AbstractID: 3552 Title: Low-Energy Photon Dose Calculations Using Various MCNP Photon Databases: Dose Comparison between MCNP, PENELOPE, and EGSnrc

**Purpose**: Recent releases of the MCNP5 and PENELOPE (2001) Monte Carlo codes use photo-atomic data from the most updated EPDL97 library, and include Doppler broadening in Compton scattering processes. Such advances in photon databases and transport algorithm are particularly important in low-energy photon dose calculations.

**Method and Materials**: We computed radial dose distributions for $r$ = 0.2–10 cm from a point source in a 50 cm-diameter sphere of water. Nine discrete energies for primary photon sources were chosen in the range of 10–150 keV. To isolate the effects of updated photoelectric data, Doppler broadening, bound electron model, and kerma approximation, we varied transport parameters and photon databases in the same simulation geometry using MCNP5 and MCNP4 with LIB04, LIB03, or LIB02 photon databases, PENELOPE, and EGSnrc.

**Results**: The results from MCNP5/LIB04 agreed with those of PENELOPE within statistical uncertainties (±1%) over the entire ranges of energies and radial distances investigated. They also agree well with EGSnrc data within about ±2% (except for doses at 10 keV). MCNP/LIB02 or LIB03, on the other hand, produced doses up to 8% lower in the range of 20–80 keV than MCNP/LIB04 and PENELOPE. Such differences stem primarily from the differences in the photoelectric data used. The dosimetric effects of Doppler broadening and bound electron model for Compton interactions appear to be insignificant in the energy range investigated. Kerma calculated by photon only transport well approximates absorbed dose in water within statistical uncertainties (±1%) except for primary photons of $E$ = 10 keV.

**Conclusion**: Low-energy photon dose and kerma in water calculated by MCNP5 and MCNP4 with the updated photon database (LIB04) are comparable to doses by PENELOPE and EGSnrc.