

**Announcement on appropriate decontamination methods of agricultural land**

30 September 2011

Nuclear Emergency Response Headquarters

This reference material announces appropriate methods and other matters as described below to decontaminate agricultural land based on Item 3-(3) of the “Guidelines for Municipal Decontamination Work” (26 August 2011, Nuclear Emergency Response Headquarters).

The methods will be updated as appropriate with the accumulation of knowledge.

## Notes

### 1. Fundamental policy for decontaminating agricultural land

Agricultural soil has characteristics that have developed through the long term agricultural activities of farmers and it has also various aspects including maintenance of ecological systems.

The fundamental goal for the decontamination of agricultural land is to reduce the radiological impacts on farmers who are involved in production activities and also on people living nearby, i.e. to reduce their external exposure to radiation to the lowest level possible, and to restore the environment to enable agricultural activities to be restarted and to provide safe agricultural products. Specifically, in the areas where the estimated radiation exposure dose is lower than 20 mSv, the dose should be reduced by 50% within 2 years and be approximately 1 mSv or less in the long run. In addition, in order to reduce transfer of radiocesium in the soil to agricultural produce, it is necessary to lower its concentration in the soil to the lowest level possible.

It should be noted that the radiocesium concentration in the agricultural soil means the average concentration in the surface soil layer where plant roots are concentrated (normally, down to 15cm from the surface of paddy fields and 15-30 cm depth from the surface for agricultural fields). Most of the radiocesium fell on agricultural land where the soil has not been plowed since the nuclear accident, and thus it still remains on the surface. Therefore, even though the concentration level may be the same for land with or without plowing, the ambient dose rate is higher for unplowed land. When decontaminating agricultural land, it is necessary to use appropriate methods depending on whether or not there has been past plowing in addition to considering the land category and the concentration of contaminated materials.

### 2. Decontamination methods for agricultural land

For unplowed land, it is normally appropriate to scrape off the topsoil layer where radiocesium remains. However, considering the cesium concentration in the soil, the current land category and soil condition, three methods can be selected: scraping<sup>1</sup>, tilling and removing by water<sup>2</sup> (tilling mixes the soil with water then the muddy water is drawn off to a sedimentation basin), or turning and plowing (in this the top layer is buried)<sup>3</sup>. Based on the “Technologies to Remove Radioactive

---

<sup>1</sup> Scraping the topsoil: According to Annex 1, the radiocesium concentration in soil can be reduced by 75-90% or more by scraping 3-5 cm off the top soil.

<sup>2</sup> Tilling/removing by water: According to Annex 1, the radiocesium concentration in soil can be reduced by 30-70% depending on the types of soil.

<sup>3</sup> Turning and plowing: According to Annex 1, using a 30 cm turn-over type plow, the radiocesium on the surface can be distributed

Materials (decontamination technologies) in the Agricultural soil” issued by the Ministry of Agriculture, Forestry and Fisheries on 14 September (Annex 1), the turning and plowing method which results in no soil for disposal can be applied to agricultural land with a radiocesium concentration in the soil of 5,000Bq/kg or less. For agricultural land with a radiocesium concentration in the soil exceeding 5,000 Bq/kg, it is appropriate to scrape, till and remove by water, or turn and plow the soil (inversion plowing).

When soil is inversion plowed, radiocesium moved to the lower layers of the soil may later be transported outside the agricultural land via groundwater flow. Therefore inversion plowing should be conducted after measuring the groundwater level and the depth to be turned should be determined based on the groundwater level. The greater this depth is, the larger the reduction effect on the ambient dose rates on the surface is. However, inversion plowing may destroy hardpans. When this happens, the hardpans have to be reconstructed.

For the radiocesium concentration in the soil at each location, survey results such as the distribution map of radioactive material concentrations in agricultural soil, prepared by the Ministry of Agriculture, Forestry and Fisheries (Annex 2) should be consulted.

For land where the soil has already been plowed, radiocesium is considered to have been mixed into the overall plowed soil layer by the plowing. In this case, inversion plowing or deep plowing of the soil are the options. For example, for the plowed soil layer of 15 cm thickness, by deep plowing of 30cm, the radioactive materials which were distributed in the range of 15cm in depth from the ground surface will be spread in the layer at 30cm depth from the surface. Therefore, reduction of the radioactive material concentrations in plowed soil layers and of ambient dose rates can be expected.

Furthermore, the sludge in the waterway around the agricultural land should be removed as necessary.

### 3. Other considerations

#### (1) Safety during the decontamination work

The decontamination work shall be conducted by securing safety according to “the measures for the prevention of radiation hazards for decontamination workers based on the Fundamental Policy for Emergency Responses on Decontamination Work and the Guidelines for Municipal Decontamination Work” (the Notifications of the Head of Occupational Safety and Health

---

down into the layer of 15-20 cm depth and the concentration on the surface layer can be reduced.

Department of the Labour Standards Bureau, the Ministry of Health, Labour and Welfare) (9 September 2011) (Annex 3).

#### (2) Management of waste soil

The methods for installing and managing temporary storage facilities of soil for disposal are shown in section 5 of the Guidelines for Municipal Decontamination Work (Nuclear Emergency Response Headquarters, 26 August 2011). When scraping off topsoil, there will be a large quantity of soil accumulated for disposal (i.e. scraping topsoil down to 4 cm depth results in approximately 40 m<sup>3</sup> per 10 a of soil for disposal). Therefore, the amount of soil for disposal needs to be estimated and temporary storage facilities need to be secured before starting the work. When soil for disposal is temporarily stored at the decontaminated land site or a nearby location during the period when a temporary storage facility is not ready, it is necessary to prepare a storage place and to consider the shielding methods, beforehand.

#### (3) Recovery of soil conditions for restarting agricultural production

The decontamination of agricultural land is not completed with only the removal of radiocesium; a series of other actions are required for restarting the agricultural production. It is expected that agricultural land after scraping and inversion plowing will result in loss of fertilizer components and organic matter from the soil and physical aspects such as permeability will be worsened. Therefore, the soil should be treated with necessary amounts of manure, fertilizers, organic matter and soil improvement materials to restore its productivity, based on the analyses of the soil conditions.

#### (4) Confirmation of the decontamination effect

After the completion of the decontamination works, not only ambient dose rates but also the radiocesium concentration in the soil should be measured.

#### (5) Removal and disposal of weeds

Half a year has passed since the nuclear accident, and weeds have grown on much of the agricultural land where the soil has not been plowed. For such agricultural land, weed removal needs to be done prior to scraping the ground surface. Since cut weeds may also be contaminated with radioactive materials, the amount of cut weeds needs to be assessed and temporary storage facilities for the weeds needs to be secured before cutting and removing them. Measures should be provided to store the cut weeds temporarily such as at the corner of the fields and covering them with waterproof sheets until the temporary storage facilities become available.

(6) Agricultural land with perennial plants

The decontamination methods described in section (2) above are mainly for agricultural land where annual plants such as rice, wheat, soya beans, vegetables and livestock feed crops are grown. For land use such as orchards and tea plantations where perennial plants are cultivated, scraping the topsoil at places where the trees or bushes will not be damaged is considered effective. However, inversion plowing and deep plowing are not suitable because these methods may damage tree roots which are distributed to lower layers of the soil. In addition to decontamination of the agricultural soil described above, efforts should be made to reduce radiocesium contained in produce as much as possible by roughly scraping the bark (removing old bark) or washing the bark of fruit trees and pruning tea bushes (removing old leaves and branches by cutting them shorter or cutting them to a place near the ground after tea picking). (Annex 4)

(7) Reduction of transfer of radiocesium from soil to agricultural produce in the production process

The Ministry of Agriculture, Forestry and Fisheries is currently testing technologies using various devices to suppress the transfer of radiocesium from soil to agricultural products. The test results will be made available to the public as they become available. In the meanwhile efforts to reduce the transfer of radiocesium to agricultural products as much as possible will continue.

(Annex 1) Technologies for removing radioactive materials from agricultural soil (decontamination technologies) (press release from the Ministry of Agriculture, Forestry and Fisheries (14 September 2011))

\* Only this reference material is attached to the expert meeting report as [Annex 1-4]

(Annex 2) Preparation of a distribution map of radioactive material concentrations in agricultural soil (press release from the Ministry of Agriculture, Forestry and Fisheries (30 August 2011))

(Annex 3) Measures for the prevention of radiation hazards for decontamination workers based on the Fundamental Policy for Emergency Responses on Decontamination Work and the Guidelines for Municipal Decontamination Work (the Notifications of the Head of Occupational Safety and Health Department of the Labour Standards Bureau, the Ministry of Health, Labour and Welfare (9 September 2011))

(Annex 4) Pruning tea bushes for the reduction of radiocesium concentration (Notifications of the Head of Occupational Safety and Health Department of the Labour Standards Bureau, the Ministry of Health, Labour and Welfare (21 September 2011))