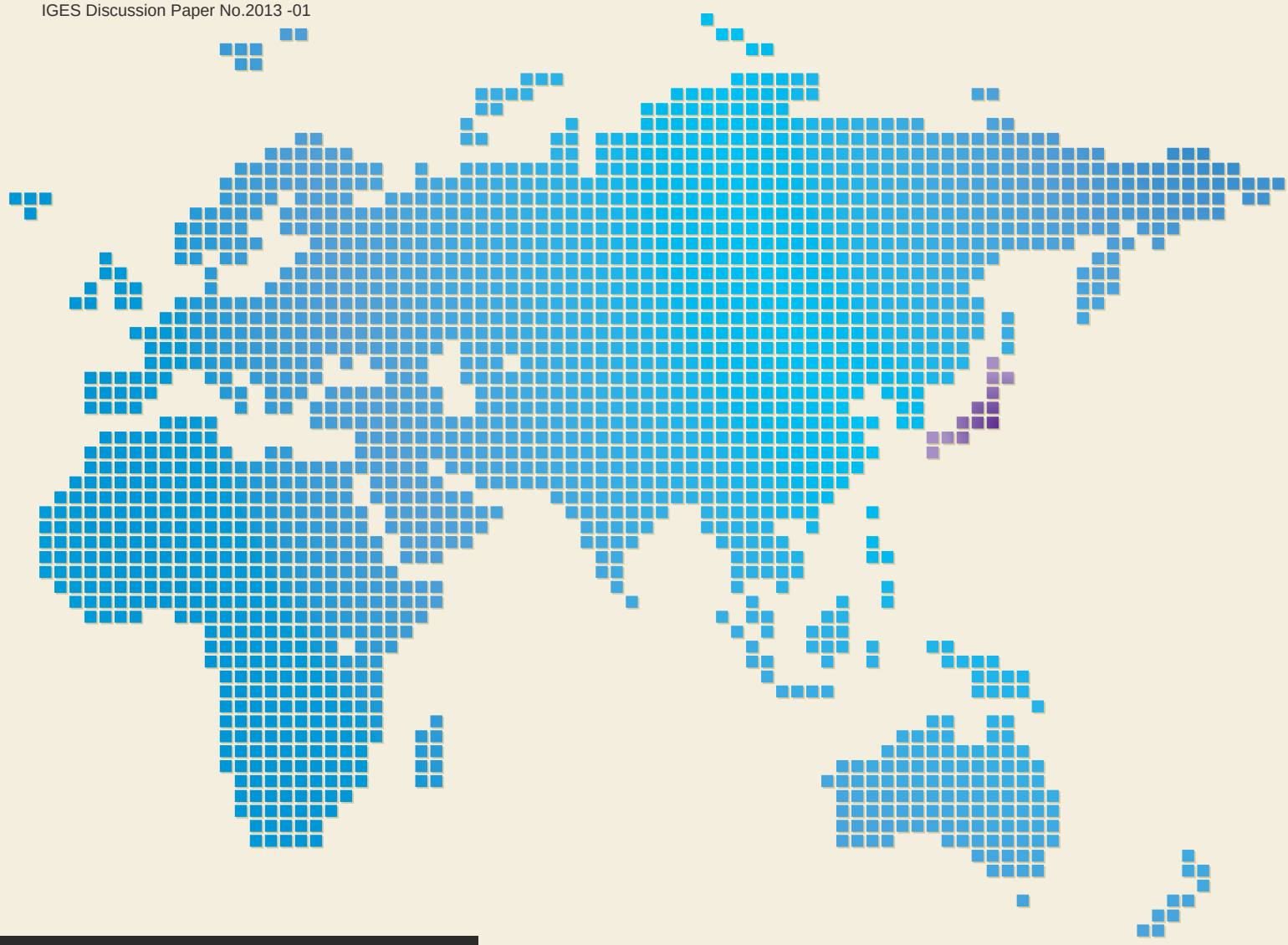
IGES Discussion Paper No.2013 -01



FAIRDO Experts | July 2013

FAIRDO2013

Challenges of Decontamination, Community Regeneration and Livelihood Rehabilitation

2nd. Discussion Paper

Fukushima Action Research on Effective Decontamination Operation | FAIRDO |

FairDO Fukushima Action Research on Effective Decontamination Operation

IGES

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1. Overview

1.1. Aims of the Discussion Paper

The dispersion of radioactive materials from the Fukushima Daiichi Nuclear Plant forced tens of thousands of citizens living in the neighbouring towns and villages to evacuate. Many evacuees hope that decontamination will be conducted quickly, and they will be able to return to their homes.

In June 2012, the Institute for Global Environmental Strategies (IGES) along with several universities including Fukushima University and experts from institutions that deal with radioactive measures in Europe, launched the Fukushima Action Research on Effective Decontamination Operation (FAIRDO). In order to contribute to effective decontamination in Fukushima FAIRDO mainly conducts surveys and analyses initiatives taken by the national government and municipalities concerning decontamination activities and communication with residents in the "Intensive Contamination Survey Areas for contamination status". It is also engaged in verification of simulation techniques and model development for supporting the formation of decontamination plans in accordance with the regional conditions.

After one year of research activities, we have realised that it is not enough to look at the mechanisms and effectiveness of the decontamination activities. We should review the issue of decontamination among the overall policies concerning reconstruction and regeneration of the hometowns as well as looking at the the rehabilitation and rebuilding of the lives of the people affected by the disaster. Therefore, in this Discussion Paper we will summarise our research activities up to March 2013 and propose actions to be undertaken by FAIRDO which will contribute to the rehabilitation and rebuilding of the lives of those affected.

1.2. Fukushima Daiichi Nuclear Power Plant Accident and Decontamination

- Accident and Evacuation: since March 2011

At 14:46 on 11 March 2011, a massive earthquake of magnitude 9.0 occurred off the Pacific Coast of the Tohoku Region, and about 40 minutes after that, a large tsunami struck. This great earthquake and tsunami caused great damage to East Japan leaving nearly 20,000 people dead or missing. The original natural disaster also led to the Fukushima Daiichi Nuclear Power Plant accident.

The Fukushima Daiichi Nuclear Power Plant is located on the coast in the eastern part of Fukushima Prefecture. At that time Reactors 1, 2 and 3 out of 6 reactors were

operational whilst Reactors 4, 5 and 6 were under periodic inspection. The tsunami knocked out the power supply, including emergency power, and made monitoring and cooling operations impossible. At 20:50 on 11 March the Government of Japan declared a nuclear emergency, and ordered residents living within a radius of 2 km from Fukushima Daiichi Nuclear Power Plant to evacuate. The range covered in the evacuation order was expanded to a radius of 3 km and then 10 km the next day. On 12 March, a hydrogen explosion occurred in Reactor 1. A hydrogen explosion also occurred in Reactor 3 on 14 March and in Reactor 4 on 15[1] March. Radioactive material was released into the atmosphere due to these explosions, and was widely diffused in Fukushima Prefecture as well as over a wide area in Eastern Japan.

On 15 March, an evacuation order was issued to all those within a radius of 20 km from the Daiichi Nuclear Power Plant, and an order to stay indoors was issued for those within a radius of 20 km to 30 km. At this stage 102,468 people had evacuated Fukushima Prefecture, of which 62,392 evacuated from the Designated Evacuation Zones while a remaining 40,256 people voluntarily evacuated from zones that were not specified for evacuation. While the total number of evacuees dropped temporarily by the end of April, it started to increase again after that. As of 22 September 2011, the number of evacuees from the Designated Evacuation Zones reached 100,510, totalling 150,837 evacuees including 50,327 voluntary evacuees[2].

In the initial period after the accident, evacuation instructions were based on the distance from the Fukushima Daiichi Nuclear Power Plant. However, on 22 April, six weeks after the accident, the government revised these instructions so that evacuation zones were decided not only based on the distance but also the amount of radiation levels actually measured. A radius of 20km from the nuclear power plant was designated as the Warning Zone, where entry was prohibited, and zones where cumulative exposure for 1 year after the accident was expected to exceed 20mSv were

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[1] Tokyo Electric Power Company (TEPCO) Outline of accident at Fukushima Daiichi Nuclear Power Plant
(http://www.tepco.co.jp/nu/fukushima-np/review/review1_1-j.html Checked on 29 May 2013)

[2] Material distributed at Fukushima prefecture disaster measures department (Reconstruction and disaster department subsequently), Ministry of Education, Culture, Sports, Science and Technology 16th Dispute Reconciliation Committee for Nuclear Damage Compensation (10 November 2011) – "Voluntary evacuation related data"
Re-cited from (http://www.mext.go.jp/b_menu/shingi/chousa/kaihatu/016/shiryo/__icsFiles/afieldfile/2011/11/11/1313180_2_2.pdf Checked on 31 March 2013). The disaster measures department and municipalities have published this data based on the reports received from evacuation sites, temporary houses, and leased houses. However, they have also cautioned that this data may not accurately reflect the reality due to leakage in reporting.

designated as “Planned Evacuation Zones”. Areas located between 20 km to 30 km from the nuclear power plant but not included in the Planned Evacuation Zones but were designated as “Emergency Evacuation Preparation Zones”[3].

Information dissemination, and instructions from the government to the disaster struck towns and villages regarding evacuation in the initial period were often delayed and created a lot of confusion. The status of release and diffusion of radioactive substances, explosions in the nuclear power plant building, and instructions for evacuation were not conveyed at the appropriate time. Therefore the local governments suffered from a lack of information, and were forced to take “solitary decisions” at their own discretion including decisions related to emergency evacuation. In Namie Town, the local government made a discretionary decision and instructed its residents to evacuate to an area in Tsushima located 20 to 30 km from the Fukushima Daiichi Nuclear Power Plant. However, on the morning of 15 March, the residents were instructed to evacuate to more remote areas. Amidst no information about the amount and direction of the spread of radioactive material, most of the residents who had evacuated to the Tsushima area, moved towards Fukushima City or Nihonmatsu City through Kawamata Town in the northwest along national highway 114. In other words, residents moved exactly in the direction where a highly radioactive plume was released. In the case of Iitate Village, the International Atomic Energy Agency (IAEA) detected radiation exceeding the accepted level on 30 March, and they recommended that the government of Japan release evacuation orders to the residents of this village. However, the government decided to reject this on 31 March, and finally on 22 April, the government disseminated a document specifying this village as the Planned Evacuation Zone from which people must evacuate. After the disaster, nine municipalities, that were forced to evacuate based on a decition by each town office, had to evacuate in a mixed form in terms of time, location, and method. Information and instructions from the government, which was supposed to form a basis for decisions, actually increased the confusion.

- Launch of decontamination activities since April 2011

People who had evacuated from the Planned Evacuation Zone and warning zone cannot return home unless the ambient radiation falls below a certain extent. Additionally, there found spots with high level of radiation out of these zones. For ensuring the safety of residents, it is necessary to measure ambient radiation and undertake decontamination activities.

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[3] On 22 April 2011 the Prime Minister’s Office announced the “Establishment of ‘Planned evacuation areas’ and ‘Emergency evacuation preparation areas’”
(http://www.kantei.go.jp/saigai/20110411keikakuhinan.html Checked on 29 May 2013)

In some areas, efforts to reduce the radiation by stripping surface soil were started about a month after the accident.

In Date city, high levels of radiation were found in schoolyards in some of the schools in the city on 7 April, and therefore, surface soil stripping was undertaken in Oguni Elementary School, Tominari Elementary School and Tominari Kindergarten. A decrease in the radiation level was confirmed after this, and on 26 May a budget of JPY1,000 million for decontamination expenses was allocated based on the discretionary decision by the city mayor[4]. Furthermore, on 30 June 2011, 113 households were noted as Specified Evacuation Recommendation Sites[5]. Decontamination was undertaken at three private homes in the specified evacuation recommendation sites from 22 to 24 July. In Koriyama City as well, removal of surface soil was undertaken, from the end of April to May 2011[6], in the schoolyard of elementary and junior high schools and day-care centres, and surface soil removal in the parks also started in July[7].

In the municipalities that made early efforts with decontamination, an implementation plan for full-scale decontamination was also formulated at a relatively early stage. Even before the full-scale enforcement of the "Act on Special Measures concerning the Handling of Pollution by Radioactive Materials (published 30 August 2011, hereinafter referred to as the "Act on Special Measures") in February 2012 (described below), Fukushima City, Date City, and Koriyama City announced their independent decontamination plans in September, October and December, 2011 respectively.

At the national level, the Cabinet Office and the Ministry of the Environment (MOE) developed a model project for decontamination technology, and they validated the technology and formulated guidelines. As a decontamination model demonstration project, the Cabinet Office outsourced work to the Japan Atomic Energy Agency (JAEA) to carry out a "Survey for preparing decontamination guidelines in Fukushima Prefecture relating to the Fukushima Daiichi Nuclear Power Plant Accident" (Guidelines Survey) on 5 August 2011, and "Decontamination Model Demonstration Project" (Demonstration Project) to. Subsequently, the results of the survey at important sites on guidelines became the model project for decontamination in the and was summarised in the "Decontamination Technology Catalogue, Edition 1" (hereafter referred to as the "Decontamination Catalogue") published by the Cabinet Office

[4] Date City (Date City Bulletin, November 2011)
[5] Fukushima Mimpo (1 July 2011)
[6] Koriyama City (Koriyama Newsletter, Special Edition of June 2011)
[7] Koriyama City (Koriyama Newsletter, September 2011)

Support Team for Residents Affected by Nuclear Accidents on 22 November 2011. On the other hand, model projects for decontamination of Special Zones with high levels of radiation were conducted in 11 municipalities specified as the Planned Evacuation Zones. This work was done with the aim of establishing effective and efficient decontamination methods for soil, and to establish safety measures for radiation protection of workers engaged in decontamination. The results of these model projects were summarised in "Guidance for undertaking decontamination activities".

Before the full enforcement of the Act on Special Measures, MOE also conducted decontamination work in each office of the Special Decontamination Areas (Naraha Town, Tomioka Town, Namie Town, Iitate Village) from 7-19 December 2011. This is because it was necessary to restore the main administrative functions as the centres that would formulate decontamination plans and handle coordination tasks before starting full-fledged decontamination. MOE commissioned employees of TEPCO and its related companies to promote decontamination activities and they cooperated in decontamination planning, preliminary decontamination tests, monitoring before and after decontamination, waste water treatment, and waste material management. The report of the overall work was published on 27 March 2012, and it has become a reference for subsequent decontamination work.

- Legislation of decontamination and guidelines since June 2011

The Nuclear Emergency Response Headquarters (Nuclear Emergency Headquarters) established under the Act on Special Measures Concerning Nuclear Emergency Preparedness (Nuclear Emergency Act, 16 June 2000) published a "Basic Policy for Emergency Response on Decontamination Work" (Emergency Response Policy) on 26 August 2011. In this Emergency Response Policy, the central government expressed its intention to take responsibility for removing decontamination due to radioactive substances in collaboration with city and prefectural governments, and local citizens for the "Earliest dissolution of concerns about contamination due to the release of radioactive material". There are four interim goals of these decontamination activities, namely, (1) Regions with annual radiation levels of 20mSv or more should take steps to reduce these levels in regular stages, (2) Regions where annual radiation falls below 20mSv should ensure annual radiation levels of less than 1mSv in the long term, (3) The estimated amount of radiation exposure for the citizens should be reduced by about 50% in two years, and (4) Children's living environment, like schools and parks, should be thoroughly decontaminated, and the estimated amount of radiation exposure for children should be reduced by about 60%. The Basic Policy mentioned "1mSv per year" as a long-term goal. However, despite its feasibility not being adequately studied, the

term came to be understood, by affected people and local governments, as if this figure represented a standard for safety or was part of the terms and conditions for residents to return to their homes[8]. “Achieving 1mSv per year” or aiming for “Restoring to the original state” before an accident has become a predetermined goal, posing a great challenge to the debate on restoration plans, and making it difficult to strike an agreement with the citizens on decontamination and returning home[9].

The contents of the Emergency Response Policy were carried forward in the Act on Special Measures enacted on 30 August 2011. The Act on Special Measures specified that the central government is responsible for the decontamination of polluted regions and treatment of waste generated as a result of decontamination. The Act also stipulated that decontamination activities be conducted in the Special Decontamination Areas by the central government and in the Intensive Contamination Survey Areas by the municipal governments. In total 101 cities, towns and villages in eight prefectures (of which 40 were in Fukushima prefecture) were designated as the Intensive Contamination Survey Areas where the annual radiation levels were estimated to be from 5mSv to 20mSv[10]. When the Act on Special Measures came into full effect in January 2012, municipalities with the Intensive Contamination Survey Areas were required to formulate decontamination implementation plans based on the Act on Special Measures in order to receive MOE’s approval, and undertake decontamination works. Some of the municipalities that had independently formulated their own

[8] For some reason the long-term goal of “1mSv/y” was interpreted as if it was the safety standard.
Firstly, the Enforcement Ordinance for the Law Concerning Prevention of Radiation Hazards due to Radio-Isotopes, etc. specified "1mSv per year" as the exposure limit for preventing radiation hazards for citizens.
Secondly, in April 2011, after the accident, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) announced the policy of setting the standards for using school playgrounds as 3.8μSv/h (which could be converted to 20mSv/y). This policy was set according to the upper limit of the International Commission on Radiological Protection (ICRP)’s recommendation that annual additional exposure of the citizens, once restored to a normal state after an accident, should be "between 1mSv to 20mSv." However, MEXT received strong criticism that "Children's lives should not be put at risk", and had no option but to announce in May to take measures to reduce radiation levels below 1mSv/y for children and students of Fukushima Prefecture".
Thirdly, as it was clearly stated in the emergency response basic policy and Special Measures Act that the aim for 1mSv (in the long-term), and areas between 1mSv to 20mSv should be decontaminated by the municipalities, many people started thinking that "unless decontaminated to the level where radiation falls below 1mSv per year, it is not safe".

[9] After that, Fukushima Prefecture and some of the municipalities expressed their opinion that "Achieving 1mSv per year" is not practical, and aiming for this figure is obstructing restoration and preventing residents from returning to their home towns, therefore, this target should be relaxed.

[10] List of Decontamination implementation areas and Contamination situation priority survey areas (MOE Decontamination Information Site, 27 December 2012)

decontamination implementation plans during 2011 were also required to amend their plans so as to fulfil the requirements of the Act on Special Measures.

Forms of land use included in the scope of decontamination are residential, public facilities, roads, agricultural land (paddies, dry fields, fruit farms and pastures), and forests. After the Fukushima Daiichi Nuclear Power Plant accident, many municipalities undertook decontamination of public facilities used by an unspecified number of citizens, especially educational facilities such as schools, kindergartens, day-care centres, and public parks used by children. Decontamination of these facilities has become closed to the settlement of the first stage[11]. On the other hand, decontamination of housing areas was conducted for 18,606 houses by the end of March 2013, about 21.5% of a total of 86,732 houses that municipalities had planned to decontaminate. Considering that the total number of houses that require decontamination has reached 365,430[12] (according to the questionnaire survey conducted on municipal governments located in the Intensive Contamination Survey Areas), the progress so far is less than 5%. Decontamination of houses has only just started.

In the Act on Special Measures, it was decided that any expenses incurred through decontamination would be borne by TEPCO. However, it will take time for the central government and over 100 municipalities engaged in decontamination to calculate and provide TEPCO with their invoices so that they can receive payment. Therefore, in order to ensure that municipalities can quickly start decontamination activities, Fukushima Prefecture has offered monetary assistance to municipalities, taken from funding received as grants from the central government.

- Decontamination related guidelines: from December 2011 to May 2013

While the Act on Special Measures was partially enforced on 30 August 2011, the Basic Principles on the Act on Special Measures that succeeded the Emergency Response Policy was only approved by the cabinet on 11 November 2011. With this, the implementation structure comprised of the relevant ministries was established with MOE at the core. On 14 December, a government ordinance for the Act on Special

[11] In the Contamination situation priority survey areas, excluding Fukushima Prefecture, decontamination has been completed in more than 80% of schools and kindergartens, and more than 60% of parks and sports facilities, but completion of decontamination of residences is just 20% of the planned number. (Material published by the Ministry of the Environment (15 February 2013) "Results of the survey about progress of contamination in the contamination situation priority survey areas (second release) (Notification)").

[12] Results of questionnaire survey conducted on municipalities (Fukushima Mimpo 3 February 2013)

Measures rules and regulations and standards for requirements and treatment of area designation was formed. This enabled the national and the local governments to undertake decontamination activities based on the Act on Special Measures. On the same day, “Decontamination Guidelines” and “Waste Material Related Guidelines” were published. These two sets of guidelines described various technical requirements concerning decontamination such as a survey of radioactive contamination, removal of radioactive material, transportation, and storage. In May 2013, revised Versions of the “Decontamination Guidelines” and “Waste Material Related Guidelines” were published.

1.3. Progress of decontamination and the challenges that have emerged

- Progress of decontamination activities

As of the end of March 2013, decontamination work at public facilities, paddy fields, and roads has been 76.9% and 66.7% completed in the respective plans of munisipalities . On the other hand, decontamination of only 21.5% of the total number of houses planned was completed by March 2013.

Of the 40 municipalities with the Intensive Contamination Survey Areas in Fukushima prefecture, 32 municipalities have plans for decontaminating houses. There is a vast difference in progress among these. While decontamination of houses has been aggressively undertaken in Fukushima City, Hirono Town, Nihonmatsu City, Date City, and Kawauchi Village, the number of houses where decontamination work has been completed is limited in other towns and cities. In nine municipalities, as of the end of March, there was not a single case of house decontamination being completed (Table 1, Figure 1).

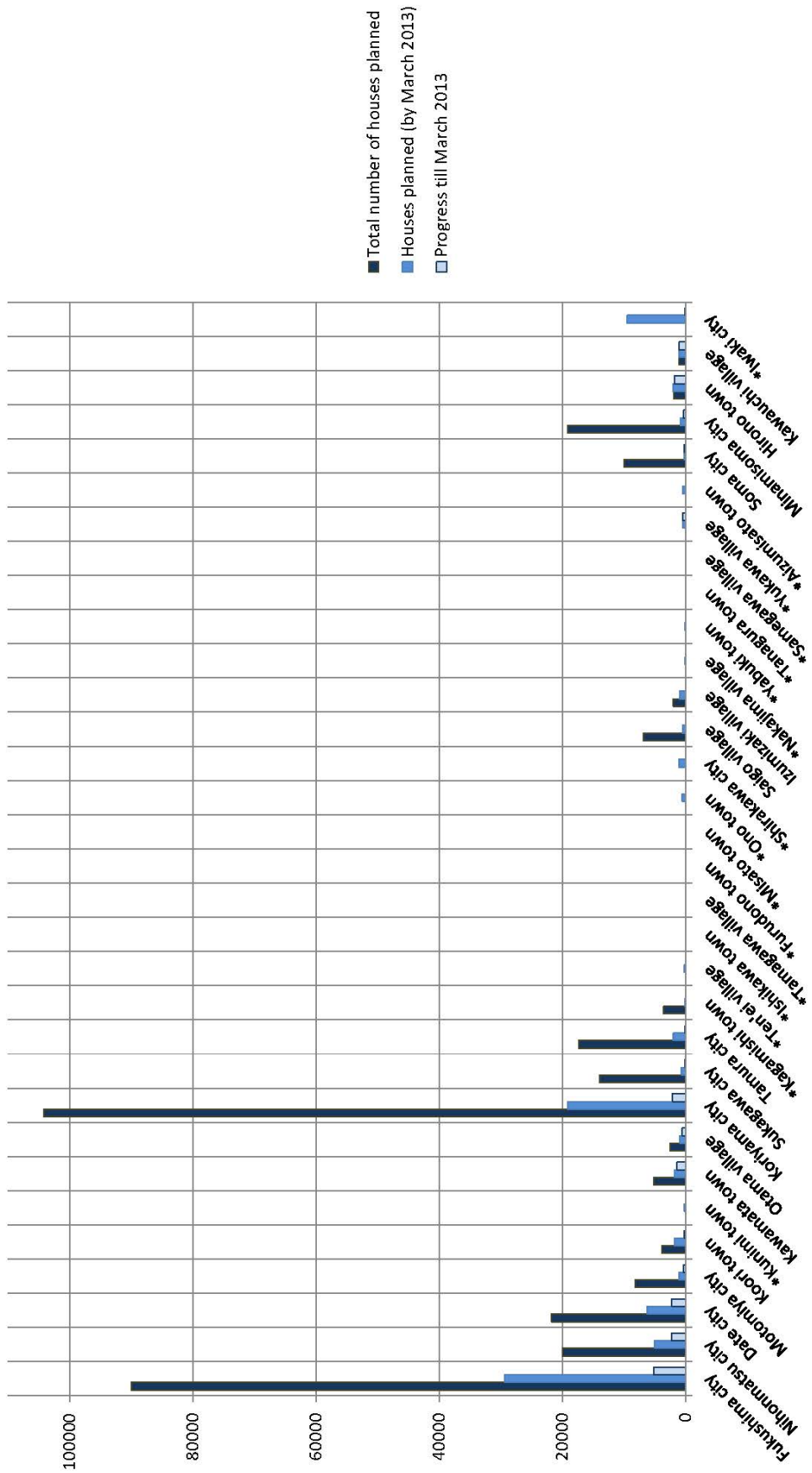
Table 1: Progress of decontamination in the Priority Survey Areas in Fukushima Prefecture focusing on (Houses, Public buildings, Roads, Paddies, Upland fields, Fruit gardens, Pastures, and Forests surrounding housing areas) and status (planned, ordered and completed) by the end of March 2013

Municipalities		Progress as of 31 March 2013 (Blank cells are not yet determined)																					
		Houses			Public buildings			Roads:km			Paddy:ha			Upland field:ha			Garden:ha			Pasture:ha			Forest in the living area:ha		
		Planned	Ordered	Finished	Planned	Ordered	Finished	Planned	Ordered	Finished	Planned	Ordered	Finished	Planned	Ordered	Finished	Planned	Ordered	Finished	Planned	Ordered	Finished	Planned	Ordered	Finished
North area	Fukushima city	29434	29434	5113	887	887	689	77.0	77.0	77.0	2355.0	2355.0	2355.0	863.0	863.0	863.0	2034.8	2034.8	2030.0	56.5	56.5	56.5	7.6	7.6	7.6
	Nihonmatsu citi	5002	8464	2294	82	117	84	114.0	234.6	125.1	2731.0	2731.0	1297.0				69.0	69.0	69.0	536.0	536.0	501.0	88.0	88.0	79.1
	Date city	6228	4492	2248	360	360	305	298.0	298.0	48.5	1336.0	1336.0	1256.0	1.0	0.6	0.6	1630.0	1630.0	1630.0	20.0	20.0	14.0	10.2	0.2	0.2
	Motomiya city	1100	669	400	180	117	113	172.0	0.0	0.0	18.4	18.4	18.4	202.0	2.0	2.0	12.0	12.0	12.0	84.0	84.0	84.0			
	Koori town	1800	734	200	112	76	32	177.0	45.0	8.0	552.0	552.0	552.0				380.0	380.0	380.0				5.5	5.5	0.0
	Kunimi town	167	0	0	40	40	21	10.0	0.0	0.0	456.0	456.0	456.0				404.9	404.9	404.9				8.2	8.2	8.2
	Kawamata town	1838	1819	1392	19	19	14	1073.0	357.0	28.5	293.4	293.4	293.4	270.6	270.6	270.6	5.0	5.0	5.0						
	Otama village	917	917	524	56	56	51	35.0	5.5	5.5	97.3	97.3	97.3	16.0	16.0	16.0	7.7	7.7	7.7	228.0	228.0	228.0			
	Koriyama city	19196	19196	2162	911	887	693	368.3	2.6	2.6	566.0	566.0	6.0	1.0	1.0	1.0	65.0	65.0	65.0	159.5	159.5	159.5	5.0	5.0	0.0
	Sukagawa city	716	668	97	140	140	133	41.5	41.5	3.0	513.0	513.0	130.0				135.0	135.0	135.0	19.0	19.0	19.0	2.8	2.8	0.0
	Tamura city	2000	2000	63	146	146	58				434.4	434.4	434.4	130.1	130.1	130.1				40.0	40.0	40.0	3.3	3.3	3.3
	Kagamiishi town	103	103	3	11	11	8				18.0	18.0	0.0				48.4	48.4	30.0						
	Ten'ei village	161	60	8	10	5	5	33.0	2.3	0.1													4.0	4.0	0.0
Centr areaal	Ishikawa town	5	5		15	15	15	2.4	0.0	0.0							35.0	35.0	35.0				2.2	2.2	2.2
	Tamagawa village	5	0	0	9	8	8																		
	Hirata village				5	0	0													130.0	130.0	0.0			
	Asakawa town				3	3	3																		
	Furudono town	7	7	7	5	5	5													4.6	4.6	4.6			
	Miharu town	28	28	0	67	67	64	115.0	115.0	111.0				70.0	70.0	70.0	14.7	14.7	14.7	60.0	60.0	60.0	17.0	17.0	17.0
	Ono town	538	0	0	29	9	9	71.0	0.0	0.0															
	Shirakara city	1100	383	31	223	223	197	92.0	92.0	43.9	4.0	4.0	4.0	0.4	0.4	0.4	32.0	32.0	32.0	40.0	40.0	40.0	19.0	19.0	4.0
	Saigo village	500	62	4	20	28	26	25.0	25.0	25.0	23.0	23.0	23.0	40.0	40.0	40.0				104.0	104.0	104.0			
	Izumizaki village	1000	519	1	7	7	7	55.2	55.2	1.0													166.3	166.3	0.0
South area	Nakajima village	103	103	0	4	4	1																		
	Yabuki town	150	79	0	22	8	8	13.0	0.0	0.0	132.0	132.0	132.0												
	Tanagura town	19	19	0	11	11	1																1.0	1.0	1.0
	Yamatsuri town																								
	Hanawa town				8	8	8																		
	Samegawa village	23	0	0	5	5	5													68.0	68.0	68.0	15.0	15.0	15.0
	Aizubange town				14	14	0																		
Aizu area	Yukawa village *1	481	481	481	41	41	41	42.8	42.8	42.8															
	Yanaizu town																								
	Mishima town				6	6	6																		
	Aizumisato town	480	465	0	20	9	0	4.0	2.4	0.0															
	Shinchi-town				9	9	8										*2	35.0	35.0						
Soso area	Soma city	223	223	223	43	43	33	18.0	16.0	16.0	*3	73.0	32.0	*3	19.0	0.0	*3	43.8	43.8	*3	39.0	0.0	*3		
	Minamisoma city	855	402	345	170	132	132	67.0	74.0	69.0	*3	12.6	12.6	*3	0.2	0.2	*3	17.8	17.8	*3	0.4	0.4	*3		
	Hirono town	2000	1908	1847	56	56	53	73.9	73.9	73.9	630.2	330.2	301.8	82.6	72.6	66.4							78.9	78.9	68.1
	Kawauchi village	1061	1061	1061	14	14	13	51.0	51.0	0.0	454.0	454.0	452.0	158.0	158.0	92.0				95.0	95.0	30.0	245.0	*4	145.0
Iwaki area	Iwaki city	9492	9492	104	344	344	305				1080.0	205.9	0.0	*5	11.2	0.0	*5	0.0	0.0	*5	0.0	0.0	3444.0	409.5	0.2
	Sub-total	86732	83793	18608	4104	3930	3155	3029.1	1610.7	680.9	11779.3	10605.2	7852.9	1853.9	1654.7	1552.3	4873.5	4970.1	4946.9	1644.6	1684.0	1409.0	4123.0	833.5	350.9
	Progress		96.6%	21.5%		95.8%	76.9%		53.2%	22.5%		90.0%	66.7%		89.3%	83.7%		102.0%	101.5%		102.4%	85.7%		20.2%	8.5%

*1	Yukawa village called for the residents' cooperatoin to decontaminate houses and roac
*2	Garden areas planned in Shinchi town's is still under finalization.
*3	Paddy, upland field, garden, pasture and forest areas planned in Soma city and Minamisoma city are still under finalization.
*4	Kawauchi village calculates Forest in the living area together with House areas.
*5	Iwaki city counts upland fields, garden and pasture together with paddy areas.

Source: Material presented by Fukushima prefecture decontamination measures division at the Study Meeting on Environment Recovery, 11 May 2013)

Figure 1: Houses planned, ordered and decontaminated by municipalities as of March 2013 (Planned numbers in the municipalities with "*" are not settled.



Source: Material presented by Fukushima prefecture decontamination measures division at the Study Meeting on Environment Recovery, 11 May 2013)

While responding to the nuclear accident, disaster-hit municipalities had to tackle various issues such as responding to the disaster caused by the earthquake and tsunami, and supporting the affected people. There were various conditions influencing their actions such as the presence and absence of hot spots, variation in concentration of contaminants between areas, and the number and type of evacuees. Furthermore, there were large differences in the number of personnel that each municipality could assign to deal with the nuclear accident, protection from radiation, and decontamination. Thus municipalities adopted various policies and methods for undertaking decontamination activities in cooperation with concerned persons, including residents. This resulted in a great deal of variation in the rate of progress.

However, those municipalities with a large number of decontaminated houses and a high progress rate did not necessarily take “superior initiatives." Reducing the amount of radiation with only decontamination does not sufficiently meet the conditions that determine whether evacuees decide to return to the same place or continue living in the same place as before the accident. Even if radiation level in certain places is reduced, it is not possible to live there unless schools, hospitals, and transportation are functional again and there is a definite, positive outlook for commercial, agricultural, forestry, and marine industries starting again. Many industries such as agriculture and fisheries are difficult to restart without the cooperation of neighbours. However, community relations have been shaken for many reasons, such as living in shelters for a long period, the specification of locations for compensation and evacuation instructions[13]. Furthermore, outside the Warning Zones and the Planned Evacuation Zones, there are some "Specific Evacuation Instruction Sites" where annual cumulative radiation exposure after the accident is expected to reach 20mSv, and as decline in radiation amount could be confirmed in the second half of 2012, these sites are gradually being dropped from the list. TEPCO has decided to stop giving compensation to households living in houses in delisted areas after March 2013. However, even if the radiation levels are reduced, it will not be possible for residents to restart their original lives. This situation may even lead to adversities for people in these areas[14].

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[13] From conversation at Date City, Ryozenmachi Oguni area during the Fukushima field survey in July 2012. For more details refer to Asia Press Network 5 March 2013 “Regionally divided ‘Evacuation recommendation sites/Fukushima and Date City’” (http://www.asiapress.org/apn/archives/2013/03/05133159.php Checked on 31 May 2013) and, Tokyo Shimbun 11 November 2012 “Cracks in residents with “Specific evacuation recommendation sites” Another damage added by the nuclear power plant accident”.

[14] According to the aforementioned article in the Asia Press Network and “Date City Survey Report: Issues after release of instructions of evacuation recommendation sites” by NPO

- Temporary storage and intermediate storage facilities

Decontamination activities generate a large amount of waste material such as the contaminated soil stripped from ground. For the time being, waste material is stored in temporary storage set up in each area. However, considering the feedback stating that "it is a cause of concern if temporary storage continues for several years", MOE announced a roadmap, in October 2011, stating that waste material generated during decontamination in Fukushima Prefecture will be transported to a large-scale intermediate storage facility that will be installed in the prefecture by January 2015. Furthermore it will be transported to final treatment facilities located outside the prefecture within 30 years after that.

Apart from soil, waste material to be stored in the intermediate storage facilities would include ash from incinerated fallen leaves and sewage sludge with a the radiation level exceeding 100,000 Becquerels. The volume of waste material is estimated to be between about 15 million cubic meters to 28 million cubic meters. The surface area of the facility is expected to be about 3 km² to about 5km²[15]. It will not be easy to reach an agreement with residents and the municipality by 2014 for such a large scale facility as it is likely to face heavy opposition from residents and local governments. In December 2011 MOE requested appropriate sites in Fukushima Prefecture and eight towns and villages in Futaba county for setting up a facility in Futaba county. In March 2012 it communicated that it is looking at setting up facilities distributed over three locations, namely Futaba Town, Okuma Town and Naraha Town. However, as the prospect of final disposal outside Fukushima Prefecture "after 30 years" is unclear, there is a very strong concern among prefectures, local towns, villages and residents that the intermediate storage facilities would end up being the final treatment facilities. It is not easy to reach an agreement with prefectures or local towns and villages. Finally in April 2013 a field survey was begun for setting up such facilities.

- Livelihood rehabilitation

While such conditions persist, the results of questionnaire surveys show that many evacuees have neither plans of returning in the future nor do they feel able to decide

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Human Rights Now, the residents came to know, for the first time, about the release of instructions regarding evacuation recommendation sites and the policy of terminating the compensation through newspaper reports.

[15] The Ministry of the Environment "Decontamination Information Site" About Intermediate Storage Facilities (http://josen.env.go.jp/area/processing/interim_storage_facility.html#04 Checked on 28 May 2013)

whether to return or relocate[16]. In many families elderly people or male family members wish to return, whereas female family members and families with small children do not want to return because of concerns that radiation may easily affect the physical health of their children.

There are evacuees who do not wish to return to the former homes, and those who do not wish to carry on living in their original homes. It is clear that there are many evacuees who wish to relocate, and it is essential that there is sufficient support for such people. In other words, after the enforcement of the Act on Support for the People Affected by the Nuclear Power Plant Accident in June 2012 which clearly stated the "Right to Evacuate", the Reconstruction Agency has started formulating detailed measures to support those evacuees who do not wish to return in their former homes, or do not want to continue living there. However, the entire picture is not yet clear[17].

Because of such circumstances, the prospect of rebuilding the lives of former residents remains unclear regardless of the wish of the evacuees either to return to, or continue to live, in their former homes, or to relocate as they do not want to return.

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[16] Amongst the people who evacuated from the eight towns and villages in Futaba county, where most areas of the towns and villages were designated as areas in need of evacuation due to their proximity to the Fukushima Daiichi Nuclear Power Plant, the preference for not returning to their former homes is especially strong. In the questionnaire survey conducted in January 2012 by Namie Town on the people who evacuated outside Namie town, in response to the question asking about their intention of returning of Namie town, 32.9% people responded that they "Would not return" even if the following two conditions were met: (1) Radiation is reduced and living infrastructure is put in place, and (2) Other town residents return to some extent. 43.5% replied that they would return if these two conditions were met. 15.7% of people replied that they would return if the former conditions are fulfilled (Kahoku Shimpo Publishing 12 January 2012 "Principal focus/Survey of people evacuating outside the town/"Do not prefer to return to Namie" 30%"). In the questionnaire survey conducted on the residents of Naraha Town, as of the end of 2011, 69.7% residents wished to return; however, in December 2012 after the designation as the evacuation zones was lifted, the percentage of people who wanted to return declined to 39.4%. (Asahi Shimbun 18 December 2012 "'People wanting to return to hometown' down to 40% Questionnaire on the residents of Fukushima and Naraha").
Additionally many evacuated from other municipalities also do not want to return. Iwaki City conducted two rounds of questionnaire surveys in November 2011 and July-October 2012. 1,300 households of residents who evacuated outside the city and "Specific people who transferred their address (People who moved their certificate of residence due to evacuation, but people who wish to receive information bulletins for maintaining connection with Iwaki City)" were surveyed in each city. However, people who replied "No" to the question "Are you considering returning to Iwaki City in the future?" increased from 15.8% to 24.6% in the case of residents who evacuated and from 32.1% to 36.6% in the case of specific people who transferred their address. (Iwaki City January 2013 "Results of questionnaire survey conducted on people who evacuated outside the city".

[17] Kahoku Shimpo 3 May 2013 "Radiation standards and areas unclear in the Citizen Conference to Promote Our Act that became effective last year"

FAIRDO started its work with the aim of contributing to “Effective Decontamination”. However, considering the status described so far, “effective” decontamination without changing the goal of “thorough radiation reduction” may not necessarily contribute to the restoration and rebuilding of the lives of those affected. It is hoped that the role of decontamination in the overall initiative for restoration and rebuilding the lives of those affected will be re-examined and re-assigned within the overall context of reconstruction, regeneration of communities and livelihood rehabilitation. We would like to present the following issues.

Issue to tackle/deal with:

Instead of aiming at “complete radiation reduction” to restore the area to its original state, it is better to clearly identify the prospects of various conditions to enable regeneration of communities and rehabilitation of the livelihoods of those affected. It is also necessary to re-examine the desired targets, scales and measures of decontamination in light of the overall actions and initiatives.

FAIRDO is not presenting such issuesproblem presentation from the standpoint of a third party. In the third year after the nuclear accident, FAIRDO plans to actively engage in initiatives that will contribute to restoring the disaster sites and rebuilding the lives of those affected. This discussion paper aims to describe the situations observed by FAIRDO members and to articulate measures to deal with the challenges in cooperation with stakeholders. In the following chapters we will describe the surveys and analyses conducted so far from the two aspects of 1) mechanisms and ways of proceeding with decontamination activities, and 2) communication and ways of reaching an agreement between the government and the residents, and between the related institutions of municipalities, and prefectures and the central government, regarding decontamination.

2. Decontamination activities in the Intensive Contamination Survey Areas

Let us begin with summarising the roles played by the central, prefectural and municipal governments engaged in decontamination activities.

2.1. Responsibilities of the governments regarding decontamination activities

The role of public entities involved in decontamination activities, namely, the central, prefectural and municipal governments in the Intensive Contamination Survey Areas are set out in Figure 2 below.

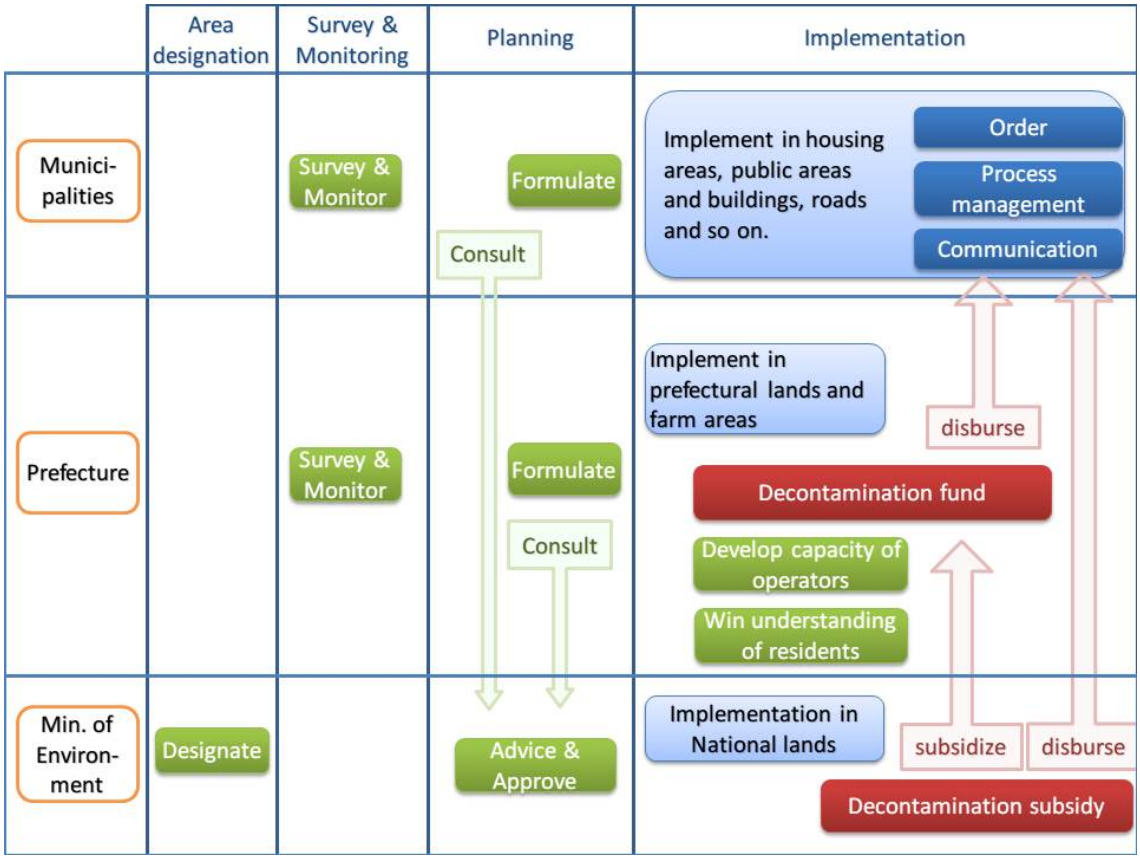

Figure 2 Role of central, prefectural and municipal governments in the Intensive Contamination Survey Areas

Areas where the ambient radiation is over 0.23μSv per hour (equivalent to over 1mSv on a yearly basis) are designated as the Intensive Contamination Survey Areas by MOE. Municipalities and prefectures where these Intensive Contamination Survey Areas are located will conduct detailed measurements of the contamination situation, and they will formulate a decontamination implementation plan based on the measurement results. Decontamination implementation plans, after consultation with

MOE and any revisions as necessary, will be finalised and approved by MOE.

The cost of decontamination activities, based on the approved plan, will be paid by TEPCO through the central government. However, for decontamination work undertaken by municipalities in Fukushima Prefecture, when it is undertaken after receiving the approval of MOE, payment will be made from the decontamination measures fund granted to Fukushima Prefecture (see Appendix 1).

There are indispensable procedures for decontamination activities which are not clearly stated in the Act on Special Measures. Fukushima Prefecture conducts activities to nurture decontamination operators and decontamination site managers, extending technical support for municipalities, and enhancing the understanding of citizens. Municipalities also hold briefing sessions on decontamination for citizens, obtain the agreement of citizens regarding temporary storage of waste material generated due to decontamination, place orders to operators who are actually undertaking the work and conduct process management and inspections. Explaining to citizens and obtaining their agreement, as well as ordering and managing operators requires a significant amount of effort. This places a huge burden on municipalities.

The division of roles and responsibilities for decontamination activities in the Intensive Contamination Survey Areas is designed such that each stage of survey measurement, plan formulation, and implementation is handled by municipalities, while the central government and the prefectural government provide resources (funds and technologies) to support the activities of these municipalities. Theoretically the mechanism is based on the principle of subsidiarity[18]. In order to verify whether this mechanism works effectively in the actual decontamination activities, and whether decontamination activities can be implemented quickly and flexibly according to the circumstances of the area, it is necessary to analyse the actions and initiatives of municipalities, prefectures, and the central government in more detail.

2.2. Actions and initiatives of municipalities

In the Intensive Contamination Survey Areas with several sites where the ambient radiation exceeds 0.23μSv per hour, each municipality is in charge of detailed procedures concerning the implementation of decontamination.

[18] Disaster risk and damages incurred at the time of the disaster vary according to the region. Therefore, in general, disaster prevention and emergency measures, and restoration initiatives should be delegated to the local municipalities and communities by dividing responsibility and resources. The central government should support decision-making and countermeasures taken at the local level (UN Disaster Prevention Strategy (2005) “Hyogo Framework for Action 2005-2015 Program Outcome Document”).

Each municipality conducts detailed measurements of the status of decontamination in the Intensive Contamination Survey Areas, and formulates decontamination implementation plans based on the Act on Special Measures. They then complete the implementation plan after discussion with MOE. Municipalities also hold briefing sessions for the residents, arrive at an agreement with the residents, and they also place purchase orders to the operators. In order to ensure that municipalities are able to promptly undertake these activities, it is necessary to secure funds for conducting decontamination activities, and assign people who can formulate plans and coordinate with the residents (set up decontamination departments if required). However not all municipalities have adequate personnel and financial capacity, and therefore it is necessary to get outside support for radiation risk, decontamination technology, and communication as and when needed.

- Implementation mechanisms

After the Fukushima Daiichi Nuclear Plant Accident, most of the municipalities with Intensive Contamination Survey Areas in Fukushima Prefecture set up departments in charge of radioactive pollution and decontamination. They measured and published the status of contamination, formulated decontamination plans, arranged briefing sessions for residents, and placed purchase orders to the operators. In Fukushima Prefecture, these departments that are related to radioactive pollution and decontamination also handle activities related to compensation for damages. Generally, the establishment of such organisations in the local governments strengthen the mechanisms needed to carry out decontamination. Setting up departments for moving ahead with decontamination (or simultaneously moving ahead with decontamination and restoration), assigning required and adequate personnel, and providing an appropriate budget helps to solve various situations that can become a bottleneck for conducting decontamination. In the following paragraphs some of the municipalities, that set up departments for handling decontamination and took the required actions at relatively early stages, will be introduced.

Fukushima City assigned an advisor for radioactive measures soon after the nuclear accident, and formulated a decontamination implementation plan in September 2011. It was the second city in the prefecture to do so, and it also set up a separate division for comprehensive radioactive measures in October 2011. When MOE announced its policy in September 2011 stating that the government will basically not provide any financial support for decontamination of places with ambient radiation of less than 5mSv per year, this department played the role of submitting a request to the central government to support all decontamination activities, and coordinated with other

cities and towns. Cities with a high population like Fukushima City have a large number of city office employees, and thus it was easy to develop implementation mechanisms for decontamination and take prompt actions right after the earthquake disaster[19].

In Date City, decontamination work such as surface soil stripping in schools and kindergartens in the city was undertaken at the end of April 2011. As this showed clear benefits, the Mayor made a discretionary decision in May to allocate JPY1,000 million for decontamination expenses, and launched a decontamination project[20]. After that, a radioactive measures unit was set up in the civic life department for handling decontamination measures, health management, and compensation for damages. The unit also made efforts to gather information and create opportunities for interactions, by initiatives such as inviting the second round of dialog (February 2012) of the International Commission on Radiological Protection (ICRP) to Date City.

Nihonmatsu City also started its independent actions at an early stage, and prepared Nihonmatsu City Radiation Dosage Reduction Policy in August 2011. In September 2011, it set up a radiation measurement and decontamination unit under the civic department, and started measuring radiation dosage and formulating a decontamination plan.

Kawauchi Village was already facing the risk of a population exodus before the earthquake disaster, and so its top priority was to use restoration as a measure to curb excessive decline and maintain the village population. (decontamination). In most areas of the village, radiation levels were not that high, so the mayor asked people to return to the village on 31 January 2012[21]. In March 2013, the village dissolved the disaster measures department, and established a restoration measures unit. This unit is currently working on full-scale restoration and decontamination-related activities[22].

However, simply establishing departments responsible for radiation measures and decontamination does not necessarily mean that decontamination activities will progress smoothly. Some of the municipalities in Fukushima Prefecture suffered huge damage from the earthquake and tsunami, and thus they experienced a shortage of personnel, resources and time for reconstruction, and could offer little support for those affected. In municipalities with smaller populations, there was a corresponding smaller number of municipality employees. Therefore, they could not assign many

19 Fukushima City Interview (13 November 2012)
20 Date City's provisional press conference (30 May 2011)
21 Kawauchi village Interview (25-27 October 2012)
22 Kawauchi Village (Kawauchi Bulletin, May 2012)

employees to work on radiation measures and decontamination. In such cases, for example, even if the department responsible for radiation measures and decontamination was established, it was difficult to smoothly proceed with measuring the status of the contamination, formulating a decontamination implementation plan, discussing with MOE, and coordinating with the residents. On the other hand, municipalities like Fukushima City, with many employees, could develop implementation mechanisms for decontamination and start decontamination activities ahead of others[23].

- Characteristic approaches to decontamination activities

Municipalities adopt various strategies for decontamination activities; in particular they place an emphasis on the different stages. Fukushima City, Date City and Koriyama City established units responsible for radiation measures and decontamination at relatively early stages, and started activities immediately. However, subsequent actions and initiatives taken by these three cities can be broadly summarised into three categories as follows: Date City focused on quick implementation; Koriyama City started decontamination of general houses after a careful verification based on the model projects; and Fukushima City adopted a balanced policy that would cover both these two categories.

Date City is one of the municipalities that started decontamination in high-level radiation areas from a relatively early stage. On 7 April 2011 they found spots with high radiation in a school playground. Date City undertook surface soil stripping in Oguni Elementary School, Tominari Elementary School, and Tominari Kindergarten by the end of the month. As a result of this it was confirmed that this decontamination had led to a reduction in the radiation levels. On 26 May the mayor took a discretionary decision to allocate JPY1,000 million for decontamination expenses, and formed the decontamination project team. Furthermore, on 30 June 2011, a total of 113 households in four areas inside the city[24] were designated as the Specific Evacuation Recommendation Sites with ambient radiation expected to exceed 20mSv per year. The city started decontamination of these houses immediately. From 22-24 July 2011, ahead of other municipalities, Date City undertook consolidated decontamination of three private houses located in specific evacuation recommendation sites. In October 2011, the city established a radiation measures department responsible for decontamination measures, health management and compensation for damages, and

[23] Fukushima City Interview (13 November 2012)
[24] Four areas of Ryozenmachi Kamioguni, Ryozenmachi Shimooguni, Ryozenmachi Ishida, and Tsukidatemachi Tsukidate

simultaneously announced a basic decontamination plan[25].

Date City's initiatives are also characteristic in its definitions of zones. The city divided decontamination areas into three categories based on the radiation level, and adopted the policy of having a different organisation structure and different persons for decontamination work for each category. To begin with, for an "A category zone" with high radiation including specific evacuation recommendation sites (where yearly cumulative radiation is expected to exceed 20mSv), it outsourced the surface decontamination to the country's largest general contractor. Here, 2,500 houses, 40 public facilities, and 180 km of city road (274 ha of residential land, and 512 ha for the entire zone) were further divided into five areas, and an operator for each area was selected based on an open offer to nominate a proposal method and comprehensive evaluation[26]. Decontamination work in a "B category zone", where the urgency of decontamination is somewhat lower than an "A category zone", (where it is assumed that yearly cumulative radiation will exceed 5mSv) is outsourced to local operators through the Date City Decontamination Support Activities Union set up in October 2012. Decontamination work in the "A category zone" and "B category zones" was completed by the end of fiscal year 2012. In the future, decontamination work in a "C Zone", which has a low emergency and legal priority for decontamination work, is planned to be undertaken with the cooperation of the residents. The city will provide residents with the required materials with the main purpose of removing micro spots[27]. Moreover, the city has also setup decontamination promotion centres in various locations to promote decontamination activities by the residents. As a part of disseminating information related to decontamination, a decontamination promotion centre bulletin is published twice a month.

These characteristic initiatives of Date City have adopted the basic concept of reducing radiation exposure to levels that are reasonably attainable (Principle of ALARA[28]) after recognising that it is necessary to carry out decontamination with priority on locations with high levels of radiation.

On the other hand, Koriyama City spent an adequate amount of time conducting trial decontamination before starting full-scale decontamination. Therefore, although the city started working on countermeasures at a relatively early stage, the progress to

[25] Date City (Date City Bulletin, November 2011)
[26] Date City (Date City Bulletin Disaster Measures Vol. 58)
[27] Interview of TEPCO decontamination staff (7 February 2013)
[28] ALARA: Abbreviation of As Low As Reasonably Achievable. Stated in the recommendation of International Commission on Radiological Protection "Recommendations of the ICRP, ICRP Publication 26 (1977)".

full-scale decontamination was considerably slower than in Fukushima City and Date City. Koriyama City undertook surface soil removal from the grounds of elementary and junior high schools and day-care centres with high levels of radiation, with work being done from the end of April to May 2011[29], and then started surface soil removal from parks in July[30]. With regard to the city's implementation mechanisms, it set up a nuclear disaster measures project team in June 2011, and in October, it set up a nuclear disaster measures direct control department that would receive direct instructions from the Mayor and Deputy Mayor. This direct control department began with 12 staff members engaged in pursuing the decontamination plan, health management and analysis, office work related to compensation for damages and counselling. The team also coordinated with other departments[31]. In April 2012, it assigned members to decontamination activities, and ramped up the team structure to 19 people.

The nuclear disaster measures direct control department developed a decontamination manual in October 2011 for the purpose of supporting voluntary decontamination undertaken by neighbourhood associations. In December, the Koriyama City basic restoration policy and Koriyama City restoration decontamination plan (initial version) were formulated and, in February 2012, the Koriyama City restoration decontamination plan (second version) was published.

In this manner, although Koriyama City began decontamination from an early stage, and also prepared and revised a decontamination implementation plan before starting large-scale decontamination, including residential land, it also spent time conducting tests on the scope of the decontamination needed. To begin with, from February to March 2012, it undertook model decontamination on one house. Using the insights gained from this, from June to August 2012, it conducted a model project for conducting surface decontamination on about 100 houses (approximately 33,000m^2) in Ikenodai, an area with relatively high levels of radiation. Based on the results of these model projects, the decontamination of ordinary houses started on 30 November 2012. In FY2012, Koriyama City placed orders for about 14,000 decontamination tasks, and proceeded with decontamination in a sequential manner.

Koriyama City spent time implementing the model project, which is at the preparatory stage of decontamination activities, because there were many residents who were concerned about the effectiveness of decontamination to reduce radiation and risks to

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29 Koriyama City (Koriyama Bulletin, June 2011 special edition)
30 Koriyama City (Koriyama Bulletin, September 2011)
31 Koriyama City (Koriyama's nuclear disaster measures Version 5, May 2012)

health. Therefore, it was necessary to carefully communicate with the residents[32]. As a result of using model projects to study various methods and techniques for reducing radiation, Koriyama City selected the technique that shortened the work period by excluding the roof of a house from the scope of contamination.

High radiation spots were found in residential areas in Fukushima City as well, including the Watari and Onami areas. The city started cleaning side ditches in Watari as well as decontaminating roads leading to elementary schools and decontaminating houses on a trial basis in July 2011[33].

In September 2011, Fukushima City formulated the Fukushima City Decontamination Implementation Plan version 1, and in October, it established a comprehensive radiation measures unit for handling radiation measures and decontamination, and coordinating compensation for damages. In light of full enforcement of the Act on Special Measures in January 2012, this unit began making revisions to the Fukushima City Decontamination Implementation Plan, and formulated the 2nd Version in May 2012. This version included a summary of the status of contamination over the city area, decontamination policy, priority of implementation of decontamination activities, decontamination actions and initiatives in each area, and a decontamination schedule.

It also started taking actions for full-scale surface decontamination from an early stage. As temporary storage for contaminated soil generated during contamination became available, surface decontamination in Onami began on 18 October 2011[34].

Fukushima City received requests from residents at an early stage due to highly contaminated spots being found in the city. Additionally, Fukushima City had a favourable environment for accumulating experience and technology for decontaminating houses. The city conducted technical verification and prepared work management standards with the support of decontamination activity promoters who were engineers from TEPCO. It also held twice-monthly process meetings with operators engaged in decontamination work, who shared information on progress in each area and other issues[35]. In short, Fukushima City started decontamination activities relatively quickly, and gathered experience from operators and from the city itself s, to ensure optimal work process. Such efforts substantially contributed to the effectiveness of decontamination activities.

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[32] Koriyama City Interview (12 November 2012)
[33] Fukushima City (Fukushima Bulletin, September 2011)
[34] Fukushima City (Fukushima Bulletin, December 2011)
[35] Fukushima City Interview (7 February 2013)

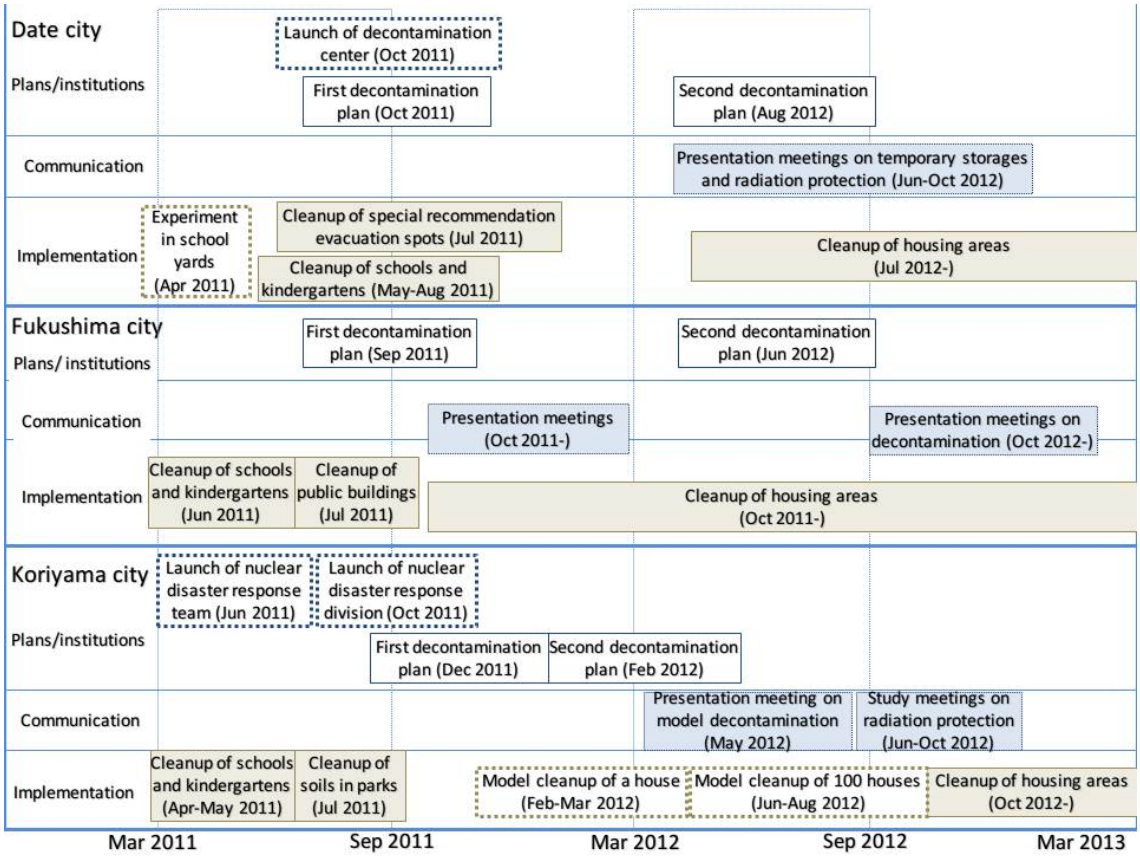

Figure 3 Implementation of decontamination activities in Date City, Fukushima City, and Koriyama City

Figure 3 summarises the actions and initiatives for decontamination undertaken by Date City, Koriyama City, and Fukushima City in chronological order. All three cities started decontamination activities within three months of the Fukushima Daiichi Nuclear Power Plant Accident. However, there were different methods for conducting decontamination activities in Date City and Koriyama City. In Date City a large budget was secured in the early stages and decontamination of residential land, including specific evacuation recommendation sites, was promptly conducted. In Koriyama City, time was initially spent on model decontamination and technical verification to accumulate insights before surface decontamination was begun. Fukushima City has adopted a balanced approach where, although it started surface decontamination of residential land in 2011, it improved the technology employed for decontamination by arranging process meetings with operators and kept increasing the number of cases for decontamination while revising the decontamination plan.

We are not in a position to judge which of these initiatives is superior or inferior.

Instead, we will continue to observe the progress of work (including issues that emerged after the completion of decontamination) keeping in mind that there were the aforementioned differences in the methods adopted by these three cities.

- Leveraging the experience accumulated by measures to deal with radiation

In some of the municipalities, radiation hot-spots were found soon after the accident. The authorities were required to communicate information to the residents in the surrounding areas as well as communicating and coordinating with the central government and the prefectural government, and verifying the decontamination technologies. Experience gained in this manner was effectively used to formulate the decontamination plan and then decontaminate public space and houses.

In Fukushima City, radiation hot-spots were found in the residential areas of Watari and Onami. The city started a trial to clean side ditches, approach roads to elementary schools and houses in Watari in July 2011[36]. In October 2011, the city secured a temporary storage site for contaminated soil in the Onami area and started surface decontamination[37].

In Date City, on 7 April 2011, radiation hot-spots were found in playgrounds of some of the schools in the city. Therefore, at the end of April, the city started surface soil stripping in Oguni Elementary School, Tominari Elementary School, and Tominari Kindergarten. Furthermore, on 30 June 2011, a total of 113 households in Ryozenmachi Kamioguni, Ryozenmachi Shimooguni, Ryozenmachi Ishida, and Tsukidatemachi Tsukidate were designated as specific recommendation sites[38]. Therefore, the city undertook consolidated decontamination of three private houses located in specific evacuation recommendation sites.

- Agreement on installation of temporary storage facilities

Gaining agreement on the installation of temporary storage facilities is indispensable for decontamination work, and influences decontamination activities just like, or perhaps even more than, the presence of a hot spot. As of 7 July 2012, out of 111 municipalities covered under the scope of decontamination (11 municipalities also had Special Decontamination Zones), only 20 municipalities could start setting up temporary storage facilities (13 municipalities in Fukushima prefecture, one in Tochigi, two in Saitama and four in Chiba)[39]. As recently as February 2013, 20 out of 40

[36] Fukushima City (Fukushima Bulletin, September 2011)
[37] Fukushima City (Fukushima Bulletin: Decontamination activities in Onami area)
[38] Fukushima Mimpo (1 July 2011)
[39] 7 July 2012 Fukushima Mimpo, Iwate Nippo etc.

municipalities with Intensive Contamination Survey Areas had insufficient temporary storage facilities[40]. Conversely, municipalities that successfully set up temporary storage facilities progressed smoothly with their decontamination[41].

Nihonmatsu City initially planned to set up a large temporary storage facility in the national forest. However the city changed its plan and decided to set up temporary storage facilities in a total of 75 places.. The storage facilities were built according to a uniform structure with high levels of safety, which was important due to being set up near where human were living. Additionally, the city proposed a plan to pay an honorarium to land owners and leaseholders on top of their normal rent (total amount of JPY50,000 per 10 acres of paddy fields). Briefing sessions for residents were held in each administrative division[42].

Kawauchi Village initially considered setting up a temporary storage facility in the national forest following the intention of the central government. However, the potential land turned out to be unfit for storage since it was sloping land, and it did not have roads that were accessible to large cargo trucks. Moreover it was expected that developing the large storage facility would take two years. Therefore, the village decided to set up temporary storage facilities in the village-owned pasture where access was easier[43].

Kawauchi Village decided to accept the proposal to set up a temporary storage facility and in this way, the village authorities and residents would be able to undertake decontamination work as one team. By the end of April 2012 the village had acquired agricultural land owned by an individual and setup a temporary storage facility[44]. As a result, decontamination of residential areas was completed on 30 October 2012[45].

Even in the same municipality the progress of decontamination may differ depending on when an agreement is reached on temporary storage facilities. Fukushima City

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[40] The Sankei Shimbun 28 February 2012 “Decontamination and storage facilities survey.50% temporary storage facilities of municipalities are ‘Inadequate’”

[41] It is necessary to consider that due to the delay in setting up temporary storage facilities, there were cases where decontamination was undertaken with the precondition of storing on site in each house.

[42] Fukushima Prefecture (Record of the proceedings of the prefectural assembly, 27 February 2012)

[43] Kawauchi Village Interview (25-27 October 2012)

[44] Fukushima Mimpo “ Temporary storage in Yugawa First in Aizu, transportation of surface soil of elementary school has started” (28 April 2012)

[45] Mainichi Shimbun “Great East Japan Earthquake: Fukushima Daiichi Nuclear Power Plant Accident For protecting children and grandchildren Residents of Yugawa village completes decontamination by working as one team Bold decision of accepting temporary storage / Fukushima” (31 October 2012)

agreed with residents in the Onami area and, consequently set up a storage facility in a large public space called "Farmers' plaza". Decontamination started in earnest in October 2011. On the other hand, the city could not find anywhere suitable in Watari to put storage facilities. The city asked residents to provide residential land to store soil generated during the work to decontaminate houses. However, the city had to first reach an agreement with the residents. Decontamination of about 700 houses finally started in March 2012.

Currently the prospects remain unclear regarding the intermediate storage facilities within Fukushima prefecture and the final storage facilities outside of the prefecture. The situation means that it is not easy to reach an agreement with the residents. Although MOE expressed its intentions to set up intermediate storage facilities in the prefecture and start transporting the waste material there in January 2015, there are strong apprehensions about whether the government can really set up these intermediate storage facilities. Any such storage may not be "intermediate (maximum 30 years)" rather, it may end up being a permanent storage facility. In an interview with municipal staff conducted by Kyodo News, the reasons for not reaching an agreement regarding temporary storage facilities were "Concerns that these facilities would become long-term facilities", "Adverse impact on environment", "Lack of suitable land", and "Concerns about harmful rumours"[46]. In chapter 3 we will look at the various communication methods introduced by municipalities to identify potential candidates for temporary storage facilities and for reaching an agreement with the residents in light of this situation.

2.3. Role of Fukushima Prefectural Government

- Prefectural actions and initiatives

The following section presents an overview of the actions and initiatives of Fukushima Prefecture which play an intermediary role between the municipalities conducting decontamination and the central government that approves the decontamination plans and bears the expenses. Fukushima Prefectural government set up an environment recovery team in June 2011 and assigned four staff members to carry out the work[47]. Subsequently, their activities were shifted to the decontamination measures department and, at present, 20 members belonging to this department are working on decontamination-related activities.

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[46] Iwate Nippo, 7 July 2012

[47] Fukushima Prefecture Interview (14 September 2012). Two members were added in August 2012, taking the team structure to 6 people.

In September 2011, the prefecture established a fund with a budget of JPY217,900 Million allocated by the national government. Expenses incurred due to the implementation of decontamination activities undertaken by the municipalities based on the implementation plans are to be paid from the fund[48]. Payment to municipalities of the expenses incurred due to decontamination activities began in November 2012 (see Appendix 1 for mechanisms and problems with funds related to decontamination).

The prefectural government undertakes decontamination of the land owned by the prefecture. At the same time it supports the decontamination activities conducted by municipalities mainly through three actions. These are namely, a) Training for operators, b) Technical support, and c) Promotion of the understanding of residents[49].

a) Training for operators

The prefecture organises decontamination training sessions for those involved in decontamination work, field supervisors and operation managers. In FY 2011 there were 15 Decontamination training sessions organised in five locations in the prefecture and with about 3,400 people in attendance. Moreover, there were 32 Radiation and decontamination training sessions, held at seven places in the prefecture, targeting the leaders of associations conducting radiation measurement or decontamination in the area. A total of 2,050 people participated in these sessions.

In FY2012 the number of people taking the Course for persons engaged in operations increased to 7,500. The prefecture also held a field supervisor course (aimed at 1,500 people) and an operation manager course (aimed at 1,000 people).

b) Technical support

Surface decontamination model projects were conducted over 10ha of land in Fukushima in the Onami area from November 2011 to February 2012. Using the decontamination methods indicated in the decontamination related guidelines of the central government, the prefecture verified the benefits of the reduction in radiation levels. Additionally, an open offer was made to accept decontamination technology from general operators, and the prefecture undertook decontamination technology verification projects for verifying and selecting radiation reduction

[48] Nuclear disaster field measures division (2011) "Initiatives and actions of Japan for decontamination" (International symposium concerning decontamination for the reproduction of environment, 16 October 2011)

[49] Fukushima Prefecture (2012) "Decontamination measures of Fukushima Prefecture" (Professional experts workshop Research concerning effective decontamination of Fukushima, 19 July 2012)

benefits and versatility.

The prefectural government issued the "Procedure for radiation reduction measures in living space (15 July 2011)", a "Municipalities decontamination implementation plan manual (distributed on 9 December 2011)", and "Technical guidelines concerning decontamination operations (January 2012)". It is striving to provide information to municipalities, prefectural residents and operators. In March 2012 the "Surface decontamination procedure", based on the results of surface decontamination model projects, was also created.

The prefecture established a Decontamination Information Plaza in coordination with MOE. The Plaza supports the municipalities, neighbourhood associations and decontamination operators by offering information about decontamination technologies, providing required materials and equipment, holding local discussion sessions and dispatching experts.

c) Promoting the understanding of residents

The prefectural government organises a "Safety and security forum" and "Local discussion forums for undertaking decontamination" for the purpose of resolving concerns and answering questions from prefectural residents about radiation and decontamination. Upon request from the municipalities, staff members from the prefectural government are dispatched to briefing sessions organised by municipalities for the residents. The prefectural government supports the operation of briefing sessions. From July 2012, site visits were also organised to promote the further development of temporary storage facilities.

Furthermore, the prefecture undertakes radiation reduction support activities to move ahead with decontamination activities with "participation" that is based on the "understanding" of the residents. This includes providing a maximum subsidy of JPY500,000 for decontamination activities undertaken independently by neighbourhood associations and Parent & Teacher Associations. In FY2011, 3,107 associations from 44 municipalities undertook decontamination activities, receiving a total subsidy of JPY1,600 million.

- Future efforts by the prefecture

The aforementioned three items are the pillars of support provided by Fukushima Prefecture so far in the decontamination activities undertaken by the municipalities. The prefectural decontamination measures department has pointed out the following

two main issues where the prefecture should make efforts in the future[50].

Firstly, efforts could be made to provide support to municipalities for promotion of decontamination . For instance, they could reduce the burdens on municipalities by providing samples or specification standards for placing orders to operators for decontamination work. Additionally, small municipalities tend to have an insufficient number of engineers compared to administrative staff, so providing more technical support could contribute to the progress. The prefecture does attempt to strengthen the technical support for municipalities in cooperation with the Fukushima recovery headquarters of TEPCO. It also provides training to operation managers who support the operation management and dispatch operation managers to the municipalities. However, there is not an adequate number of decontamination workers available.

Secondly, support could be provided for setting decontamination management targets. There is sometimes confusion and difference of opinion among residents, operators and municipalities regarding judgments about completion of the decontamination. The prefecture could propose a process and framework so that each municipality can set appropriate decontamination management goals which consider the regional circumstances.

In addition to such issues envisaged by Fukushima Prefecture decontamination measures department, municipalities undertaking decontamination activities have different requests with regard to actions and initiatives taken by the prefecture. In particular, the prefecture could further support information-sharing and collaboration among municipalities. For instance, currently Fukushima Office for Environmental Restoration individually replies to inquiries received from the municipalities. The prefecture could make efforts to summarise and coordinate information required by the municipalities and contribute to a more effective operation of the restoration office. It is also hoped that the prefecture will provide personnel support to the municipalities that have a limited number of staff members for decontamination activities. The prefecture could also reduce the gap in technology and experience between municipalities by setting up information-sharing and discussion sessions and inviting staff members from these municipalities[51] to attend these sessions.

2.4. Actions and initiatives of the central government

After the Fukushima Daiichi Nuclear Power Plant accident, it was decided that, among the government ministries and agencies, the MOE will be responsible for

[50] Fukushima Prefecture Interview (4 February 2013)
[51] Fukushima City Interview (7 February 2013)

decontamination. MOE conducts decontamination activities in the Special Decontamination Areas whilst supporting municipalities to undertake decontamination in the Intensive Contamination Survey Areas.

- Roles of the Ministry of the Environment

MOE is responsible for a) specifying the target areas, b) formulation of decontamination related guidelines, c) discussion and approval of the decontamination implementation plan formulated by the municipalities, and d) providing funds for the decontamination activities undertaken by the municipalities.

a) Specifying the target areas

On 19 December 2011, 102 places (40 of which were in Fukushima Prefecture) with ambient radiation levels exceeding 0.23μSv/h were designated as Intensive Contamination Survey Areas. After that, designated areas were changed twice, on 24 February 2012 and 14 December 2012. At present, 40 areas in Fukushima Prefecture and 61 areas in other prefectures are designated as Intensive Contamination Survey Areas.

b) Formulation of guidelines

In December 2011 MOE announced two sets of guidelines, namely, the "Decontamination guidelines" and the "Waste material related guidelines". The "Decontamination guidelines" specify the survey and measurement methods for measuring the environmental contamination in the Intensive Contamination Survey Areas as well as measures for decontamination of soil, collection and transportation of the removed soil, and storage of the removed soil (storage at the site and storage at the temporary storage facilities). On the other hand, the "Waste material related guidelines" stipulate the methods for surveying the status of contamination, treatment of general waste material, designated industrial waste material, and decontaminated waste material, as well as methods for measuring the radioactivity concentration.

If the activities of municipalities are in accordance with the Decontamination guidelines, then the cost is covered by funds from the radiation reduction measures special emergency response grant (hereinafter referred to as the "Grant Funds") formulated on 22 December 2012. However if the municipalities decide to conduct decontamination work using other methods, they are required to

separately discuss this with MOE[52]. The Decontamination guidelines have been criticised for the lack of flexibility in their application. For example, it has been found that because tiled roofs cannot be cleared of radiation through high-pressure washing, tiling the roofs with new material will help to efficiently reduce the radiation. However, because retiling roofs is not included in the Decontamination guidelines, the method used for decontaminating tiled roofs is to wipe off radioactive materials from the surface[53]. Likewise, most of the decontamination technologies proposed by Fukushima Prefecture were based on its independent technical verification and were not included in the Decontamination guidelines due to reasons such as being too expensive[54].

The second version of the guidelines, published in May 2013, contained many revisions, including items such as a detailed summary and description of the concept of surface contaminants density (surface radiation rate) and the concept of surface radiation rate, as well as the addition of new contamination technologies whose benefits were verified after the release of the first version. For instance, ultrahigh pressure water washing and steam washing were added. The explanation about safety was greatly improved with the addition of a description of the elution measurement data for radioactive caesium and the periodic monitoring measurement data for underground water. Moreover, efforts were made so that the guidelines could be easily understood. For instance the sequence of decontamination work was clearly shown using a flowchart and photographs[55]. However, information was limited in terms of cost, the expected effects of reducing radiation and the amount of contaminated waste material that resulted from certain methods. Hardly anything was mentioned about communication with the residents and consensus-building.

c) Consultation and approval of decontamination implementation plans

MOE considered the contents of the decontamination implementation plans prepared by the municipalities and, after asking for some required changes, it approved the plans. After receiving approval from MOE for the implementation

[52] The Ministry of the Environment Decontamination Team, 14 February 2012 "Q&A related to grant money for special emergency projects for radiation reduction measures"; The Ministry of the Environment, 14 February 2012, "Decontamination related Q&A"
[53] Exchange of opinions with European experts (Experts Workshop "Research concerning effective decontamination of Fukushima", 19 July 2012)
[54] Exchange of opinions with experts (Experts Workshop "Research concerning effective decontamination of Fukushima", 19 July 2012)
[55] Decontamination related guidelines Version 2 (The Ministry of the Environment, 2 May 2013)

plans, the municipalities could access decontamination expenses from the "Fund" of MOE or the prefecture. After the Decontamination guidelines were published, previously formulated decontamination implementation plans had to be amended according to the details of the revised guidelines. It used to take more than 2-3 months of discussion to gain MOE approval of decontamination implementation plans. This was one of the bottlenecks in the stage before decontamination activities could start. After the release of the decontamination promotion package in October 2012, this discussion time was shortened drastically.

d) Providing funds for decontamination activities undertaken by the municipalities

For decontamination activities undertaken by the municipalities, funds are to be provided from the grant money for special emergency projects for radiation reduction measures. However, there are some limitations regarding the methods and objects of decontamination that are covered by the scope of this funding. For instance, MOE will not provide fiscal support to municipalities for promoting decontamination activities conducted by private enterprises or organisations, such as kindergartens. In February 2012, requests to improve access to funds were submitted by nine municipalities in Chiba Prefecture that were designated as Intensive Contamination Survey Areas .

- Fukushima Office for Environmental Restoration

Along with the full-scale implementation of the Act on Special Measures on 1 January 2011, MOE set up the Fukushima Office for Environmental Restoration in Fukushima Prefecture. This office handles activities such as keeping track of decontamination concessions in the prefecture and providing advice for formulating decontamination plans, decontamination implementation by the municipalities, verifying the benefits of model projects and process management for the reduction of radiation in evacuation areas. Furthermore, to supplement the administrative processing capabilities, due to a shortage of municipal staff members, in April support centres were set up in five locations in Fukushima Prefecture[56].

The Fukushima Office for Environmental Restoration was not given sufficient

[56] The Ministry of the Environment (2011) About establishment of "Fukushima environment reproduction office (Notification)"
The Ministry of the Environment (2012) "Establishment of Fukushima Office for Environmental Restoration (Notification)". The office is established in five locations, namely, North Office, Central and South Office, Hamadori North Office, Hamadori South Office, and Aizu Office.

authority to deal with decontamination soon after its establishment. Thus, various local conditions could not be reflected in policies. When the office received inquiries from municipalities about decontamination techniques that were not mentioned in the guidelines, the office had no option but to ask MOE whether these techniques could be used or not[57]. To deal with such ineffectiveness and accelerate decontamination, MOE announced the "Decontamination promotion package" in October 2012[58]. The package ensured that authority concerning decontamination and waste material treatment was transferred from the ministry to the Restoration office, and included directions to double the number of staff involved in negotiation with landowners, strengthen collaboration with Hello Work to secure broad-based availability of decontamination staff, as well as to strengthen provision of information on the benefits of decontamination, implementation status and the effects of radiation.

With the implementation of the decontamination promotion package, the response time for inquiries was reduced from 2-3 months to 2-3 weeks[59]. Previously, each municipality also needed approval from central government for its decontamination methods. Now, when a particular method is approved for one municipality, it can be used in other municipalities as well[60]. This gives more scope to make decisions in the field.

- Fragmentation among ministries and agencies

Disaster-hit areas have many other issues apart from environmental radiation levels. Other than decontamination activities overseen by MOE, central ministries and agencies pursue multiple projects simultaneously. These include safety assurance and restoration in collaboration with the local municipalities and the residents. It has been pointed out that the actions and initiatives of the assigned authority were fragmented and lacked mutual collaboration. Prefectures and municipalities in disaster-hit regions had no option but to follow time-consuming, inconvenient procedures, such as obtaining approval after conducting separate discussions with MOE regarding decontamination, with the Ministry of Health, Labour and Welfare (MHLW) regarding the exemption of health insurance premiums for residents, and with the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) regarding infrastructure recovery.

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[57] Fukushima Prefecture Interview (4 February 2013)
[58] The Ministry of the Environment (2012) "Announcement of decontamination promotion package (notification)"
[59] Fukushima Prefecture Interview (4 February 2013)
[60] Technologies that could be used in other municipalities based on this policy are shot blast, recovery type high pressure washer, etc.

Furthermore, this fragmentation caused challenges to the municipalities in their decontamination activities such as holding briefing sessions with the residents and discussions with the landowners. While various people affected have a number of concerns related to rebuilding their lives, such as the rearrangement of the evacuation zones, compensation for damages, and restoration of local industries and schools, it is not easy to reach an agreement with the residents regarding the scope of decontamination, technology and temporary storage of the waste material generated from the decontamination work. Above all, compensation process and its lack of clarity to the residents living in specific evacuation recommendation areas and their surroundings is a major hurdle for the decontamination process. Even outside the Planned Evacuation Zones, residences located in the areas where annual additional radiation exposure is expected to exceed 20mSv (3.2 μ Sv/h when converted to aerial radiation after considering the shielding effect due to average living time indoors) were designated as specific evacuation recommendation sites at the discretion of the municipalities.

The instruction standards varied among municipalities, and the residents were not informed of the decision making process. Therefore there was a strong sense of distrust among the residents. Based on TEPCO's compensation polic set up in reference to the guidelines of the Dispute Reconciliation Committee for Nuclear Damage Compensation of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), monthly compensation of JPY100,000 per person is to be paid to the households living in specific evacuation recommendation sites. On the other hand, households that are not designated as specified recommended evacuation spots have had a one-time compensation payment of JPY80,000 per person and JPY600,000 to pregnant women and children under 18[61]. Such a difference in the compensation amount paid to households living in the same area and the same settlement created serious confusion and lead to emotional confrontations[62]. This confusion within the local society hampered consensus-building efforts with the residents for setting up temporary storage facilities and implementing decontamination plans. It also had a

[61] In the "Supplement to intermediate guidelines" announced by the Dispute Reconciliation Committee for Nuclear Damage Compensation of the Ministry of Education, Culture, Sports, Science and Technology on 6 December 2011, TEPCO was asked to pay consolation money of JPY80,000 per adult and JPY400,000 to pregnant women and children under 18 by the end of 2011 as damages to the households who voluntarily evacuated from 23 municipalities out of 49 municipalities in Fukushima Prefecture. In February 2012, TEPCO announced that it would be increasing the consolation money to be paid to pregnant women and children to JPY600,000.

[62] Date City interview, Oguni Area (20 July 2012) and Asia Press Network, aforementioned article.

negative effect on the progress of decontamination. Specific evacuation recommendation sites were set up to ensure the safety of residents and as a guide to evacuation instructions based on detailed measurements of the radiation levels. However, adequate consideration was not given to the fact that compensation paid to the residents makes a large difference to the ability to sustain life and resources for rebuilding.

Ministries/Agencies	Major responsibilities related to decontamination
Ministry of the Environment	Overall measures on radioactive materials caused by the nuclear power plant accident Monitoring of ambient radiation
Ministry of Agriculture, Forestry and Fisheries	Monitoring of radiation of agricultural, pastoral and fisheries products Monitoring of radiation of farmlands Restriction of crops Soil amelioration
Ministry of Health, Labour, and Welfare	Monitoring of radiation of food Restriction of shipment and/or consumption of food Monitoring of radiation of tap water Reduction/exemption of health insurance
Ministry of Economy, Trade and Industry	Setting and revision of evacuation zones
Ministry of Land, Infrastructure, Transport and Tourism	Reconstruction of the infrastructures
Ministry of Education, Culture, Sports, Science and Technology	Formulation of the guidelines for compensation Gathering and publishing of the monitoring results of ambient radiation (until 18 September 2012; the Atomic Power Control Committee took over the role from 19 September 2012)
Reconstruction Agency	Overall planning, coordination and implementation of reconstruction Support to prefectural and municipal governments

Table 2 Role and responsibility of ministries and agencies in decontamination and restoration

When the Ministry of Economy, Trade and Industry (METI) proposed a rearrangement of the evacuation zones in December 2011, 11 municipalities included in the scope of rearrangement requested that the central government disclose the "Overall vision of rebuilding of life such as decontamination and compensation, and infrastructure restoration".

- Consolidation in Fukushima Headquarters for Fukushima Reconstruction

After its establishment in February 2012, the Reconstruction Agency was unable to immediately demonstrate its coordination capabilities adequately. The municipalities raised concerns about the Reconstruction Agency such as "It does not have any authority or free resources" and "What is the role of Reconstruction Agency"[63].

With the purpose of removing vertically-divided administration and taking flexible measures near the site, the Fukushima Headquarters for Reconstruction and Revitalization was established in Fukushima City in February 2013, consolidating the functions of the Fukushima Regional Bureau of Reconstruction, the Fukushima Office for Environmental Restoration, and the Nuclear Emergency Response Headquarters. Municipalities welcomed the establishment of this headquarters that is expected to ensure quick, on-site decision-making requiring coordination and collaboration between ministries and agencies. [64]. Fukushima Headquarters for Reconstruction and Revitalization was assigned some authority over budget execution in May 2013 and it has started carrying out full-scale actions. Time will tell if this headquarters is able to meet expectations, and effectively and dynamically respond to local needs[65].

[63] Mainichi Shimbun "Re-Fukushima: Great East Japan Earthquake Chapter 1 Shivering Municipalities/1 Believe in hometown reconstruction, and continue direct discussions with the country (1) / Fukushima" (17 January 2013)
[64] NIKKEI Shimbun 2 May 2013 "'Fukushima Headquarters for Fukushima Reconstruction' in 3rd month of its establishment Positive feedback for consolidation of reconstruction agencies"
[65] Fukushima Minyu 26 May 2013 Editorial "Transfering authority to Fukushima Headquarters for Fukushima Reconstruction for smooth and dynamic response"

Contamination activities in the priority survey areas: Summary

The surface decontamination of radioactive materials that were scattered over a wide area was the first such decontamination project attempted by the national, prefectural and municipal governments. They did not have adequate experience and technology regarding planning and execution of the project at the initial stage.

Decontamination activities in the Intensive Contamination Survey Areas were planned and implemented by the municipalities with the support of the national government and the prefecture. Many municipalities have established dedicated departments, such as a radiation measures department, that focused exclusively on responding to the nuclear accident. However it is difficult for small municipalities to assign adequate personnel for decontamination activities. Municipalities are facing difficult issues such as trying to reach an agreement with residents regarding the location of temporary storage facilities for storing the waste material generated during the decontamination process. And of course, in addition to responding to the nuclear accident, municipalities have many other activities.

Some of the municipalities started model projects from early on, and conducted technical verification with the cooperation of research institutions and promotion members (TEPCO). They could accumulate knowledge and insights into decontamination technologies and procedures for reaching an agreement with the citizens. However, experience and insights gained in this manner are not being shared with other municipalities.

There needs to be robust information exchange concerning personnel resources and technology, experience, etc. so that municipalities can smoothly implement actions and initiatives. Expectations are high that the Fukushima Headquarters for Reconstruction and Revitalization and Fukushima Prefecture will play more of an active role in coordinating and improving the exchange of information.

3. Communication and Consensus Building

While undertaking decontamination activities, the central government and the municipalities have to share information and arrive at an agreement with the stakeholders, including the residents, to decide the targets and technologies for decontamination, obtain permission to enter target houses, set up temporary storage facilities for waste material generated due to decontamination, decide a method of waste water treatment, and deal with the expected effects of radiation reduction. In this chapter, we will touch upon and study the types of information related to decontamination and the steps taken to issue such information. We will study the methods used by the municipalities to communicate with residents.

3.1. Information and sources

During the emergency response right after the nuclear accident, information was not provided by the central government in a timely manner and this caused confusion. In the disaster-hit areas some residents evacuated despite the need to evacuate being low, while others evacuated to areas along the same path as the radioactive plume. During the intermediate stage of reconstruction there was confusion regarding the radiation level that was acceptable in terms of allowing the use of school playgrounds, safety standards of food and health survey of the prefectural residents. All of this confusion led to the suspicion that the central government and administrative agencies were underestimating the risk of radiation. Even today the information released by the central government and the administrative agencies is not fully trusted.

To implement decontamination and restoration in the disaster hit areas and to rehabilitate the lives of those affected, the central government and the local governments make administrative decisions while municipalities and communities attempt to build a collective consensus, and families or individuals make decisions on a daily basis. In order to ensure rational decisions, information must be offered through appropriate means and in adequate amounts. Based on this understanding, information concerning radiation can be broadly divided into the three categories of “Generally required information”, “Information required for collective decision-making”, and “Information supporting individual or family decisions”.

“Generally required information” affects the policies and programmes of the central government and the prefectural government. This includes information regarding risk and levels of radiation, as well as the decontamination system and overall

contamination conditions due to the nuclear power plant accident. Considering these characteristics, in most cases, this kind of information is released by the central government or the prefectural governments. Because such information needs to be widely disseminated and easily understood by residents and communities, it is mostly released through mass media or over the Internet.

"Information required for collective decision-making" can be further divided into two types. Firstly, technical information, such as that related to decontamination technology, is required for formulating the decontamination implementation plans. This type of information is provided in abundance by engineers and professional experts who work in various fields and belong to national and prefectural institutions, and universities. Special mechanisms that allow a direct exchange of opinions between professional experts and communities could be useful for fully utilising them for decontamination activities at the community level. In this regards, the Decontamination Information Plaza could play quite an important role. Secondly, community-level decisions and activities are supported by location-specific information, such as contamination conditions within communities and temporary storage facilities. Such information is mostly gathered by community organisations, agricultural cooperatives and city offices. It is communicated via bulletins and/or municipal newsletters, briefing sessions and other opportunities.

"Information supporting individual or family decisions" includes personal radiation exposure data, ambient and surface radiation of houses, contamination status of schools and other neighbourhood facilities, and radiation levels in food. This kind of information is mostly provided by municipalities, agricultural cooperatives and consumer cooperatives. In some cases, information measured by individuals or civil organisations is also disseminated. Since this data includes private information, it is often exchanged on a one-to-one basis.

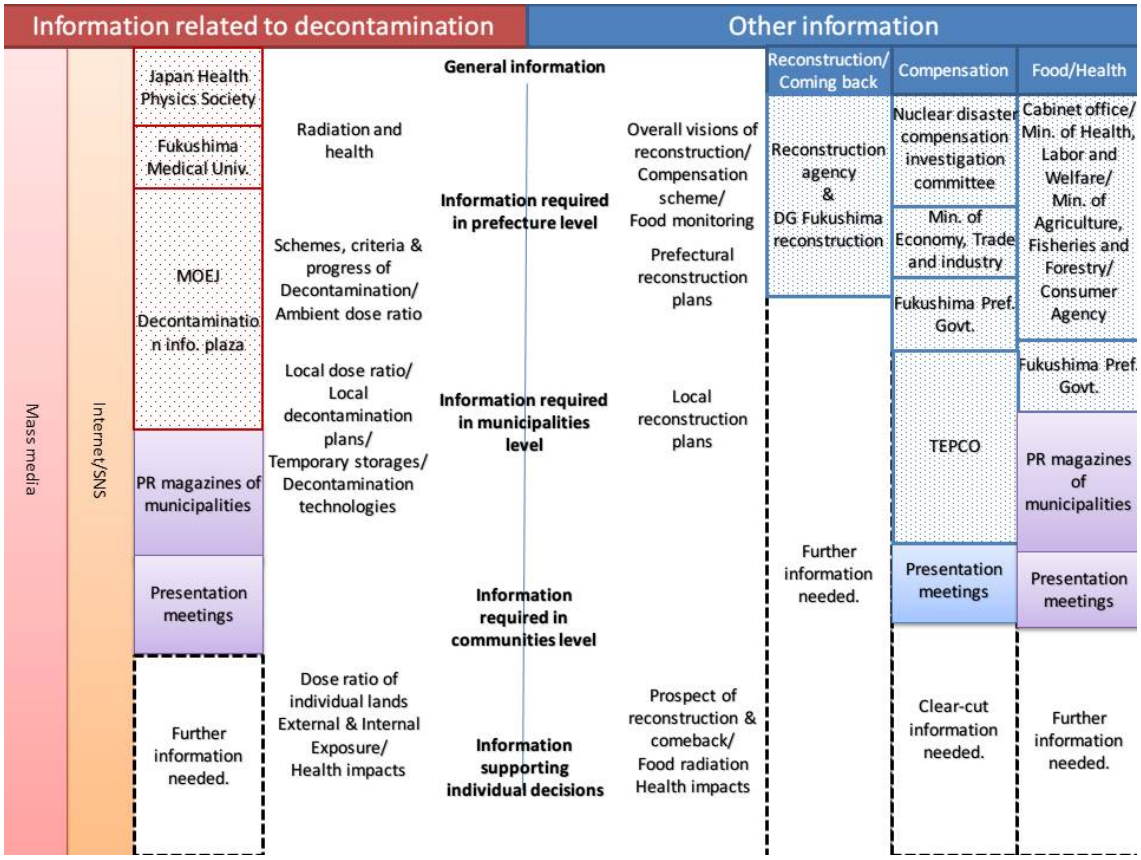

Figure 4 Information related to radiation

Modes of communication are carefully designed to ensure that different types of information are fully utilised in the decision-making process. We will look into the modes of disseminating and sharing information related to decontamination with a focus on communication by the municipalities and the activities of the Decontamination Information Plaza.

3.2. Communication with residents by the municipalities

The communication approaches used by municipalities to communicate with residents are categorised as follows.

- Elaborate communication at the planning stage

In the first approach, time is spent on model projects, the results of which are reflected in the decontamination implementation plans. Koriyama City, which created a decontamination plan for over 100,000 houses, is a representative example of this approach. In October 2011, Koriyama City organised a briefing session for the "Koriyama City radiation reduction stimulation support project and Koriyama City radioactive material removal manual". After this briefing session, attended by about

300 persons including directors of neighbourhood associations and the PTA , the city started organising briefing sessions for each neighbourhood association and, until the middle of January 2012, such sessions were held almost every week. On request, Decontamination Information Plaza staff members also participated in the briefing sessions. This was in addition to city staff members and professional experts.

Koriyama renewal decontamination plan (1st version) published by Koriyama City on 27 December 2011, reflected opinions and insights that were made during briefing sessions held for each neighbourhood associations. Participants in the briefing sessions gave constructive opinions about collaborating with the civic associations. They also raised criticisms regarding issues such as "actions and steps taken for decontamination activities are slow", and "why are neighbourhood associations required to undertake decontamination activities?".

Koriyama City undertook a model decontamination project on one house in Ikenodai area in January 2012, and conducted a surface model decontamination project from February to March 2012. At that time as well, briefing sessions were held with neighbourhood associations. Based on the results of the model projects, the city started to decontaminate general houses in October 2012. However, briefing sessions concerning the decontamination of general houses started on 17 October 2012 and, until the middle of November, such sessions were held about 10 times.

In addition to the briefing sessions, the city also provided information regarding decontamination through bulletins, the city newsletter, pamphlets supplied with newspapers, television programmes (about 15 minutes after September 2012), the Internet (publishing a radiation map, estimated exposure on the access roads to schools, etc.), and it also answered inquiries from residents over the telephone.

Most of the inquiries received by Koriyama City from the residents were about the storage of the waste material generated by decontamination. This is because the temporary storage facilities in the city were not decided, and each household was requested to store waste material on the premises of the houses targeted for decontamination. Many residents asked for a clear explanation regarding the location and scale of this temporary storage.

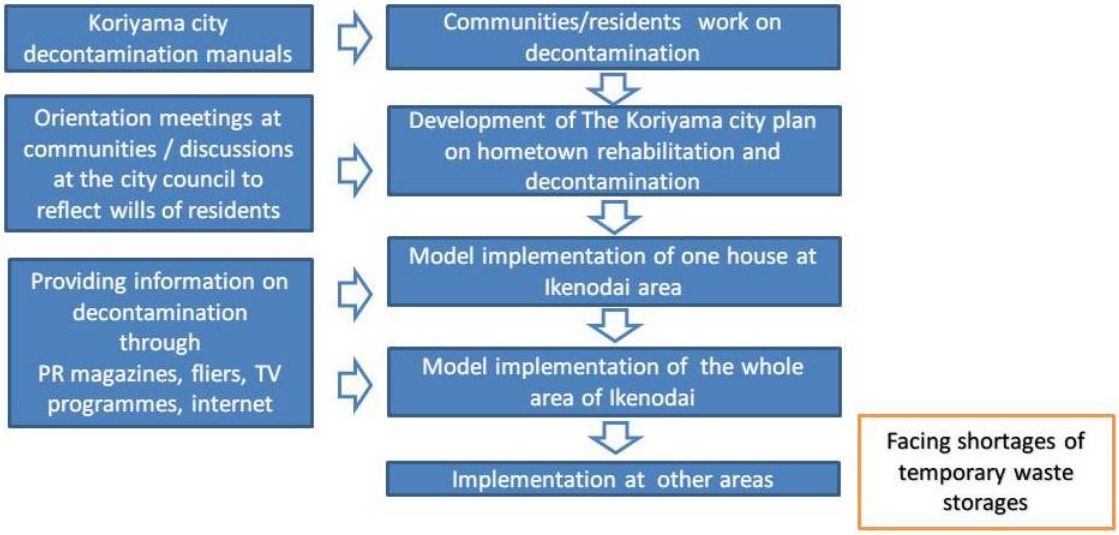

Figure 5 Formulation of decontamination implementation plan, communications and implementation of decontamination in Koriyama city

In this manner, Koriyama City put efforts into communicating with the residents during the planning stage. However the city faced several issues. Firstly, the number of residents participating in the briefing sessions gradually declined. This happened as residents deepened their understanding about decontamination and radioactive waste material. Moreover, there is still the possibility of finding hot spots with high levels of radiation even after the completion of decontamination activities in the city. In such cases, neighbourhood associations will conduct decontamination as needed. With regard to decontamination work led by the residents, close, personal communication with the residents is vital. To this end, Koriyama City is also engaged in an information exchange with Fukushima City.

- Focusing on individual communication at the implementation stage

The second approach focuses on direct communication at the implementation stage instead of frequently communicating with the residents at the formulation stage of the decontamination implementation plan. Kawauchi Village, having both the Special Decontamination Areas and the Intensive Contamination Survey Areas, as well as having evacuated the entire village, adopted this approach. The evacuation zones in Kawauchi Village were revised after 1 April 2012, and they were changed to the "areas preparing for the lifting of evacuation orders", "residency restriction zones," and difficult-to-return areas. The village decontamination implementation plan (1st version) was published on 30 September 2011, and the 2nd version was published on 10 October 2012. In the plan, it mentions that the "basic policy for decontaminating the village is to remove the radioactive material as much as possible, and an absolute

condition is that the health of village residents is protected". The final goal of the plan is to get closer to the ambient radiation of 0.23μSv/h.

The village did not conduct any briefing sessions or collect the opinions of residents at the plan formulation stage. However, after the plan was formulated, the village organised a briefing session about the plan at temporary houses and evacuation shelters. With regard to the decontamination of houses in the Intensive Contamination Survey Areas, the village asked the target residents to return to their homes at once, and explained the method of decontamination at the site. Moreover, even during measurement before and after decontamination, the village asked the residents to temporarily return and observe the procedure. Explanation at that time was provided by cooperation between the village office and the decontamination workers.

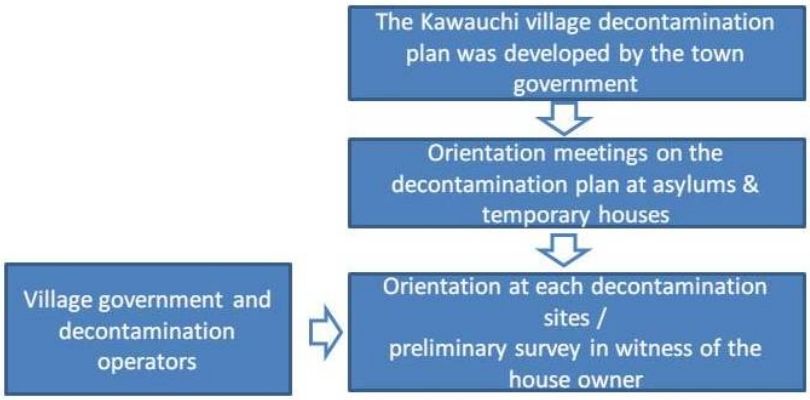

Figure 6 Formulation of decontamination implementation plan, communication and implementation of decontamination in Kawauchi Village

In Kawauchi Village decontamination workers faced difficulties when giving explainations to residents at the sites. For instance, some of the residents raised unique requests for implementing decontamination, and others were not fully satisfied with the results.

Moreover, because actions and initiatives were taken to encourage residents to return from the evacuation areas to the village, some residents expressed concerns about the effect of additional radiation exposure, and thought that it was not yet time to return. Friction also occurred amongst the villagers due to the difference in compensation depending on whether their residence was inside or outside the evacuation zone. Difficulties in explaining the radiation risks and the setting of the evacuation zones resulted in confusion.

- Seeking communication suitable for the planning stage and the implementation

stage respectively

In the third approach, communication was emphasised when the plan was formulated as well as at the implementation stages. Fukushima City falls under this type, and the city used various opportunities such as handling hotspots, briefing sessions when formulating the area decontamination plan, and three party discussions when conducting decontamination.

As already introduced, Fukushima City conducted model decontamination in the Watari area in July 2011, and formulated the "Fukushima City decontamination plan (version 1)" by incorporating these results. In May 2012, this plan was revised to version 2, and at present, decontamination based on this plan is in progress.

The briefing session in the Watari area was attended by many participants from outside of the area, including other prefectures, and the briefing session lasted from 7pm to 12am. For improving such conditions the city decided that the neighbourhood associations would take centre stage and lead the sessions, and that only residents from the area concerned will be allowed to join the discussion. This revision enabled detailed and productive discussions to take place.

Based on the experiences in the model area, and knowing that Katsushika-ku in Tokyo had held a 'Disaster prevention town festival' for "Urban zones below the average sea level", Fukushima City decided to move forward, holding briefing sessions for decontamination measures committee members of the area, brainstorming sessions between committee members and neighbourhood associations, and individual three party discussion.

Representatives from branches of city offices in 19 areas of Fukushima City were assembled (about three representatives from each area), and a briefing session about priority decontamination areas was held. After this session the regional decontamination measures committee was established in branch offices in May 2012. The committees comprised about 20 members including 15 persons from the committee for promoting autonomies, the league of neighbourhood associations, Parent & Teacher Associations, and municipal councillors. The committees would be the first to receive explanations of decontamination activities from the city. After that, the regional decontamination measures committee and the chair of the neighbourhood association held a brainstorming session for about 2 hours to decide the priority of decontamination.

After the briefing session and the brainstorming session, there was a trilateral

discussion for 2 hours among the city officers, the decontamination operators, and the residents. If the residents had any objections to the decontamination methods, they were encouraged to consult the chair of the neighbourhood association. Distrust in the central government and administration often manifested in such discussions.

Figure 7: Implementation process for decontamination measures in Fukushima City
Photograph: Workshop held in the decontamination measures committee

Fukushima City had a shortage of personnel for handling decontamination activities since it had to communicate with 25,000 families. The city's comprehensive radiation measures department employs 46 persons at present, but this is not sufficient to conduct about 500 individual discussions every week. Therefore, supervisors contracted by the city are dispatched to trilateral discussions with the residents and the decontamination workers. Currently 100 supervisors contracted by the land surveyors association are working. However there are still not enough staff members. To cover the shortage the city requested support from the construction association. About 400 supervisors, contracted by the prefecture, were also sent. Decontamination promoters, sent by TEPCO and contracted by MOE. also offered technical support. Fukushima City asked promoters to summarise the activities and meetings records,

and provide technical advice. The city developed an effective collaboration with the promoters. One of the officers of Fukushima City expressed hope that such activities will play an even more important role in the future.

- Discussion on the three approaches

We have seen that there are characteristic approaches to the communication between the municipalities and the residents. These approaches were adopted according to the constraints of each municipality, such as status of contamination and evacuation, and administrative manpower. It is not possible to say in general which method is superior. Rather than looking at the merits and demerits of actions and initiatives, we can recognise them as a learning process through which municipalities and residents, faced with difficult challenges, have sought effective communication and cooperation. The points of such mutual learning could be further studied in future.

The three approaches have a few attributes in common. First, vertical collaboration among municipalities and the prefecture and national government was gradually improved though collaboration between the prefecture and the municipalities; this could be further improved. Second, reflection on the experience at field level is not always smoothly done. Third, effective fulfilment of human resources is also a challenge. Horizontal collaborations among the municipalities could be much improved.

Decontamination promoters, contracted by MOE, play an important role in the decontamination activities undertaken by municipalities by offering technical support. Since the promoters work in multiple municipalities, they tend to understand the characteristic progress and challenges of each municipality . Thus they could also contribute to improved collaboration between municipalities.

Some of the municipalities once adopted top-down communication and this caused strong distrust in areas with relatively high contamination. This experience led to the development of participatory decision-making processes with progressively successful communication resulting in agreements to proceed with decontamination activities. Fukushima City provides a good example of a learning process where residents and city government gained a deeper understanding whereby residents took the initiative to set the priority actions for decontamination.

3.3. Information-sharing among municipalities

Each municipality that undertakes decontamination activities accumulates different know-how based on their experience of decontamination technologies, negotiation with

institutions concerned such as the central government and the prefectural government, communication with the residents, and actions for consensus building. On the other hand, some municipalities are finding it difficult to take action due to the status of contamination in the region. They are also having trouble arriving at a consensus with residents. If the experience and know-how of those municipalities that have made good progress with their decontamination plans could be shared, it would give substantial support to those municipalities having difficulties. Unfortunately there has not been much horizontal information-sharing so far.

As mentioned in the previous chapter some municipalities have requested that Fukushima Prefecture act as an intermediary and promote information-sharing between the municipalities. However, it is not possible for Fukushima Prefecture to effectively play such a role. On 13 October 2011, the prefecture established a decontamination and waste material measures promotion council to undertake decontamination of material contaminated with radiation and treatment of the contaminated waste material in collaboration with local departments. However only five meetings were held with the last meeting on 12 January 2012[66]. The prefecture recently held informal meetings and invited the municipal governments from five locations in the prefecture to attend. It is hoped that such meetings will be held periodically.

3.4. The Decontamination Information Plaza

Fukushima Prefecture together with MOE established the Decontamination Information Plaza to dispatch professional decontamination experts to areas in need at the request of municipalities. The Plaza is also used for gathering and disseminating information related to volunteer activities of decontamination[67].

At the time of its establishment it was believed that there was not much leeway for the involvement of residents inthe decontamination activities. The Plaza placed priority in providing support to decontamination staff members in the municipalities as well as decontamination operators. It fell to the municipal employees to deal with the risk of decontamination and radiation, and carry out communication with the residents

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[66] Fukushima Prefecture "Fukushima Prefecture Decontamination and waste material measures promotion council]: http://wwwcms.pref.fukushima.jp/pcp_portal/PortalServlet;jsessionid=18D5EB4D0BB6B48299C1E3930983FEF8?DISPLAY_ID=DIRECT&NEXT_DISPLAY_ID=U000004&CONTENTS_ID=27199 (Checked on 27 March 2013)

[67] The Ministry of the Environment (2012) "Dispatch of professional experts by decontamination information plaza (notifications)"

regarding radiation protection, which was a heavy burden for them.

The Decontamination Information Plaza underwent a renewal in July 2012 in line with the full-scale implementation of surface decontamination. The Plaza made more efforts to disseminate information to ordinary citizens on decontamination and radiation risk, and on how to protect themselves against. The Plaza is located on the first floor of a building near Fukushima Station, and has a large exhibition display showing how to use radiation measurement devices, and outlining the status of contamination and progress of decontamination. There is also a Q&A system on decontamination with a touch panel[68].

The Plaza assigned external decontamination staff comprising three teams of about 10 members each to support the municipalities located far from Fukushima City. They also hold mobile exhibitions in remote locations.

- Challenges faced by the Plaza and the focus of future activities

Although the Information Plaza carried out more information dissemination, most residents in the Intensive Contamination Survey Areas obtain information from the mass media rather than from the Plaza.

The Plaza was established to provide information in lieu of the central government. So from the standpoint of those affected by the nuclear disaster, it could be said that this information is being offered from the offender to the victim. It could be that this information on radiation risk, radiation protection, and methods and progress of decontamination activities, is provided "to explain the decontamination activities undertaken to fulfil the responsibilities of the offender." Therefore it has not been easy to respond to various concerns from residents about safety, security and risks.

The Plaza staff consider that local expectations on decontamination activities "until radiation is reduced below 1mSv/year" are exceedingly high, and this is one of the obstacles toward reconstruction. They are seeking alternative methods to contribute to the region as well as further engaging in activities to promote decontamination. As people have gradually become aware of the Plaza, they have requested information on decontamination activities as well as on other issues such as radioactive substances in foods and the impact on their health. The Plaza introduces residents to organisations, such as the Fukushima Prefecture Health Management Centre and the Consumer Agency, that can provide more detailed explanations. The Plaza thus connects people

[68] The Ministry of the Environment (2012) 7 July 2012 (Saturday) "Decontamination information plaza - Viewing space. Opens after renewal"

looking for information with the appropriate information sources.

Moreover, with regard to information-sharing between the municipalities described earlier, there is a possibility that the Information Plaza could also contribute. In the 2nd round of ICRP dialogue held right after the establishment of the Decontamination Information Plaza, overseas experts expressed their hope that the Plaza would play a key role in supporting information exchange at a regional level, accumulating knowledge and know-how, and strengthening radiation protection measures through independent efforts at the regional level[69].

The Plaza must step up to respond to the informational needs of residents and municipalities, and improve both its information and dissemination methods.

[69] 2nd Round of ICRP Dialog (2012) "Conclusion of the dialog seminar and recommendation Restoration of living environment after Fukushima nuclear power plant accident"

Communication and Consensus Building: Summary

In the initial stages of decontamination activities, communication between the municipalities and the residents on decontamination was mainly in the form of briefing sessions to simply "make the residents understand" the decisions taken by the government.

In these briefing sessions the government and the professional experts provided residents with information about the targets and technologies available for decontamination, temporary storage etc. Mutual communication was scarce, and the concerns and requests of the residents were not sufficiently reflected in consensus-building.

Some municipalities, like Fukushima City, organised smaller scale meetings and gradually succeeded in improving communication with residents, after a few rounds of trial and error.

However, in many cases, consensus-building using such communication sessions was not easy. The number of residents living in the decontamination target areas, status of evacuation of the residents, and number of staff members in the municipality differs greatly between municipalities.

Furthermore, there are several issues emerging on participatory decision-making. Firstly, those municipalities already building consensus through conversation with residents need to share their experiences with other municipalities. Secondly, communication methods should be carefully designed according to the different status of each municipality. Fukushima Prefecture and the Decontamination Information Plaza could further contribute to addressing such issues and support participatory decisions made by the municipalities.

4. Decontamination, community regeneration and livelihood rehabilitation

So far we have seen the framework, communication and consensus building for decontamination activities. However, simply reducing the ambient or surface radiation by decontamination does not provide sufficient conditions to rehabilitate the livelihoods of those affected by the disaster. In this chapter we will look at issues other than decontamination that effect the rehabilitation process. Although these issues may appear to have only a slight connection with decontamination, they are quite important, in particular for those people who have been forced into long-term evacuation and who are not able to decide whether to return to their former homes or relocate permanently.

4.1. Regeneration of communities/hometowns and rehabilitation of livelihoods

The people affected by the disaster require comprehensible and sufficient data, on aspects such as the expected decline in radiation over time, so that they can think about the direction they need to take to rehabilitate their lives. Such data helps people accept concepts of security and risk, and forms the basis of their hopes for regeneration of their hometowns and rehabilitation of lives.

Some municipalities have many areas where coming back would be difficult for a long period of time. In such areas there is a low possibility of returning even after decontaminating the entire region spending a large sum of money. Therefore, alternative strategies could be considered, including undertaking decontamination intensively in the Evacuation Instructions Release Preparation Areas that have an ambient radiation level of 5mSv/y or below, and preparing the front line for restoration there. However, even in the potential areas of such front lines, people express concerns about radioactive material being transferred from the rivers or surrounding forests. It is necessary to provide people with the data to support their decisions.

In the early period after the disaster, the majority of the disaster-hit municipalities and their residents wished for a quick return. However, with the passage of time, people accepted that immediate restoration of their regional society is difficult, particularly in the “difficult-to-return areas” and the “residency restricttion zones.” Certainly, the aim that all residents will return may not be possible as a basic approach of reconstruction. It would be more practical to seek measures to rehabilitate daily lives in new places or in temporary communities. The direct path of “Decontamination > Return > Reconstruction” is no longer the only strategy. The options for local governments, communities and individuals need to be reconsidered.

These options include rebuilding lives in the evacuation area, forming new communities, and maintaining and developing links to hometowns.

Decontamination may not always be effective for reducing radiation to a level where the residents can live in the decontaminated areas. Even if radiation levels are reduced, former residents may not always be able to return and rebuild their original lives. The decontamination plans need to be re-examined in the overall context of reconstruction. In this regards Namie Town seeks to improve the current situation, in which people have been evacuated separately and communities have been divided, by building public housing for revitalisation. The town aims to build temporary communities in low radiation areas in the town and the neighbourhood areas, and then rebuild the whole area. Whether such an aim will lead to effective regeneration of communities requires further observation.

Decontamination itself does not restore the original state of the area. The evacuees are not able to come back and resume their lives unless schools, hospitals, and the transportation system are all functional once again. They would also need hope that commerce, agriculture, forestry, and fishing could be restarted..

A number of families have female family members or young couples with children in different places who do not wish to return even though elderly family members or male family members do wish to return. There has been a number of significant decline in the number of children and infants in elementary schools and kindergartens.

It is difficult to resume many industries, like agriculture, forestry and fisheries, without the cooperation of neighbours. However, the population of agricultural regions has declined for various reasons. Paddy areas have long suffered from ageing and depopulation issues, however quite a few rice farmers gave up agriculture after the nuclear accident. Furthermore, community ties are also crumbling due to reasons including the differences in the levels of compensation. Restoring agriculture to the status quo is not possible in practice.

There needs to be investment in rebuilding and maintaining infrastructure, such as schools, community centres and hospitals, so as to prepare and maintain the living environment. It is also necessary to invest in nurturing new industries that will generate employment, bearing in mind that those type of industries were going through difficult times before the accident. An integrated junior- and senior- high school and a research laboratory for renewable energy are under consideration. It is hoped that further efforts will be made in this regard.

In another example, residents in the Ryozenmachi Oguni area of Date City voluntarily conducted a trial cultivation of rice. They also brought samples of other crops to the community centre, conducted radiation inspections and regularly published the results. Such initiatives are supported by NGOs and Fukushima University.

A number of agricultural cooperatives working in the prefecture have installed their own testing equipment with the support of the cities and research institutions. They measure how much radiation produce has been exposed to and confirm the safety of this produce accordingly. Actions and initiatives by producers to ensure the safety of their produce should be continuously supported by the governments, research institutions and other organisations. Consumers also need to know that such products are safe, and this should be communicated widely when the procucts are shipped.

It should be recognised that the prevention of health damage caused by radioactive materials requires control and reduction of both external dose and internal dose[70]. Decontamination is only effective on ambient radiation levels at the decontaminated site, i.e. external dose. It is important to restrict exposure at decontamination sites including residential areas, schools and roads. However decontaminating all sites is impractical. Other measures to control radiation exposure also needs to be implemented, such as avoiding radiation hot-spots, and paying attention to people's daily behaviour and movement patterns. Control of internal dose (via ingesting food) needs to cover food purchased commercially as well as home-grown food.

4.2. Decontamination, compensation and return

Compensation for physical and mental damage, damage to businesses and job opportunities, including harmful rumours, as well as expenses required for evacuation and return have been paid by TEPCO. These payments are provisional payments and compensation payments based on the policy of the Dispute Reconciliation Committee for Nuclear Damage Compensation under MEXT. However, there was dissatisfaction and mistrust surrounding the details and scope of compensation, and related procedures .

As mentioned in Chapter 2, the amount of compensation differs greatly according to whether the area was designated for evacuation or not. Households that evacuated to temporary housing from the "returning difficult areas", "living restricted areas", and "specific evacuation recommendation sites" received JPY100,000 per month per person. However, people who voluntarily evacuated from areas other than the designated

[70] Basic purpose of "Radiation Protection" undertaken in Europe is to comprehensively minimize the exposure to radiation.

areas/sites received only a small amount of compensation (JPY600,000 to pregnant women and children under 18 years of age, JPY80,000 to adults).

Since specific evacuation recommendation sites were designated for each house, compensation varied greatly among different neighbours in the same communities, and this resulted in confusion within the communities.

Additionally, in the initial policy draft only 23 municipalities with relatively high levels of radiation in the prefecture were specified as targets of compensation. Not unsurprisingly, the remaining 26 municipalities expressed strong dissatisfaction about this. On 22 March 2012, TEPCO announced that it was going to pay compensation of JPY200,000 to children and pregnant women in nine of these 26 municipalities. Fukushima Prefecture criticised TEPCO's policy and announced that it would pay compensation to the target municipalities on 29 March as follows: 1) the Prefecture would make additional payment of JPY100,000 to residents from the nine municipalities where TEPCO was going to pay JPY200,000 as compensation; 2) the remaining 17 municipalities would be paid half the amount of compensation to be paid to the 23 municipalities specified in the "Intermediate policy"; and 3) other residents would be paid JPY40,000. The municipalities also accepted this proposal.

As a reduction in radiation is observed, instructions to evacuate are being lifted and more and more evacuation zones are being delisted, enabling evacuees to return and local governments to revise their reconstruction plans. Residents should be pleased to return to their homes but if evacuation instructions are lifted, then this may coincide with termination of compensation. This can become a major challenge in rehabilitating livelihoods. According to the second supplement of the intermediate policy indicated by the Dispute Reconciliation Committee for Nuclear Damage Compensation under MEXT in March 2012, compensation will be terminated "after a reasonable period of time from the lifting of evacuation instructions." However this "reasonable period of time" is decided based on the future situation. TEPCO announced that in March 2013 it would terminate compensation to those residents where specific evacuation recommendations had been lifted at the end of 2012. Despite strong protests from the residents, municipalities and Fukushima Prefecture, compensation was in fact terminated. The "reasonable period of time" before termination of compensation remains unclear. This is one of the reasons that revisions of the evacuation zones do not proceed smoothly in some municipalities. It is understandable that more and more evacuees "didn't want to (or abandoned hopes to) return".

On 20 July 2012, METI suddenly announced the detailed standards for compensation

of goods and articles. Four days later, TEPCO announced the details of compensation. Because the policy of the Dispute Reconciliation Committee for Nuclear Damage Compensation under MEXT was too detailed and somewhat difficult to understand, there were reports in the beginning that defining the contents of compensation in detail would be a welcome move. However, the policies announced by METI and TEPCO were mired with several problems. First, non-disclosure regarding the screening process for compensation for land and buildings; second the amount of compensation was calculated based on a general assessment value (in other words, the longer the house had been used, the less the owner was paid); third, the compensation was not sufficient to obtain a house in the place of evacuation. Moreover, the relationship was unclear between the policies announced by METI and TEPCO and the policy which had already been announced by MEXT. People became anxious that they would reach the "upper limit" of compensation. Because of such issues, the legal team for those affected by the nuclear accident severely criticised these announcements[71].

Additionally, people claiming compensation for damages have to individually negotiate with TEPCO. This places a massive burden on them because negotiation takes a great deal of time. Since 1 September 2011 the Atomic Damages compensation dispute Resolution Centre (ADR Centre) has been acting as an intermediary in compensation negotiations between TEPCO and those affected . However, the screening takes about 8 months on average, and out of 5,659 claims received up until 4 March 2013, resolution through amicable settlement has taken place in just 1,770 cases (amicable settlement ratio of 31.3%). Moreover, the number of claims has been increasing at a rate of 400 per month from March 2012, and there are over 3,000 cases where mediation is not yet complete. Therefore, resolution is expected to take a long time[72].

Compensation is also paid to business entities and organisations. Here also the policies indicated by the central government and TEPCO have caused resentment. In the beginning, the target of compensation in agriculture, forestry and fisheries was limited, and then it was gradually expanded. However, there are cases where TEPCO has refused provisional payment to some organisations such as schools, hospitals, and tourism companies. The methods for estimating the amount of compensation are unclear, for example with tourism companies, TEPCO announced that 80% of the

[71] The legal team for the disaster affected people 23 August 2013 "Opinion about the compensation standards announced by METI and TEPCO" (http://ghb-law.net/?p=494 Checked on 31 March 2013)

[72] Amicable settlements 30% Atomic damages compensation dispute resolution centre Over 3000 pending cases (Fukushima Mimpo, 6 March 2013)

reduced income would be paid, but later it withdrew this offer. Such confusion is a source of deep-rooted distrust.

Policies and actions on compensation carried out by the central government and TEPCO are different from the situation on decontamination as far as the system is concerned. However, for the residents, there is a close connection between compensation and decontamination due to the establishment and revision of evacuation zones. The sense of distrust with respect to compensation has led to a general sense of distrust about decontamination and overall support activities for restoration and rebuilding of life.

The essential problem is that the amount of compensation is calculated using the formula “damage incurred by the residents or the union, and facilities due to accident”, instead of “what is required for rebuilding lives and rebuilding businesses after returning or migrating”. The method for determining the extent of “damage”, and the calculation formula for the amount of compensation is announced unilaterally after they are decided somewhere beyond the reach of the those affected or the disaster-hit companies and industries. It is only natural that such policies have generated such serious confusion within the society and economy of the disaster areas. The prospect of returning home, regenerating communities, and rehabilitating lives has become more and more distant due to the confusion caused by the compensation policies.

4.3. “Out-of-town community/temporary town” scheme

It is expected that as an evacuee may become longer and exceed the deadline for providing emergency temporary housing based on the Disaster Relief Act. Municipalities facing the issue of securing lifestyles and resident levels that can withstand long-term periods living as an evacuee, have conceptualized out-of-town communities (also known as temporary towns) as the frontier base toward reconstruction.

Whether this scheme will be effectively introduced and will be able to shed light on the future prospects of rehabilitating the lives of people affected by the disaster requires careful observation. Life in out-of-town communities includes both prolonged evacuee life and life as a settled community. Many evacuees have already worked out different scenarios for rebuilding their lives rather than living in the “out-of-town community.” Some of them have purchased houses on their own at a different location. An “out-of-town community” is not the only option for rebuilding the lives of evacuees.

The significance of this scheme lies in the fact that it offers additional options to the

local people whereas the prospects are unclear regarding reductions in radiation levels, compensation, industries and jobs.

4.4. Interim storage facilities and decommissioning of the reactors

MOE has proposed to build interim storage facilities in two locations in Futaba Town, six locations in Okuma Town, and one location in Naraha Town. From 2015 MOE will start moving the waste material currently stored in temporary storage sites. Futaba Town and Okuma Town will witness the progression of the decommissioning of six nuclear reactors at the Fukushima Daiichi Nuclear Power Plant. Naraha Town and Tomioka Town host the Fukushima Daini Nuclear Power Plant, and the prefecture would like to decommission four nuclear reactors located at this power plant. However the intentions of TEPCO are still unclear.

At this stage, no unanimous decision has been made on how the installation of interim storage facilities can be accepted by the municipalities in the regions concerned. Increasingly it has come to be understood that the acceptance of interim storage facilities is inevitable for solving the problem of a lack of temporary storage sites for the waste generated by decontamination activities. However while the prospects of transportation to the final treatment facility are not yet clear, such installation of interim storage facilities may not be easily accepted. Additionally, MOE, Fukushima Prefecture and eight municipalities in Futaba County, initially agreed to set up an opportunity to discuss the issue together. However, this discussion was not held, and instead municipalities had to handle the matter individually. While they were facing the issue of restoring the nuclear plant as well as the problem of interim storage facilities, it was extremely difficult for the individual municipalities to formulate a plan for local reconstruction and restoration within their administrative range.

The development of reconstruction plans is an important opportunity to clarify the identity of the region as well as identify the steps needed to regenerate disaster-hit areas and support the lives of the people affected by the disaster. Up until now the municipalities have formulated plans aimed at quick reconstruction acting on the expectations of the residents. In the plans, it has been difficult to raise the issues of interim storage facilities and the decommissioning of nuclear reactors. However, while the municipalities formulated their restoration plans, they have understood that some of the larger issues will not be handled at the individual municipality level. One of these issues is coordination with the host municipalities in the out-of-town communities (temporary towns) mentioned earlier and the other is hosting the interim storage facilities.

Decontamination, community regeneration and livelihood rehabilitation: Summary

Gradually, people are thinking that it is not realistic to expect ful reconstruction of communities, or that all residents will return to their former homes. Instead the rehabilitation of livelihoods, job opportunities and societies should be pursued even with the current status of evacuation/migration.

Decontamination activities need to be re-examined in the context of reconsidering the reconstruction of communities and clarifying the desired state of the region after decontamination is completed.

The issues mentioned here, such as decontamination, rehabilitation of lives, compensation, and return to former homes, are intricately linked. There cannot be any prospects for restoration and rebuilding of lives if even one of them is left out, or unless one of these conditions is compromised to achieve another.

It is necessary to look for methods to convince diverse stakeholders and build a consensus by discussing multiple related conditions in one place and untangling the issues that are found at all stages of decontamination. This includes planning, communication and consensus building and implementation.

5. FAIRDO's Messages and Actions

5.1. FAIRDO's Messages: Looking back at "Decontamination"

At the beginning of this discussion paper, we presented the necessity of re-examining the desired targets, scales and measures of decontamination in light of the overall actions and initiatives in this area. In further consideration of the problem, we have analysed decontamination activities.

Firstly, municipalities made huge efforts to undertake the unprecedentedly large project, of clearing up radioactive materials scattered across a huge area. Despite various problems, such as insufficient human resources, knowledge and experience, substantial progress had been made. While decontamination of public facilities progressed in many municipalities, progress in decontaminating houses has been varied due to the diverse conditions and approaches adopted by the municipalities. Some of the municipalities undertook decontamination activities shortly after the accident and accumulated valuable knowledge about decontamination technologies, modes of communication with the residents and consensus-building. However such knowledge and experience was not shared with other municipalities.

Secondly, municipalities and decontamination operators need to communicate with the local people and form an agreement with them on a number of issues such as the targets and expected effectiveness of decontamination, temporary storage of waste material. There are various conditions to be agreed as people have differing expectations for rebuilding their lives, according to their family structure, industry, and relation with the regional society. In many cases, such conditions are "explained" in briefing sessions after the decisionby authorities has been made. However, it is hoped that the people themselves will be able to participate in the collective decision-making process, and make decisions either as individuals or as families.

Thirdly, rehabilitation of the lives of those affected requires a wide range of conditions to be met besides the reduction of radiation. The policies to reconstruct or maintain such conditions as compensation, infrastructure redevelopment, administrative services and employment support, are decided differently yet are closely interlinked. Decontamination has been seen as a separate issue from other measures for reconstruction, and the aim of "returning to the status quo before the disaster" has been the target of the national, prefectural and municipal governments as well as the local people. This aim implied the unrealistic expectation of reducing radiation to the same levels as before the accident, that is 1mSv/y or less, through decontamination activities.

In order to have concrete options and take action, residents need clearer prospects of the conditions needed to rehabilitate their lives. Some of the issues can be addressed by proceeding further with decontamination activities. However, there needs to be a change in the way of thinking on overall reconstruction policies, including decontamination. In other words, the aim "to restore the status quo" needs to be abandoned.

FAIRDO's Message (1) "Re-examine the scope of decontamination"

The ambient/surface radiation level is one of many conditions required for rehabilitating the lives of those people affected by the disaster. Decontamination needs to be conducted at appropriate levels that are balanced with measures that are in place to achieve other conditions.

"Appropriate levels" should not be determined by any single authority, such as the national, prefectural or municipal governments. It is impossible to set a condition that everyone can agree on as, according to their family structure, occupation, relation with neighbours and so on, people have various expectations for rehabilitating their lives.

If the diversity of these conditions and desires is not sufficiently taken into account, serious challenges may occur. For instance, people with expectations that radiation will be completely reduced may not be able to decide whether to come back or move and people who do not wish to return may not receive sufficient support. Furthermore a reduction in the level of radiation will lead to the termination of compensation and this may be difficult for some people. Finally, even after radiation has been reduced people will still be unable to return to their former lives as it is uncertain whether their neighbours will return and the rebuilding of infrastructure and services will be delayed. Efforts should be made to avoid such situations.

It is also important that the prospects of radiation reduction depends heavily on the selection of decontamination targets and technologies. Individuals and families will not be able to select the policies to be used for rehabilitating their lives unless they understand these prospects, and when they are involved in collective consensus building regarding regional reconstruction.

FAIRDO's message (2) Participation of residents and assurance of choices

The decisions of individuals and families regarding the rehabilitation of their lives should be treated with the utmost respect.

Additionally, public participation should be assured in the collective decision-making process for reconstructing areas and regenerating communities.

To respect the decisions of individuals or families, and ensure participation in consensus building, it is necessary to provide opportunities for exchanging information and having discussions.

Instead of "communicating after everything is settled" residents need to be involved from the survey and analysis stage. Building prospects through discussion with professional experts and government officers is an effective way of developing a consensus and communicating on the scope and targets of decontamination, as well as decontamination technologies and temporary storage facilities.

Such communication methods would significantly increase the burden on the municipalities in the short term. However, by sharing the methods of communication and consensus-building and the outcomes of decontamination activities with other municipalities, the burden would be reduced in the medium to long term.

5.2. FAIRDO's actions for shifting away from the "status quo" approach, and promoting participatory consensus building toward diverse forms of livelihood rehabilitation

FAIRDO plans to introduce several mechanisms and technologies in collaboration with the institutions concerned towards enabling the change in thinking described above.

FAIRDO's actions

(1) Initiatives for participatory and consensus building
- ✓ Preparation of regional round table discussions
- ✓ Utilisation of simulation tools including RODOS model, etc. for plan formulation and consensus-building
- ✓ Utilisation of brief assessment for consensus-building on temporary storages

(2) Promotion of information exchange and information-sharing between stakeholders to reduce the burdens of the initiatives mentioned above
- ✓ Establishment of an information platform

It is extremely important that information needed on an individual basis is provided by trustworthy institutions, and that support is provided so that individuals can obtain this information themselves. Additionally, since radiation and other risks are differently understood by each individual, it should also be kept in mind that the information required may also differ. In this regards there may not be sufficient information related to the expected reduction of radiation.

In addition to the physical risks, socio-economic risks also need to be taken into account. Radioactive material released by the accident has already affected society and the economy in various ways. Residents living in the region are required to select their place of residence and lifestyle after comparing completely different types of risks, namely, physical risks and socio-economic risks.

Furthermore, in many places it is not realistic to reduce ambient or surface levels of radiation to the "status quo" level before the accident or "below 1mSv/y". The regional environment management plan should be developed assuming that radioactive material will remain even after decontamination. The vision for the future of the region could elaborate upon these conditions.

- Establishment of regional roundtable discussion

FAIRDO aims to establish regional roundtables so that stakeholders can share and discuss conditions as well as formulating visions for the future. Several attempts have been made at the community level and municipal or prefectural level, including the "Association for Restoring a clean Oguni free from radiation" and "Ethos of Fukushima". In the "Association for Restoring a clean Oguni free from radiation", people themselves take detailed measurements of aerial radiation in the region, create maps, and measure

radioactive material in food in community public halls. However, administrative support is limited, and so such activities have not been replicated much in other areas. It has become increasingly important for the disaster-hit areas to set up opportunities for residents, community groups and the governments to share trustworthy information.

Initiatives taken in Belarus should be studied in this regards. In Belarusian schools, information sharing systems for disseminating information about radiation and its health effects are in operation. Local medical institutions also participate, and individuals who are trusted by the local residents share information using local organisations. If decontamination progresses in Fukushima and more people return, such information-sharing systems could be effective.

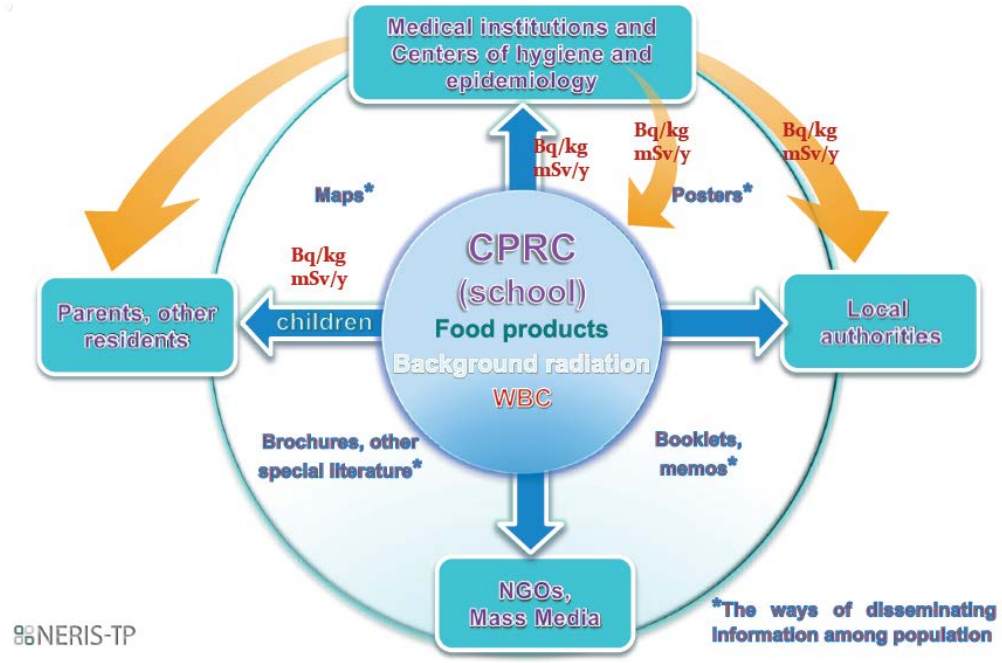

Figure 8 Information sharing system in Belarus (CPRC)

To reflect local conditions it would be beneficial to stimulate discussions at the municipal or community level. The next figure is an image of a roundtable where face-to-face discussions among stakeholders are held transparently to facilitate decision-making for decontamination and reconstruction activities.

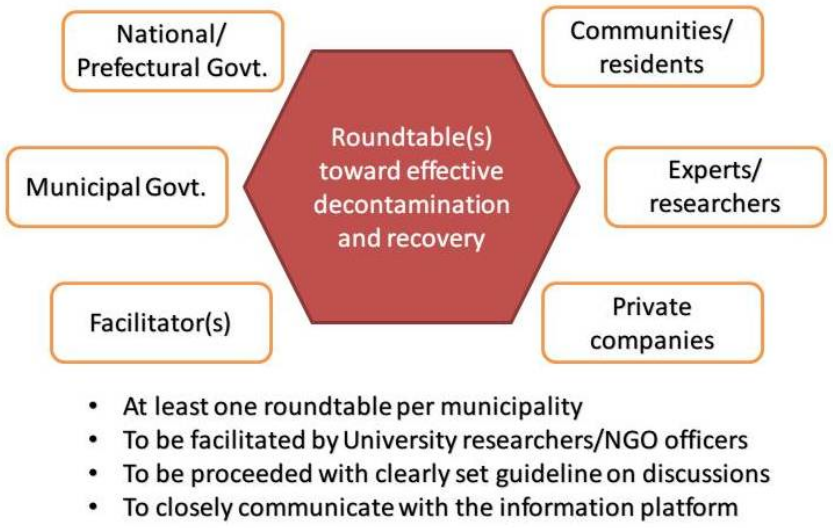

Figure 9: Image of the roundtable

During the initial stages after the nuclear power plant accident confusion in the transmission of information led to anxiety and distrust of the "safety standards" for radiation released after that. Additionally this confusion resulted in an excessive expectation that decontamination would be able to "restore the status quo" or result in "achieving 1mSv/y or less" in ambient radiation levels. Even after the initial stages had passed, municipalities and residents were forced to take relentless action. These actions included setting up temporary storage sites, accepting the interim storage facilities plan, obtaining compensation and developing reconstruction plans including the "out-of-town community" schemes. Opinions and measures that were independently expressed by the "professional experts" resulted in more confusion, and may not have helped municipalities and residents to address such difficult challenges.

The municipalities in the disaster areas and those affected by the nuclear accident should be provided with more options for actions. This is possible through increased opportunities to exchange information with the governments and the professional experts.

While it has been difficult to attain the "status quo", despite the massive efforts put towards this aim so far, it is necessary to design more comprehensive measures for radiation protection which include internal dosee protection, health management and food control. It is also necessary to provide more support to the evacuees, such as securing houses and work, allaying concerns about welfare, medical treatment and education. The roundtable could be utilised for developing such measures.

We would propose setting up and operating at least one roundtable for each municipality. The core of this roundtable operation would be that all stakeholders have an equal place at the table. Therefore, it is hoped that university researchers or NPOs will act as facilitators instead of government officials.

- Using simulation tools for formulating plans and consensus building

The precondition for consensus-building, related to the scope, methods and priorities of decontamination, is the sharing of important information between the residents, governments and professional experts, that is related to the regional environment. It is hoped that surveys and discussions will be conducted with the participation of the residents, instead of one-way communication of information from the government or the professional experts. Required information, in the context of aiming at radiation protection, and restoration and rebuilding of life after the nuclear accident, includes the status of radioactive contamination, the possibility of radiation exposure, the means of protection, the expected reduction of radiation through decontamination and its cost. It would be better if this information could be used for detailed calculations about the region, area and life styles of residents.

For example, when considering the decontamination implementation plan, it would be beneficial to look at the plan from the standpoint of reducing residents' exposure to radiation (reducing exposure that occurs in normal life) rather than evenly reducing aerial radiation in the target areas.

Construction companies and IT consulting companies have developed tools to support the preliminary simulation of radiation reduction. In addition to this, the Japan Atomic Energy Agency (JAEA) provides a "Calculation System for Decontamination Effect (CDE)" at no cost. CDE is a system developed for the purpose of calculating changes in aerial radiation rates before and after decontamination in agricultural villages or mountain areas where towns are scattered. It is possible to obtain fairly accurate data regarding aerial radiation distribution because aerial meshes used in calculations can be set to a minimum of 5m, and mutual influence between meshes can also be considered. Moreover, the effect of inclined surfaces can also be included in the calculation. Therefore it is a suitable system for areas covered in the scope of decontamination this time because of the large number of mountains and agricultural areas. CDE provides ambient radiation levels for soil and air. Therefore, it will serve as a useful tool when municipalities are formulating decontamination implementation plans for their target areas. However it has limitations in terms of its use for studying methods to contain radiation exposure by looking at the movement patterns of the

residents, and its use by the government or the operators in communicating with the residents.

In Europe, RODOS (The Real-time On-line Decision Support System) was developed based on the experience of responding to the 1986 Chernobyl nuclear power plant accident. RODOS forecasts the movement of radioactive material during an emergency response to nuclear disasters (nuclear power plant accidents, terror attacks etc.) and in the medium term, after some time has passed since the accident. Thus it supports stakeholders' decision-making by enabling a comparison of scenarios to be made based on the forecast. Unlike CDE, which measures the benefits of reducing aerial radiation through decontamination, RODOS is a tool that makes it possible to see the effects of containing additional exposure once the residents have started living normally after decontamination, and it can be used as a tool to support decision-making.

RODOS embeds information about all nuclear power plants in Europe and monitors data such as weather. In the emergency response phase for incidents such as nuclear accidents or terror attacks, it is possible to calculate the release and spread of radioactive material in the air and propose countermeasures. Besides, in the medium-to-long term, it is also possible to calculate the behaviour of radioactive material after they have settled on the ground, as well as the cost and benefits of different decontamination technologies. With regard to models that look into long-term measures, there is a model for residential areas (ERMIN), a model for agricultural industry (AgriCP), a hydrology model (HDM), and a forest model (FDMF). From 2003, they have become a part of EURANOS (European Approach to Nuclear and Radiological Emergency Management and Rehabilitation Strategies), which is a project implemented by the European Committee in preparation for nuclear accidents.

FAIRDO has been working on verifying the applicability of ERMIN to the disaster areas in Japan. ERMIN is capable of calculating the concentration of contamination of various environment media in urban areas with a high density of population and houses. It is also able to calculate the radiation rate both inside and outside of houses, as well as additional exposure taking into account the normal behaviour of the residents in several scenarios including whether decontamination is conducted or not. Furthermore, it also calculates the expenses required for decontamination work, the quantity and concentration of waste, and the radiation that workers are exposed to. Thus it supports the formulation of decontamination plans by evaluating and comparing multiple decontamination scenarios.

ERMIN has several deficiencies in comparison to CDE. Firstly, it can only deal with a minimum unit of space in a 100m mesh while CDE deals with a 5m mesh. Secondly, the mutual influence of gamma rays across meshes cannot be taken into account[73]. Thirdly, the effect of inclined surfaces cannot be calculated, which limits the accuracy of calculating the reduction of ambient radiation levels when compared to CDE. Fourthly, it cannot be applied to Japan unless differences are taken into account between Europe and Japan in terms of soil, trees, configuration and material used in houses . Given such limitations the FAIRDO team tried to verify the applicability by comparing model-based calculations and actual changes in radiation. They took a playground in Kashiwa City as a sample, and obtained a certain amount of reproducibility. Then the team conducted a similar verification in the Yonomori area of Tomioka Town and the Okuma Town area of Fukushima Prefecture where decontamination model verification projects of the Cabinet Office were undertaken. Based on indoor and outdoor radiation, and the lifestyle pattern of the residents, the team calculated the effect of decontamination on limiting additional exposure.

ERMIN is capable of simultaneously calculating various factors a few years after the accident and after the decontamination operation, which contribute to radiation levels and the contamination concentrations of each environmental medium. It is also capable of prioritising the target of decontamination based on regional conditions. ERMIN shows multiple decontamination scenarios with cost, amount and concentration of waste material, level of radiation dose to the workers. By means of visualizing those factors it clearly shows the difficulty of reducing radiation to zero even after decontamination. In other words, the risks after decontamination are shown.

Examples of calculations that can be made by ERMIN are shown below. These calculations could be used when the municipalities are formulating a decontamination implementation plan, communicating with the residents regarding the contents of the plan, making corrections as required and reaching a consensus.

- How many years would it take to reach the annual additional exposure of 1mSv (or 20 mSv), and how much decontamination work would be required in areas with high radiation levels?
- To what extent can the radiation levels be reduced with decontamination work within a certain feasible range and within the limited expenses available?
- To what extent can radiation levels be reduced following decontamination work, given the limited capacity of temporary storage?

[73] Average free progression of γ rays is about 70m, and in ERWIN that measures in the minimum mesh of 100m, and the mutual influence between meshes was at a level that would not pose any problem even if it were to be ignored.

- To what extent does the proportion of time spent indoors and outdoors effect additional radiation exposure?
- What effect does changing the cutting depth have on additional radiation exposure?

In addition, ERMIN gives a visual interpretation of the data required to discuss the formulation of decontamination implementation plans with stakeholder involvement. It could also be utilised for communicating about the formulation of decontamination implementation plans.

Model	Minimum Grid	Interaction across grids	Manners of describing the factors	Indoor dose	Transmission of radioactive materials among environmental media	Slope effects	Factors calculated	Suited target areas
ERMIN	100m	Impossible to take into account	3D disposition of houses, buildings, roads and soil	Possible to calculate	Possible to calculate	Impossible to take into account	Costs, amount of waste, exposure of the workers, amount of works	Urban area
CDE	5m	Possible to take into account	Atmosphere and soil only	Impossible	Impossible to calculate	Possible to take into account	Impossible	Farm lands and mountainous areas

Table 3 Comparison of CDE and ERWIN

- Consensus building regarding installation of temporary storage facilities using a brief assessment

Various approaches have been adopted during consensus-building for setting up temporary storage facilities and a great deal of experience has been gained. Taking into account that sufficient communication among stakeholders is a necessary condition for consensus-building, brief assessments carried out over 3 to 4 months may also be useful in addition to the existing approaches[74].

In particular, consensus-building on setting up temporary storage sites, with sufficient participation from the residents, may substantially contribute to the progress of

[74] In Japan, environmental assessment has mostly been applied to large projects. Thus, assessment is considered to be an activity that is takes both money and time . However, assessment is also applied to smaller projects in Europe and the United States. This is usually through using simplified methods that do not require much money or time. If issues that need to be closely explored are discovered as a result of this simple assessment, then a detailed assessment is conducted. Such cases do not exceed 1% of the overall cases in the United States.

decontamination. While the prospect of interim storage facilities remains unclear, there is a concern that temporary storage sites will end up becoming interim storage facilities. In such cases it is important to provide information for residents in a prompt and trustworthy manner. The one-way process of decision-making without providing appropriate information and without the consent of the stakeholders is not effective.

Information disclosure and the participation process form the core of environmental assessment[75]. The simple assessment enables information, such as activity plans and environmental impacts, to be provided quickly and this accelerates consensus-building.

- The information platform

It is also important to create a mechanism to share information produced by the municipal, prefectural and national governments, as well as other organisations and individuals.

With regards to procedures and techniques adopted by municipalities regarding decontamination activities, it can be expected that there will be a huge burden placed on the municipalities. This burden can be alleviated by accumulating and sharing issues and experiences.

Restoring the status quo (or achieving 1mSv/y) through decontamination activities is not realistic. It is no longer practical to implement measures that are aimed at the target suggested by the governments or professional experts. Individuals, families, communities and municipalities have begun pursuing various "plan-B" scenarios for reconstruction, regeneration and rehabilitation. Measures, methods and technologies to support such pursuits, decisions and/or agreements could be further introduced.

Having said that, such decisions are not easily made if information related to the present status and future outlook is limited, or if there is a large gap in understanding among the stakeholders. It is necessary to share, at least, prospects such as the

[75] The simple assessment method is not yet popular in Japan. Some of the attempts adopted by construction companies and so on could also be recognised as simple assessments. However, such voluntary initiatives of private enterprises without active involvement of government(s) may not always win the trust of the residents. In some cases near-public entities, such as universities, successfully win trust among local people by making use of simple assessments. In 2010 the Tokyo Institute of Technology conducted a simple assessment before constructing a high-rise building at Suzukakedai Campus located in Midori-ku, Yokohama City. Necessary information was presented to the stakeholders and opportunities for participation were provided to them through the sessions. As a result of this the simple assessment process went smoothly and was completed in about 3 months. Local residents highly appreciated the approach taken by the university. ('What is environmental assessment' Iwanami Shinsho pp. 129-132)

expected reduction of radiation (when it is impossible to go under 1mSv/y), and ask such questions as “which decontamination technology will have more of a positive impact on health?”, “how much money and time will these methods require?”, or “when will the local infrastructure and public services restart after decontamination?”. Additionally, “what are practical supportive measures for those people affected by the disaster to rebuild their lives?” could also be an important question.

It should also be pointed out apart from monitoring conducted by the central and prefectural governments, research institutions and NGOs, citizens themselves also monitor radiation doses on their own and disseminate this information. Such situations are favourably accepted, but it can easily create confusion at community, family or individual levels. There needs to be a transparent process in which information/data is developed, circulated and consumed in order to ensure that individuals or families, and communities can easily access trustworthy information.. Transparent information processes could also contribute to stakeholders communicating with each other on an equal footing, and thus facilitate the decisions of individual, family, or communities.

FAIRDO proposes to establish an information-sharing platform that will be a hub for necessary information in cooperation with municipalities in Fukushima Prefecture, related institutions or professional institutions.

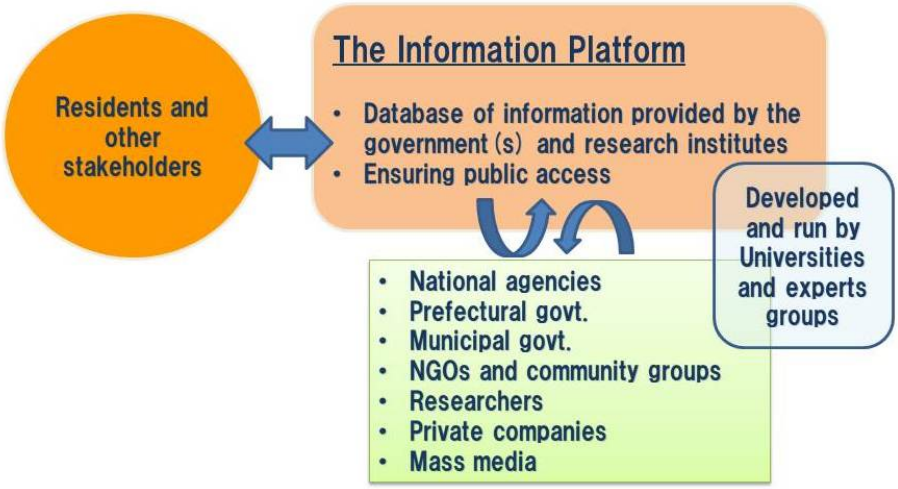

Figure 10 The Information platform

5.3. Conclusion

To reflect the local conditions, and communication needed to facilitate collaboration, FAIRDO has conducted empirical research on decontamination activities regarding three aspects, namely, governance and decontamination implementation plans. While conducting the research we understood that it was necessary to re-examine the scope of

decontamination in relation to the overall efforts of reconstruction, regeneration of communities and rehabilitation of livelihoods, rather than just pursuing "more effective decontamination." On such an understanding FAIRDO proposed several activities including roundtables and an information platform.

The information platform would be established and operated in close cooperation with a wider range of information sources as well as the Decontamination Information Plaza. The accessibility of information should also be carefully designed. Moreover, a mechanism to ensure a two-way information exchange should be introduced. We are aware that a great deal of expertise and manpower would be required to operate this platform. FAIRDO will try to coordinate with various institutes, including universities, research institutes and NPOs.

Similarly, the establishment of a roundtable in each municipality would require close coordination and cooperation with the prefecture and the municipalities.

FAIRDO will to conduct a series of roundtable meetings in Fukushima Prefecture to discuss the desired form and functions of such a platform and the community roundtables. We will be asking for cooperation from stakeholders, including the ministries and agencies, the prefectural government, the municipal governments, universities, NPOs, and experts involved in reconstruction after Fukushima Daiichi Nuclear Power Plant Accident.

Appendix 1: Framework of funds in relation to decontamination

FAIRDO has analysed the status of funds required and disbursed for decontamination and related issues from the three aspects of amount of funds, ease of using the funds, and promptness of payment.

The Act on Special Measures puts an obligation on TEPCO to bear the decontamination costs[76]. With regard to the actual flow of funds, the national government will first pay the cost of decontamination conducted by the municipalities, and it will then charge TEPCO. For smooth disbursement of funds while reducing the burden on the government coffers, the Nuclear Damage Liability Facilitation Fund[77] was setup in cooperation with other power companies. TEPCO can borrow up to JPY 5 trillion from this fund to cover the cost incurred from decontamination, compensation and decommissioning reactors.

Amount of funds

It is difficult to provide the necessary amount of funds while maintaining TEPCO'S capability to fulfil its obligations, and reduce the excessive impact on public finances. However, in spite of these issues the required funds should be disbursed in a timely manner.

The total amount of funds needed to get the issues caused by Fukushima Daiichi Nuclear Power Plant accident under control is not yet clear. Several researchers and organisations have tried to estimate the amount of funds required for decommissioning, decontamination and compensation. As shown in the table below, the results of calculations vary from JPY1.5 trillion to JPY40 trillion or more. In November 2012 TEPCO stated that the total cost, including decontamination, intermediate storage facilities, decommissioning and compensation would add up to JPY10 trillion. Third party researchers, such as The Society for Remediation of Radioactive Contamination in Environment and Prof. Nakanishi's Research Group, estimate JPY10 to JPY30 trillion. The estimated costs vary so much partly because some of them include the cost for decontaminating forest areas while others do not. Additionally, the cost of setting up the interim storage facilities is not yet clear. However most estimates bring the total amount to over JPY10 trillion if all of these costs are included.

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[76] In Chapter 5 Expenses, Article 414 of the Special Measures Act, it is mentioned that "Measures taken, based on this law, for handling environmental pollution caused by radioactive material from the accident, shall be treated as damages to be compensated by the nuclear plant operator as stipulated in Article 3, Paragraph 1 of the Act Concerning Compensation for Nuclear Power Plant damages (Act No. 147 of 1961), and it should be borne by the concerned nuclear power plant operator".

[77] Atomic Energy Damage Compensation Law (Distributed and Enforced on 10 August 2011)

Purpose		National Government[78]	TEPCO[79]	Society remediation of radioactive contamination in the environment [80]	Prof. Junko Nakanishi's Group[81]	Japan centre for economic research[82]
decontamination	Houses	✓	✓	✓	✓	✓
	Farmland					
	Roads					
	Forests	-				
Radioactive wastes disposal		✓	NA	✓	✓	✓
Intermediate storage facilities		-	✓	NA	✓	NA
Compensation		-	✓	-	-	✓
Decommissioning		-	-	-	-	✓
Estimated amount		**JPY1.5 trillion**	**JPY10 trillion**	**JPY10 trillion**	**JPY30 trillion**	**JPYMore than 40 trillion**

Table: Cost estimation for getting the issues caused by
Fukushima Daiichi Nuclear Power Plant Accident under control

Such large scale estimations may prompt us to carefully reconsider the cost and benefit of decontamination in terms of coverage or target radiation levels. Radiation decays with time, therefore putting a vast amount of money into decontamination activities may result in just slightly shortening the time before radiation levels decrease. It is necessary to practically discuss the appropriate level of investment in decontamination out of the total finance spent on the overall reconstruction policies[83].

Quality of funds, or ease of use

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[78] Cumulative amount from 3rd revised budget for year 2011 to the initial budget for year 2013 (The Ministry of the Environment, Decontamination Information Website < http://josen.env.go.jp/about/tokusohou/summary.html> Viewed on March 2013)

[79] TEPCO "Management policy for reconstruction" (7 November 2012)

[80] Oral presentation by Prof. Masatoshi Morita, The Society for Remediation of Radioactive Contamination in Environment (The Society for Remediation of Radioactive Contamination in Environment 5th Conference (12 March 2013))

[81] Oral presentation by Prof. Junko Nakanishi, Fellow of National Institute of Advanced Industrial Science and Technology (Asahi TV News Reporting Station (Broadcasted on 14 March 2013))

[82] From Japan Center for Economic Research "Thinking about terms and conditions of continuing nuclear power plants" (25 July 2012) Figure 1-1 Comparison of continuing nuclear power plants and cost of doing away with nuclear power by 205 0 (Total amount for 40 years) <http://www.jcer.or.jp/policy/pdf/pe(jcer20120725).pdf>

[83] It has been announced that Iitate village estimated JPY32.24 Billion would be required for decontamination of the entire village including forests (Iitate Village Decontamination Plan, 28 September 2011). Whether it is appropriate to conduct such expensive decontamination requires careful consideration, taking into account that the gross annual assets of Iitate Village are about JPY1.40 Billion (Fukushima Prefecture, 126th Annual Fukushima Prefecture Statistics 2012). Of course, decontamination is not conducted simply for the sake of the recovery of local economies. Such a "cost-benefit analysis" would be criticized as having a narrow perspective.

Sufficient funds may not be effectively utilised unless there is a mechanism for allocating money to the necessary targets in a timely manner. Considering that the purpose of decontamination is not only to reduce the radiation levels, but also to restore the safety and security of the residents, it is essential that funds are flexibly used to fulfil the requirements in disaster-hit areas.

However, the current funding mechanism does not effectively allocate funds to conduct decontamination with certain technologies required in the field. Decontamination expenses are calculated based on the list of technologies specified in the decontamination related guidelines. However, only limited technologies are available if municipalities intend to claim back the costs, whereas a wide range of technologies, that have proved to be effective in local contexts, may not be financially supported.

Moreover, after the decontamination guidelines were prepared in December 2011, they were not revised until the release of the second version in May 2013. Therefore, some of the technologies which have already been proven to be ineffective remained on the guidelines. For instance, radioactive materials remaining after a certain period of time are strongly adhesive and thus it is difficult to remove them with high-pressure washing[84]. Additionally, the decontamination guidelines set forests that are 20m from housing areas as being outside of the area to be decontaminated. However radioactive materials may be adsorbed by forests located 50m away and this may also significantly affect the radiation levels of the houses. To more effectively cover the decontamination expenses, it is hoped that there will be more frequent revisions made to decontamination guidelines or that they will be applied more flexibly.

The establishment of an integrated fund aiming at decontamination and reconstruction would mitigate some of the above issues. For instance, decontamination using high-pressure washing technology cannot be applied to some houses to decontaminate the roofs of houses, so the contaminated roofs need to be replaced. However, since putting on new roofs is understood as "reconstruction" work, the cost cannot be claimed as a decontamination expense[85]. An integrated fund could substantially alleviate and improve such inflexibility.

Moreover, expanding the scope of forest decontamination after revising the decontamination guidelines may lead to effective decontamination. Fukushima Prefecture promoted biomass power generation using thinned wood generated during

[84] Asahi Shimbun "High pressure washing of roofs has low decontamination effect – From accident to passage of time" (12 January 2012)
[85] Exchange of opinions with European professional experts (Professional experts workshop "Research concerning effective decontamination of Fukushima", 19 July 2012)

forest decontamination, assuming that branches of tress can be processed using biomass power generation,

Prompt payment of funds

Prompt payment of funds is just as important as securing the quality and quantity of funds. The current funding mechanism means that it takes quite a long time for the funds to reach the decontamination site since a series of approvals are required from the prefecture, national government, TEPCO and so on. Even at the national level, MOE put in a claim with TEPCO and that has not responded to in a timely manner. On the other hand, Fukushima Prefecture provides grant money for municipal decontamination activities. The municipal governments also try to secure their funds in hand for the sake of quick implementation. In such manners, promptness of funding is at least partly realised at the decontamination sites.

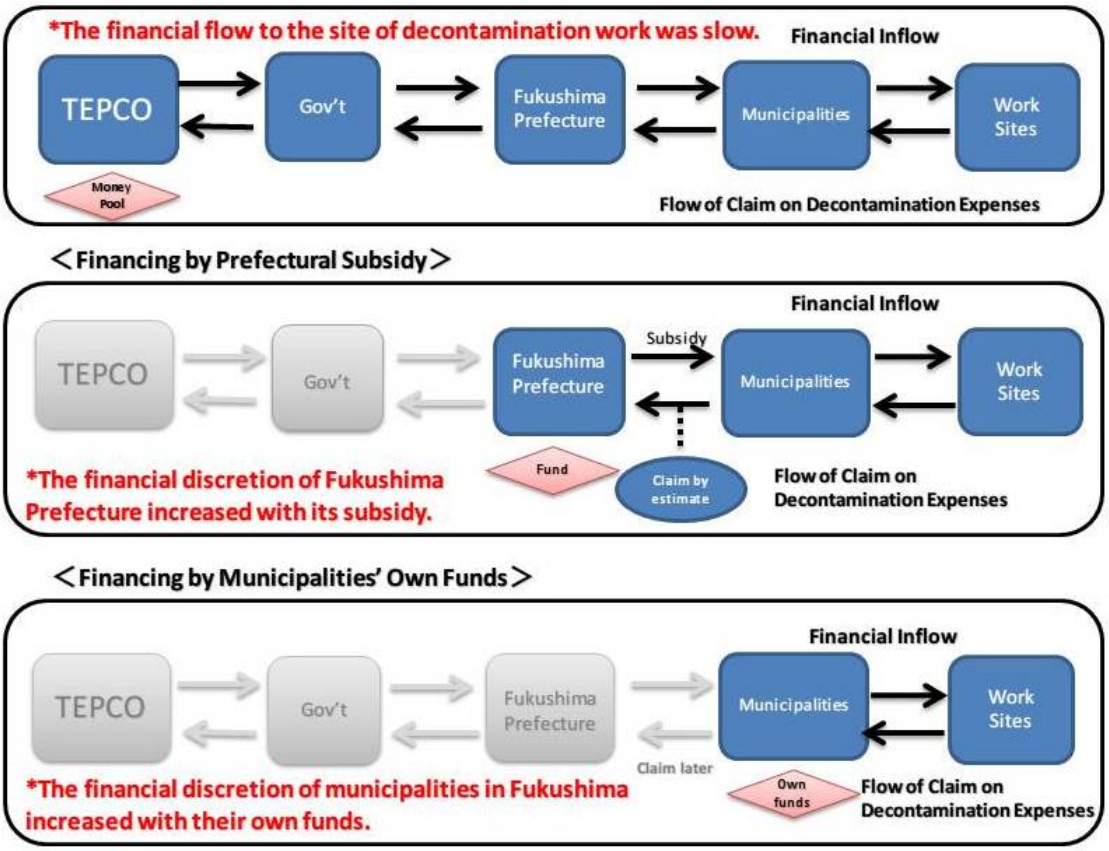

Figure 5 Funds for decontamination expense and flow of making a claim

- The National level: claiming from TEPCO

The cost of munisipalities' decontamination operation is covered by the national government which in turn claims compensation from TEPCO. Although TEPCO has

received about JPY2 trillion so far from the Nuclear Damage Liability Facilitation Fund[86], it appears that the payment from TEPCO to the government has been delayed. A total of JPY10.5 billion out of JPY14.9 billion that MOE has claimed has not yet been paid[87].

On the other hand, the national government introduced monetary measures such as grants and subsidies for decontamination expenses and lump-sum payments, for more trouble-free sourcing of funds by the municipalities[88].

- Prefectural level: Financial support to the municipalities through grant aid

In order to promote the decontamination activities of the municipalities, Fukushima Prefecture launched several measures including the Decontamination Grant Aid which came into force on 9 December 2011[89].

The background of this fund is that the central government established the Fukushima Fund for Management of Residents' Health (out of JPY21.8 billion for the East Japan Earthquake Reconstruction and Restoration Reserves the budget for decontamination accounted for JPY18.4 billion). Fukushima Prefecture capitalised on this money and established its Decontamination Measures Grant Aid for promoting municipal decontamination activities. While other prefectures are required to ask MOE for a Radiation Reduction Measures Special Emergency Response Subsidy[90] this unique fund in Fukushima Prefecture somewhat alleviates the municipalities' burden. Fukushima Prefectural government gains the Prefectural Assembly's approval and disburses the grant when municipalities' make a claim for the costs incurred by decontamination work, based on the decontamination implementation plans, conducted by the municipalities and costs incurred by setting up temporary storage for waste material generated due to decontamination. These costs will be finally claimed by the central government from TEPCO as compensation. Approximately JPY14.58 billion was approved in 2012. Fukushima City, Date City, and Koriyama City were the top receivers with JPY3.97 billion, JPY3.04 billion, and JPY1.59 billion respectively[91].

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86 TEPCO (2013) "Regarding correction of "Implementation plan in specific nuclear facilities in Fukushima Daiichi Nuclear Power Plan""

87 Mainichi Shimbun "TEPCO: JPY10.5 Billion of decontamination cost unpaid" (22 March 2013)

88 The Ministry of the Environment (2013) "Decontamination promotion package"

89 Fukushima Prefecture (2011) "Summary of grant aid to decontamination measures and projects"

90 The Ministry of the Environment (2013) "Decontamination promotion package"

91 Fukushima Prefecture (2012) "Status of contamination in municipal decontamination areas pertaining to decontamination measures grant aid (End of December 2012)"

The basic unit price of cost to be reimbursed is decided based on Annex-Table 1 and 2 in the summary guide to decontamination activities grant aid. For instance, the basic unit price for surface removal and decontamination of soil for an independent house with an area of 400 m^2 is JPY150,000 (375 /m^2)[92]. Municipalities formulate budgets based on the stipulated basic unit price[93].

The grant fund has several issues toward more effective support for the municipalities' activities. The fund basically supports the technologies specified in the decontamination guidelines or decontamination measures implementation procedure. However sometimes municipalities request to apply for certain technologies to meet the requirements of the decontamination sites, but these requests are not supported[94].

- Municipality level: Using the funds in hand

As was mentioned in Chapter 2 of the main report, some municipalities conducted decontamination ahead of others, even before the enactment of the decontamination measures grant aid in December 2011. Those municipalities made use of their own funds that were on-hand, for the initial cost. In particular, Date City judged that it would be able to claim these costs from TEPCO at a certain point, and decided to use the funds available on-hand to establish the decontamination units[95].

To promote the use of these on-hand funds in hand, it is necessary to develop a system where the municipalities can claim reimbursement after using their own funds at decontamination sites.

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92 Fukushima Prefecture (2011) "Summary of grant aid to decontamination measures and projects"
93 Interview of Koriyama City (12 November 2012)
94 Date City Interview (4 February 2013)
95 Mainichi Shimbun "(Debate) Decontamination, Is this fine? Hanzawa-san, Nakanishi-san, Hosono-san, 2 Years After Great East Japan Earthquake" (12 March 2013)

Appendix 2: Development and verification of decontamination technologies

Decontamination catalogue

- The Clean-up Subcommittee of the Atomic Energy Society of Japan's "EURANOS Data Sheet" and "Catalogue Ver. 1"

On 23 April 2011, JAEA's "Nuclear Safety" Survey Committee set up the "Clean-up Subcommittee for the reconstruction of Fukushima Hamadori", which was unable to resolve several issues that had resulted from the accident. From 2002 to 2006, this subcommittee translated the "Comprehensive handbook for managing residential areas (Generic Handbook for Assisting in the Management of Contaminated Inhabited Areas in Europe Following a Radiological Emergency)" from the outcomes of the EURANOS (European Approach to Nuclear and Radiological Emergency Management and Rehabilitation Strategies) project implemented by the European Committee in preparation for emergency situations related to radiation such as nuclear power plant accidents. On 12 August 2011, it was published as "EURANOS Decontamination Data Sheet Translation Ver. 1.0" (hereinafter referred to as "EURANOS Data Sheet")[96].

Based on EURANOS Data Sheet, the "Decontamination Technology Catalogue Ver. 1" (hereinafter referred to as "Catalogue Ver. 1") was prepared which described 64 technologies, including an assessment of the possibility of applying this handbook to Japan. It was published on 27 October 2011[97]. In Catalogue Ver. 1, it was possible to compare the contents of the EURANOS Data Sheet with the additional information given by the Clean-up Subcommittee. Furthermore, in Catalogue Ver. 1, roofs, walls, premises, and the inside area of rooms are mentioned in the scope of decontamination. Areas other than the living environment are also included in the scope of decontamination, such as hydroponic gardens, farmland, orchards, forest, water area, rubble and animal carcasses. In all, 27 out of 64 technologies described in the catalogue are not related to living environments (out of that, 20 are unique to Japan).

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[96] EURANOS Data Sheet. In this, there are 59 technologies of decontamination for residential environments. There are not only decontamination methods, but their effectiveness, waste material amount, cost, and side effects are also described.

[97] In Catalogue Ver. 1, roof, wall, premises, and the inside area of rooms are mentioned in the scope of decontamination. Furthermore, in Catalogue Ver. 1, not only living environments, but also hydroponic gardens, farmland, orchards, forest, water area, rubble, and animal carcasses are also included in the scope of decontamination. Therefore, 27 items out of 65 items are not related to living environments. 20 items out of these 27 items are Japan specific, and some of these 20 items include items under research at the time of announcement. Japanese literature, as well as that from overseas, was also referred to for finalising the items.

- Cabinet Office's "Decontamination Technologies Catalogue Version 1"

The Clean-up Subcommittee's insights were incorporated into the initiatives taken by the national government. On 22 November 2011, the Cabinet office's Nuclear Disaster Victims Life Support Team published the "Decontamination Technologies Catalogue Version 1" by summarizing the outcomes of the decontamination technologies survey that was conducted by the government, combined with information described in Catalogue Ver. 1 and the Clean-up Subcommittee's EURANOS Data Sheet. The Decontamination Catalogue categorised the target areas for decontamination into residential buildings, gardens, roads, schools, kindergartens, day-care centres, trees found in living areas and agricultural land. The Catalogue also lists 23 different radiation reduction technologies for each decontamination target. Decontamination of swimming pools and volume reduction technologies appeared for the first time in the Decontamination Catalogue. Furthermore, there are methods based on EURANOS Data Sheet and, because most of them are already verified, the detailed precautions and benefits of decontamination are described. It is also noted that this Decontamination Technology Catalogue is "Comprehensively summarized, and it does not indicate the scope of application of monetary measures in decontamination by the national government".

Development of decontamination technologies

- Technical tests and selection by the Cabinet Office

The decontamination model project mentioned here is one of the two projects outsourced by the Cabinet Office to JAEA on 22 September 2011 as a "Decontamination demonstration project in the evacuation zone pertaining to the Fukushima Daiichi Nuclear Power Plant accident". Another one outsourced to JAEA is "Decontamination technology demonstration experiment project (hereinafter referred to as "Trial Project"). The Trial Project was an open offer to find promising and feasible new decontamination technology, and evaluate its effectiveness by conducting verification tests. The open offer asked for technologies in the areas of decontamination work streamlining technologies, volume reduction technologies for removing materials such as soil, technologies related to temporary storage and transportation of removed materials, and technologies related to decontamination support. The selection was made based on the experience of JAEA, and considered whether the technology helps to improve the problems. A total of 25 technologies were selected from 305 applications, and the report was published in June 2012. Some of the technologies that were selected will be introduced in the following paragraphs.

It has already been mentioned in the EURANOS Data Sheet that roads and buildings can be decontaminated by washing with high pressure water of 15 MPa or more, and this has also been confirmed by JAEA. However, high-pressure washing removes a large amount of material due to physical wear, and thus damages the property. Working on roof tiles is dangerous since it requires working at height. In order to prevent secondary contamination, decontamination methods that do not use water are preferable. Therefore, several methods were tested such as grinding with a polishing agent that includes water, using special water, washing with ultrahigh-pressure water, and grinding and stripping without using water. Washing with ultrahigh-pressure water pressurized up to 280 MPa had a very successful removal effect, and the water used could be taken up. Therefore, it was evaluated as a technology that can be immediately applied. The method of grinding using a polishing agent had a medium removal effect, and it was evaluated as a technology that can be immediately applied. The method of grinding and stripping without using water also had a medium removal effect and low cost, and it was evaluated as a technology that can be immediately applied. For the special water method, the method of using nano bubble water as a substitute for surfactant, and Ozone water that acts as an oxidizing agent was selected. However, it could not be confirmed whether the benefits were comparable to the cost.

Trial decontamination of swimming pools in schools was conducted mainly by JAEA using adsorption-flocculating agents with a focus on zeolite. The method of using a combination of flocculating agent and ferrocyanide iron was selected, although this method has not yet been verified by JAEA. Ferrocyanide iron is mentioned in Catalogue Ver. 1. The method based on a ferrocyanide iron formulation adsorbent flocculating agent is indicated as having the problem of cyanide treatment, but it is evaluated as a technology that can be immediately applied.

The smaller the soil particle size the higher the adsorption of Cs (Cesium) per unit weight. Therefore, the technology for efficient recovery of the clay content of the small soil particles is effective. In addition to six technologies using wet classification, two technologies for direct removal of Cs were selected. As far as the cost of classification is concerned the key points are the location and scale of the classification process, as well as how much volume reduction can be obtained. Using classification at the decontamination site has cost benefits, but if the proportion of fine particles is high in the original soil then the volume of reduction efficiency will be low and this will result in high costs. Direct removal of Cs requires high temperature heating and washing, and therefore, despite the high decontamination effect, soil will lose the nutrients required for farm produce. In any case, the development of agricultural land decontamination

technology is very much required.

So far, there has not been any basic data such as the changes in aerial reduction due to the contamination of forests. However, an investigation was conducted by the Fukushima Prefecture Forestry Research Centre and decontamination benefits were found by removing fallen leaves. Volume reduction by incineration is effective for the treating plants, like grass, and livestock manure which contains radioactive material, or for treating organic matters such as mulch and bark,. However, because of concern about secondary pollution due to fly ash, processing and treatment methods other than incineration are strongly preferred. Therefore, two technologies for volume reduction through composting (fermentation) by microorganisms were selected. It was confirmed that by mixing the livestock manure, as a source of nitrogen necessary for composting, the reduction in the volume of both the livestock manure and plants can be achieved at once, but it cannot be used as fertiliser. In addition, the mechanism of aeration and heating for promoting reactions is a challenge.

- Technical verification by the Ministry of the Environment

Test projects outsourced by the Cabinet Office to JAEA were subsequently taken over by MOE's "Decontamination Technology Verification Project" (hereinafter referred to as the "Technology Projects"), and they are still outsourced to JAEA. For technology projects, the purpose was to collect information about decontamination technologies, conduct technical decontamination, and make evaluations to formulate the technical policy for decontamination projects at MOE. During 2011, 296 proposals were received and 22 were selected. The report was published in December 2012. The key feature of these selections s about half of proposals, 10 proposals, to be precise, were related to the treatment of organisation matters and incineration ash not formulated in the decontamination related guidelines.

With regard to the decontamination methods for road surfaces and concrete, three proposals for high pressure washing and ultrahigh pressure washing were selected. These treatment methods are the same as the ones tested in the test projects outsourced by the Cabinet Office, but they are conducted by different operators. Additionally it was found that the parameters that increase the decontamination effect were high pressure, small water amount, and strong pulling force. With regard to soil, four proposals for classification based methods, and one proposal for surface soil stripping were selected, and it was confirmed that comparable benefits as the verification projects are obtained. However, for the decontamination of soil it is necessary to put in place reuse standards rather than technologies.

Regarding the decontamination of organic materials, two cases of volume reduction by combustion and four cases of biomass power generation and ethanol conversion were selected. From these results, while Cs will remain in the charred objects, it is confirmed that Cs does not move into the gas and ethanol generated due to heating. Three cases in these assume that the electricity will be sold. Furthermore, because not only the cost of the initial investment, but also the cost of transporting wood will also be incurred, it is necessary to build a mechanism considering these points. With regard to parks, two cases were selected. While the treatment methods for parks are not described in the decontamination guidelines, the cost of removing wood chips (park chips) is covered in the scope of compensation. MOE recognises that establishing a treatment method for parks is a challenge. Parks were washed, and after washing, volume reduction was done through compaction. It could be confirmed that parks could be decontaminated up to the provisional tolerance value of fertilizers. However, considering that it may be bought in due to rumours, and considering the risk of fire due to fermentation while sediments are stored, it is preferred that it be incinerated rather than used. With regard to incinerated ash, two cases of volume reduction through solidification and washing with Prussian blue were selected. Even if fly ash is solidified, Cs will elute, and therefore it is necessary to continuously develop technology to prevent elution. Besides, it is accepted that it is important to stabilise Cs by reducing the volume of contaminants through Prussian blue based washing. This evaluation is similar to the test activities.

The technology projects for fiscal year 2012 adopted 15 out of 173 proposals. Of these, 8 proposals are techniques related to incineration ash and organic matter treatment, including burkes. For fiscal year 2013, proposals again being invited by the Reconstruction Agency and MOE.

Thus, several projects were launched to search for new technologies, but these results have not yet been reflected in the decontamination guidelines. The methods described in the decontamination guidelines are included in the scope of the subsidy. As the guidelines are used by the residents, it is recommended that usable technologies are incorporated as much as possible because that will give more options to the residents. Moreover, just like the Decontamination Catalogue and handbook of EURANOS, it is better to describe all items that may help the residents make selections, such as effectiveness, cost, results achieved by actual decontamination, and detailed precautions.

Decontamination work support system

- IT Support for field surveys and dialogues with land owners

IT based systems to support decontamination activities through radiation monitoring before/ after decontamination, formulation of plans and so on with data collected in a timely fashion at the site have been introduced by a number of organisations and private companies. JAEA's Calculation system for the Decontamination Effect (CDE) is among the most popular. Construction companies such as Taisei Construction, Ando Hazama, and Kajima also developed data analysis and presentation systems for using in their own decontamination operations. Some of the IT companies and consulting companies like Pasco, Infomatics and Fujitsu provide similar systems to the municipalities or the vendors.

The above-mentioned systems can be run on generic notebook computers or tablet devices. We could categorise them into two types, the cloud computing type and the stand-alone type.

The "Calculation system for Decontamination Effect: CDE" developed by JAEA is a stand-alone system. User can download the CDE programme from JAEA's website free of cost, and run it on Microsoft Excel. Map information and radiation information must be entered by the user.

Other systems require users to input and convert data into forms on the site by using generic mobile devices. Then the data is transferred to a cloud-based database. It should be noted that most of the operators working for decontamination works already had their own data systems before the Fukushima Daiichi Nuclear Power Plant Accident for various reasons including sharing updated information with the owner of the site, designing firms/consultants and supervising company and JV companies at the site in a timely manner. MLIT has also promoted such information-sharing systems. The rapid spread of smart devices such as smartphones and tablets has also facilitated the use of network-based systems. For example the Taisei Corporation installed its own e-procurement system in 1998. It has run the "Construction Site Series" offered by Mitsubishi Corporation since 2003 which connects construction sites managed by more than 13,000 companies. Another example is the SaaS type cloud service "Forms@Tovas" from Kokuyo S&T which supports the management of ledger sheets from generation to dissemination. In 2011, it developed a "Field Pad" application for iPhone/iPad for the purpose of improving operations in construction management and for improving quality management. In such cloud-based systems, users can simply use a smart device to create documents either by inputting the information or taking photographs at the construction sites.

The Taisei Corporation's decontamination system "TISD" is also capable of completing a

survey, selecting of decontamination technology, and preparing explanatory documents for the landowners at the site. The TISD application is installed on an Android-based tablet device, which is used at the site to input data from field surveys (photographs of building, etc.) and land building surveys (material, damage check, etc.). Then radiation information and map information is obtained, and the survey results are uploaded to the server. In this manner the data is shared with other teams/operators working at different sites. Upon selection of the decontamination technology the system also generates a letter of consent to be filled out by the landowner (signaturebased electronic authentication). Thus all activities required before starting the work can be done at the site. The introduction of the system reduced the preparation time by 75% compared to that of decontamination model projects which were done without the system. The time needed to prepare documents was shortened by a little less than 30% and personnel costs were reduced by 40%[98]. According to Taisei, preparing explanatory documents for landowners took the most time in the overall decontamination model projects. For the time being since Taisei launched decontamination activities, it has conducted field surveys and land building surveys separately. However, thanks to TISD both surveys are now simultaneously conducted. While the model project took 20 days for survey and planning it takes just 15 days to complete them after installation of TISD.

- Support of monitoring technologies

The development of various technologies to support monitoring/measurement is underway. Some of them reduce the measurement time while others improve the accuracy of radiation measurement in a spot or in a wider area range.

JAEA has developed the "Gamma Plotter" as a technology for reducing the measurement time. The Gamma plotter is a portable device equipped with GPS (Satellite based global positioning system) antenna, which monitors the distribution of flat gamma rays. JAEA has also developed a surface radiation measurement device called the "Scintillating fibre" which is a detection tool of 20m in length. The Scintillating fibre shows the measurement result of radiation in real time on a PC display or as a map. In addition, a system to calculate the ambient radiation at 1m altitude over the ground surface with an unmanned helicopter flying at 50m altitude to estimate the distribution of the ambient and surface radiation before and after decontamination is installed. A system for measuring gamma radiation on earth from a

[98] "Tablets used for decontamination activities" The Nikkan Kensetsu Kogyo Shimbun, 22 February 2012.
Yuri Shimizu, Yohei Tanabe, Yasuhiro Sato (2012) Development of construction management technique using next generation mobile devices, Taisei Construction Technology Centre Report, Vol. 45, 61-1 - 61-5.

150-300m altitude by mounting highly sensitive radiation detection in the aircraft is also under development[99].

The Nishimatsu Construction Co., Ltd. has developed the "Aerial radiation mapping system" in collaboration with Ibararaki Technical High School and Digimate. This system simultaneously measures and records the ambient radiation distribution and navigation function by using high precision positions (RTK-GNSS). Through this system, the operator does not need to conduct a preliminary survey of the measurement position. Moreover, one measurement operator can simultaneously very efficiently measure ambient radiation at multiple sites in a short time[100].

The Obayashi Group has selected AMEC Group's "Orion Scanplot" for verification experiments[101]. This is a mobile radiation monitoring system with a mapping function that collates detailed radiation distribution with GPS. Kajima also uses the GPS-linked monitoring system, and undertakes radiation surveys and records values for construction surfaces in detail[102].

[99] As measurement is done from above, the concentration of radioactive material on the ground surface is calculated after considering the decay due to elevation.
[100] http://www.nishimatsu.co.jp/news/2012/prel1116.html
[101] http://www.robonable.jp/news/2011/08/31obayashi.html
[102] http://www.kajima.co.jp/news/digest/mar_2013/feature/josen/index-j.html

Appendix 3: Outline of EURANOS and RODOS

EURANOS and RODOS: Historical Background

- EURANOS (European Approach to Nuclear and Radiological Emergency Management and Rehabilitation Strategies)

EURANOS is a project that was under the supervision of the European Committee between 2004-2009. It formulated guidelines for emergency response measures related to nuclear and radiological emergency conditions. A total of 33 research institutions and 17 countries participated in the emergency response centre. They described technical and administrative measures for emergency response and medium-to-long term recovery with regard to food life systems, residential areas, and drinking water.

Among the handbooks created as one of the outcomes of EURANOS, the "Comprehensive handbook for managing residential areas", "Datasheets", "Factors related to measures", and "Features of radionuclide and problems of waste material" describes 50 items of decontamination technologies for use in the residential environment. These handbooks enable countermeasures to be formulated by making comprehensive judgments of factors such as the costs and benefits of evacuation, shielding and decontamination, social and ethical problems and so on. Comprehensive countermeasures could be developed which include risk assessments, radiation in unit deposition amount of radioactive nuclide, the radiation rate, shielding coefficient, half-life period, energy value, waste material, and radiation exposure of workers.

The handbooks were translated into Japanese by the Clean-up Subcommittee of the Atomic Energy Society of Japan and published as the "EURANOS Data Sheet."

- RODOS (The Real-time On-line Decision Support System)

Based on the concept developed through the EURANOS project, RODOS was developed as a model simulation tool. After the Chernobyl nuclear power plant accident in 1986, European countries realised that they were inadequately prepared for such an event, and that they had taken inappropriate measures to protect people from radiation. With this background RODOS was developed as a forecast model for nuclear disaster emergency response to predict the release of radioactive materials and their subsequent movement in air by using meteorological models. It has been a part of EURANOS since 2003. In 2009, JRODOS, running on JAVA, was also developed.

RODOS is capable of comparing multiple scenarios based on the model calculations from a long-term and short-term perspective. Thus it can be used as a decision-support

tool. Having information on nuclear power plants over Europe and monitoring data for weather information, it can calculate the atmospheric release and diffusion of radioactive material in the case of an emergency such as acts of terrorism and nuclear accidents, and propose the countermeasures. After the emergency phase it shows the behaviour of the radioactive material after it has been deposited. The long-term measures include several types that are specific to the targets, such as the model for residential areas (ERMIN), model for agriculture (AgriCP), hydrological model (HDM), and forest model (FDMF).

Web-HIPRE, the decision-support tool, prioritises countermeasures based on the weight set for each user with regard to factors such as cost, amount of work, radiation exposure of workers, and decontamination benefits.

- ERMIN

FAIRDO has been testing the applicability of ERMIN, the model for calculating the behaviour of radioactive materials in residential areas, and the potential benefits of decontamination. The data to be input to this model are (1) the initial deposit amount (Bq/m^2) in the target area; (2) the environment setting, and (3) decontamination details. From the deposit amount input the initial deposit amount for each environmental medium is estimated (including outflow of wet deposition). Then the retention (breakdown and outflow) of radioactive materials is calculated. For instance, asphalt road, concrete, soil, grass, etc. Next, the radiation rate (Sv/h) at the sites inside the grid is calculated from the contamination concentration (Bq/m^2) of each environmental medium. This uses a Monte Carlo Code based simulation. When thinking about three dimensional spaces including buildings, by calculating the emission of γ rays from a certain contamination source it is possible to calculate the aerial decay and shielding effects. The calculation outputs are the contamination concentration and radiation of each environmental medium in the target areas, the aerial radiation rate, the radiation exposure of workers, amount and concentration of removed materials after decontamination, and cost.

Appendix 4: FAIRDO (Action and Research on Effective Decontamination Reflecting the Circumstances of the Contaminated Regions)

FAIRDO is an action research project launched in June 2012 for the purpose of offering various advice and guidance in a timely and appropriate manner for the effective implementation of initiatives for full scale decontamination undertaken by the national, prefectural and municipal governments from 2012 onwards. FAIRDO formed a team of interdisciplinary experts from Japan and overseas, and collaborated with the communities and agents for decontamination such as municipalities. FAIRDO attempts to propose effective decontamination methods, and engages in activities that contribute to improvements in communication and decision-making in decontamination operations.

The research team is composed of academic experts who are actively involved in decontamination and reconstruction in Fukushima through various channels, as well as European researchers who played a central role in the EURANOS project. Throughout the project period of two years, it conducted research concerning the three themes of effective governance on decontamination, development of decontamination plans that reflect local conditions, and communication that promotes collaboration with the local residents. At the same time, FAIRDO also conducts activities including dialogue meetings in the field. The objectives of each research theme are as follows.

- Theme 1: Effective governance on decontamination

  Theme 1 aims to conduct research on and analysis of several issues including the roles and responsibilities among key stakeholders, financial mechanisms at each level of radioactivity monitoring, development of decontamination plans, coordination, implementation and ex-post assessment, information flow, and effective use of human capital including experts. As well as this it aims to make a comparison of the governance systems for decontamination in Europe and Japan. It also intends to make recommendations for a more adequate decision-making process and for effective governance on decontamination, including relevant laws and regulations.

- Theme 2: Development of decontamination plans that reflect the local conditions

  Theme 2 aims to make recommendations for the most effective strategies for decontamination, based on the experiences gained from Europe and looking at estimates according to existing European models on decontamination. It also intends to identify the factors necessary to apply optimal decontamination models

to the current situation in Fukushima based on the Real-time Online Decision Support System for nuclear emergency management ('RODOS') and the European approach to nuclear and radiological emergency management and rehabilitation strategies ('EURANOS').

- Theme 3: Communication that promotes collaboration with local residents

  Theme 3 aims to observe and analyse the current risk communication on decontamination at selected research sites, and then carry out a comparative analysis of risk communication among municipalities and between lessons learned in Europe and Japan. If close coordination on risk communication can be identified at the research sites then it will also attempt to put risk communication into practice at the local level.

Fukushima Action Research on Effective Decontamination Operation

FAIRDO2013

Challenges of Decontamination, Community Regeneration and Livelihood Rehabilitation

[2nd Discussion Paper]

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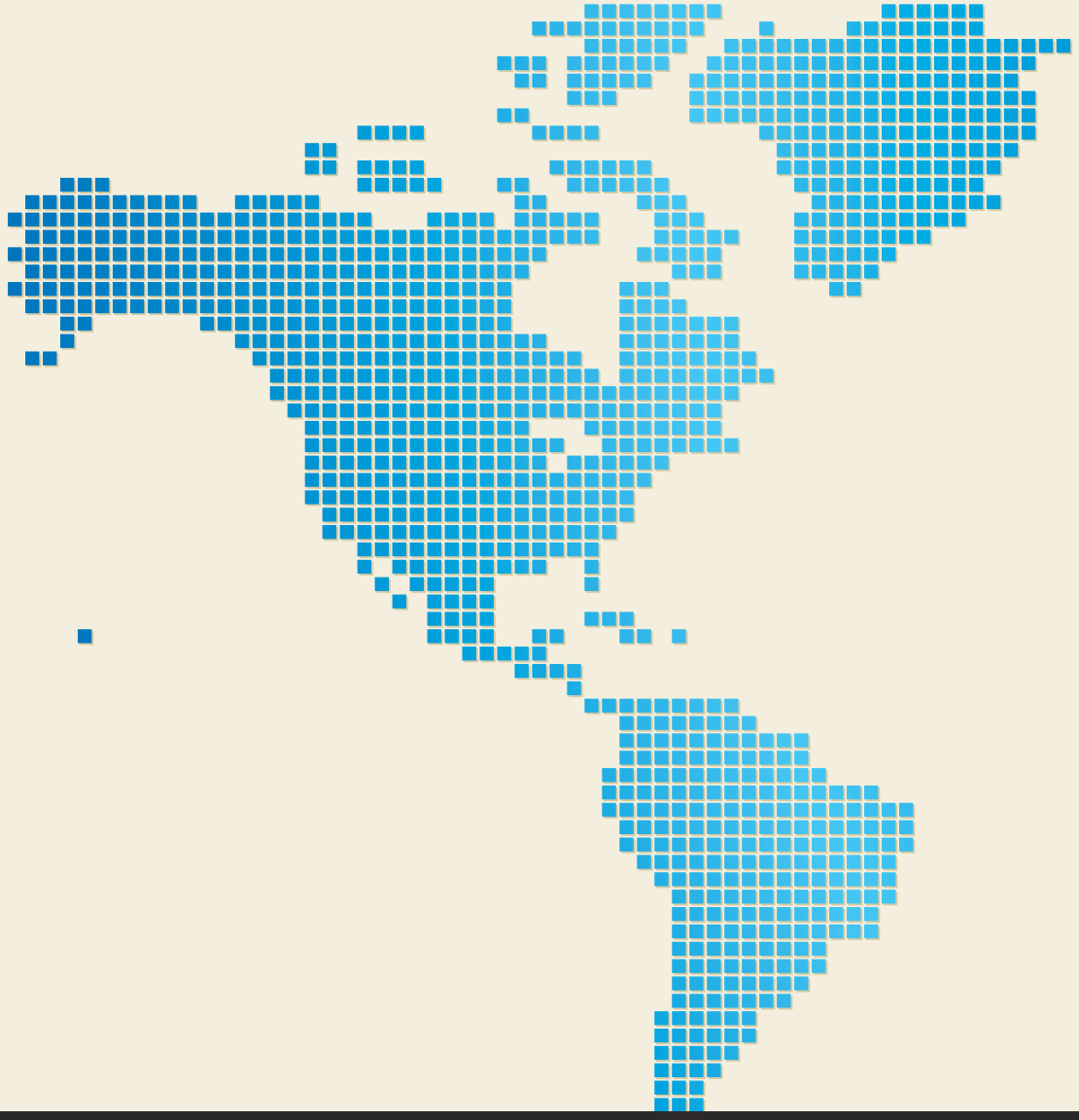

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