

AbstractID: 10682 Title: A novel approach for determining radiation-induced second cancer risks from selected prostate treatments using Monte Carlo simulations and an anatomically-realistic computational phantom

**Purpose:** There is an important and growing concern about the potential elevated risk of radiation-induced second cancers associated new forms of radiation treatments. Concurrently with the recently formed AAPM Task Group 158 we have developed a framework to calculate volume-averaged organ doses to patients using the Monte Carlo method. Using previously calculated organ doses from selected 3D-CRT and IMRT treatments of prostate cancer, this study calculates radiation-induced second cancer risks from these treatments utilizing the BIER VII report methodology.

**Method and Materials:** A detailed model of a Varian Clinac 2100C was combined with the RPI Adult male computational phantom to calculate volume-averaged organ doses from a 3D-CRT 4-field box treatment, a box treatment plus a 6-field boost treatment, as well as a 7-field IMRT treatment. Based on these organ doses, organ-specific excess relative risks (ERR) and lifetime attributable risks (LAR) were determined using the methodology outlined in the recently published BEIR VII report. The total whole-body LAR was determined for each treatment using arbitrary but clinically relevant monitor unit (MU) values of 10,000 and 40,000 for the 3D-CRT and IMRT treatments.

**Results:** For organs closest to the primary beam the ERR/MU is higher for the IMRT treatment compared to the 3D-CRT treatments, resulting from an increase in the number of fields needed for IMRT treatments. For organs further away from the treatment volume the ERR/MU appears slightly higher for the 3D-CRT treatments, as a consequence of the added neutron component of the 18-MV primary beam. The total whole-body LAR for the IMRT treatment was 2%, compared to about 0.4% from the box treatment and 0.9% from the box plus boost treatment.

**Conclusion:** The tools presented in this study improve upon previous methodologies by using the most accurate dosimetry methods as well as the most practical second cancer risk models.