ABSTRACT

Experimentally Determined Tissue Air Ratios and
Scatter Air Ratios for Collimated Beams
of 14 MeV Neutrons

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Tissue air ratios (TAR) and scatter air ratios (SAR) for collimated beams of 14 MeV neutrons were determined from depth dose curves measured in air and water using a 1/2" spherical tissue equivalent proportional counter. Central axis depth dose data were obtained as a function of field size and depth in a water phantom for an SSD of 125 cm. The collimator consisted of two sets of jaws constrained to move in arcs centered on the target edges and was continuously variable from a 3 x 3 cm to a 20 x 20 cm field size at 125 cm SSD. Each collimator jaw was 50 cm thick with 30 cm of steel followed by 20 cm of polyethylene. Addition of a 5 cm thick steel field trimmer served to minimize the difference in penumbra between vertical and horizontal beam profiles and produced field scans that were flat over 80% of the field dimension and were reduced to 20% of the central axis dose at 1.2 field radii in air. Initial investigations were made using an NE 102 plastic scintillator, taking advantage of the high counting rate to optimize the collimation and experimental procedures. The proportional counter used in these experiments was a 1/2" LET counter manufactured by EG&G which utilized inherent gamma discrimination

capabilities to measure the absorbed dose due to neutron interactions with LET ranging from 3.5 to 100 keV/μ. Depth dose data in air and phantom were measured with a precision of ± 2% and were smoothed before the TAR and SAR calculations were made. The scatter air ratios measured for 14 MeV neutrons have roughly the same characteristics as Cobalt 60 SAR but are almost twice the magnitude at all depths and reach a maximum at about 60% of the peak depth for Cobalt for all field sizes.