

Title: Evaluation of the impact of PL/hBN and PL/B4C on the neutron leakage generated by the LINAC in the treatment room

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Abstract: In this study, the maximal reduction of neutron leakage into the treatment room and bunker walls was evaluated by placing three stratified layers of PL/hBN and PL/B4C at distinct spatial coordinates within a medical linear accelerator facility. Simulations were conducted using the MCNPX code, focusing on "Photon flux per therapeutic X-ray dose" and "Neutron leakage and neutron density per therapeutic X-ray dose." The results indicated that adding PL/hBN and PL/B4C layers achieves the desired dose with a lower photon flux. The PL/hBN layer in a better proportion reduced flux compared to the PL/B4C layer. It was found that the PL/hBN layer can reduce neutron leakage and density in the air by up to 60.43 % and 50.08 %, respectively, while the PL/B4C layer achieved reductions of 44.32 % and 34.86 %. Additionally, reductions in neutron leakage and density within the bunker walls reached 95.61 % and 86.22 % with the PL/hBN shield, and up to 80.46 % and 70.59 % with the PL/B4C shield. These findings underscore the effectiveness of these layered neutron shielding measures in reducing neutron populations within the treatment room air and enhancing bunker protection.

Keywords: Polyethylene/h-BN, Polyethylene/B4C, Neutron leakage, LINAC, MCNPX code, Neutron shielding

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