

Re-suspension processes of radioactive Cs emitted by the FNDPP accident in summer and autumn –possibility of biosphere-atmosphere circulation of radioactive Cs

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Radionuclides emitted in the Fukushima dai-ichi nuclear power plant (FNDPP) accident have been deposited on the soil, ocean and vegetation. Re-suspension of radioactive cesium (Cs) from the soil and vegetation to the atmosphere may be one of significant path in the diffusion of radionuclides after the accident. As well as continuous monitoring of radionuclides in the atmosphere, understanding of the re-suspension processes of radioactive Cs to the atmosphere is essential to predict its environmental influence now and future.

We are monitoring the radioactivity concentration of atmospheric Cs-134/137 at several sites at Tsushima and Yamakiya, Fukushima, where deposition amount of Cs-134/137 is relatively high.

Atmospheric suspended particle are collected with high-volume air samplers mounted at these sites, and gamma-ray emission from them were measured with Ge detector. The measured concentrations of atmospheric Cs-134/137 at Tsushima indicated their seasonal variation: they increased in spring, attained their maximum in summer, and decreased in autumn.

SEM observation of atmospheric samples showed that organic particles were dominant in summer and autumn. Fraction of carbon in the samples was positively correlated with activity concentration of Cs-134/137, indicating that these organic particles bring Cs-134/137 in the atmosphere. Chemical analysis of the atmospheric samples shows some organic components from biogenic origin were rich in their fraction of high rad Cs-134/137 activity. Bio-aerosol sampling was also conducted and its preliminary result showed that many biogenic particles such as spores and bacteria found in the samples. Comparison of activity of Cs-134/137 in rainwater collected inside and outside broad-leaf forest in Tsushima showed that Cs-134/137 activity was several times higher in rainwater in forest. Atmospheric activity was also increased during rain. These results showed that Cs-134/137 was rich on the surface of vegetation, and that it moved from vegetation to the atmosphere and soil by rain. Water soluble components and insoluble organic components were extracted from atmospheric particle samples obtained in summer and autumn with ultrapure water and H₂O₂, respectively. Simultaneously, 40-65% of Cs-134/137 was extracted with pure water and 10-40% of Cs-134/137 was extracted with H₂O₂. Although water soluble aerosols such as NaCl and sulfates were included in the samples, we suppose that Cs-134/137 extracted by water was contained in the organic particles because Na and S was much less than C in the samples. We cultured poplar shoots in the solution obtained from the extraction of atmospheric samples by pure water during 48 hours, and found that similar amount of Cs-134/137 existed in roots of poplar, its leaves and branches, and remained solution after the cultivation although major part of Cs-134/137 was adsorbed grass beads used in the cultivation. These results strongly suggested that Cs-134/137 is circulating among vegetation, soil, and atmosphere.

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