

Terrestrial concentration ratio database: Analyses by wildlife groups and RAPs

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Abstract

Developed to support activities of the International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP), the international Wildlife Transfer Database (WTD; www.wildlifetransferdatabase.org/) provides the most comprehensive compilation of radionuclide transfer parameters (concentration ratios) for wildlife. The concentration ratio ($CR_{wo-media}$) is a constant that describes the ratio between the activity concentration of a radionuclide in the whole-organism and the activity concentration of that radionuclide in a reference environmental medium (e.g. soil or filtered water).

The WTD now contains over 100,000 $CR_{wo-media}$ values, including summarised data from some studies ($n > 1$ for an individual database entry) and individual CR values ($n = 1$). These data have been used to generate summary statistics – mean and standard deviation (both arithmetic and geometric) and range – for broad wildlife groups (e.g. amphibian, arthropod, mammal, reptile, shrub, tree etc). Group specific summarised $CR_{wo-media}$ values (generally arithmetic or geometric mean) are used in most of the modelling approaches currently implemented for wildlife dose assessment.

Beyond the broad organism group summary statistics presented within the WTD, it is possible to generate $CR_{wo-media}$ summary statistics for some organism sub-categories (e.g. carnivorous, herbivorous and omnivorous birds). However, using a statistical analysis approach that we have developed for the analysis of summarised datasets (<https://wiki.ceh.ac.uk/x/PgC6Cw>), we have shown that there is currently little statistical justification for the use of organism sub-category $CR_{wo-media}$ values.

Large variability is a characteristic of many of the organism-radionuclide datasets within the WTD, even within individual input data sets. Therefore, the statistical validity of defining different $CR_{wo-media}$ values for these broad wildlife groups may also be questioned. With the ongoing development of the ICRP Reference Animals and Plants (RAP) approach, there is also a requirement for the derivation of transfer parameters for individual RAPs. Again, the statistical validity of this may be questioned.

Focussing on the terrestrial database, in this paper we present some initial analyses of $CR_{wo-media}$ values at the broad wildlife group level and for a selection of ICRP RAPs. Based on these analyses, we make recommendations for the future derivation, compilation and application of wildlife group $CR_{wo-media}$ values.