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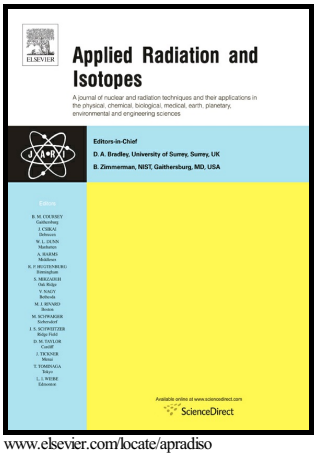
Sunil C



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Analysis of the radiation shielding of the bunker of a 230 MeV proton cyclotron therapy facility; Comparison of Analytical and Monte Carlo techniques

Sunil C[1]

Accelerator Radiation Safety Section, Health Physics Division, BARC
*Email: csunil11@gmail.com

Abstract

The neutron ambient dose equivalent outside the radiation shield of a proton therapy cyclotron vault is estimated using the unshielded dose equivalent rates and the attenuation lengths obtained from the literature and by simulations carried out with the FLUKA Monte Carlo radiation transport code. The source terms derived from the literature and that obtained from the FLUKA calculations differ by a factor of 2 to 3, while the attenuation lengths obtained from the literature differ by 20-40%. The instantaneous dose equivalent rates outside the shield differ by a few orders of magnitude, not only in comparison with the Monte Carlo simulation results, but also with the results obtained by line of sight attenuation calculations with the different parameters obtained from the literature. The attenuation of neutrons caused by the presence of bulk iron, such as magnet yokes is expected to reduce the dose equivalent by as much as a couple of orders of magnitude outside the shield walls.

Keywords, proton therapy, radiation shielding, Monte Carlo, FLUKA, analytical technique, attenuation length.

[1] Present address: EP/CMX, CERN, Geneva 1211, Switzerland