Patients undergoing intensity modulated radiation therapy (IMRT) are subjected to secondary radiation (leakage through the accelerator head and scatter within the patient) that delivers dose to healthy tissue outside the treatment field. At energies above 8 MeV, this secondary radiation includes neutron radiation as well as photon. This secondary radiation is a function of the beam-on time of the accelerator; dynamic multi-leaf collimator (DMLC) IMRT treatments require up to 10 times the number of MU’s as a conventional treatment, resulting in up to 10 times the secondary radiation. The secondary radiation poses a health risk to the therapy patient as secondary fatal malignancies may develop.

Neutron fluences are measured with gold foils in moderators and photon doses are measured with TLD in an anthropomorphic phantom. MU data is based on clinical cases. For a prostate IMRT case, preliminary neutron data from a Varian 2100, 18 MV beam show dose equivalent levels on central axis of 1.6 Sv. Secondary photon doses, predicted by AAPM TG-36, reach as high as 1.4 Sv to the bladder and colon (for a prostate treatment). The organ with the greatest risk of secondary fatal malignancy is the colon, at 2.5E-2. Data is collected for neutron and photon doses for several accelerators and energies, and risk estimates specific organs are tabulated. The final values determine what health risk to patients exists from secondary radiation during IMRT.