

Paper:

# Perception, Participation, and Effect of Nuclear Emergency Response Drills

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**This study aims to make public the findings on the following questions regarding nuclear emergency response drills from the perspective of engaged residential organizations in local communities: What kind of local knowledge did the nuclear emergency response drills formulate among residents? What types of evacuation behaviors did the residents adopt based on such local knowledge? What kinds of difficulties did the residents experience when they actually evacuated?**

**Keywords:** nuclear emergency response drill, evacuation, community

## 1. Background of Awareness of Issues

The entire populations of Naraha Town and Tomioka Town in Futaba County, Fukushima Prefecture were forced to evacuate out of the affected areas due to the Great East Japan Earthquake, which struck off the Pacific Ocean on March 11, 2011. Naraha Town and Tomioka Town are located within a range of about 20 km from Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Plant (hereinafter, "1F"), where nuclear accidents occurred. Both of the towns are also positioned in such a way as to sandwich Fukushima Daini Nuclear Power Plant (hereinafter, "2F"), which was shut down in the wake of the aforementioned nuclear accidents (Fig. 1).

While the evacuations from the giant tsunami that hit East Japan's coastal regions on March 11, 2011 were undoubtedly disastrous for the townspeople<sup>1</sup>, it was far more problematic that the entire population of the disaster-affected towns was forced to evacuate due to the nuclear accidents at "1F." In Naraha Town and Tomioka Town in particular, all of the townspeople were forced to flee "as far as possible in their own ways," such as through adopting the mentality of "tsunami tendenko (Tsunami! Let each one look out for oneself)." In the sense of securing a "stable life" for those disaster victims, the situations in these areas remain unchanged and chaotic even now.

Criticisms for such chaotic evacuation processes immediately after these nuclear accidents were directed at

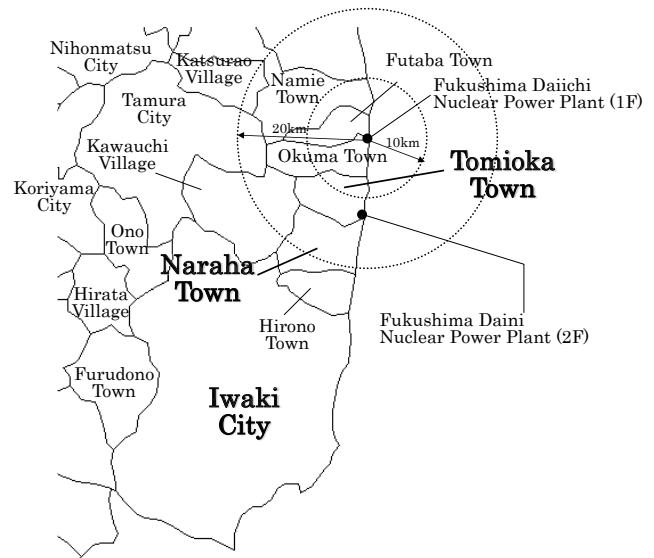


Fig. 1. Coastal (Hamadori) Region of Fukushima Prefecture.

the "Nuclear Emergency Response Drills"<sup>2</sup> that had been conducted for many years before the earthquake. Such critical perceptions should not have been directed exclusively at the prefectures and the nuclear power plant operators (such as the Tokyo Electric Power Company and others), but should also be aimed toward the residents (and their organizations), because interview and questionnaire surveys found that they had such a sense of security that the nuclear power plants "would probably be alright" and did not show much interest in the emergency response drills.

We conducted questionnaire surveys and subsequent interviews in the summer of 2012 with the local residents and organizations who had embraced a "safety myth" as local knowledge.<sup>3</sup> We also observed how they responded to the drills for assumed nuclear accidents, how practical and effective such drills turned out at the actual nuclear accidents, and what problems they experienced at

1. The disaster-affected districts are Namikura District in Naraha Town and Hotokehama District and Kegaya District in Tomioka Town.

2. The drills conducted on November 25-26, 2010 prior to the Great East Japan Earthquake were the twentieth such drills.

3. In reference to the discussions in Yoshihara (2012) [1], the local knowledge is not something that simply denotes "communal knowledge and/or awareness," but something that derives from the community structure able to form such local knowledge or from the activities and/or exchanges among residents as a basis (Matsumoto (2013) [2]).

that time.<sup>4</sup> This paper reveals the findings and interpretations of these analyses and survey responses.

## 2. Overview of Nuclear Emergency Response Drills

As previously mentioned, Naraha Town and Tomioka Town, located within 20 km from 1F and 2F, had been engaged in annual nuclear emergency response drills for

4. Studies that deal with both the accidents of 1F and the residents' evacuations can be largely classified into the following categories: time-development studies on the conditions prior to the earthquake, immediately after the earthquake, and longer after the earthquake, the same as for other disasters, and studies on the matters specific to nuclear accidents such as liabilities, compensations, and decontaminations. Specifically, studies on the conditions prior to the earthquake include Ishii (2003) [3], Funabashi and Shibata (2008) [4], and Akashi and Hachiya (2011) [5], all of which discussed the nuclear emergency response drills. In addition, such studies include Yamaguchi (2013) [6], Honma (2014) [7], and Nitta (2014) [8], all of which discussed the disaster prevention measures in the wake of the accidents at 1F. Studies on the conditions immediately after the earthquake include not only large-scale national and municipal surveys on the "evacuations right after the Earthquake" (e.g., "Factual Surveys on Evacuations at Nuclear Power Plant's Accidents in Great East Japan Earthquake") but also Yoshihara (2013) [9] on the individual or family-based evacuations of the residents in Okuma Town where 1F is located and Sasaki (2013) [10], which discussed the evacuations from a communication perspective. Most other studies are related to the evacuees' living conditions in evacuation shelters and their health problems. Living in evacuation shelters and corresponding health problems after the evacuees move from the evacuation shelters to rented or temporary housings may include, for example, support, welfare, family, and living space. As for the support and welfare categories, Matsuda and Tsuga (2014) [11] discussed the actual conditions from the perspective of financial support, and Yamakawa and Kanki (2014) [12] classified the supporting systems and processes. As for the category of family, Yamane (2013) [13] and Konno and Sato (2014) [14] dealt with maternal and child evacuations. Meanwhile, Ishikawa and Tsujiuchi (2014) [15] dealt with the living space, and Tsujiuchi (2015) [16] and Ochi (2015) [17] dealt with the health problem.

Studies on living after the earthquake include a study on the frictions and coexistence with receiving residents. As for the classification of evacuees from the nuclear accidents, the sociological society for the study of wide area evacuations classifies them into "forced evacuations" on evacuation orders and "voluntary evacuations"; the latter is further classified into evacuations within and outside the prefecture. The current nuclear accidents caused such long-period and large-scale evacuations that the relationships between the evacuees and the receiving side became very complex, which further caused frictions with receiving residents. Most of the evacuees from Futaba County evacuated into Iwaki City in the same region of Hamadori. Kikuchi and Takagi (2015) [18] discussed the structure of consciousness of Iwaki citizens; Kawazoe (2014) [19] applied political demarcations to the aforementioned structure of consciousness of Iwaki citizens. Konno and Harada (2015) [20] further extended the discussions to coexistence with receiving residents. Tashiro (2015) [21] and Yoneda (2015) [22] dealt with those who evacuated farther and who are placed in similar living conditions. Takahashi (2014) [23] dealt with the acceptance of refugees by local government.

Studies on the conditions long after the earthquake should first take up the issue of moving and settle in another place. In the wake of the current nuclear accidents, the national government decided to divide Futaba County into three zones as follows: "zone in preparation for the lifting of the evacuation order"; "restricted residence area"; "difficult-to-return area." In particular, the majority of areas in Okuma Town and Futaba Town are designated as "difficult-to-return zones," and the great majority of residents live in the "difficult-to-return zones" in Namie Town, although the areas so designated are small in size. Therefore, the reconstruction methods for those towns, including their housing conditions, would be quite different from those for the tsunami-affected areas in Iwate Prefecture and Miyagi Prefecture. After the earthquake, the "provisional towns" concept was presented (e.g., Imai (2012) [24] and Hitomi (2014) [25]), but it was scaled down to the distributed towns concept, probably due to the aforementioned issues with the receiving municipalities and residents (For example, the March 10, 2014 issue of Fukushima Minyu News reports asked, "What has become of the 'provisional town concept'?" It is now distributed towns, for which infrastructure improvements are needed). Their discussions are now focused on the "double resident registrations" (Imai (2015) [26] and others). The essential elements for the "reconstruction of the disaster-affected areas" are: for the recovery/reconstruction of Futaba County, for example, they are decontamination, "evacuation plans" in the event of some trouble at the de-

what were assumed to be incidents at 1F or 2F. In the 2010 drills<sup>5</sup>, for example, they assumed a scenario that 1F lost its external power source due to some issues with the electric generator installed on 1F's No.5 nuclear reactor, followed by the reactor's automatic shut-down (i.e., an "event stipulated in Article 10 of the Nuclear Emergency Preparedness Act"). On the following day, an "event stipulated in Article 15 of the Nuclear Emergency Preparedness Act" was thought to occur due to the nuclear reactor's cooling functional loss. However, the event was eventually brought under control by the restoration of the emergency diesel generator. The fiscal 2010 drills for assumed nuclear accidents at 1F were mainly sponsored by Fukushima Prefecture, Hirono Town, Naraha Town, Tomioka Town, Okuma Town, Futaba Town, and Namie Town. Practically, however, Futaba Town and Okuma Town were the main sponsors for the drills (Futaba Town took the initiative in the fiscal 2010 drills including those that were sponsored by the national government).

Such drills were alternately conducted every other year for 1F and 2F. The fiscal 2007 drills<sup>6</sup> for assumed accidents at 2F's No.4 nuclear reactor took place in Naraha Town and Tomioka Town, with the initiative taken by Naraha Town. The drills mainly took place in the following places: Naraha Town – Town Office, Health and Welfare Hall, Naraha Substation of Tomioka Firefighting Station, Naraha North Kindergarten, Naraha South Kindergarten, Naraha North Daycare Center, and Naraha South Daycare Center; Tomioka Town – Town Office, Po-

commissioning work of reactors, and community planning based on such evacuation plans. As for the decontamination, Itonaga (2012) [27] refers to the case of Iitate Village as a part of its reconstruction processes, and Kawasaki (2014) [28] describes the status-quo, effects, and issues of the decontamination work. As for community planning, Sugano and Matsumura (2013) [29] dealt with the reconstruction of Namie Town, and Miyakoshi (2015) [30] took reference from the incident at Chernobyl. As for the evacuation plans, Fukushima Prefecture's Disaster Prevention Council formulated the "Fukushima Prefecture's Regional Disaster Prevention Plans: Part Nuclear Emergency Response."

Finally, we introduce some discussions on more general issues. As for media communication during the 2011 earthquake, the use of social media such as Twitter and Facebook (which is increasing due to smartphones) contributed greatly to the transmission of information immediately after the nuclear accidents. Likewise, it became a big issue as to how to transmit and deliver information. Fukunaga (2011) [31] discussed the broadcasting media's status in the transmission of information right after the accidents, and Inoue (2015) [32] referred to the gaps between damages caused by harmful rumors and what the residents wanted the media to communicate. As for liabilities/compensations, these should be quite different from those for natural disasters in that such residents were forced to evacuate due to the disasters caused by the accidents at the power plant operator's installations. Nomura (2011) [33] discussed the scheme for liabilities, and Yokemoto [34, 35] outlined the way that such a scheme should be operated.

The following references have overviewed the studies on the Fukushima Nuclear Accidents and the residents' evacuations. Yoshihara (2013) [9] discussed, in terms of the community's engagement, how local residents became engaged in the disaster prevention drills and how practical and effective such drills turned out in their actual evacuations. However, it did not explicitly describe any differences among the administrative districts. This study, therefore, aims to reveal from a viewpoint of the local residential organization's engagements such as district councils what kind of local knowledge was formulated by the nuclear emergency response drills (section 3), what kinds of evacuation behaviors resulted from such local knowledge (section 4), and what problems they experienced when they evacuated.

5. Please refer to the "Fukushima Prefecture's Nuclear Emergency Response Drill Implementation Plan for Fiscal 2010" [36–38] and the same for other fiscal years.

6. The nuclear emergency response drills were conducted on October 22–23, 2007. For more details, please refer to the "Fukushima Prefecture's Nuclear Emergency Response Drill Implementation Plan for Fiscal 2007," prepared by Fukushima Prefecture.

**Table 1.** Nuclear emergency response drills since fiscal 2001.<sup>7</sup>

Implementation Items			2001	2002	2003	2004	2005	2006	2007	2008	2009*	2010	
Assumed Accidents			2F	1F	2F	1F	2F	1F	2F	1F	2F	1F	
Participants (persons according to the sponsors)			1,477	1,609	1,587	1,082	2,304	2,300	2,093	4,011	1,349	2,400	
Assumed Drills	Kinds of Drills Implemented	Comprehensive Drills	Drills where on a certain scenario plural organizations participate and mainly practice their cooperative activities										
		Element Drills	Drills conducted on individual elements and less focused on the participants' cooperation										
	With or Without Blind Drill Elements	Blind Elements	Drills where participants may act flexibly according to the circumstances without drawing on scripts or a collection of speeches										
		No Blind Elements	Drills that generally proceed as planned in accordance with scripts or a collection of speeches										
	Progress Levels of Assumed Accidents	Occurrence of trouble		○	○	○	○	○	○	○	○	○	○
		Occurrence of an event stipulated in Article 10 of the Nuclear Emergency Preparedness Act		○	○	○	○	○	○	○	○	○	○
		Occurrence of an event stipulated in Article 15 of the Nuclear Emergency Preparedness Act		○	○	○	○	○	○	○	○	○	○
		Release of radioactive materials		○	○	○	○	○	○	○	○	○	○
		Restoration measures											
	Major Meetings in Off-Site Center	Countermeasure coordination meetings on site		○	○	○	○	○	○	○	○	○	○
		Meetings among functional team leaders		○	○	○	○	○	○	○	○	○	○
		Meetings to decide emergency response policies				○				○	○		○
		General meetings of joint countermeasure councils		○	○	○	○	○	○	○	○	○	○
		Countermeasure coordination meetings on site											
	Status of Response by the Ministry of Education, Culture, Sports, Science and Technology	Organizational response									○		
Dispatch to site				○	○	○	○	○	○		○		
Contact and communication									○				
Emergency Monitoring Drills	Contents of Implemented Emergency Monitoring Drills	On Ground	Measure spatial radiation dose rates				○	○	○	○	○	○	
			Measure radioiodine concentration levels in atmosphere	○	○	○	○	○	○	○	○	○	
			Collect/measure environmental samples				○	○	○	○	○	○	
		At Sea	Measure spatial radiation dose rates			○			○	○	○	○	
			Measure radioiodine concentration levels in atmosphere	○		○							
			Collect/measure environmental samples								○		
	In Air	Measure spatial radioactive dose rates	○		○			○	○	○	○		
		Use of SPEEDI Network System					○	○	○	○	○		○
		Use SPEEDI graphics					○	○	○	○	○		○
Medical Drills for Emergency Radiation Exposures	Medical Drill Items for Emergency Radiation Exposures	Screening, inquiries, etc. conducted at first-aid stations		○	○	○	○	○	○	○	○	○	
		Conveyance to initial radiation exposure medical institutions			○	○	○	○	○	○	○	○	
		Conveyance to secondary medical facilities				○		○	○	○	○	○	
		Conveyance to tertiary medical facilities									○		
		Conveyance of stable iodine preparations to evacuation shelters					○	○	○	○			○
Drills for General Population	Public Relations/Traffic Regulations	Publicity by using the disaster warning radio system		○	○	○	○	○	○	○	○	○	
		Publicity by using communal publicity vehicles					○	○	○	○	○	○	
		Traffic regulations by police officers					○	○	○	○	○	○	
Drills with Participation of Local Residents	Residential Evacuations / Indoor Evacuations	Indoor evacuations		○	○	○	○	○	○	○	○	○	
		Indoor evacuations in concrete structures											
		Evacuations to evacuation shelters		○	○	○	○	○	○	○	○	○	
Lectures	Lectures for General Population	Lectures on nuclear emergency response		○	○	○	○	○	○	○	○		
		How to handle stable iodine preparations					○	○				○	

lice Station, Firefighting Station, Imamura Hospital (Initial Radiation Exposure Medical Institution), Tomioka Middle Schools No.1 and No.2. The Overview of the Fukushima Prefecture's Nuclear Emergency Response Drills for Fiscal 2007 shows that about 2,100 persons participated in the drills with the following priority items: trainings for communication/contact with fishing boats at anchor or sailing at sea and for their evacuation; trainings for firefighting by the nuclear power plant's in-house fire brigade, and for communication/contact with local firefighting stations to ensure their mutual cooperation; trainings to convey stable iodine preparations to first-aid sta-

tions and distribute/dose them to evacuees. The nuclear emergency response drills conducted since fiscal 2001 are summarized in **Table 1.**<sup>8</sup>

As **Table 1** shows, the general populations (including

7. This table was prepared by us on the homepage "Status of Nuclear Emergency Response Drill Implementation." The nuclear emergency response drill items for 2001-2003 are different from those for 2004 and afterward, so that you may find some inconsistency in items between the former and later years. The nuclear emergency response drill items for 2009\* were prepared on the Fukushima Prefecture's homepage, hence same inconsistency with the items for 2001-2003.

8. The nuclear emergency response drills for fiscal 2009 were conducted in response to an "assumed terrorists' attack to the nuclear power plants" according to the Fukushima Prefecture's homepage, "Nuclear Emergency Response Drills."

schools) are mainly engaged in the “trainings with participation of local residents” and the “lectures.” The former refers to the trainings for indoor evacuations, or for evacuations to evacuation shelters. Meanwhile, the latter refers to the lectures on nuclear emergency response in one year, and on how to handle stable iodine preparations in another year.

The aforementioned trainings or lectures for the general populations are actually not intended for the entire town populations, but rather exclusively for local residential organizations such as firefighting organizations like fire brigades or women firefighting teams.<sup>9</sup> In terms of the administrative districts of Naraha Town, they were Namikura in fiscal 2001, Namikura, Shimo Shigeoka, and Eidan in fiscal 2003, Namikura and Kami Shigeoka in fiscal 2005, and Namikura, Eidan, Shimo Shigeoka, and Shimo Ide in fiscal 2007. Among the administrative districts of Tomioka Town, they were Ota, Kami Kori, Shimo Koriyama, Shimizu, Nishihara, Ekimae, and Hotokehama in fiscal 2003, Kegaya, Shimo Koriyama, Ota, Kami Motomachi, Motomachi, Nishihara, Chuo, Shimizu, and Iwaido in fiscal 2005, and Kegaya, Ota, and Shimo Koriyama in fiscal 2007.

These represent merely a portion of 18 administrative districts of Naraha Town and 27 administrative districts of Tomioka Town (denoted by the bold and underlined text in **Figs. 2** and **3**). In addition, only a small number of people in such limited numbers of administrative districts actually participated or planned to do so. In fiscal 2001, for example, planned participants stood at 60 persons in Namikura of Naraha Town and 27 persons in each of these administrative districts of Tomioka Town. In fiscal 2003, planned participants decreased to 25 persons in Namikura and to 10–15 persons in Tomioka Town. The participants from the aforementioned fire brigades and women firefighting teams were 40 persons in Naraha Town and 110 persons in Tomioka Town (in fiscal 2001). Under the circumstances, practically all evacuation drills were primarily conducted by the towns and fire brigades as emergency firefighting organizations and district councils were in a sense “mobilized” to those evacuation drills.<sup>10</sup> Nuclear emergency response drills conducted by a very limited number of people on the so-called “myth of safety” were destined to be evaluated as “impractical and ineffective” even before the Great East Japan Earthquake.

Nuclear emergency response drills sponsored by the national government and municipalities might be effective to such municipalities and operators, but may not act as such a system in which local residents (and organizations) become positively engaged. Actually, while the national government and municipalities remained chaotic on March 12, 2011, local residents were put into much greater trouble to the degree that they decided to evacuate

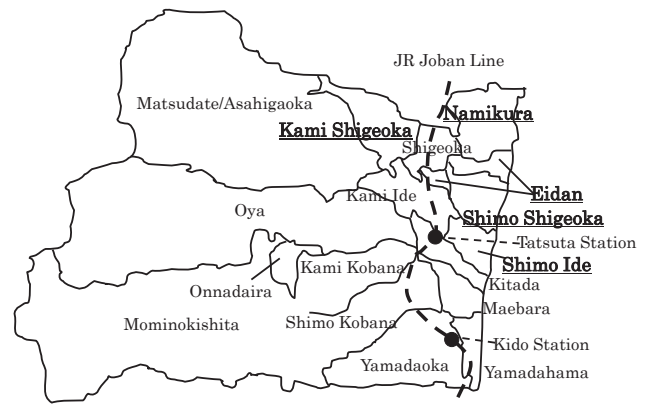


Fig. 2. Naraha Town (prepared by the authors).

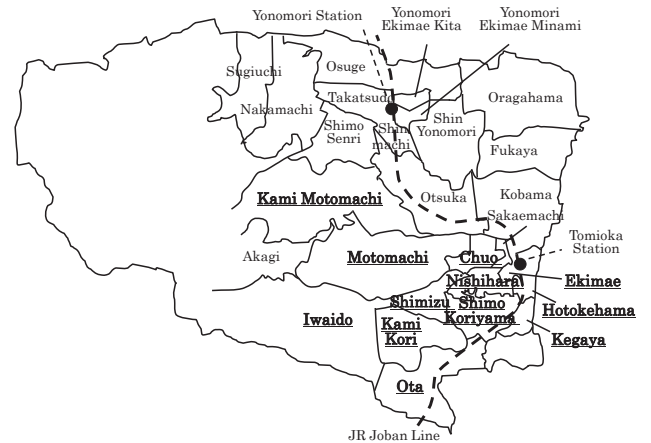


Fig. 3. Tomioka Town (prepared by the author).

on their own. Based on the findings of questionnaire surveys and interviews, this paper describes in the following sections the “awareness of and participation in the nuclear emergency response drills” prior to the Great East Japan Earthquake, as well as the actual evacuation conditions in the wake of the March 12, 2011 nuclear accidents.

### 3. Awareness of and Participation in Nuclear Emergency Response Drills

Based on the findings of the interviews we have continuously conducted since the summer of 2012, this section reviews the awareness of and participation in the nuclear emergency response drills prior to the Great East Japan Earthquake. We have reviewed the actual conditions not just in Naraha Town and Tomioka Town, but also in the districts where emergency response drills had been conducted as well as where such drills had not been conducted (as designated by the prefectural government since fiscal 2001 to the best of our knowledge).

#### 3.1. Naraha Town

We have so far conducted interview surveys with 54 people (79 times in total) who positively responded

9. Please refer to the “Fukushima Prefecture’s Nuclear Emergency Response Drill Implementation Plan” for each year. Please note, however, that Fukushima Prefecture’s homepage has no descriptions on the numbers of participants (planned) in the fiscal 2007 nuclear emergency response drills by the administrative districts.

10. For more details, please wait for the findings of the surveys we are now conducting in Naraha Town.

to the question of “availability for individual interviews” in the questionnaire surveys we conducted with the general population of Naraha Town in the summer of 2012. Out of the 18 administrative districts of the town, six districts – Asahigaoka, Ottojiro, Kami Kobana, Mominokishita, Onnadaira, and Osaka – were not subject to the interview surveys, and none of them was directly engaged in the nuclear emergency response drills.

### 3.1.1. Districts Where Drills Were Implemented

At least five districts – Shimo Ide, Kami Shigeoka, Shimo Shigeoka, Namikura, and Eidan – conducted the drills in fiscal 2001, 2003, 2005, and 2007 prior to the Great East Japan Earthquake. Following are some of the comments made by the residents in those districts about their awareness of the drills.

#### Shimo Ide

It was the season of frequent fires, so fire brigades were out on their rounds, shouting “Look out for fire!” (N9)

#### Kami Shigeoka

In response to some assumed accidents at the nuclear power plant, evacuation drills were conducted once in a while: drills in response to not-so-severe accidents, in which the residents were merely called out by the public radio system to gather at the gathering place. (N17)

Evacuation drills were usually conducted in response to some assumed accidents at the nuclear power plant: Naraha Town-sponsored drills in which the villagers gathered at the gathering place for assumed evacuations by bus or for distribution of boiled rice by women firefighting teams. Those drills were found impractical and ineffective during the March 11, 2001 earthquake. (N18)

Nobody believed in the possibility of any accidents at the nuclear power plant, hence no nuclear emergency response drills such as evacuation drills (nor any participation in them). (N19)

When I joined T Industries, we were educated about the safety of the nuclear power plant and were told that it is 120% safer than those in other countries. So I was really shocked at the accidents at the nuclear power plant here. (N20)

#### Shimo Shigeoka

Some members of my family might have participated in the drills. (N24)

#### Namikura

The evacuation drills were intended for assumed accidents at the nuclear power plant. Despite so many evacuation drills, they were found impractical and ineffective when nuclear accidents really happened. (N26)

#### Eidan

Evacuation drills were conducted once a year in cooperation with Tokyo Electric Power Company and the town. These were superficial evacuation drills in response to assumed accidents at the nuclear power plant, which, however, were found hardly practical or effective at the actual nuclear accidents. No evacuation drills were ever

conducted on a municipality basis. (N27)

Tokyo Electric Power Company had conducted evacuation drills in cooperation with the national government, the prefecture, and the town several years before. The evacuation drills consisted of the evacuation and decontamination activities, which, however, were found impractical and ineffective when nuclear accidents actually happened. (N28)

People living in the drill-implementation areas of Naraha Town, who might be slightly aware of the nuclear emergency response drills (probably not in detail) and actually participated in them, felt such drills “superficial” and “were found impractical and ineffective when accidents actually happened.” Those comments might be symbolically represented by the comment “120% safer than the nuclear power plants in other countries.” (N20)

### 3.1.2. Districts Where No Drills Were Implemented

What did people living in other administrative districts think about the nuclear emergency response drills? Following are some of their typical comments:

#### Kami Ide

Town fire brigades annually conducted evacuation drills as a part of the nuclear emergency response drills. My cousin told me he participated in such drills as a member of the fire brigade, but I am not directly engaged and have no idea about the details. (N4)

Nuclear emergency response drills were jointly implemented by eight towns and villages, where I participated as a member of the fire brigade. What remains in my memory about the drills is that I put on protective clothing and rescued assumed victims. (N8)

#### Kitada

I have ever attended the seminars sponsored by some circles associated with Tokyo Electric Power Company, where and when we learned about the nuclear power plant systems and visited their nuclear power plant. My wife also participated in such seminars organized on a town/village basis, for which a bus was arranged to carry the participants from each town/village. The systems were such that we could attend the seminars just for one year and introduce other people for the following year. (N10)

#### Oya

Neither my district nor I was personally involved in the nuclear emergency response drills, which were conducted by the town authorities with notice boards set up at various points of the district to notify evacuation sites to the townspeople. But we did not participate in them. (N11)

#### Matsudate

Nuclear emergency evacuation drills were conducted on weekdays. The regional fire brigade director (in the first division of the regional fire brigade No.5) seemed to be directly told by the town authorities to check the radio apparatus and telephones. But I have never participated in such drills. (N15)

### Shimo Kobana

Evacuation drills were conducted in the large section of the village once a year without fail in response to an assumed fire breakout. The assembly hall was designated as an evacuation site. A pretty large number of people participated in the drills. No nuclear emergency evacuation drills were conducted on the belief that the nuclear power plant should be safe. (N32)

No nuclear emergency response drills were especially conducted. (N39)

I remember I once participated in the nuclear emergency response drills no more than ten years before. Participants seemed to be from Maebara District as well as Shimo Kobana. We were told that there should be “participants from such and such districts.” (N40)

Tokyo Electric Power Company organized evacuation drills once a year either in the spring or in the autumn. I myself have participated in such drills. People in the districts of Namikura and Shimo Shigeoka moved to the village offices by bus. I received emergency provisions or helped distribute boiled rice at the community center. Despite the annual implementation of evacuation drills, I found them impractical and ineffective. (N41)

### Yamadaoka

I know about the nuclear emergency response drills but have never participated in them. (N42)

The nuclear emergency response drills were conducted in the daytime on a weekday, so that participants were limited to those who could take a day off (for example, senior levels who took a day off to participate in the drills just for social reasons.) The drills were conducted in the daytime on a weekday without rendering any real outcomes. (N45)

### Maebara

The nuclear emergency response drills were conducted on a weekday, and participants gathered in an open space. I myself participated in the drills conducted on the premises of Tokyo Electric Power Company. My family did not participate in the drills conducted by the town authorities. It seems to be just a handful of people who participated in the drills. (N50)

### Yamadahama

The fact that two nuclear power plants are located here and that their geological surveys were conducted has led me to believe in their safety. I have expressed this to the trainees. Overconfidence in the safety of the nuclear power plants has inhibited any implementations of nuclear emergency response drills. (N54)

The general population who was slightly aware of the nuclear emergency response drills was the fire brigades and attendees of the seminars.<sup>11</sup> People’s feeling that the nuclear emergency response drills lacked real applicability seems to derive from: a popular belief in the “safety of nuclear power plants” (now found to be wrong); the fact that the drills were conducted “in the daytime on a weekday”; and that there were “a handful of participants.”

Although we must not jump to conclusions from these responses to interview surveys, the “drills” conducted in Naraha Town do not necessarily seem to have helped to raise residents’ awareness of the evacuations.

## **3.2. Tomioka Town**

We have conducted interview surveys with 61 people (99 times in total) who positively responded to the question of “availability for individual surveys” in the questionnaire surveys we conducted with the general population of Tomioka Town in the summer of 2012 (the same time frame as Naraha Town). Out of the 27 administrative districts of the town, four districts – Takatsudo, Osuge, Kami Motomachi, and Fukaya – were not subject to the interview surveys. With the exception of Kami Motomachi, none of these districts was directly engaged in the nuclear emergency response drills.

### **3.2.1. Districts Where Drills Were Implemented**

The following twelve districts conducted nuclear emergency response drills in fiscal 2001, 2003, 2005, and 2007 prior to the Great East Japan Earthquake disaster: Kami Motomachi, Motomachi, Iwaido, Shimizu, Kami Kori, Ota, Shimo Koriyama, Kegaya, Hotokehama, Ekimae, Nishihara, and Chuo.

#### Motomachi

Despite the nuclear power plants located in the town, no drills were conducted here. I have only once participated in a large-scale drill. We complained among ourselves: “Kegaya and Ota districts are unreasonably favored (by Tokyo Electric Power Company who offered them a one-night trip).” We think drills should be conducted in different districts of the town in turn. (T27)

#### Iwaido

I have participated in the town-wide nuclear emergency response drills for the past several dozen years as a member of the women’s department in the seniors’ club. The drills, which were not intended to prepare us for any possible nuclear accidents, were found impractical and ineffective. (T29)

#### Shimizu

It was only the officers who participated in the town-sponsored nuclear emergency evacuation drills. I participated in the drills just for pleasure because there were some helicopters readied, and because the drills proceeded in accordance with the manual. (T30)

Joint drills were conducted biennially in cooperation with the prefecture in response to possible nuclear accidents. (T32)

#### Kami Kori

What I did was just listened to the broadcast news. (T33)

#### Shimo Koriyama

Nuclear emergency evacuation drills and earthquake evacuation drills were both conducted. The former drills

11. See the above footnote 10.

became so greatly stereotyped and routine according to the manuals that no more than 60 people participated in the drills from the entire town. (T35)

#### Kegaya

Evacuation drills in response to an assumed tsunami, earthquake, or nuclear accident were biannually conducted by the administrative district, with participants mainly from the fire brigades and seniors' clubs. With some people at work, the participation rate might be around 50% of the residents. (T36)

I participated in the nuclear emergency response drills, which were conducted in the autumn every other year. In the drills, we took a bus dispatched to pick us up in the presence of police officers and members of the self-defense force, went to the Yonomori Daini Junior High School to receive inspections and eat convenience foods, and returned home. My wife participated in them without fail. (T37)

I participated in the annual nuclear emergency response drills around October 2009, when I, a driver's license holder for large vehicles, drove a bus to the evacuation site at the Yonomori Daini Junior High School to take the drill participants there. (T39)

#### Hotokehama

The nuclear emergency response drills, which were focused on evacuation drills, were mainly sponsored by the town authorities (none were sponsored by the administrative district). People participated in the drills partially for the pleasure of riding a helicopter, and the drills were found impractical and ineffective when accidents actually happened at the nuclear power plant. Such drills have been conducted several times so far, in which everybody in the administrative district participated. (T41)

Fukushima Daini Nuclear Power Plant is closely located. The designated evacuation site was the gymnasium of the Yonomori Daini Junior High School. As an official of the administrative district, I reported: "X people have evacuated from Hotokehama Community." Probably the evacuees were as many as ten people. I told the community people that the town office would ready a bus so that they could just take it to the evacuation site. I myself participated in the drills only once in the autumn seven to eight years before. The drills gave me no particular sense of presence. (T42)

#### Nishihara

The nuclear emergency evacuation drills were annually conducted not solely by the town authorities but jointly in cooperation with Tokyo Electric Power Company, Okuma Town, and others. No towns/villages or town/village people were particularly mobilized to participate in the drills, so that people associated with Tokyo Electric Power Company were the only participants of the drills, which almost became ceremonial. (T46)

Some residents participated in the large-scale drills sponsored by Tokyo Electric Power Company and the town authorities, which did not take place every year. The residents only participated on the town's requests. (T47)

I did not know that the nuclear emergency evacuation drills had been conducted prior to the March 11, 2011 Great East Japan Earthquake. (T49)

In response to any possible accidents at the nuclear power plants of Tokyo Electric Power Company, drills were probably conducted a couple of times a year. Actually, such drills seemed focused on Kegaya, Ota, Hotokehama, and other coastal districts that are located close to the Fukushima Daini Nuclear Power Plant. (T51)

In Tomioka Town, where drills were conducted in fiscal 2001, 2003, 2005, and 2007, most of the town areas except for some administrative districts were not designated as the areas where drills should be continuously implemented. Whereas the aforementioned comments were admittedly partially influenced by the informants' ages and other properties, most of the townspeople should have been fully aware of the availability of such drills through the media or wireless-activated disaster warning system. Under such circumstances, some participants commented that they participated in the drills just "for pleasure," that the drills eventually became too "ceremonial," and that the drills gave the participants no "sense of presence."

### **3.2.2. Districts Where Drills Were not Implemented**

#### Nakamachi

The district chief participated in the nuclear emergency evacuation drills. He seemed to be no sense of tension during the drills, and I wondered if such drills would be meaningful. (T4)

With the district located about 9.7 km from each of the Fukushima Daiichi and Daini Nuclear Power Plants, we were advised to participate in the nuclear emergency response drills, but such drills have never been conducted. (T6)

#### Shimo Senri

Participation rates for the nuclear emergency evacuation drills should vary with the administrative districts. Four to five members of the district's fire brigade would participate in the drills from Shimo Senri just for diplomatic reasons. (T8)

Tokyo Electric Power Company annually sponsored and implemented the nuclear emergency response drills for the Daini Nuclear Power Plant in the form of exchange meetings with the district chief and women's association. I actually attended such meetings just two months ahead of the Great East Japan Earthquake. Specifically, such meetings took place around the time when the important anti-earthquake building was constructed, and we confirmed at the meetings how we should behave in the event of a great earthquake. I asked the officials of Tokyo Electric Power Company about the National Route 288 and prefectural roads that would serve as evacuation routes, and they answered saying that prefectural affairs were not their business. (T10)

#### Yonomori Ekimae Kita

I have heard about the nuclear emergency evacuation



drills from the local disaster warning radio system, but have never participated in the drills. (T13)

Shinmachi

The nuclear emergency response plan included such measures as to arrange 160 to 200 buses, anyway no fewer than 100 buses, but there were just four buses of Joban Kotsu available in Tomioka Town. It was obvious to us that the nuclear emergency response plan would be impractical and ineffective in that sense. The nuclear emergency response plan also says that the communities subject to evacuations would be changed according to the directions in which the wind blows, but we knew that we could not stay here silently, just watching the neighbors evacuating in front of us. (T17)

Otsuka

Nuclear emergency response drills were conducted, and the local fire brigades participated in them. Such nuclear emergency response drills were mainly intended for the districts of Kegaya, Hotokehama, and Kobama, and we felt them rather irrelevant. (T24)

I have never participated in the nuclear emergency response drills. I watched them on TV and felt them rather ceremonial. (T26)

Kobama

The nuclear emergency response drills, sponsored by the national government (as stipulated in Articles 10 and 15 of the Nuclear Emergency Preparedness Act), were conducted once a year, probably in October for two days. The annual nuclear emergency response drills are based on the regional nuclear disaster prevention plan and other drills, on the ordinary disaster prevention plan. Those drills were too strictly manualized to be practical and effective. (T52)

Oragahama

Only a limited number of administrative districts conducted nuclear emergency response drills systematically. Specifically, they are Kegaya, Hotokehama, Ekimae, Shimo Koriyama, and Ota, which are located closer to the Fukushima Daini Nuclear Power Plant. In those districts, the drills were mainly conducted by the town authorities on weekdays. Other districts were solicited to support the drills by distributing cooked rice or through local women’s associations. (T55)

Shin Yonomori

The district was not solicited to mobilize the residents or participate in the nuclear emergency response drills implemented by Tokyo Electric Power Company, but I myself participated in them as a district welfare commissioner. The drills were mainly intended for Kegaya and other subject districts, and several hundred people [per district] participated in them: they were picked up at the gathering place by bus and taken to the Tomioka Daini Junior High School for screening or decontamination purposes. My participation was just to complete the numbers required for the drill to be conducted, and I had no particular role to play. (T61)

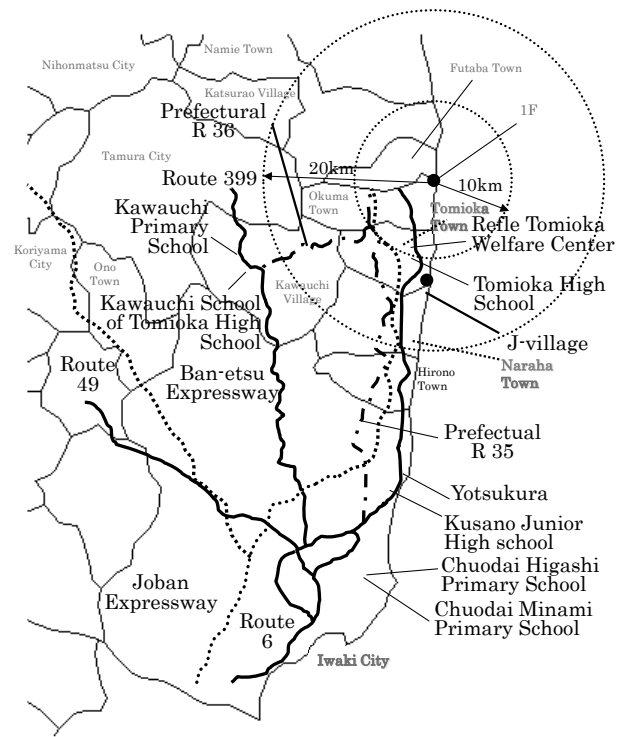


Fig. 4. Main roads and facilities.

In the aforementioned districts, where no nuclear emergency response drills were individually conducted, the district officials and local fire brigades participated. The nuclear emergency response drills seemed impractical and ineffective to the participants because they were “too strictly manualized” (T52) and lacked flexibility, and because only a limited number of people or districts participated in them. Such was also the case for Naraha Town.

The following describes how and where the nuclear emergency response drills were conducted prior to the Great East Japan Earthquake. The actual conditions in Okuma Town are the same as described above. In Reference [9] (2013), Yoshihara referred to the “resident participation drills and their hidden bottleneck,” and to the “mobilized resident participation that practically spoiled such cooperative features as inherently connoted by communities.” It seems that the same observations by Yoshihara were seen in Naraha Town and Tomioka Town, as well. We should especially note, however, that most of the residents behaved based on a shared belief that the “nuclear power plants are safe.”

**4. Evacuation Conditions After Nuclear Accidents – Effects of Drills –**

The preceding section has discussed, based on the interview survey findings, the awareness of and participation in the nuclear emergency response drills conducted prior to the Great East Japan Earthquake. The findings reveal that the residents did not take the drills very seriously as demonstrated by the residents’ comments: “The nuclear



**Table 2.** Information sources on which residents decided to evacuate (in terms of the evacuees at the nuclear accidents).

	BASE	Prefecture, Town (including disaster warning radio system)	Police Office, Fire Station, and Fire Brigade	Own Family Members/Relatives	TV/Radio	Neighborhood Association and/or Neighborhood Council	Neighbors (including disaster warning radio system)	Personnel at Workplace/Schools	Cell Phone, Internet
Total	436	51.8	22.2	22.2	22.0	20.6	18.3	6.9	3.2
Kami Ide	55	▽ 38.2	23.6	25.5	21.8	↑ 30.9	20.0	3.6	5.5
Shimo Ide	20	45.0	∴ 35.0	∴ 10.0	30.0	20.0	15.0	△ 20.0	5.0
Kitada	23	47.8	↑ 39.1	30.4	17.4	17.4	26.1	8.7	4.3
Oya	18	61.1	11.1	16.7	16.7	11.1	16.7	-	-
Matsudate	13	61.5	23.1	15.4	30.8	15.4	30.8	15.4	-
Kami Shigeoka	25	60.0	32.0	24.0	28.0	16.0	↓ 4.0	8.0	-
Asahigaoka	1	-	-	-	-	-	-	-	-
Shigeoka	19	47.4	10.5	26.3	↓ 5.3	26.3	26.3	10.5	-
Shimo Shigeoka	19	∴ 68.4	26.3	10.5	15.8	10.5	15.8	5.3	-
Namikura	15	↓ 26.7	20.0	-	33.3	33.3	26.7	-	△ 13.3
Eidan	17	52.9	23.5	11.8	23.5	∴ 5.9	23.5	11.8	-
Ottojiro	-	-	-	-	-	-	-	-	-
Kami Kobana	26	↑ 69.2	23.1	26.9	26.9	23.1	19.2	7.7	-
Shimo Kobana	53	↑ 64.2	18.9	15.1	26.4	20.8	∴ 11.3	-	1.9
Yamadaoka	60	50.0	18.3	28.3	∴ 15.0	16.7	21.7	6.7	1.7
Maebara	15	46.7	26.7	33.3	26.7	△ 46.7	26.7	6.7	△ 13.3
Yamadahama	12	41.7	8.3	16.7	16.7	25.0	8.3	8.3	-
Mominokishita	-	-	-	-	-	-	-	-	-
Onnadaira	2	50.0	-	-	-	▲ 100.0	-	-	-
Osaka	1	100.0	-	-	-	-	-	-	-

emergency response drills gave them no sense of reality because they absolutely believed in the safety of the nuclear power plants.” Contrary to the residents’ shared belief in the safety of the nuclear power plants, March 12, 2011 fell on them as “the Day.” This section therefore describes, based on both the findings of the interview surveys and questionnaire surveys, how and where the residents evacuated after the nuclear accidents. **Fig. 4** shows the main roads and facilities in the neighborhoods that the residents mentioned in the interview surveys.

#### 4.1. Naraha Town

##### 4.1.1. Questionnaire Survey Findings

The following descriptions on how and where the residents evacuated when the nuclear accidents occurred on March 12, 2011, following the March 11, 2011 earthquake tsunami are based on the questionnaire surveys we conducted in the summer of 2012.<sup>12</sup> First, we list the information sources that triggered the residents’ evacuations by the administrative district (**Table 2**). The administrative districts shaded in **Table 2** are where nuclear emergency response drills were conducted in fiscal 2001, 2003, 2005, and 2007. In total, 51.8% of the total evacuees decided to evacuate based on the information from

the “prefecture, town (including their disaster warning radio system)”; 22.2% from the “police office, fire station, fire brigade” and “own family members/relatives”; 22.0% from the “TV/radio”; 20.6% from the “neighborhood association and/or neighborhood council”; and 18.3% from the “neighbors.” The residents’ evacuations were predominantly triggered by the information from the “prefecture, town (including their disaster warning radio system).”

On the basis of administrative districts, the “personnel at workplace/school” (20.0%) in Shimo Ide is the only information source about which we noticed some notable difference (a significant difference of 1% and 5%). As far as the questionnaire survey findings show, they would at least suggest that the district-wide participation in the evacuation drills<sup>13</sup> did not work as well as expected. As for the other districts, in Maebara District, the “neighborhood association and/or neighborhood council” accounted for 46.7%, just for reference.

Next, those with whom the evacuees evacuated to the first evacuation shelters are listed (**Table 3**). Most of the evacuees evacuated together with “family members/relatives” (77.5%), “neighbors” (11.0%), and others (less than 10% each). The survey findings seem to reconfirm that the evacuations were not systematically organized but instead individually conducted.

In the administrative districts where evacuation drills were conducted, some significant difference was only

12. The notation of the numbers in the tables hereinafter is “%” unless otherwise specified. The analyses hereinafter are conducted with Assum for Windows, a tabulation software. Significant differences from the total are symbolized as follows: ▲▼: 1%, △ ▽: 5%, ↑ ↓: 10%, ∴: 20%.

13. This is due to the fact that the indicated percentages are not based on the participants in the nuclear emergency response drills.

**Table 3.** People with whom residents evacuated to first evacuation shelters (in terms of the evacuees at the nuclear accidents).

	BASE	Family, Relatives	Neighbors	By Oneself	Friends, Acquaintances	Members of Neighborhood Association	In Groups as Instructed by Municipalities
Total	436	77.5	11.0	9.4	7.8	2.5	2.3
Kami Ide	55	↑ 87.3	10.9	5.5	5.5	–	–
Shimo Ide	20	75.0	∴ 20.0	5.0	15.0	△ 10.0	5.0
Kitada	23	87.0	17.4	4.3	8.7	▲ 13.0	△ 8.7
Oya	18	77.8	5.6	16.7	5.6	–	–
Matsudate	13	92.3	–	7.7	–	–	–
Kami Shigeoka	25	84.0	12.0	4.0	4.0	–	4.0
Asahigaoka	1	–	–	–	–	–	▲ 100.0
Shigeoka	19	↑ 94.7	5.3	5.3	5.3	–	–
Shimo Shigeoka	19	68.4	10.5	–	–	5.3	5.3
Namikura	15	66.7	13.3	13.3	↑ 20.0	–	–
Eidan	17	↓ 58.8	11.8	17.6	5.9	5.9	–
Ottojiro	–	–	–	–	–	–	–
Kami Kobana	26	84.6	3.8	11.5	11.5	–	3.8
Shimo Kobana	53	79.2	9.4	9.4	11.3	1.9	1.9
Yamadaoka	60	75.0	↑ 18.3	8.3	10.0	1.7	1.7
Maebara	15	▼ 46.7	13.3	▲ 46.7	–	6.7	–
Yamadahama	12	66.7	8.3	16.7	8.3	∴ 8.3	∴ 8.3
Mominokishita	–	–	–	–	–	–	–
Onnadaira	2	100.0	–	–	–	–	–
Osaka	1	100.0	–	–	–	–	–

noticed as to the “members of neighborhood association/neighborhood council” (10.0%) in Shimo Ide District. As for the other districts, the “members of neighborhood association/neighborhood council” in Kitada and the “by oneself” in Maebara are similarly worth noting. This apparently shows that how residents evacuated is closely related to the information sources based on which they decided to evacuate.

#### 4.1.2. Interview Survey Findings

Sugano and Takagi (2012) [39] reports: at 8 am on March 12, the town office decided on their own to prompt the town-wide evacuations to Iwaki City and established the emergency operations center at Chuodai Minami Primary School in Iwaki City on the same day; Around 5,400 people evacuated into Iwaki City by the end of the day. Let us now review whether the evacuation drills conducted by the following administrative districts prior to the nuclear accidents were found practical and effective.

##### Shimo Ide

We were ordered to evacuate toward Iwaki City because of the accidents at the nuclear power plant, so I drove my own car to evacuate to Yotsukura in Iwaki City where my daughter lived. (N9)

##### Kami Shigeoka

Upon hearing the town’s radio system calling for us to “flee in the direction of Iwaki City,” I evacuated to Kusano Junior High School. (N17)

In the morning, I learned from the town’s broadcasting system that some accidents broke out at the nuclear power plant and we were ordered to evacuate southward, so I

evacuated to Iwaki City in my own car together with four other family members except my son. (N18)

On the morning of the 12<sup>th</sup>, the disaster warning radio system called for us to evacuate “southward immediately” so I headed for Iwaki City. (N20)

##### Shimo Shigeoka

My son, (who had been on a searching mission as a member of the fire brigade as ordered by the town authorities), returned home and told us to “flee immediately because the nuclear power plant is on the verge of crisis,” which was much earlier than the town’s broadcasting system. So we evacuated in three cars as a group of eleven at around 8:30 am. (N24)

I could not clearly hear the disaster warning radio system. The fire brigade made rounds, calling for our evacuations. I put up a notice on the entrance: “I will leave earlier than you, so please come and join me later.” Having no idea where I should flee, I decided to take Prefectural Route No.35 (commonly known as “Sanroku Route”). (N25)

##### Namikura

At around 7:00 am, Tomioka Town (where I moved to because my house was damaged by the previous day’s tsunami) publicly called for our evacuations, so I returned to Naraha Town temporarily and was told to evacuate to Kusano Primary School. (N26)

##### Eidan

We were all of a sudden told in the morning to “evacuate because of the nuclear accidents,” so I fled southward in the clothes I happened to wear. (N27)

In the morning, the disaster warning radio system in-

**Table 4.** Information sources on which residents decided to evacuate (in terms of the evacuees at the nuclear accidents).

	BASE	Prefecture, Town	Neighbors	Police Office, Fire Station, Fire Brigade	Own Family Members, Relatives	TV/Radio	Neighborhood Association, Neighborhood Council	Personnel at Workplace/Schools	Cell Phone, Internet
Total	1267	51.5	26.4	22.4	21.3	18.1	11.4	5.1	3.1
Sugiuchi	25	△ 72.0	20.0	16.0	∴ 32.0	12.0	4.0	8.0	∴ 8.0
Nakamachi	47	57.4	25.5	▽ 8.5	25.5	23.4	▲ 25.5	-	2.1
Takatsudo	29	51.7	∴ 37.9	∴ 10.3	↑ 34.5	∴ 6.9	10.3	△ 13.8	-
Simo Senri	28	△ 71.4	32.1	∴ 10.7	21.4	17.9	7.1	3.6	7.1
Osuge	44	∴ 40.9	22.7	20.5	▽ 9.1	13.6	6.8	6.8	-
Yorunomori Ekimae Kita	47	59.6	29.8	17.0	23.4	14.9	12.8	-	2.1
Yorunomori Ekimae Minami	64	53.1	29.7	25.0	15.6	▲ 31.3	9.4	1.6	4.7
Shinmachi	67	↑ 62.7	26.9	17.9	16.4	↓ 9.0	9.0	∴ 1.5	3.0
Akagi	13	▼ 15.4	30.8	▲ 76.9	15.4	7.7	-	-	-
Kami Motomachi	12	58.3	16.7	25.0	33.3	8.3	∴ 25.0	-	-
Otsuka	103	46.6	26.2	22.3	∴ 15.5	16.5	13.6	2.9	3.9
Motomachi	73	↓ 41.1	28.8	26.0	24.7	↓ 9.6	12.3	∴ 1.4	1.4
Iwaido	18	∴ 33.3	33.3	↓ 5.6	27.8	11.1	5.6	5.6	-
Shimizu	82	▽ 40.2	△ 37.8	18.3	25.6	22.0	∴ 6.1	3.7	2.4
Kami Kori	9	66.7	11.1	22.2	△ 55.6	11.1	△ 33.3	-	∴ 11.1
Ota	9	44.4	11.1	33.3	33.3	22.2	△ 33.3	-	∴ 11.1
Shimo Koriyama	28	50.0	25.0	25.0	↓ 7.1	17.9	-	7.1	-
Kegya	8	△ 87.5	-	25.0	-	25.0	12.5	-	-
Hotokehama	4	75.0	-	△ 75.0	25.0	↑ 50.0	△ 50.0	↑ 25.0	-
Ekimae	28	57.1	∴ 39.3	32.1	21.4	21.4	△ 25.0	∴ 10.7	7.1
Nishihara	69	∴ 59.4	26.1	21.7	18.8	15.9	△ 20.3	∴ 1.4	1.4
Chuo	60	51.7	∴ 35.0	∴ 15.0	20.0	16.7	15.0	1.7	1.7
Kobama	67	∴ 59.7	23.9	20.9	23.9	19.4	13.4	3.0	1.5
Fukaya	18	50.0	22.2	33.3	22.2	11.1	-	-	-
Oragahama	33	51.5	∴ 15.2	27.3	24.2	∴ 9.1	9.1	6.1	3.0
Sakaemachi	8	△ 87.5	37.5	↑ 50.0	25.0	-	12.5	-	∴ 12.5
Shin Yorunomori	94	51.1	30.9	25.5	20.2	19.1	∴ 6.4	5.3	3.2

structed us to evacuate to Iwaki City, so we evacuated in each family’s car to Chuodai Higashi Primary School in Iwaki City. (N28)

These interview survey findings are too insufficient to deduce any statistic implications. It is only N25 who mentioned the fire brigade’s engagement, whereas all other interviewees were told to evacuate by the disaster warning radio system and evacuated “individually with one’s family members/relatives.” As far as the questionnaire and interview survey findings, we may conclude that the nuclear emergency response drills implemented by Naraha Town were found to be nearly impractical and ineffective.

## 4.2. Tomioka Town

### 4.2.1. Questionnaire Survey Findings

Let us now review the actual conditions in Tomioka Town. For the information sources on which the residents decided to evacuate, **Table 4** shows the following: In total, the “prefecture, town (including disaster warning radio system)” accounts for 51.5%; the “neighbors,” 26.4%; the “police office, fire station, fire brigade,” 22.4%; the “own family members/relatives,” 21.3%; the “TV/radio,” 18.1%; and the “neighborhood association and/or neighborhood council,” 11.4%. While the “prefecture, town (including disaster warning radio system)” is the dominant information source on which the residents decided to evacuate (as was the case in Naraha Town), a rather large percentage of 26.4% for the “neighbors” is a characteristic phenomenon of Tomioka Town.

In the administrative districts, some significant differences were noticed as to the “neighbors” (37.8%) in Shimizu and the “neighborhood association and/or neighborhood council” in Ekimae and Chuo (25.0% in Ekimae; 20.3% in Chuo). That seems to suggest rather “good communication among residents,” or the evacuation drills were found practical and effective in those districts. In addition to the aforementioned administrative districts, the “neighborhood association and/or neighborhood council” accounted for 25.5% in Nakamachi, which is noteworthy as the questionnaire and interview surveys found that they had been very active in the emergency response activities or events even before the Great East Japan Earthquake.

**Table 5** shows with whom the residents evacuated to the first evacuation shelters. Most of the evacuees mentioned “family members/relatives” (77.6%), followed by the “neighbors” (11.3%). This was similar to the case of Naraha Town, suggesting that the evacuations were not systematically organized in Tomioka Town, either. In the administrative districts, the “neighbors” (20.0%) and the “neighborhood association/neighborhood council” (8.3%) mentioned by the residents in Chuo are noteworthy because, taking into account the questionnaire survey findings, their evacuation processes ranging from communication to evacuations seemed nearly systematic in Chuo District.

### 4.2.2. Interview Survey Findings

According to the “Memories and Records on the Great East Japan Earthquake/Nuclear Disasters” [40] published by Tomioka Town, on the morning of March 12, 2011,

**Table 5.** With whom residents evacuated to first evacuation shelters (in terms of the evacuees at the nuclear accidents).

	BASE	Family, Relatives	Neighbors	By Oneself	Friends, Acquaintances	Members of Neighborhood Association	In Groups as Instructed by Municipalities
Total	1267	77.6	11.3	11.0	8.4	2.5	0.5
Sugiuchi	25	84.0	16.0	4.0	4.0	4.0	-
Nakamachi	47	83.0	12.8	8.5	4.3	↑ 6.4	-
Takatsudo	29	86.2	6.9	10.3	6.9	-	-
Simo Senri	28	∴ 89.3	▲ 32.1	-	3.6	-	-
Osuge	44	77.3	9.1	9.1	6.8	-	-
Yorunomori Ekimae Kita	47	▲ 93.6	8.5	8.5	4.3	4.3	-
Yorunomori Ekimae Minami	64	79.7	7.8	7.8	9.4	-	-
Shinmachi	67	76.1	▲ 22.4	14.9	∴ 3.0	4.5	-
Akagi	13	92.3	7.7	-	-	-	-
Kami Motomachi	12	91.7	16.7	-	-	-	-
Otsuka	103	↑ 84.5	11.7	9.7	7.8	1.0	-
Motomachi	73	80.8	15.1	∴ 5.5	5.5	∴ 5.5	1.4
Iwaido	18	83.3	11.1	5.6	11.1	-	-
Shimizu	82	80.5	9.8	9.8	11.0	3.7	-
Kami Kori	9	88.9	11.1	11.1	11.1	-	-
Ota	9	77.8	22.2	-	11.1	▲ 33.3	-
Shimo Koriyama	28	78.6	∴ 3.6	10.7	7.1	3.6	△ 3.6
Kegaya	8	▼ 37.5	25.0	△ 37.5	12.5	-	-
Hotokehama	4	75.0	-	25.0	-	▲ 25.0	-
Ekimae	28	↓ 64.3	10.7	17.9	↑ 17.9	3.6	-
Nishihara	69	76.8	↓ 4.3	11.6	4.3	2.9	-
Chuo	60	78.3	△ 20.0	11.7	8.3	▲ 8.3	∴ 1.7
Kobama	67	76.1	11.9	14.9	∴ 13.4	-	-
Fukaya	18	83.3	5.6	5.6	5.6	-	-
Oragahama	33	81.8	-	12.1	6.1	-	-
Sakaemachi	8	▼ 37.5	25.0	25.0	↑ 25.0	▲ 25.0	-
Shin Yorunomori	94	△ 86.2	11.7	▼ 2.1	7.4	-	1.1

the townspeople were notified by the disaster warning radio system to evacuate to Kawauchi Primary School, Kawauchi Branch School of Tomioka High School, to Iwanosato in the neighboring Kawauchi Village, or to the districts' gathering places. Let us now review how the residential organizations were engaged in the evacuation processes.

#### Motomachi

We were told to evacuate in the morning. Some people took a bus parked at the Welfare Center, and others moved in their own cars in their own ways. (T27)

At 8:00 am, we were told to evacuate. My dormitory mates told me to "flee immediately" but in the absence of any disaster warning radio broadcastings, I had no idea why we had to flee. (T28)

#### Iwaido

At 8:00 am, the disaster warning radio system called for us to evacuate and we decided to evacuate together, probably much earlier than others in the village. We called out to the people on the way of our evacuation: "Let's evacuate! Walkers evacuate to Rifure and all others to Kawauchi!" (T29)

#### Shimizu

As a leader of the Association/Council, I saw to it that the villagers had all been evacuated before I evacuated. So I would have been a rather late evacuee. (T30)

Although some people walked to the Seven-Eleven convenience store to get some rice balls, we went to Tomioka High School to get some information, where

someone told us: "Why don't you go to the village office where they are broadcasting some news?" So we decided to go to the village office, where we learned that the "Dai-ichi Nuclear Power Plant is on the verge of crisis," and were separated from each other there. (T32)

#### Kami Kori

At around 5:00 am, hearing people's talks that the "Tokyo Electric Power Company's Daiichi Nuclear Power Plant is on the verge of crisis, so let's flee," we all rushed to flee. I talked with my father and was told to evacuate to Kawauchi Village. Meanwhile, I did not chat with anybody except my family members, and had a glimpse of one of my acquaintances in Kami Kori. (T33)

#### Ota

My neighbors happened to catch the evacuation instructions and told me to evacuate. (T34)

#### Shimo Koriyama

The district could not act on its own, leaving everything to be judged and decided by the town authorities. (T35)

#### Kegaya

Mr. Y's cell phone received a message: "The Daiichi Nuclear Power Plant has exploded. Flee to Kawauchi." I first replied that I would not flee because I had a dog, but he so strongly admonished me to "stop talking that way" that we headed for Kawauchi together in a car. (T37)

At around 7:00 am, I went to Tomioka Station to find to my surprise that nothing happened. So I guessed that nothing should have happened in Kegaya, either. I went

to the town office at around 9:00 am and was told by the town mayor to “transfer the residents by bus from Tomioka High School,” so I went to Rifure Tomioka, from where I drove a bus to evacuate the residents to Kawauchi. (T39)

#### Hotokehama

In the morning, we were ordered to evacuate because of the nuclear accidents, so I drove my own car to evacuate to a daughter-in-law’s home in Kawauchi Village. (T40)

#### Ekimae

In the morning, we were ordered through the town’s disaster warning radio system to evacuate to Kawauchi Village. The town authorities had specified the evacuation processes in detail in the event of a nuclear accident long before, but I felt angry to find that they turned out impractical and ineffective when the nuclear accidents actually happened. (T43)

There was nobody in the neighborhood. Soon, the broadcasting system called for us to evacuate to Kawauchi, so I first went to my sister’s home to get some rice balls before departing for the evacuation to Kawauchi. (T44)

#### Nishihara

My son dropped by my house to say that “one of the fire brigade members told me to evacuate to Kawauchi.” I did not notice that the disaster warning radio system also called for our evacuations. (T45)

When I returned home in the morning, my wife told me that “the disaster warning radio system called for the townspeople to evacuate to Kawauchi,” so we decided to evacuate together in my son’s car. (T46)

#### Chuo

Upon the evacuation order, I moved to Manabinomori and was evacuated by bus to Kawauchi Village at around 2:00 pm. (T47)

My mother’s sister’s husband living in Okuma came to my house to say: “Everybody is escaping, so you too should flee in a hurry.” At around 9:00 am we loaded sleeping futon-mats and other things in a car and evacuated as a family of three. When I passed through the town, I noticed a lot of people still at home. I was told by one of the same fire brigade members that a large number of people evacuated to Kawauchi. I could hardly catch the town’s radio broadcasting. There was no systematic calling out but occasional calling out to the people we happened to meet; I myself told the evacuation order to my fellow members of the fire brigade. (T48)

As the former district chief, I made rounds in Chuo District together with my son. It seemed that at 8:15 am, there was a broadcasting calling for evacuations, which I could hardly catch. I returned to the Second Primary School just before 9:00 am to find nobody but my family remaining there. (T50)

Even before it was so broadcast, I was told by the town assembly member living in front of my house that the “Daiichi Nuclear Power Plant is on the verge of crisis.” So at around 7:30 am, we decided to evacuate to Kawauchi

in three cars as a group of nine plus a dog. (T51)

Since we have reviewed the actual conditions in Tomioka Town based on the interviewees, we cannot generalize them. However, the residents in the districts subjected to the nuclear emergency response drills apparently learned the nuclear accidents and evacuation instructions by word of mouth rather than from the disaster warning radio system. Whether they evacuated by bus or by their own cars seems to have been a deciding factor for whether they were scattered from each other or not. It should be noted that district chiefs (or experienced persons) made rounds in the neighborhood, calling for evacuations (T30, T50).

## **5. Did Nuclear Emergency Response Drills Formulate Local Knowledge?**

The Great East Japan Earthquake entailed not just tsunami disasters but also nuclear accidents as described in this paper. The preceding sections of this paper have discussed the relationships between the nuclear emergency response drills prior to the Great East Japan Earthquake and the residents’ evacuation behaviors. Could these previously mentioned nuclear accidents formulate any particular local knowledge? It is too early at this point to discuss such a question. Instead, we have checked with the same surveyed participants whether in the nuclear emergency evacuation drills prior to the Great East Japan Earthquake, the residents actually evacuated in response to the calling from the districts and/or fire brigades (**Tables 6 and 7**).

The administrative districts where nuclear emergency response drills were implemented prior to the Great East Japan Earthquake are shaded in **Tables 6 and 7**. Although not statistically meaningful, it is only in Shimo Shigeoka District (N23, N25) among the administrative districts of Naraha Town where the nuclear emergency evacuation drills were conducted in fiscal 2001, 2003, 2005, and 2007 that the residents evacuated upon the calling from the fire brigades, district, and/or sections. Among the administrative districts where no nuclear emergency evacuation drills were conducted, it is in Kami Ide District (N8), Matsudate District (N15, N16), Shimo Kobana District (N32, N33), and Yamadaoka District (N45, N60) that the fire brigades participated in the disaster prevention drills in some way or another, and where the residents evacuated upon the calling from the fire brigades, districts, and/or sections.

As for Tomioka Town, it was only in Shimizu District (T30) among the administrative districts, where the nuclear emergency evacuation drills were conducted, that the residents evacuated upon the calling from the fire brigades, district, and/or sections. In Kegaya District, the district, sections, and/or fire brigades called for the residents to evacuate from the March 11, 2011 tsunami (T36, T37, T38, T39, T66), but the tsunami disasters could have possibly caused dysfunction on March 12, 2011. In

**Table 6.** Actual conditions of drills/evacuations in administrative districts of Naraha Town.<sup>14</sup>

Before the disaster	Activities	Events	Organizations	Issues	Names	NERD	Evacuations on March 11	Evacuations on March 12	Before the disaster	Activities	Events	Organizations	Issues	Names	NERD	Evacuations on March 11	Evacuations on March 12		
Kami Ide		L	L		N1	×		×	Eidan		L	L		N27	○	△ Neighbors' Engagement	×	None	
		L	L		N2	×		×			L	L		N28	○	△ Neighbors' Engagement	×	None	
		L	L		N3	△		×						N31	×	×	None		
		L	L		N4	△		×						N32	×	×	None	○ Fire Brigade's Engagement	
		L	L		N5		×	None		×				N33	×	×	None	○ Fire Brigade's Engagement	
		L	L		N6	△		×		None				N34	×	×	None	×	None
		L	L		N7	△		×		None				N35	△	×	None	×	None
		L	L		N8	○		○ Fire Brigade's Engagement			Simo Kobana				N36	×	— Stand-by at DCH	—	Stand-by at DCH
Simo Ide	L			N9	×	×	None	×					N37	×	×	None	×	None	
Kitada		L			N10	△		△ Neighbors' Engagement						N38	×	×	None	×	None
		L			N58	×	△ Neighbors' Engagement	×						N39	×	×	None	×	None
Oya	L				N11	△		×						N40	△	×	None	×	None
	L				N12									N41	○	×	None	×	None
	L				N13	×		△ Neighbors' Engagement					M	N42	△	×	None	×	None
	L				N14	×	×	None	×				M	N43	×	△ Neighbors' Engagement	△	Neighbors' Engagement	
	L				N59	×	×	None	×			M	N44	×	×	None	×	None	
Matsudate		M		M	N15	△	×	None	⊙ Engagement by District				M	N45	△	○ Fire Brigade's Engagement	○	Fire Brigade's Engagement	
		M		M	N16	△	×	None	○ Fire Brigade's Engagement				M	N46	×	×	None	×	None
Kami Shigeoka	M	M			N17	△	×	None	×				M	N60	△	×	None	⊙ Engagement by District	
	M	M			N18	○	×	None	×				L	N47					
	M	M			N19	×							L	N48	×	○ Fire Brigade's Engagement	×	None	
Shigeoka					N20	△	×	None	×				L	N49	△	△ Neighbors' Engagement	×	None	
	L				N22	○	— Stand-by at Town Office	—	Stand-by at Town Office				L	N50	○	×	None	×	None
Simo Shigeoka					N23			○ Fire Brigade's Engagement						N51	×	△ Neighbors' Engagement			
					N24	△	×	None	△ Neighbors' Engagement					N52	○	×	None	×	None
					N25		×	None	○ Fire Brigade's Engagement					N53	○	⊙ Engagement by District	×	None	
Nami kura		M	M		N26	○	○ Fire Brigade's Engagement	×	None					N54	×	△ Neighbors' Engagement	×	None	

Nakamachi District (T4) and Shimo Senri District (T8), though not subject to the nuclear emergency drills, the fire brigades aware of the drills called for the residents to evacuate.

14. The inputs in the columns of “activities,” “events,” and “organizations” indicate significantly more, significantly less, or no significant differences (blank) in the numbers of activities, events, and organizations in

different administrative districts prior to the earthquake when compared to the town averages as found by the questionnaire surveys conducted in the summer of 2012. As for the symbols, in the “nuclear drills,” ○ denotes awareness and participation; △, awareness only; X, no awareness. In the “evacuations,” ⊙ denotes engagements by district/sections (in evacuations); ○, engagements by fire brigades/voluntary disaster prevention organizations; △, calling-outs by neighbors; X, none (including no calling-outs for those on stand-by at home.) The same notation applies to **Table 7**.



Table 7. Actual conditions of drills/evacuations in administrative districts of Tomioka Town.

Before the disaster	Activities	Events	Organizations	Issues	Names	NERD	Evacuations on March 11	Evacuations on March 12	Before the disaster	Activities	Events	Organizations	Issues	Names	NERD	Evacuations on March 11	Evacuations on March 12	
Sugiuchi	M	M	M	M	T1				Kogaya	M	M	M	L	T36	○	○ Fire Brigade's Engagement	× None	
Nakama chi	M	M	M		T2		× None	× None		M	M	M	L	T37	○	○ Fire Brigade's Engagement	× None	
	M	M	M		T3		⊙ Engagement by District	× None		M	M	M	L	T38		○ Fire Brigade's Engagement	× None	
	M	M	M		T4	○	⊙ Engagement by DDPC	○ Fire Brigade's Engagement		M	M	M	L	T39	○	⊙ Engagement by District	× None	
	M	M	M		T5	×	× None	× None		M	M	M	L	T66	○	⊙ Engagement by District	× None	
	M	M	M		T6	×	⊙ Engagement by District	× None		Hotok hama	M	M			T40		○ Fire Brigade's Engagement	× None
Simo Senri			M		T8	△	⊙ Engagement by District	⊙ Engagement by District	M		M			T41	○			
			M		T9	△	× None	× None	M		M			T42	○			
			M		T10	○	× None	× None	Ekimae	M	M	M	M	T43		× None	× None	
Yono mori Ekimae Kita					T12	×	× None	× None		M	M	M	M	T44		× None	× None	
					T13	△	× None	× None	Nishi hara	M				T45	○	× None	× None	
					T14	×	× None	× None		M				T46	○	× None	× None	
					T15	×	× None	× None	Chuo		M	M		T47	○	⊙ Engagement by District	× None	
		L			T16		⊙ Engagement by District	× None			M	M		T48	×	× None	× None	
Sin machi	L		L		T17	○		× None			M	M		T49	×	× None	× None	
	L		L		T18	×	× None	× None			M	M		T50	×	× None	× None	
Akagi		M	L		T19	△		× None		M	M		T51	△	× None	× None		
Otsuka	L				T21	△	× None	× None	Kobama			L		T52	○		× None	
	L				T22	×	× None	× None			M		L		T53		× None	× None
	L				T23		× None	× None			M		L		T66			
	L				T24	○	○ Fire Brigade's Engagement	× None	Oraga hama		M			T55	△	× None	× None	
	L				T25	×	× None	× None			M			T56		○ Fire Brigade's Engagement	× None	
	L				T26	△	× None	× None			M			T57	○	× None	× None	
Moto machi		M			T27	○	△ Neighbors' Engagement	× None	Sakae machi			L		T58	×	⊙ Engagement by District	× None	
		M			T28	○		× None					L		T59	×	⊙ Engagement by District	× None
Iwaido					T29	○	× None	△ Neighbors' Engagement	Shin Yono mori	L	L	L		T60	△	△ Neighbors' Engagement	× None	
Shi mizu		L	L		T30	○	⊙ Engagement by District	⊙ Engagement by District		L	L	L		T61	○			
		L	L		T31					L	L	L		T62	△	× None	× None	
		L	L		T32	△	× None	× None		L	L	L		T63		× None	× None	
Kami Kori					T33	△	× None	× None		L	L	L		T64	○	△ Engagement by Office	△ Engagement by Office	
Ota		M	M		T34		× None	× None		L	L	L		T65	△	× None	× None	
Simo Kori yama	M	M	M	L	T35	△	× None	× None										

M:more, L:less, NERD:Nuclear Emergency Response Drills, DDPC:District's Disaster Prevention Council



Taking account of the questionnaire survey findings described in section 4, such massive evacuations do not seem to have been made possible as a result of the nuclear emergency evacuation drills. Instead, these should rather be attributed to “personal” factors. The interview surveys we are now conducting in Naraha Town and Tomioka Town on the nuclear emergency response drills prior to the Great East Japan Earthquake and those that will be conducted in the future are revealing that unlike the emergency drills for tsunamis or fires, residents (and/or residential organizations) did not seem very enthusiastic about participating in the nuclear emergency response drills. Further, they were not so strongly “mobilized” toward such drills by the prefecture or town/village offices. In addition, the myth that “nuclear power plants are safe” seems to have exacerbated the chaos since March 12, 2011.

Finally, let us see if the nuclear accidents at 1F could lead to formulating any particular local knowledge. At the very least, the nuclear emergency response drills in Naraha Town and Tomioka Town evidently did not help to formulate such local knowledge in relation to the evacuations in the event of a nuclear accident. The greatest inhibiting factor lies not only in the widely known “myth of safety,” but also in that residents were “passively” mobilized to the nuclear emergency response drills based on their belief in the safety of nuclear power plants.

Taking another look at the previously mentioned discussions, we notice that in addition to the said “myth of safety,” risks involved in the nuclear power plant are so “invisible” that unlike natural disasters, nuclear emergency response drills for assumed nuclear accidents are difficult to incorporate residents’ individual opinions or ideas into. As a result, administrative offices and nuclear power plant operators have rather unilaterally established the contents and types of many of the nuclear emergency response drills.

As evacuations would not rely on the administrative offices, we thought that neighboring residents should take elderly neighbors to the First Evacuation Shelter (gymnasium). (T52)

Six to seven years prior to the Great East Japan Earthquake, we organized the town’s first disaster control council. It was of such structure that the district chief, vice chief, accountants, group leaders, and others had their distinctive roles so that they could take the initiative in the disaster control activities. (Partially omitted) The disaster control council functioned well at the Great East Japan Earthquake. (T4)

As the prior comments suggest, residents were aware of and prepared for the evacuations in the event of a tsunami or other natural disasters, which actually worked well to some extent.

On the other hand, (nuclear emergency response) drills were too strictly manualized and actually turned out impractical and ineffective. (T52)

As for the nuclear emergency evacuation drills, the district chief participated from Nakamachi District. I somewhat doubted that the evacuation drills practiced by sim-

ing participants were meaningful: I felt no sense of urgency in there and burning a house would have made a big change to the drills. In addition, as such drills did not take account of evacuations from any tsunami, they should have turned out completely impractical and ineffective in Kegaya District, which was actually hit by the tsunami. (T4)

As these comments suggest, the nuclear emergency response drills were too “strict” for the residents to adapt by themselves. In addition, the drills completely lacked a sense of urgency. In other words, unlike evacuation drills in response to natural disasters such as tsunamis, in regards to nuclear emergency evacuation drills it is hard to incorporate residents’ creative ideas or opinions in the discussions on their emergency preparedness. This may be one of the reasons why no particular local knowledge was formulated among the residents on nuclear emergency response drills. Then, in the wake of the Great East Japan Earthquake, could any local knowledge be formulated from the lessons we have learned from the current nuclear accidents as well as from the subsequent nuclear emergency response drills?

We have learned that such (nuclear emergency response) drills could turn out practical and effective only if local people were fully aware of them; such awareness will grow stronger by the participation by and the communication among the neighbors. (T52)

Nonetheless, the “Fiscal 2014 Nuclear Emergency Response Drills in Fukushima Prefecture” [41, 42] states that the residents were mobilized from a wider range of districts on a larger scale; unlike other disaster prevention drills, it seems that residents did not positively take part in the planning of the drills, nor did they positively participate in them. Although we need to examine the aforementioned fiscal 2014 nuclear emergency response drills in more detail, any local knowledge about the nuclear emergency evacuations could only be formulated in the process of having discussions among residents and establishing the evacuation rules as T52 suggested in his comments. In other words, local knowledge could be formulated if the nuclear emergency response drills were so programmed as to incorporate such a process of popular engagements.<sup>15</sup>

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15. We would like to withhold our views on this matter because we are now examining it in more detail. We need to examine how the residents’ awareness for “invisible risks” would change in the wake of the earthquake, and whether and how such changes in the residents’ awareness would lead to their behaviors.

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**Academic Societies & Scientific Organizations:**

- Japan Society for Urbanology (JSU)
  - Japan Association of Regional and Community Studies (JARCS)
  - Japan Society of Civil Engineers (JSCE)
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