AbstractID: 7758 Title: Design of a jig for thermoluminescence dosimetry of brachytherapy sources in liquid water and the determination of a correction factor for water-equivalent plastics

Purpose: To develop a method for measuring the characteristics of brachytherapy sources in water, rather than in water-equivalent plastics, and to use this method to determine the correction factor for water-equivalent plastic.

Method and Materials: Small thermoluminescence dosimeter (TLD) capsules were constructed from capillary tubes to hold 14 mg of lithium fluoride powder. Plastic jigs were designed to hold the capsules in circular pattern around a brachytherapy source, or in a spiral pattern radiating away from the source. The radioactive source was mounted on the tip of a thin graphite rod with its long axis either parallel or perpendicular to the TLD pattern. The jigs were placed in a water phantom to enable measurement of all TG-43 parameters. A Solid Water™ phantom was constructed to hold the TLD capsules in exactly the same circular pattern around the source. TLD measurements were made in water and Solid Water^{TM} at 1.00 cm distance from a model 6711 ^{125}I source to determine a correction factor for the Solid Water^{TM},. Similar measurements were also made with a model CS-1 ^{131}Cs source.

Results: The measured correction factor for Solid Water^{TM} was 1.05 +- 0.02 at a distance of 1.00 cm from the model 6711 ^{125}I source. This value is in good agreement with a Monte Carlo-based value published previously. Similar measurements with the model CS-1 ^{131}Cs source produced the same result within experimental uncertainties.

Discussion: The preferred medium for therapy dose measurements is liquid water. However, dosimetry measurements reported in the literature are limited to water-equivalent plastics. The correction factor for plastic phantoms is based on Monte Carlo calculations, and must be validated by actual measurements.