THE RESULTS OF NUMERICAL SIMULATION OF THE DETECTION DEVICE AND MEASUREMENT GEOMETRY FOR DEEP RADIATION MONITORING

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Water and sediment control, contaminated as a result of radiation accidents at nuclear power plants, is one of the tasks of radiation monitoring within to overcome the consequences of such accidents.

Submersible spectrometer AT6104DM designed to provide water and sediment radiation monitoring and represents the probe based on the scintillation detection NaI (Tl) size 63x63 mm inside waterproof stainless steel container and PDA module with applied software. Functions control in situ measuring is realizing by 150 m deep-sea cable.

In the result of theoretical researches have been calculated the response functions in the form of theoretical spectra of monitored radionuclides in definite measuring geometries. The results of mathematical modeling of the gamma emitting transfer process allowed to estimate with an acceptable accuracy the dimensions of the measurement object, in particular the critical radius - radius of contaminated sediments surface which provides 90-95 % of the response function. Theoretical spectra of radionuclides ^{134}Cs and ^{137}Cs for contaminated depths 5, 10, 15 and 20 cm and values of the critical radius allowed to develop an algorithm for monitored radionuclides activity measuring by in situ method without information about radionuclides depth distribution in sediments.

Verification of the developed mathematical models carried out in the Tohoku region, Japan. Experimental studies of the radionuclides activity measuring in sediment carried out in irrigation ponds with known distribution in depth and activity level of Cs-134 and Cs-137. Variations at the level of 20–25% indicated a good degree of correspondence of mathematical models.