

CONTAMINATION OF BELARUS TERRITORY BY NUCLEAR FUEL PARTICLES

V. Mironov, J. Matusevitch, S. Bouliga, and V. Kudrjashov
Institute of Radiobiology of National Academy of Belarus, Minsk, Belarus

A characteristic feature of the Chernobyl NPP accident has been the intake of finely dispersed fuel particles (FP) into the biosphere. They consist from nuclear fission products and actinides with a high specific activity. The rate of radionuclides transfer (Sr, Pu, Am and others) capsulated FP is very low in comparison with condensed component of their fall out and global fall-out after nuclear weapon tests. Radionuclides transform into a mobile state and their involving into biological cycles are determined by the destruction rate of fuel particles.

Distribution of FP in soils of contrast (turf, sod-podzol, sand and sandy loam) types in areas contaminated as a result of the Chernobyl accident were analysed in the present work in order to specify parameters and mechanism of vertical migration. The study was performed on the basis of the isotope uranium-236. This radionuclide is absent in nature. The levels of the soil contamination of alienation zone of Chernobyl NPP with technogenic uranium were estimated.

Radiochemical extraction and purification of uranium were carried out using AV-17 anionite from hydrochloric solution and extraction by diethyl ester. The isotopic ratio of uranium was determined using mass-spectrometer HEX-ICP-QMS (Platform ICP, Micromass Ltd., Manchester, UK). Mass-spectrometer was calibrated using standard CCLU-500. On the basis of experimental data on content of uranium-236 (Chernobyl origin) and known correlation between uranium isotopes in the active core of the reactor as well as in the natural uranium the levels of the soil contamination with isotopes uranium-235 and uranium-238 additional to the natural levels were estimated. The average meaning of nuclear fuel burn up and levels of radioactive contamination of soil surface on territories, situated on different distances from Chernobyl NPP were estimated with using these values. The more than 80% of Chernobyl origin uranium are in upper 0 -10cm soil layer, regardless of the soil type.

The grade of destruction of FP on different radioactive tracks using ratio of various valence state of uranium leaching with carbonate solution was made. The results of calculation of destruction rate of FP show that there is close relation with soil properties (acidity and structure of organic materials) and properties of FP (grade of oxidation). The values of transformation constant of FP may be used for prognosis of radionuclides transformation into mobile forms and for investigation of radiological situation in Chernobyl NPP zone.