An evaluation of the JRODOS Food Chain and Dose Module for Terrestrial Pathways (FDMT)

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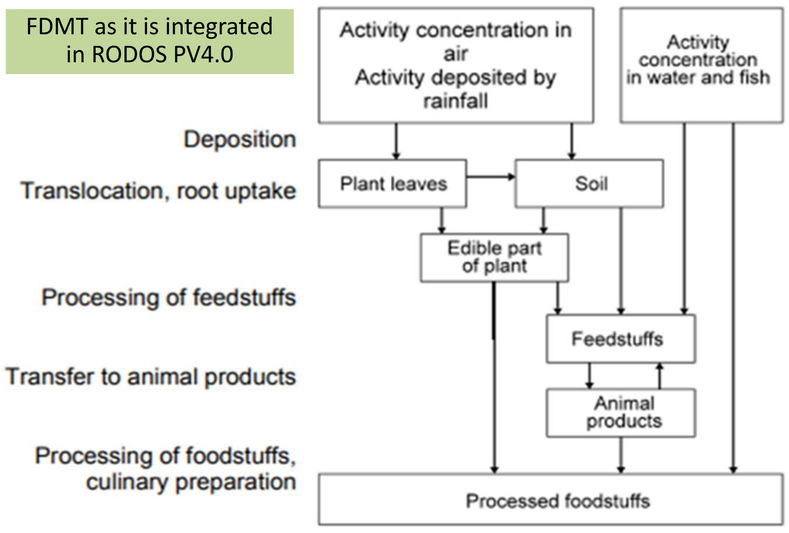


FDMT (Food Chain and Dose Module for Terrestrial Pathways)

The FDMT software (Müller et al., 2004) has been implemented in both the "Real-time On-line Decision Support System" (RODOS, now referred to as JRODOS, Levdin et al. 2010) and the "Accident Reporting and Guiding Operational System" (ARGOS, Hoe et al., 2008). The module allows for the prediction of radionuclide activity concentrations in various, mainly agricultural, food products.

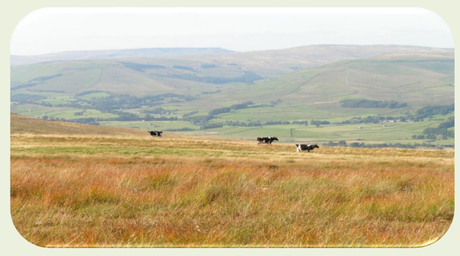
FDMT is largely based upon the earlier dynamic model ECOSYS-87 (Müller & Pröhl, 1993). Much of the developmental work including the numerical specification of many of the parameters used in ECOSYS-87 (and therefore FDMT) was completed in the 1980s and hence did not consider the large numbers of radioecology studies prompted by the 1986 Chernobyl accident. Furthermore, the original parameter collation was mainly specific to Southern German agricultural conditions.

In this poster we compare radioecological parameter values in FDMT with the latest international recommendations (i.e. IAEA, 2010).

How FDMT is used in the ARGOS/JRodos Decision Support System

Root uptake in FDMT is calculated using the soil-to-plant concentration ratio (Bq/kg fresh mass plant to Bq/kg dry mass soil (TF_i)). In IAEA (2010) TF_i is referred to as F_v and is defined on a plant dry mass basis.

The transfer of radionuclides from feed into animal products is described by the transfer coefficient, TF_m, which is used to describe both milk and meat in FDMT. In IAEA (2010) F_m and F_f are used to describe the transfer coefficients for milk and meat respectively.

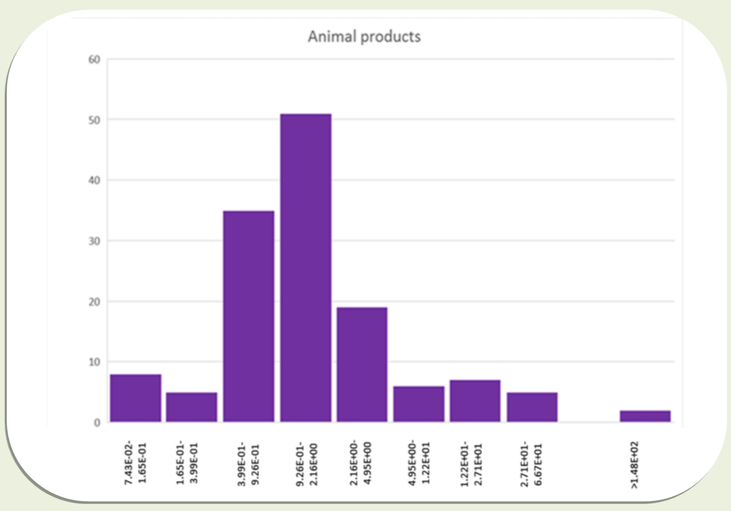


Tasks conducted as part of CONFIDENCE work package 3

We compared the default FDMT transfer parameter values for crops and animal products (taken from Müller et al., (2004)) to data presented in the latest International Atomic Energy Agency (IAEA) handbook (IAEA, 2010). To enable comparison we converted the IAEA dry mass values to fresh mass by applying dry matter content percentages as given in IAEA (2010).

The IAEA compilations and FDMT do not use the same categories of crops, information on what crop groupings from IAEA (2010) we have assumed map onto the FDMT groupings is presented in Brown et al. (2018; CONCERT Deliverable 9.13). Where comparison is possible:

- 90% of the default FDMT TF_m values are within an order of magnitude of the latest recommended IAEA values for milk and, only the TF_m for iodine and pork is more than an order of magnitude lower in FDMT than the value quoted in IAEA (2010)
- For crops, less than 70% of the default FDMT TF_i values were within an order of magnitude of the respective value in IAEA (2010)
- Of the 10 values where the FDMT value was more than an order of magnitude lower than the IAEA value, seven of the comparisons were for Te. All of the Te values presented in IAEA (2010) are based on single values and hence confidence in them is low
- Other values in FDMT which were more than an order of magnitude lower than the IAEA value were single values for Ce (grass), Mo (cereals) and Zr (root vegetables)
- Most of the 49 FDMT values which were more than an order of magnitude higher than in IAEA (2010) (some values were three to four-orders of magnitude higher) were for Ag, I, La, Na, Pu, Sb and Y



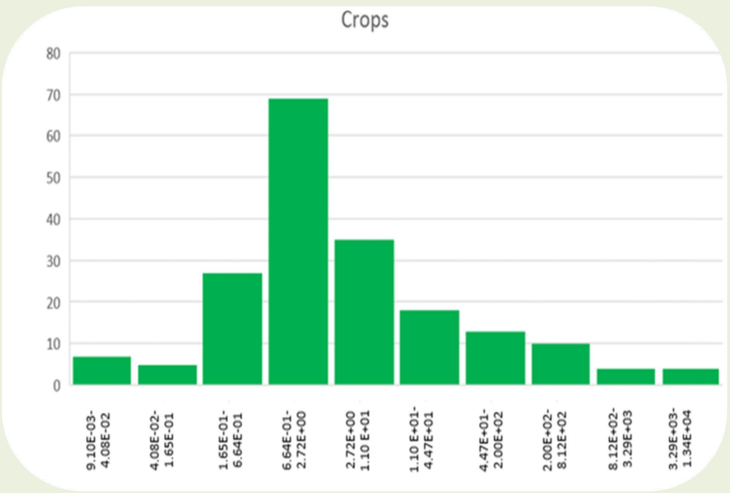
Distribution of the ratio between the default FDMT transfer coefficient values for farm animal products and the recommended value in IAEA (2010). A value of one would mean both data sources have the same value

Recommendations

Although in many instances, the default transfer parameter values used in FDMT are within an order of magnitude of those in the latest international compendium (i.e. IAEA, 2010), in a number of cases there is considerable disagreement between the FDMT and IAEA values.

It is therefore recommended that FDMT be updated.

Greater transparency is also required on how default values in FDMT have been derived when data are lacking.



Distribution of the ratio between the default FDMT transfer coefficient values for crops and the recommended value in IAEA (2010). A value of one would mean both data sources have the same value

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