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Fukushima and Ocean Radioactivity

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Abstract

The triple disaster of the March 11, 2011, earthquake, tsunami, and subsequent radiation releases from Japan's Fukushima Dai-ichi nuclear power plant were unprecedented events for the ocean and society. In this article, the radioactive releases from this event are compared to natural and prior human sources, with particular attention to cesium-137 and -134 radioisotopes. Total releases from Fukushima are not well constrained, with estimates from atmospheric fallout and direct ocean discharge spanning 4 to 90 peta Becquerels (PBq), but are most likely in the 15–30 PBq range. This source is smaller than any ^{137}Cs remaining in the North Pacific from global and close-in fallout from the 1960s. It is of similar magnitude to ^{137}Cs released to the ocean from the Sellafield nuclear reprocessing site on the Irish Sea, though of greater magnitude than fallout that reached the ocean from the 1986 Chernobyl nuclear power plant disaster in the Ukraine. The fate of Cs is largely determined by its soluble nature in seawater, though uptake in sediments does occur via cesium's association with both detrital particles and biological uptake and sedimentation. A mass balance of Cs supply from rivers and ongoing leakage from nuclear power plants suggests that sediments will remain contaminated for decades. This may be one reason why Cs concentrations in benthic fish stay elevated over predictions, causing fisheries to remain closed near Fukushima and ongoing concern to the public.

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