Comparison of Measurements and Calculations on Shielding Experiments using TL Detectors

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Abstract

Experiments are performed in the irradiation tunnel of the 100 kW research reactor of the Institute of Nuclear Technics of the Technical University of Budapest. Neutron reaction rates and gamma dose rates are measured in a straight cylindrical duct and in ducts with bends of 30, 60 and 90 degrees. $^6$LiF and $^7$LiF samples were used to measure the neutron reaction rates and Al$_2$O$_3$ samples were used to measure the gamma dose rates.

Neutron calculations are performed by two-dimensional discrete ordinates and three-dimensional Monte Carlo codes at the Interfaculty Reactor Institute of the Delft University of Technology and the results are compared with the measurements. The agreement is generally within 30%, which is quite satisfactory in such difficult geometries. The gamma ray calculations are done by point-kernel codes. Because they are still in progress, no results are yet available.

1 Experiments

Analysis on neutron and gamma ray streaming through ducts is usually done by simple methods, because two- and three-dimensional transport codes require too long CPU times. To judge the capabilities of transport codes in real streaming problems (steel-walled ducts in concrete, irradiated with a typical reactor spectrum), experiments have been performed at the Institute of Nuclear Technics of the Technical University of Budapest. Concrete blocks containing straight and bent ducts with angles of 30, 60 and 90 degrees, were irradiated by the 100 kW research reactor. The neutron reaction rates were measured by coupled pairs of $^6$LiF (TLD600) and $^7$LiF (TLD700) thermoluminescence dosimeters, while the gamma dose rates in the ducts were measured by Al$_2$O$_3$ dosimeters.