Measurement of neutron and gamma dose rates from a lithium target at proton energies up to 2.3 MeV and lithium thicknesses from 1 to 208 µm

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Boron neutron capture therapy, which requires an intensive beam of neutrons of the epithermal energy range, is considered to be a promising treatment method for malignant tumors. It is generally accepted that neutron generation as a result of ^{7}Li(p,n)^{7}Be and ^{9}Be(p,n)^{10}B threshold reactions at proton energies in the region of 2-3 MeV allows to form a neutron beam, which meets the requirements of BNCT to the greatest extent. At the Budker Institute of Nuclear Physics, an epithermal neutron source consisting of a vacuum insulated tandem accelerator to produce a proton beam and a lithium target for neutron generation has been proposed and created. It is known that the interaction of protons with lithium produces 478 keV gamma-ray flux comparable to that of neutrons. To reduce this undesirable gamma-ray flux, the thickness of the lithium layer is chosen so that the proton energy at the layer outlet is slightly lower than 1,882 MeV, the ^{7}Li(p,n)^{7}Be reaction threshold. The report presents and discusses the results of measuring of neutron and gamma dose rates from the lithium target at proton energies up to 2.3 MeV and lithium thicknesses from 1 to 208 µm. It was found that using a thin lithium layer reduces the undesirable dose of gamma radiation by 2 times without reducing neutron yield.

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