Theory of Reliability in Radiation Ecology

Yuriy A. Kutlakhmedov[1], Anastasiya G. Salivon[1], Svetlana A. Phelovskya[1], Victor V. Rodyna[1], Irina V. Matveeva[2] and Valentina P. Petrusenko[2]

[1] *Institute of Cell Biology and Genetic Engineering, NAS, Kiev, 03022,Ukraine, E-mail: ecoetic@yandex.ru*
[2] *Faculty of Ecological Safety, National Aviation University, Kiev, 03126,Ukraine, E-mail: ecoetic@yandex.ru*

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For twenty years after Chernobyl catastrophe, we studied capability of plants of different kinds to store and retain the radionuclide tracer ^{137}Cs as the measure of stability and reliability of the ecosystem biota exposed to gamma-radiation and chemical pollutants. We introduced two parameters to quantify the ecosystem reliability. First, radiocapacity is defined as the upper level of radionuclide contamination, above which the ecosystem biota species begin to manifest depression and/or suppression of growth. Then, the factor of radiocapacity is defined as probability of the biota constituents to retain the radionuclide tracer. The more is the factor of radiocapacity the higher is reliability of the relevant biota components. With knowledge of the ecosystem structure and these parameters, it is possible to estimate ability of ecosystems to provide the proper distribution and redistribution of the tracer. In particular, we showed that ecosystems of the serious type of organization, like slope and mining ones that are incapable to provide the proper pollutant migration, exhibit low radiocapacity and, thus, low reliability. Using this approach along with the data of geoinformational analysis, we can predict the principal seats of location of pollutants in specific ecosystems and estimate appropriate dose loads and risks.