Calculation of dose rates due to 4.44 MeV gamma emitted by Am-Be source.

Original research

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Abstract: Monte Carlo simulations (MCS) are carried out to estimate dose rates at several locations due to cylindrical Am-Be source, which emits 4.4 MeV gamma ray with sufficient intensity. Since, the source is contained in a doubly encapsulated thick stainless steel which prevents the escape of 59.5 keV X-ray emitted by it and hence does not contribute for the dose rate outside the source. It is found in the literature the measurement of count spectrum for this gamma ray obtained with 2"×2" NaI (Tl) crystal at a particular distance. The dose rate from the count spectrum is deduced by estimating the photon flux and then convoluting with the ANSI-FLUX-TO-DOSE conversion factor. It is to be noted here to get the photon flux, the counts under the photo-peak and single and double escape-peaks are considered. The agreement between the simulated result and the deduced rate is very good.

Besides, Monte Carlo simulations have been carried out to estimate the dose rates due to both neutrons and gamma rays. The gamma rays comprises of those produced in the source as a result of alpha interaction as well as those secondary gamma rays produced in the structural materials. Significant amount of gamma rays are due to 4.4 MeV gamma ray from the source and 2.2 MeV gamma ray produced by the hydrogen present in the concrete structure due to absorption of a neutron. The gamma dose rates for 4.44 MeV and 2.2 MeV are deduced from the count spectrum (as mentioned above). MCS results are compared with dose rates deduced with count spectrum and are in good agreement. The neutron and total gamma dose rates measured with neutron survey meter and GM survey meter are compared with the MCS result. Agreement is excellent in the case of neutron whereas a large discrepancy observed in the case of total gamma dose rate.