AbstractID: 9331 Title: Radiological low dose measurement with an OSL dosimetric system

Purpose: A method has been developed to measure low dose in radiology using the Landauer microStar OSL reader and microdot dosimeters. The depletion rate (the fraction of trapped electrons participating in the formation of the signal in a reading) has been established and the noise behavior following consecutive readings modeled.

Method and Materials: While microdot dosimeters can be used to measure dose levels as low as 10 μGy, caution must be used as repeated expositions of these dose integrators rapidly limits the accuracy of the readings. Around 4000 doses were measured with a set of 362 dosimeters, each dosimeter being reused after reading. Each dosimeter was read multiple times, and a bank of nearly 70000 measurements was acquired. In order to obtain exposition dose, a method taking the multiple readings of the dosimeter into account was devised to estimate accumulated dose before and after exposition. The difference between these two values was the estimated exposition dose. It was found that low doses were more accurately measured when dosimeter accumulated dose was kept below 1500 μGy. This was achieved by exposing the microdot dosimeters to tungsten light for twelve hours. The dosimeter accumulated dose was reset to 30 μGy, without affecting significantly the dosimeter operating characteristics.

Results: We found that the relation between the noise variance and the accumulated dose is quadratic for doses between 50 μGy and 10 mGy in the case of 90-140 kV exposure. Noise variance dictates that 200 readings be done in order to estimate the dosimeter rate of depletion with sufficient accuracy. The rate of depletion for the microdot dosimeter is -0.29% ± 0.03 (2 standard deviations).

Conclusion: OSL allows measuring 10 μGy doses with an error of ± 3 μGy, but only with multiple readings after exposition and light induced resetting to zero.