AbstractID: 11643 Title: A Skeletal Model for Marrow Dosimetry in the ICRP Reference Adult Female

Purpose: The skeleton is of critical interest in internal radiation dosimetry. Accurate absorbed dose estimates to the hematopoietic tissues in the active (red) bone marrow and osteogenic tissues in the shallow active bone marrow are of primary importance in predicting the short-term deterministic (myelotoxicity) and long-term stochastic (leukemia and/or osteosarcomas induction) effects of radiation exposure. Presently, there are no international standards for skeletal reference models that are based upon a female subject. The purpose of this project is to complete the skeletal model for the ICRP reference adult female.
Method and Materials: The development of this female skeletal reference model involves harvesting of major skeletal sites, as well as ex-vivo CT imaging of the skeletal sites. The ex-vivo CT scans provide image data for quantifying both trabecular spongiosa and cortical bone ratios within the bone site through manual image segmentation and constructing 3D anatomic models of the bone site for subsequent paired-image radiation transport simulations. After review of each bone site's ex-vivo CT scan, samples of spongiosa are strategically excised for imaging via microCT. Next, the microCT scans of each bone site's microstructure and ex-vivo CT scans of each bone site's macrostructure are coupled and imported into the PIRT (Paired-Image Radiation Transport) code. PIRT is able to track particle energy deposition both at the macroscopic scale and the microscopic scale simultaneously.
Results: The end result of running these simulations will be absorbed dose estimates to the active bone marrow from the following sources: cortical bone surface and volume sources, trabecular bone surface and volume sources, and the trabecular active marrow itself. These will be compiled and available for use in estimating dose for the reference adult female.
Conclusion: This reference skeletal model will be used to determine skeletal masses and accurate bone marrow dose estimates from radiation exposures.