

Neutron Fields Measurements at IREN Facility behind Biological Shielding

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The radiation fields behind the shields of the JINR nuclear facilities are formed mainly by neutrons of a wide energy spectrum. Radiation control in the fields of mixed (neutrons and gamma rays) and scattered radiation is a difficult task, especially in cases where the upper neutron energy exceeds 15–20 MeV. This is due to the fact that the mechanisms of interaction of neutrons with matter (and, accordingly, the sensitivity of neutron dosimeters) change strongly with an increase in their energies from thermal to tens and hundreds of MeV. The most adequate technique for determining the values of the effective dose of neutrons is associated with the measurement of their energy distribution and the use of calculated fluence-effective dose conversion factors in the geometry of human irradiation typical for the measurement site. To measure the spectrum of scattered neutrons in a wide energy range, a multisphere spectrometer is used, according to the readings of which the neutron spectrum at the measurement point is then restored.

This paper describes the results of measuring neutron spectra at two points at the Resonance Neutron Source (IREN) of the Laboratory of Neutron Physics, JINR. To obtain powerful neutron fluxes, this source uses an electron gun and a thick tungsten target, in which photoneutrons are produced from the bremsstrahlung of electrons in the target. Based on the obtained spectra, the effective neutron dose rates at the measurement points were determined, which is important both for assessing the radiation situation at IREN and for comparison with the readings of neutron dosimeters of the automated radiation monitoring system.