

Comparison of the Photoneutron Spectra and Fluence Rates Generated from a High Energy Linear Accelerator using Hard and Dynamic Wedges

Since the advent of the high-energy medical linear accelerator, there has been a great deal of interest in photoneutron production. Although a great deal of work has been published on photoneutrons, the effect of hard and dynamic wedges on the neutron fluence rate and energy spectrum has not been investigated.

In this work, the neutron energy spectrum and fluence rate was measured for a Varian 2100C/D 18-MV photon beam using polyethylene multispheres with a lithium iodide detector. Measurements were taken for each sphere for a 10x10-cm open field, a 10x10-cm field modified by a 60-degree hard wedge, and a 10x10-cm field modified by an enhanced dynamic wedge. The neutron measurements were taken with the photon output at the calibration point held constant at 100 cGy (no wedge factors).

The shape of the neutron spectrum did not change with the addition of hard or dynamic wedges. However, the maximum neutron fluence did change, with an 18% decrease observed for a 60-degree hard wedge and a 15% increase for a 60-degree enhanced dynamic wedge. Because of the increase in photon output required for treatment with 60-degree dynamic wedges due to the small wedge factors, the total number of neutron generated per treatment can increase as much as 222%.