Fukushima Dai-ichi and the Ocean: 10 years of study and insight Abstract Submission Form : Entry # 65

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Session

Biological uptake of radionuclides

Abstract Title (English, limited to 300 characters)

Dose rates to marine organisms and seafood consumers from the Fukushima accident: temporal and spatial dose rates across the Pacific

Abstract (English)

Although extensive radionuclide measurements have been made on marine fish, sediment and seawater samples following the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident, there are relatively few calculations of the resulting dose rates to marine fish and to seafood consumers. Here we report estimated dose rates based on a range of publicly-available data from near the FDNPP and across the Pacific Ocean.

The highest dose rates to marine fish occurred within the first year following the accident. A typical 1 kg demersal fish (e.g., Hexagrammos otakii) at 3 km from the FDNPP had a 0.10 μGy h-1 median dose rate in 2012, due to radionuclides released by the accident, which decreased to 0.02 μGy h-1 in 2015 and <0.01 μGy h-1 in 2020. The estimated dose rates to fish were higher near the release point with 45 μGy h-1 (median within the FDNPP port, 2012-13) and decreased with distance, i.e., 0.10 μGy h-1 at 3 km and 0.002 μGy h-1 at 100-200 km.

Fish within the FDNPP port received about 99% of their dose from ‘accident radionuclides’ in 2012-13, while at 3 km the proportion reduced to about 20% and was 1% at 100-200 km. At more distant locations (Aleutian and Hawaiian Islands, E. Pacific), some fish had increased doses due to the accident. However, these increases were minuscule and typically peaked

at <0.1% of the usual dose rates that fish receive from the ambient radionuclides in the ocean ecosystem.

For consumers of seafood, there was little change in dose rates after the accident due to the restrictions on commercial fishing in affected areas and an extensive seafood testing program. As a comparative exercise, we calculated dose rates to a hypothetical person who consumed 50 kg of fish muscle from a range of locations including areas where fishing was prohibited. This illustrative scenario suggests that had the hypothetical consumer eaten fish from very near the FDNPP (~3km) they would have received about 13% of their seafood dose from ‘accident radionuclides’ in 2012-2013 (0.13 mSv median, primarily from 134,137Cs, 90Sr, 110mAg), which reduced to 1.6% in 2015 and <1% in 2020. At more distant locations (e.g., Hawaii, E. Pacific) the data indicate that increases from the accident were <0.1% of the usual seafood dose from existing ambient radionuclides that are always present and dominated by natural radionuclides (210Po, 226,228Ra, 228,230Th, 40K)