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Calculation of doses from secondary neutrons during operating medical linac

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For cancer treatment medical linear accelerators are applied to be using for creation of electron beams and bremsstrahlung radiation. When a beam of bremsstrahlung photons with energies above 8 MeV interacts with the structural elements of the accelerator, photonuclear reactions occur, as a result of which secondary particles, mainly neutrons, are formed. This radiation may cause an additional dose load on the patient, as well as unacceptable conditions for the work of personnel.

The contribution of photoneutron radiation to the dose in the treatment room is not evaluated and is not taken into account in modern planning systems. Secondary particles pose a serious radiobiological hazard. The relatively small contribution of photoneutrons to the radiation flux leads to a great increase of the dose in the irradiated tissues, which is unacceptable in the oncology treatment.

To estimate the contribution of secondary particles to the dose, the head of a medical linac is modeled. The model is verified based on the depth dose distribution in water. As a result of the work, the spectra of secondary neutrons were obtained, their average energy was estimated, and the contribution of photoneutron radiation to the dose was calculated.

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