Investigation on distribution of radioactive substances in Fukushima (19) Assessment of the radiation doses to Japanese cedar affected after the Fukushima accident

*Rena Mikailova[1,2], Yuichi Onda[1], Sergey Fesenko[2], Kato Hiroaki[1]

[1] Univ. of Tsukuba, Japan, [2]RIRAE, Russia

Abstract

The research is aimed at the assessment of the dose rates to Japanese cedar trees which were exposed to ionizing radiation after the accident. The dose rate calculations were performed by dosimetric models developed and parameterized according to the radiocaesium measurements in different components of forest ecosystems of Fukushima Prefecture.

Keywords: dose rate, dosimetric model, radioactive contamination, nuclear accident, dose assessment, non-human biota

1. Introduction

To understand the consequences of Fukushima radiation accident for tree tier of the forest ecosystems, it is necessary to get the information about the dose absorbed by plants. Japanese cedar (*C. japonica*) belongs to endemic species of Japan, and a number of studies were performed to understand its contamination rate [1,2], but there is a lack in publications about the dose rates, which Japanese cedar tree got due to the external exposure to radioactive substances.

2. Methodology

To calculate doses, we used a dosimetric model, which considers forest biomass, vertical distribution of radiocaesium, as well as attenuation and scattering of photons in the environment. The environment is displayed as a set of horizontal thick layers within the vertical profile of the ecosystem with a set of dimensions: thickness (m), density (kg/m^3), radionuclide concentration (Bq/m^3).

3. Results and Discussion

The estimated absorbed dose rates for the mature forest of Japanese cedar lied in the values ~51-87 μGy/day in 2011 depending on the height of the detector point, and by 2015 they decreased to ~20-41 μGy/day. Comparison of the dose rate decrease to the decay rate of $^{134,137}Cs$ showed that the calculated dose rates decrease faster than the decay rate. This could be due to environmental processes in the forest ecosystem.

4. Conclusion

The absorbed dose rates are lower than the ICRP DCRLs for RAPs and do not indicate any significant biological consequences within the DCRL range of 0.01-0.1 mGy/day.

References

[1] Coppin, F. et al (2016). Radiocaesium partitioning in Japanese cedar forests following the “early” phase of Fukushima fallout redistribution. Sci. Rep. 6, 37618; DOI: 10.1038/srep37618

[2] Kato H., Onda Y., Hisadome K., Loffredo N., Kawamori A. Temporal changes in radiocesium deposition in various forest stands following the Fukushima Dai-ichi Nuclear Power Plant accident. J. Environ. Radioact., 166 (2017), pp. 449-457