

AbstractID: 10134 Title: Dose Reductions of Bismuth Shields in Diagnostic Radiology: Measurements and Monte Carlo simulations

Purpose: To assess the dosimetric characteristics of bismuth breast shields for a CT beam with ion chamber measurements and Monte Carlo simulations.

Method and Materials: Primary attenuation and backscatter effects of both adult and pediatric bismuth superficial organ (e.g. breast) shields were measured with a 0.18-cc ion chamber and a rectangular slab phantom made of a tissue equivalent material. Simulated CT beams (120 kVp with 100~400 mAs) were used to irradiate the ion chamber with and without bismuth shields. Both 2-ply (pediatric) and 4-ply (adult) bismuth shields (F&L Medical Products, Vandergrift, PA) were placed at the front of the chamber for primary attenuation measurements and at the back of the chamber to measure backscatter radiation. Radiation doses were measured free-in-air and in the tissue-equivalent slabs. Monte Carlo simulations for the same measurement settings were performed by using EGSnrc/BEAMnrc code.

Results: Mean radiation dose reduction from primary attenuation was about 23% (2-ply) and 40% (4-ply) for the free-in-air and tissue slab measurements. The radiation dose increase from backscatter was around 2% for both the 2-ply and 4-ply shields. The Monte Carlo simulations produced the dose reduction from primary attenuation was about 20% (2-ply) and 38% (4-ply), and the dose increase from backscatter was around 6% for both shields.

Conclusion: Primary attenuation is the dominant factor that induces radiation dose changes in bismuth shields in CT examinations. The dose contribution from backscattered radiation in bismuth shields is very small.

Conflict of Interest (only if applicable):