

AbstractID: 3802 Title: Helical Tomotherapy leakage radiation half and tenth value layers in concrete and lead

Purpose: According to NCRP Report 51, if the leakage TVL is not measured, the primary radiation TVL should be used for the shielding design. Varian measured its own 90° leakage TVL in 1995. To determine which TVL value is most suitable for Hi-Art II Tomotherapy, its leakage radiation half and tenth value layer in concrete and lead are measured.

Methods & Materials: Film dosimetry is used to identify the high leakage region on the Hi-Art II Tomotherapy machine. The entire surface area of the machine was covered with Kodak XV2 films. After identifying the high leakage region, an ion chamber was used to measure the leakage. The ion chamber (Exardin A12) was placed near the high leakage region, and located 1.13m above floor level and 2m away from the radiation isocenter. To allow for enough build up for high energy photons a 1cm bolus was added to the existing ⁶⁰Co buildup cap. The leakage radiation was measured by adding blocks of concrete and lead in front of the ion chamber. The exposure data was recorded using a PTW Unidose electrometer. The half and tenth value layers of concrete and lead were calculated. All measurements were obtained under normal treatment conditions (800 MU/min, 360° rotation) for a period of 7 minutes.

Results: The measured leakage radiation HVL and TVL values of the Hi-Art II helical Tomotherapy machine are 0.011m (0.44") and 0.044m (1.74") in lead, and 0.066m (2.61") and 0.282m (11.11") in concrete, respectively.

Conclusion: The leakage radiation TVL in concrete and lead obtained for Hi-Art II helical Tomotherapy machine are close to published data for 90 degree leakage radiation of Varian (1995), but significantly lower than the NCRP (1997) data for primary radiation.