AbstractID: 8586 Title: The response of LiF:Mg,Ti thermoluminescent dosimeters to low-energy photons

Purpose: To characterize the component of the LiF:Mg,Ti TLD response to the low-energy photons of ^{125}I and ^{103}Pd LDR brachytherapy sources and x-ray beam qualities of M40 and M80, that cannot be predicted by cavity theory or Monte Carlo methods. To provide a methodology for determining accurate energy correction factors for experiments performed in a variety of scatter conditions and to provide an example of how to apply the results of this work will also be presented. **Materials and Methods:** TLD-100 chips were exposed to ^{125}I and ^{103}Pd LDR brachytherapy sources using the known geometry of the University of Wisconsin Variable Aperture Free Air Chamber. Dose calculations were based on primary determinations of air-kerma strength and Monte Carlo simulations of the full irradiation and source geometry. For comparison purposes and to examine the effects of dosimeter size and scatter conditions, a series of x-ray experiments were performed to compare the response of chips (3x3x0.89mm) to microcubes (1x1x1mm) and free in air irradiations to irradiations in a PMMA holder. **Results:** The results of the x-ray experiments agreed well with the work of Nunn et al. (Med. Phys. 2006) and confirmed that the "solid-state" component of the energy response was largely independent of irradiation geometry. The results of the ^{125}I experiments exhibited good reproducibility for the single ^{125}I source, but the ^{103}Pd measurements seem to exhibit source-to-source variability. More experiments are needed for both isotopes to determine the nature of these observations. **Conclusion:** For all radiation qualities used in these experiments it was found that Monte Carlo simulations appear to underestimate the dose response of LiF:Mg,Ti when compared to measured response. As a result, the previously published values for the dose rate constants of LDR brachytherapy sources are likely overestimates.