Comparison of Different Build-Up Factor Calculations with Monte Carlo Simulations

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Abstract. Deterministic codes are widely used in the decommissioning process for dose rate calculations, waste management, shielding designs, and other purposes. These calculation codes count scattered photons by attenuation of incident photon beam and application of Build-up factor (BUF). When two or more significant shielding layers are present in geometry arrangement there are two options what to do: use BUF for one material in the geometry or use a formula for effective BUF calculation. Different formulas for effective BUF calculation are now available (e.g.: Broder, Lin & Jiang formula, Harima − Nishiwaki, Kitazume, Kalos and others). In this paper, BUF calculations for different geometry arrangements obtained with different interpolation forms and different formulas for BUF calculation of stratified slabs are presented. Obtained results are compared with Monte Carlo calculations. The main aim of the paper is the comparison of different presented approaches for BUF calculation. The decisive factors for comparison are accuracy, user difficulty and applicability for different multilayer shields. The results obtained show that if the user does not know for which single material to choose the BUF, there is a risk of creating a huge calculation error. On the other hand, a ± 20% error may be acceptable, and it is necessary to use one of the presented formulas for effective BUF calculation to achieve it.