

Validation of the Advanced Environmental Transfer and Dose Assessment Model for Radionuclides Released from the Nuclear Fuel Reprocessing Plant in Rokkasho

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Abstract

The first commercial nuclear fuel reprocessing plant in Japan, located in Rokkasho, Aomori Prefecture is now undergoing its final testing using actual spent nuclear fuels. The advanced environmental transfer and dose assessment model (AdvETDAM) was developed for estimating areal and temporal distributions of the radionuclides around the plant and the radiation doses resulting from the radionuclides. To validate the model using actual field data, concentrations of radionuclides (^3H , ^{14}C , and ^{129}I , etc.) in various environmental samples collected around the plant and the environmental γ -ray dose at IES were measured. Because no nuclear fuel rods have been sheared or dissolved at the plant since October 2008, concentration levels of the radionuclides in most environmental samples collected in FY 2011 were similar to the background ones before the plant test operation, excluding several samples of soil and sediment.

The validation results of AdvETDAM, that is monthly γ -ray dose rates from ^{85}Kr at IES, are reported here using the data obtained from April 2006 to February 2009 (FYs 2006-2008) when many nuclear fuel rods were sheared and dissolved and significant amounts of radionuclides were released from the plant. A four-dimensional data assimilation technique was applied to wind velocity and direction for improving accuracy of estimated γ -ray dose rate by ^{85}Kr . Although the accuracies of the predictive values for wind velocity and direction were improved, that for the γ -ray dose rate was not. Further study is required to improve the accuracy of the model.

Distribution and transfer of several radionuclides in Fukushima Prefecture were studied to clarify their movement in the terrestrial environment. The obtained results will be used for AdvETDAM to improve the accuracy of model prediction. We researched the re-suspension rate of radiocesium in Koriyama City, distribution of ^3H (FWT, OBT) in plant and soil samples around Fukushima Dai-ichi Nuclear Power Plant and transfer rate of radiocesium via two small rivers (the Hiso River and Wariki River) in a mountainous area in Iitate Village, Fukushima Prefecture. Results of the transfer rate of radiocesium via the rivers are mainly reported here. The discharge rates of radiocesium in 2011 via the Hiso and Wariki Rivers were estimated as 0.5% and 0.3% of the total inventory of the catchment area of each river, respectively, by the analysis of measurement results of river water flow rate and transfer rate of radiocesium and precipitation data from the literature. Most of the radiocesium was transported as a particulate form in river water.

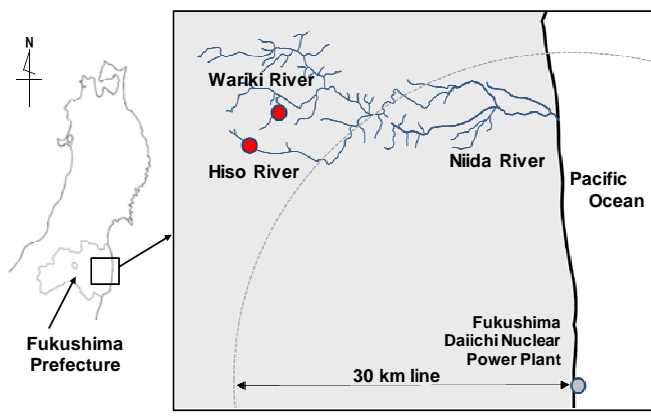


Fig. 1 Sampling locations.

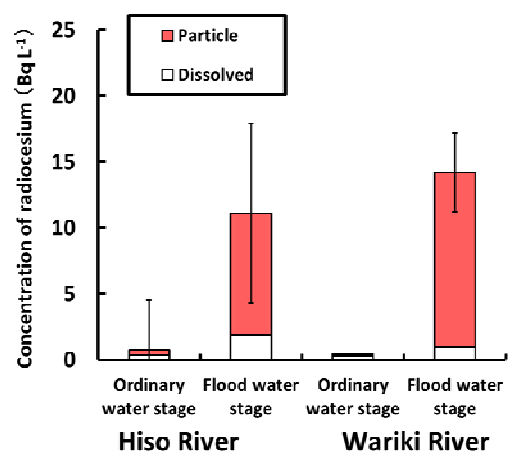


Fig. 2 Concentration of radiocesium in river water samples.

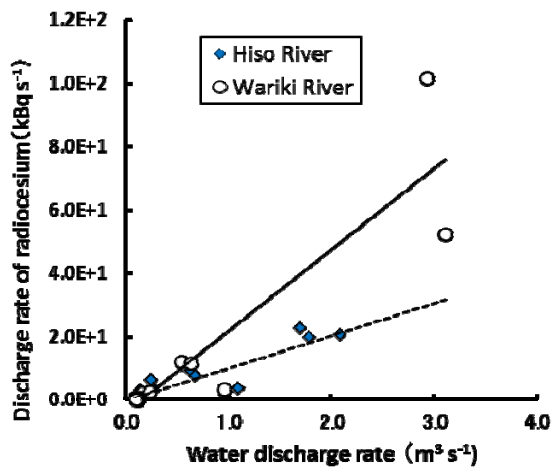


Fig. 3 Relationships between the discharge of radiocesium and the water discharge rate of the river waters.

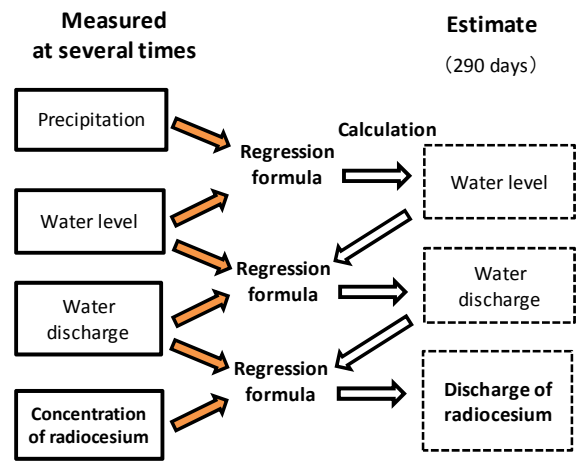


Fig. 4 Scheme to estimate radiocesium discharge from rivers.