AbstractID: 11037 Title: The Manageable Levels of Induced Radioactivity in Medical Accelerators from High Energy Photon Beams

Purpose: To summarize various relevant aspects of photon activation in medical linear accelerators using high energy x-rays.

Material and methods: For high energy medical accelerators (above 10 MV), One radiation safety concern is neutron production from photonuclear interactions which leading to exposure of personnel. Advanced radiotherapy use much longer beam-on times for the same delivered dose compared to the conventional treatment. The activation dose to personnel can be substantially higher. The characteristics and levels of radiation from activation can be determined using measurements and Monte Carlo simulations. The activity buildup during weeks and the doses to patients and medical staffs can be estimated under typical clinical conditions. With detailed accelerator model, the location and quantity of activations can be determined using Monte Carlo simulation.

Results: Most isotopes produced through photon and neutron activation processes were identified through measurements. The principal photon activation products decay primarily through beta emissions followed by gamma-rays, with half-lives from several minutes to several days. Most photon activations occur along the beam-line components where the photon flux is the highest, while the neutron activations occur everywhere in the treatment room. The induced activities buildup from Mondays through Fridays and decay up through weekends. The additional exposure to the patient due to induced radioactivity is negligible compared to the overall radiation exposure during treatment. The additional exposure to the staff is small at an estimated level of about 1-2 mSv/yr which is below the safety limits.

Conclusions: The potential hazard to staff from induced radioactivity in the use of high energy x-rays is considered to be low and manageable. ALARA principles are followed when deciding steps to reduce this small exposure to an even lower level. The dose reduction strategies suggested should be followed only if these actions are considered reasonable and practical in the individual clinics.