

Distribution of radionuclides in the surface seawater developed by aerial radiological survey

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This study investigated the distribution of anthropogenic radionuclide in the surface seawater derived from the Fukushima Dai-ichi Nuclear Power Plant (FNPP1) observed by aerial radiological survey as an initial attempt. The aerial radiological survey over the coastal region was performed by the U.S. Department of Energy National Nuclear Security Administration (DOE/NNSA) within a 30 km radius of the FNPP1 on 18 April 2011. We found good correlations between the in-situ activities of radionuclide (¹³¹I, ¹³⁴Cs, ¹³⁷Cs) in the surface seawater and gamma-ray peak count rates by aerial radiological surveys (correlation coefficients for ¹³¹I, 0.89; ¹³⁴Cs, 0.96; ¹³⁷Cs, 0.92). Based on these relations, we find that the area with high concentrations extend south-southeast from the FNPP1. The maximum concentrations of ¹³¹I, ¹³⁴Cs, and ¹³⁷Cs reached 329, 650, and 599 Bq L⁻¹, respectively. The ¹³¹I/¹³⁴Cs ratios in surface waters of the high activities area on 18 April were about 0.6-0.7. Considering the radioactive decay of ¹³¹I (half-life: 8.02 d), we determine that the radionuclides in this area are due to direct release from FNPP1 to the ocean. These also confirm that the aerial radiological survey might be very effective to investigate the surface distribution of anthropogenic radionuclides in the surface seawater. Furthermore, the model reproduced the distribution pattern of the FNPP1 derived radionuclides, although simulated results by regional ocean model are underestimated.

Keywords: Airborne surveys, Ocean, Anthropogenic radionuclide, Gamma-ray peak count, Regional Ocean Modeling System, Fukushima Daiichi Nuclear Power Plant