaster recovery planners do not know how the limited insurance pool would be prioritized after a major offsite event or what type and how much assistance Congress might provide if necessary. The Fukushima accident prompted calls for Congress to clarify these points under Price-Anderson.²³⁰ After four years and headlines long since dimmed, legislative action seems unlikely.

b. U.S. Planning Guidance and Gaps

Updated in 2013 to incorporate some Fukushima lessons, the Environmental Protection Agency's (EPA) *Protective Action Guides and Planning Guidance for Radiological Incidents (PAG Manual)* provides direction for the radiation management aspects of a disaster involving widespread nuclear/radiological contamination. The manual provides recommended criteria (specific radiation dose limits) for implementing protective actions in the early and intermediate phases such as population evacuation and extended relocation. For the late phase, the *PAG Manual* outlines a decision making process rather than a specific target dose level, noting the specifics of the situation and the community's input is necessary for the late phase decisions. The manual emphasizes the necessity and importance of community involvement in the decision making process regarding setting cleanup priorities, determining cleanup levels and procedures, timing

²²⁹ U.S. Nuclear Regulatory Commission, "Backgrounder on Nuclear Insurance and Disaster Relief," accessed February 20, 2015, <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/nuclear-insurance.html>

²³⁰ Ryan Morhard, and Sanjana Ravi, "The Price-Anderson Act and the Role of Congress in Compensating Victims After a Catastrophic Nuclear Disaster," *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 10, no. 4 (2012): 343.

for reoccupancy, and waste storage and disposal locations.²³¹ The Department of Energy (DOE) *Operational Guidelines* provide more technical detail including calculation of stay times for responders and public reentry to retrieve possessions or maintain property.²³²

The *Radiological Emergency Preparedness (REP) Program Manual* includes “Planning Standard M: Recovery and Reentry Planning and Post-Accident Operations.” The planning standard advises states and local governments to include in their radiological emergency plans procedures for coordinating relocation and temporary reentry and permanent return into the area. Specific details about the content of these procedures and the complexities for extended relocation periods are not included. The planning standard refers to the *PAG Manual* for technical guidance.²³³

The Department of Homeland Security published *Key Planning Factors for Recovery from a Radiological Terrorism Incident* as a draft guide in follow up to pilot regional planning initiatives in 2012. This document identifies unique issues of a radiological disaster during the short, intermediate, and long term recovery phases. Designed as a supplement to general disaster recovery planning guidance, it also emphasizes managing the technical aspects of radiological contamination. The *Key Planning Factors* document is particularly useful for framing the public information and stakeholder involvement issues and making the case for establishing communications plans and pre-designated stakeholder working groups during pre-incident planning. It also explains the major elements to include in contaminated debris management planning.²³⁴

²³¹ U.S. Environmental Protection Agency, “PAG Manual: Protective Action Guides and Planning Guidance for Radiological Incidents,” 2013, <http://www.epa.gov/radiation/rert/pags.html#pags>

²³² Charley Yu et al., *Preliminary Report on Operational Guidelines Developed for use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident* (Argonne, IL: Argonne National Laboratory, 2009).

²³³ Federal Emergency Management Agency, *Radiological Emergency Preparedness Program Manual*, 2013, <http://www.fema.gov/media-library/assets/documents/32780?fromSearch=fromsearch&id=7576>

²³⁴ Lawrence Livermore National Laboratory, “Key Planning Factors: For Recovery from a Radiological Terrorism Incident,” Federal Emergency Management Agency, 2012, <https://www.fema.gov/media-library/assets/documents/31723>.

The *PAG Manual*, *REP Program Manual*, and *Key Planning Factors* documents appropriately focus on the radiation management decisions that local, state, and federal leaders will make. They are designed for the audience of the radiation protection professional rather than the lay decision maker. This leaves a guidance gap for local community leaders who must manage the larger disaster recovery, including both the radiation management aspects as well as support for relocated residents and businesses and reconstruction of damaged buildings and infrastructure. Local leaders require decision guidance designed for them that addresses the full range of issues they will face after a radiological disaster in an integrated manner. The 2014 NCRP Report No. 175, as well as additional observations from the Fukushima disaster recovery will be a useful resource for such guidance.

Open and transparent communication with the public throughout the development and execution of cleanup strategies is a critical function for local governments. EPA, FEMA, and the Nuclear Regulatory Commission have published public information/risk communication guides for radiological disaster response and early recovery. These include: *Communicating Radiation Risks Crisis Communications for Emergency Responders*; *Communicating During and After a Nuclear Power Plant Incident*; and *Improvised Nuclear Device Response and Recovery: Communicating in the Immediate Aftermath*.²³⁵ All of these provide local officials guidance for the early phase and reentry after different types of radiological incidents. Basic risk communication practices identified in the Japan case, such as establishing trust and using varied means of communication are addressed. However, the guides do not address the complex public interactions that will be necessary to manage extended relocation situations after widespread offsite contamination occurs.

²³⁵ U.S. Environmental Protection Agency, "Communicating Radiation Risks," 2007, http://www.epa.gov/rpdweb00/basic/info_prod.html;

Federal Radiological Preparedness Coordinating Committee, *Communicating during and after a Nuclear Power Plant Incident*, Federal Emergency Management Agency, 2013, <http://www.fema.gov/media-library/assets/documents/33011>; Federal Emergency Management Agency, *Improvised Nuclear Device Response and Recovery: Communicating in the Immediate Aftermath*, 2013, http://www.fema.gov/media-library-data/20130726-1919-25045-0892/communicating_in_the_immediate_aftermath__final_june_2013_508_ok.pdf

FEMA has published several all-hazards planning guidance documents that touch upon some of the key practices identified in the Japan case. FEMA's 2009 *Evacuee Support Planning Guide* (FEMA P-760) is a planning guidebook for States or local governments to prepare to accept and support large numbers of evacuees from other communities and/or states.²³⁶ This *Guide* encourages states and communities to plan for managing an influx of evacuees with or without notice and if possible, in coordination with potential impact communities. It provides planning options for some of the issues discussed in the Japan case such as: tracking evacuees; decontamination for evacuees affected by radiological, chemical, or biological contamination; mitigating infrastructure and public service impacts due to increased user base; development of joint public information plans between both the impact and host community; coordinating social services benefits between jurisdictions; and preparing for return/reentry to impact community. Some of these recovery topics get minimal treatment and the perspective is mostly from the host community's as opposed to the impact community's role. Both perspectives are important.

In 2012, FEMA published the *Catastrophic Housing Annex* to its Hurricane Plan.²³⁷ This annex is among the most recent of FEMA's efforts to improve planning for temporary housing support in the wake of Hurricane Katrina. Many of the issues regarding housing raised in the Japan case are addressed in this *Annex*. It includes an extensive selection of climate suitable options for temporary housing, with available rental housing in habitable areas near the impact zone as the most preferred. The *Annex* promotes the application of a zoned approach to providing housing focusing initial resources in the less damaged peripheral areas that is similar to the concept of offsite remediation prioritization in the Japan case. Radiological planners may not initially look to the *Annex* as a guide since it is tied to the Hurricane Plan. States and communities could use the options and guidance in the *Annex* for housing after any type of disaster,

²³⁶ Federal Emergency Management Agency, *Evacuee Support Planning Guide*, 2009, <https://www.fema.gov/media-library/assets/documents/16941>

²³⁷ Federal Emergency Management Agency, *Catastrophic Housing Annex*, 2012, <https://www.fema.gov/media-library/assets/documents/29218>

including radiological. Inquiries at FEMA indicate that an all hazards version of the *Annex* is under development.

FEMA's 2007 *Debris Management Guide*, (FEMA-325) provides states and communities general guidance for planning debris management operations.²³⁸ It includes a brief reference to the additional complexities that radiological contamination would pose, but no specific planning guidance recommendations.

All the best guidance and plans will not matter if the responsible officials are unaware they exist or have never practiced or even discussed with colleagues how they would be used after a real disaster. The EPA sponsored a full scale recovery phase radiological exercise called Liberty RadEx in 2010. A full scale nuclear recovery exercise is out of reach for most state and community budgets, but tabletops designed to probe the issues and decision points that arise months and years after a large disaster can be very useful for preparing leaders and testing partnership structures. There is a growing recognition within the emergency management community that more frequent and effective disaster recovery exercises are needed. The Government Accountability Office and the Department of Homeland Security Inspector General have both made recommendations for more recovery-focused exercises.²³⁹

2. Geographical and Cultural

Whereas the U.S. and Japan have relatively similar governmental and disaster management structures, from a geographical standpoint they are night and day. Both countries are subject to a wide variety of natural hazards, including earthquakes, hurricanes/typhoons, volcanoes, severe winter storms, landslides, and flooding. For Japan, however, large, deadly disasters are far more frequent because of its exposed,

²³⁸ Federal Emergency Management Agency, *Debris Management Guide*, 2007, <https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/debris-management-guide>

²³⁹ Gene Aloise, *Combating Nuclear Terrorism: Actions Needed to Better Prepare to Recover from Possible Attacks using Radiological or Nuclear Materials* (Washington, DC: U.S. Government Accountability Office, 2010), <http://www.gao.gov/assets/310/301288.pdf>, 26; Richard L. Skinner, *Assessment of Federal Emergency Management Agency's Emergency Support Function Roles and Responsibilities* (Washington, DC: U.S. Department of Homeland Security, Office of Inspector General, 2010), http://www.oig.dhs.gov/assets/Mgmt/OIG_11-08_Nov10.pdf, 47.

compact situation atop four tectonic plates.²⁴⁰ Japan is essentially a cluster of islands of the Pacific coast of Russia, China, and Korea. Its land area is 377,887 square kilometers and its population is just under 127 million, with a density of 349 people per square km. The U.S., in contrast, has only 35 people per sq. kilometer and vast tracts of undeveloped land area.²⁴¹ In addition, over 80 percent of the land in Japan is unsuitable for development because of the terrain, nearly 73 percent of which is mountainous. This has resulted in large, populous cities along the thin coastlines that make up 8 percent of the land area.²⁴²

These geographic differences are critically important when comparing policy options related to relocation of communities and dealing with hazardous waste. High population density is linked with slower disaster recovery in part due to difficulties providing temporary housing.²⁴³

Geographical considerations are not the only factors at play for recovery decision makers mulling temporary versus permanent relocation and how to deal with the waste, but they are significant. The bottom line is that Japan simply has less land suitable for development than the U.S. From this angle, it's easy to understand why Japan is fighting to reclaim all of the land spoiled by the radiological contamination as quickly as possible. It is also easy to understand the quandary of what to do with the growing mountains of contaminated waste temporarily, let alone permanently.

The politics surrounding community relocations related to public works and disaster hazards are traditionally very sensitive. Japan already has a somewhat ugly history of state coerced relocations of small, defenseless villages sitting in the way of

²⁴⁰ Peter Duus, "Dealing with Disaster," in *Natural Disaster and Nuclear Crisis in Japan: Response and Recovery after Japan's 3/11*, ed. Jeff Kingston (New York: Routledge, 2012), 175.

²⁴¹ World Bank, "Population Density," accessed January 23, 2015, <http://data.worldbank.org/indicator/EN.POP.DNST>; Ministry of Internal Affairs and Communications, Government of Japan, "Population Estimates by Age (5-Year Age Group) and Sex," accessed March 1, 2015, <http://www.stat.go.jp/english/data/jinsui/tsuki/index.htm>

²⁴² "Japan Facts," National Geographic, accessed January 23, 2015, <http://travel.nationalgeographic.com/travel/countries/japan-facts/>; "Coastline Lengths," World by Map, accessed January 23, 2015, <http://world.bymap.org/Coastlines.html>

²⁴³ Aldrich, *Building Resilience: Social Capital in Post-Disaster Recovery*, 13.

future dams the national government has planned to bolster the country's limited freshwater resources.²⁴⁴ The U.S. has its own history with relocations for dams and ongoing divisiveness over sites for nuclear waste storage.

A number of the key practices discussed here require fostering willing and supportive host communities for the large groups of displaced disaster survivors. In the immediate emergency phase after disasters, U.S. communities near and far are eager to offer help and take in evacuees. Hosting the influx of strangers for months and years is far less desirable. Social Capital researcher Aldrich describes temporary housing trailers in the U.S. as “public bads.” In other words, something that has broad public benefits but negative side effects for a small segment of the population. This is one aspect of the other, darker side of social capital that has been explored in both economic and sociology literature. Whether it be temporary housing or temporary waste storage, communities with high levels of social capital are better equipped to fight off the placement of “public bads” too near for comfort.²⁴⁵

Sociologists have long held that American society is more individualistic compared to community oriented societies in East Asia.²⁴⁶ There are certainly pockets of close-knit communities dotted all over the U.S. landscape, many founded by immigrants who banded together to create small homes away from home. The Vietnamese-American Village de L'Est worked together closely to bring back their neighborhood more quickly than others after Hurricane Katrina soaked New Orleans.²⁴⁷ Residents of the Louisiana bayous are known to be deeply attached to their coastal homeland passed down for generations.²⁴⁸ Neighborhoods like these may not be open to accepting permanent relocation away from their home so easily even in the face of radiological contamination.

²⁴⁴ Daniel P. Aldrich, *Site Fights: Divisive Facilities and Civil Society in Japan and the West* (Ithaca, NY: Cornell University Press, 2008), 95–113.

²⁴⁵ Aldrich, *Building Resilience: Social Capital in Post-Disaster Recovery*, 134–147.

²⁴⁶ Jonathan Haidt, *The Righteous Mind: Why Good People are Divided by Politics and Religion* (New York, New York: Random House LLC, 2013), 113.

²⁴⁷ Aldrich, *Building Resilience: Social Capital in Post-Disaster Recovery*, 131.

²⁴⁸ David Burley et al., “Place Attachment and Environmental Change in Coastal Louisiana,” *Organization & Environment* 20, no. 3 (2007): 348.

On the whole, however, with no restrictions of movement among states, many U.S. cities and towns have relatively transient populations attracted by job opportunities or other reasons.²⁴⁹ In the post disaster environment, those with job mobility and limited property and social attachments in the area may prefer to move than wait out a lengthy cleanup process. When compared in that very broad sense, a policy of supporting self-determination for residents to relocate permanently would be more likely to succeed in many parts of the U.S. than it would have in Japan. Such community and personal family decisions cannot be dictated and are never made lightly. Balancing residents' self-determination versus a community desire to stay together and rebuild is extremely difficult after any significant disaster.

In the U.S., geographical and cultural factors will play out differently depending on the region affected, so it is difficult to make simple comparisons. No community wants to lose its tax base or worse yet completely dissolve itself by supporting permanent relocation of residents and businesses. No state wants to promote relocations that move residents and businesses (and therefore tax revenue) out of state. No community is eager to accept a waste storage site for contaminated materials in its midst. At the same time, community leaders want to help their residents recover as quickly as possible, even if the individual's path differs from the community's. The U.S. has more land to work with than a country like Japan, perhaps enabling more feasible options for communities to consider in their recovery planning.

H. COMPARATIVE ANALYSIS SUMMARY

Table 7 summarizes the findings described above of the comparison of the key practices observed in the case study to the U.S. policy environment. Frequently the comparison to the U.S. environment is based on available guidance and plans. Further research would be necessary to determine how often these guidance documents are

²⁴⁹ David Ihrke, *Reason for Moving: 2012 to 2013* (Washington, DC: U.S. Census Bureau, 2014). <http://www.census.gov/prod/2014pubs/p20-574.pdf>; U.S. Census Bureau, "Estimates of the Components of Resident Population Change: April 1, 2010 to July 1, 2013," accessed January 23, 2015, <http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>

applied in practice and exercised, necessary components for true capability development. Chapter VI will outline the recommendations derived from these findings.

Table 7. Key Practices Comparative Summary for U.S. Applicability

Public Information/Risk Communication Key Practice	Government Level Japan	Observations Japan Case	U.S. Political / Govt. Structure	U.S. Geog. / Cultural
Establish and maintain trust	Central	Early missteps; difficult to regain	Already in guidance	Need applies
Use multiple means of outreach	Central, Prefectural, Municipal	Improved after early stage	Already in guidance	Need applies
Ensure direct contact between community and relocated residents	Municipal	Community cohesion; flow of information to residents about home community; participation in recovery planning	Guidance needs more emphasis	Need applies
Combat stigma in host communities	Central, Prefectural, Municipal	Limited efforts resulted in discrimination and demands for decontamination certificates	Guidance needs more emphasis	Need applies
Local leader engagement	Prefectural, Municipal	Improved public trust	Guidance needs more emphasis	Need applies
In person radiation education seminars and stations	Prefectural, Municipal	Assisted residents to understand risk and manage dose; earlier identification of those needing more assistance	Guidance needs more emphasis	Need applies

Set national, flexible dose limit range for incident	Central	Improved earlier confusion due to fluctuating/relaxed standards; likely facilitated earlier reoccupancy in some areas	EPA <i>PAG Manual</i> : incident specific late phase decisions; clearance level policy very controversial	Community stakeholder input expected by public; community consensus will require significant effort
Recovery Planning Key Practice	Government Level Japan	Observations Japan Case	U.S. Political / Govt. Structure	U.S. Geog. / Cultural
Participatory recovery planning	Central, Prefectural, Municipal	Recovery visions and priorities nationally and for each locality; stakeholder involvement	Already in guidance, but recovery planning and stakeholder involvement not institutionalized	Public scrutiny of decisions expected
Separate, new Reconstruction Agency	Central	Centralized recovery management; criticism of slow bureaucracy continues	State level not federal	NA
Surveys of relocated residents	Prefectural, Municipal	Improved information flow between residents and communities for planning	New outside health monitoring	No significant issues anticipated; Privacy Act applies
Arrangements with host communities	Municipal	Keeps community members together; gathering place for community meetings	Guidance needs more emphasis	Need applies

Balance community cohesiveness vs. individual self determination	Central, Prefectural, Municipal	Official support for both retaining communities and support of livelihoods; some residents feel pressured to return	Guidance needs more emphasis	Relocation acceptable option
Financial Support Key Practice	Government Level Japan	Observations Japan Case	U.S. Political / Govt. Structure	U.S. Geog. / Cultural
Dispute Reconciliation Committee	Central	Buffer between affected parties and TEPCO; Detailed Guidelines; Compensation for psychological distress and evacuation costs early; Reduced court actions	Not currently addressed	Need applies
Central government financial backing for TEPCO	Central	Ensures financial support for TEPCO compensation; Government/taxpayers bearing costs at least for near term	U.S. law differs substantially	U.S. precedent exists

Payment for real estate loss to facilitate permanent relocation	Central, Prefectural, Municipal	Recommended March 2012, implemented March 2013, expanded December 2013; negotiations with local governments may have slowed implementation	Limited funding resource currently	Relocation potentially more acceptable option
Temporary Housing Key Practice	Government Level Japan	Observations Japan Case	U.S. Political / Govt. Structure	U.S. Geog. / Cultural
Expanded housing options	Central, Prefectural, Municipal	Faster transition from shelters to temporary housing; small units separate extended families	U.S. already employs varied methods	Post Katrina lessons prompted U.S. review of housing options
Long term use of temporary structures	Prefectural, Municipal	Unit deterioration and significant maintenance requirements	Post Katrina lessons prompted U.S. review of housing options; improvements still in progress	Post Katrina lessons prompted U.S. review of housing options
Offsite Remediation Key Practice	Government Level Japan	Observations Japan Case	U.S. Political / Govt. Structure	U.S. Geog. / Cultural
Divided responsibilities central and local governments based on severity of contamination	Central, Prefectural, Municipal	Reduced burden on local governments	Concern for consistency and equitable treatment	More typical joint efforts

Prioritized decontamination of areas with lower radiation levels	Central	Focused effort in lower level areas to support earlier reoccupancy; missed opportunity to facilitate early permanent relocations from most contaminated areas	Similar concept included in FEMA Housing Annex & Response Guidance	Requires robust stakeholder involvement & communication planning
Central government subsidies for municipalities providing storage sites	Central, Prefectural, Municipal	Provided after lengthy negotiations; temporary site identification delayed remediation	Pre-planning is preferred	Environmental Justice implications
Demonstration projects to assess and compare methods	Central, Prefectural, Municipal	Prioritizes resources for proven methods; lower cost methods identified	No significant issues anticipated	Requires communication planning
Study to assess use of personal dosimeter measurements to support late phase decision making	Central, Prefectural, Municipal	Mixed reactions from local officials, experts, and media; study ongoing	Not addressed in current guidance	Further assessment useful
Community Resettlement Key Practice	Government Level Japan	Observations Japan Case	U.S. Political / Govt. Structure	U.S. Geog. / Cultural

Staged reoccupancy to support remediation and decommissioning	Municipal	Capitalizes on localized, disaster-based economic boom; some businesses able to reopen and/or change model for new customer base; keeps community active	Further assessment useful	Further assessment useful
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VI. RECOMMENDATIONS AND CONCLUSION

We have to envisage the return of the next generation, even if we were not able to return.

—Shiro Izawa, Mayor of Futaba, Japan²⁵⁰

Can we forge something positive out of Fukushima’s catastrophe to improve disaster recovery readiness in the U.S.? How can the U.S. best capitalize on the lessons from Japan’s experience managing relocated communities and preparing for reconstruction and reoccupancy after a nuclear disaster?

One of the most disheartening findings of this study is that government and TEPCO officials seemingly recognized a need to help the residents and business owners in the most contaminated areas move on, but for a variety of reasons allowed the bureaucratic process to drag on for years before providing definitive policy and financial support. It is clear that local and state officials in the U.S. also will not be eager to assist taxpaying residents move elsewhere and give up on the community’s future. There are no easy solutions for this agonizing situation. It is impossible to overstate how important and how underappreciated the public information management and stakeholder engagement capability is to the disaster recovery process, especially when widespread contamination is involved. What is possible, is for high risk communities to reduce the time required for such decision making after disaster by giving serious consideration to the existential threat such a hazard might pose and planning for structured, open, and frank discussions with the public to inform its recovery strategy.

It is also possible—and advisable for the federal government to review the mechanisms available to support communities, individuals, and businesses in such a situation. Does it make sense to design a compensation system that requires court and congressional intervention as is currently the case under the Price-Anderson Act? If the Price-Anderson authority does not apply or is exceeded, are existing disaster assistance

²⁵⁰ “Debate Begins for Governments over Ishiba’s no-Return Remark,” *The Asahi Shimbun*.

authorities adequate to support long term or permanent relocations? What benefit is there to waiting for the catastrophe to occur before acting on these policy gaps?

Possibly the easiest and least controversial next step to address the issues raised by this study is to incorporate the lessons Fukushima has provided into national guidance for radiological disaster recovery planning and management. Local and state governments will be at the center of the maelstrom if a significant radiological disaster happens here. They will be managing the recovery—and they will need help.

A. POLICY RECOMMENDATIONS

State and community leaders and planners have a clear need for national guidance that outlines anticipated disaster recovery decision points and related public information messaging requirements and strategies. Jurisdictions that neighbor high risk areas have an equal if not more pressing need to understand their potential role after a significant radiological disaster. Ideally, the guidance would integrate both radiation management and general recovery support for the full continuum from evacuation to resettlement. This would help all involved communities envision the planning needs to support long term evacuees while preparing for future reoccupancy.

The following, more detailed recommendations highlight topics or key practices that emerge from this comparative analysis and represent gaps in current U.S. radiological disaster planning guidance. Based on the analysis in Chapter V, all of the suggested practices have basic applicability for the U.S. None are culturally or politically unique to the conditions in Japan. Combined with existing guidelines, the specific additions and or emphasis points below would provide more comprehensive planning support for communities and states. For ease of reference, the recommendations appear in the same order as the policy themes that frame Chapters IV and V.

1. Communities should plan in advance to ensure evacuated residents are able to stay in contact with local officials and that local officials will be able to track and communicate directly with residents. This point is useful for all types of disasters that may result in extended displacement of large numbers of people. Current guidance discusses registries for health monitoring and/or tracking of evacuees who have special needs or receive transportation assistance. The need to establish and maintain contact

between the community and all residents during extended displacements for recovery support and planning purposes is not emphasized.

2. State and national officials should prepare to provide public information about radiation and health to the media outlets and local officials in communities expected to host large concentrations of evacuees to help counteract discrimination and stigma against incoming evacuees. This point is briefly mentioned in the *Evacuee Support Planning Guide*, but could be strengthened and cross-referenced in other guidance documents specifically targeted to public information professionals.
3. Public information and risk communication guidance should stress not only the importance of a trusted spokesperson, but the importance of strong personal engagement by the local executive leadership in the stakeholder involvement for late phase decision making and recovery planning process.
4. As recommended by the University of Tokyo media research team, state and local officials should plan to provide in person radiation education seminars tailored to those living or working near the evacuation zones as well as evacuees as soon as the situation has stabilized.²⁵¹ The seminars can serve multiple purposes, to educate the public more effectively about radiation risk and self-protection measures to reduce individual dose, as well as identifying populations that may require additional support.
5. The population survey regimes developed by the prefectures and villages in Japan are a useful model for U.S. states and communities to incorporate needs and plans of individuals into community recovery planning. Current U.S. guidance focuses on health surveys only.
6. Local jurisdictions should establish host community relationships/arrangements pre-disaster, including plans for temporary municipal offices and provision of significant community and social services such as schools, daycare, and eldercare to evacuees.
7. Guidance should emphasize the importance of supporting self-determination for individuals and families, yet offer strategies for gently promoting community resilience and cohesiveness during the period of temporary relocation.
8. Local and state officials should delineate as early as possible areas where reoccupation will not be possible for a minimum of x years (e.g., three or five). They should establish mechanisms to facilitate permanent relocation at the earliest possible point for those who prefer not to wait in order to reduce uncertainty and anxiety.

²⁵¹ Sugimoto et al., “The Relationship between Media Consumption and Health-Related Anxieties,” e65331.

9. The Catastrophic Housing Annex of FEMA's Hurricane Plan would be more useful as an all hazards plan/annex that could be referenced in radiological planning guidance or plans.
10. Guidance should more explicitly explain the relationship and tradeoffs between the cleanup decisions and storage and disposal options, including the time required to implement decisions.
11. As IAEA recommended, from an early point officials should emphasize in public information and education forums the benefits of an iterative, strategic reduction of radiation dose over time as compared to the tradeoffs involved with setting a single, rigid, low dose target.²⁵²
12. Local and state governments, particularly those located near nuclear power plants, should consider options for temporary storage and disposal of contaminated debris in their disaster debris management planning. The EPA *PAG Manual* provides guidance for contaminated debris disposal planning. FEMA should update its general debris planning guidance (*Debris Management Guide*, FEMA-325) to ensure consistency with the updated *PAG Manual*.

B. OPPORTUNITIES FOR FUTURE RESEARCH

Given that the Fukushima recovery is relatively young with at least six more years of occupancy restrictions in some areas, we will have the opportunity to learn much more from the experience. This thesis has merely dipped into the myriad of complex disaster recovery issues and management strategies that are being discovered and tested in Japan. Five concepts mentioned in the case study that particularly warrant further study for potential U.S. policy consideration are: 1) the impact of the November 2013 policy shift to financially support property owners who buy homes elsewhere; 2) the establishment of a radiation dose range with a near term target of under 20 mSv/y for reoccupancy and a long term goal of 1 mSv/y; 3) the use of personal dosimeter measurement for supporting late phase decision making; 4) review of compensation guidelines to establish initial guidelines for future use in the U.S.; and 5) initial reestablishment of evacuated communities as base settlements to support remediation and decommissioning work.

²⁵² International Atomic Energy Agency, *Final Report: The Follow-up IAEA International Mission*, 12.

1. Real Property Compensation Policy Impact

For the property owners who had made up their minds to leave their home town permanently and resettle elsewhere, the November 2013 Cabinet decision to ensure compensation for 75 percent of the difference in the sales price was definitely a welcome event. It is not clear if the central government or prefecture or municipalities are tracking and monitoring the outcomes of these choices and ultimately, the policy. It is also unclear what will be done with the real estate left behind. It would be useful to track how many families and businesses accept this option and to what extent it affects the return population for the impacted communities. Follow up with the families could also yield information to compare the psycho-social impacts for those who permanently relocate versus those who wait and return.

Potential research questions for study include: what is the correlation between the number of residents accepting the real estate compensation and the return population of the municipality over time; what is the disposition of the abandoned properties and what impacts do they have on neighborhoods over time; and how well do permanently relocated people cope as compared to those who remained in temporary lodgings awaiting return?

2. Radiation Dose Range

As discussed in the Literature Review, the ultimate question that planners struggle with for nuclear/radiological disaster recovery is “how clean is clean?” The Central Government of Japan made a relatively early decision to adopt the under 20 mSv/y dose range in order to enable the development of specific remediation and reoccupancy strategies for the affected communities. Current U.S. policy, as outlined in the EPA *PAG Manual* sets a PAG for the intermediate phase, recommending relocation of the public at or above 20 mSv in year one and 5 mSv for subsequent years. For the late phase, EPA recommends a site specific process to determine dose levels for reoccupation that are acceptable to the community.

Future updates of the *PAG Manual* will benefit from monitoring and assessment of the implementation of the dose range in Japan from the perspective of how it affected

the reoccupancy. Potential research questions for study include: to what extent and how communities are able to successfully continue to reduce dose after initial reoccupation; how quickly community members demonstrate acceptance of the standards by moving back and reestablishing businesses in the areas opened for reoccupancy; and what public communication methods about community remediation and reoccupancy decisions and managing dose were most effective over time?

3. Personal Dosimeters for Estimating Future Dose

Chapter IV, Section D describes efforts by Japanese officials to transition from estimating dose for the purposes of making remediation and reoccupancy decisions based solely on environmental readings to using individual dosimeter readings. Currently, this concept is not addressed in the EPA *PAG Manual* or the DOE *Operational Guidelines*.

U.S. policy will benefit from monitoring and evaluating the potential benefits of these methods that are the object of ongoing studies in Japan. Potential research questions include: what are the actual benefits in terms of reduced relocation durations and remediation costs; at what point in the remediation planning and implementation process is the transition to individual dose measurement most feasible and effective; and what are the most successful means of explaining this change of method to the public?

4. Compensation Guidelines

Japan's Dispute Reconciliation Committee has developed detailed, carefully considered guidelines for TEPCO's compensation for nuclear damages. The law authorizing the Reconciliation Committee existed prior to 2011. The Committee benefited from the work of the Reconciliation Committee set up to address compensation after the 1999 criticality incident at Tokaimura that had only completed its work the year prior.²⁵³ The scope of the Fukushima accident far exceeded that of Tokaimura, so the new Committee of respected lawyers, scientists, health professionals has spent considerable effort and time developing and supplementing the compensation guidelines between 2011 and December 2013. This necessary work to review and assess the various

²⁵³ Nuclear Energy Agency, *Japan's Compensation System for Nuclear Damage*, 22.

forms of damages in order to make equitable determinations has resulted in delays in the actual compensation payments.

U.S. policymakers could invest time and effort now to review the Japanese guidelines in comparison with the current planned compensation framework of the American Nuclear Insurers, the entity that would make compensation payments if a U.S. nuclear plant accident occurred.²⁵⁴ Potential research questions include: what gaps in types of compensation coverage exist; what is the transition plan between the insurance coverage and the subsequent Court administered compensation; is there an accident scenario threshold that may warrant a more expedient progression to court and/or congressional action to facilitate timely compensation; and what are the potential benefits and/or hurdles to establishing a third party oversight or dispute resolution mechanism?

This pre-incident effort could ensure that residents and businesses would not need to wait for years for decisions about the types and amounts of compensation to be provided. This topic is included as a recommendation for further study because it has complex legal implications to be considered.

5. Staged Reoccupancy in “Base Settlements”

In its first draft revitalization plan of March 2012, the town of Okuma determined it would focus remediation efforts in the least contaminated area of Okawara and resettle it first as a base community to support the decontamination and decommissioning work (see Chapter IV, Section E). Okuma’s experience implementing this idea is still in early stages. It will be useful to monitor and document the successes and lessons of this approach over the next 10 to 50 years.

The U.S. could include a detailed case study of the Okawara base settlement as a means for staging the reoccupancy of Okuma in future planning guidance. Potential research questions for study include: does Okawara attract former residents and businesses of Okuma as well as temporary workers; what strategies for counteracting stigma related to the base settlement are most effective; and how well does Okawara and

²⁵⁴ American Nuclear Insurers, *Emergency Response: Some Answers to Frequently Asked Questions*.

Okuma overall recover as the decontamination and decommissioning work supporting the local economy diminishes?

C. CONCLUSION

It only takes a brief look at the blog of Mayor Endo of Kawauchi to know that he instinctively knew much of what he needed to do as the leader of his community after the 3/11 disaster. He has been the champion for keeping his community together and rebuilding and returning as quickly as possible. Still, even a well-seasoned public manager would ask for guidance and best practices for addressing the overwhelming challenges he has faced after the Fukushima meltdown. Shepherding a community through an extended period of involuntary relocation due to radiological contamination requires that local officials understand the fundamentals of highly technical issues, standards, and data to support complicated recovery decisions. At the same time, they must understand and support the basic needs of citizens and businesses and how these interrelate with the radiation hazard impacting the community.

Disaster survivors need leaders who value the kind of interactive exchange of information that the National Academies envisioned when it redefined risk communication in 1989.²⁵⁵ Open communication and engagement between the community members, leaders, and technical experts provides a path to make the kind of difficult decisions widespread contamination would compel. Survivors need leaders who will understand and carefully consider the long term implications of policy options for the community as well as its residents and businesses—even when they diverge. These themes must be at the center of any program of guidance and training for managing radiological disaster recovery.

With all the requirements and burdens community leaders face just to manage day to day affairs of local government, it may be optimistic to expect they will also prepare for recovery from a low frequency/high impact nuclear disaster. In the U.S., communities within a ten mile radius of nuclear power plants prepare, train for, and exercise emergency plans for radiological accidents. Logic would imply that if it is enough of a

²⁵⁵ National Research Council, *Improving Risk Communication*, 21.

risk to warrant preparing for responding to a radiological disaster, then preparation for the recovery is prudent also. Experience demonstrates, however, that preparedness for recovery tends to be a lower priority for communities when allocating scarce resources. Outside those communities closest to nuclear power plants, most small to moderately sized communities' expertise for managing radiation hazards will be limited to the fire department's hazardous materials team and perhaps a specially trained staff at the regional hospital. For both response and recovery, it is reasonable to assume most communities, even those with nuclear power plants nearby, will require additional technical support from the state and federal government if a radiological incident occurs.

Guidance and job aids for the intermediate and late phase (recovery) are all the more critical since community preparedness in advance is likely to be limited. If an incident were to occur, federal and state officials must be prepared to provide "just in time" training and technical assistance for local leaders based on pre-prepared intermediate and late phase decision making guidance.

As with all emergency preparedness, we hope to never need to put our efforts to prepare for nuclear/radiological disasters into real practice. The plight of the communities surrounding Fukushima Daiichi reminds us that we must be ready all the same.

Nana korobi ya oki—Fall seven times, stand up eight.

—Japanese proverb

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LIST OF REFERENCES

- Acton, James M., and Mark Hibbs. *Why Fukushima was Preventable*. Washington, DC: Carnegie Endowment for International Peace, 2012.
- Aldrich, Daniel P. *Building Resilience: Social Capital in Post-Disaster Recovery*. Chicago: University of Chicago Press, 2012.
- . *Site Fights: Divisive Facilities and Civil Society in Japan and the West*. Ithaca, NY: Cornell University Press, 2008.
- Aloise, Gene. *Combating Nuclear Terrorism: Actions Needed to Better Prepare to Recover from Possible Attacks using Radiological or Nuclear Materials*. Washington, DC: U.S. Government Accountability Office, 2010.
<http://www.gao.gov/assets/310/301288.pdf>
- Aoki, Miki. “Radioactive Dust Released during Fukushima Cleanup Reaches as Far as Miyagi Prefecture.” *The Asahi Shimbun*, July 31, 2014.
<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201407310044>
- . “Residents Failed by Fitful Rebuilding.” *Japan Times*, March 11, 2013.
<http://www.japantimes.co.jp/news/2013/03/11/national/residents-failed-by-fitful-rebuilding/#.VM4JldLF-So>
- . “Study: Cesium from Fukushima Debris Removal Likely Spread 50 Km.” *The Asahi Shimbun*, July 16, 2014.
<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201407160064>
- Becker, Steven M. “The Fukushima Dai-Ichi Accident: Additional Lessons from a Radiological Emergency Assistance Mission.” *Health Physics* 105, no. 5 (2013): 455–461.
- . “Learning from the 2011 Great East Japan Disaster: Insights from a Special Radiological Emergency Assistance Mission.” *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 9, no. 4 (2011): 394–404.
- . “Risk Communication and Radiological/Nuclear Terrorism: A Strategic View.” *Health Physics* 101, no. 5 (2011): 551–558.
- Brittingham, Rochelle, and Tricia Wachtendorf. “The Effect of Situated Access on People with Disabilities: An Examination of Sheltering and Temporary Housing after the 2011 Japan Earthquake and Tsunami.” *Earthquake Spectra* 29, no. s1 (2013), S433–S455.
- Brumfiel, Geoff, and Ichiko Fuyuno. “Fukushima’s Legacy of Fear.” *Nature* 483, no. 7388 (2012): 138–140.

- Burley, David, Pam Jenkins, Shirley Laska, and Traber Davis. "Place Attachment and Environmental Change in Coastal Louisiana." *Organization & Environment* 20, no. 3 (2007): 347–366.
- Covello, Vincent T. "Risk Communication, Radiation, and Radiological Emergencies: Strategies, Tools, and Techniques." *Health Physics* 101, no. 5 (2011): 511–530.
- Crowley, K., and John R. Elliott. "Earthquake Disasters and Resilience in the Global North: Lessons from New Zealand and Japan." *The Geographical Journal* 178, no. 3 (2012): 208–215.
- Duus, Peter. "Dealing with Disaster." In *Natural Disaster and Nuclear Crisis in Japan: Response and Recovery after Japan's 3/11*, ed. Jeff Kingston (175–187). New York: Routledge, 2012.
- Fackler, Martin. "Japan's Nuclear Refugees, Still Stuck in Limbo." *New York Times*, October 1, 2013. http://www.nytimes.com/2013/10/02/world/asia/japans-nuclear-refugees-still-stuck-in-limbo.html?pagewanted=all&_r=1&
- Federal Emergency Management Agency. *Catastrophic Housing Annex*. 2012. <https://www.fema.gov/media-library/assets/documents/29218>
- . *Debris Management Guide*. 2007. <https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/debris-management-guide>
- . *Evacuee Support Planning Guide*. 2009. <https://www.fema.gov/media-library/assets/documents/16941>
- . *Improvised Nuclear Device Response and Recovery: Communicating in the Immediate Aftermath*. 2013. http://www.fema.gov/media-library-data/20130726-1919-25045-0892/communicating_in_the_immediate_aftermath__final_june_2013_508_ok.pdf
- . *Long Term Community Recovery Planning Process: A Self-Help Guide*. Washington, DC: Federal Emergency Management Agency, 2005. <https://www.fema.gov/media-library/assets/documents/6337>
- . *Radiological Emergency Preparedness Program Manual*. 2013. <http://www.fema.gov/media-library/assets/documents/32780?fromSearch=fromsearch&id=7576>
- . *A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action*. Washington, DC: Federal Emergency Management Agency, 2011. <https://www.fema.gov/media-library/assets/documents/23781>

- Federal Radiological Preparedness Coordinating Committee. *Communicating during and after a Nuclear Power Plant Incident*. Federal Emergency Management Agency. 2013. <http://www.fema.gov/media-library/assets/documents/33011>
- Figueroa, Pablo M. "Risk Communication Surrounding the Fukushima Nuclear Disaster: An Anthropological Approach." *Asia Europe Journal* 11, no. 1 (2013): 53–64.
- Filyushkin, I. V. "The Chernobyl Accident and the Resultant Long-Term Relocation of People." *Health Physics* 71, no. 1 (1996): 4–8.
- Fountain, Henry. "Chernobyl: Capping a Catastrophe." *New York Times*, April 27, 2014. <http://www.nytimes.com/interactive/2014/04/27/science/chernobyl-capping-a-catastrophe.html>
- Fukushima Nuclear Accident Independent Investigation Commission. *Official Report Executive Summary*. Tokyo, Japan: The National Diet of Japan, 2012.
- González, Abel J. "The Recommendations of the ICRP Vis-À-Vis the Fukushima Dai-ichi NPP Accident Aftermath." *Journal of Radiological Protection* 32, no. 1 (2012): 1–7. http://iopscience.iop.org/0952-4746/32/1/N1/pdf/0952-4746_32_1_N1.pdf
- Greer, Alex. "Earthquake Preparedness and Response: Comparison of the United States and Japan." *Leadership and Management in Engineering* 12, no. 3 (2012): 111–125.
- Haidt, Jonathan. *The Righteous Mind: Why Good People are Divided by Politics and Religion*. New York, New York: Random House LLC, 2013.
- Harlan, Chico. "Japan's Nuclear Victims Seek Compensation, but Not a Day in Court." *The Washington Post*, June 25, 2012. http://www.washingtonpost.com/world/japans-nuclear-victims-seek-compensation-but-not-a-day-in-court/2012/06/25/gJQAe8GO1V_story.html
- Harnett, Sam. "Not Everyone Wants the Clean-Up in Fukushima to be Over." *Public Radio International*, October 15, 2014. <http://www.pri.org/stories/2014-10-15/not-everyone-wants-clean-fukushima-be-over>
- Hasegawa, Reiko. *Disaster Evacuation from Japan's 2011 Tsunami Disaster and the Fukushima Nuclear Accident*. Paris, France: Institut du développement durable et des relations internationales, 2013. http://www.iddri.org/Publications/Collections/Analyses/STUDY0513_RH_DEV_AST%20report.pdf

- Haworth, Abigail. "After Fukushima: Families on the Edge of Meltdown." *The Guardian*, February 23, 2013.
<http://www.theguardian.com/environment/2013/feb/24/divorce-after-fukushima-nuclear-disaster>
- Hongo, Jun. "One in Five Japanese Cautious about Fukushima Food." *The Asahi Shimbun*, October 2, 2014. <http://blogs.wsj.com/japanrealtime/2014/10/02/one-in-five-japanese-cautious-about-fukushima-food/?KEYWORDS=fukushima>
- Hooper, Rowan. "Fukushima: Health Disaster or PR Fail?" *The Japan Times*, September 7, 2013, http://www.japantimes.co.jp/news/2013/09/07/national/science-health/fukushima-health-disaster-or-pr-fail/#.U_AmAsVdWS0
- Houts, Peter S., Paul D. Cleary, and Teh-Wei Hu. *Three Mile Island Crisis: Psychological, Social, and Economic Impacts on the Surrounding Population*. University Park, PA: Pennsylvania State University Press, 1988.
- Ihrke, David. *Reason for Moving: 2012 to 2013*. Washington, DC: U.S. Census Bureau, 2014. <http://www.census.gov/prod/2014pubs/p20-574.pdf>
- Inajima, Tsuyoshi, and Yuji Okada. "Tepco under State Control as Government Gets Shares for Cash." *Bloomberg*, July 31, 2012.
<http://www.bloomberg.com/news/articles/2012-07-31/tepcu-under-state-control-as-government-gets-shares-for-cash>
- International Atomic Energy Agency. *Final Report: The Follow-Up IAEA International Mission on Remediation of Large Contaminated Areas Off-Site the Fukushima Daiichi Nuclear Power Plant*. Vienna, Austria: International Atomic Energy Agency, 2014.
- . *Report on the Preliminary Fact Finding Mission Following the Accident at the Nuclear Fuel Processing Facility in Tokaimura, Japan*. Vienna, Austria: International Atomic Energy Agency, 1999.
- International Radiation Protection Association. *Guiding Principles for Radiation Protection Professionals on Stakeholder Engagement*. 2008. Report no. IRPA 08/08. <http://www.irpa.net/members/54494/%7B86D953FC-5B32-4BF9-91CE-739C8F615F4B%7D/Stakeholder-Engagement-Guiding-Principles.pdf>
- Isoda, Yuzuru. "Refuge Life of Evacuees from the Fukushima Nuclear Accident Analysis of Okuma Town Survey Based on Human Capital Theory." *The 2011 East Japan Earthquake Bulletin of the Tohoku Geographical Association* (October 31, 2011). <http://tohokugeo.jp/articles/e-contents26.html>
- Isomura, Kentaro. "Decontamination Worker Moved by What He Saw Writes Poetry in Fukushima." *The Asahi Shimbun*, May 28, 2014.
<http://ajw.asahi.com/article/0311disaster/recovery/AJ201405280003>

- Kaneko, Yuka. "Livelihood Support for the Early Recovery in the Great East Japan Earthquake and Tsunami: Lessons for Developing Countries." *Journal of International Cooperation Studies* 20, no. 2/3 (2013): 75–104.
http://www.research.kobe-u.ac.jp/gsics-publication/jics/kaneko_20-2&3.pdf
- Kingston, Jeff, ed., *Natural Disaster and Nuclear Crisis in Japan: Response and Recovery after Japan's 3/11*. New York: Routledge, 2012.
- Kinley III, David, ed., *Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine*. 2nd ed. Vienna, Austria: International Atomic Energy Agency, 2006.
- Kirichenko, Vladimir A., Alexander V. Kirichenko, and Day E. Werts. "Consequences and Countermeasures in a Nuclear Power Accident: Chernobyl Experience." *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 10, no. 3 (2012): 314–320.
- Kodera, Yoichiro. "One-Third of Namie Evacuees Expect to Never Return Home." *The Asahi Shimbun*, January 14, 2012.
<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201201140042>
- Kondo, Tamiyo, and E. Maly. *Housing Recovery by Type of Resident Involvement: Providing Housing vs. Mobilizing Residents*. Shanghai: International Society of Habitat Engineering and Design, 2012.
- Lochard, Jacques and Serge Prêtre. "Return to Normality after a Radiological Emergency." *Health Physics* 68, no. 1 (1995): 21–26.
- Maly, Elizabeth, and Yoshimitsu Shiozaki. "Towards a Policy that Supports People-Centered Housing Recovery—Learning from Housing Reconstruction after the Hanshin-Awaji Earthquake in Kobe, Japan." *International Journal of Disaster Risk Science* 3, no. 1 (2012): 56–65.
- Marples, David R. "The Chernobyl Disaster: Its Effect on Belarus and Ukraine." In *Long Road to Recovery; Community Responses to Industrial Disaster*, edited by James K. Mitchell, (183–230). United Nations University Press, 1996.
- . *The Social Impact of the Chernobyl Disaster*. London: Macmillan Press, 1988.
- Maruko, Mami. "Fukushima Evacuees Seek End to Limbo." *The Japan Times*, June 19, 2014. http://www.japantimes.co.jp/news/2014/06/19/national/fukushima-evacuees-seek-end-limbo/#.VFw0_TTF-So
- McCormick, Sabrina. "After the Cap: Risk Assessment, Citizen Science and Disaster Recovery." *Ecology & Society* 17, no. 4 (2012).
<http://www.ecologyandsociety.org/vol17/iss4/art31>

- McCurry, Justin. “Fukushima Nuclear Disaster: Three Years on 120,000 Evacuees Remain Uprooted.” *The Guardian*, September 10, 2014.
<http://www.theguardian.com/world/2014/sep/10/fukushima-nuclear-disaster-japan-three-years-families-uprooted>
- . “Fukushima Residents May Never Go Home, Say Japanese Officials.” *The Guardian*, November 12, 2013.
<http://www.theguardian.com/environment/2013/nov/12/fukushima-daiichu-residents-radiation-japan-nuclear-power>
- . “Fukushima Town Revealed in Google Street View Two Years after Tsunami.” *The Guardian*, March 27, 2013.
<http://www.theguardian.com/environment/2013/mar/27/fukushima-google-street-view-meltdown-tsunami>
- Medvedev, Grigori. *The Truth about Chernobyl*. Trans. Evelyn Rossiter. New York: Basic Books, Inc., 1991.
- Ministry of Economy, Trade and Industry, Government of Japan. *Rearranging Restricted Areas and Areas to which Evacuation Orders Have Been Issued, etc.* 2012.
http://www.meti.go.jp/english/earthquake/nuclear/roadmap/pdf/20120330_01a.pdf
- Morhard, Ryan, and Sanjana Ravi. “The Price-Anderson Act and the Role of Congress in Compensating Victims after a Catastrophic Nuclear Disaster.” *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 10, no. 4 (2012): 340–345.
- Murayama, Takehiko. *Social Impacts Induced by Radiation Risk in Fukushima*. Porto, Portugal: International Association for Impact Assessment, 2012.
<http://www.iaia.org/conferences/iaia12/uploadpapers/Final%20papers%20review%20process/Murayama,%20Takehiko.%20%20Social%20impacts%20induced%20by%20radiation%20risk%20in%20Fukushima.pdf>
- National Council on Radiation Protection and Measurements. *Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents*. Bethesda, MD: National Council on Radiation Protection and Measurements, 2014.
- National Research Council. *Improving Risk Communication*. Washington, DC: National Academy Press, 1989.
- Nomura, Shuhei, Stuart Gilmour, Masaharu Tsubokura, Daisuke Yoneoka, Amina Sugimoto, Tomoyoshi Oikawa, Masahiro Kami, and Kenji Shibuya. “Mortality Risk amongst Nursing Home Residents Evacuated after the Fukushima Nuclear Accident: A Retrospective Cohort Study.” *PloS One* 8, no. 3 e60192 (2013).

Nuclear Emergency Response Headquarters. *Basic Concept and Issues to be Challenged for Rearranging the Restricted Areas and Areas to which Evacuation Orders have been Issued Where Step 2 has been Completed*. Tokyo, Japan: Cabinet Office, Government of Japan, 2011.

———. *Report of Japanese Government to the IAEA Ministerial Conference on Nuclear Safety-the Accident at TEPCO's Fukushima Nuclear Power Stations*. Tokyo, Japan: Cabinet Office, Government of Japan, 2011.
http://japan.kantei.go.jp/kan/topics/201106/iaea_houkokusho_e.html

Nuclear Energy Agency. *Japan's Compensation System for Nuclear Damage*. Issy-les-Moulineaux, France: Organization for Economic Co-operation and Development, 2012. <https://www.oecd-nea.org/law/fukushima/7089-fukushima-compensation-system-pp.pdf>

Nuclear Safety Commission of Japan. *Basic Policy of the Nuclear Safety Commission of Japan on Radiation Protection for Termination of Evacuation and Reconstruction*. 2011.
http://www.nsr.go.jp/archive/nsc/NSCenglish/geje/20110719suggest_4.pdf

Okwu, Michael, Aaron Ernst, and Azmat Khan. "Inside Fukushima's Ghost Towns." *Al Jazeera*, January 6, 2014. <http://america.aljazeera.com/watch/shows/america-tonight/america-tonight-blog/2014/1/6/fukushima-decontaminationghosttowns.html>

Otsuki, Noriyoshi, and Yuri Oiwa. "Government Estimates all Fukushima Areas Safe for Living by 2021." *The Asahi Shimbun*, June 24, 2014.
<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201406240055>

Pamintuan-Lamorena, Maan. "Government Team Keeps High Radiation Data on Three Fukushima Municipalities from the Public." *Japan Daily Press*, March 26, 2014, <http://japandailypress.com/government-team-keeps-high-radiation-data-on-three-fukushima-municipalities-from-the-public-2646381/>

Peters, Ellen M., Burt Burraston, and C. K. Mertz. "An Emotion-Based Model of Risk Perception and Stigma Susceptibility: Cognitive Appraisals of Emotion, Affective Reactivity, Worldviews, and Risk Perceptions in the Generation of Technological Stigma." *Risk Analysis* 24, no. 5 (2004): 1349–1367.

Peters, Richard G., Vincent T. Covello, and David B. McCallum. "The Determinants of Trust and Credibility in Environmental Risk Communication: An Empirical Study." *Risk Analysis* 17, no. 1 (1997), 43–54.

Reconstruction Agency, Government of Japan. *Current Status and Path toward Reconstruction*. Tokyo, Japan: Cabinet Office, 2013.
http://www.reconstruction.go.jp/english/130528_CurrentStatus_PathToward_FINAL.pdf

- Saito, Mari, and Lisa Twaronite. "Fukushima Farmer Takes on Nuclear Plant Operator over Wife's Suicide." Reuters. July 9, 2014.
<http://www.trust.org/item/20140709205521-oxacp/?source=search>
- Sample, Ian. "Fukushima Two Years On: A Dirty Job with no End in Sight." *The Guardian*, December 3, 2013.
<http://www.theguardian.com/environment/2013/dec/03/fukushima-daiichi-tsunami-nuclear-cleanup-japan>
- Schoch-Spana, Monica, Nidhi Bouri, Kathleen Minton, Ryan Morhard, Ann Norwood, Sanjana Ravi, Tara Kirk, *Mass Population Displacement After a Nuclear Terrorist Attack: How to Hasten and Strengthen the Recovery of Uprooted Communities*. Baltimore, MD: UPMC Center for Health Security, 2013.
- Siembieda, William. "Multi Location Disaster in Three Countries: Comparing the Recovery Process in Japan, Chile and New Zealand." *Focus: Journal of the City and Regional Planning Department* 9, no. 1 (2012): 43–50.
- Skinner, Richard L. *Assessment of Federal Emergency Management Agency's Emergency Support Function Roles and Responsibilities*. Washington, DC: U.S. Department of Homeland Security, Office of Inspector General, 2010.
http://www.oig.dhs.gov/assets/Mgmt/OIG_11-08_Nov10.pdf
- Shiozaki, Yoshimitsu. "Housing Reconstruction and Community Development." In *The Great East Japan Earthquake 2011 Case Studies*. Kobe, Japan: United Nations International Recovery Platform, 2013.
http://www.recoveryplatform.org/outfile.php?id=1026&href=http://www.recoveryplatform.org/assets/irp_case_studies/ENGLISH_RECOVERY%20STATUS%20REPORT%20JAPAN_revised%202014.3.27.pdf
- Slovic, Paul. "Perceived Risk, Trust, and Democracy." *Risk Analysis* 13, no. 6 (1993): 675–682.
- Slovic, Paul, Melissa L. Finucane, Ellen Peters, and Donald G. MacGregor. "Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality." *Risk Analysis* 24, no. 2 (2004): 311–322.
- Smith, Jim T. and Nicholas A. Beresford, *Chernobyl: Catastrophe and Consequences*. Chichester, UK: Springer, 2005.
- Stilger, Bob. "Fukushima's Future." Open Democracy. February 3, 2014.
<https://www.opendemocracy.net/transformation/bob-stilger/fukushima%E2%80%99s-future>
- Suzuki, Itoko, and Yuko Kaneko, *Japan's Disaster Governance: How Was the 3.11 Crisis Managed?* vol. 4. New York: Springer Science & Business Media, 2013.

- Takahashi, Kenjiro. "Consumers Suddenly More Wary of Produce from Fukushima." *The Asahi Shimbun*, October 2, 2014.
<http://ajw.asahi.com/article/0311disaster/fukushima/AJ201410020033>
- Takenaka, Kazumasa, and Kaname Ohira. "TEPCO to Seek Billions More for Fukushima Compensation." *The Asahi Shimbun*, March 21, 2012.
<https://ajw.asahi.com/article/0311disaster/fukushima/AJ201203210049>
- Tanaka, Yasuo, Yoshimitsu Shiozaki, Akihiko Hokugo, and Sofia Bettencourt. *Reconstruction Policy and Planning*. Washington, DC: World Bank, 2013.
- Tanigawa, Koichi, Yoshio Hosoi, Nobuyuki Hirohashi, Yasumasa Iwasaki, and Kenji Kamiya. "Loss of Life After Evacuation: Lessons Learned from the Fukushima Accident." *The Lancet* 379, no. 9819 (2012): 889–891. DOI: 10.1016/S0140-6736(12)60384-5.
- Tisdall, Simon. "Fukushima Ghost Towns Struggle to Recover amid High Radiation Levels." *The Guardian*, January 1, 2014,
<http://www.theguardian.com/environment/2014/jan/01/fukushima-ghost-towns-high-radiation-levels-tsunami>
- Urabe, Tomoyoshi. "Wooden Temporary Housing in Fukushima Prefecture: Focusing on Log Construction." In *The Great East Japan Earthquake 2011 Case Studies (75–79)*. Kobe, Japan: United Nations International Recovery Platform, 2013.
- Ubaura, Michio. "Reconstruction Urban Planning: Current Status and Future Challenges." In *The Great East Japan Earthquake 2011 Case Studies*. Kobe, Japan: United Nations International Recovery Platform, 2013.
- Uranaka, Taiga, and Antoni Slodkowski. "Special Report: Tsunami Evacuees Caught in \$30 Billion Japan Money Trap." Reuters. October 31, 2014.
<http://www.trust.org/item/20141031005413-ux955/?source=jtOtherNews1>
- Umeda, Sayuri. *Japan: Legal Responses to the Great East Japan Earthquake of 2011*. Law Library of Congress. 2013. <http://www.loc.gov/law/help/japan-earthquake/>
- United Nations Development Programme. *The Human Consequences of the Chernobyl Nuclear Accident: A Strategy for Recovery*. New York: United Nations, 2002.
<http://www.un.org/ha/chernobyl/docs/report.pdf>
- World Health Organization. *Health Risk Assessment from the Nuclear Accident after the 2011 Great East Japan Earthquake and Tsunami, Based on a Preliminary Dose Estimation*. Geneva, Switzerland: World Health Organization, 2013.
http://www.who.int/ionizing_radiation/pub_meet/fukushima_risk_assessment_2013/en/,

Yin, Robert K. *Case Study Research: Design and Methods*, vol. 5. 3rd ed. Thousand Oaks, CA: Sage Publications, 2003.

Yu, Charley, Jing-Jy Cheng, Sunita Kamboj, Stephen Domotor, and Andrew Wallo. *Preliminary Report on Operational Guidelines Developed for use in Emergency Preparedness and Response to a Radiological Dispersal Device Incident*. Argonne, IL: Argonne National Laboratory, 2009.

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