AbstractID: 3388 Title: Characteristics of induced activity from medical linear accelerators

Purpose: To investigate radiation protection issues related to induced activity in typical medical linear accelerators (linac).

Method and Materials: A calibrated ionization chamber survey meter was used to measure the induced activity on Clinac 2300C/D using a standard setup: 18 MV photon beam, 10×10 cm^2 field, a dose rate of 400 MU/min, and two points of measurement: machine isocenter (point I) and on the isocenter axis 1 m off the isocenter (point C). The experiments were carried out in early mornings before clinical work to maintain a steady radiation background for the measurements.

Results: Higher beam energy, higher dose rate, larger field size, and the use of multileaf collimators result in higher activation levels at the isocenter. The induced activity decays faster for a larger field and longer irradiation times. The activation level reaches its practical saturation value (0.04 mSv/h at point I) after about 30 min of irradiation. Successive "doses" of 300 MU were given every 15 minutes to determine the trends in the activation level (6 - 8 μSv/h at point I) in a typical clinical mode. As well, a long- term (85 hours) decay curve was measured to evaluate the long-term decay of room activation after a typical day of clinical linac use. A mathematical model for the activation level at the isocenter has been established and shown to be useful in explaining and predicting the induced activity levels.

Conclusions: Typical residual exposure rate in the morning before clinical use of the linac is ~1 μSv/h and 0.6 μSv/h for points I and C, respectively. A whole day of clinical use of a high energy linac can raise the activation level about 30% compared to the level after the first irradiation. More than 70% of the induced activity will decay within one hour after an irradiation.