Purpose: Thermoluminescent dosimeters are used routinely for dosimetric measurements of photon and electron fields. However, no work has been published characterizing TLDs for use in combined photon and electron fields. This work investigates the response of TLD-100 (LiF:Mg,Ti) in mixed fields of photon and electron beam qualities.

Methods: TLDs were irradiated in a 6 MV photon beam, 6 MeV electron beam, and a NIST traceable cobalt-60 beam. TLDs were also irradiated in a mixed field of the electron and photon beams. All irradiations were normalized to absorbed dose to water as defined in the AAPM TG-51 report. The average response per dose (nC/Gy) for each linac beam quality was normalized to the average response per dose of the TLDs irradiated by the cobalt-60 standard.

Irradiations were performed in a water tank and a Virtual Water™ phantom. Two TLD dose calibration curves for determining absorbed dose to water were generated using photon and electron field TLD response data. These individual beam quality dose calibration curves were applied to the TLDs irradiated in the mixed field.

Results: The TLD response in the mixed field was less sensitive than the response in the photon field and more sensitive than the response in the electron field. TLD determination of dose in the mixed field using the dose calibration curve generated by TLDs irradiated by photons resulted in an underestimation of the delivered dose, while the use of a dose calibration curve generated using electrons resulted in an overestimation of the delivered dose.

Conclusions: The relative response of TLD-100 in mixed fields fell consistently between the photon and electron relative responses. When using TLD-100 in mixed fields, the user must account for this intermediate response to avoid an over- or underestimation of the dose due to calibration in a single photon or electron field.