AbstractID: 4789 Title: Neutron Fluence Measurements around the Siemens Oncor Medical Linear Accelerator Utilizing Gold Foil Activation

Introduction

Neutron production in photon beams from high energy Linacs is a concern in radiation therapy centers. Neutrons are produced in the accelerator's head when high energy photons strike high Z materials of the target. Through a (γ, n) reaction, energy from the photon gets transferred to the atomic nucleus which then decays via the ejection of a neutron. In this paper, we measured the neutron fluence produced from the new Siemens Oncor using the Moderated Gold Foil Activation Method. In the process, neutron head leakage, in-beam neutron contamination, the Q factor used for shielding purposes, and an estimate of the dose a patient may receive from a typical course of treatment were also measured and will be reported.

Methods

Two gold foils were calibrated to provide a fluence per activity per gram conversion factor. The gold foils were then placed between two 3"x6" polyethylene cylinders which were covered in 0.025" cadmium metal. The gold foils were placed at distances of 112cm and 140cm from the target in the patient plane and exposed to doses that ranged from 5-10 photon Gy. After a 24 hour wait period, the activated gold foils (Au-198) were read on a Capintec 3000 MCA with a ROI set at a value of 400 to 424 KeV with the center at 412 KeV. The calculated activity at the time of irradiation was used to determine the fast neutron fluence.

Results

The average neutron fluence measured from a 20cm x 20cm field was $1.6 \times 10^{6} \pm 7.7 \times 10^{4}$ n/cm^2/Gy. The Q value was calculated to be $0.27 \times 10^{12} \pm 0.3 \times 10^{11}$ n/Gy.

Conclusion

The measured neutron fluence and calculated Q value from the Siemens Oncor is slightly higher than the published values for other Siemens accelerators, but is within the range for other accelerators.