AbstractID: 4772 Title: Miniature TLDs for use in beta dosimetry

Purpose: To demonstrate the production and utility of new miniature thermoluminescent dosimeters (TLDs) for use in electron fields such as those generated by $^{90}Sr/^{90}Y$ intravascular brachytherapy (IVBT) sources

Method and Materials: Square lithium fluoride Harshaw TLD rods were cut into $1x1x0.5mm^3$ "half-microcubes" for measurements of dose near a Novoste Beta-Cath $^{90}Sr/^{90}Y$ IVBT source pellet. Calibration exposures were performed with a Tracerlab RA-1 $^{90}Sr/^{90}Y$ ophthalmic applicator directly traceable to the NIST absorbed dose to water standard. All beta exposures were made in liquid water since it is the reference medium of interest. TLDs were read 24 hours post-exposure using a Harshaw 3500 planchet reader. TLD mass was tracked throughout the investigation, and individual TLD response characterization factors were determined from ^{60}Co exposures before and after each $^{90}Sr/^{90}Y$ exposure.

Results: Radial depth dose measurement (and consequently radial dose function) results show slightly decreased volume averaging effects and increased precision of half-microcubes compared to standard $1x1x1mm^3$ microcubes. Half-microcube measurements also correspond within uncertainty estimates to radiochromic film data and to data published by Soares et al (Med Phys, 25(3), 1998), which is the current NIST standard for IVBT beta sources. Monte Carlo statistical modeling with the MCNP5 transport code served to corroborate the measured radial dose function.

Conclusion: Particularly for investigation of beta emitting sources, decreasing the volume over which TLDs average dose provides slightly increased precision in the measurement of relative dose rate at the 2mm reference depth. Precision changes from 12.2% for microcubes to less than 11% for half-microcubes at the 95% confidence interval. Both sets of measurements also avoid the experimental uncertainty inherent in most current published work by eliminating the conversion to water from data taken in water-mimicking media. TLDs were used to take advantage of their relatively well-known response to changes in energy, dose, and dose rate.