Geophysical Research Abstracts
Vol. 19, EGU2017-425, 2017
EGU General Assembly 2017

THE CONCEPT OF CONVERSION FACTORS AND REFERENCE CROPS FOR THE PREDICTION OF 137Cs ROOT UPTAKE: FIELD VERIFICATION IN POST-CHERNOBYL LANDSCAPE, 30 YEARS AFTER NUCLEAR ACCIDENT

Olga Komissarova (1) and Tatiana Paramonova (2)
(1) Russian Federation (komissarova-olga93@yandex.ru), (2) Russian Federation

One of the notable lessons obtained from nuclear accidents could be revealing the general features of 137Cs root uptake by agricultural crops for prediction the radionuclide accumulation in plants and its further distribution via food chains. Transfer factors (TFs) (the ratio of 137Cs activities in vegetation and in soil) have become a basis for such assessment when the characteristics of radioactive contamination, soil properties and phylogenetic features of different plant taxons important for root uptake are known. For the sake of simplicity the concept of conversion factor (CF) was accepted by IAEA (2006) to obtain unknown value of TF from the TF value of the reference crop cultivated on the same soil. Cereals were selected like reference group of agricultural crops. Presuming TF for cereals equal 1, CFs for tubers and fodder leguminous are 4, for grasses – 4.5, for leafy vegetables – 9, ets.
To verify TFs and corresponding CFs values under environmental conditions of post-Chernobyl agricultural landscape the study in the area of Plavsky radioactive hotspot (Tula region, Russia) was conducted. Nowadays, after 30 years after the Chernobyl accident ($\sim$ the first half-life period of 137Cs), arable chernozems of the territory are still polluted at the level 126-282 kBq/m2. The main crops of field rotation: wheat and barley (cereals), potatoes (tubers), soybean (leguminous), amaranth (non-leafy vegetables), rape (“other crops”), as well as galega-bromegrass mixture (cultivated species of grasses) and pasture grasses of semi-natural dry and wet meadows have been studied. Accumulation parameters of 137Cs in aboveground biomass, belowground biomass and edible parts of the plants were examined separately.
Experimentally obtained 137Cs TFs in cereals are 0.24-0.32 for total biomass, 0.07-0.14 for aerial parts, 0.54-0.64 for roots and 0.01-0.02 for grain. Thus, (i) 137Cs transfer in grain of wheat and barley is insignificant and (ii) corresponding TFs values in both crops are reasonably consistent with each other. Normalizing 137Cs TFs in investigated crops to the mean TF value for the grain of cereals, the following CFs are realized: 0.8 for potatoes and 1.0 for rape, 1.4-3.5 for cultivated species of grasses and almost the same – 1.3-3.2 – for pasture grasses, 5.8 for soybean, 7.0 for amaranth. The data are not exactly, but satisfactory agree with IAEA recommendations and have revealed the similar order of CFs for plant groups.
Another situation is found when CFs are calculated on the basis of 137Cs TFs in aboveground and especially in total biomass of cereals. Since wheat and barley are capable to accumulate relatively elevated amount of the radionuclide in roots and definite 137Cs is translocated into leaves and stems, such CFs for crops are estimated as <0.8 and <0.6 taking into account average TFs in aboveground and total biomass of cereals correspondently. Hence cultural cereals are more likely accumulators of 137Cs rather than excluders.
As a whole, the concept of conversion factors and reference crops for the prediction of 137Cs transfer into plants have considerable promise, but invites further investigation and precise observing conditions.

The study was conducted with the support from the RFBR (14-05-00903).