

Effects of the rapid change of environmental temperature on the migration and bioaccumulation of technogenic radionuclides in soils

Petya Kovacheva¹⁾, Miryana Slaveikova¹⁾, Romyana Djingova¹⁾, Marin Ayranov²⁾,
Dorothea Schumann²⁾

¹⁾ Faculty of Chemistry and Pharmacy, University of Sofia, Sofia 1164, Bulgaria

²⁾ Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland

PKovacheva@wmail.chem.uni-sofia.bg

Rapid variations of the environmental conditions, like sharp temperature increase or freezing, soil drought or floods are commonly observed phenomena in the last decade all over the world. They cause changes of soil properties, such as pH, cation exchange capacity, redox potential, organic matter decomposition etc., thus influencing the environmental fate of radionuclides, released in nature because of nuclear accidents, operation of nuclear power plants, leakage from radioactive waste repositories etc. The changes in the geochemical fractionation of the radionuclides in soils, provoked by the rapid temperature variations influence their migration and distribution through the food chains.

This study presents the effects of the rapid temperature increase and deep freezing on the geochemical forms of ²⁴¹Am, ⁶⁰Co, ¹³⁷Cs and ⁵⁴Mn one month after its entrance in four soil types from Bulgaria. The effects of the storage conditions on geochemical fractionation of the radionuclides were investigated by using single extraction of exchangeable ¹³⁷Cs with 1 M NH₄NO₃ and sequential extraction of ²⁴¹Am, ⁶⁰Co and ⁵⁴Mn, followed by gamma-spectrometric measurement. The influence of temperature rise up to 40 °C, continuing one month, on the transfer factors of ⁶⁰Co, ¹³⁷Cs and ⁵⁴Mn from the soils to orchard grass (*Dactylis glomerata L.*) was evaluated. The results of the investigations showed that the sharp variations of environmental temperature should be considered when risk assessment of the migration of technogenic radionuclides is to be performed. The sharp and rapid temperature changes in the first month after radioactive contamination lead to increase of the risk from distribution of radionuclides in loamy-sand soils.

Acknowledgments: This study was performed with the financial support of the National Science Fund, Ministry of education youth and science of Bulgaria, Contract No. DDVU 02_60/2010.