Environmental Remediation in the Affected Areas in Japan
July 11, 2019

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Main Points:
Environmental Remediation in the Affected Areas in Japan

I. IAEA International Follow-up Mission

II. Result and Effect of the Whole Area Decontamination

III. Management of the Removed Soil and Waste

IV. Communication to the Public and International Societies
I. IAEA International Follow-up Mission

II. Result and Effect of the Whole Area Decontamination

III. Management of the Removed Soil and Waste

IV. Communication to the Public and International Societies
What is IAEA International Follow-up Mission?

IAEA conducted the investigation on decontamination status in Japan in October 2013 and as a follow-up, it is to give advice for issues and evaluate the progress on environmental remediation activities for off-site decontamination. They sent a mission consisted of 16 IAEA and international experts to Japan from October 14 to 21 in 2013 and investigated.

The mission submitted the overview report on 21st October. The final report was made in the same year and shared with international societies.
Key Points of the Advice from the IAEA International Follow-up Mission

This report provides conclusions for the assessment of specific topics in the remediation program including 8 advice taking into account both international standards and the experience of remediation programs in other countries, which will further help to increase public confidence. The government of Japan will enforce the necessary measures based on these advice.

◆ Radiation Protection of the Public
  - Increase efforts to communicate that any level of individual radiation dose in the range of 1 to 20mSv per year is acceptable and in line with the international standards (Advice 2).
  - Strengthen efforts to explain to the public that an additional individual dose of 1mSv per year is a long-term goal, and that it cannot be achieved in a short time (Advice 2).

◆ Decontamination activities
  - Continue the optimization of the remediation of forest areas around residential areas by concentrating efforts in areas that bring greatest benefit in reducing doses to the public and avoid damage to the ecological functions (Advice 6).

◆ Collection and provision of the information
  - Communicating the entire remediation and reconstruction programs and how the various components interact (for example, trade-offs between reducing exposure and increasing waste volumes) (Advice 3).

◆ Review and assessment of the external agencies
  - Assess the benefits that could be derived from a more active participation of NRA in the review of remediation activities (Advice 1).
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IV. Communication to the Public and International Societies
Whole area decontamination was completed in 100 municipalities in 8 prefectures on March 19, 2018, excluding the Difficult-to-Return Zones (DRZ).

Municipalities where whole area decontamination was completed

<table>
<thead>
<tr>
<th></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>Total</td>
<td>100</td>
<td>Completed in March 2017</td>
</tr>
</tbody>
</table>

※There are both SDA and ICSA in Minamisoma, Tamura, Kawamata, and Kawauchi.
The MOE has budgeted approx. JPY 2.9 trillion (= USD 27 billion) for decontamination until the end of March 2019.

17mil.㎥ (among which approx. 16.5mil. ㎥ were from Fukushima Prefecture) of soil and wastes were removed by the end of March 2018.

MOE published "Decontamination Project Report" about experiences, knowledge and lessons learned through the decontamination works in March 2018.

### Scale of Whole Area Decontamination Project

<table>
<thead>
<tr>
<th>Decontamination in SDA</th>
<th>Decontamination in ICSA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of labor:</strong></td>
<td><strong>Total number of labor:</strong></td>
</tr>
<tr>
<td>approx. 13,700,000 workers</td>
<td>approx. over 18,400,000 workers</td>
</tr>
<tr>
<td>※ as of the end of March 2018</td>
<td>※ estimated from interviews with relevant municipalities as of the end of March 2018</td>
</tr>
<tr>
<td><strong>Budget:</strong></td>
<td><strong>Budget:</strong></td>
</tr>
<tr>
<td>approx. JPY 1.5 trillion</td>
<td>approx. JPY 1.4 trillion</td>
</tr>
<tr>
<td>※ MOE's budget until the end of March 2019</td>
<td>(within Fukushima Pref. : approx. JPY 1.4 trillion, outside Fukushima Pref. : approx. JPY 40 billion</td>
</tr>
<tr>
<td>※ MOE's budget until the end of March 2019</td>
<td>※MOE's budget until the end of March 2019</td>
</tr>
<tr>
<td><strong>Volume of the removed soil:</strong></td>
<td><strong>Volume of the removed soil:</strong></td>
</tr>
<tr>
<td>approx. 9,100,000㎥</td>
<td>approx. 7,900,000㎥ (estimation)</td>
</tr>
<tr>
<td>※ Estimation as of the end of March 2018</td>
<td>(within Fukushima Pref.: approx. 7,400,000㎥, outside Fukushima Pref.: approx. 500,000㎥, both are estimations as of March 2018)</td>
</tr>
</tbody>
</table>

※Considered 1US$ = JPY107
Air dose rate reduction was achieved by decontamination 18 years earlier comparing to the case without any decontamination works.

Decontamination is reconstruction foundation for the affected areas. It is contributed to recovery such as lifting evacuation order by earlier reduction of air dose rate.

- Estimated the transition by natural decay and weathering until March 2018 at 340,000 monitoring spots before decontamination excluding air dose rate reduction by decontamination.

- Estimated the transition until March 2018 at 340,000 monitoring spots in consideration of natural decay and weathering including air dose rate reduction by decontamination.

Air dose rate average was 59\% decreased compared to non-decontaminated areas. If it had not been for decontamination, it would have taken about 18 years to decrease the dose rate down to 0.32\(\mu\)Sv/h.

Monitoring result before the decontamination between Nov. 2011 - July 2016 and monitoring result estimated after the decontamination from 340,000 spots between Dec. 2011 – June 2017.

Air dose rate average in August 2011, obtained at 340,000 monitoring spots before decontamination, in consideration of natural decay and weathering.
Compared air dose rate of 7 months after the accident (as of November 5, 2011) with that of 91 months after the accident (as of October 16, 2018), the latter decreased by 74%. It was confirmed that the decrease was faster than natural attenuation as an overall tendency.

**Distribution map showing transition of the air dose rate within 80km radius**

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"Result of airborne monitoring in and around Fukushima Prefecture (NSR / as of March 8, 2019)"
By revised “Act on Special Measures for the Reconstruction and Revitalization of Fukushima in 2017, 6 municipalities could make plans to construct “Special Reconstruction and Revitalization Base(SRRB)”, aiming at lifting evacuation orders and allowing the residents to return homes.

The dismantling and decontamination works started in 6 municipalities.
In March 2016, Reconstruction Agency, Ministry of Agriculture, Forestry and Fisheries and MOE cooperated to summarize “Integrated Measures towards Restoration of Fukushima Forestry” at “Relevant ministries’ project team for restoration of Fukushima forestry” (ministerial level)

 Already selected 14 districts as a model areas and have been conducting model projects to comprehensively proceed satoyama restoration

I. Measures towards restoration of forestry

1. Measures to secure safety in living environment
   - Forest decontamination neighboring residential houses, construction of fences to prevent soil runoff, if necessary

2. Measures towards restoration of Satoyama around residential houses
   - Decontamination where people have daily access in the forest
   - Measures to reconstruct forestry in broad leaf forest
   - Comprehensive promotion to proceed satoyama restoration selecting model area

※Selection status for the model areas
   Sep. 6, 2016: Kawamata, Hirono, Kawauchi, Katsurao
   Dec. 22, 2016: Soma, Nihonmatsu, Date, Tomioka, Namie, litate
   March 2, 2018: Tamura, Minamisoma, Naraha, Okuma

3. Measures towards restoration of forest deep in mountains
   - To promote demonstration project to forestry restoration and forest development and to implement radiation protection if needed
   - To establish a guidebook on radiation safety and security measures easy to understand for the workers

II. Measures on investigation research for the future

- Radiation monitoring in the woods, investigation research for radiation dose decrease and radiological dynamic state, and efforts to continue restoration of forest and forestry

III. Information transmission and communication

- Latest information transmission by web-site, PR magazines on the government’s measures for restoration of forest and forestry
- To continue the efforts to secure safety of Fukushima people and communicate including experts’ dispatch
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IV. Communication to the Public and International Societies
The national government will take necessary measures to complete the final disposal of removed soil stored in the Interim Storage Facility, at the outside of Fukushima Prefecture within 30 years from the start of ISF.

The national government as a whole has been promoting measures for volume reduction and recycling of the removed soil to decrease the volume for final disposal outside the Prefecture.

- Remove foreign materials
- Classify by concentration
- Quality control

Recycling materials

Removed soil

TSS

ISF

Covering soil

Recycling materials

Recycling use managing in public project

<Recycling>

<Final disposal outside of Fukushima Prefecture>
By early 2020, max. 60% of the removed soil from approx. 1,300 TSS will be transported to the ISF, and up to 40% of land restoration will be completed, according to estimation based on prospect of the transportation to the ISF and continuously aim to proceed transportation and land restoration at an early stage.

*FY2018: Approx. 1.8 mil.㎥  
FY2019: Approx. 4 mil.㎥ are planned

**Prospects by the end of 2019**

<table>
<thead>
<tr>
<th></th>
<th>ICSA Decontamination</th>
<th>SDA Decontamination</th>
<th>Total sum of ICSA and SDA decontamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieved by the end of 2016</td>
<td>116  43</td>
<td>165  57</td>
<td>229  89</td>
</tr>
<tr>
<td>Achieved by the end of 2017</td>
<td>159  43</td>
<td>222  57</td>
<td>318  89</td>
</tr>
<tr>
<td>Prospect by the end of 2018</td>
<td></td>
<td></td>
<td>540~580</td>
</tr>
<tr>
<td>Foresight by the end of 2019</td>
<td></td>
<td></td>
<td>420 450</td>
</tr>
</tbody>
</table>

Photos provided by Nihonmatsu City
Towards the transportation of all the targeted objects (14 mil. m$^3$*) to the ISF, the transportation volume has been sequentially increasing in the light of land acquisition and facility construction.

*As of January 2019

< Announcement of “Policy on Interim Storage Facility Project in FY2019” on December 6, 2018 >

- During FY 2019, approx. 4 mil. m$^3$ will be transported, aiming to eliminate TSS close to the residential areas
- By the end of March 2022, MOE aims to complete transportation of almost all the removed soil and waste (except DRZ) which have been temporarily stored within Fukushima Prefecture.

Ad-hoc Policy on Transportation to the Interim Storage Facility

Planned to complete transportation for almost all the soil and waste by the end of March 2022

Cumulative volume of transportation: Approx. 2,624 (the end of March 2019)

Transportation Volume

Cumulative volume of transportation: Approx. 785 (the end of March 2018)

Cumulative volume of transportation: Approx. 2,624 (the end of March 2019)

Actual volume Approx. 1,839

Okuma IC in service

Actual volume Approx. 551

Actual volume Approx. 188

Actual volume Approx. 46

FY2015

FY2016

FY2017

FY2018

FY2019

FY2020

FY2021

Planned to transport 2,000 – 6,000 based on the ad-hoc 5 year plan

Okuma IC has been used for the transportation in the wake of its opening on March 31, 2019
In Fukushima Prefecture, large quantities of removed soil and waste have been generated from decontamination works.

The Interim Storage Facility is necessary to safely and intensively manage and store the soil and waste until the final disposal.

Removed soil and waste derived of decontamination works, and specified wastes (> 100,000 Bq/kg) are stored.

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

※ This drawing is as of December 2018 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

ISF Construction Information Center

MOE has established the ISF Construction Information Center along Route 6. The information about progress of ISF and radiation monitoring are available. At the front, you can enjoy donated “TSS wall paint” by high school students in Date City.
Soil storage facility started the operation in October 2017 in Okuma and in December 2017 in Futaba.
Construction of the facility started in November 2016.
The operation of Reception/Separation facilities started in August 2017.
The storage of the removed soil started in October 2017 after the completion of the soil storage facilities.
Technology Development Strategy for Volume Reduction & Recycling of the Removed Soil

- Towards the final disposal of the removed soil outside Fukushima Pref., MOE will promote recycling of the soil after volume reduction technology 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
  - Precedence and verification of classification technology development
    - Volume for final disposal
  - Study on other technology verification except classification
    - Volume for final disposal
  - Transition to actual project
    - Volume for final disposal

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

- Promotion for recycling
  - Summarize the basic concept of recycling
    / Implement model demonstration / Study on policy and promotion / Publish a guidance
  - Embody where to use recycled materials / Full-scale promotion for recycling
  - Implementing 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):

- Strategy target (FY2024):
Recycled soil

Concepts on Safe Use of the Removed Soil for Recycling (June 2016)

【Basic Concept】
The removed soil can be used for public projects and others with a responsible management system after necessary treatment, e.g. removal of debris, classification treatment. The use will be limited, such as the basic structure material of an embankment which is not assumed to change shape artificially, and be managed appropriately. The recycled soil should be used under the management and this is different from the concept of “clearance”.

Limited use

- The use will be limited to the material which is not assumed to change shape artificially for a long time period, e.g. basic structure material of banking for coastal levees or seaside protection forests, embankment materials for roads, cover soil for waste disposal sites, landfill materials and basic structure for farms of flowers and energy crops.

Appropriate management

- The projects will be public projects and others with a responsible management system.
- The radioactive cesium concentration in the removed soil should be limited in order to confine the additional exposure dose. The additional exposure dose should be below 1mSv/y during the construction and below 0.01mSv/y at the time of service.
- Covering soil should be installed, scatter and leakage should be prevented, ground form change should be observed, and the data should be recorded.

How to proceed recycling

As the environmental improvement towards the practical recycling of the removed soil, demonstration projects and model projects based on the above concepts should be implemented keeping the safety against radiation, studying specific verification of the management method and building stakeholders’ and public understanding.
Demonstration Project for Recycling in Minamisoma City

Demonstration project is currently being implemented in Minamisoma City, studying specifically on handling radiation during the procedure of recycling and ensuring the quality of the recycled soil as construction material in order to promote safe recycling and reuse of the removed soil in a step by step manner.

1. Preliminary treatment / quality control process (April 2017-)
   - 1. Open sandbags and remove large stones and debris
   - 2. Further eliminate smaller debris
   - 3. Classify soil by concentration
   - 4. Control quality

   Control quality of soil to be used for an embankment (such as water content and grain sizes)

2. Test embankment process (May 2017-)
   - 5. Construct test embankment / Monitoring

   • Construct a test embankment (covered with uncontaminated soil by 50cm)
   • Continue to measure the air dose rate and other indicators

   - Air dose rate was not much changed before and after opening of sandbags of the removed soil
   - Since the test embankment was constructed, radioactive materials have not been detected in the leachate

   - Total amount of soil in embankment: approx. 4,000 tons
   - Recycled soil out of total soil: approx. 700 tons
   - Average of radioactive concentration: 771Bq/kg

   Prepare and keep records on site

   【Result of council of advisers】
   ◆ Confirmed safety in this method for recycling demonstration
   ◆ To accumulate data continuously conducting demonstration project
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Information Exchange with Local Communities

MOE has been making efforts to share the information with local communities;

◆ “Environmental Regeneration Plaza” provides seminars and dispatches experts to town meetings and schools with the cooperation of Fukushima Prefecture

◆ “Reprun” was newly established to help people understand specified waste landfill project.

◆ “ISF Construction Information Center” provides you the progress of ISF and radiation monitoring data.
Ministry of the Environment, Japan (MOE) released an English booklet in August 2017. English website, “Environmental Remediation” was also renewed and two TV shows are available on MOE’s website.

**English booklet**

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

**Renewal of the MOE web-site**


**TV programs**

**“Fukushima Diaries” by Discovery Channel:** In this 30-minutes show, three famous bloggers from overseas visited different destinations in Fukushima Pref. with their own interests. They showed the viewers what is really going on in Fukushima [http://josen.env.go.jp/en/movie_publication/cooperation_index.html](http://josen.env.go.jp/en/movie_publication/cooperation_index.html)

**Channel Japan/CNBC ASIA:** CNBC broadcasted 15-minutes program 4times in a row. Each program showed you the key persons in Fukushima how hard they work to fight against misconceptions and to revitalize Fukushima. Each content is as follows;

#1 The story of Mr. McMichael, who tries to help widely communicate correct information on Fukushima to international communities

#2 The story of two young people who are eager to revitalize their hometown, Fukushima

#3 The story of small factories that tackle on the development of robots for decommission.

#4 The story of Dr. Hayano, who teaches what is radiation from academic point of views.
Dec. 5, 2016
The 4th Meeting of Japan-Ukraine Joint Committee for the cooperation to advance aftermath response to accidents at nuclear power stations (@Tokyo)

Apr. 17-21, 2017
The 3rd IAEA-MOE Experts Meeting on Environment Remediation of Off-Site areas after the Fukushima Dai-ichi Nuclear Power Station Accident (@Tokyo)

Oct. 26-27, 2017
The 6th Annual Japan-UK Nuclear Dialogue (@London)

Nov. 6-10, 2017
The 4th IAEA-MOE Experts Meeting on Environment Remediation of Off-Site areas after the Fukushima Dai-ichi Nuclear Power Station Accident (@Tokyo)

Nov. 21, 2017
The 7th Meeting of the Japan-France Nuclear Cooperation Committee (@Tokyo)

Nov. 27, 2017
The 5th Meeting of Japan-Ukraine Joint Committee for the cooperation to advance aftermath response to accidents at nuclear power stations (@Kiev)

Aug. 8, 2018
The 5th Meeting of US-Japan Bilateral Commission on Civil Nuclear Cooperation (@Tokyo)

Oct. 25, 2018
The 7th Annual Japan-UK Nuclear Dialogue (@Tokyo)

Nov. 21, 2018
The 8th meeting of the Japan-France Nuclear Cooperation Committee (@Paris)
Updated information is available on the web-site below: