A NUMERICAL BOX MODEL WITH LAGGING ARGUMENT FOR THE SIMULATION OF ^{90}SR TRANSPORT IN THE KIEV RESERVOIR

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The floodplain areas near the Chernobyl Nuclear Power Plant (ChNPP) and surrounding catchments are heavily contaminated by radionuclides, especially ^{90}Sr. The major fraction of the radionuclide wash-off comes from the watershed of the Pripyat River, the right-hand tributary of the River Dnieper. ^{90}Sr run-off from these watersheds is transported to the Black Sea through a system of six reservoirs located along the Dnieper River. The first of them is the Kiev reservoir.

There are many approaches and models for contamination transport modeling in surface waters (IAEA, 1985; Rauch et al., 1998; Whicker et al., 1999). However, an increase in the predictability of models in the post-Chernobyl situation requires development of methods for modelling transport of radionuclides. There is, nevertheless, the possibility of comparing mathematical models and field measurements. A set of models of different complexity (from three-dimensional to box models) was developed to simulate radionuclide transport in the Dnieper reservoirs (Morozovet al., 1996). The simplest of these is WATOX, a box (complete mixing) model, for which variables are averaged over the volume of the compartment representing either the whole reservoir or its major sections. Such models are less sensitive to the quality of initial data than the existing more complex 1-, 2-, or 3-dimensional models. The use of latter models imposes fundamental constraints on the possibility of obtaining accurate predictions because of the need for a large body of accurate initial and boundary data, as well as considerable computer time. The paper presents a new box model – UNDBE with the same simplicity and with same requirements for initial data as WATOX, but with improved predictability, as well as calibration and validation. The model takes into account the time of transportation of water (and, consequently, of the pollutant) through a reservoir and mixing the pollutant in a certain part of compartment volume to the moment of completion of transportation.Results of a comparison with the box model for complete mixing, calibration of the model on a dataset of field measurements through critical 1994 and validation on data through 1991, 1999 critical situations are given. The post-Chernobyl measurements were used. With help of model the possible influence of modes of operation the Kiev HPP on concentration ^{90}Sr is appreciated.

The Kiev hydroelectric power plant may change water discharge and volume of the reservoir, flow velocity, time of water transportation and as a result to change concentration of a pollutant in the outflow of the reservoir. 1)2)The possible influence of modes of operation of the Kiev HPP on change of concentration ^{90}Sr was appreciated with help of the new model.

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