AbstractID: 8829 Title: Radiation Enclosure Shielding Calculations for a Laboratory-based Small Animal Conformal Radiation Therapy Device:

Purpose: Present radiation shielding calculations associated with a new laboratory-based small animal conformal radiation therapy device (SACRTD). ***Methods:*** SACRTD uses a Seifert 225kV X-ray tube, which produces ~100 times more penetrating radiation (at maximum tube voltage) than a typical 120kV diagnostic X-ray imaging tube. Shielding calculations were performed assuming beam energy of 250kV. The Seifert maximum and leakage dose equivalent rates at 1m are ~13Sv/hr and <10 mSv/hr, respectively. The a $6x6x6ft^3$ shielded enclosure consist of a steel frame from which two layers of $10lb/ft^2$ lead blankets are hung (~½inch lead equivalent). A lead-lined door (~½inch lead) was also constructed. The holding structure for all components was constructed using modular framing systems (80/20 Inc). The X-ray source is mounted ~40in from the floor, which is a primary barrier. Shielding calculations were performed following the NCRP Report#49, which is still applicable to sources up to 500kV. ***Results:*** Assuming maximum occupancy and use factor, T=U=1, the thickness of the primary barrier required to shield the primary beam at 1m was determined to be ~0.6inch of lead while for secondary and leakage radiation were ~0.3inch and 0.17inch of lead, respectively, for a maximum allowed weekly exposure $P = 0.08 R / week$.The primary beam was shielded with 1 inch of lead while the secondary and leakage barriers consisted of ½ inch of lead equivalent. In addition, the therapy radiation beam is further shielded by a beam collimation attachment. Other radiation safety features (door interlock, radiation monitors and alerts) have been incorporated. A preliminary radiation survey was conducted. ***Conclusion:*** A laboratory-based radiation shielded enclosure for a SACRTD meets or exceeds the requirements of NCRP Report#49.