Purposes: To characterize the response of Al2O3:C optically stimulated luminescence detectors (OSLDs) to 6 MV x-ray beams and to determine the optimal bleaching method that would allow the re-use of the OSLDs.

Methods: OSLDs were exposed to a 6 MV x-ray linac beam in the dose range from 50 mGy-10 Gy. Readouts were performed with a commercial OSLD reader (microStarTM, Landauer Inc.). For 50 mGy and 100 mGy doses, OSLDs were readout using the reader's low-dose mode, which provides higher stimulation power compared to the high-dose mode. All other readouts were performed using the high-dose mode. The OSLD response to dose, bleaching time and repeated readouts (depletion) were determined. Bleaching of the OSL signal was performed using a 250 W halogen lamp with two methods: (a) direct exposure to light; and (b) exposure using a long-pass optical filter to block wavelengths shorter than 495 nm.

Results: The OSLD dose-response was linear for the investigated dose range. After 100 readouts, the OSL signal was depleted by (24.5 ± 0.7) % and (3.16 ± 0.07) % with a depletion rate of (0.251 ± 0.002) and (0.023 ± 0.002) %/readout for low- and high-dose modes, respectively. After a 5 min bleaching time, (85.1 ± 1.4) and (70.5 ± 2.0) % reductions in the OSL signal for all doses was attained using methods (a) and (b), respectively. After a 100 min bleaching time, (99.5 ± 0.2) % reduction was attained.

Conclusions: We observed linearity of the OSLD's dose response for the investigated dose range. A 100 min bleaching time was sufficient to bleach 99.5 % of the OSL signal for both bleaching methods. The depletion rate using the low-dose mode is 11 times higher than using the high-dose mode. For the high-dose mode of the reader, the depletion rate is independent on dose.