Brown et al. Derivation of transfer parameters for Arctic Marine Biota A 57

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The initial stage of an environmental impact assessment requires quantification of radionuclide transfer in the study area. This paper evaluates the robustness of the concentration factor (CF) approach in assessing radiological impact on reference Arctic marine biota. By comparing region-specific data sets with recommended generic values for CFs, we tested the hypothesis that transfers to Arctic biota differ from transfers observed in temperate areas for ^{90}Sr, ^{137}Cs, $^{239,240}Pu$ and ^{99}Tc. Despite the general paucity of data and great uncertainty regarding radionuclide CFs in reference biota, we conclude that the use of Arctic-specific CFs for Sr and Pu can be justified in some cases where differences from generic CFs seem apparent. Where CF data are absent, a biokinetic modelling approach with allometric considerations might be used to bridge data gaps. Such an approach has been used here to estimate the trophic transfer of ^{137}Cs and ^{239}Pu in a marine food chain consisting of four trophic levels. For the simulation concerning ^{137}Cs, the preliminary results suggest that it takes more than five years to attain equilibrium for higher trophic levels (polar cod and harp seal). Biomagnification appears to occur at the lower trophic levels, but not at the highest (seal). For ^{239}Pu, transfer to successively higher trophic levels is low: there is a fall of several orders of magnitude between primary producers, represented by phytoplankton, and polar cod, representing trophic levels 3 and 4. However, the model predicts that this decreasing trend in activity concentrations along the food chain is reversed for the highest trophic level, represented by seal. The simulated results for seal display equilibrium activity concentrations about two orders of magnitude higher than those observed for polar cod (one of its prey species). However, equilibrium (165 years) is not reached during the life span of a seal. The equilibrium ^{137}Cs CFs are approximately 50 l kg^{-1} for zooplankton, 130 l kg^{-1} for polar cod, and 70 l kg^{-1} seal. The predicted equilibrium ^{239}Pu CFs are 2.5 •103 l kg^{-1} for zooplankton and 25 l kg^{-1} for polar cod. For seal, following a one-year equilibration period, a CF of approximately 75 l kg^{-1} is predicted.