AbstractID: 4901 Title: Energy response of LiF:Mg,Ti Thermoluminescent Dosimeters to moderately filter x-ray spectra in the range of 20 to 250 kV relative to 60Co

Purpose: To use experimental methods to determine the response of LiF:Mg,Ti thermoluminescent dosimeters (TLDs) irradiated using moderately filtered (M-series) x-ray spectra in the energy range of 20 to 250 kV relative to the response to ^{60}Co photons. Also, to determine if LiF:Mg,Ti TLDs are intrinsically linear detectors (i.e. the response is proportional to energy imparted).

Method and Materials: TLDs were irradiated to a known air kerma using the NIST traceable M-series x-ray beams, which were located at an Accredited Dosimetry Calibration Laboratory (ADCL), in the range of 20 to 250 kV. Using each x-ray beam, several sets of TLDs were irradiated to different air kerma levels to take into account any dose non-linearity. TLD response was then compared to that from several sets of TLDs irradiated at corresponding air kerma levels using ^{60}Co. The Monte Carlo code MCNP5 was used to correct for scatter from the holder and to determine the predicted/expected TLD response to the experimentally used x-ray beams.

Results: The measured TLD energy response compared to the response to ^{60}Co shows a rapid decrease toward very low photon energies. This response dropped to approximately 0.90 at the lowest effective energy of 11.5 keV. The highest response was found to be 1.37 at an effective energy of 28.5 keV. The results showed poor agreement between measured energy response and calculations using the mass-energy absorption coefficients of pure LiF. A significant increase in measured response compared to calculated response was seen at effective energies higher then 25 keV.

Conclusion: These results demonstrate that the measured energy response differs by up to 14% from Monte Carlo calculations and is highly dependent on the energy of the source. The results also suggest that LiF:Mg,Ti TLDs are not intrinsically linear with energy imparted.