AbstractID: 9508 Title: Monte-Carlo “Virtual” Calibration of Counting Efficiency for Assessing Patient Internal Radioactivity Burden Using Organ-adjustable RPI Adult Male Phantom

Purpose: To give better representation of a patient anatomy, the BREP methods was used to design virtual patients whose organ sizes and locations can be adjusted for virtual calibrations.

Materials and Methods: From the RPI Adult Male mesh model which has over 140 organs or tissues, a voxelized phantom containing over 22 million voxels of size of 3.2mm × 3.2mm × 3.2mm was created. With a Monet Carlo simulation interface, the mesh model was adjusted to match the patient whose body shape, weight and height were known. Geometrical descriptions of the RPI Adult Male phantom and a HPGe detector were ported into the MCNPX code to simulate typical whole-body and lung counting scenarios. The counting efficiencies of the RPI Adult Male were calculated and compared to those of the NORMAN, BOMAB and LLNL.

Results: The RPI Adult Male’s whole-body counting efficiencies differed from NORMAN’s and BOMAB’s efficiencies by 1% to 8% over energies from 105 to 1460 keV. A comparison of the lung counting efficiencies of the RPI Adult Male and NORMAN found differences of 341% at 17.751 keV, 66% at 26.345 keV, 20% at 45.6 keV, 13% at 59.541 keV, and 2% ~ 9% at energies from 80.997 to 1332 keV. The difference between the RPI Adult Male’s lung counting efficiency and LLNL’s efficiency is much greater, from 24% at 1332 keV to 2290% at 17.751 keV.

C**onclusions:** The whole-body counting efficiencies of the RPI Adult Male are in good agreement with those of NORMAN and BOMAB. This suggests that the BOMAB may be acceptable to simulate workers with similar size, weight and height. Notably different lung counting efficiencies were observed of the RPI Adult Male, NORMAN and LLNL. For more accurate internal dosimetry, the deformable RPI phantoms will be very useful, especially when aided with partial-body patient-specific parameters.