E1 – 04

Gamma dose rate in natural radioactivity of bricks of different local regions

Natural building materials act as sources of radiation and also shields against outdoor radiation. The indoor radiation comes mainly from the activity concentration of the natural radionuclides of the ^{238} U series, ^{232} Th series and ^{40} K in the building materials. Estimated absorbed dose rates in air within masonry dwellings is reported to be 80 nGy h^{-1}. The objective of the present study was to estimate the radiation hazard due to natural radioactivity in bricks and to calculate the gamma radiation dose rate from the bricks used in Sri Lankan buildings.

Specific activities of the natural radionuclides in sixteen clay and four cement brick samples collected from kilns in different areas in Sri Lanka were analyzed by gamma ray spectrometry. The gamma radiation hazard associated with these bricks was assessed according to the values of two different indices, Radium equivalent activity Ra_{eq} and Representative level index I_{yr}. In terms of the Ra_{eq} a criterion has been used to limit the annual radiation dose from building materials to 1.5 mGY. Ra_{eq} is convenient for comparing the specific activities of materials containing different concentrations of the radionuclides measured and the values ranged from 50 – 365 Bq kg^{-1} in the samples measured in this study.

Based on these values an annual external radiation dose ranging from 0.21 – 1.48 mGy y^{-1} is calculated inside buildings constructed using bricks. Values of the sum of the three quotients for all studied brick samples ranged between 0.133 – 0.987 and 9is under the criterion limit of <1. The I_{yr} index can be used to estimate the level of gamma radiation hazard associated with the natural radionuclides in specific building materials. Thirteen of the clay bricks and one cement brick sample exceeded the upper limit of the representative level of the index, unity.

Absorbed dose rates in air was calculated using coefficient values 0.0414, 0.632 and 0.461 nGy h^{-1} per Bq kg^{-1} for ^{40} K, ^{232} Th and ^{226}Ra respectively. The values obtained are in reasonable agreement with the dose rate calculated using $Ra_{eq.}$ If the entire day is spent

inside a typical masonry building the activity utilization index is unity by definition and is deemed to imply a dose rate of 80 nGy h^{-1} (0.70 mGy h^{-1}).

In the present study dose rate from the cement bricks is less than this value ranging from 0.35 – 0.57 mGy h^{-1}. However, 10 of the clay bricks gave a dose rate greater than this value. The highest dose rate measured was 1.475 mGy y^{-1} from Mahiyangana which is double the typical value 0.70 mGy y^{-1}.