AbstractID: 11567 Title: Skeletal neutron dose response function development for use in proton therapy

Purpose: To develop a set of human skeletal neutron absorbed dose response functions for an inhomogeneous, multi-region bone model and neutron energies ranging from 10 eV to 150 MeV for use in neutron dose assessment in proton therapy. **Method and Materials:** The neutron absorbed dose response function equation was formulated after reviewing ICRU Report 63 and a previously-published photon absorbed dose response function formulation. The neutron absorbed dose response function equation is a function of the neutron energy, the isotope with which the neutron interacts, the emission particle considered, and the source and target bone regions. The first reaction considered was neutron scattering on hydrogen. The neutron angular distribution and elastic scatter cross-section were retrieved from the Evaluated Nuclear Data File. After optimization for numerical integration, proton specific absorbed fraction data was used to calculate the neutron absorbed dose response function for 13 skeletal sites. The neutron kerma response function was also calculated for comparison. This procedure will be extended to neutron-induced proton production in the remaining elements present in the human skeleton. **Results:** The relative error of the neutron kerma response function with respect to the neutron dose response function is heavily dependent upon skeletal site. It ranges from 0.07 for the sacrum to 0.52 for the femur and the humerus. The hydrogen component of the neutron dose response function is small at low neutron energies due to thermal neutron proton production in nitrogen, comprises nearly all of the neutron dose response function at medium neutron energies, and decreases for high neutron energies. **Conclusion:** The neutron kerma dose response function is a good approximation for the neutron dose response function at low neutron energies, as the emitted protons do not travel far before they deposit all of their energy, and at high energy, as charged particle equilibrium is approached.