Environmental distribution and migration of cesium-bearing microparticles emitted from the Fukushima accident

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Radionuclides including radioactive Cs were released into the environment due to the Fukushima Daiichi Nuclear Power Plant accident in 2011. Two years after the accident, glassy water-resistant particles incorporating radioactive Cs were first reported. Such glassy particles are called cesium-bearing microparticles (CsMPs). CsMPs have been studied because (i) they have information on the condition in the reactor at the time of the accident, and (ii) there is concern about the exposure to humans and other organisms.

Several types of CsMPs have been reported, which is assumed to reflect the difference in the accidental progress of each unit. Type-A particles emitted from Unit 2 were dispersed to wide area of eastern Japan including Kanto region due to their small size (~0.1–10 μm). Type-A particles were also isolated from the river, estuary, and ocean, which suggested that Type-A particles were transported from land to ocean through river systems. In addition, Type-A particles apparently increased the Kd and CF values in the river and ocean. In the ocean, Type-A particles are not likely to be found in coastal sediments because they would be transported farther offshore. Type-B particles emitted from Unit 1 were deposited within 20 km north-northwest of the FDNPP due to their large size (10–500 μm). Type-C particles emitted from Unit 3 were probably deposited directly on the ocean surface, which also affects the Kd and CF values in the ocean. Type-C particles are not likely to be transported farther offshore due to their large size (10–500 μm), which suggested that they are found only in coastal sediments. The result of dissolution experiment for Type-C particles in seawater will also be presented. These deposition areas depending on each type of CsMPs were consistent with the direction of atmospheric plumes observed in each emission event of the corresponding unit. These results will contribute to the prediction of the migration of radioactive Cs and assessment of radioactive Cs uptake by organisms.