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Investigating a redistribution of naturally occurring radioactive material (NORM) in dwelling walls

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Depending on their concentration, naturally occurring radioactive materials (NORM) used for the construction of walls in living rooms may contribute elevated levels of radiation exposure for inhabitants. The main path of exposure by building materials is thought to be due to gamma radiation of ^{40}K and the progenies of the ^{238}U and ^{232}Th decay chains. Many efforts have been focused on developing computational methodologies to evaluate and predict the indoor gamma dose rate. Those studies investigated factors such as concrete density or wall thickness of the material as well as factors relating to the dimensions of the room with respect to gamma ray exposure.

Here, we re-implemented a well-established room model (Mustonen, 1984). This model approximates the gamma ray exposure at any point in a model room by accounting for the source strength, radiation absorption by concrete including build-up factors and the $1/r^2$ decrease due to the distance to the source. The results of our re-implemented model compare well with other models, which focus on the radiation exposure in the midpoint of the room. In addition to concrete density and wall thickness, we focus our investigation on a non-homogenous distribution of NORM in walls, ceiling and floors. We compare different configurations of NORM distributions with respect to the radiation exposure in the room centre and with the average received within the room at a height of 1.25m.

References:

Mustonen, R. (1984). Methods for evaluation of radiation from building materials. Radiation Protection Dosimetry 7, 235-238.