

Harmonization of TL/OSL Retrospective Dosimetry Techniques using Personal Objects of Industrial Radiography Worker

Hyungjoon Yu^{1*}, Hyunseok Lee¹, Jeongtae Lee¹, Hanjin Lee¹, Hyoungtaek Kim², and Yoomi Choi²

¹Department of Radiological Emergency Preparedness, Korea Institute of Nuclear Safety, Daejeon, Republic of Korea

²Radiation Safety Management Division, Korea Atomic Energy Research Institute, Daejeon, Republic of Korea

*E-mail: hjryu@kins.re.kr

Keywords: retrospective dosimetry, industrial radiography, thermoluminescence, optically stimulated luminescence, electronic personal dosimeter

The exposure dose of workers in the field of industrial radiography is the highest on average among all radiation workers, and radiation exposure events exceeding the dose limit are also the most frequent. It is often reported that personal dosimeter was not worn intentionally or accidentally in the accident of radiation exposure, and retrospective dosimetry techniques are used to analyze TL/OSL signals of personal belongings to assess doses. In this study, actual field exposure test was performed by using various materials and irradiation device of non-destructive test by representing the exposure accident scenario. The radiation source was Ir-192(32.99 Ci), and TLD, OSLD, mobile phone and electronic personal dosimeter were attached on the surface of the chest of female and male physical phantoms, respectively. The female phantom was exposed for two hours at 30 cm away from the source, while the male phantom was exposed for seven hours at 100 cm away. Reading of TLD and OSLD were referred to dosimeter reading service provider. TL on display glass and the OSL on the resistor of mobile phone, and OSL on the resistor of the electronic personal dosimeter were measured with Risoe TL/OSL reader. Monte Carlo simulation with MRCP(Mesh type Reference Computational Phantom) and Geant4 code was also carried out for comparing the estimated doses to reference dose. And harmonization of various materials for fortuitous dosimeter were evaluated. The TLD and OSLD readings measured at 1 m were overestimated by 40% and 28%, respectively, relative to the effective dose calculated by simulation. For 30 cm, more than twice. The difference is due to the effect from the point source at close distances compared to the aligned extended radiation field where the legal dosimeters have been calibrated. In addition, TLD and OSLD provide $H_p(10)$ as a deep dose, which is conservatively evaluated relative to the effective dose. When the accident is occurred, dose assessment reflecting the situation of accident are needed because the legal individual monitoring system may not accurately reflect the dose of exposed person at a close distance from the source. The TL of the display glass and OSL of the resistor of mobile phone, and OSL measurements of EPD resistor all showed similar results within 20% of TLD and OSLD. Although there is a difference between $H_p(10)$ and the absorbed dose of materials, it is shown that the feasibility of fortuitous dosimeters such as mobile phones and electronic personal dosimeter can be an alternative means in case of an accident without a personal dosimeter.