Behavior of radiocesium at sediment-water interface off Fukushima

S. OTOSAKA[1*], M. FUKUDA[2] AND T. AONO[2]

[1] Japan Atomic Energy Agency, 2-4 Shirakata, Tokai, Ibaraki 319-1195, Japan (*correspondence: otosaka.shigeyoshi@jaea.go.jp)

[2] National Institutes for Quantum and Radiological Science and Technology, 4-9-1 Anagawa, Inage-ku, Chiba 263-8555, Japan

Within a year after the accident of Fukushima Daiichi Nuclear Power Plant (FDNPP) that occurred on March 11, 2011, 0.2±0.05 PBq of ^{137}Cs was deposited onto the seabed. Theconcentration of ^{137}Cs in seabed sediment has also shown a decreasing trend, but the rate is slow relative to that in the seawater. Consequently, it is pointed out that the seafloor off Fukushima can continuously supply ^{137}Cs to the bottom waters and benthic foodweb. In this study, behavior of dissolved radiocesium near the seafloor is discussed from the distributions of ^{137}Cs in overlying water (seawater collected from ~30 cm above the seabed) at 14 stations and in pore water at three stations off Fukushima.

The ^{137}Cs concentrations in overlying water, collected during 2015 and 2016, ranged between 5 and 283 mBq/L, and increased in stations where higher ^{137}Cs concentrations were observed. Concentrations in overlying water were 2~3 times higher than those in seawater collected from intermediate (3~5 m above the bottom) layers. Finally concentrations in pore water were 10~30 times higher than those in overlying water.

Regardless of the pore size of the filter (0.45 μm, 0.2 μm and 1kDa) used for filtration, ^{137}Cs concentrations in overlying water were similar at each station. We can therefore consider that radiocesium is “dissolved” in the overlying water and has been diffused from the seabed through the porewater. Nevertheless, the effect of ^{137}Cs supply to the benthic environment is insignificant because estimated amount of ^{137}Cs transferred to benthic organisms does not lead to ^{137}Cs activities exceeding the regulation limits at most stations.

Apparent distribution coefficients (K_d) of ^{137}Cs between sediment and porewater were 140~350 L/kg, and fell within a certain range regardless of the concentration or penetration depth of ^{137}Cs in the sediment. This indicates that an equilibrium of the accident-derived ^{137}Cs has been approximately established in the sediment-porewater system.