

AbstractID: 9242 Title: Monte Carlo Neutron Shielding Evaluation of Treatment Vaults Built to NCRP 49 or NCRP 151 Recommendations

Purpose: To use MCNP5 to compare and contrast the recommendations found in NCRP 49 and NCRP 151 pertaining to neutron shielding.

Method and Materials: An Elekta SL25 accelerator head with nominal peak energy of 18MV was modeled in MCNP5 and verified against known measured beam characteristics. Neutron angular and energy distributions produced by the Elekta SL25 were calculated using the photoneutron production feature of MCNP5. These neutron distributions were then used as source terms for shielding calculations in simulated treatment vaults designed to either NCRP 49 or NCRP 151 standards.

Results: The neutron penetration calculations indicate that shielding for megavoltage teletherapy units, i.e. those with energies greater than 10MV, should include materials designed to prevent neutron leakage. A quantitative assessment of neutron dose contributions to personnel outside of the treatment vaults will be presented.

Conclusion: Although the phenomenon of photoneutron production has been well known for some time recommendations for shielding these neutrons in megavoltage teletherapy settings are relatively recent. This study may be used by those institutions considering upgrading existing units to ones with higher energies or by new sites to justify the added expense of incorporating shielding aimed at preventing neutron leakage.