Progress on Off-site Cleanup Efforts in Japan

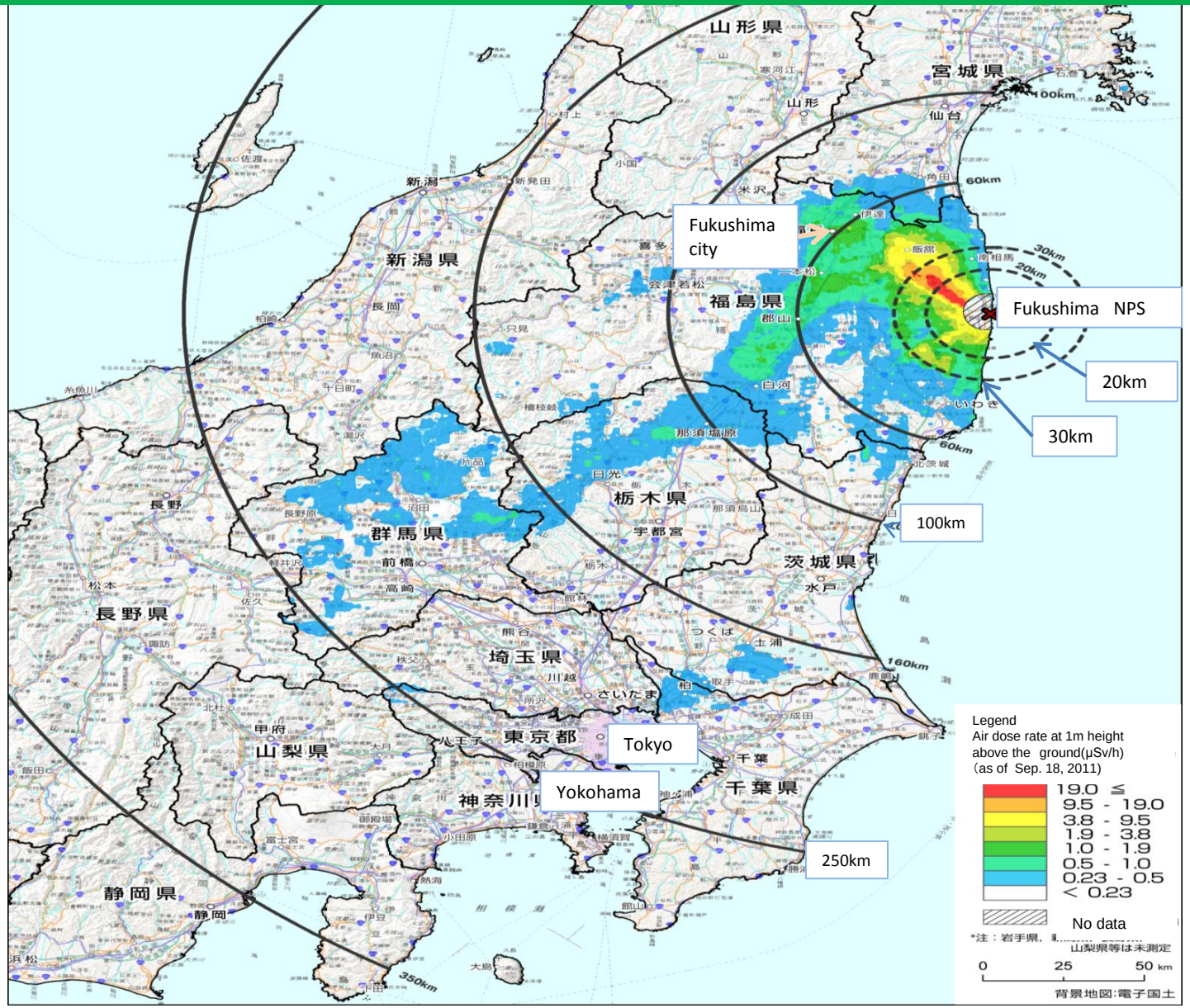
October 2013

Ministry of the Environment, Japan

Outline

- **Policy Framework**
- Progress in Special Decontamination Area
- Progress in Intensive Contamination Survey Area
- Decontamination technology
- New policies announced in Sep 2013
- Efforts to secure Interim Storage Facility

Radioactive Pollution Caused by the Accident at TEPCO's Fukushima Dai-ichi NPS



Framework of Decontamination

Legislation for Promoting Decontamination

- The Act on Special Measures Concerning the Handling of Radioactive Pollution came into force on January 1, 2012.
- Based on this Act the followings are carried out:
  - Planning and implementation of decontamination work
  - Collection, transfer, temporary storage, and final disposal

Special Decontamination Area

- 11 municipalities in (former) restricted zone or planned evacuation zone (<20km from the NPS, or annual cumulative dose is >20mSv)
- Decontamination is implemented by the national government

(*) Entire area of Naraha, Tomioka, Okuma, Futaba, Namie, Katsurao, and Iitate.
Some area of Tamura, Minami Soma, Kawamata, and Kawauchi.

Intensive Contamination Survey Area

- 100 municipalities in 8 prefectures (*), in which over 0.23 μSv/hour of air dose rate (equivalent to over 1 mSv/Year) is observed, were designated.
- Decontamination is implemented by each municipality. The national government will take financial and technical measures.

(*) Iwate, Miyagi, Fukushima, Ibaraki, Tochigi, Gunma, Saitama, and Chiba

Relation between air dose rate and annual radiation exposure

The annual additional exposure dose based on the air dose rate is estimated by the following assumption;

"staying at inside a house for 16 hours and outside for 8 hours every day", and

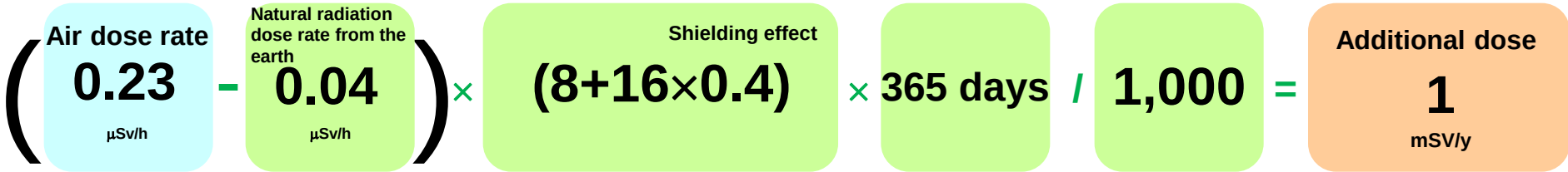
"the shielding effect inside a wooden house is 0.4 times."

Due to these assumptions, actual radiation dose received is generally considered to be less than the estimated values.

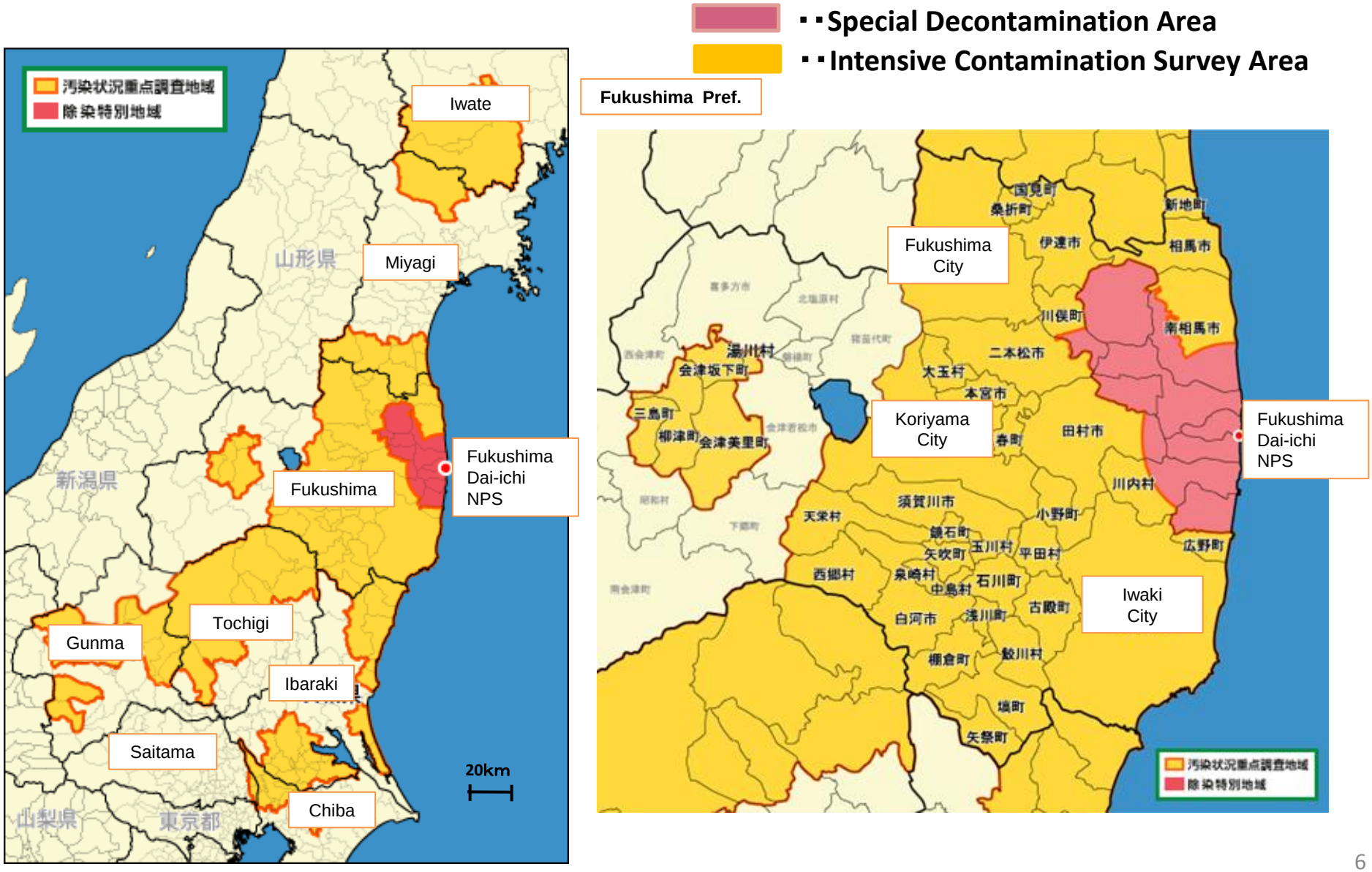
[Correlation between air dose rate and additional exposure dose]

To estimate the additional exposure dose based on the air dose rate, the following formula is used.

For instance, when the air dose rate is 0.23μSv/hr., the annual additional exposure dose is equivalent to 1mSv.



Special Decontamination Area and Intensive Contamination Survey Area



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Current Status of the Areas to Which Evacuation Order have been Issued (as of End of Aug, 2013)

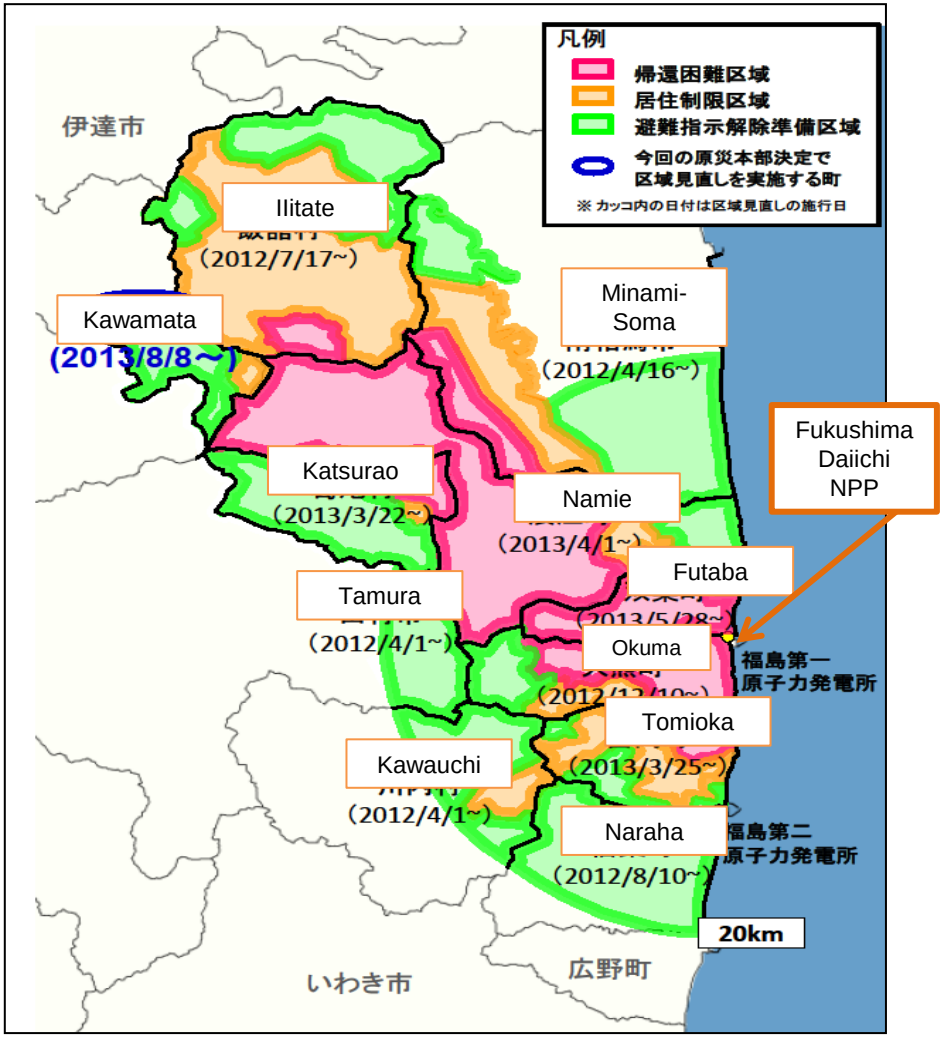
Ahead of the decontamination in the Special Decontamination Area, Decontamination Plans are to be elaborated taking into account the progress of rearrangement of the Restricted Areas and Deliberate Evacuation Area.
The rearrangement has been completed on Aug 7 2013.

3 categories after the rearrangement:

Area 1: <20mSv/yr
Evacuation orders are ready to be lifted:

Area 2: 20 – 50 mSv/yr
Residents are not permitted to live:

Area3: >50 mSv/yr
Residents will have difficulties in returning for a long time:



Decontamination Policy for Special Decontamination Area

Policy in FY2012 and 2013

Decontamination should be implemented taking into account the level of air dose rate.

◆**Area less than 20mSv/year**: Aiming to reduce additional exposure dose to less than 1mSv/year as long-term goal.

◆**Area from 20～50mSv/year**: Aiming to reduce exposure dose in residential and farmland area to less than 20mSv/year.

> Decontamination work in all municipalities in the Area has been uniformly scheduled to be completed within 2 years, assuming the securing of temporary storage sites and consent of landowners, etc.

> In the case of areas more than 50mSv/year, demonstration projects will be implemented. Lessons learned will be taken into consideration in future decontamination policy.

Policy Review at Sep. 2013

Decontamination work will be implemented in cooperation with reconstruction measures depending on the situation of each municipality. Additional measures for further progress will be conducted. (Refer to the following slide.)

Progress in the Special Decontamination Area

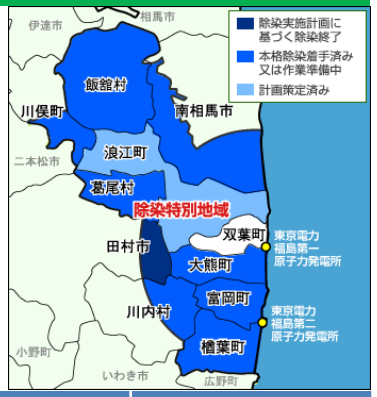
Decontamination work are begun from areas in which preparation is completed. As of Sep 2013, Decontamination Plan has been established in 10 municipalities out of 11 target municipalities. Decontamination work has been in operation or in preparation in 9 municipalities and has been completed in 1 city according to its plan.

Progress Status	Population in Decontamination Target Area (approx. Figure)	Decontamination Target Area (ha) (approx. figure)	Rearrangement of the Restricted areas, etc.	Progress of the Decontamination Work			
				Decontamination Plan	Temporary Storage Site (as of the end of Aug, '13)	Content of landowners, etc. (As of the end of Jul., '13)	Decontamination activities (As od Aug., 30, '13)
On full scale decontamination work / On preparation							
TAMURA	400	500	Apr. 2012	Apr. 2012	Secured	Competed	Completed in June. 2013
NARAHA	7,700	2,000	Aug. 2012	Apr. 2012	Secured	Almost completed	In progress
KAWAUCHI	400	500	Apr. 2012	Apr. 2012	Secured	Completed	In progress (houses and roads completed)
MINAMI-SOMA	13,300	6,100	Apr. 2012	Apr. 2012	approx. 20% secured	approx. 30%	In progress
IITATE	6,000	5,100	Oct. 2012	May 2012	approx. 20% secured	approx. 30%	In progress
KAWAMATA	1,200	1,300	Aug. 2013	Aug. 2012	approx. 80% secured	approx. 90%	In progress
KATSURAO	1,400	1,700	Mar. 2013	Sept. 2012	approx. 20% secured	Almost completed	In progress
NAMIE	18,800	3,200	Apr. 2013	Nov. 2012	approx. 10% secured	approx. 10%	Under bidding procedure
OKUMA	400	400	Nov. 2012	Dec. 2012	approx. 70% secured	approx. 60%	In progress
TOMIOKA	11,300	2,800	Mar. 2013	Jun. 2013	approx. 50% secured	In preparation	Contractor decided In preparation of work
Plans not yet formulated							
FUTABA	300	200	May. 2013	Under coordination	Under coordination	Under coordination	Under coordination

Note: Decontamination work in a municipality are to be implemented based on the premises of formulation of the decontamination plan, consent of land owners and securing of temporary storage sites.

Progress in the Special Decontamination Area

- Progress (implementation ratio) of the decontamination work planned in 2012 and 2013 are as follows:
- Difference is observed among municipalities depending on circumstances regarding preparation as well as operation of decontamination work.



As of Jul. 2013	Tamura	Naraha	Kawauchi	Iitate	Kawamata	Katsurao	Okuma
Living area	100%	51%	100%	3%	0%	2%	3%
Farmland	100%	68%	1%	1%	3%	0.1%	11%
Forest	100%	65%	69%	2%	6%	25%	6%
Road	100%	25%	100%	0.3%	0%	1%	6%

Note 1: Implementation ratio is calculated in a area basis: Areas completed / Areas planned in 2012 and 2013.
Note 2: Figures in tables are not finalized yet.

Result of the review on decontamination at Sep. 2013

Current Status

Difference has been observed on the progress between municipalities in the Special Decontamination Area reflecting each municipality's circumstances as below.

In the case of excessive time consumed for arrangements with stakeholders BEFORE decontamination is begun.

○Time consumed for:

- rearrangement of Restricted Areas and Deliberate Evacuation Area
- establishment of decontamination plans
- Securing temporary storage sites
- Obtaining consent of decontamination etc.

In the case of excessive time consumed WHILE decontamination is already in progress in venues.

○Time consumed for

- Negative effect of the elements such as snow
- Additional compensation work etc.

Challenges based on past experience

○Securing working staff (ie. labor-intensive work)
○Enhancement of safety measures
○Handling of heavy traffic volume for the transportation of workers and removed soils, etc., and that of waste generated from workers' daily life

Cooperation with reconstruction-related measures

○facilitation of the cooperation above (ex. Construction of infrastructures and core facilities for reconstruction, and Land use change)
○Proper schedule, taking into account the expected timing of evacuees' return

Future Direction

○Decontamination work will be implemented in cooperation with reconstruction measures depending on the situation of each municipality, by revising the current plan which has been uniformly scheduled to be completed within 2years.
○Additional measures will be introduced for speed-up and facilitation.
○Decontamination plans of 6 municipalities (Minamisoma, Iitate, Kawamata, Katsurao, Namie and Tomioka) will be amended by the end of this year while 3 municipalities (Naraha, Kawauchi and Okuma) are on schedule to finish within FY 2013. As for Futaba, coordination towards the formation of a plan will be continued. In Tamura, decontamination work has already been completed.

Summary on Decontamination Effect

Information for decontamination effect of early decontamination project(mainly in 2012), e.g. model project and preliminary decontamination work implemented in Fukushima by the national government and relevant municipalities, were collected. As a result, reduction rate of surface concentration of contamination(cpm) were;

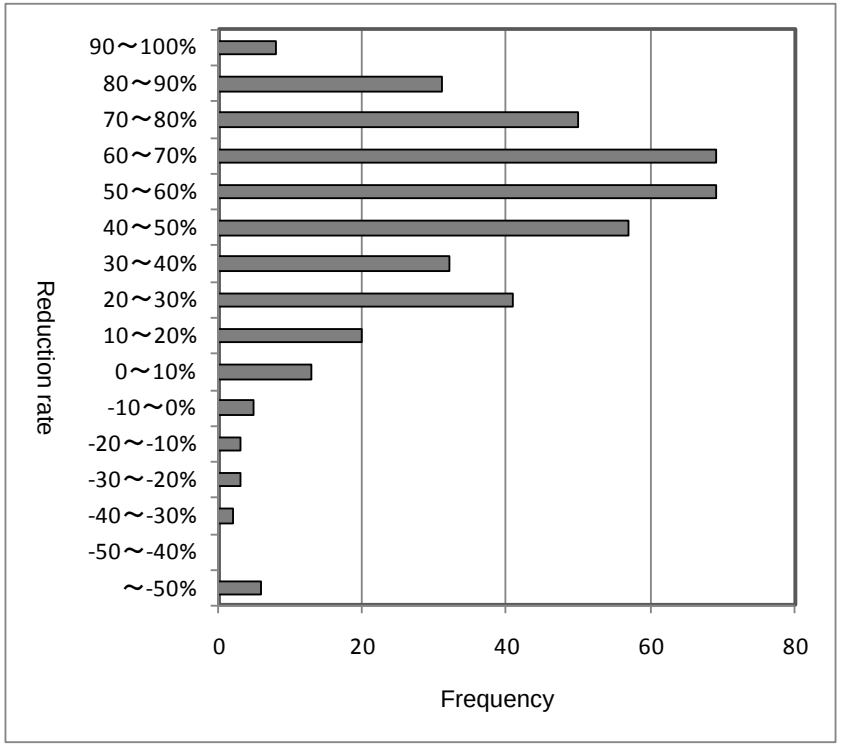
- 50-70% reduction by washing,
- 30-70% reduction by high-pressure washing,
- 70-90% reduction by scraping on surface decontamination of asphalt-paved roads, and

as for decontamination work of playground, 80-90% reduction by top soil removal, which are acknowledged as a certain effectiveness.

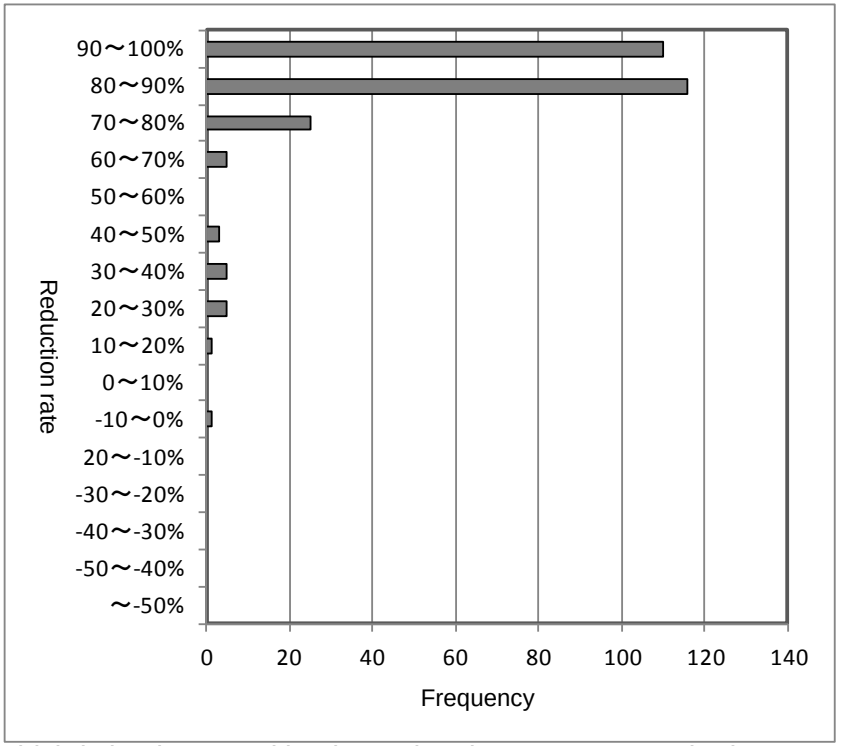
※the data is based on reduction rate of surface concentration of contamination on each decontamination method.

※The result of this analysis is tentative. The methods were not consolidated and not up-dated at that time.

Example) Decontamination work on asphalt-paved roads



Example) Decontamination Work on Playground

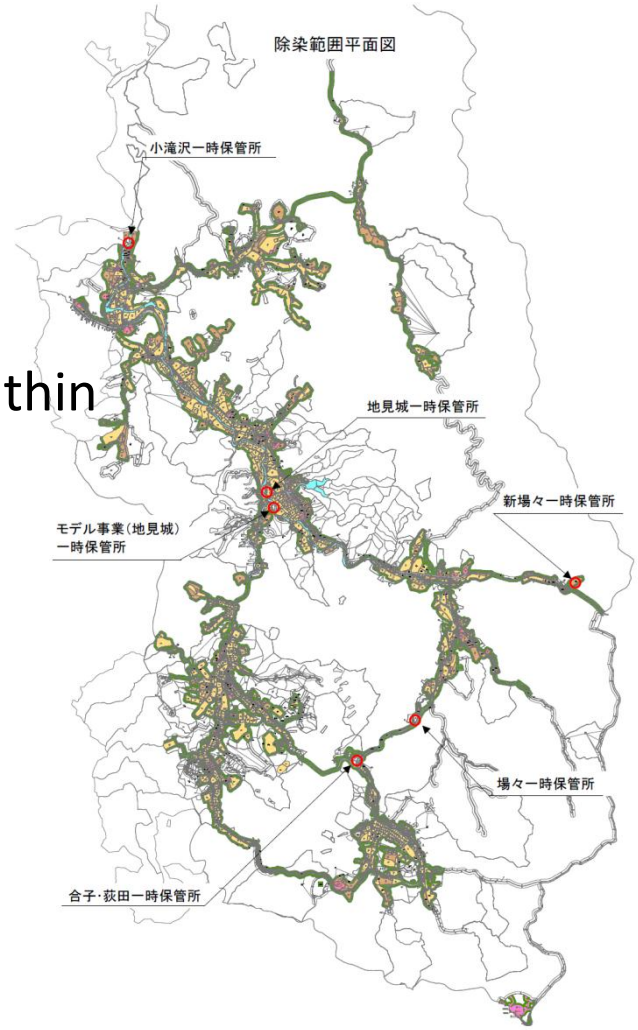


Reference：Announcement on “Effectiveness of decontamination work which is implemented by the national government and relevant municipalities in decontamination project”（Jan. 18, 2013）

Overview of the Decontamination Project in Tamura City

Decontamination work based on the Decontamination Implementation Plan has been finished in Tamura City.

- Work Period：July 5, 2012～June 28, 2013
- Number of Workers：Max. 1,300/day
  （A total of 120,000 man day）
- Decontamination target area：
  residential area and a part of forests (area within 20m from the edge) in Furumichi, Miyakoji district
- Volumes of work
  - Buildings　228,249㎡(121 family unit)
  - Roads　95.6km
  - Farmland　1,274,021㎡
  - Forests　1,921,546㎡



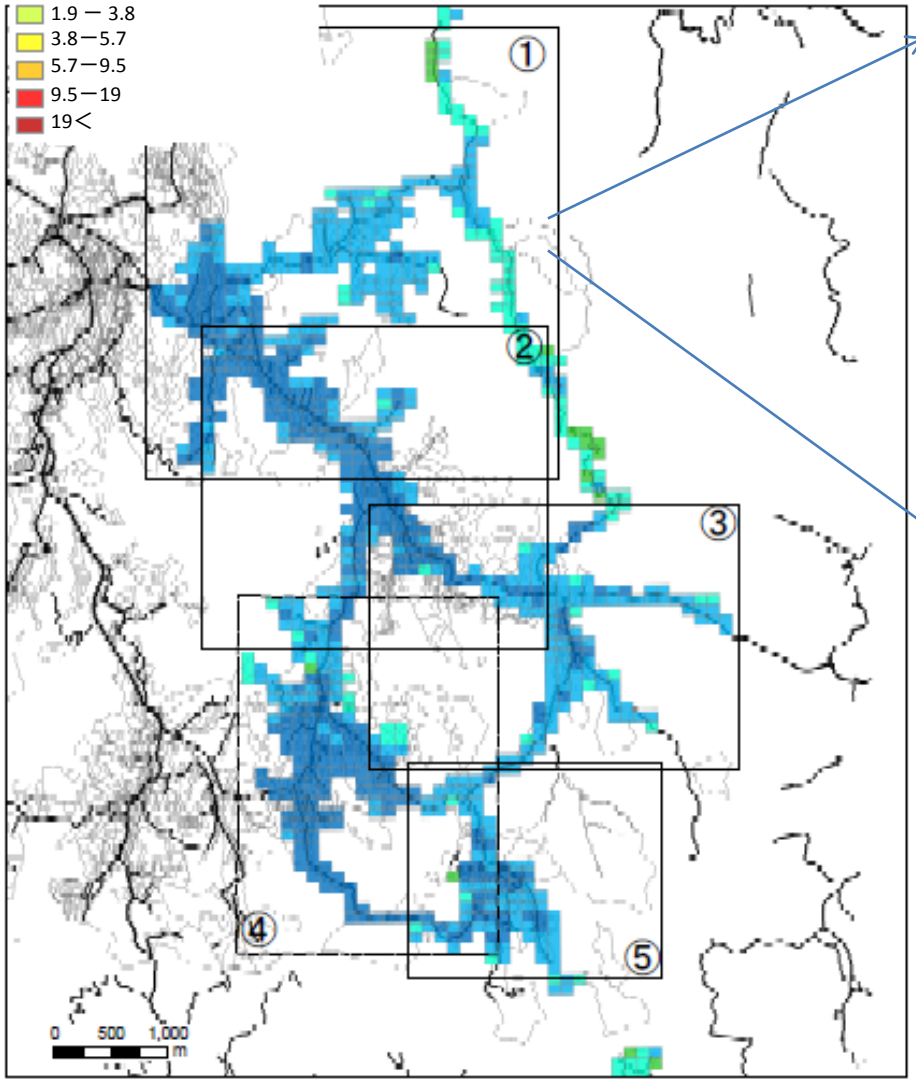
Effect of Radiation Dose Reduction by Decontamination Work in Tamura City

Tamura City

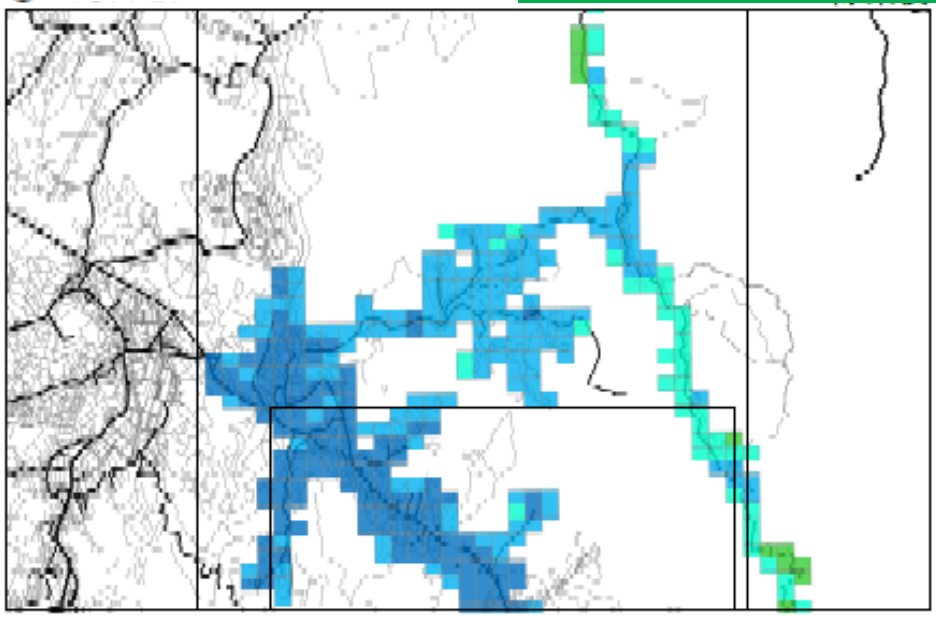
(Average of Air Dose Rate at the height of 1m above ground)

≦0.23
0.23－0.5
0.5 － 0.75
0.75 － 1.0
1.0 － 1.9
1.9 － 3.8
3.8－5.7
5.7－9.5
9.5－19
19＜

After

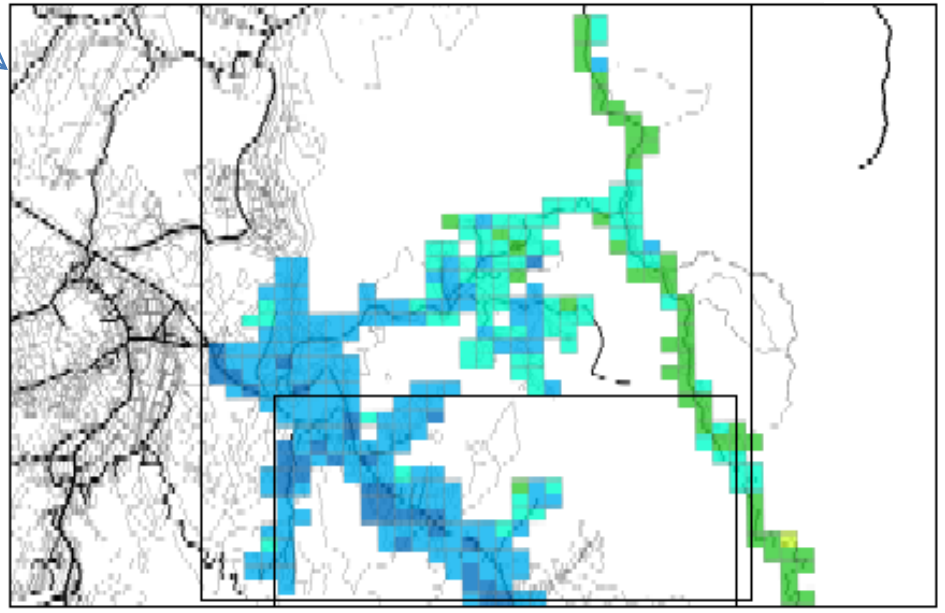


①Kotakizawa District

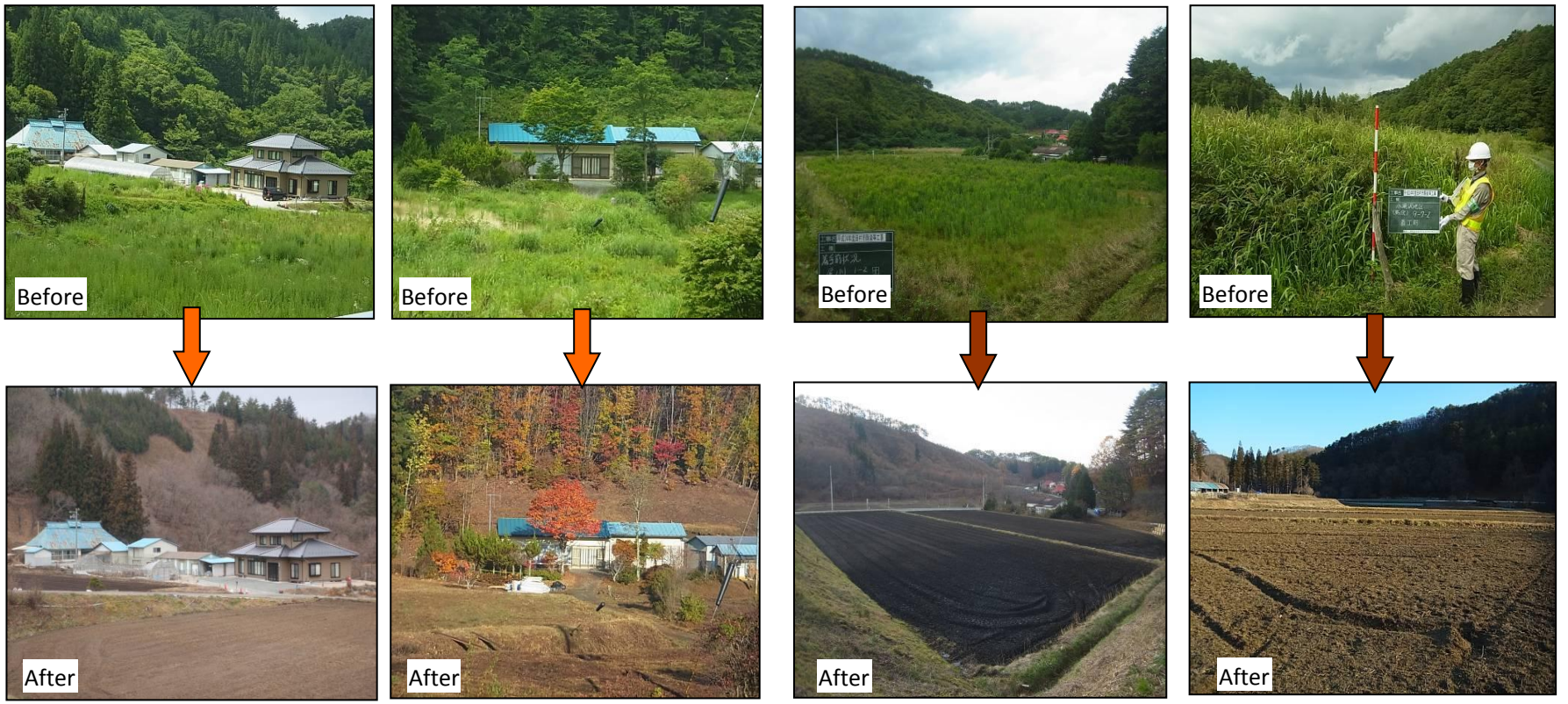


①Kotakizawa District

Before



Before & After the Decontamination Work



Decontamination Activities

Wiping off rooftop and walls

Wiping off a gutter

High pressure water cleaning of a drain pipe

High pressure water cleaning of paved road

Mowing and removal of sludge

Removal of crushed stones and topsoil, and cover with clean soil

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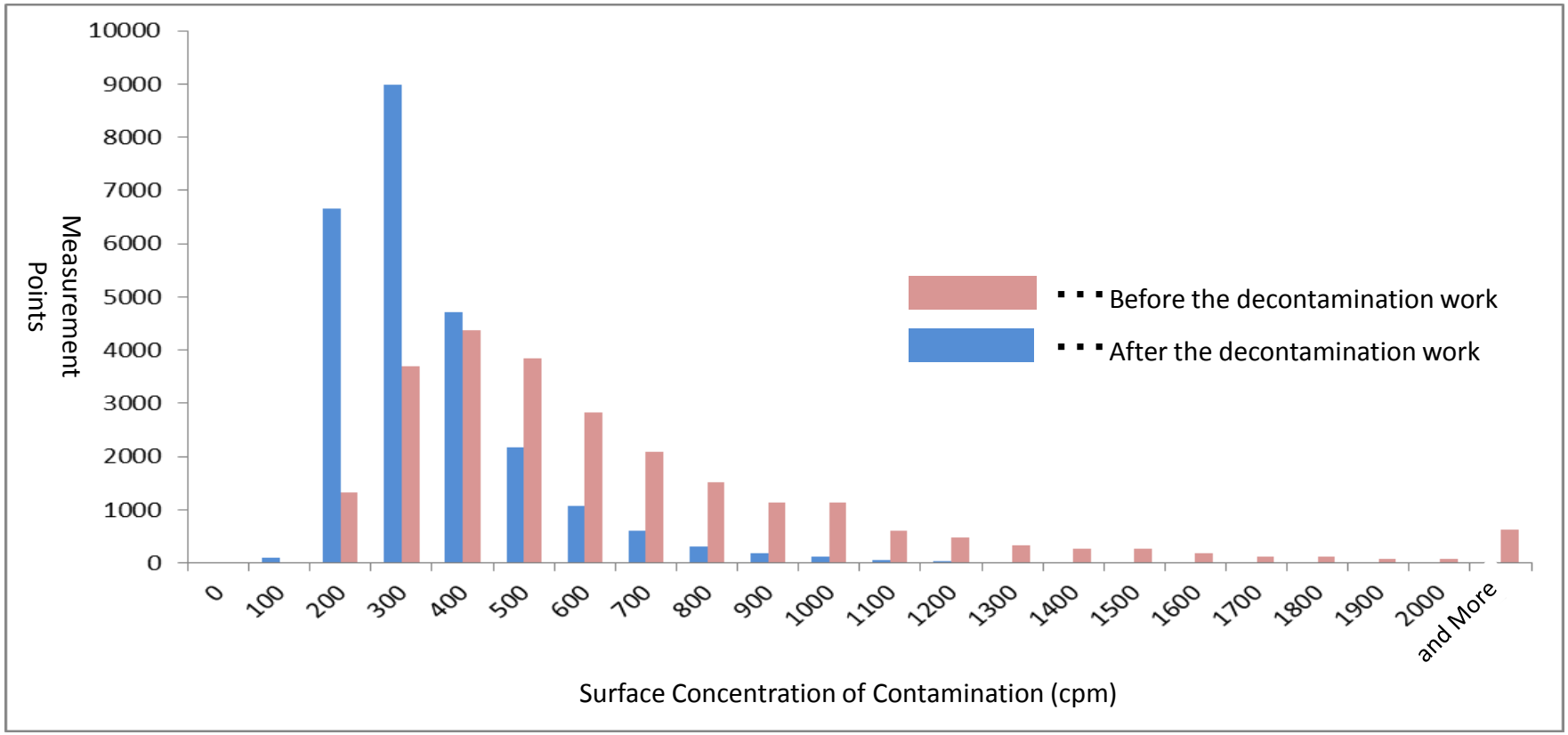
Effect of Reducing Radiation Dose by Decontamination Work （Surface Concentration of contamination*）



*Surface concentration of contamination is the number of radiation per minute counted by a detector . As it is detected at the level above 1cm from decontaminated surface, changes due to the figures can be clearly evaluated.

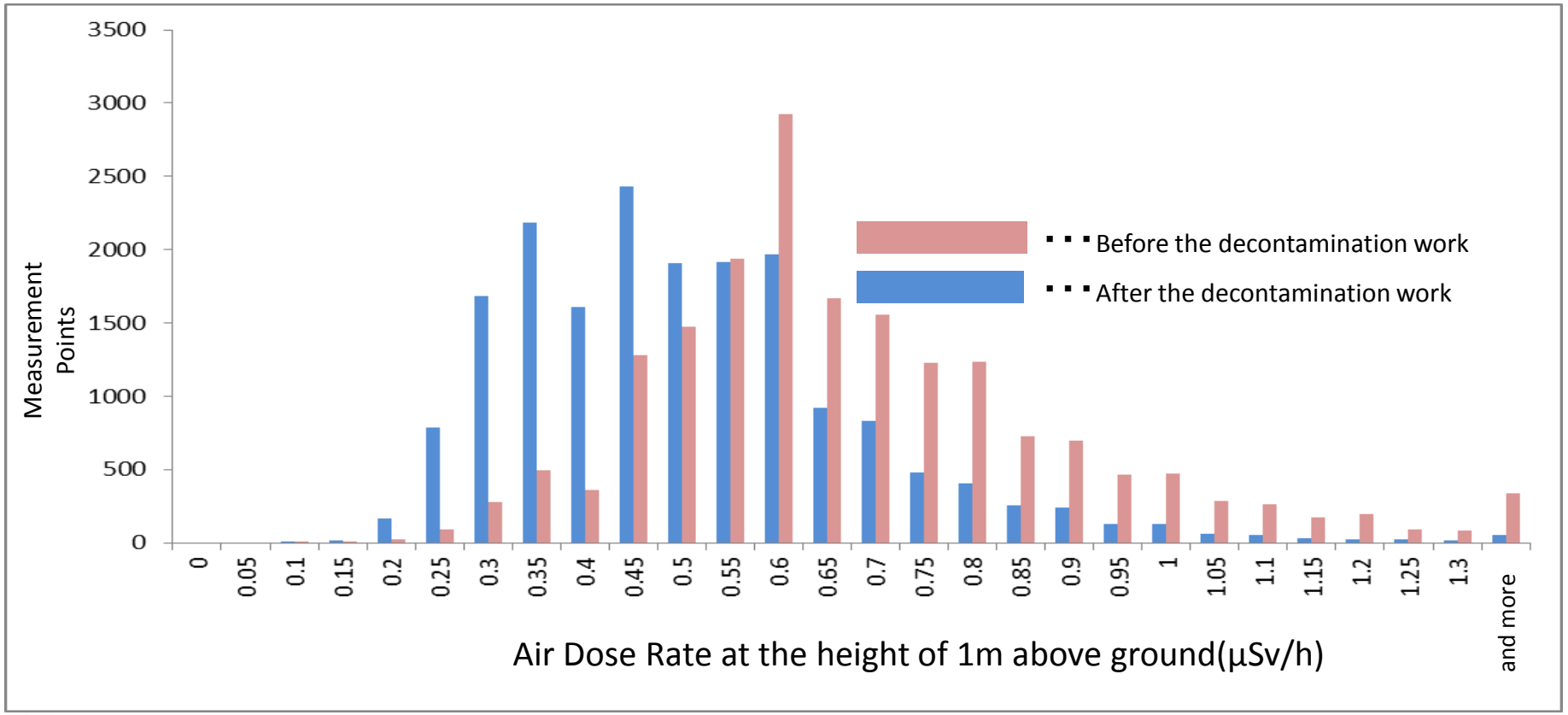
※The measurement was taken before and after the decontamination work so that natural attenuation effect after the work was not included.

- Measurement period before the decontamination work : July 25, 2012～May 23, 2013
- Measurement period after the decontamination work : August 7, 2012～May 30, 2013

Effect of Radiation Dose Reduction by the Decontamination Work
- Surface Concentration of Contamination -

	Surface Concentration of Contamination (cpm)	Measurement Points	Average Value before the Decontamination Work (cpm)	Average Value after the Decontamination Work (cpm)	Reduction Rate
Residential Area	more than 900	2,370	1,784	398	78%
	600～900	1,706	753	338	55%
	300～600	4,271	453	274	40%
	less than 299	3,190	243	193	20%
Farmland	more than 900	95	1,230	432	65%
	600～900	323	722	359	50%
	300～600	1,961	436	286	34%
	less than 299	801	263	218	17%
Forest	more than 900	527	1,229	520	58%
	600～900	1,201	742	475	36%
	300～600	2,097	475	383	19%
	less than 299	155	280	276	1%
Roads	more than 900	1,019	1,206	352	71%
	600～900	1,314	758	331	56%
	300～600	2,342	456	270	41%
	less than 299	730	260	214	18%

Effect of Radiation Dose Reduction by Decontamination Work (Air Dose Rate at the height of 1m above ground)



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- Measurement period before the decontamination work: July 25, 2012～May 23, 2013
- Measurement period after the decontamination work: August 7, 2012～May 30, 2013

Effect of Reducing Radiation Dose by Decontamination Work

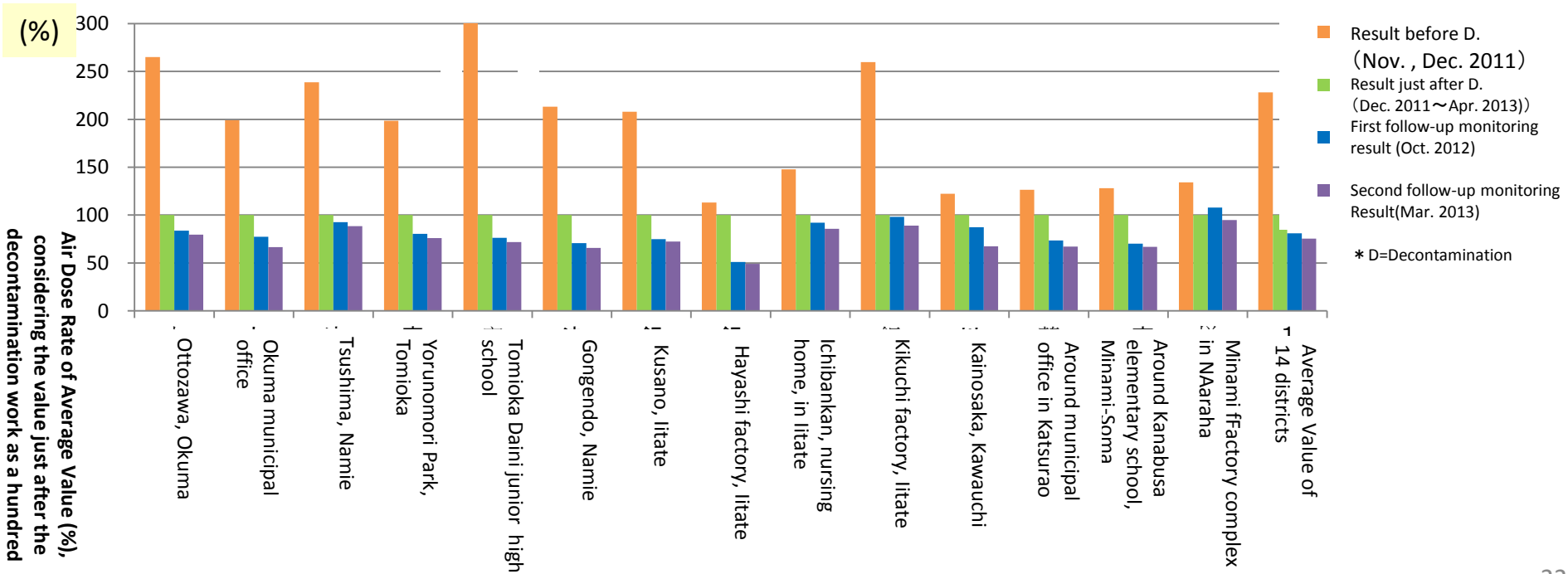
（Air Dose Rate at the height of 1m above ground）

	Radiation Dose before the Decontamination Work（μSv/h)	Measurement Points	Average Value before the Decontamination Work（μSv/h)	Average Value after the Decontamination Work（μSv/h)	Reduction Rate
Residential Area	1.0 or more	383	1.24	0.54	56%
	0.75～1.0	1,107	0.86	0.50	42%
	0.5～0.75	2,789	0.62	0.41	35%
	less than 0.49	2,179	0.42	0.32	24%
Farmland	1.0 or more	93	1.14	0.76	33%
	0.75～1.0	565	0.86	0.60	30%
	0.5～0.75	1,654	0.63	0.48	24%
	less than 0.49	685	0.45	0.37	17%
Forest	1.0 or more	505	1.23	0.84	32%
	0.75～1.0	1,176	0.87	0.67	23%
	0.5～0.75	1,800	0.64	0.54	16%
	less than 0.49	482	0.45	0.41	8%
Roads	1.0 or more	189	1.24	0.89	28%
	0.75～1.0	591	0.85	0.63	27%
	0.5～0.75	1,871	0.62	0.46	27%
	less than 0.49	1,526	0.42	0.33	21%

Post-Decontamination Monitoring

- Average value of air dose rate has not been increased according to the investigation results up to now.
- Post-Decontamination Monitoring is under implementation at the same points of the previous monitoring in Tamura City.

Changes of Air Dose Rate after the Decontamination Model Project



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Progress in Intensive Contamination Survey Area ①

100 municipalities, designated as Intensive Contamination Survey Area, shall implement monitoring surveys and formulate the decontamination implementation plan (the plan) which stipulates area, method and contractors to implement decontamination work.

○As of the end of March 2013, the plans have been formulated in 94 municipalities.

○As the decontamination target covers large areas including public facilities, residential houses, roads, farmland and forest, municipalities shall clarify the objects and priorities, with consideration to the protection of public health.

⇒Decontamination work is being implemented based on decontamination plans developed by each municipality. In regard with the work schedule of the plans, 5 years is set in many municipalities mainly in Fukushima prefecture, and 2-3 years is defined in municipalities in other prefectures.

Progress in Intensive Contamination Survey Area ②

Decontamination work have been progressed according to decontamination plans of each municipality. Especially at spaces related to children and public facilities, it is getting close to the end; however, it might take period of years to be completed in whole.

Outside Fukushima pref. (As of the end of Jun., 2013)	Ordering Ratio (Number of Order/number of planning)	Implementation Ratio (Number of actual achievement/number of planning)
Schools and nurseries	almost on order	almost completed
Park, Sports facilities	approx. 80%	approx. 80%
Residential houses	approx. 60%	approx. 30%
Other facilities	approx. 30%	approx. 30%
Roads	approx. 30%	approx. 30%
Farmlands & meadows	approx. 80%	approx.60%
Forests(in living areas)	Partially on order	Partially implemented

Note: The number of planning is the number which is planed as of the end of Jun, 2013, so it might increase in future.

Within Fukushima pref.※ (As of the end of Jun., 2013)	Ordering Ratio (Number of order/number of planning	Implementation Ratio (Number of actual achievement/Number of planning)
Public facilities, etc.	approx. 80%	approx. 60%
Residential houses	approx. 50%	approx. 20%
Roads	approx. 40%	approx. 20%
Farmlands & meadows	approx. 90%	approx. 80%
Forests(in living areas)	approx. 30%	approx. 10%

Note:
The number of planning is the number planed by the end of FY2013. On the other hand, whole number including that of after FY 2013 is yet fixed in many municipalities.

※The table “Within Fukushima pref. “ is based on the investigation result conducted by Fukushima prefecture.

Result of the review on decontamination at Sep. 2013

Checkup the status of municipalities tackling leading decontamination and completing decontamination work based on on-going decontamination plan. Effective information shall be shared widely among municipalities in consideration of municipalities' status.

○The municipalities, implementing leading decontamination work, have been accumulating various original and innovative measures and know-hows, from the view point of the promotion of effective and efficient decontamination work and mutual understanding between local residents.

Example: Excerpted from " Good Practice Collection"(compiled by Fukushima Office for Environmental Restoration, MOE)

・Volume reduction of the waste(twigs, etc.) discharged from decontamination work (in Date city)

・Cooperation with local residents, delivery of Q &A materials for smooth operation for explanatory meetings (in Fukushima city)

Chipping operation in decontamination site

Committee for countermeasures for decontamination area

Questionnaire booth

○There are municipalities of which decontamination work have completed according to the plan as of Jun., 2013

With accelerating and streamlining of decontamination work in consideration of each municipality's status, information shall be shared by updating Good Practice Collection and by guidelines, and also exchanging opinions among municipalities.

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Decontamination model demonstration project

Overview of the project

In FY2011 we carried out verification experiments on the technologies required for the effective implementation of decontamination in twelve municipalities including the Restricted Area and the Deliberate Evacuation Area.

The system for implementing the project

Government (Cabinet Office)

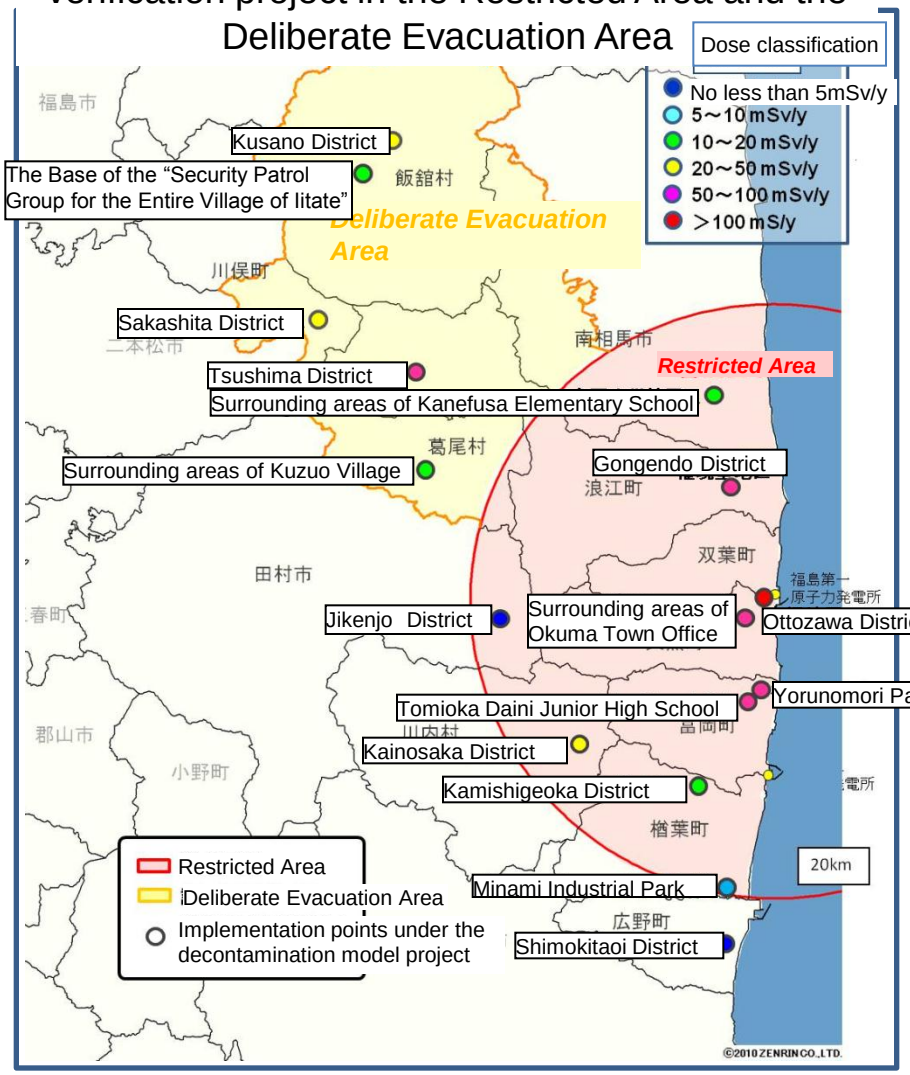
↓ Commission

Headquarters of Fukushima Partnership Operations, Japan Atomic Energy Agency

Public invitation for projects

- Municipality group "A": Taisei JV (Minami-Soma City, Kawamata Town, Namie Town, Iitate Village)
- Municipality group "B": Kashima JV (Tamura City, Futaba Town, Tomioka Town, Kuzuo Village)
- Municipality group "C": Obayashi JV (Hirono Town, Okuma Town, Naraha Town, Kwauchi Village)

Target areas for the decontamination model verification project in the Restricted Area and the Deliberate Evacuation Area



- Each municipality group is defined to include the followings:
  - Various targets for decontamination: forests, farmlands, residential land, buildings, roads
  - Various dose levels: high (＞100mSv/year), middle (20 -100mSv/year), low (5 -20mSv/year)

A notification was given by Futaba Town that it would not implement the decontamination model verification project at that time.

Overview of the result of the decontamination model demonstration project

- Areas with dose rates around 30mSv/year (5.7μSv/h): The dose rate was reduced to less than 20mSv/year (3.8μSv/h) as a result of decontamination.
- Areas with dose rate above 40mSv/year (7.6μSv/h): The dose rate was reduced by about 40 to 60% as a result of decontamination. However, it didn't come down to below 20mSv/year.
- The decontamination effect tended to be greater as the air dose rate before decontamination was higher.

Result of the decontamination model verification project (Excerpt)(Land use classification item is "Near the residential areas")

Target areas for decontamination	Decontamination method	Average value before decontamination (μSv/h)	Average value after decontamination (μSv/h)	Average air dose rate Reduction ratio
Okuma Town	Weed control in gardens, topsoil stripping, wiping off the roofs and walls etc.	11.5	3.9	66%
Namie Town	Weed control in gardens, topsoil stripping, wiping off the roofs and walls etc.	10	5.7	43%
Tomioka Town	topsoil stripping, high-pressure washing, pavement profiling, blasting etc.	7.9	4.2	47%
Namie Town	Weed control in gardens, topsoil stripping, high-pressure washing etc.	5.7	2.6	54%
Iitate Village	Weed control in gardens, topsoil stripping, high-pressure washing etc.	3.6	2.2	39%
Kawamata Town	Weed control in gardens, topsoil stripping, water cleaning, brushing etc.	3	1.7	43%
Kuzuo Village	Weed control in gardens, topsoil stripping, cleaning of the roofs and walls, wiping off the walls etc.	1.7	1.3	23%
Minami-Soma City	Weed control in gardens, topsoil stripping, high-pressure washing, brushing etc.	1.3	1.1	19%

Source: "Summary of the Report on the decontamination model verification project in the Restricted Area and the Deliberate Evacuation Area etc."
by the Team in Charge of Assisting the Lives of Disaster Victims, Cabinet Office, March 2012

Formulation of the Decontamination Guidelines

- Technical guidelines for carrying out decontamination
- Developed to complement the Ordinance of the Ministry of the Environment
- Used as reference when ordering decontamination projects and the like

Contents

1. Guidelines on the methods of investigating and measuring the status of environmental pollution in intensive survey areas
2. Guidelines pertaining to measures on decontamination and the like
3. Guidelines pertaining to the collection and transportation of the removed soil
4. Guidelines pertaining to the storage of the removed soil

Techniques used for decontamination ①

- **Houses, buildings**
  - **Removal of deposits from the roof, deck , and gutters**
  - **Wiping off the roofs and walls, high-pressure washing etc.**
- **Gardens and standing trees**
  - **Mowing, removal of fallen leaves, topsoil stripping etc.**
- **Roads**
  - **Removal of deposits in the ditch, high-pressure washing etc.**

Decontaminating paved surfaces (by a collective type high-pressure water cleaner)

Decontaminating roofing tiles (by wiping-off)

Decontaminating gardens (by removing soils etc.)

Photos provided by: Date City

Techniques used for decontamination ②

- **Schoolyards, gardens and parks**
  Stripping of soils and topsoils etc.
- **Farmlands**
  Reversal tillage, soil disturbance using water, stripping of topsoils etc.
- **Forests and woods**
  Removal of fallen leaves and lower twigs, pruning etc.

Decontaminating a schoolyard

Photo provided by: JAEA

Decontaminating a grass plot

Photo provided by: Japanese Society of Turf grass Science

Decontaminating a forest (by removing fallen leaves)

Photo provided by: JAEA

Demonstration Project for Decontamination technology

1. Overview

National government is soliciting decontamination technologies potentially usable in decontamination works, aiming to contribute to diffusion of similar technologies and progress of decontamination consequently, by supporting new technologies' development and evaluating effectiveness, economical aspects, and efficiency, etc. of the technologies.

2. Targeted Technologies

-1. Technologies to raise efficiency of decontamination works
-2. Technologies to reduce volume of contaminated waste and soil
-3. Technologies to treat contaminated waste by radioactive material
-4. Technologies to collect and treat contaminated water
-5. Technologies to transport and store removed object

3. Budget: JPY 2.1million(including tax) max. per case

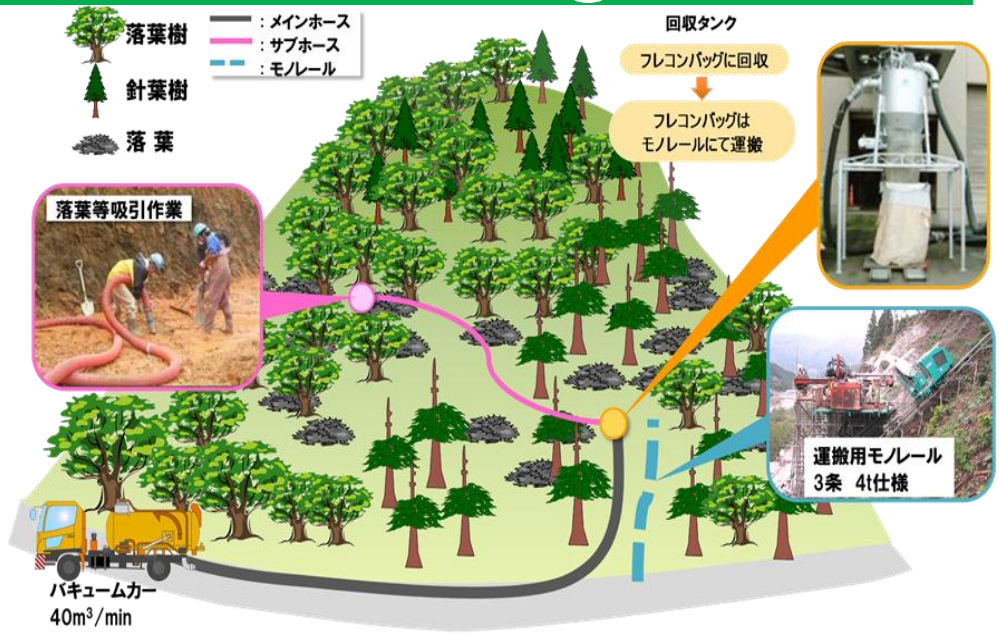
4. Status:

Cabinet office – 25 new technologies (Nov. 2011 – Feb. 2012)
Ministry of the Environment – 22 new technologies (May 2012 – Sep. 2012),
15 new technologies (Nov. 2012 – Mar. 2013),
11 new technologies (Aug.2013 — Dec.2013)

Example of Demonstrated Technologies that was actually used in the Decontamination Site ①

Efficiency of decontamination in forest

This system is collecting fallen leaves in the forest and bagging and transporting them, in the middle point between worker and cleaner truck, In order to work more efficiently and to expand the scope of work.



Decontamination using ultra-high pressure water in road, sidewalk, etc.

Decontamination of pavement using ultra-high pressure water (Up to 280MPa).

Example of Demonstrated Technologies that was actually used in the Decontamination Site ②

The turbid water treatment and reducing sludge

The turbid water left after the washing is purified using coagulation and precipitation. Sludge is processed in a small filter press to obtain dewatered filter cake.

Water treatment equipment

Small filter press

Decontamination method without using water

A decontamination method without using water for contaminated painted surfaces of buildings is demonstrated using a dust vacuum sander and stripping paint.

dust vacuum sander

stripping paint

Example of Demonstrated Technologies that reduce soil volume

[1] Classification technology

(*1)Classification means to separate off only small clay fractions with cesium from the removed soil by polishing, screening and washing the removed soil, taking account of the characteristic that cesium easily adheres to small particles of the clay.

- The classification technology has an effect of an average 80% decontamination rate. For instance, contaminated soil of 10,000-20,000Bq/kg can be decontaminated to 2,000-4,000Bq/kg. Volume reduction rate is 60-90% (depending on the particle size distribution)
- It costs 3,500-15,000 yen/t (depending on the number of years running and size)

[2] Cesium sublimation technology by rotation heating

- By using rotating heater and reaction accelerator together, separate cesium from soil, which is then collected by a bag filter. This purified soil can be used as a base course material, etc.
- This technology can effectively decontaminate cesium with 99.8%-99.9% removal rate. For example, if the soil is contaminated up to 67,000Bq/kg, it can reduce it to below the clearance level (100 Bq/kg) and collect all other cesium by a bag filter. The volume reduction rate is 98-99% (however, the volume of purified soil is doubled because reaction accelerator is needed to add the same amount of the soil).
- Assuming a new plant needs to be built, it will cost about 200,000 yen/t (400t/day, for 10 years running)

[3] Chemical processing

- Collect cesium by using the combination of oxalic acid and heat. They plan to load them onto trucks.
- The effect of this technology is 77-93% decontamination rate. For example, if the soil is contaminated at 5,000Bq/kg, it can reduce it to 450Bq/kg. The volume reduction rate is 95%.
- It will cost 50,000-100,000 yen/t (15t/day, for 2 years running).

Portal site to search the technology for decontamination "Decontamination Technology Options eXploration"

1.Overview

Ministry of the Environment established Portal site to provide the information of the useful new decontamination technologies developed by companies.
The following items are published on this Website.

- The registered technology related to decontamination, through a simple evaluation by experts.
- The evaluation by experts in terms of the effectiveness, economical aspects, and efficiency, etc. of the technologies, if the companies which have technologies want the evaluation.
- The technology issues which is registered by decontamination workers, etc.

2.Expected Effects

- Promoting the cooperation between the company which have a new technology and company which carry out decontamination.
- Promoting the use of new technology in the decontamination site.

3.URL

https://www2.env.go.jp/dtox/

Outline

- Policy Framework
- Progress in Special Decontamination Area
- Progress in Intensive Contamination Survey Area
- Decontamination technology
- **New policies announced in Sep 2013**
- Efforts to secure Interim Storage Facility

Future Directionin
In the Special Decontamination Area

- Decontamination work will be implemented in cooperation with reconstruction measures depending on the situation of each municipality, by revising the current plan which has been uniformly scheduled to be completed within 2years.
- Additional measures will be introduced for speed-up and facilitation.
- Decontamination plans of 6 municipalities (Minamisoma, Iitate, Kawamata, Katsurao, Namie and Tomioka) will be amended by the end of this year while 3 municipalities (Naraha, Kawauchi and Okuma) are on schedule to finish within FY 2013. As for Futaba, coordination towards the formation of a plan will be continued. In Tamura, decontamination work has already been completed.

Follow up measures after completion of decontamination work based on a plan

(Confirmation of maintenance of decontamination effects)

- Conduct relevant monitoring so as to confirm whether air dose reduction by decontamination would be maintained.

(Follow-up decontamination work)

- Implement decontamination work in the case of that newly-found contaminated areas(*) or areas in which un-decontaminated points are found, while considering radiation level there.

  (*) Supposing such area whose air dose rate is higher than that of surrounding area because contaminated soil, etc. is re-accumulated there associated with fallen leaves or rain water and, as a result, air dose rate goes up significantly after the decontamination.

- Require a careful judgment to decide the follow-up decontamination implementation, considering various circumstances of each case. MOE will publish guidance for it by analyzing actual cases.

(Others)

- Take relevant measures including risk communication matters based on the ongoing discussion at the Nuclear Emergency Response Headquarters on radiation protection measures.
- In regard with measures on rivers and lakes, monitoring will have been conducted.

Measures on forest areas

A. Around residential areas

- Make an additional measure possible to remove organic residuals 5m in width from the edge in the case the effects of prior decontamination (by removing organic deposits such as fallen leaves 20m in width) is found to be limited.
- Make an exceptional measure possible to widen the area of decontamination to over 20m in case relatively high air dose rate is monitored around the house even though prior decontamination has been done, supposing such a house located in a valley, etc.

B. Cultivating farm for mushroom

- Make the implementation of standard decontamination method possible, which have been approved around residential areas (20m wide), in a case where cultivating business is expected to be sustained.

C. Forest in whole

- Collaborative measures will be conducted by Ministry of the Environment and Forestry Agency.

  MOE: measures regarding monitoring on runoff and/or diffusion of contaminated soil as well as countermeasures against them

  Forestry Agency: measures to take proper forestry management

Outline

- Policy Framework
- Progress in Special Decontamination Area
- Progress in Intensive Contamination Survey Area
- Decontamination technology
- New policies announced in Sep 2013
- **Efforts to secure Interim Storage Facility**

Efforts to secure Interim Storage Facility

Oct., 2011 Ministry of the Environment announced the **Basic Principles for Interim Storage Facility (ISF) (the roadmap),** and explained to the heads of relevant municipalities

Main Contents

- The National Government shall secure, maintain and manage ISF
- The National Government shall make utmost efforts **to start the operation of ISF within about 3 years(by January, 2015)**
- Materials to be stored are limited to soil and waste generated in Fukushima prefecture

Dec., 2011 The Ministry requested Fukushima Pref. and 8 towns in Futaba County to examine location sites within Futaba county

Mar., 2012 The Ministry explained the Fukushima Pref. and 8 towns that IFS may be located separately in 3 towns (Futaba, Okuma and Naraha)

Aug., 2012 The Ministry proposed the investigation for ISF to Fukushima Pref. and 8 towns

Nov., 2012 The Fukushima Pref. announced the acceptance of the investigation proposed by the Ministry at the consultation meeting with the mayors of Futaba County's towns and villages

May., 2013 Boring survey has started in Okuma

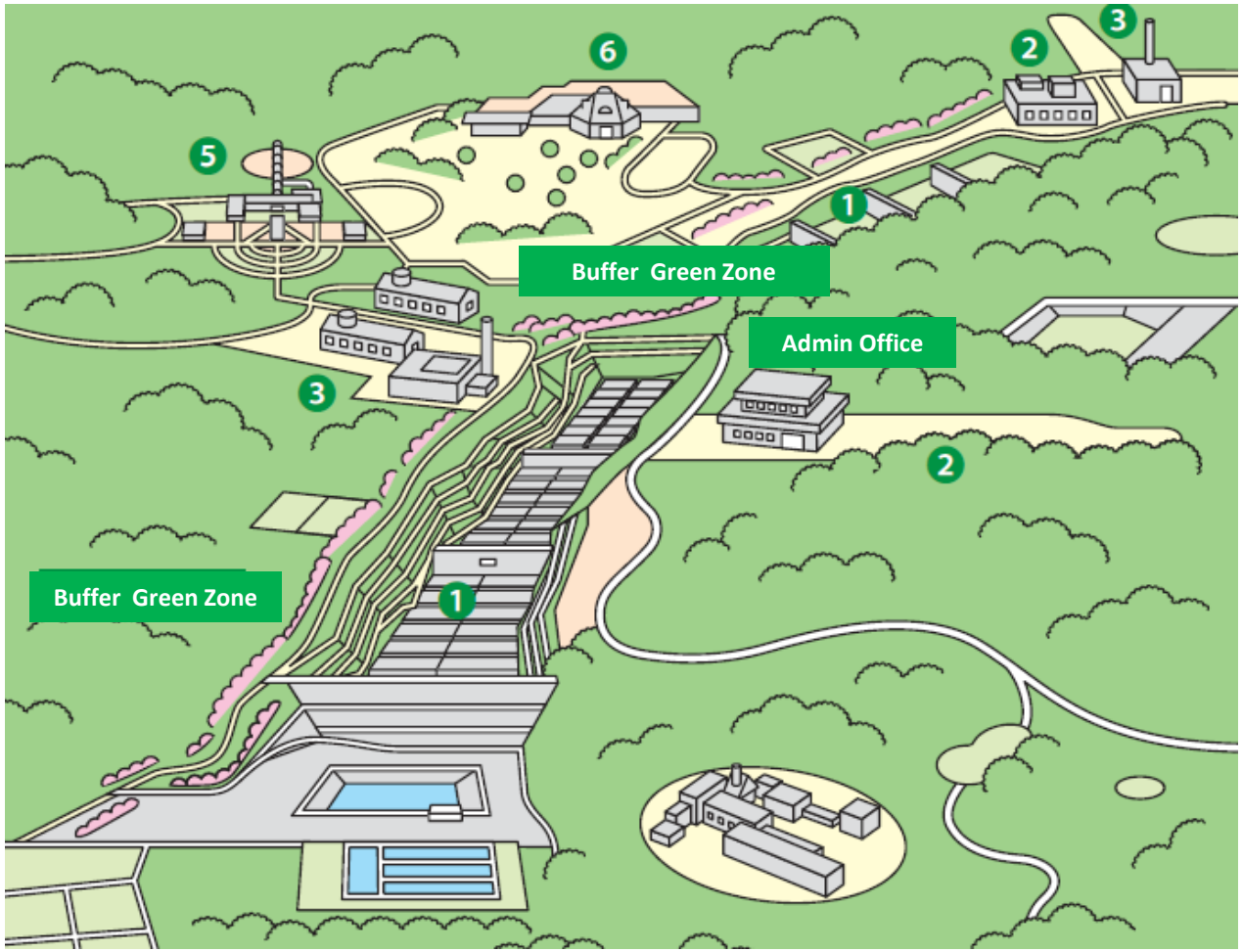
Jul., 2013 Boring survey has started in Naraha

Jun., 2013 Study Group on environmental protection and safety measures for ISF was established.

Sep., 2013 Futaba Town accepted the investigation for ISF.

Illustration of Interim Storage Facility

ISF will be consisted of facilities with various functions



①Storage Facility

②Emplacement & Segregation Facility

③Volume Reduction Facility

④24-hour monitoring Equipment(placed in several points, not specifically indicated in the figure)

⑤R & D Facility

⑥Public information Center

Scale of the whole facility（estimation）
Total storage volume ranges between 15-28 million ㎥, which is 12-23 times big as a baseball stadium(approx. 1.24million ㎥)

Concept of Structure of Storage Facility

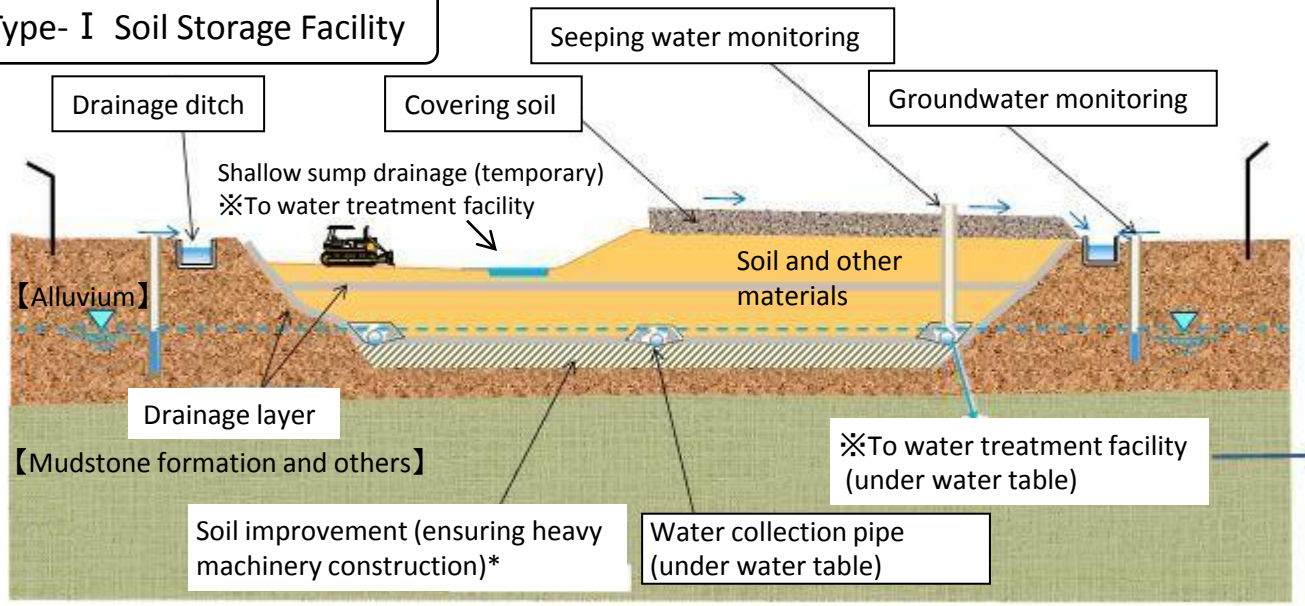
	Type-I Soil Storage Facility	Type-II Soil Storage Facility	Waste Storage Facility
Main substances for storage (Radioactive cesium concentration)	Soil and other materials that do not risk polluting public water area and groundwater with radioactive cesium （ 8,000Bq/kg or less ）	Soil and other materials exceeding the condition shown in left column (More than 8,000Bq/kg)	Waste
Measures to prevent water seeping into ground water	—	Seepage control and other infrastructure (Seepage control sheet and other infrastructure or low-permeability soil layer)	Package

Schematic View of Type- Ⅰ Soil Storage Facility

<Type-I >

Applicable geography and geology
Any low land

Radioactive cesium concentration
8,000Bq/kg or less



*Basement: In the case of alluvium, soil improvement (approximately up to 1m depth) will be performed. In the case of mudstone formation, no action will be needed.

Concept of Structure of Storage Facility

Schematic View of Type- II Soil Storage Facility

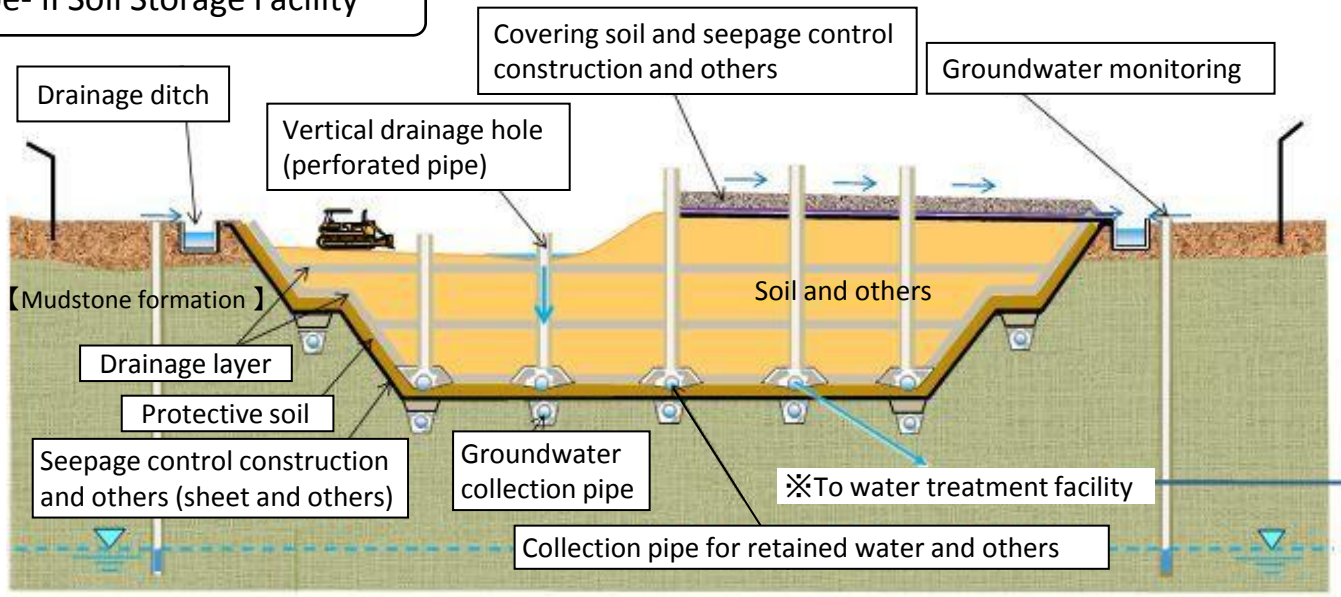
<Type – II >

Leakage control
Seepage control sheet patterns

Applicable geography and geology

Hill , Tableland

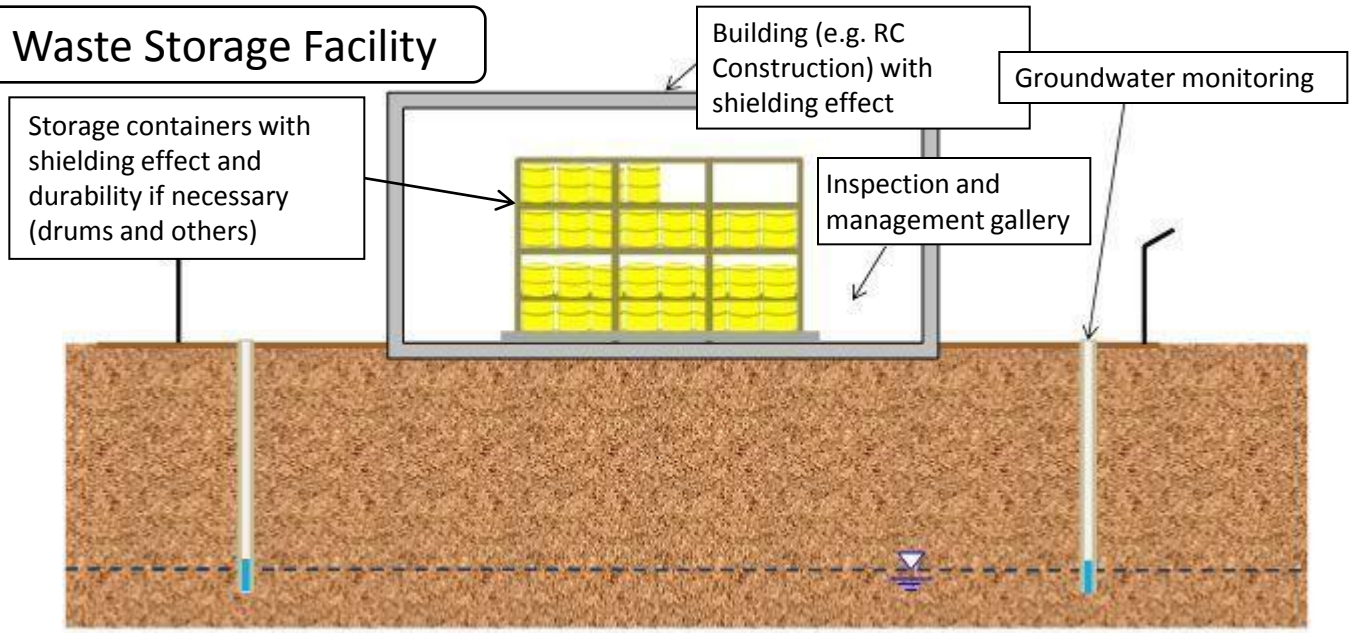
Radioactive cesium concentration
more than 8,000Bq/kg



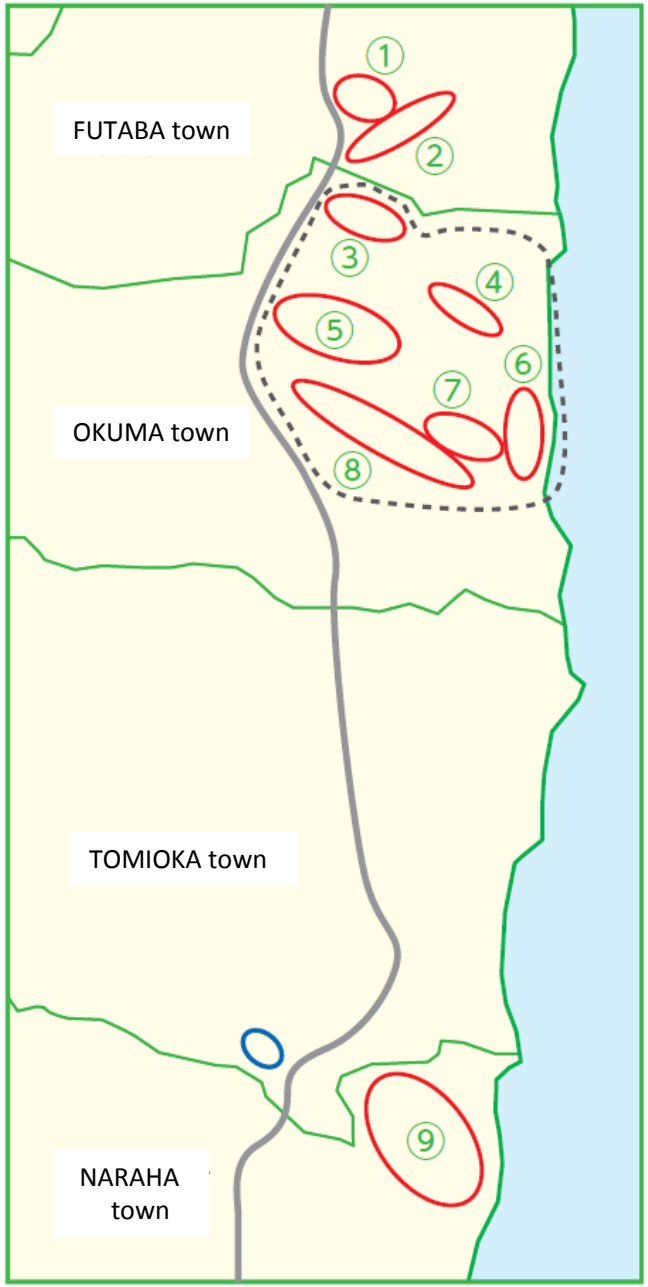
Schematic View of Waste Storage Facility

Applicable geography and geology
Hill, Tableland

Radioactive cesium concentration
More than 100,000Bq/kg



Outlook for Selecting Potential Survey Sites for ISF



Potential sites will be selected from 3 towns (Futaba, Okuma and Naraha).
Survey sites are selected taking into account existing data and the following conditions:

- ○Effective utilization of existing geological formation, e.g. plateaus and hills
- ○Utilization of existing facility
- ○Utilization of sites contributed to disaster prevention

Potential sites for preliminary survey

Existing controlled landfill site

※The indicated potential survey sites serve only as a rough outline as envisaged to carry out the preliminary survey at the present day.

Reference

Overview of the Decontamination Technology Demonstration Test Project 2011

The project aims to identify effective technologies that can be utilized in future decontamination operations and evaluate their effectiveness through demonstration tests to confirm their decontamination effects, economic efficiencies, safety, etc.

Following a public call for proposals (outlined below), demonstration tests were conducted on the 25 technological proposals listed in the table

< Outline of the public call >

○ Target areas: technologies for

- improving decontamination work efficiencies
- reducing volumes of wastes, such as removed soil
- transport and temporary storage of wastes
- decontamination support

○ Number of adopted proposals: 25

○ Budget for the demonstration test project: about 20 million yen per proposal with modification as necessary and appropriate

○ Implementation period: November 2011 until end February 2012

● Outline of the selected decontamination technology test proposals and contractors

Decontamination target	Method	Features	No.	Implementer (contractor)
Soil	Heat treatment	Reaction acceleration agent	1	Taiheiyo Cement Corporation
	Separation	Pump separation	2	ROHTO Pharmaceutical Co., Ltd.
		Wet separation	3	Takenaka Corporation
			4	Kumagai Gumi Co., Ltd.
			5	Hitachi Plant Technologies, Ltd.
			6	Konoike Construction Co., Ltd.
			7	Sato Kogyo Co., Ltd.
	Chemical treatment	Organic acid treatment	8	Toshiba Corporation
Sewage Sludge	Elution	Organic reagent treatment	9	Nippon Steel Engineering Co., Ltd.
Parks, roads and buildings	Cutting and stripping	Stripping paint	10	Shiga Toso Co. Ltd.
	Special water-based washing	Nano-bubble water	11	Kyoto University
		Molecular cluster ozone water	12	Nature's Company
	High-pressure water jet washing	Ultra-high pressure (280 MPa)	13	KICTEC Incorporated
	Blasting and stripping	Wet blasting	14	Macoho Co., Ltd.
Tsunami debris	Washing	Washing with water	15	Toda Corporation
		Dry ice cleaning	16	Kantechs Co., Ltd.
Reduction of volume of plants and cow dung	Conversion into manure	100°C or higher	17	Japan Aerospace Exploration Agency
		50-60°C	18	Mikuniya Corporation
Water	Sorption	Zeolite blocks	19	MAEDA Corporation
		Iron ferrocyanide	20	Tokyo Institute of Technology
Woodland and timber	Stripping and solidification	Stripping and cement-based solidification	21	Taisei Corporation
	Washing	Washing with water and incineration	22	Koriyama Chip Industry Co., Ltd.
		High-pressure water jet washing and water treatment	23	Neonite Corporation
	Thinning	Focus on air dose rates	24	Fukushima Prefectural Forestry Research Center
	Undergrowth clearing & stripping	Improving efficiencies of forest decontamination methods	25	Obayashi Corporation

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MOE Decontamination technique Demonstration Project 2011

- **Publicly elicit potential decontamination techniques for the demonstration aiming at identifying techniques applicable in the decontamination in the future and verifying decontamination efficiency, cost efficiency, and safety (Applications received in December 28, 2011 – February 29, 2012)**
- **22 techniques listed in the table were selected by the review committee consisted of experts.**
- **Results of the demonstration tests are to be compiled and evaluated in September.**

Objects	Techniques	Features	Organizaitons	No.
Road surfaces and concrete	High pressure water cleaning	High pressure water cleaning (Max. 20 MPa), Recovery, treatment and recirculation of the contaminated water.	Fukushima Komatsu Forklift Co. Ltd.	1
	Ultra-high pressure water cleaning	Ultra-high pressure water (Max. 200 MPa) cleaning of walls etc. with a suctorial and self-propelled system	Muramoto Corporation	2
	Ultra-high pressure water cleaning/stripping	Large-, medium-, and small-scale ultra-high pressure (Max. 250 MPa) water cleaning system for paint stripping	Todenkogyo Co. Ltd.	3
Soil	Classification	Automated wet classification, scrubbing cleaning (wet system) and treatment of concentrated residues.	Shimizu Corporation	4
		Mixed air jet pump, Swirl classification system (wet system)	Maezawa Industries, Inc.	5
		Mixed air pump, Sieve-based classification (wet type)	Radioactive Waste Management and Nuclear Facility Decommissioning technique Center	6
		Grinding and classification (dry system) and surface grinding (dry system)	Fuji Furukawa Engineering & Construction Co. Ltd.	7
	Stripping of topsoil	Areal measurement of radiation dose rate with an optical fiber, and removal of surface soil	IHI Corporation	8
Bottom sediment in irrigation ponds	Coagulation sedimentation	Coagulation sedimentation (Fast)	Mitsubishi Kakoki Kaisha Ltd.	9
	Dredging/classification	Dredging system and centrifuge classification (wet system)	Toyo Construction Co. Ltd.	10
Organics	Volume reduction	Incineration (low temperature incineration)	Tohoku University	11
	Carbonization	Carbonization (transportable type)	Yamaguchi Seisakusho Co. Ltd.	12
	Biomass power generation and production of ethanol	Pyrolytic gasification and carbonization, and utilization of the generated gases	Tekken Corporation	13
		Production of ethanol (using grasses and woods)	Contig-I Inc.	14
		Phytoremediation and production and gasification power generation of ethanol (using polysaccharide plants)	Japan Groundwork Association	15
		Thermal decomposition (carbonization and gasification), and combustion of the charcoal	Konoike Construction Co. Ltd.	16
Bark	Cleaning	Grinding cleaning	Aizudoken Corporation	17
		Water cleaning and compression molding	Toonokosan Corporation	18
Incineration ash	Solidification (Superfluid method)	Solidification and volume reduction of incineration ash using solidification agent and external vibration	Hazama Corporation	19
	Cleaning	Leaching of Cesium from fly ash and adsorption of cesium with Prussian blue	Koriyama Chip Industry Co. Ltd.	20
Debris	Abrasion	Wet blasting	Macoho Co. Ltd.	21
	Grinding/classification	Moisture solidification & abrasion classification (dry system)	Takasago Thermal Engineering Co. Ltd.	22

MOE Decontamination technique Demonstration Project 2012

- **Publicly elicit potential decontamination techniques for the demonstration aiming at identifying techniques applicable in the decontamination in the future and verifying decontamination efficiency, cost efficiency, and safety (Applications received in May 25, 2012 – August 31, 2012)**
- **15 techniques listed in the table were selected by the review committee consisted of experts.**
- **Results of the demonstration tests were compiled and evaluated in May, 2013.**

Objects	Techniques	Features	Organizaitons	No.
Road surfaces and concrete	Ultra high pressure water cleaning	Ultra high pressure water (Max. 180 MPa), less water, recovery, treatment and recirculation of the contaminated water.	Shimizu Corporation	1
	Cutting	Special bit and thin-layer cutting.	NIPPO Corporation	2
Soil	Scraping	Remote-controlled scraping machine for high slope.	Fukasawa Co. Ltd.	3
Sewage sludge	Incineration	Water glass solidification and ferric ferrocyanide.	Tokyo Institute of Technology	4
Water	Water treatment	Adsorption of Cs ion and filtration using functional carbide.	GAIA Institute of Environmental Technology Inc.	5
Bottom sediment	Dredging	Thin-layer dredging and capping.	Taisei Corporation	6
Organics	Carbonization	Superheated steam carbonization.	Shirakawaido Boring Inc.	7
	Volume reduction	Low-temperature pyrolysis and bio-fuel.	Toonokosan Corporation	8
	Incineration	Mobile in-furnace air cooling incinerator and volume reduction.	Shinseigiken Engineering Co. Ltd.	9
	Washing	Water washing and measurement of surface contamination density.	NEONITE Co. Ltd.	10
Incineration ash	Melting	Melted slag and volume reduction.	Kobe Steel Co. Ltd.	11
	Solidification /non-leachability	Compound synthetic resin solidification.	E&E Techno Service Co. Ltd.	12
		Granulation, solidification and washing.	Obayashi Corporation	13
Utilization		Concrete debris utilization.	Toda Corporation	14
Waste treatment		Multifunctional fill.	Asahi-Kasei Geotechnologies Co. Ltd.	15

MOE Decontamination technique Demonstration Project 2013

- **Publicly elicit potential decontamination techniques for the demonstration aiming at identifying techniques applicable in the decontamination in the future and verifying decontamination efficiency, cost efficiency, and safety (Applications received in February 14 – May 24, 2013)**
- **11 techniques listed in the table were selected by the review committee consisted of experts.**
- **Results of the demonstration tests are to be compiled and evaluated in December.**

Objects	Techniques	Features	Organizaitons	No.
Soil	Fluoride salt	Cs elution using fluoride salt at normal temperature and pressures.	Swing Corporation	1
	Vacuum pressure	Dewatering and solidification using cement and vacuum pressure.	Maeda Corporation	2
Bottom sediment	Classification	Classification for bottom sediment at present location.	Aomi Construction Co., Ltd.	3
Organics	Shredding, suction and recovery	Laborsaving for greenery decontamination using shredding and suction.	Fukushima Komatsu Forklift Co., Ltd.	4
	Drying and shredding	Drying, shredding and classification for mixture of plant and soil.	Obayashi Corporation	5
Monitoring	Unmanned helicopter and hyper spectrum	Mapping of air dose rate using unmanned helicopter and of vegetation and land coverage using hyper spectrum.	Chiba University	6
	Measurement of container unit	Radioactivity concentration measurement of container unit.	Toshiba Corporation	7
Incineration ash	Washing	Saving waste water load using high efficiency washing.	Fujita Corporation	8
	Washing and magnetic separation	Recovery of Cs using magnetic nanoparticle coated with absorbent after washing.	Taisei Corporation	9
Waste	Organic acid	Cleaning up aluminum radiator using organic acid.	E&E Techno Service Co., Ltd.	10
	Blasting	Cleaning up waste household electrical appliance for recycling using balsting with sodium bicarbonate.	Chugai-technos Corporation	11