Purpose: Optically stimulated luminescent dosimeters (OSLD) are becoming more popular for dose measurement in a clinical setting. The OSLD response is dependent on photon energy and that energy response is typically determined only for the photon spectrum at the reference dose calibration point (dmax on CAX for a 10cmx10cm field). Previous work has shown that variations exist in photon energy spectra as a result of measurement conditions and treatment parameters; however the effects of these energy variations on OSLD response have not been characterized.

Method and Materials: Theoretical energy correction factors were calculated for a range of clinical conditions, including 6MV static and modulated (IMRT) fields, in-field and out-of-field measurement positions, and in the presence of heterogeneous materials. These factors were calculated using previously determined photon energy spectra and Burlin cavity theory. Measured energy correction factors using OSLD nanoDots™ from Landauer, Inc. have also been determined under matching conditions, and the measured and calculated responses were compared.

Results: When OSLD are used to measure dose for in-field locations, the dosimeter response was as much as 5% different from the reference location due to perturbations in the spectra. The presence of heterogeneities at in-field measurement locations did not significantly impact the OSLD response; however a substantial energy response occurred for the soft spectra that exist outside of the treatment field. At these measurement locations, OSLD may over-respond by 20% or more, relative to the response at the dose calibration location.

Conclusion: OSLD exhibit a non-trivial energy response due to the increased effective atomic number. Variations in the photon energy spectra may impact the response of OSLD by as much as 20% and additional non-reference energy correction factors may be necessary when measuring dose away from the dose calibration position.

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