

## Sources

- United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), 2008 annual report
- International Commission on Radiological Protection (ICRP), 2007 recommendations
- The Guidelines for Medical Exposure by Japan Association of Radiological Technologists
- "Radiation in the Living Environment (Calculation of the National Exposure Dose)," new edition prepared by the National Institute of Radiological Sciences based on the sources above (May 2018).

mSv: millisievert

## Environmental Remediation

<http://josen.env.go.jp/en/storage/>


## The Environmental Regeneration Plaza

<http://josen.env.go.jp/plaza/eng/index.html>


## Interim Storage Facility Information Center

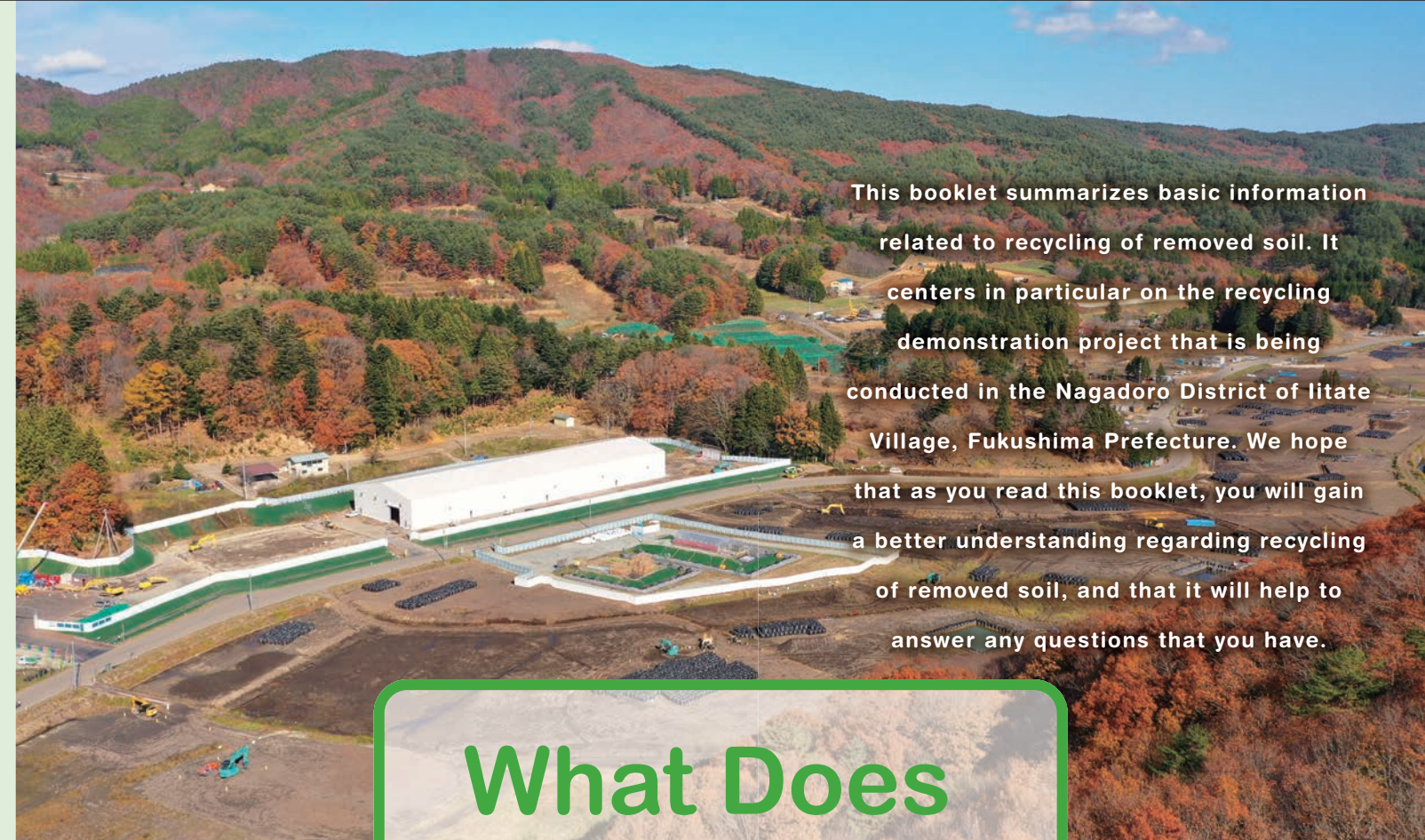
[https://www.jesconet.co.jp/interim\\_infocenter/en/index.html](https://www.jesconet.co.jp/interim_infocenter/en/index.html)


## ©Contact information

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(October 2022)



This booklet summarizes basic information related to recycling of removed soil. It centers in particular on the recycling demonstration project that is being conducted in the Nagadoro District of Iitate Village, Fukushima Prefecture. We hope that as you read this booklet, you will gain a better understanding regarding recycling of removed soil, and that it will help to answer any questions that you have.

## What Does

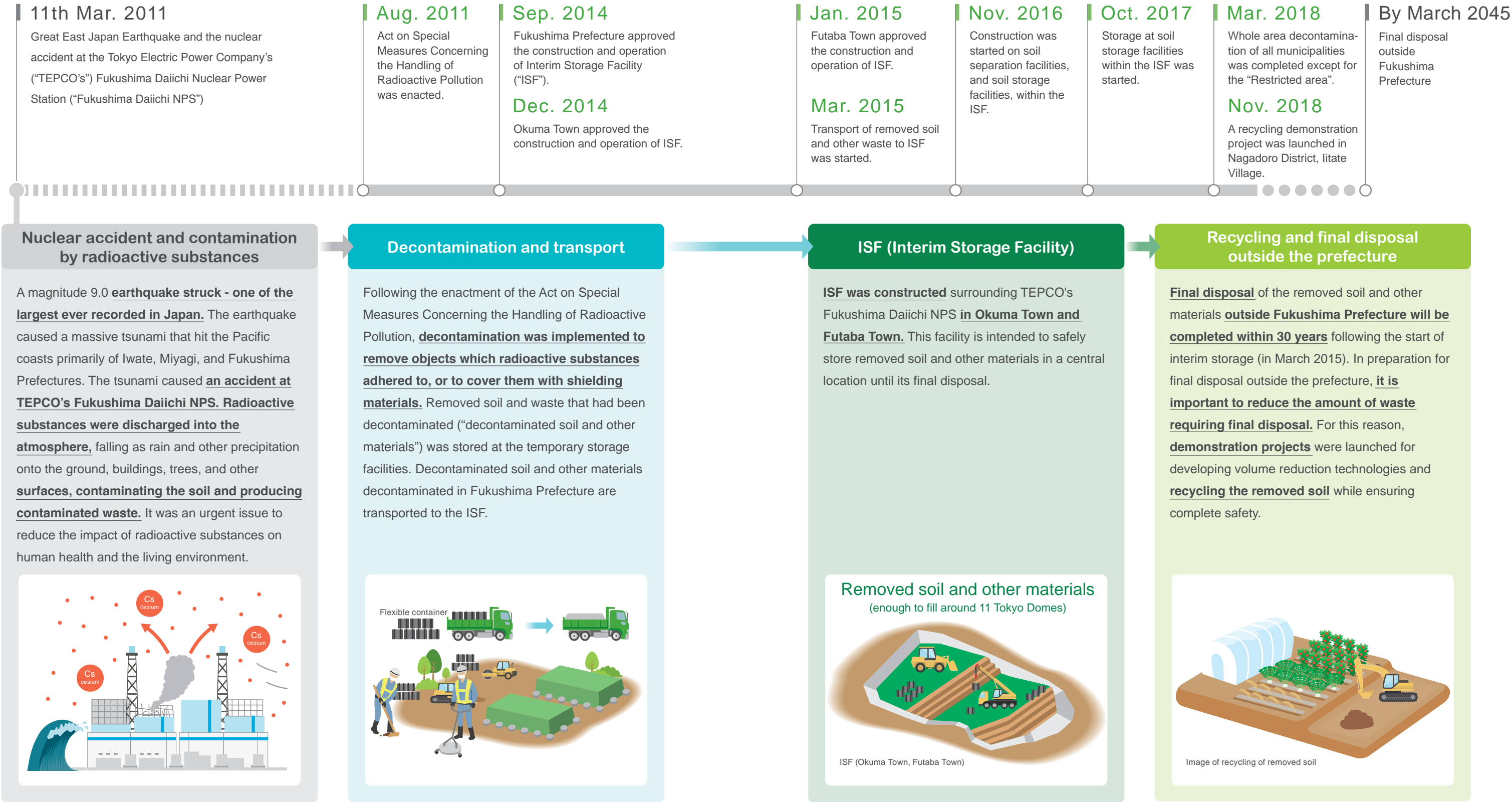
## “Recycling of Removed Soil”

## Mean?





1 Past and Future Measures Taken for Removed Soil



Contents

1 Past and Future Measures Taken for Removed Soil ... 1

2 What Does "Recycling of Removed Soil" Mean? ..... 7

3 Environmental Regeneration Project in Nagadoro ..... 9  
District of Iitate Village

4 Process of Creating Recycled Soil..... 11

5 Process of Creating Agricultural Embankments..... 13

6 Cultivation Results from Demonstration Project..... 15

7 Confirmation of Paddy Field Function from..... 17  
Demonstration Project

8 Tours of Nagadoro District ..... 18

9 PR Activities..... 21

© FAQ ..... 23

[Reference] Basic Knowledge About Radiation..... 25

# 1 Past and Future Measures Taken for Removed Soil

## Decontamination

One property of radioactive cesium is that it adheres easily to clay minerals, and once it has adhered, it is difficult to dissolve in water. Therefore, in order to lower the radiation dose resulting from radioactive substances in the environment, the first step was to **remove and shield the soil where there was adhering radioactive cesium and move it far away** from living areas.



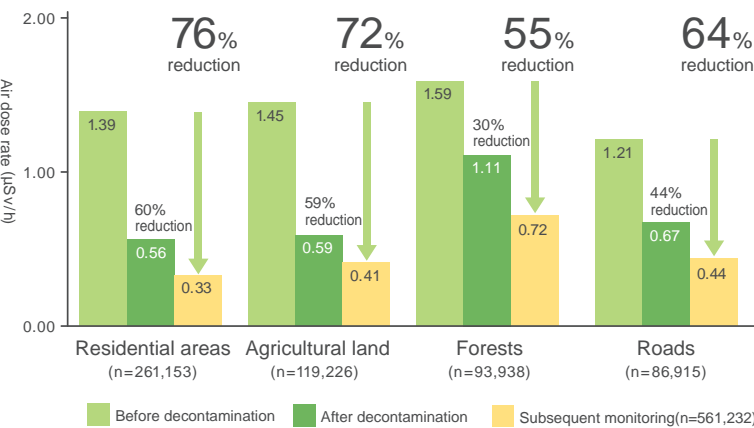
- Surface soil was removed from gardens, and replaced by additional soil from outside.
- Leaves and other accumulated substances were removed from rain gutters.
- Roofs were wiped, and accumulated substances were removed.



- The measures below were taken at fields and paddies,  
1) Surface soil was removed, and replaced by an additional soil 2) Reversal tillage which replaces bottom soil at a depth of around 30 cm 3) Deep plowing of fields

In residential areas, **decontamination reduced the air dose rate by 60%, and subsequent monitoring verified a reduction of 76%**. This confirms that the effects of whole area decontamination are being maintained.

### Effects of decontamination



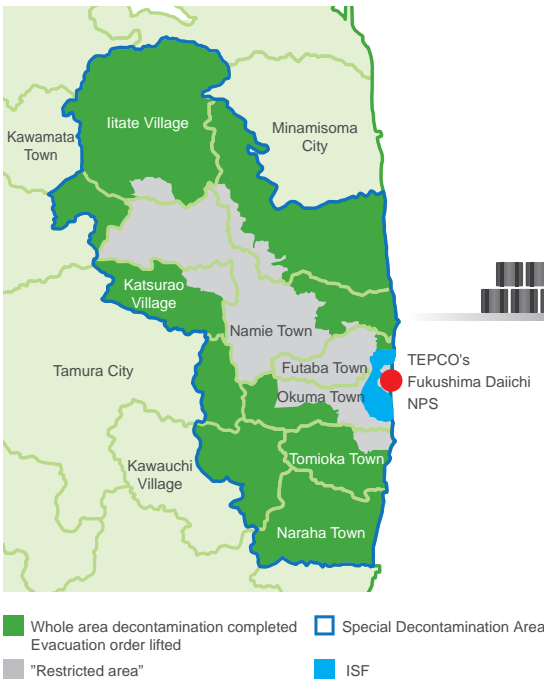
Whole area decontamination was completed by March 2018.

Except for the designated "Restricted area", whole area decontamination was completed in all 100 cities, and villages in eight prefectures. The decontamination work involved over 30 million people in total.

Lifting of evacuation orders following decontamination

Following the completion of decontamination and other measures, the Nuclear Emergency Response Headquarters lifted the evacuation orders in the Areas under Evacuation Orders which had previously covered 12% of Fukushima Prefecture land, leaving the remaining 2.4% consisting of "Restricted area".

### Special Decontamination Areas



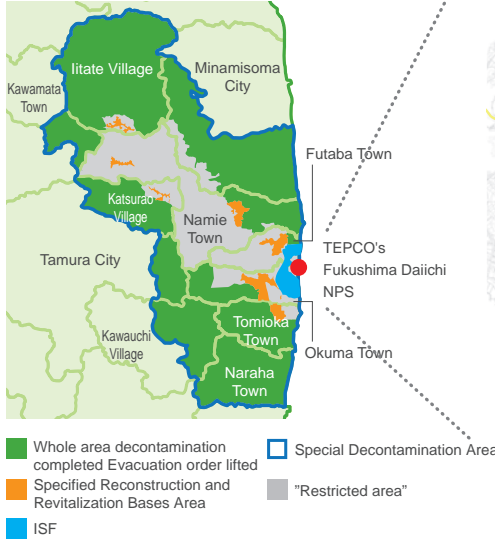
## Interim Storage Facility

**The ISF was constructed in order to manage removed soil and other waste materials.** It was prepared so as to surround TEPCO's Fukushima Daiichi NPS, with **Okuma Town and Futaba Town making the extremely difficult decision to approve** their construction. The facility covers an area of around 1,600 ha. Construction was started in November 2016 and storage at the soil storage facilities was started in October 2017.

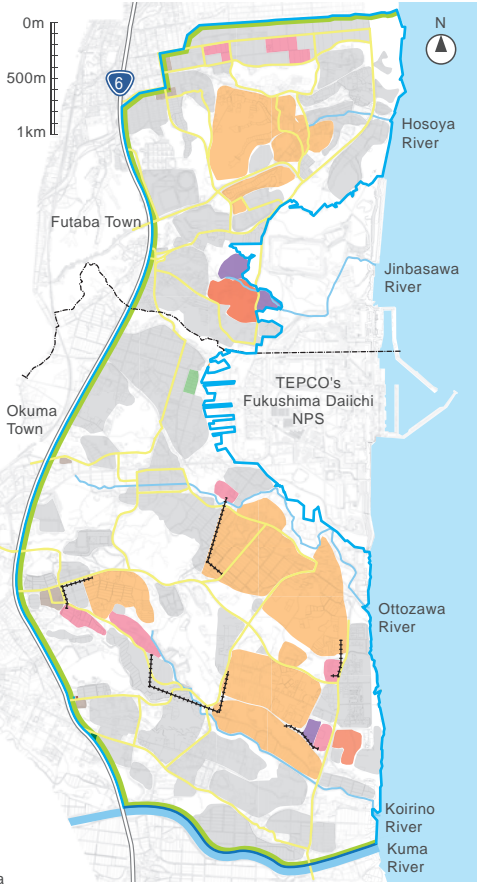


View of the ISF

### ISF



In consideration for the severe environmental damage in Fukushima and the unreasonable burdens on the residents, **the law requires that all soil removed as a result of decontamination in Fukushima Prefecture undergo final disposal outside the prefecture within 30 years.**



### Voices of town residents where ISF was accepted



Former mayor of Okuma Town  
**Toshitsuna Watanabe**

It has been 10 years since I was told, "An evacuation order has been issued. Go west."

10 years ago on the morning of March 12, I received a call from the prime minister's office. "An evacuation order has been issued, Evacuate to theand go west." Having been so instructed, the residents boarded buses and headed for the evacuation sites, still unaware of the severity of the nuclear accident. The 10 years since that time were a series of terrible events. Telling myself that there nothing to do but keep moving forward, we made it to this point. Of course, what was most difficult was the decision to accept the ISF. Some residents approved since we would be unable to return, some objected because they wanted to protect the land of their ancestors, and some were willing to cooperate under certain conditions. The town residents were divided into three incompatible opinions. One resident in his 90s told me, "It was hard during the war, but they never told us to 'leave'. This is worse than the war."

Because the opposing residents were in the majority, as mayor I could have told the national government that we refused. However was there another place that would accept the contaminated soil from Okuma Town? If not, then Okuma would remain contaminated. In that case, it was better to cooperate with the national government and work to rebuild the lives of the residents. We succeeded in convincing the residents and decided to accept the facility.

I intend to leave future town development to my successors. I hope that they will approach it in the spirit of creating a new future city.



Official, Koriyama Administrative District, Futaba Town  
**Hideki Mori**

Providing land for the Revitalization of Fukushima – I think our ancestors will forgive us.

When we accepted the ISF, I collected the opinions of the local residents together with Yoshihiko Saito and Shoichi Fukuoka. If we would be unable to return for 30 years, I thought that accepting the ISF on the land that had been passed down from and developed by our ancestors was a way to make effective use of it. I also hoped that doing so would provide hope to the people of Fukushima Prefecture and everyone in Japan. For this reason, I believed that our ancestors would forgive us, and the residents of Koriyama District agreed to provide their land, though they did it with broken hearts.

We have lost much over the past 10 years, including our lands, homes, and our community. I sometimes wonder if there was no way they could have created a facility that would have allowed the whole community to move together. When I see the lifting of the "Restricted area" and the recoveries in other areas, I also wonder if we would also have

been able to return in 10 years if we had not accepted the ISF. I think the national and prefectural governments have a responsibility to take our concerns seriously and provide long-term support.

After 30 years, I strongly want the Ministry of the Environment ("MOE") and the national government to restore the land in the current Koriyama District so that any person would want to live there, and pass it on to the next generation.



# 1 Past and Future Measures Taken for Removed Soil

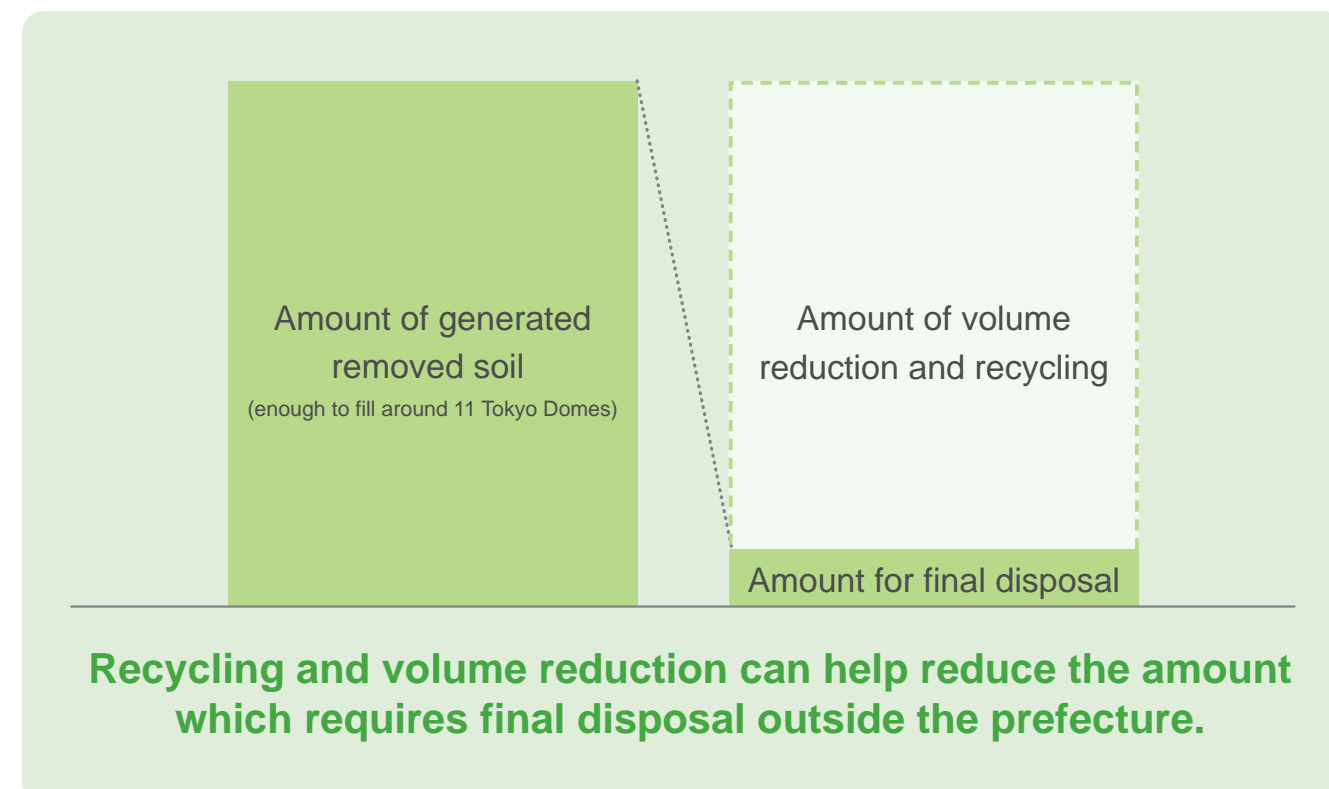
## The need for volume reduction and recycling of removed soil

The amount of removed soil that was transported to the ISF is **enough to fill around 11 Tokyo Domes**.  
**The keys to reducing the amount which requires** final disposal outside the prefecture **are volume reduction and recycling.**

Reference: Volume to fill the Tokyo Dome = 1.24 million m<sup>3</sup>(Formula: 100 m × 100 m × 124 m)

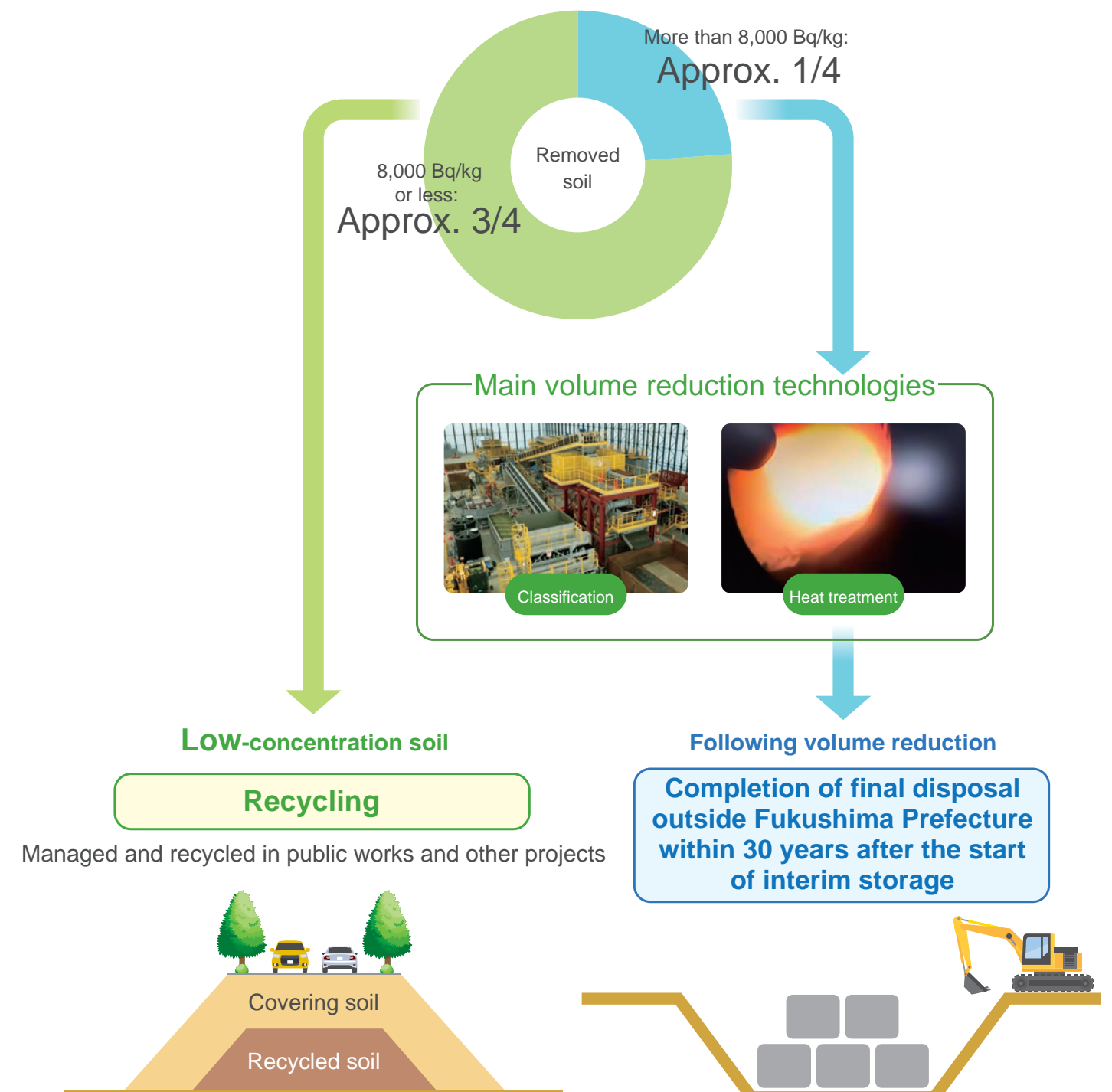


View of the ISF



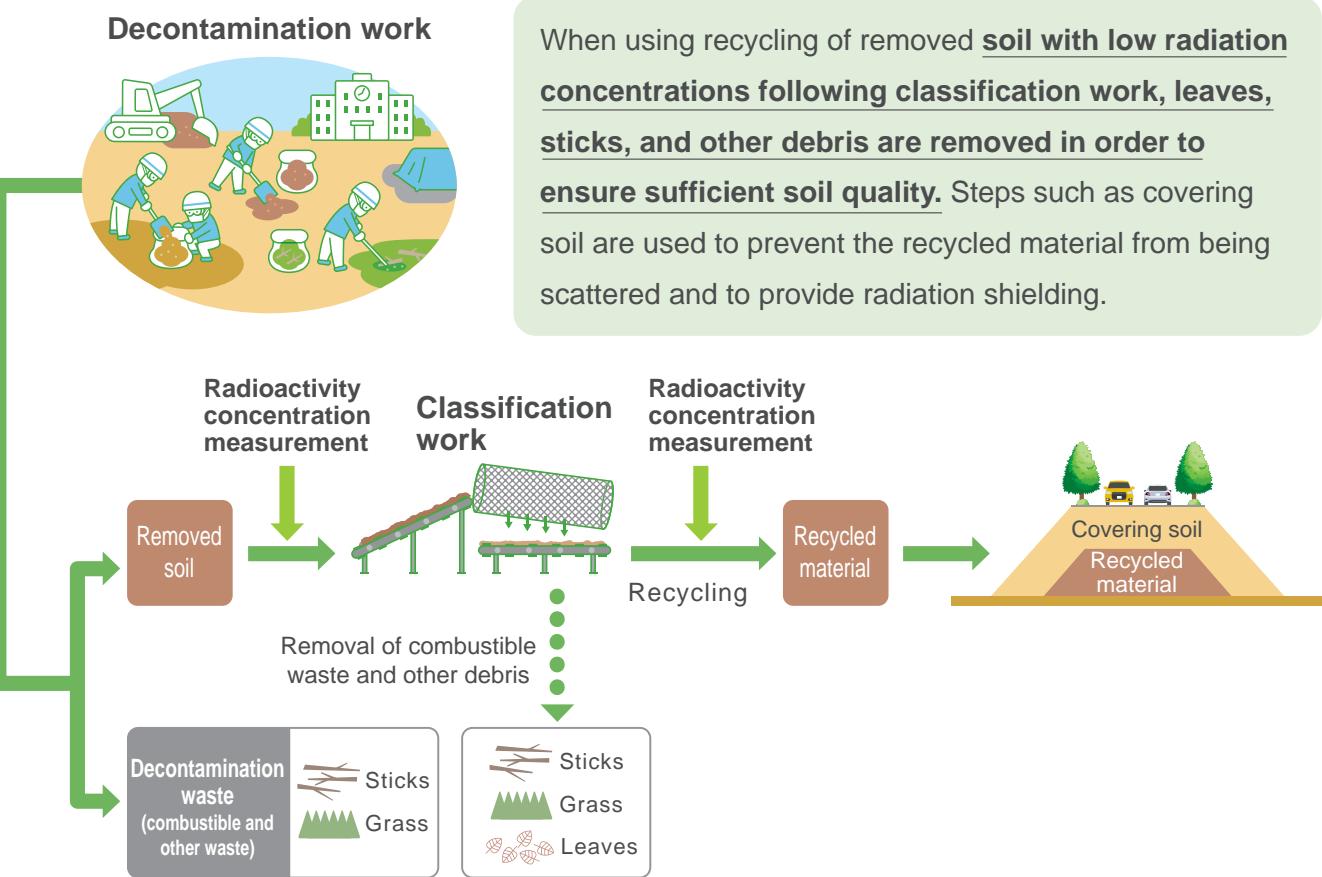
**The use of recycling and volume-reduction technologies will reduce the amount of final disposal, premised on the absolute requirement of ensuring complete safety.**

©Distribution of radiation concentration in removed soil



2 What Does “Recycling of Removed Soil” Mean?

Recycling of removed soil

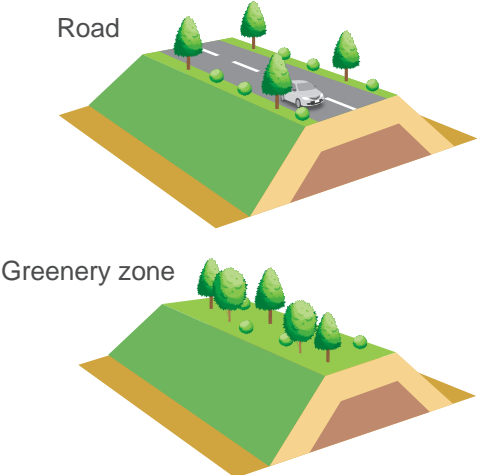


When using recycling of removed soil with low radiation concentrations following classification work, leaves, sticks, and other debris are removed in order to ensure sufficient soil quality. Steps such as covering soil are used to prevent the recycled material from being scattered and to provide radiation shielding.

Expected purposes of use

Uses for the recycled materials are limited to embankments and other structural foundations in public works and similar projects, where no man-made changes to the structure shape are expected.

- Embankments covered by soil, asphalt, concrete, or other substance (such as for railways, roads, and seawalls)
- Embankments covered by covering soil for planting (such as coastal disaster protection forests)
- Covering soil, earthen dikes, and other structures at waste treatment sites
- Landfill material and filler that are covered by planting soil (such as in greenery zones)
- Agricultural sites that are covered by soil or other material



Measures to ensure safe recycling and use

Recycled materials are used under suitable management based on the major premise of ensuring safety.

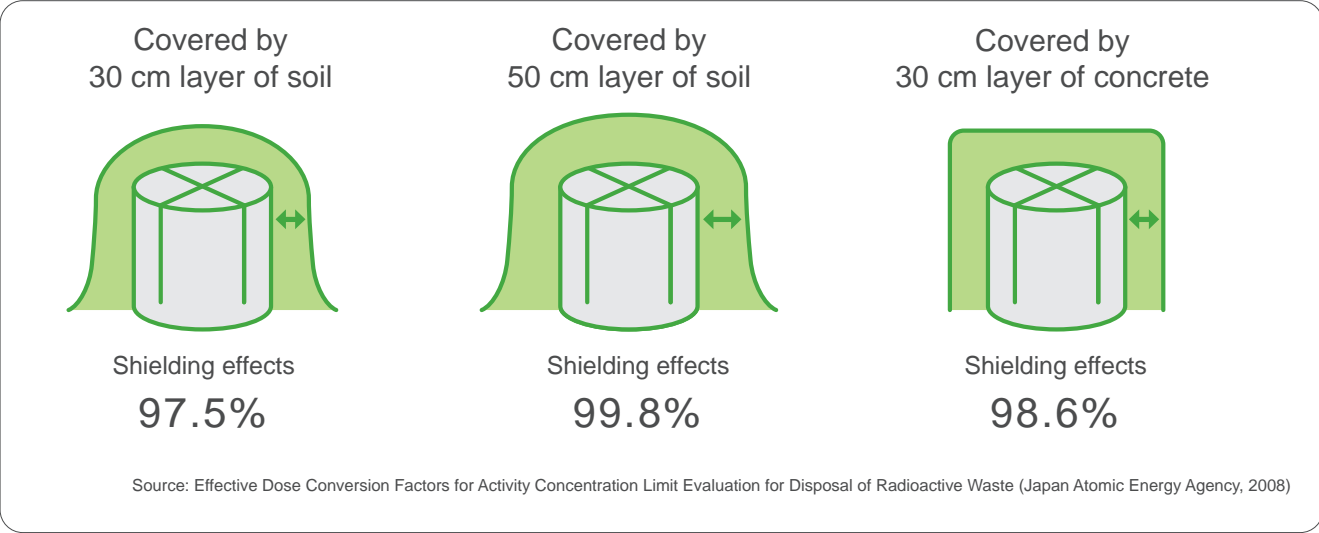
Radiation concentrations are set (in principle 8,000 Bq/kg or less) in order to limit the additional radiation dose received by nearby residents and workers not to exceed 1 mSv/year. Covering soil or other shielding, as well as measures to prevent dispersion and outflow, are also used. (50 cm of soil covering soil can cut 99% or more of radiation.)

© Shielding conditions, radiation concentration limits, and thickness of covering soil or other material in the use of recycled materials

|            | Shielding condition  | Concentration of materials available for recycling* (Bq/kg) | Thickness of required covering soil or other material to further reduce the additional radiation dose |
|------------|--|---|---|
| Embankment | Covering with soil, asphalt, or similar material (for purposes other than agricultural use)                        | below 8,000   | over 50 cm  |
|            | Covering with soil or other materials (top layer after covering is used for horticultural crops or resource crops) | below 5,000   | over 50 cm  |

\* When work period is 1 year

© Radiation blocking effects





### 3 Environmental Regeneration Project in Nagadoro District of Iitate Village

#### About Nagadoro District in Iitate Village

Following the Great East Japan Earthquake on March 11, 2011, Iitate Village was **designated as a Deliberate Evacuation Area on April 22 of the same year, forcing all village residents to evacuate**. With progress in decontamination and other works, **the evacuation order was lifted for most parts of Iitate Village at the end of March 2017**. However the **Nagadoro District was designated "Restricted area"** and is currently the only part of Iitate Village where the evacuation order has not been lifted.

On April 20, 2018, the reconstruction and revitalization plan for the Iitate Village Specified Reconstruction and Revitalization Bases Area was approved. Decontamination, infrastructure, and other recovery efforts are now being carried out intensively in order to create an environment for people to return. As part of these efforts, **it was decided to create agricultural and other land in the agricultural recovery zone utilizing recycled soil and covering soil**.



Scenes from Iitate Village

#### ◎ Nagadoro District, Iitate Village



#### Overview of the Iitate Village Nagadoro District environmental regeneration project

##### Overview

**This project aims to create embankments of farmland that are easy to farm by removing foreign objects from removed soil with radiation concentration of 5,000 Bq/kg or less to create recycled soil used for embankments that will be covered with covering soil. In addition, using the removed soil generated from the village contributes to reducing deliveries to the ISF.**

##### History

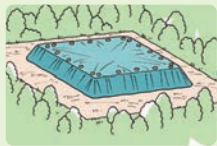
- November 20, 2017: Iitate Village submitted a request for an environmental regeneration project to the Ministry of the Environment.**
- Apply the knowledge about recycling of removed soil from studies now being conducted by the national government, and restoration of the environment by creating and collecting land in Nagadoro District, including the use of removed soil from within the village.
  - Effective support will be provided within the Nagadoro District following the environmental restoration in order to enable long-term soil use for cultivation of horticultural and resource crops.
- November 22, 2017: The following agreement was concluded between Iitate Village, the Nagadoro Administrative District of Iitate Village, and the Ministry of the Environment.**
- The Ministry of the Environment and Iitate Village will contribute to a recovery not only in the Nagadoro District but in all of Iitate Village and Fukushima Prefecture through this environmental restoration project that includes the use of recycled removed soil in the Nagadoro District.
  - The Ministry of the Environment, Iitate Village, and Nagadoro Administrative District will cooperate and carry out this demonstration project with full consideration to safety and security based on input from experts.



#### Actions conducted by the Ministry of the Environment

##### Transport from Temporary Storage Sites within the village

Removed soil will be transported from Temporary Storage Sites within the village to a recycling facility in Nagadoro District.



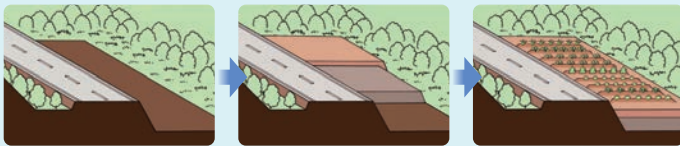
Temporary Storage Sites within the village

##### Recycling

The recycling facility will remove contaminants from removed soil that has a radiation concentration of 5,000 Bq/kg or less, and will otherwise process the soil in order to create recycled soil for use in embankments.

##### Creation of agricultural embankments and other land

The recycled soil is used to raise the level of the agricultural land, which is then covered with soil to block radiation and create land which can be easily farmed.



Before creation of agricultural embankment During creation After creation

#### Actions conducted by Iitate Village

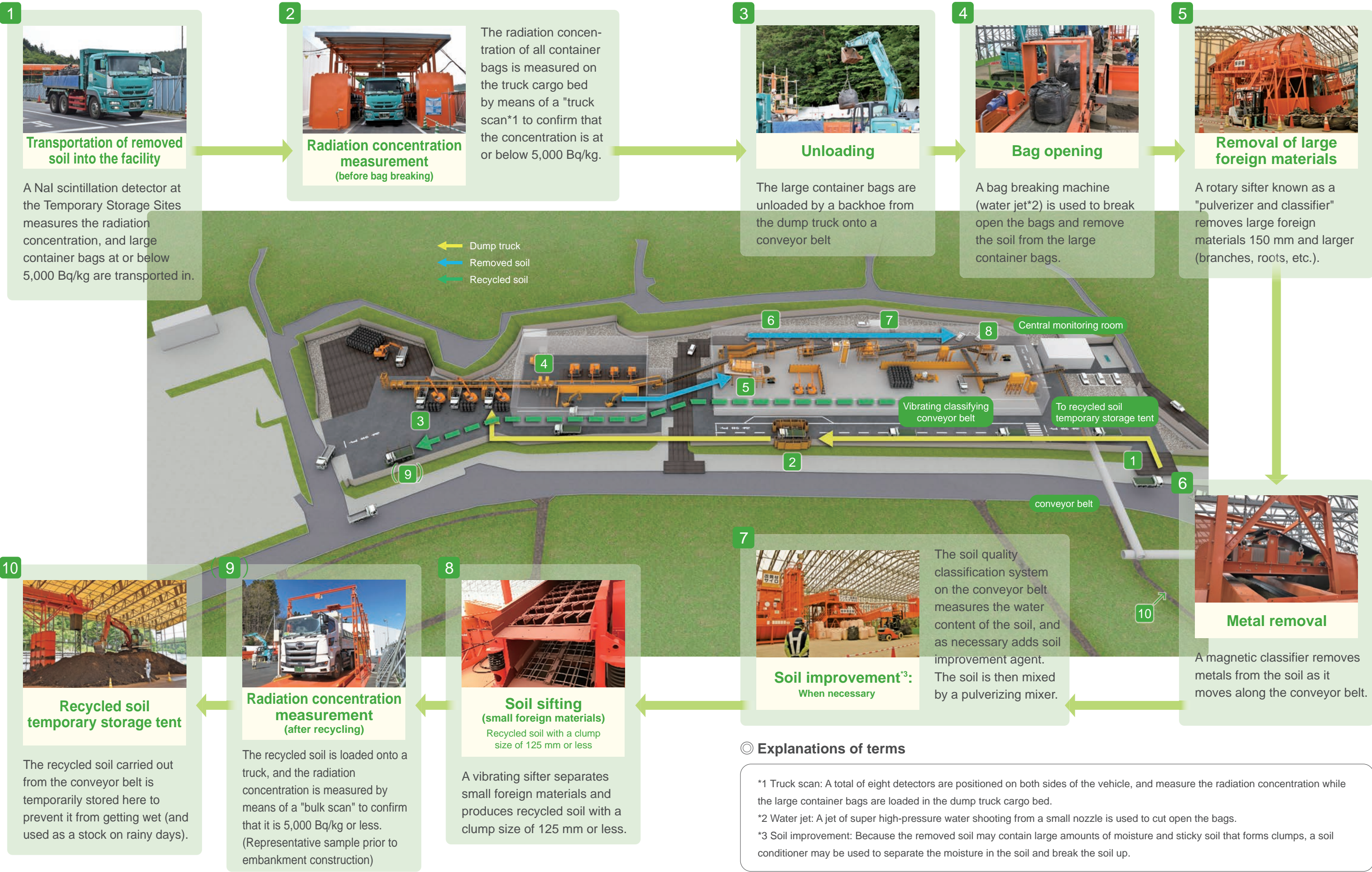
##### Preparation of fields and farming



Image of cultivation on agricultural land following the environmental regeneration project



# ④ Process of Creating Recycled Soil

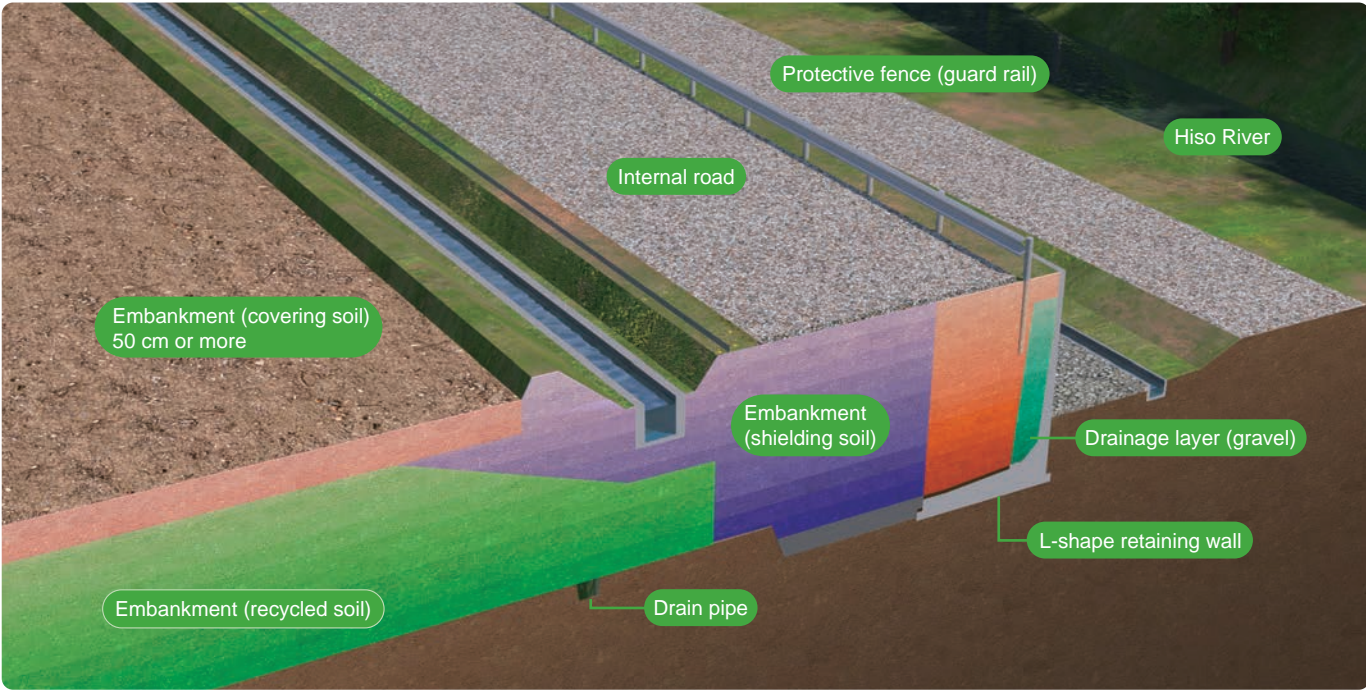




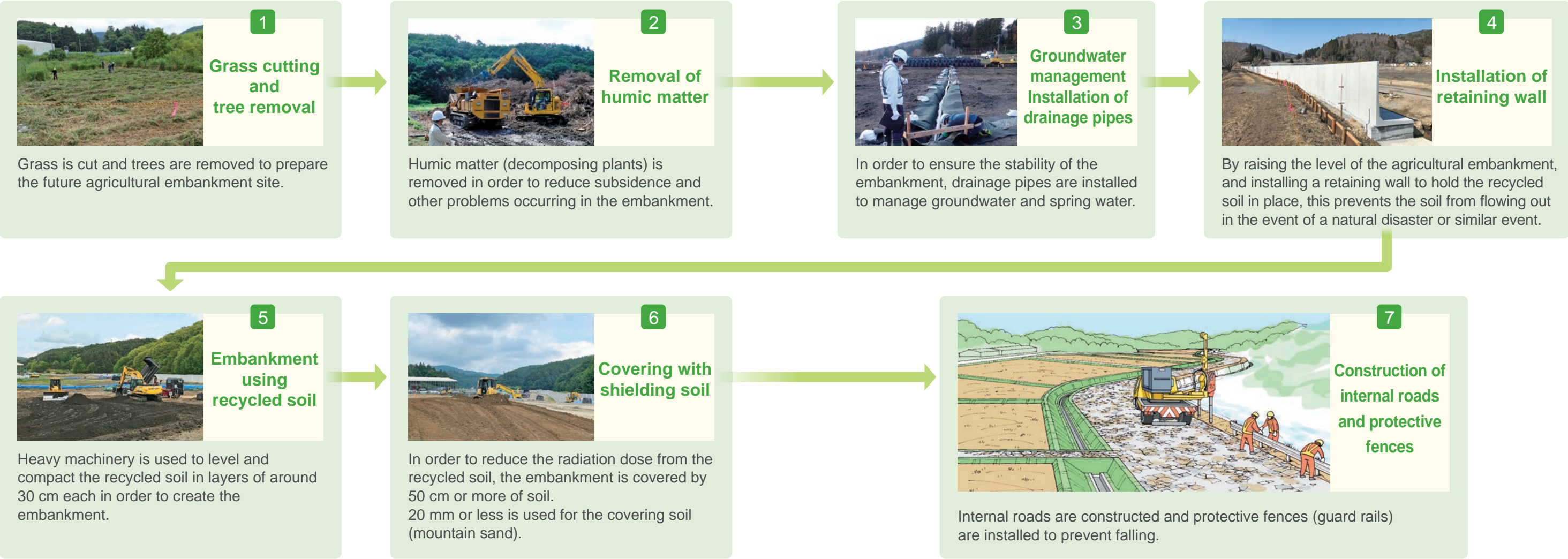
# 5 Process of Creating Agricultural Embankments



©Completed image



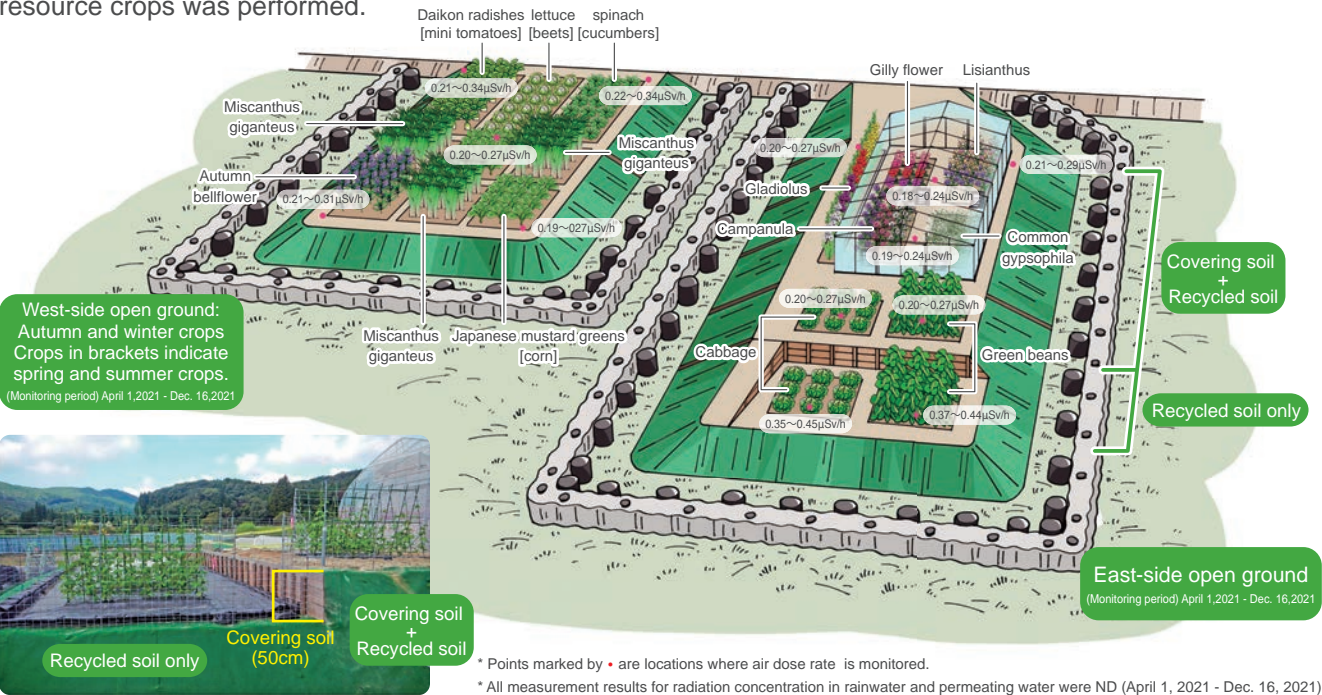
©Cross-section diagram showing location of L-shape retaining wall (representative image)



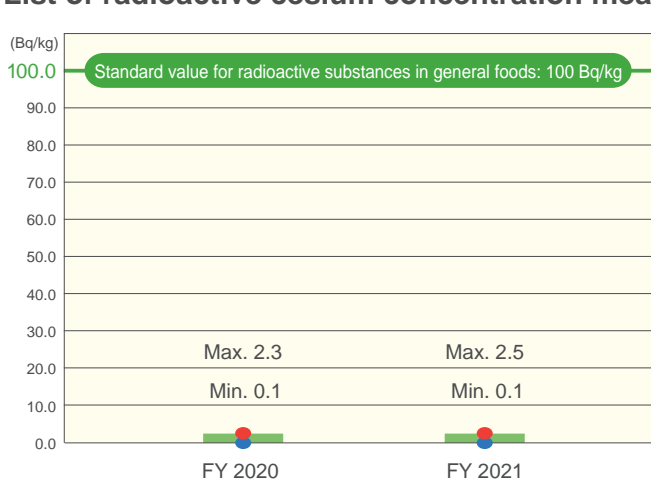


6 Cultivation Results from Demonstration Project

In addition to the creation of agricultural embankments, embankments were also created in Nagadoro District for conducting tests in order to confirm safety and soil productivity, and test cultivation of flowers, vegetables, and resource crops was performed.



List of radioactive cesium concentration measurement results



The concentrations of radioactive cesium in the crops harvested in FY 2020 and FY 2021 were **0.1 - 2.5 Bq/kg**. This is far below the standard of **100 Bq/kg** for radioactive cesium in general foods.

Calculation of internal radiation dose

Person who consumed 100 g (0.1 kg) of green beans (2.5 Bq/kg) every day for 365 days (Calculated with an internal dose for consumption of 1 Bq cesium 137 of 0.013 μSv\*.)

$0.013 \times 2.5 \times 0.1 \times 365 = 0.00118625 (\text{mSv}) \Rightarrow$  Internal radiation dose of approximately 0.0012 mSv

\* Source: International Commission on Radiological Protection (ICRP). Created based on ICRP Publication 119, Compendium of Dose Coefficients based on ICRP Publication 60, 2012. (Unified Basic Materials (R2 Vol. 1 P58))

Working for the restoration of agriculture in the Nagadoro District, we received advice on cultivation methods from local residents while growing crops on agricultural land where covering soil had been applied on the top of recycled soil to block the radiation. The results were able to confirm the safety and productivity of the soil.

Voices of residents from Nagadoro District, litate Village



Head of the litate Village Nagadoro Administrative District

Shinichi Shigihara

It is important to move forward.

At that time, we requested over and over that the same decontamination, dismantling, and other work that was being performed in other administrative districts also be performed in Nagadoro District, however no progress was made. As a result, we felt anxious that the conditions of devastation were going to continue indefinitely. The ages of the residents were becoming higher, and we could not wait forever. It was due to the importance of moving things forward that we approved the environmental regeneration project.

We are currently constructing 34 hectares of agricultural land. However, we must not stop once this project is over. As the residents are getting older, there is nothing we can do if this expanse of agricultural land is simply subdivided and handed over. We need persons who can manage and operate this large amount of farmland. I would like to see the bureaucratic sectionalism eliminated, and achieve cooperation among the village, prefecture, and national government. We must prove that agriculture can succeed on this land.

Ideally, I would like to see agricultural corporations form, and for people who want to start farming and the grandchildren of the Nagadoro residents to want to move to Nagadoro as long as there are places for them to work.

Source: Fukushima Environmental Regeneration Vol. 14 (MOE)



litate Village Nagadoro Administrative District

(At left) Keiko Shigihara

(Center) Kiichi Shouji

(At right) Yoshitomo Shigihara

I want to restore the rich nature and beautiful scenery of my hometown.

Kiichi: We have started demonstration tests for flower cultivation in greenhouses, crops in open-air fields, and now rice paddies. It makes me very happy to see the scenery of Nagadoro from before the disaster return little by little.

Yoshitomo: I hope that the ultimate goal of this demonstration project is to make Nagadoro a place where people will want to live and to farm. The recycling of removed soil and construction of the agriculture infrastructure after decontamination are all for that purpose. This area should be a model for agriculture in mountainous regions across Japan, where the population is growing increasingly aged. That is why I call Nagadoro my "dream hometown" and "dream country." I want to create this kind of hope-filled land here and promote it to the rest of Japan.

Keiko: It has been 25 years since I moved to Nagadoro. I think I am even more fond of the place than my husband, who was born here. I want to restore the rich nature and beautiful scenery of my hometown. I hope that people all over Japan can see how the MOE and all of us are working hard to restore this district to what it was before the disaster. I pray that this will be a place where our grandchildren can play without care in the future.

Source: Fukushima Environmental Regeneration Vol.18 (MOE)

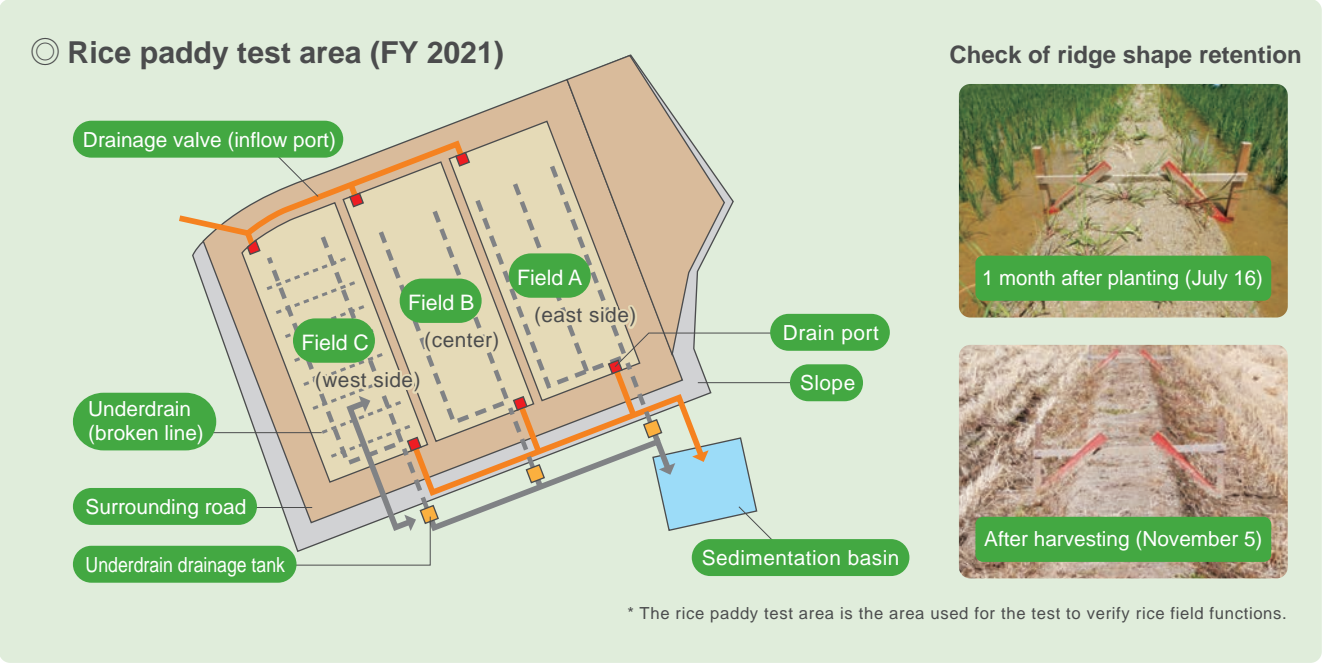


# 7 Confirmation of Paddy Field Function from Demonstration Project

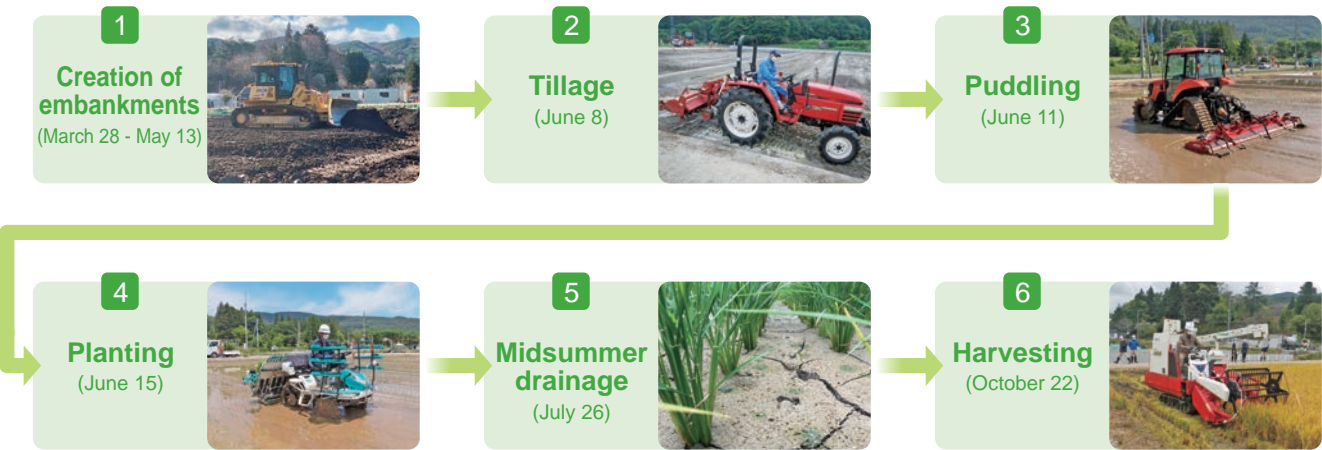
- This test is intended to check whether the land can function properly as a rice paddy. Specifically, it is checking the water permeability and drainage performance of the embanked soil (installing underdrainage and checking how well the field drains), and checking the durability of the soil (whether or not the surface is maintained without problem even when a tractor or other machinery drives over it).
- We are performing all steps from planting to harvesting, however it is all just in order to evaluate the machine work. All of the harvested rice will be discarded. It will not be shipped.
- In the future, we will consider further improvement measures for water permeability.

◎Reference: Radioactive cesium concentration results (Bq/kg)

| Sample name | FY 2021 |
|-------------|---------|
| Rice straw  | 6.5     |
| Brown rice  | 0.5     |
| Husks       | 1.3     |



## ◎ Main work (FY 2021)



**Investigation of water organisms**

An investigation was conducted to determine the extent to which water organisms had returned. Compared with other rice paddies in the first year after resuming operations, the numbers of water insects were fewer. However except for that point, the results showed approximately the same trends as other fields. It is expected that continuing to plant using the same system will result in improved biodiversity.

Water scorpion found during the investigation (Photo: National Institute for Environmental Studies)

# 8 Tours of Nagadoro District

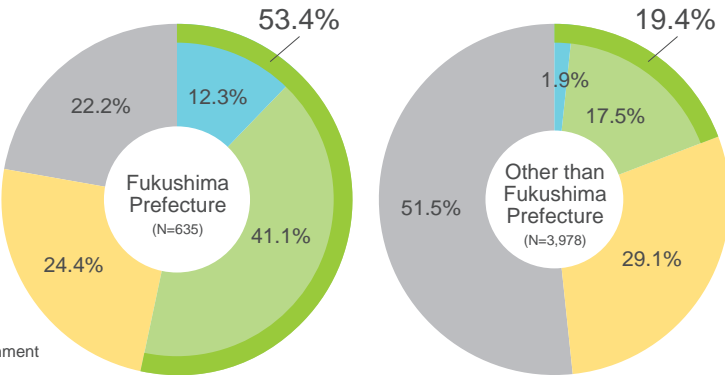
## Level of awareness regarding the policy for final disposal outside the prefecture

**Final disposal outside Fukushima Prefecture of removed soil and other waste from Fukushima is a promise made by the national government. It is prescribed by law and is the responsibility of the national government. On the other hand, the level of awareness of this policy was only around 50% within the prefecture, and around 20% outside the prefecture.**

Q : Were you aware that a law has been established requiring final disposal of removed soil and other waste outside the prefecture within 30 years after the start of interim storage?

Fully aware Had heard of it but know little about it Had heard of it but know nothing about it Never heard of it

Source: From results of an FY 2021 Internet survey by the Ministry of the Environment



## About tours of the environmental regeneration project area in Nagadoro District, Iitate Village

For the purpose of better understanding of the Nagadoro District environmental project, observation tours of around 1.5 hours (around 2.5 hours including travel time) are conducted in the district. We very much hope for your visit. (Reservations are required.)

**Places to visit (examples)**

Central monitoring room Recycling yard Cultivation tests Test area for checking rice paddy function

**Details**

- Dates/times:** Notice of tour dates and times is provided on the homepage.
- Meeting location:** Parking area of Iitate Sports Park \* Travel within the village is by microbus.
- Required time:** Around 2.5 hours(travel time 1 hour, environmental project area 1.5 hours)
- Participation fee:** Free \* Advance reservations are required.

\* Caution: Because the tour enters a designated "Restricted area", pregnant women and children less than 15 years of age may not participate.

**Reservations & Contact information**

- Reservations:** For details, please see the special homepage. Send the necessary information either by email or telephone to make a reservation.
- Contact:** Email: [johocenter@jesconet.co.jp](mailto:johocenter@jesconet.co.jp) TEL: +81-(240)-25-8377 Interim Storage Facility Information Center <Staff in charge of the Nagadoro District Environmental Project tours>

◎Established by: Ministry of the Environment  
◎Operated by: Japan Environmental Storage & Safety Corporation (JESCO)

**Special website**

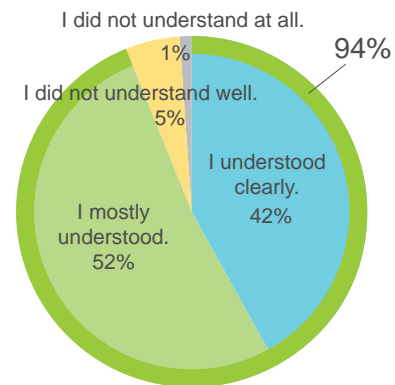
Only in Japanese



## 8 Tours of Nagadoro District

### Questionnaire survey of tour participants

In response to the question, "Having participated in the tour, do you now understand the Nagadoro project?" more than 90% of respondents said that they "clearly" or "mostly" understood.



#### Comments from survey respondents:

- The careful explanation made things very clear.
- I hope that after getting a start in Iitate Village, recycling will also be used in other municipalities as well.
- I think it is good as long as it is scientifically confirmed to be safe.
- It is necessary to gain public understanding of people by disclosing the data
- I remain concerned. I did not understand about safety.
- 5,000 Bq is too high. The level should be 100 Bq or less.

#### Comments from participants in the tour of the Iitate Village Nagadoro District environmental restoration project

Visits by students from

Fukushima Prefectural **Asaka High School**, Fukushima Prefectural **Fukushima High School**, and Fukushima Prefectural **Futaba Future High School**.



- I understood that safe recycling of uncontaminated soil is possible.
- I was surprised that the radiation levels were not much different in the crops grown with 50 cm of cover soil on the removed soil and those planted directly in the removed soil.
- How should we convey the information? I would like to think of a trustable way to communicate this information to people outside the prefecture and overseas.

Visit by students from Fukushima Prefectural **Sukagawa Toyo High School**

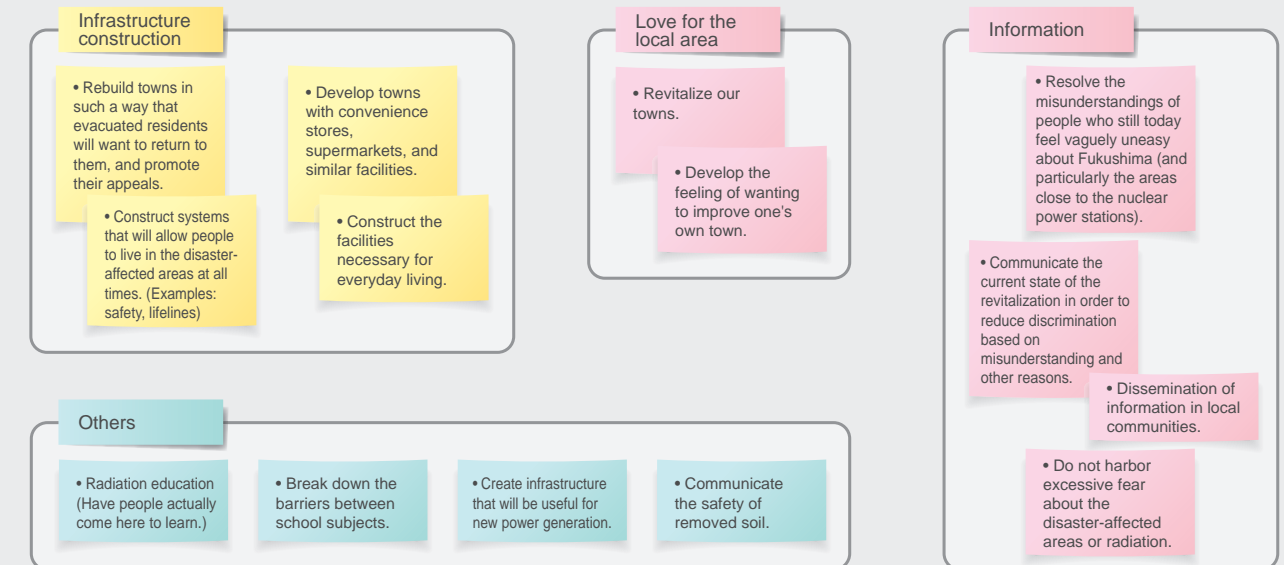


- I thought it was wasteful to throw away the test-planting vegetables even though their radioactive cesium levels were below the standards. To dispel harmful rumors, I think that celebrities and Fukushima residents should demonstrate the safety of the foods by eating them.
- In order to communicate to persons who are uninterested in the problem of final disposal outside the prefecture, you should use the Internet and SNS, make promotional videos on YouTube, and have PR presented by celebrities who are popular among younger people.

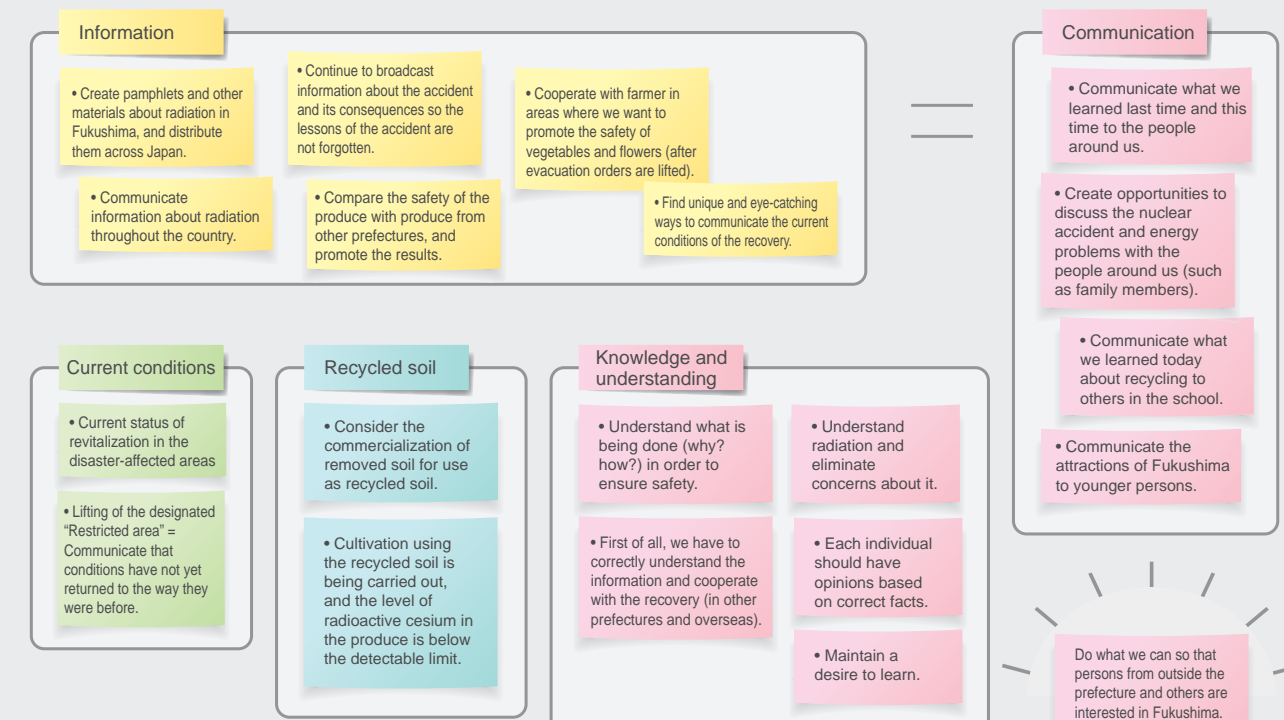
### Main opinions expressed during post-tour discussions

At the group discussions held by Asaka High School, Fukushima High School, and Futaba Future High School in 2021, the students divided into groups and discussed "what we as individuals and the government should do for the revitalization" and "what we learned that we want to communicate to other people," and presented their conclusions.

#### "What we as individuals and the government should do for the revitalization"



#### "What we learned that we want to communicate to other people"





## 9 PR Activities

### A forum to discuss "Fukushima and the Future Environment"

On the 10th anniversary of the Great East Japan Earthquake and the accident at TEPCO's Fukushima Daiichi NPS, the MOE began a program aiming at future reconstruction and recovery in Fukushima titled, "Fukushima - The Next 10 Years." As part of this program, it will dramatically reinforce its activities intended to generate understanding across Japan for achieving the government's responsibility of final disposal outside the prefecture of removed soil and other waste from Fukushima Prefecture. As one part of these activities, it will hold discussion meetings in locations across Japan aimed at producing understanding regarding the necessity and safety of volume reduction and recycling. Information about these meetings is updated continually on the MOE homepage.



Only in Japanese

### "Fukushima and the Future Environment"

A forum to discuss



### Exhibits of potted plants using removed soil

Exhibits are being held of potted plants using removed soil from Fukushima Prefecture. In addition to the MOE building, plants are also placed in the Prime Minister's office, Reconstruction Agency, the head office of the Liberal Democratic Party of Japan, Shinjuku Gyoen National Garden, the National Institute for Environmental Studies, and other locations.



MOE (Office of the Minister of the Environment)



the Reconstruction Agency  
(Office of the Minister for Reconstruction)

Following the installation of potted plants in the MOE building, **there was no change in the air dose rate** around the plants compared to before installation.

### Exhibition of flowers cultivated in Nagadoro District

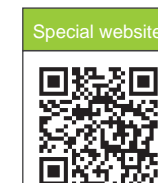
In October 2021, an exhibition of flowers grown in the Nagadoro environmental regeneration project area was held in front of the ticket gates at Fukushima Station on the Fukushima Transportation Iizaka Line. (Exhibitions were also held at the discussion forum and at the Environmental Regeneration Plaza.)



### Introduction on the TV program *Nasubi Asks Questions*

This TV mini-series featured the TV celebrity Nasubi reporting on a variety of questions related to matters such as decontamination and radiation. In Part 9, students from Sukagawa Toyo High School visited Nagadoro District in Iitate Village, and viewers witnessed a tour of the recycling demonstration project for removed soil.

All episodes beginning from Part 1 broadcast in 2013 can be viewed on the Nasubi Asks Questions homepage. "Nasubi's Explanation" and "Further Questions" for each episode are linked with the contents of the broadcast, and can be viewed together with the videos.



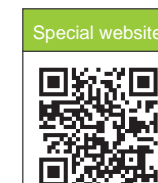
Only in Japanese

### PR Brochure Fukushima Environmental Regeneration

The PR brochure Fukushima Environmental Regeneration is published in order to broadly communicate the programs of the MOE aimed at reconstruction and regeneration of the disaster-affected areas. In the past, vol. 7, 9, 14, 16, and 18 contained information about the project in Iitate Village Nagadoro District. Back issues are also available.



Only in Japanese



Only in Japanese



**What measures are taken by the national government for many people to understand about the final disposal of removed soil will be outside Fukushima prefecture?**

Through programs such as the following, steps are being taken so that this can be understood by a wide range of people. If you would like to participate, please contact the Ministry of the Environment.

◎Holding of tours which anyone may participate in (tour locations: ISF (Okuma Town, Futaba Town), and the removed soil recycling demonstration project in Nagadoro District (Iitate Village)).

◎Tours based on individual request

◎Discussion forums held in places across Japan (So far they have been held in Nagoya and Fukuoka, and there are plans to hold them in more locations in the future.)

◎Guest lecturers for students of the next generation and others (So far, lectures have been conducted at Fukushima Prefectural Asaka High School, Fukushima Prefectural Fukushima High School, Fukushima Prefectural Futaba Future High School, and Fukushima Prefectural Sukagawa Toyo High School, and other schools.)

◎Pamphlets, CM broadcasts, Ministry of the Environment homepage, etc.

Final disposal outside the prefecture

**Why is it necessary to recycle the removed soil?**

It is necessary in order to reduce the volume of soil for final disposal. The removed soil that was generated in Fukushima Prefecture is currently being stored at ISF in Okuma Town and Futaba Town, and final disposal outside of Fukushima Prefecture will be completed by March 2045. However, 3/4 of the removed soil has a radiation concentration of 8,000 Bq/kg or less and can be safely recycled. One of the keys to final disposal will be determining how much soil can be recycled for the reduction of the immense volume of soil equal to around 11 Tokyo Domes.

Recycling

**What level of radioactive concentration is required for recycling to be possible?**

The maximum concentration is set based on the purpose of use and the work period so that the additional radiation dose received by nearby residents and workers as a result of the recycled soil is not more than 1 mSv per year (= same level as the long-term decontamination target). In general, the maximum limit is 8,000 Bq/kg.

Radioactive concentration

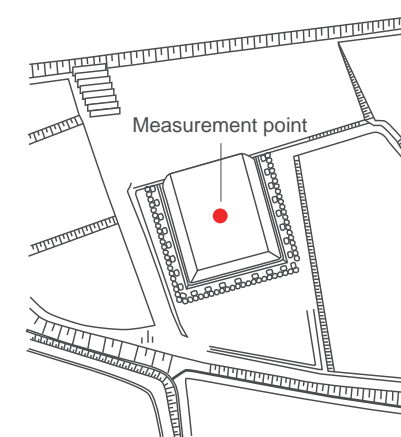
**I am concerned about the safety of the recycling demonstration project. What kind of safety measures are in place?**

First, soil with low levels of radioactive concentration is used so that the additional radiation dose as a result of the recycled soil is lower than 1 mSv per year (= same level as the long-term decontamination target). Covering soil is also applied on top of the recycled soil to block the radiation, and monitoring is performed to confirm safety. Monitoring results so far have not found any increase in the air dose rate, and have not detected any radioactive cesium in the seepage water.

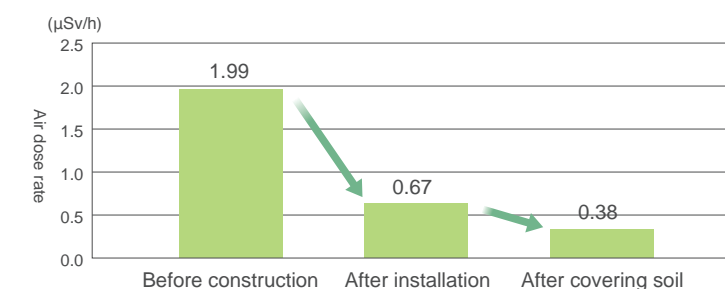
Safety measures

#### ◎ Air dose rate measurement results above the embankments

In FY 2019, test embankments were created using recycled soil and covering soil. The air dose rates were measured before embankment construction, after recycled soil installation, and after covering soil installation.



#### ◎ Air dose rate measurement results



\* Measurement date before construction: April 19, 2019

\* Measurement date after recycled soil installation: May 31, 2019

\* Measurement date after covering soil installation: June 6, 2019

Note: Recycled soil work period: May 15 - 31, 2019. Covering soil work period: June 3 - 5, 2019

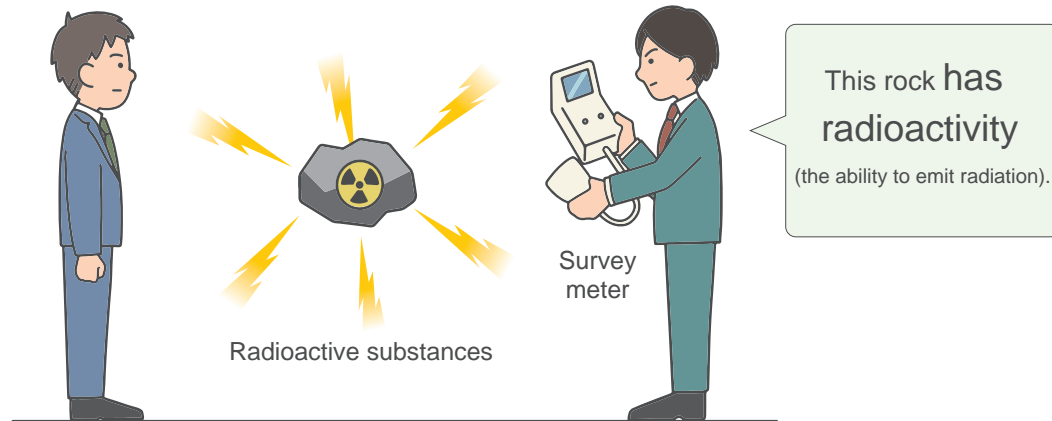


# [Reference] Basic Knowledge About Radiation

Source: BOOKLET to Provide Basic Information Regarding Health Effects of Radiation, FY 2020 Edition

## Radioactivity and radiation

## Units of radioactivity and radiation



### Becquerel (Bq)

<Unit for intensity of radiation>  
1 becquerel = one nucleus decays  
(disintegrates) per second

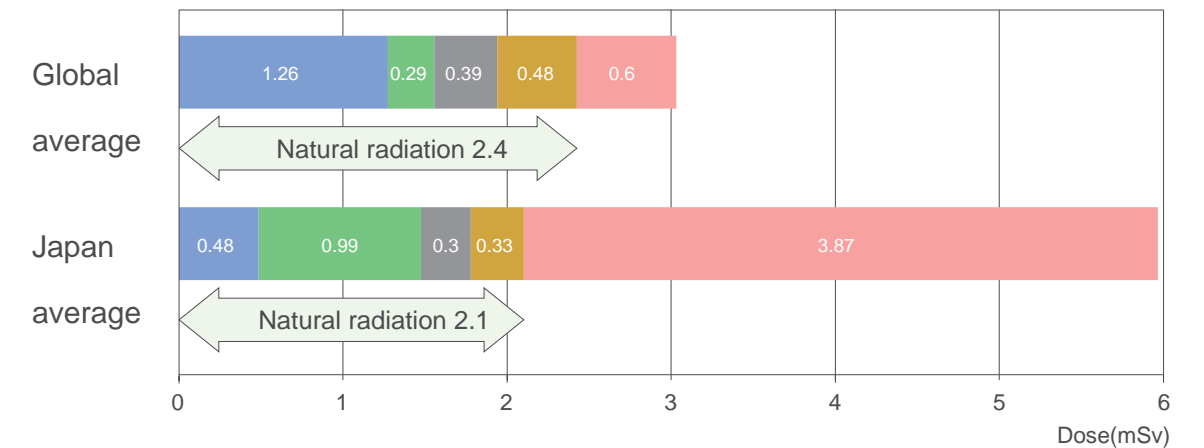
### Sievert (Sv)

<Unit of radiation exposure dose which a  
person receives>  
It is associated with radiation effects.

## Radiation around us

## Comparison of exposure doses per year

◎Exposure in our daily life (annual) ■ Radon, thoron ■ Foods ■ Outer space ■ Ground ■ Medical exposure



Source: Created based on a 2008 report from the United Nations Scientific Committee on the Effects of Atomic Radiation(UNSCEAR) and on "Environmental Radiation in Daily Life" from the Nuclear Safety Research Association (2011).

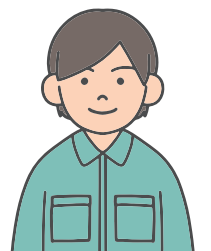
## Radiation around us

## Natural radioactive materials in the body and foods

◎Radioactive materials in our bodies  
(When body weight is 60 kg)

(Bq)

|                |   |       |
|----------------|---|-------|
| Potassium 40   | Nuclides originating from the earth                       | 4,000 |
| Carbon 14      | Nuclides derived from N-14 originating from cosmic rays   | 2,500 |
| Rubidium 87    | Nuclides originating from the earth                       | 500   |
| Tritium        | Nuclides derived from N-14 originating from cosmic rays   | 100   |
| Lead, polonium | Nuclides of the uranium series originating from the earth | 20    |



◎Radioactivity concentrations (potassium 40) in foods (Bq/kg)

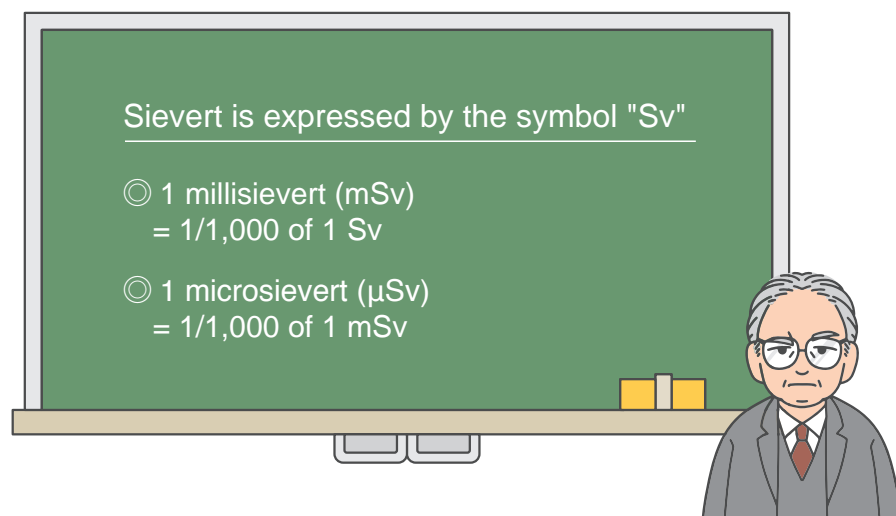
|               |     |                          |       |
|---------------|-----|--------------------------|-------|
| Rice          | 30  | Spinach                  | 200   |
| Milk          | 50  | Potato chips             | 400   |
| Beef          | 100 | Green Tea                | 600   |
| Fish          | 100 | Dried shiitake mushrooms | 700   |
| Powdered milk | 200 | Dried kelp               | 2,000 |



Source: Created based on "Research on Data about Living Environment (1983)" from the Nuclear Safety Research Association.

## Units of radiation

## Origin of Sievert



**Rolf Sievert** (1896-1966)

Founder of the physics laboratory at Sweden's Radiumhemmet  
Participated in the foundation of the International Commission on Radiological Protection (ICRP).