AbstractID: 3075 Title: Point-to-Organ Dose Scaling Factors for Use in Pediatric Radiology

Purpose: The purpose of this study was to develop a comprehensive set of point-to-organ dose scaling factors (SF_{POD}) for pediatric radiology.

Method and Materials: A physical tomographic newborn phantom was used in conjunction with an identical computational model to develop SF_{POD}. SF_{POD} were developed using Monte Carlo simulations of various radiographic and CT exams of a pediatric patient. Doses calculated included both organ doses and point doses, which were calculated at the same places at which doses were measured using MOSFET dosimeters in the physical phantom. Bone marrow dose was calculated using fluence-to-dose conversion coefficients. The resultant SF_{POD} values can then be used to calculate organ doses in the physical phantom from point dose measurements. The SF_{POD} were calculated at several energies and an average was used to generate general SF_{POD}.

Results: Individual SF_{POD} ranged from 0.82 to 1.08. Also, the SF_{POD} for the sigmoid colon/rectum was 1.71. This was due to improvements or updates to the computational phantom that occur on a regular basis as more sophisticated tools become available. Therefore, SF_{POD} are useful not only for organ dose calculation in the physical phantom, but can also be used to incorporate improvements to the computational phantom into the physical phantom when physical alteration is impossible.

Conclusion: This work demonstrates the benefits of having both physical and computational phantoms created from the same data set. A physical phantom alone is of limited use due to errors associated with only measuring point doses in organs. A 20% uncertainty in dose for an exam may seem trivial, but consider a pediatric patient subjected to 10 exams during childhood. The same 20% uncertainty propagated over 10 exams takes on new meaning. Also, it has been demonstrated that improvements to the computational phantom can be transferred to the physical phantom by using associated SF_{POD}.