A New Leg Voxel Model in Two Different Positions for Simulation of the Non-Uniform Distribution of ^{241}Am in Leg Bones

Majid Khalaf[1], Richard Brey[1], and Sergei Tolmachev[2]

[1]Idaho State University, Pocatello, ID; *[2]United States Transuranium & Uranium Registries, College of Pharmacy, Washington State University, Richland, WA*

A high quality new leg voxel model in two different positions (straight and bent) has been developed for in-vivo measurement calibration purpose. This voxel phantom is a representation of a human leg that may provide a substantial enhancement in Monte Carlo modeling, because it more accurately models different geometrical leg positions and the non-uniform distribution of ^{241}Am throughout the leg bones, instead of assuming a one-position geometry and a uniform distribution of radionuclides. This was accomplished by performing a radiochemical analysis on small sections of the leg bones from the USTUR case 0846. To construct the voxel model, high resolution (2 mm) Computed Tomography (CT) images of the United States Transuranium and Uranium Registries USTUR case 0846 leg were obtained in different positions. Thirty-six objects (universes) were segmented manually from the CT images using the 3D-Doctor software. Bones were divided into 30-small sections with an assigned weight exactly equal to the weight of bone sections obtained from radiochemical analysis of the USTUR case 0846 leg. The segmented images were then converted into a boundary file and the Human Monitoring Laboratory (HML) voxilizer was utilized to convert the boundary file into the leg voxel phantom. Excluding the surrounding air regions, the straight leg phantom consists of 592,023 voxels, while the bent leg consists of 337,567 voxels. The resulting leg voxel model is now ready for use as a MCNPX input file to simulate in-vivo measurement of bone seeking radionuclides.

USTUR-0335A-12