AbstractID: 4609 Title: Photon and electron specific absorbed fractions from the UF pediatric tomographic phantoms

Purpose: To calculate photon and electron specific absorbed fractions (SAF) by utilizing series of realistic tomographic phantoms of pediatric patients.

Method and Material: The series of UF tomographic phantoms, 9-month male, 4-year female, 8-year female, 11-year male, and 14-year male, developed at University of Florida, were imported into the EGSnrc Monte Carlo code for this study. Monoenergetic photons and electrons were simulated as homogeneously distributed in various source organs. All possible source-target organ pairs were considered to calculate absorbed fractions at the target organs from both internal electron and photon emitters localized in source organs.

Results: The new sets of photon and electron SAFs were tabulated for the particle energies from 0.01 MeV to 4 MeV. The photon SAFs were compared with those from the ORNL phantoms. It was shown that ORNL phantoms failed to correctly represent the proximities of certain organ pairs and caused significant discrepancies from the UF phantom in terms of photon SAF values. The electron self-absorbed fractions calculated from the UF phantoms were compared to that given in the ICRP Publication 30 assumptions. For higher electron energies, the assumption of 100% self-absorption in the ICRP schema was shown to be incorrect, especially for the smaller phantoms and smaller organs with large surface-to-volume ratios. For example, the thyroid self absorption was only 21% for 4 MeV electrons in the UF 9-month phantom.

Conclusion: Photon and electron SAFs were calculated for various ages of pediatric patients by utilizing realistic tomographic computational phantoms. It was shown that the tomographic phantoms accurately represent the shapes of various internal organs and their proximities to surrounding organs. The explicit consideration of electron transport demonstrates that the traditional assumption of full energy deposition by energetic beta-particles can be in error, especially for the younger and smaller patients of this age series.