

Direct and indirect entrance surface dose measurement in X-ray diagnostics using nanoDot OSL dosimeters

ABSTRACT

This study investigated the suitability of nanoDot optically stimulated luminescence (OSL) dosimeters for entrance surface dose (ESD) measurements in common X-ray diagnostics. OSL dosimetry system supplied by Landauer Inc, (Glenwood, IL, USA) consisting of nanoDot OSL dosimeters and microStar reader were used. ESDs were measured with nanoDots placed on whole-body anthropomorphic phantom (for direct measurements) and in free air without backscatter material (for indirect measurements) in accordance with the IAEA Technical Report Series No. 457. Measurements were carried out in five X-ray projections including AP abdomen, AP chest, PA chest, AP thoracic spine and AP skull. The mean ESD for each projection was evaluated from multiple measurements with three different field sizes. Mean ESDs (direct measurements) for AP abdomen, AP chest, PA chest, AP thoracic spine and AP skull were 4.3 mGy, 0.7 mGy, 0.3 mGy, 6.8 mGy and 2.8 mGy respectively. While in the case of indirect measurements, the corresponding mean ESD values were 4.8 mGy, 0.7 mGy, 0.2 mGy, 7.2 mGy and 3.7 mGy respectively. The results were found to be within IAEA and European Commission (EC) diagnostic reference levels (DRLs) range. The percentage difference of the ESDs measured by direct and indirect methods in all projections were between 0 to 40%. It was affirmed that nanoDot OSL dosimeter is a good candidate for ESD measurement in common radiographic examinations, while taking into account the effect of energy dependence.

Keyword: Entrance surface dose; X-ray diagnostics; NanoDot OSL dosimeters; NanoDot optically stimulated luminescence