Long-term Effects Behavior of Radioactive Cesium in the Environment: Outflow from Forest Soil

Surveys conducted so far revealed that the annual outflow rate of Cs-137 from forest soil is around 0.02% to 0.3% of the total amount of Cs-137 deposited on nearby watershed soil.

[Table 1] Outflow of radioactive Cs from watershed areas to rivers (Outflow rates)

Watershed area	Kawamata Town			Mt. Tsukuba	Marumori Town
	Around Mt. Iboishi*1	Around Mt. Ishihira*1	Around Mt. Kodaishi*1	Around Kasumigaura*2	Upstream of the Udagawa River*2
Survey period		44 to 45 days*3		21 months	15 months
Amount of Cs-137 deposited on soil (kBq/m^3)	544	298	916	13	170-230
Amount of outflow of Cs-137*4 (kBq/m^3)	0.087	0.026	0.021	0.06	0.22-0.34
Percentage of the amount of Cs-137 outflow against the total amount of Cs-137 deposited on soil	0.016%	0.009%	0.002%	0.5%	0.12-0.15%
Percentage of the annual amount of outflow of Cs-137*5	0.13%	0.07%	0.02%	0.26%	0.10-0.12%

*1: (Source) Outcome report of the FY2012 commissioned radiation measurement project, "Establishment of Methods to Ascertain Long-term Effects of Radioactive Materials Released due to the Accident at Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS," JAEA
*2: (Source) National Institute for Environmental Studies, 2012 and 2013
*3: Extracted and totaled comparable data for these three watershed areas obtained from October 1 to 9 or 10, from October 22 to November 3, and from November 29 or 30 to December 18 or 19, 2012 (44 to 45 days)
*4: ○ Watershed areas around Mt. Iboishi, Mt. Ishihira and Mt. Kodaishi: Total amount of Cs-137 in river water (dissolved Cs-137, suspended substances (SS) and large organic matters (leaves and branches flowing in the river))
- Dissolved Cs-137: The concentration of dissolved Cs in normal times (August and October 2012) multiplied by the river flow rate
- SS: The radioactive Cs concentration in SS samplers multiplied by the SS flow rate, which was obtained based on contiguous data from a turbidity meter and the river flow rate
- Large organic matters: The radioactive Cs concentration in organic matters multiplied by the total amount trapped

○ Watershed areas around Kasumigaura and the upstream of the Udagawa River: Cs-137 derived from SS
*5: The data indicated in the above table is converted into the annual outflow rate based on the outflow rate against the amount of Cs-137 deposited on soil and the survey period (calculated by the Ministry of the Environment).
Natural decay of radioactive cesium and precipitation during the survey period are not taken into consideration in the calculation.

Radioactive materials that adhered to tree leaves and branches immediately after the accident have transferred to the mulch layer and soil on the forest floor over time. At present, approx. 80% is retained in the soil surface layer and is strongly fixed in mineral soil (p.179 of Vol. 1, "Behavior of Radioactive Cesium in the Environment: Adsorption and Fixation by Clay Mineral").

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Reference:

• The material for the 16th meeting of the Environment Recovery Committee

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