

# **Report on Survey Results**

## **Project for the Verification and Development of Technical Measures to Control Radioactive Materials in Forests**

### **Introduction**

Forests account for some 70% of all areas affected by radioactive materials released as a result of the accident at the Fukushima Daiichi Nuclear Power Plant. Forests have many functions. They develop water resources and prevent mountain disasters. To fulfill these functions, forests need care (forestry operations) such as thinning.

Accordingly, since FY2011, the Forestry Agency has built testing sites in Tamura City, Hirono Town, Kawauchi Village, and elsewhere in Fukushima Prefecture to verify technical measures for the control of radioactive materials in forests. Some of the measures verified are important and necessary for forestry operations.

The Agency has already published a summary of verification results in the “Results of the Project for the Verification and Development of Technical Measures to Control Radioactive Materials in Forests” (hereinafter referred to as the “Summary Edition”). This report provides a brief summary of the survey results and verification methods, together with data used in the survey.

### **Summary**

#### **1. Verification of the Impact of Litter Removal and Logging on Air Dose Rates**

Logging, litter removal, and other forestry operations were performed within one to two years after the nuclear disaster. A monitoring survey has been conducted to verify the impact of these forestry operations on the air dose rates in forests. Clear-cutting and thinning have had varying but significant effects on the air dose rates. The survey has found that taking radioactive materials out of forests by way of logging or litter removal causes the air dose rates in the forests to decline, and that the volume of radioactive materials removed from the forests has an impact on the degree to which the air dose rates are reduced.

The survey has also verified the impact on the air dose rates at the edge of a forest assumed to neighbor a residential area; the correlation between the coverage of forestry operations and the air dose rates; and the impact of forestry operations on the movement of radioactive materials. Moreover, the survey examined litter layers, soil, surface runoff, and litter fall to verify how these factors influenced the increases/decreases of the air dose rates.

#### **2. Grasp of Factors Leading to Air Dose Rate Fluctuations in Forests**

A monitoring survey was conducted in forests near a residential area from 2013 to 2018 to compare locations where decontamination (litter removal) was applied and locations where no decontamination measures were taken. The air dose rates in the first year after the decontamination work varied among different locations, but no difference was found in changes in the air dose rates after the second year in terms of the location, whether decontamination was conducted, or the tree species in the forests.

#### **3. Verification of Effects of Erosion Control Works on the Movement Control of Radioactive Materials**

Litter removal on a steep slope may cause the surface soil to move. The survey has verified the effects of general erosion control works on the movement control of radioactive materials.

The survey has observed a rise in the movement rates (characteristic value to indicate soil erosion) of soil and radiocesium, and thus found that litter removal from forest floors has a considerable impact on the movements of soil and radiocesium in soil. The survey has also confirmed that the movement of radiocesium caused by fine soil is three to four times greater than that caused by falling leaves and other organic matters, and that the movement control of fine soil will considerably control the movement of radiocesium.

#### **4. Grasp of the Impact of Erosion Control Works on Air Dose Rates**

A survey has been conducted to verify whether erosion control works performed primarily to prevent surface soil from being washed away by covering forest floors have a secondary effect in reducing the air dose rates. The survey has confirmed that erosion control work elicits effects that shield radioactive materials and that the magnitude of the effects depends not on the type of covering materials but on the thickness and apparent density of such materials.

#### **5. Verification of the Effects of Adsorbents on the Movement Control of Radioactive Materials**

A survey has applied muddy water control works using general flexible steel frames filled with zeolite-based adsorbents or other adsorbents to verify their effects on the movement control of radioactive materials. Most radiocesium in torrent water is attached to floating sand and is difficult to capture with adsorbents. The survey has concluded that adsorbents do not have any expected effects.

## 6. Verification of the Effects of Torrent Works on the Movement Control of Radioactive Materials

A survey has verified the effects of torrent works (soil saving dam) on the movement control of radioactive materials (such works normally aim to control the erosion of torrent beds). The survey has found that the capture ratio of radioactive materials is about 0-30% in normal years, but also that the ratio is vulnerable to changes in the climate and varies excessively from year to year. Water captured is sometimes released again when, for example, it heavily rains.

## 7. Grasp of Radioactive Materials Contained in Trees Regenerated by Sprouting

Fukushima Prefecture was once well-known for the production of mushroom logs, but quite a few producers had to give up production after the accident at the Fukushima Daiichi Nuclear Power Plant. A monitoring survey has been conducted since 2013 to grasp the movement of radiocesium to konara oak and sawtooth oak trees used to produce mushroom logs. While the survey has found that the concentration of radiocesium is increasing in the shoots of some trees monitored, it has yet to gain a clear picture of the movement of radioactive materials.

## 8. Verification of the Effects of Potassium on the Absorption Control of Radioactive Materials in Mushroom Bed Logs

Some studies have confirmed that potassium fertilization has effects on radioactive levels in agriculture, including in paddy rice fields. A field survey has verified the effect of potassium fertilization on the absorption control of radioactive materials for konara oak trees. Survey work is still underway to determine if potassium can effectively control the absorption of radiocesium at testing sites where water-soluble (immediately effective) potassium chloride-based fertilizer was applied in March 2017.

## 9. Verification of the Effects of Forestry Machines in Reducing the Impact of Radioactive Materials on Workers

A survey has found that the working hours have a greater impact than the air dose rate of the working environment on the external doses to which forest workers are exposed, and that a shortening of working hours (improved productivity) using high-performance forestry machines effectively reduces the doses to which forest workers are exposed.

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