Abstract ID: 16234 Title: Computational Internal Dosimetry Methods as Applied to the UF Series of Hybrid Phantoms

Purpose: To compute specific absorbed fractions for monoenergetic photons and electrons for all UF hybrid ICRP-reference phantoms. Ultimately, radionuclide S values will be calculated for all radionuclides of interest in nuclear medicine.

Methods: Voxelized versions of the UF newborn hybrid computational phantoms were used in conjunction with the radiation transport code MCNPX v2.6 to determine the absorbed fraction of energy per unit mass (SAF) for a variety of source-target organ combinations for 21 photon and electron energies. A method known as a fluence-to-dose response function was used, for the first time in a model of the newborn child, to determine the absorbed dose to active marrow and total shallow marrow, the radiosensitive tissues of the skeleton. A novel method for minimizing the poor statistics associated with electron transport was also introduced. First, a simulation was completed which only tracked primary electrons, giving the dose contribution solely attributed to collisional energy losses. Next, a simulation was completed which recorded the initial energy of any photons produced by the primary electrons. Monoenergetic photon SAFs, determined previously, were then weighted according to each monoenergetic electron bremsstrahlung energy spectrum so as to procure low uncertainty photon dose from the primary electrons.

Results: The novel method for electron dosimetry was benchmarked and found to be an accurate and effective way of reducing the uncertainty associated with electron cross-dose. S values were generated for Tc-99m and compared to estimates provided by OLINDA/EXM 1.0. Noticeable differences were seen for both self-dose and cross-dose scenarios.

Conclusion: The work performed represents a state-of-the-art internal dosimetry model, and once dosimetry has been performed on the entire UF series of phantoms, the results will be incorporated into an online accessible software package which can be of use in imaging and dose optimization for pediatric nuclear medicine patients.