Off-Site Environmental Remediation in Affected Areas in Japan

August 2020

Ministry of the Environment, Japan
Result and Effect of Off-Site Decontamination

Interim Storage Facility

Disposal of the Specified Waste

Communication to the Public and International Societies
Decontamination and Waste Treatment based on the “Act on Special Measures”

Measures on decontamination of soil contaminated by radioactive materials

① Special Decontamination Areas (SDA)
- Designation of SDA by the Minister of the Environment
- Development of the decontamination implementation plan in the SDA by the Minister of the Environment
- Decontamination implementation by the National Government

② Intensive Contamination Survey Areas (ICSA)
- Designation of the ICSA by the Minister of the Environment (The areas with more than 0.23μSv/h)
  ※ 0.23μSv/h is not the decontamination target, but designation criteria for the ICSA
- If the area is more than 0.23μSv/h, after the monitoring survey by municipality mayors
- Development of Decontamination Implementation Plan by the municipality mayors
- Implementation of decontamination by municipality mayors based on the plan (the national government allocates the budget)

Management of waste contaminated by radioactive materials

Specified waste

① Waste within the countermeasure area
- Designation of contaminated waste management area※ by the Minister of the Environment
- ※ Designated areas which meet requirements to be contaminated by radioactive materials at certain level necessary to manage waste under special management

② Designated waste
- A management plan for waste within the countermeasure area is formulated by the Minister of the Environment

Specified domestic waste and specified industrial waste

- It is stipulated by MOE’s ordinance that the waste applied for waste treatment law, but might be contaminated by radioactive materials diffused from the NPP accident. It is managed based on treatment criteria of the waste treatment law and special treatment criteria on the Act on Special Measures
Whole area decontamination based on the Act on Special Measures was completed on March 19, 2018, excluding the Difficult-to-Return Zones (DRZ).

### Result of Whole Area Decontamination

**<Intensive Contamination Survey Areas (ICSA)>**

**<Special Decontamination Areas (SDA)>**

→ Whole area decontamination in the SDA was completed at the end of March 2017

<table>
<thead>
<tr>
<th>Municipalities where whole area decontamination was completed</th>
<th>SDA (11)</th>
<th>ICSA (93)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Fukushima Pref.</td>
<td>43</td>
<td>11</td>
</tr>
<tr>
<td>Outside Fukushima Pref. (7 Pref.)</td>
<td>57</td>
<td>—</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>Completed in March 2017</strong></td>
</tr>
</tbody>
</table>

※There are both SDA and ICSA in Minamisoma, Tamura, Kawamata, and Kawauchi
Air dose rate in residential areas has been decreased 60% by the decontamination and it is confirmed that effect of the whole area decontamination is maintained.

NOTE: The chart shows the air dose rate average in each category (aggregated data of measuring points). Residential areas include schools, parks, cemeteries, and large-sized facilities, farmland includes orchard, and forests include slopes, grassland and lawn.

Post-decontamination monitoring was implemented after 6 months to a year after the decontamination work. The latest result of post decontamination monitoring in municipalities were summarized:


Effects of Decontamination in SDA

<Air dose rate measured at the height of 1m from the ground / Transition according to land category> (N=561,232)

[Air dose rate (μSv/h)]

<table>
<thead>
<tr>
<th>Category</th>
<th>Before decontamination</th>
<th>After decontamination</th>
<th>Post-decontamination monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential areas</td>
<td>1.39</td>
<td>0.56</td>
<td>0.33</td>
</tr>
<tr>
<td>Farmland</td>
<td>1.45</td>
<td>0.59</td>
<td>0.41</td>
</tr>
<tr>
<td>Forests</td>
<td>1.59</td>
<td>1.11</td>
<td>0.72</td>
</tr>
<tr>
<td>Roads</td>
<td>1.21</td>
<td>0.67</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Residential areas (n=261,153)  Farmland (n=119,226)  Forests (n=93,938)  Roads (n=86,915)
Currently, the volume of removed soil stored in Fukushima Prefecture has decreased to approx. 6.7 mil. m³.※
※ It is the volume as of the end of April 2020 in SDA and as of the end of March 2020 in ICSA, calculating a bag as 1 m³.

194 TSS are planned to complete land restoration by the end of March 2020 and in FY2020, MOE will aim to restore land in about 280 TSS.

<Image of transportation and land restoration>

Transportation to the ISF and restoration in TSS

Storage situation  After land restoration

Restart of farming by the landowner

<Number of TSS which will be restored (Estimation)>

Total number of TSS (1,359)

Achieved as of the end of FY2016

Achieved as of the end of FY2017

Achieved as of the end of FY2018

Achieved as of the end of FY2019

Foresight as of the end of FY2020

Photos: provided by Nihonmatsu City
In all 6 municipalities (Futaba, Okuma, Namie, Tomioka, Iitate and Katsurao), demolition of houses and decontamination work have started. Especially, in public facilities such as station square, nurseries, and gymnasium, demolition and decontamination work were completed.

Towards the goal of lifting evacuation order at entire SRRB in Spring of 2022-2023, MOE is conducting demolition and decontamination cooperating with relevant ministries.
Result and Effect of Off-site Decontamination

Interim Storage Facility

Disposal of the Specified Waste

Communication to the Public and International Societies
In Fukushima Prefecture, large quantities of the soil and waste have been generated from off-site decontamination work.

ISF is necessary to manage and store above mentioned soil and waste, as well as the specified waste (>100,000 Bq/kg) intensively and safely until the final disposal.

The total volume is currently estimated at around 14 mil. m³, with the further review reflecting the actual circumstances.

※ This drawing is as of March 2020 and might be modified according to land acquisition and facility construction status.
Current Status of Interim Storage Facility

Photo of the ISF taken by drone

Source: http://www.jesconet.co.jp/interim_infocenter/index.html
## Progress of Land Acquisition of the ISF

As of the end of July 2020

### Whole Area

<table>
<thead>
<tr>
<th>Item</th>
<th>Ratio to the whole area</th>
<th>Ratio and the number of people registered to whole registration record (2,360 pers.※1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landowners with contact information</td>
<td>Ca. 1,590ha ※1 99.4%</td>
<td>Ca. 2,090 pers. ※1 88.6%</td>
</tr>
</tbody>
</table>

### Private land

<table>
<thead>
<tr>
<th>Item</th>
<th>Ratio to the whole area</th>
<th>&lt;Reference&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private land</td>
<td>Ca. 1,141ha 89.9%</td>
<td>Ca. 1,471ha (92.0%)</td>
</tr>
<tr>
<td>Public land</td>
<td>Ca. 43ha 13.2%</td>
<td>Ca. 1,185ha (74.1%)</td>
</tr>
<tr>
<td>Other public land</td>
<td>Ca. 287ha (17.9%)</td>
<td>1,778 pers. ※2 75.3%</td>
</tr>
</tbody>
</table>

※1 Including National / Local government

### National/Municipality land

<table>
<thead>
<tr>
<th>Item</th>
<th>Ratio to the whole area</th>
<th>&lt;Reference&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>National/Municipality land</td>
<td>Ca. 330ha (Ca. 21%)</td>
<td>Ca. 1,270ha (Ca. 79%)</td>
</tr>
</tbody>
</table>

### Private land

<table>
<thead>
<tr>
<th>Item</th>
<th>Ratio to the whole area</th>
<th>&lt;Reference&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private land</td>
<td>Ca. 1,141ha 89.9%</td>
<td>Ca. 1,471ha (92.0%)</td>
</tr>
</tbody>
</table>

### Progress of Land Acquisition of the ISF

- **Ca. 1,600ha**
- **Ca. 1,270ha** (Ca. 79%)
- **Ca. 1,141ha** 89.9%
- **Total Ca. 1,185ha (74.1%)**
- **Ca. 1,590ha 99.4%**
- **Ca. 2,090 pers. 88.6%**
Soil Separation Facility started the operation in October 2017 in Okuma and in December 2017 in Futaba.

Soil Separation Facility

- Roof
  - Conveyor belt
  - Container bag opener
  - Sieving machine
  - Container bag residue
  - Sieving machine
  - Plant
  - Separated removed soil

Soil Storage Facility

- Equipment for container bag opener
- Equipment for separation
- Unloading equipment
- Separated soil
- Storage
  - Conveyor belt w/roof
  - Bulldozer
  - Outfall

Transport

- Seepage control
- Leachate treatment
  - Retained water, etc.
  - Leachate collection pipe
Operational Status of the ISF

- Construction of the facility started in November 2016
- The operation of Soil Separation Facilities started in June 2017 in Futaba, and in August 2017 in Okuma
- The storage of the removed soil and waste started in October 2017 in Okuma and in December 2017 in Futaba after the completion of the Soil Storage Facilities

Soil Separation Facility (in Futaba)  Soil Storage Facility (in Okuma)
Transportation to the ISF

- Transportation of the soil and waste from TSS to the ISF has been implementing mostly using 10-ton dump trucks.
- Cumulative total of approx. 8.33mil. $\text{m}^3$ has been transported so far, which makes approx. 60% of the whole transport target object (14mil. $\text{m}^3$ as of the end of October 2019), was delivered to the ISF (as of the end of June 2020).
- Safe and secure transportation will be sequentially conducted.

Transport status to ISF

- Municipalities which completed the transportation
- Target municipalities in FY2020

A truck leaving from the ISF gate

A truck transporting the soil and waste

Interim Storage Facility
In order to transport estimated volume of 14 mil. m$^3$ to ISF, MOE is conducting the transportation, getting the local understanding on the “Safety first” basis. ※As of October 2019

By the end of FY2021, MOE aims to complete the transportation of the removed soil and waste (except in DRZ) which are temporarily stored in Fukushima Prefecture.

In FY2019, approx. 4 mil. m$^3$ of the soil and waste will be transported to ISF and MOE plans to transport almost the same amount in FY2020.

---

**Ad-hoc Policy on Transportation to the Interim Storage Facility**

- **Transportation volume by single year basis (10$^3$ m$^3$) / bar graph**
- **Cumulative volume of transportation: Approx. 8,331 (August 6, 2020)**
- **Cumulative volume of transportation: Approx. 6,683 (as of the end of 2019)**
- **Cumulative volume of transportation: Approx. 2,624 (as of the end of FY2018)**
- **Cumulative volume of transportation: Approx. 785 (as of the end of FY2017)**

- **Achieved volume of Transportation in FY2020: approx. 1,648 (August 6, 2020)**
- **Goal: about the same amount as in FY2019**
- **Goal: approx. 4,059**

- **Okuma IC in service**
- **Joban Futaba IC in service**

---

**Planned to complete transportation for almost all the soil and waste by the end of FY 2021**

---

**Cumulative transportation Volume (10$^3$ m$^3$) / line graph**

Source: Added the estimated volume of transportation in FY2020 based on achieved volume of transportation between FY2015-2019 and policy of Interim Storage Facility project in FY2020.
### 8 Steps towards the Final Disposal outside Fukushima Prefecture within 30 years from the Start of the ISF

- **MOE** conducts R&D to examine how the final disposal to be implemented taking into account the effect of radioactive decay and the potential of volume reduction and recycling.
- **MOE** shares the information with the public to build the consensus for recycling of lower contaminated soil and the final disposal outside Fukushima Prefecture.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP 1</td>
<td>Comprehension of trends in R&amp;D domestically and internationally</td>
</tr>
<tr>
<td>STEP 2</td>
<td>Studying the direction of future R&amp;D</td>
</tr>
<tr>
<td>STEP 3</td>
<td>Furthering R&amp;D</td>
</tr>
<tr>
<td>STEP 4</td>
<td>Studying the direction of the final disposal, taking into account studies of possibilities of volume reduction and recycling</td>
</tr>
<tr>
<td>STEP 5</td>
<td>Investigation, review and adjustment concerning final disposal sites</td>
</tr>
<tr>
<td>STEP 6</td>
<td>Land preparation of final disposal sites</td>
</tr>
<tr>
<td>STEP 7</td>
<td>Installation of waste to final disposal sites</td>
</tr>
<tr>
<td>STEP 8</td>
<td>Completion of final disposal</td>
</tr>
</tbody>
</table>

**Timeline**

- **STEP 1**: Start of ISF
- **STEP 2**: 30 years from the start of ISF

**Steps**

1. **STEP 1**: Comprehension of trends in R&D domestically and internationally
2. **STEP 2**: Studying the direction of future R&D
3. **STEP 3**: Furthering R&D
4. **STEP 4**: Studying the direction of the final disposal, taking into account studies of possibilities of volume reduction and recycling
5. **STEP 5**: Investigation, review and adjustment concerning final disposal sites
6. **STEP 6**: Land preparation of final disposal sites
7. **STEP 7**: Installation of waste to final disposal sites
8. **STEP 8**: Completion of final disposal

**Development of public understanding of final disposal outside Fukushima Prefecture**

**Taking soil and waste out of the facility through volume reduction and recycling**

**Notes**

- **MOE** conducts R&D to examine how the final disposal to be implemented taking into account the effect of radioactive decay and the potential of volume reduction and recycling.
- **MOE** shares the information with the public to build the consensus for recycling of lower contaminated soil and the final disposal outside Fukushima Prefecture.
Technology Development Strategy for Volume Reduction & Recycling of the Soil from Off-site Decontamination Work

- Towards the final disposal of the removed soil outside Fukushima Pref., MOE will promote recycling of the soil after volume reduction as much as possible, which consequently would lead to reduce the volume of soil for the final disposal.
- After clarifying the objectives and priority of technology development and volume reduction & recycling, basic technology development is planned to be completed within 10 years, then move onto a phase of treatment.
- On the premise of securing safety, MOE will try to realize the recycling in the possible field, building public understandings for the safety.
- Based on technology development and prospect of recycling in the future, MOE would propose some options for structure and necessary dimension of the final disposal.

Process management of strategy

- Technology development / verification
  - Prioritize and verify classification technology development
  - Study on other technology verification except classification

- Study on the final disposal
  - Study on combination of technologies for volume reduction
  - Select a technology / Study on method for the final disposal

- Promotion for recycling
  - Realize the method for the final disposal

- Building the public understandings
  - Embody where to use recycled materials / Full-scale promotion for recycling

- Implementation of information dissemination measures (face to face dialog, consensus building activities, etc.) / Establish necessary systems (cooperation with relevant ministries and human resource development)

Interim target (FY2018)

- Volume for final disposal
- Volume of recycling

Strategy target (FY2024)

- Volume for final disposal
- Volume of recycling

Transition to actual project

- Volume for final disposal

Study on combination of technologies for volume reduction

- Volume for final disposal
- Volume of recycling

Select a technology / Study on method for the final disposal

- Volume for final disposal
- Volume of recycling

Realize the method for the final disposal

- Volume for final disposal
- Volume of recycling

Embody where to use recycled materials / Full-scale promotion for recycling
MOE announced “Basic concept” in June 2016 to realize the use of the removed soil under proper management after volume reduction and recycling materialization as basic premise of radiation safety.

According to a policy of this Basic Concept, MOE implements demonstration project, confirms radiation safety, studies specific management system, as well as to foster understandings of public all over Japan, and proceed with full-scale recycling towards environmental improvement.

**Limited Use**

- The use of contaminated soil will be limited to public project whose management entity and responsible system are clear such as basic structure of banking, which assumed not to change shape artificially for a long time.
  
  E.g. coastal levee, seaside protection forest, embankment materials for roads, cover soil for waste disposal site, landfill materials and filler for land development, and farmland for flowers and energy crops

**Proper Management**

- The additional exposure dose should be restricted below 1mSV/y during the construction and below 0.01mSv/y in use
- Radioactivity concentration level possible for recycling of the soil is below 8,000Bq/kg as a principle and set in accordance to the use.
- Shielding is installed to cover soil and prevent the leakage and scattering. The data is also recorded.

Covering soil should be designed to ensure the necessary thickness to confine the additional exposure dose, even under general repairing of a civil engineering structure.
Demonstration Project for Recycling in Iitate Village

A demonstration project in Iitate Village is as follows; In response to the request from Iitate Village, the removed soil stored at TSS will be recycled, and experimented in cultivation of flowers and energy crops in Nagadoro Borough.

Contents of the demonstration project

1) Transport the removed soil from TSS in Iitate Village to the stock yard in Nagadoro Borough
2) Produce the recycled soil by separating foreign materials from the soil, classifying upon the radioactive concentration, and controlling the quality after construction of the recycling facility
3) At the demonstration project site, develop the basement of the farmland with the recycled soil covering the surface with uncontaminated soil
4) Conduct test cultivation at the farmland in the demonstration project site

Image of the demonstration project

- Area to produce the recycled soil (Nagadoro Borough)
  - Recycling facility: <Bag opening, removal of foreign substances, quality control, classification by concentration>
  - Temporary storage for recycled soil
  - Impermeable sheets (under the tents)
  - ※Measures are implemented to prevent scattering of radioactive materials both in recycling facility and in temporary storage

※ Radiation monitoring is conducted during the project
Result and Effect of Off-site Decontamination

Interim Storage Facility

Disposal of the Specified Waste

Communication to the Public and International Societies
Flowchart of the Specified Waste and Removed Soil Treatment Generated within Fukushima Prefecture

**Specified Waste**
- Waste in the countermeasure areas (within former Restricted Area and Deliberate Evacuation Area)
  - e.g. Disaster waste and waste generated from demolition of houses
- Designated waste (with more than 8,000 Bq/kg)
  - e.g. Incineration ash, agricultural waste (rice straw, and compost)

**Decontamination**
- Soil
- Waste
- Minimizing the volume

**Interim Storage Facility**
- More than 100,000 Bq/kg of radioactive concentration
- 100,000 Bq/kg or less of radioactive concentration

**Landfill Facility for Specified Waste**
- Minimizing the volume
- For final disposal

Note: Waste other than the specified waste will be applied for Waste Management Law. For a certain range, criteria of the Act on Special Measures will be applied
Progress on Waste Disposal in the Countermeasure Areas (Fukushima Prefecture)

◆ Approx. 2.72 mil. tons of disaster waste have completed the transportation to the TSS
  *As of the end of June 2020
  480,000 tons of them were incinerated, while 1.65 mil. tons of them were recycled.
  MOE has already landfilled 140,000 tons of the disaster wastes.
◆ The transported disaster waste has been recycling as large as possible.

Amount of the disaster waste already transported to the TSS (t)

<table>
<thead>
<tr>
<th>Countermeasure area</th>
<th>Difficult-to-Return Zones</th>
<th>TIF (incl. facilities under construction and dismantlement)</th>
</tr>
</thead>
</table>

Dismantling of a damaged house
Temporary incineration facility at Okuma

As of March 10, 2020

Futaba
Namie
Okuma
Tomioka
Naraha
Katsurao
Minamisoma
Tamura
Kawauchi
Iitate
TEPCO Daiichi NPP
TEPCO Daini NPP

April 2016       April 2017      April 2018       April 2019        April 2020
Amount of the disaster waste already transported to the TSS (t)

- Already incinerated
- Already recycled
- Storage amount in TSS
To promote waste disposal across municipalities: city/town/village hosting Temporary Incineration Facilities accept waste from other cities.

**Date City (130t/day) <Completed>**
- Waste generated by decontamination from Date area (Date City, Kunimi Town, Kori Town, Kawamata Town)

**Nihonmatsu City (120t/day)**
- Agricultural waste, waste generated by decontamination from Adachi area (Nihonmatsu City, Motomiya City, Otama Village)

**Katsurao Village (200t/day)**
- Waste generated by decontamination, disaster waste in the village
- From Tamura City, Miharu Town, Kawauchi Village

**Tamura City, Kawauchi Village (60t/day)**
- Agricultural waste from 24 municipalities in Aizu-Kennan, such as Kenchu, Kennan, Iwaki, kawauchi Village

**Itate Village (240t/day)**
- Waste generated by decontamination, disaster waste in the Village
- Sewage sludge, agricultural waste from outside the village (Fukushima City, Date City, Kunimi Town, Kawamata Town, Minamisoma City) <Completed>

**Namie Town (300t/day)**
- Waste generated by decontamination, disaster waste in the Town
- Waste generated by decontamination, disaster waste in Tomioka Town
- Disaster waste from Futaba Town
- Buried livestock in Futaba Town, boars caught in the DRZ (July 2019-)

**Tomioka Town (Final disposal)**
- Household waste from 8 towns and villages in Futaba County
- Waste within Countermeasure Areas.
- Designated waste within the Prefecture

Countermeasure area
- TIFs managed by the government
- TIF managed by municipalities in Date district
As for Landfill disposal project for specified waste, the transportation to the site started on Nov. 17, 2017
134,198 container bags of waste were transported (as of the end of July 2020)
Monitoring survey result before and after transportation shows no significant increase of air dose rate

Outline of the facility
- To use existing controlled landfill site (formerly Fukushima Eco Tech Clean Center)
- To locate it in Tomioka (access from Naraha)
- The facility has been nationalized after local coordination
- Positioning as the final disposal site

Landfill object/Transport period
- Waste within the countermeasure areas (with radioactivity concentration of 100,000Bq/kg or less): 6 years
- Designated waste within Fukushima Pref. (100,000Bq/kg or less): 6 years
- General waste in 8 municipalities in Futaba County: 10 years
- Waste with more than 100,000Bq/kg will be transported to the ISF

Outline of the history
- 14.12.2013 The government requested Fukushima Pref, Tomioka and Naraha Towns to accept the project
- 04.12.2015 Fukushima Pref., Tomioka and Naraha conveyed the message to accept the project
- 18.04.2016 Nationalized the controlled landfill site
- 27.06.2016 Fukushima Pref. and both Towns sighed the safety agreement
- 13.11.2017 The government announced Fukushima Pref. and both Towns to start the transportation
- 17.11.2017 Started transportation
- 24.08.2018 Established Reprun Fukushima, the information center of the specified waste
- 20.03.2019 Solidification treatment facility for the specified waste has started operation

Related facilities
1. Landfill facility for specified waste
2. Specified waste information facility, Reprun
3. Solidification treatment facility for specified waste
Result and Effect of Off-site Decontamination

Interim Storage Facility

Disposal of the Specified Waste

Communication to the Public and International Societies
Information Sharing with International Communities

MOE has been making efforts to share correct information with international communities to eliminate misconception towards Fukushima Prefecture.

English booklet

A comic style booklet, “Nasubi no Gimon”, was released in August 2017, explaining radiation measures for food, etc.

MOE English web-site


Recent Activities on international matters

- MOE set a display booth in G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth in 2019, introducing environmental remediation project in Fukushima. MOE also explained the current status to leaders and high-level government officials in the world.

- International Atomic Energy Agency (IAEA) and MOE held “IAEA-MOE Experts Meetings” on environmental remediation four times between 2016 and 2017, now working on a summary report of these meetings.