

AbstractID: 13021 Title: Evaluation of the use of optically stimulated luminescent detectors and thermoluminescent detectors for measuring the output of self-shielded x-ray units and the absorbed dose to patients from a CT procedure

Purpose: To evaluate the use of optically stimulated luminescent detectors (OSLDs) and thermoluminescent detectors (TLDs) for calibrating kilovoltage x-ray units replacing ^{137}Cs and ^{60}Co irradiators used for blood sterilization and radiobiological studies and to measure absorbed doses to patients undergoing CT procedures. **Method and Materials:** The OSLDs are 0.7 cm diameter, 0.02 cm thick, plastic disks containing $\text{Al}_2\text{O}_3:\text{C}$ within a light-tight plastic holder and TLD 100 LiF chips with dimensions $0.038 \times 0.32 \times 0.32 \text{ cm}^3$. Relative sensitivity factors were determined for the detectors. Two self-shielded x-ray devices operating at 160 kVp with effective monoenergetic energies of 70 KeV, and a CT unit with effective monoenergetic energy of 47 KeV were investigated. The unit irradiating blood uses two opposed x-ray sources. A 6 MV photon beam was used to calibrate the detectors. To determine the energy dependence of the detectors over the range of kilovoltage energies relative to 6 MV photons, an orthovoltage therapy unit provided effective monoenergetic energies from 15 to 90 KeV. For x-ray irradiations the detectors were placed in a cylindrical tissue equivalent phantom having dimensions similar to a blood packet and a small animal. For the CT measurements the detectors were placed on the patient surface. **Results:** The energy response of the detectors was approximately linear from 30 to 90 KeV with the OSLD response increasing faster with decreasing energy than the TLDs due to the difference in their atomic number. Accounting for energy dependence, their dose measurements agreed within the estimated uncertainty of 5% (1SD) for the x-ray units and patient CT measurements. Timer errors of 2.5 and 1.3 s were measured for the single and double x-ray units, respectively. **Conclusion:** With energy corrections both detectors provide relatively simple and accurate measurements of the output for the x-ray units and absorbed dose to patients undergoing a CT procedure.