Lesson Learned from the Implementation of Decontamination in Japan

May 25, 2016

Hiroyuki Kuroda

Policy Researcher

Ministry of the Environment, Japan

1.Current Situation of Off-site Decontamination

2. Decontamination Report

3. Future Challenge

Decontamination based on the “Act on Special Measures”

1) Special Decontamination Area

Designation of SDA by the Minister of the Environment

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Development of the decontamination implementation plan in the SDA by the Minister of the Environment

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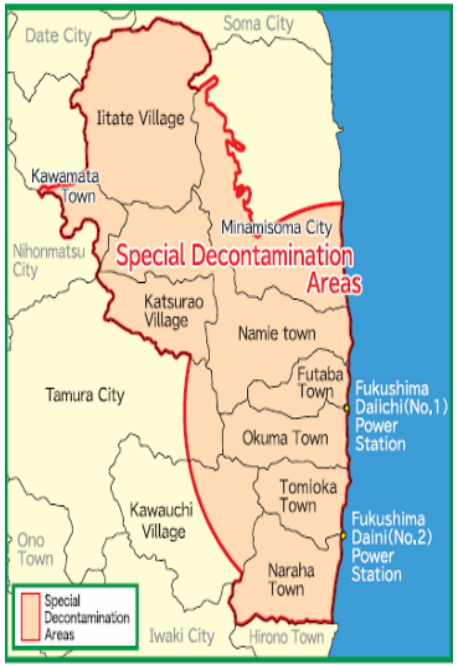

Implementation of decontamination by the national government

2) Intensive Contamination Survey Area

Designation of ICSA by the Minister of the Environment
(Areas where air dose rate is 0.23μSv/h or more)
※0.23μSv/h is a criterion for designation of ICSA and not a decontamination target

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Survey measurement by the mayors of the municipalities

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Development of the decontamination implementation plan by the mayors of the municipalities

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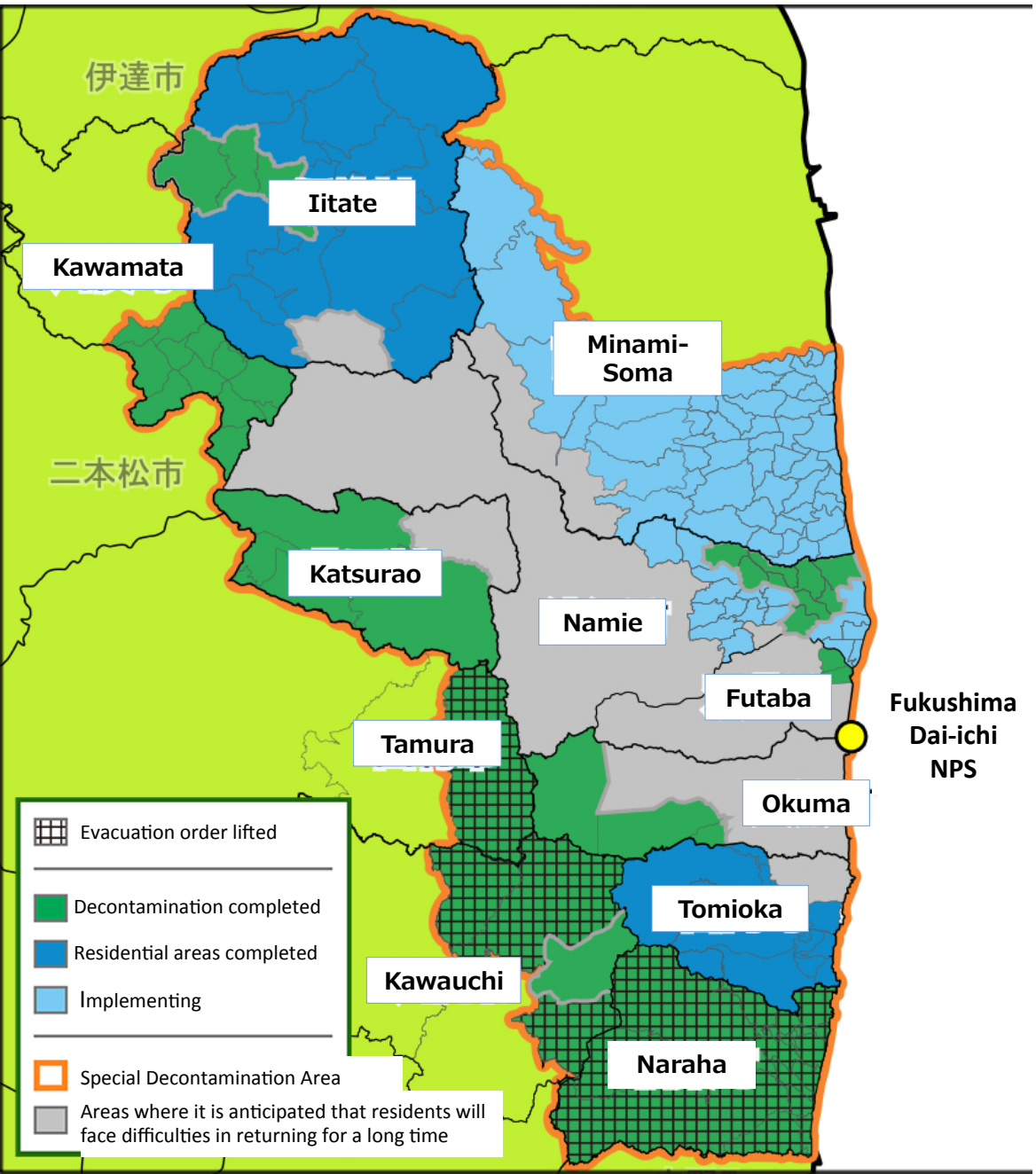
Implementation of decontamination by the municipalities, etc.
(The national government allocates budgets.)

Note: The air dose rate 0.23μSv/h corresponds to a cautiously estimated individual exposure dose of 1mSv/y assuming that people spend ① 8 hours outside ② 16 hours in a wooden house with a low shielding rate in a day

Decontamination and disposal of soil at NPS

Implemented by the nuclear power station operating company in charge (TEPCO)

Progress in the Special Decontamination Area② (As of the end of March, 2016)



＜Municipalities in which evacuation order were lifted＞

Municipality	Evacuation order was lifted on
Tamura city	April 1, 2014
A part of Kawauchi village (former “areas to which evacuation orders are ready to be lifted”)	October 1, 2014
Naraha town	September 5, 2015

Progress in the Special Decontamination Area ③ (As of the end of March, 2016)

Main Topic

- Decontamination in progress with max. 11,700 labor per day (Feb. 16 – Mar. 31, 2016)
- Decontamination has completed in Minami-Soma and Tomioka (residential area), Futaba (whole area)

1. Municipalities implementing whole area decontamination (aimed to complete all the decontamination by March 2017)

	Securement of TSS Note 1,3	Consent on decontamination Note 3	Execution rate (%) Note 2,3			
			Residential area	Farmland	Forest	Road
Iitate	Secured	almost completed	100	55	86	48
Minami-Soma	Mostly secured	approx. 90%	88	33	58 (53)	39
Namie	approx. 90%	almost completed	48 (44)	37 (36)	75 (61)	68
Tomioka	Secured	Completed	100 (93)	98 (85)	100	99.7 (98)

2. Municipalities completed decontamination

	Time of Completion Note 4
Tamura	June 2013
Naraha	March 2014
Kawauchi	March 2014
Okuma	March 2014
Katsurao	December 2015
Kawamata	December 2015 Note 5
Futaba	March 2016

Note 1: The ratio shows: Contracted TSS area / Necessary TSS area. It might change because of increase and decrease of the necessary area depending on the progress of decontamination construction

Note 2: Implementation ratio: Decontamination-completed area / Target decontamination area. They might be both revised with future investigation. "Areas where it is anticipated that residents will face difficulties in returning for a long time" are basically not included

Note 3: Numbers in () are the numbers in a previous month. Numbers without () have not been changed from the previous month

Note 4: Time of decontamination completion means the time which decontamination is completed in the area with resident's consent. If the area is not decontaminated, it will be eventually decontaminated once the consent is obtained

Note 5: A part of farmland struck by heavy rain disaster is not included

Progress in the Intensive Contamination Survey Area ①

◇ Number of municipalities designated as the Intensive Contamination Survey Area:
104 (at the start) → 97 (at present)
The designation was lifted in seven municipalities because of the radiation dose decrease, etc.

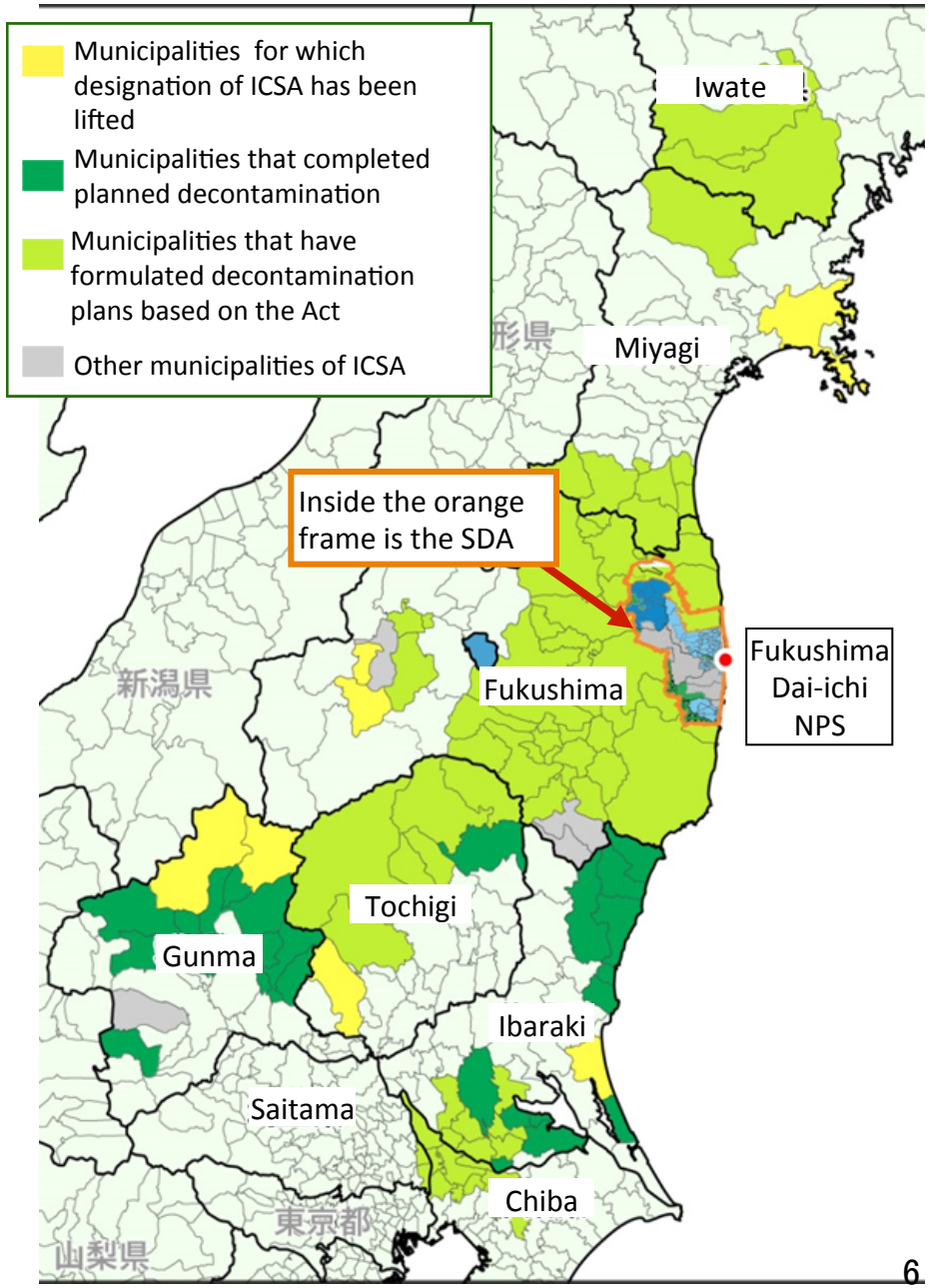
◇ Municipalities that formulated decontamination implementation plans:
93 municipalities (all that had intended to do)

◇ Municipalities that have completed or almost completed their plans (and continued monitoring of air dose rates).
49 municipalities

◇ Municipalities in process of implementing decontamination based on the plans:
44municipalities
In most of the decontamination plans , ending time period is set between FY2015- FY2016.

◇ The progress of decontamination
•**In Fukushima Pref.** (as of the end of March 2016):
Public facilities: approx. 90%
Residential houses: approx. 80%
Roads: approx. 50%　Forests in living area: approx. 50%

•**Outside Fukushima Pref.** (as of the end of Dec. 2015):
Schools & nurseries/ parks, sports facilities / residential houses: almost completed
Roads: approx. 90%
Farmland & meadows/ forests in living area: completed



Progress in Intensive Contamination Survey Area ③

Within Fukushima Prefecture (As of the end of March 2016)	Ordering Ratio (Number of ordering/Number of planning	Executing Ratio (Number of actual achievement/ Number of planning)
Public facilities, etc.	mostly ordered	approx. 90%
Residential houses	approx. 90%	approx. 80%
Roads	approx. 70%	approx. 50%
Farmlands & meadows	mostly ordered	approx. 90%
Forests(in living areas)	approx. 70%	approx. 50%

Note: The number of planning areas have been continuously revised, based on the investigation result made by Fukushima Prefecture

Outside Fukushima Pref. (As of the end of Dec. 2015)	**Ordering Ratio （Number of Ordering/number of planning）**	**Executing Ratio (Number of actual achievement/ number of planning）**
Schools and nurseries	mostly ordered	almost completed
Park, Sports facilities	mostly ordered	almost completed
Residential houses	mostly ordered	almost completed
Other facilities	approx. 90%	approx. 80%
Roads	mostly ordered	approx. 90%
Farmlands & meadows	ordered	completed
Forests(in living areas)	ordered	completed

Note: The number of planning is the total number until the end of Dec. 2015, which might be increased in future depending on each municipality's status.

1. Current Situation of Off-site Decontamination

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Decontamination Report

MOE developed the Decontamination Report, a comprehensive report regarding the basic policies and framework of decontamination, contractors' experience on project management, applicable conditions and effects of actual decontamination technologies, in March 2014. MOE aims to convey the experience of decontamination and lessons learned both domestically and internationally and to contribute to improvement of decontamination through compiling the information.

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Basic Features of Environmental Decontamination in Japan

- The principal radionuclide causing environmental pollution is **cesium**

- Decontamination should be conducted to **reduce the impact on human health or the living environment** not only in **housing areas and public facilities**, but also in more diverse and wide areas such as **roads, farmlands, forests (living zone only),** and the like

- Decontamination should be implemented as soon as possible in order to **realize return of residents previously living in the evacuation areas**, to **secure their safety**, and to allow them to **rebuild their lives** as soon as possible

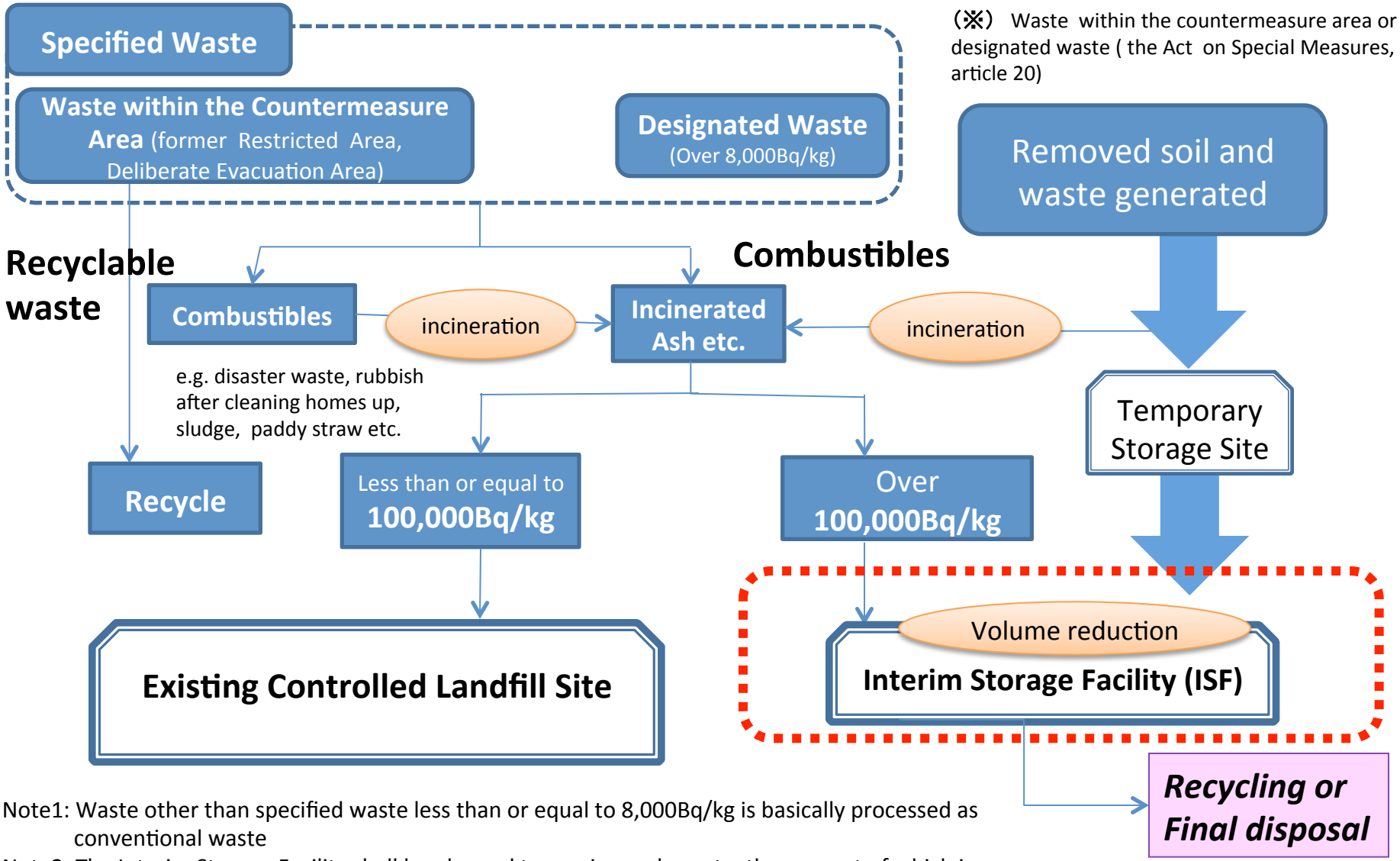
- **Residents' opinions** and their way of life should **be respected**; decontamination should be conducted by paying due consideration to the **protection of private rights and maintenance of the community**

Overview of decontamination procedures

< Implementation Items >	< Necessary Investigation and Measurements >
1. Designate intensive contamination survey area	Investigations and measurements to determine whether or not a municipality
2. Determine decontamination zones where decontamination and other measures will be carried out	Investigations and measurements on the environmental contamination status within the intensive contamination survey areas
3. Implement detailed measurements in the decontamination zones	Detailed measurements designed to determine if it is necessary to conduct decontamination in individual facilities, as well as to decide on the methods for decontamination
4. Implement decontamination and other measures based upon the decontamination plans	Perform measurements before and after the decontamination measures
5. Collect, transfer, and store the removed soil generated, in association with decontamination and other measures	Monitor the air dose rate and the radioactivity concentrations when the removed soil is being stored
6. Cancel the intensive contamination survey area designation	Investigations and measurements to determine whether or not a municipality meets the designation requirements

*In addition to the above, continuous investigations and measurements must also be carried out where appropriate for the sake of monitoring the changes in the dose rate

Management and Treatment of Decontamination Soil and Waste（Fukushima pref.）

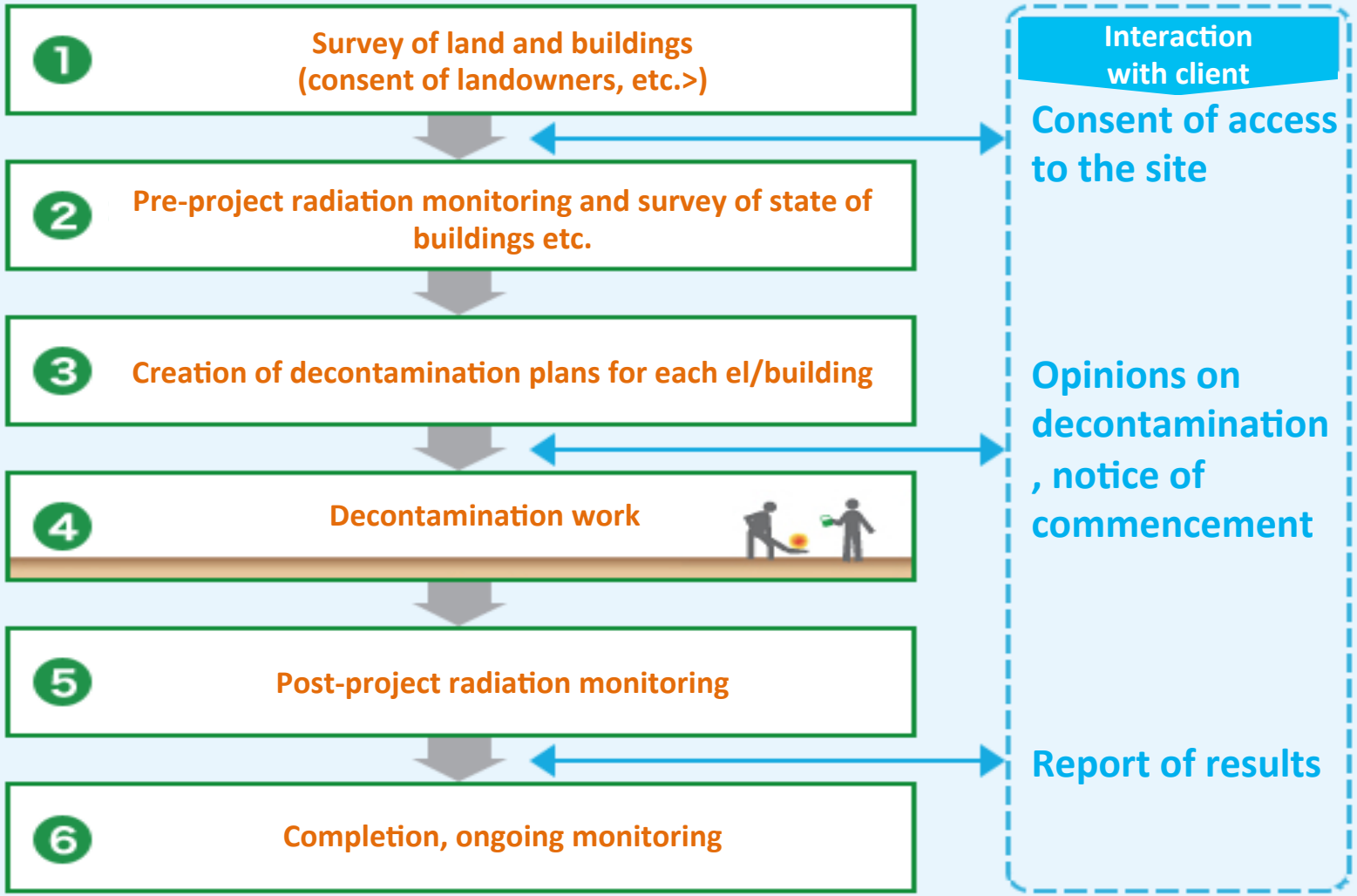


Note1: Waste other than specified waste less than or equal to 8,000Bq/kg is basically processed as conventional waste

Note2: The Interim Storage Facility shall be planned to receive such waste, the amount of which is difficult to estimate at the present

Management of Decontamination Project

Flow of decontamination process



Effect of Decontamination

Effect of decontamination work by national and local governments (Major results)

Air dose rate*1,2 (Measured at 1m height)	Before decontamination: 0.36 – 0.93 μSv/h ↓ After decontamination: 0.25 – 0.57 μSv/h		
Reduction rate (average) of air dose rate*2,3	<1μSv/h before decontamination	1-3.8μSv/h before decontamination	> 3.8μSv/h before decontamination
	32%	**43%**	**51%**
Example of reduction rate of surface concentration of contamination *4	Asphalt-paved roads: 50-70% by washing, 30-70% by high-pressure washing Playground(Soil): 80-90% by stripping off surface-dirt		

*1: Range from 25 to 75 percentile values of the air dose rate.
*2: Data measured at 50cm height in children's living environment is not included.
*3: Average reduction rate of the air dose rate for different dose levels before decontamination.
(Reduction rate (%)= (1-air dose rate after decontamination / air dose rate before decontamination) x100.)
*4: Released in "Announcement on 'Effectiveness of decontamination work which is implemented by the national government and relevant municipalities in decontamination project'（Jan. 18, 2013）"

Verification of Decontamination Effect

Examples for wiping roofs and rooftops in residential areas

Work Schedule	Air dose rate at 1 cm above the surface (μSv/h)	Surface contamination density (without shielding cpm)	Decontamination rate of Spatial dose rate at 1 cm away from the surface (%)	Decontamination rate of Surface contamination density (%)
before wiping	1.2	1.32×10^{3}	—	—
after first wiping	1.0	6.00×10^{2}	11	33
after second wiping	1.1	5.57×10^{2}	9	36
after third wiping	1.0	5.00×10^{2}	11	39
after tenth wiping	1.0	5.20×10^{2}	10	27

The effect of decontamination depends on the various factors such as the material and the surface condition of decontamination target, their deterioration status, etc.

Lessons Learned for Decontamination Works ①

1. Importance of Establishing Legal Framework for Decontamination

MOE-Little experience for Public Project

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Making Legal standard and Guidelines with Cooperation of Other Ministries

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Quick start of Decontamination Works

Lessons Learned for Decontamination Works ②

2. Significance of Securing Technology for Decontamination by Private Sector

- Project management was crucial on large scale decontamination project, with severe constraints
- Decontaminators by private construction companies quickly secured the decontamination technologies and appropriately assigned large quantities of equipment, materials and human resources (workers)
- Pilot projects by decontaminators led to establish efficient methods for decontamination

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Securing Quality of the Works

Lessons Learned for Decontamination Works ③

3. Well-organized Management

Making uniformed procedures and system for projects

PDCA cycle management by decontaminators

But improper decontamination reported

MOE established “Proper Decontamination Promotion Program”

- Clarify business operator’s responsibility
- Strengthen MOE organization and check the work regularly

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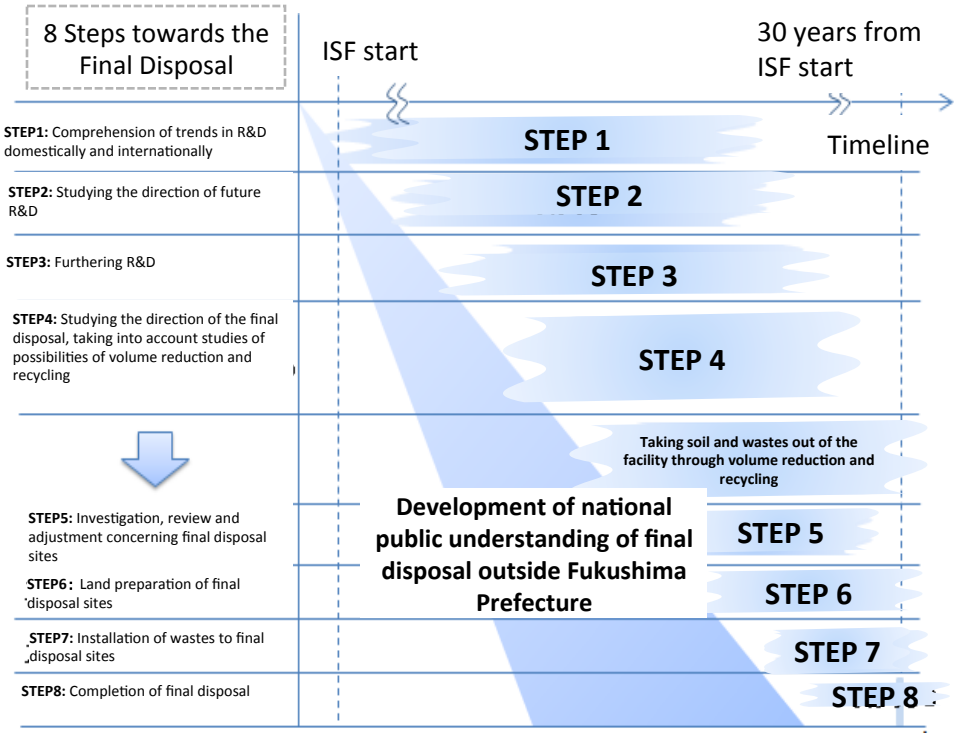
Measures towards the Final Disposal of Decontamination Soil outside Fukushima Pref.

8 steps towards the final disposal and technological review

◆Measures will be processed according to 8 steps towards the final disposal

◆MOE established a meeting with experts reviewing development and concept of volume reduction and recycling technologies, and sequentially proceed them from the possible field

⇒ MOE shall plan final disposal volume, radioactive concentration, structure and dimension of the site based on technological review and measures, then discuss investigation and adjustment of the final disposal site



Strategy for volume reduction & recycling technology development and the roadmap

In April 2016, MOE summarized “Strategy for volume reduction & recycling technology development” and “Roadmap” as a mid-and long term policy concerning recycling promotion of technology development and decontamination soil after volume reduction treatment towards final disposal outside Fukushima based on the discussion among experts meeting

<Major contents>

◆Volume of the final disposal shall be reduced while increasing the target purified materials as much as possible, and treat decontamination soil by using volume reduction technology

◆Basic technology development will be completed within a decade in order to implement volume reduction & recycling

◆To realize the recycling of purified materials, MOE shall foster the national public for safety and securement, and shall make efforts concerning recycling business operators and social acceptance, cooperating with relevant ministries

Public Communication

Provision of basic and comprehensive information

■Web http://josen.env.go.jp/en/ ■Call centers in Fukushima and in Tokyo

Decontamination Information Plaza (Information hub run by MOE and Fukushima Pref.)

■**Providing interactive communications with people and municipalities**

- Interactive exhibition and workshops
- Dispatch of experts to municipalities, communities, schools, etc.






Pamphlets, comic books, and videos

■**Providing easy-to-understand information with detailed data on decontamination and radiation**

- Distributed at meetings, workshops, city offices, banks, and supermarkets in Fukushima, and also available on the Web

Collaboration with news organizations

■**Providing information that helps people understand remediation and the state of the region after remediation, in collaboration with media organizations in Fukushima**

(Media is the largest information source for Fukushima people)

- Newspaper ads and TV/radio programs
- "Thanks Helmet", a campaign to motivate the decontamination workers and improve relationships between the residents and the workers


Development of national public understanding

■**Widely disseminate information of remediation and the state of the region after remediation to the public so that they can correctly understand the current status of Fukushima and its products**



PR of rice harvested from decontaminated paddy fields

Exhibition at Tokyo about "Steps for Restoration of Fukushima"

Cooperation with International Societies

Information exchange through bilateral frameworks (U.S., France, UK, etc.) and international organizations (IAEA, OECD/NEA, etc.)

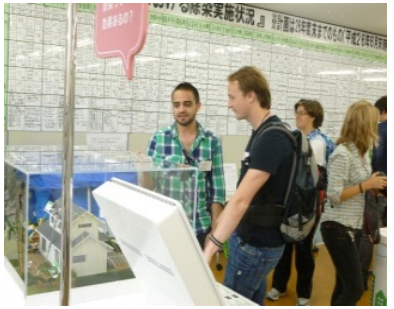
MOE has exchanged information among policy makers and experts, concerning decontamination policy, methods, and research for the environmental behavior of radioactive materials and utilized shared knowledge and information to review and implement its decontamination activities.

Nov.3-4,2015
4th Meeting of Decommissioning and Environmental Management Working Group (DEMWG)
U.S./Japan Bilateral Commission (BLC) on Civil Nuclear Cooperation (@Washington D.C.)

Nov.10-11,2015
The 5th meeting of the Japan-France Nuclear Cooperation Committee (@Tokyo)

Nov.24-25,2015
The 4th Japan-UK Nuclear Dialogue (@London)

Nov. 26, 2015
The 3rd Meeting of Japan-Ukraine Joint Committee for the cooperation to advance aftermath response to accident at nuclear power stations(@Kiev)



Nov. 27, 2015
The 3rd Meeting of Japan-Belarus Joint Committee for the cooperation to advance aftermath response to accident at nuclear power stations(@Minsk)

Feb.4-5,2016
The 1st IAEA-MOE Experts Meeting on Environment Remediation of Off-Site areas after the Fukushima Dai-ichi Nuclear Power Station Accident (@Tokyo)

Bridge Gap for Future