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Recent development of wildlife transfer databases

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INTRODUCTION

The transfer of radionuclides to wildlife in the environmental radiological assessment models developed over the last two decades is most often described by the whole-organism concentration ratio (CR_{wo-media}). This parameter relates activity concentrations in wildlife to those in environmental media (typically soil for terrestrial ecosystems and water for aquatic ecosystems).

When first released in 2007, the ERICA Tool (Brown et al. 2008) contained the most comprehensive and well documented CR_{wo-media} database available for wildlife. The ERICA database was based upon databases established in the EU funded FASSET (https://wiki.ceh.ac.uk/x/ZILJbg) and EPIC (https://wiki.ceh.ac.uk/x/ZoLJbg) projects. It was subsequently used in an update of the USDOE RESRAD-BIOTA model (http://web.evs.anl.gov/resrad/home2/biota.cfm) to enable uncertainty analyses.

Evaluation of the various models available to conduct environmental radiological assessments identified that the transfer component contributed significantly to the uncertainty of assessments (e.g. Beresford et al. 2008). Consequently, the wildlife transfer database (WTD; www.wildlifetransferdatabase.org/) (Copplestone et al. 2013) was established to collate wildlife transfer parameter values and assist the IAEA and ICRP in the production of reports on recommended transfer parameter values. The WTD was initially populated using the ERICA Tool database. Many additional data were subsequently input including, a review of Russian language literature, and data from Canadian monitoring programmes associated with nuclear power plants, U-mining and related industries.

In 2011, data in the WTD were summarised and used by the ICRP to produce a report on recommended transfer parameters for its Reference Animals and Plants (RAPs) (Strand et al. 2009). There were few data for many radionuclides for the RAPs which are defined at the taxonomic level of family. For instance, there were no data for bee (the Apidea family).
Concurrently summaries of the WTD were used by the IAEA to produce a handbook of transfer parameters for wildlife (see Howard et al. (2013) and Yankovich et al. (2013)).

At the time the WTD was used to prepare the IAEA and ICRP reports, it contained information from 523 references. There were 50,061 lines of data entered into the WTD representing 86,979 CR values for 1438 species and 71 elements. Of these, 24,884 were CR\textsubscript{wo-sediment} values for freshwater organisms; these were used by neither the ICRP nor IAEA as they were likely to be highly site-specific given that they incorporate transfer processes from sediment-to-water and from water-to-biota. The remaining CR\textsubscript{wo-media} values were comprised of: terrestrial estuarine (n=141), brackish water (n=4230), freshwater (n=17,687), marine (n=10,189) and terrestrial (n= 29,848) ecosystems.

Here we summarise recent development and application of the WTD and analyses of the data.

DEVELOPMENT OF THE WTD SINCE 2011

Between 2011, when the WTD was used to provide values for the ICRP and IAEA reports, and the end of 2013, c. 17,000 additional CR\textsubscript{wo-media} values were added. The new inputs include data for: representative species of the ICRPs RAPs from a UK forest; monitoring data from Finland and Japanese estuaries; Canadian wildlife; Pu from US weapons testing programme sites (Johansen et al. 2013); wild plants and invertebrates from north western USA; and an ad-hoc review of refereed literature published after 2011. Additionally, data already in the WTD from Australia were reviewed with reference to original source reports not previously considered and amended where required (see Hirth et al. these proceedings). Amongst the additional entries were the first reported transfer data applicable to the ICRP RAP bee (Barnett et al. 2014; Sheppard et al. 2010). The number of elements included now totals more than 80.

The revised WTD was quality checked by considering the degree of variation in the data for each organism-element combination and the change between WTD versions. This identified a number of errors (e.g. double entry of data, unit conversion errors and entries based on a dry matter rather than the required fresh weight basis) all of which have now been rectified.

Revised summary values were generated from the WTD in December 2013 (available from: www.wildlifetransferdatabase.org). Figure 1 presents changes in CR\textsubscript{wo-media} values from the ERICA database through the IAEA report to the WTD as of December 2013 using terrestrial reptiles as an example. This demonstrates the amount of additional data added (in this case mostly from the review of Wood et al. 2010) and quality control (e.g. the change in the ERICA Cs and Sr values is largely the consequences of errors noted by Barnett et al. (2009) whilst the change in natural radionuclide values from IAEA TRS to WTD 2013 is mostly the consequence of the re-evaluation of Australian data (Hirth et al., these proceedings).

ANALYSES OF THE WTD VALUES

Evaluations of the WTD to date have demonstrated that there is no statistical justification to summarise data at levels below generic organism (e.g. ‘fish’, ‘mammal’, etc.) (Wood et al. 2013; Beresford et al. 2013). This is in part a consequence of biases and limitations within the
underlying datasets of the WTD. Given the uncertainty in CR$_{\text{wo-media}}$ data, we suggest that summarised CR$_{\text{wo-media}}$ values are used with caution above initial, highly conservative, screening-level assessments.

Wood et al. (2013) demonstrated problems in the method used to calculate geometric statistics from the WTD and we have made a spreadsheet available to better estimate GM statistics (https://wiki.ceh.ac.uk/x/PgC6Cw).

Figure 1. A comparison of CR$_{\text{wo-soil}}$ values for terrestrial reptiles from the ERICA database (ERICA 2007), IAEA technical report series handbook (IAEA TRS) and WTD in December 2013 (WTD 2013).

THE FUTURE

The WTD values as of December 2013 have been used to derive an updated set of default CR$_{\text{wo-media}}$ values for a pending revision of the ERICA Tool (Brown et al. these proceedings) and are being used to parameterise a screening methodology being developed by the IAEA.

For the foreseeable future we will continue to maintain and update the WTD by releasing revised summary values as sufficient additional data are added (we envisage releases of new summary values every two years). Please visit www.wildlifetransferdatabase.org/ if you have data to include in future WTD versions.

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