Policy Perspectives

An Ounce of Nuclear Prevention: A Window into Japanese Evacuation Planning for Nuclear Accidents

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Introduction

In the wake of the Fukushima Daiichi nuclear accident, 98,000 people left their homes under Japanese government orders to evacuate. Many of them did not know what had happened at the plant until the evacuation notice. Those living within a 3km radius were the first to go on March 11, 2011. As the seriousness of the accident became apparent, the areas of evacuation were gradually expanded. Thus, many residents were forced to re-evacuate to other places several times without accurate information from the Japanese government. There were no preparations in place for wider-area evacuations.²

The 2011 accident highlighted the need for better evacuation planning and in 2012, the Nuclear Regulatory Authority (NRA) requested that municipalities lying within 30km from the nuclear power plant formulate evacuation plans. However, as in

other cases of Japanese policy, the responsibilities are murky. While towns and prefectures plan for evacuations, they have demanded that the central government take responsibility for actual responses.

January 11, 2016

This has been the case of Ikata Town and Ehime Prefecture, home to the Ikata Nuclear Power Plant. In fact, Ehime Governor Tokihiro Nakamura and Ikata Mayor Kazuhiko Yamashita made the restart of their reactors contingent on the central government asserting responsibility. This seemed to be more important than actual proof that evacuation plans were sufficient. In fact, just days before the Japanese government held a drill to test evacuation plans, Governor Nakamura and Ikata Town Mayor Yamashita approved the restart of the local reactors. This raises several questions: Should evacuation plans be required to license the operation of reactors

¹ "福島の復興に向けた取組."Reconstruction Agency. July 7, 2015.

http://www.reconstruction.go.jp/topics/main-cat1/sub-cat1-

^{1/20150707}_jikankouenshiryo_douyuukai.pdf

² "第4部被害の状況と被害拡大の要因."The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. October 25, 2012.

http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/pdf/naiic_honpen_honbun4.pdf

(as they are in the United States)? Did local politicians serve their constituents well? What is an appropriate formula for sharing responsibilities in nuclear matters in Japan?

accident occurs, prevent the situation from worsening.³⁴

As the Fukushima Daiichi nuclear accident

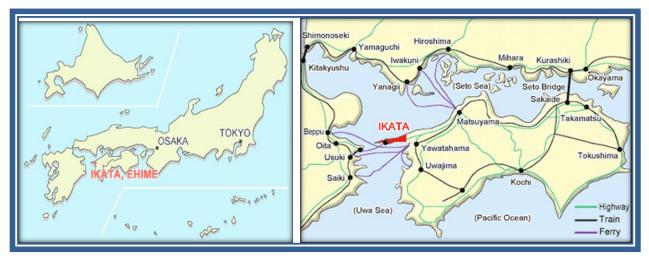


Figure 1 Ikata Town. Source: Ikata Town Web.

What are the Nuclear Emergency Response Guidelines?

In 2012, the NRA formulated the Nuclear Emergency Response Guidelines for nuclear disaster evacuation measures. Local government and municipalities had to revise their local disaster management plans to respond to incidents involving radiation.

Nuclear disaster prevention measures are based on the International Atomic Energy Agency (IAEA) concept "Defense in Depth." In order to maintain safety of nuclear power plants, "Defense in Depth" advocates multiple safety measures. In Japan, "Defense in Depth" was designed to prevent accidents, prevent expansion of accidents, and if an

demonstrated, nuclear emergency preparedness in Japan clearly had several gaps including the lack of detailed evacuation plans for the public, education and training, and an adequate emergency response system. ⁵

Since 2011, Japan has added two elements into the "Defense in Depth" concept: severe accident response and emergency response against accidental radiation release. To cover the latter element, local government and municipalities have created local disaster management plans.⁶

Previous guidelines required evacuation plans for people living within 8km of a nuclear power plant site. Since Fukushima,

³ Koike, Takuji. "新規制基準と原子力発電所の再稼働."ISSUE BRIEF, no. 840 (2015).

http://dl.ndl.go.jp/view/download/digidepo_889127 0_po_0840.pdf?contentNo=1.

⁴ The Defense in Depth comprises five levels. Before the Fukushima nuclear accident, Japan focused on levels one through three, which were for plant design, but highlighted the importance of the fourth

and fifth levels for emergency planning and adequate emergency response system after the Fukushima accident.

⁵ "原子力災害対策指針."NRA. October 31, 2012.https://www.nsr.go.jp/data/000024441.pdf. ⁶ "原子力発電の防災対策."

http://www.kepco.co.jp/corporate/info/pr/el_mess age/pdf/elme1_p30.pdf.

that zone has been expanded to 30 km, partly in response to the Diet's Independent Investigation Commission report which stated that the Japanese government provided little information for residents, forcing them to decide for themselves whether or not to evacuate. Moreover, as the accident worsened, the Japanese government frequently expanded the evacuation zone. Evacuation orders for 30km away from Fukushima Daiichi Nuclear Power Plant were delayed about a month due to slow decision-making by the Government Nuclear Emergency Response Headquarters. 7 Still, only three of ten municipalities received evacuation orders from the central government. And when municipalities issued evacuation orders, only 40-60% of residents received them.⁸ Clearly, this situation needed to be improved.

The new NRA guidelines now require municipalities to define measures, routes, and an evacuation destination⁹ for residents living in both the Precautionary Action Zone (5km away from nuclear power plant) and the Urgent Protective Action Planning Zone (5-30km away from nuclear power plant).¹⁰

Ikata Nuclear Power Plant and evacuation plan

Ikata Town is located in southwestern Ehime Prefecture, Japan. The total population is 10, 238 and almost half of the population are senior citizens. The major industries in Ikata Town include citrus cultivation and coastal fisheries. ¹¹ The Ikata Nuclear Power Plant, which is owned by Shikoku Electric Power Company (EPCO), started operating in 1977. The Ikata No.3 reactor suspended operations in April 2011, following the NRA's new safety assessment after the Fukushima Daiichi nuclear accident.

About 55 companies and a total 1,450 people work at the Ikata Nuclear Power Plant. The Ikata Nuclear Power Plant has three reactors. The No.3 reactor is one of four reactors that uses mixed oxide (MOX) fuel in Japan – fuel that combines plutonium and uranium in oxide form. This detail is important because both the government and industry are keen on restarting reactors that use MOX so that they can demonstrate the need to start up the brand new Rokkasho Reprocessing Plant (RRP). ¹³ RRP was expected to operate by October 2013, but its

^{7 &}quot;第4部 被害の状況と被害拡大の要因."The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. October 25, 2012

http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/nai ic.go.jp/pdf/naiic_honpen_honbun4.pdf.

^{*}第4部被害の状況と被害拡大の要因."The National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission. October 25, 2012.

http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/nai ic.go.jp/pdf/naiic_honpen_honbun4.pdf.

⁹ Local governments in the PAZ and UPZ use new NRA guidelines to formulate evacuation plans, but these are not subject to NRA inspections or to central government review.

¹⁰ Fuketa, Toyoshi. "Nuclear Regulation Authority - Overview, Timeline for Establishment, Current and Future Plans -." November 27, 2012. http://nassites.org/fukushima/files/2012/10/NASFuketa.pdf. ¹¹ "愛媛県で暮らそう! えひめ移住支援ポータルサイト."Ikata Town.

http://www.e-iju.net/city/20070830143432.php. ¹² "原子力技術・人材の維持について." 原子力技術・人材の維持について. 電気事業連合会. August 7, 2014.

http://www.meti.go.jp/committee/sougouenergy/d enkijigyou/genshiryoku/pdf/004_04_01.pdf.

13 Yukari Sekiguchi," Politics and Japan's Rokkasho Reprocessing Plant," *Policy Perspectives Series*,
Center for Strategic and International Studies.
September 14, 2014.

opening has been delayed. If brought online, it would produce four tons of plutonium annually for MOX fuel. As of July 2015, Japan owns roughly 47.8 tons of plutonium. ¹⁴ When RRP starts full operation, the stockpile will increase. Thus, restarting MOX reactors like the Ikata No.3 reactor will be key in keeping Japan's plutonium balance from growing radically.

Ikata Town falls within the 30km radius of the nuclear power plant and is now required to demonstrate an evacuation plan for a severe nuclear accident. The Sadamisaki Peninsula poses particular challenges, however, because the nuclear power plant blocks residents from heading inland, leaving them with few exit options. A working team established in September 2013 discovered this after an evacuation drill in October 2013. 1516

After the drill, Ehime Prefecture realized that the 5,000 residents at the tip of the headland would need to be evacuated by sea and air. In February 2014, the Ehime Prefecture and the working team revised their evacuation plans for these 5,000 residents living in what is known as the Preventive Evacuation

Area¹⁷ to evacuate at the same time as those in the 5km zone around the plant (the Precautionary Action Zone). ¹⁸ According to the Ehime Prefecture, it will take more than 16 hours for 5,000 residents to be sent by commercial ships. If the Maritime Self-Defense Force ship is used in addition to commercial ships, it will take four and a half hours.

An evacuation plan remains essential for Ikata Town because the town rests near the Nankai Trough, which runs from the Shizuoka Prefecture to the Miyazaki Prefecture. This Nankai Trough could generate a large-scale earthquake in the near future and cause immense damage. In March 2014, the Japanese Cabinet Office requested Ikata Town to reinforce the evacuation plan against a tsunami triggered by the Nankai Trough earthquake. According to the Japanese government's estimation, the Nankai Trough earthquake would generate a 4.2 - 13.7 meter tsunami which would reach the Mitsukue and Misaki harbors in Ikata Town. 19 The Great East Japan Earthquake, generated a 2.9 meter tsunami Matsushima, that reached Miyagi Prefecture ²⁰, and swept up 26 out of 73

http://csis.org/publication/politics-and-japans-rokkasho-reprocessing-plant-0

¹⁴ "Japan's Plutonium." Cabinet Office, Government of Japan. July 21, 2015.

http://www.aec.go.jp/jicst/NC/iinkai/teirei/siryo201 5/siryo28/siryo3.pdf.

^{15 &}quot;地域防災計画・避難計画策定支援."Cabinet Office, Government of Japan.

http://www8.cao.go.jp/genshiryoku_bousai/keikaku/keikaku.html.

¹⁶ "Ehime Holds Evacuation Drill Based on Ikata Plant Fallout." The Japan Times, October 22, 2013. http://www.japantimes.co.jp/news/2013/10/22/nati onal/ehime-holds-evacuation-drill-based-on-ikata-plant-fallout/#.UmZrSIMO_9k.

¹⁷ "地域防災の充実に向けた 取り組み."Cabinet Office, Government of Japan.

http://www.city.nagaoka.niigata.jp/shisei/cate01/nuclear-safety/file/kensyu 20150127-03.pdf.

¹⁸ "愛媛県広域避難計画の修正について(平成 27年 6月)."Ehime Prefecture. June 1, 2015.

https://www.pref.ehime.jp/h15550/kouikihinannkei kaku.html.

^{19&}quot;伊方町防災計画 津波災害対策編" 伊方町防災 会議. August, 2013.

https://www.town.ikata.ehime.jp/uploaded/attachment/756.pdf

²⁰ "災害時地震・津波速報 平成 23 年(2011年)東北地方太平洋沖地震." 気象庁. August 17, 2011

http://www.jma.go.jp/jma/kishou/books/saigaiji/saigaiji_201101/saigaiji_201101.pdf.

sightseeing ships. ²¹ Although Ehime Prefecture plans to use ships for evacuation, it's not clear that all harbors will be safe or operable.

On September 2, 2015, the NRA's regular meeting revealed that the Japanese government planned to conduct a two-day comprehensive disaster drill in November in order to test the revised evacuation plans.²²

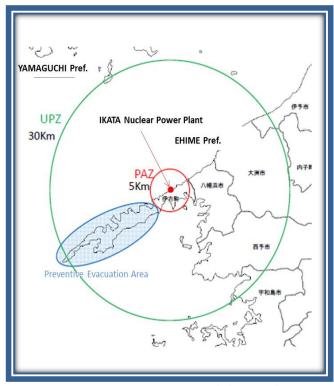


Figure 2 Preventive Evacuation Area and Ikata Nuclear Power Plant. Source: Cabinet Office.

²¹ "松島観光の震災と復興." February 28, 2013. https://www.iist.or.jp/jp-m/2013/0216-0882/. ²² "伊方原発、11月に総合防災訓練 国主 導." Ehime Shimbun, September 3, 2015.http://www.ehimenp.co.jp/news/local/20150903/news20150903182.h tml

降-3号機、地元手続き完了." Jiji, October 26,

²³ "Permission for Changes in Reactor Installation of

This review of the evacuation plan was important because on July 15, 2015, Ikata No.3 reactor received approval to restart under the NRA's safety assessment.²³ But to actually restart the reactor, Shikoku EPCO would need the consent of Ehime Prefecture and Ikata Town.

Governor Nakamura had already laid out conditions for his consent. He wanted the central government's assurance of a sufficient evacuation plan; a comprehensive safety procedures from Shikoku EPCO; and an acceptance of these plans by the municipalities. ²⁴ In addition, Governor had asked Nakamura the central government to be the primary responders in the event of a nuclear accident and delayed his approval for the restart of the No.3 reactor until Prime Minister Abe confirmed this central government responsibility.²⁵ On October 6, at the meeting of Japan's Nuclear Emergency Council, Prime Minister Abe agreed that it is the central government's duty to take responsibility in the event of an accident in order to protect the lives of people and their property.²⁶

In what seems like a backwards approval process, however, Mayor Yamashita and Governor Nakamura consented to the restart before the new drill could take place

2015.

http://www.jiji.com/jc/zc?k=201510/2015102600057.

²⁵ 伊方原発に関する知事メッセージ(平成 **27** 年). Ehime Prefecture. July 21, 2015.

http://www.pref.ehime.jp/gen/chiji_message27.htm l#h270721.

²⁶ "Nuclear Emergency Preparedness Council (The Prime Minister in Action)." Nuclear Emergency Preparedness Council (The Prime Minister in Action). October 6, 2015.

Ikata Nuclear Power Station Unit 3, Shikoku Electric Power Co., Inc." July 15, 2015. https://www.nsr.go.jp/data/000115068.pdf. ²⁴ "中村愛媛知事が同意=伊方再稼働、年明け以

on November 8 and 9. Yamashita approved the restart on October 23 and Nakamura approved it three days later. When he announced his approval, Nakamura stated that his three conditions had been met but it was far from clear that a sufficient evacuation plan was place. In fact, Prime Minister Abe called for a drill to study the effectiveness of emergency response in Ikata Town in September. Presumably, Ehime Prefecture and Ikata Town required this as part of the central government's assurance of sufficient evacuation procedures.

Drill on November 8-9, 2015

On November 8 and 9, 2015, the two-day drill simulated an earthquake (6 on the Japanese seismic scale) and radiological material release outside the Ikata Nuclear Power Plant. The simulation reported the following events: 8:30 a.m. the earthquake occurs, triggering failure of cooling functions in the No.3 reactor. By 3:15 p.m., the Prime Minister declares a nuclear emergency situation and orders the residents of the Precautionary Action Zone and Preventive Evacuation Area to evacuate. On the 9th, residents gathered for radiation checks, and went to Oita Prefecture, 14km away. The evacuees used a Maritime Self-Defense Force ship and ferry, which was first time that residents had tested a sea evacuation.²⁷ The drill reportedly planned for a helicopter evacuation of an injured worker but poor weather conditions stranded the worker. These are important lessons for future planning.

Ikata Town called only 67 residents for this drill, and senior citizens and children were excluded.²⁸ According to the evacuation plan, about 5,000 residents have to evacuate using ship in the case of a severe accident. The number of participants in the drill was very small compared to what the actual number would be. After the Fukushima Daiichi nuclear accident, a major issue was how to support older people during evacuations. Around the Fukushima nuclear accident, 89.1% of earthquake-related deaths were above age 66. 29 In 2015, 43% of Ikata's population was 65 years old or older. Ikata Town will have to think through more carefully how to support the evacuation of older people and perhaps include them in future drills.

On December 22, 2015, Ehime Prefecture revealed the results of a questionnaire of residents who attended the drill. About 22% of people were still concerned about evacuations in case of severe accidents. The major reasons of concern were road conditions and traffic congestion. ³⁰ Regarding impressions of the drill, 80% of participants said that the drill was facilitated smoothly. In fact, participants were given the detailed schedule before the drill. This allowed them to prepare for the drill and follow the schedule during the drill. This also

http://japan.kantei.go.jp/97_abe/actions/201510/06 article1.html.

²⁷ "伊方原発で大規模訓練 過酷事故想定、海自艦で住民避難." *Nikkei*, November 9, 2015.

http://www.nikkei.com/article/DGXLASDG09H6X_Z0 1C15A1CR0000/.

²⁸ "日本一長い半島" の原発 避難訓練から見えた課題."NTV, December 9, 2015.

http://www.ntv.co.jp/every/sixteen/743122.html

²⁹"東日本大震災における高齢者の被害状況."Cabinet Office, Government of Japan. 2013. http://www8.cao.go.jp/kourei/whitepaper/w-2013/zenbun/s1_2_6_07.html ³⁰"伊方原発事故」で2割が「避難困難」…愛媛県が防災訓練検証の中間とりまとめ," Sankei Shimbun, December 24. http://www.sankei.com/west/news/151224/wst151 2240018-n1.html00

raises questions about how realistic the drill was. 31 In the United States the Nuclear Regulatory Commission (NRC) approves evacuation plans for all nuclear energy facilities as a prerequisite for an operating license. Also, the NRC requires all nuclear facilities to conduct drills and State and local government officials also have to participate in drills.³² Unlike Japan's drills, residents are excluded. However, the NRC clearly mentions that State and local governments are responsible for choosing implementing the appropriate protective actions for the public and that drills should aim to maintain the skills of emergency responders and to identify and correct weaknesses³³ Even if residents are excluded, drills in the United States might be more realistic than those in Japan, given that operating licenses depend in part on their effectiveness. 34

Finally, the drill assumed that only an earthquake would occur. But, according to the Japanese government's estimation, the Nankai Trough earthquake would generate a tsunami that would reach the Ikata Town. It's unclear that residents can use ships for evacuation if an earthquake triggers a

tsunami. If anything is to be learned from Fukushima, it is that planning needs to include provisions in response to a tsunami.

Conclusions

The requirement for local government approval to restart nuclear power plants (and to start up new nuclear power plants) has cascading effects on emergency planning in Japan. By law, an evacuation plan is not required nor is NRA approval of that plan – just local government approval.³⁵ In the case of the Ikata Nuclear Power Plant, approval seemed to rest on that demonstrating that the central government would take responsibility in the event of an accident. 36 This was probably aimed at winning public support for the reactor When Governor Nakamura was restart. asked about the premature approval, he stated that coming up with disaster response measures is an ongoing process and therefore the restart of the reactor should not be linked to this condition.

The national level of government is no less culpable. When the local government approved the restart, Prime Minister Abe stated that the central government "accepted" the evacuation plan, 37 but made

³¹ "日本一長い半島" の原発 避難訓練から見えた課題."NTV, December 9, 2015.

http://www.ntv.co.jp/every/sixteen/743122.html ³² "Fact Sheet on Emergency Preparedness at Nuclear Power Plants." U.S. NRC. http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-emerg-plan-prep-nuc-power.html

³³ "Federal, State, and Local Responsibilities." U.S. NRC. http://www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/federal-state-local.html

³⁴ If the NRC finds inappropriate protective measure during periodic evaluated exercises, reactor will have to shut down in the worst case. See also "Frequently

Asked Questions About Emergency Preparedness and Response." NRC.

http://www.nrc.gov/about-nrc/emerg-preparedness/faq.html#18

³⁵ An account in the Diet by Prime Minister Shinzo Abe, February 21, 2014.

http://www.shugiin.go.jp/internet/itdb_shitsumon_pdf_t.nsf/html/shitsumon/pdfT/b186034.pdf/\$File/b186034.pdf

³⁶ "伊方原発の避難計画を了承 原子力防災会議." *Nikkei*, October 6, 2015.

http://www.nikkei.com/article/DGXLASFS06H1V_W 5A001C1EAF000/.

³⁷ An account in the Diet by Prime Minister Shinzo Abe, February 21, 2014.

no comment about the adequacy of the plan. 38

The case of Ikata seems to suggest that the government processes governing the restarts lack rigor. It was not clear that the central government was prepared to evacuate the people of Ikata Town in case of an emergency prior to the drill. And granting approval for restart prior to the drill reinforces the impression that the situation has not changed at all.

The central government and the local government must work together to create sufficient evacuation plans. However, an old hierarchical system between these levels of government continues to hamper cooperation. The local governments tend to expect the central government take greater responsibility. But as central government planners have suggested, local input is essential for creating workable evacuation plans. A more rigorous process needs to be developed at all levels of government and for structured sharing of responsibilities. Otherwise, it will become difficult to create evacuation plans that sufficiently protect the lives of Japanese citizens. In the case of a severe accident, all levels of government have roles to play.

In the case of Fukushima, the central government devised plans while local governments kept working without reliable information. This division resulted in limited communication between the central and local government. The Ehime Prefecture and the working teams revised their evacuation plans, but their knowledge of what each

government can do to help still has not been shared enough. The Governor is elected by local residents, and the governor's priority should be to protect local residents. The local government in this arena should be operating in parallel with the central government. Moreover, it should ask the central government to clarify certain points. The local government needs to be responsible for protective actions, while the central government should act as a mediator between the local government and utilities in order to facilitate information exchange on nuclear issues. Such an approach could improve coordination between the central and local government for ordering, implementing, and confirming evacuations.

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http://www.shugiin.go.jp/internet/itdb_shitsumon_pdf_t.nsf/html/shitsumon/pdfT/b186034.pdf/\$File/b186034.pdf

An account in the Diet by Prime Minister Shinzo Abe, February 21, 2014.