Progress on Off-site Cleanup Efforts in Japan

October 2013

Ministry of the Environment, Japan
• 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

Legend
Air dose rate at 1m height above the ground (μSv/h) (as of Sep. 18, 2011)

- 190 ≤ 95
- 95 - 38
- 38 - 19
- 19 - 10
- 10 - 0.5
- 0.5 - 0.23
- < 0.23
- No data
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
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.

\[
\text{Air dose rate} \times \text{Shielding effect} \times \text{Days per year} / 1000 \text{ (mSv/y)}
\]

\[
(0.23 \times (8 + 16 \times 0.4)) \times 365 / 1000 = 1 \text{ (mSv/y)}
\]

National average

Assuming spending 8 hours outside and 16 hours inside a wooden house (radiation is reduced to 40% due to shielding) every day

1,000μSv=1mSv

Annual dose
• 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
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:

Area 3: >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.

<table>
<thead>
<tr>
<th>Progress Status</th>
<th>Population in Decontamination Target Area (approx. Figure)</th>
<th>Decontamination Target Area (ha) (approx. figure)</th>
<th>Rearrangement of the Restricted areas, etc.</th>
<th>Decontamination Plan</th>
<th>Temporary Storage Site (as of the end of Aug, ’13)</th>
<th>Content of landowners, etc. (As of the end of Jul., ’13)</th>
<th>Decontamination activities (As of Aug. 30, ’13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NARAH</td>
<td>7,700</td>
<td>2,000</td>
<td>Aug. 2012</td>
<td>Apr. 2012</td>
<td>Secured</td>
<td>Almost completed</td>
<td>In progress</td>
</tr>
<tr>
<td>KAWAUCI</td>
<td>400</td>
<td>500</td>
<td>Apr. 2012</td>
<td>Apr. 2012</td>
<td>Secured</td>
<td>Completed</td>
<td>In progress (houses and roads completed)</td>
</tr>
<tr>
<td>MINAMISOMA</td>
<td>13,300</td>
<td>6,100</td>
<td>Apr. 2012</td>
<td>Apr. 2012</td>
<td>approx. 20% secured</td>
<td>approx. 30%</td>
<td>In progress</td>
</tr>
<tr>
<td>IITATE</td>
<td>6,000</td>
<td>5,100</td>
<td>Oct. 2012</td>
<td>May 2012</td>
<td>approx. 20% secured</td>
<td>approx. 30%</td>
<td>In progress</td>
</tr>
<tr>
<td>KAWAMATA</td>
<td>1,200</td>
<td>1,300</td>
<td>Aug. 2013</td>
<td>Aug. 2012</td>
<td>approx. 80% secured</td>
<td>approx. 90%</td>
<td>In progress</td>
</tr>
<tr>
<td>KATSURAO</td>
<td>1,400</td>
<td>1,700</td>
<td>Mar. 2013</td>
<td>Sept. 2012</td>
<td>approx. 20% secured</td>
<td>Almost completed</td>
<td>In progress</td>
</tr>
<tr>
<td>NAMIE</td>
<td>18,800</td>
<td>3,200</td>
<td>Apr. 2013</td>
<td>Nov. 2012</td>
<td>approx. 10% secured</td>
<td>approx. 10%</td>
<td>Under bidding procedure</td>
</tr>
<tr>
<td>OKUMA</td>
<td>400</td>
<td>400</td>
<td>Nov. 2012</td>
<td>Dec. 2012</td>
<td>approx. 70% secured</td>
<td>approx. 60%</td>
<td>In progress</td>
</tr>
<tr>
<td>TOMIOKA</td>
<td>11,300</td>
<td>2,800</td>
<td>Mar. 2013</td>
<td>Jun. 2013</td>
<td>approx. 50% secured</td>
<td>In preparation</td>
<td>Contractor decided in preparation of work</td>
</tr>
<tr>
<td>FUTABA</td>
<td>300</td>
<td>200</td>
<td>May. 2013</td>
<td>Under coordination</td>
<td>Under coordination</td>
<td>Under coordination</td>
<td>Under coordination</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>As of Jul. 2013</th>
<th>Tamura</th>
<th>Naraha</th>
<th>Kawauchi</th>
<th>Iitate</th>
<th>Kawamata</th>
<th>Katsurao</th>
<th>Okuma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Living area</strong></td>
<td>100%</td>
<td>51%</td>
<td>100%</td>
<td>3%</td>
<td>0%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Farmland</strong></td>
<td>100%</td>
<td>68%</td>
<td>1%</td>
<td>1%</td>
<td>3%</td>
<td>0.1%</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Forest</strong></td>
<td>100%</td>
<td>65%</td>
<td>69%</td>
<td>2%</td>
<td>6%</td>
<td>25%</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Road</strong></td>
<td>100%</td>
<td>25%</td>
<td>100%</td>
<td>0.3%</td>
<td>0%</td>
<td>1%</td>
<td>6%</td>
</tr>
</tbody>
</table>

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

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 2 years.
- 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.

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
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)
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

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

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

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

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

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

- Result before D. (Nov., Dec. 2011)
- First follow-up monitoring result (Oct. 2012)
- Second follow-up monitoring Result (Mar. 2013)
* D=Decontamination
• 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
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.
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.

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

<table>
<thead>
<tr>
<th>Inner Fukushima pref.※ (As of the end of Jun., 2013)</th>
<th>Ordering Ratio (Number of order/number of planning)</th>
<th>Implementation Ratio (Number of actual achievement/Number of planning)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public facilities, etc.</td>
<td>approx. 80%</td>
<td>approx. 60%</td>
</tr>
<tr>
<td>Residential houses</td>
<td>approx. 50%</td>
<td>approx. 20%</td>
</tr>
<tr>
<td>Roads</td>
<td>approx. 40%</td>
<td>approx. 20%</td>
</tr>
<tr>
<td>Farmlands &amp; meadows</td>
<td>approx. 90%</td>
<td>approx. 80%</td>
</tr>
<tr>
<td>Forests(in living areas)</td>
<td>approx. 30%</td>
<td>approx. 10%</td>
</tr>
</tbody>
</table>

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

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.
• 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
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, Kusuo Village)
- Municipality group “C”: Obayashi JV (Hirono Town, Okuma Town, Naraha Town, Kwauchi Village)

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.
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.

Overview of the result of the decontamination model demonstration project

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

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
• 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

○ 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 roofing tiles (by wiping-off)

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

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 grass plot

Decontaminating a schoolyard

Decontaminating a forest (by removing fallen leaves)

Photo provided by: Japanese Society of Turf grass Science

Photo provided by: JAEA
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:
   15 new technologies (Nov. 2012 – Mar. 2013),
Decontamination using ultra-high pressure water in road, sidewalk, etc.

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

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

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.
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/
• 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
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 2 years.

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.
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

1. Storage Facility
2. Emplacement & Segregation Facility
3. Volume Reduction Facility
4. 24-hour monitoring Equipment (placed in several points, not specifically indicated in the figure)
5. R & D Facility
6. Public information Center

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

<table>
<thead>
<tr>
<th>Main substances for storage (Radioactive cesium concentration)</th>
<th>Type-I Soil Storage Facility</th>
<th>Type-II Soil Storage Facility</th>
<th>Waste Storage Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil and other materials that do not risk polluting public water area and groundwater with radioactive cesium (8,000Bq/kg or less)</td>
<td>Soil and other materials exceeding the condition shown in left column (More than 8,000Bq/kg)</td>
<td>Waste</td>
<td>Package</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measures to prevent water seeping into groundwater</th>
<th>Type-I Soil Storage Facility</th>
<th>Type-II Soil Storage Facility</th>
<th>Waste Storage Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>—</td>
<td>Seepage control and other infrastructure (Seepage control sheet and other infrastructure or low-permeability soil layer)</td>
<td>Waste</td>
<td>Package</td>
</tr>
</tbody>
</table>

### 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

- Leakage control
- Seepage control sheet patterns
- Applicable geography and geology: Hill, Tableland
- Radioactive cesium concentration more than 8,000Bq/kg

![Diagram of Type- II Soil Storage Facility]

**Schematic View of Waste Storage Facility**

Applicable geography and geology
Hill, Tableland

Radioactive cesium concentration
More than 100,000Bq/kg

- Building (e.g. RC Construction) with shielding effect and durability if necessary (drums and others)
- Groundwater monitoring
- Inspection and management gallery
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

※The indicated potential survey sites serve only as a rough outline as envisaged to carry out the preliminary survey at the present day.
Reference
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 selected decontamination technology test proposals and contractors

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

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

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

<table>
<thead>
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<th>Objects</th>
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<tr>
<td>Soil</td>
<td>Fluoride salt</td>
<td>Cs elution using fluoride salt at normal temperature and pressures.</td>
<td>Swing Corporation</td>
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<td>Vacuum pressure</td>
<td>Dewatering and solidification using cement and vacuum pressure.</td>
<td>Maeda Corporation</td>
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<td>Bottom sediment</td>
<td>Classification</td>
<td>Classification for bottom sediment at present location.</td>
<td>Aomi Construction Co., Ltd.</td>
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<td>Organics</td>
<td>Shredding, suction and recovery</td>
<td>Laborsaving for greenery decontamination using shredding and suction.</td>
<td>Fukushima Komatsu Forklift Co., Ltd.</td>
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<td></td>
<td>Drying and shredding</td>
<td>Drying, shredding and classification for mixture of plant and soil.</td>
<td>Obayashi Corporation</td>
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<tr>
<td>Monitoring</td>
<td>Unmanned helicopter and hyper spectrum</td>
<td>Mapping of air dose rate using unmanned helicopter and of vegetation and land coverage using hyper spectrum.</td>
<td>Chiba University</td>
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<td>Measurement of container unit</td>
<td>Radioactivity concentration measurement of container unit.</td>
<td>Toshiba Corporation</td>
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<td>Incineration ash</td>
<td>Washing</td>
<td>Saving waste water load using high efficiency washing.</td>
<td>Fujita Corporation</td>
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<td>Washing and magnetic separation</td>
<td>Recovery of Cs using magnetic nanoparticle coated with absorbent after washing.</td>
<td>Taisei Corporation</td>
<td>9</td>
</tr>
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<td>Waste</td>
<td>Organic acid</td>
<td>Cleaning up aluminum radiator using organic acid.</td>
<td>E&amp;E Techno Service Co., Ltd.</td>
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<td>Blasting</td>
<td>Cleaning up waste household electrical appliance for recycling using blasting with sodium bicarbonate.</td>
<td>Chugai-technos Corporation</td>
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</table>