AbstractID: 7437 Title: Do obliquity factors apply to 30° scattered radiation from megavoltage photon beams?

Purpose: To determine the obliquity factor for megavoltage x-rays for 30° scattered radiation in various materials by Monte Carlo.

Methods and Materials: NCRP report #151 discusses the concept of the obliquity factor for primary barriers. Briefly stated, if the primary beam is incident at an angle θ to a barrier of thickness t, then the effective barrier thickness, t_s is given by $t/\cos(\theta)$. For secondary radiation, there are no explicit recommendations. However, in section 7 of that report, the following statement appears (p.115): "It would not be appropriate in this case *[secondary radiation]* to apply the obliquity factor of cos(30°), ….." The MCNP Monte Carlo code, v4.2C, has been used to generate scattered radiation at 30° to a secondary barrier for 4, 6, 10, 15 and 18 MV bremsstrahlung x-ray beams for concrete, lead and steel. The barrier thickness was increased from zero to a thickness sufficient to reduce the fluence (f4 tally) to $<10^{-2}$. A transmission curve was created for each energy-barrier material combination by normalizing to zero thickness. The data was then compared to the values in NCRP #151 for concrete and lead.

Results: The results for the first TVL show an average obliquity factor of 25.7° ± 3.3°, except for 10 MV in concrete where the value was 11.8°. The obliquity factor for the first two TVLs averaged 27.9° ± 5.0°, again, except for 10 MV in lead where the value was 15.0°.

Conclusions: The calculated TVLs for obliquely incident scattered radiation are less than those given in NCRP #151. This implies that use of an obliquity factor for scattered radiation is appropriate, but that the angle is less than the nominal 30°. This could well be due to the solid angle subtended by the scattered beam at the detector that would energetically favor lower angles.