

Migration Behavior of Radiocesium Derived from the Fukushima Dai-ichi Nuclear Power Plant Accident in Natsui River and Tone River

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The accident of Fukushima Dai-ichi Nuclear Power Plant due to the Tohoku earthquake, which occurred on 11 March 2011, has released a large amount of radioactive materials to the atmosphere. This accident resulted contamination of radioactive cesium (^{134}Cs and ^{137}Cs) on land, rivers and sea around Fukushima Prefecture. Radioactive cesium widely deposited on land and transported from watershed through river system to the ocean. In this study concentration of ^{134}Cs and ^{137}Cs in river water has been investigated for dissolved and particulate phase. River water sample was collected at a fixed station from the Tone River and the Natsui River at normal and high flow condition during 2018-2019. Suspended solids were separated using continuous flow centrifugation and dissolved cesium were co-precipitated using ammonium molybdophosphate (AMP) method.

The AMP precipitated and suspended solids were dried to determined radioactive cesium concentration using HPGe gamma spectrometry. Investigations of cesium concentration in the rivers have been performed to understand factors controlling transport of radiocesium during different condition. The maximum concentration of ^{134}Cs and ^{137}Cs at normal condition was 0.7 mBq L^{-1} and 7.9 mBq L^{-1} in the Tone River, and 1.1 mBq L^{-1} and 11 mBq L^{-1} in the Natsui River, respectively. After the rainy events and typhoon, the concentration of ^{134}Cs and ^{137}Cs in river water was increased. Total concentration of ^{134}Cs after the rainy events in the Tone River and the Natsui River was $18 - 37 \text{ mBq L}^{-1}$ and 40 mBq L^{-1} respectively, and concentration for ^{137}Cs was $211 - 411 \text{ mBq L}^{-1}$ and 447 mBq L^{-1} respectively. During the study period, 97-100 % of ^{134}Cs and ^{137}Cs was distributed by suspended solid in the Tone River and 95-100 % of ^{134}Cs and ^{137}Cs in the Natsui River after the rainy events. These results indicate that behavior of suspended solids is a main factor controlling variation of concentration of ^{134}Cs and ^{137}Cs in both rivers.

Keywords: Radioactive Cesium, River water, Suspended solids, Fukushima Dai-ichi Nuclear Power Plant