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Consideration on Reflected Dose Component (Medical Perspective)

Photon dosimetry is indispensable in designing an irradiation medical facility shielding. The purposes of radiation shielding are to protect the patients, the department staff, visitors and the public. As an example, for controlled and public areas, the radiation dose level should be in a reference value range of 0.75 μSv/h and 0.5 μSv/h [1]. While doing the calculations for the required wall thicknesses to protect people outside of the treatment area, it might be necessary to evaluate for the contribution of reflected photons energy fluence and its contribution to the dose. It is important to evaluate the particles that might be reflected by a certain region in designing an irradiation facility shielding, particularly in the medical application where the patient or personnel are within the room during the procedure.

From a dose standpoint, there is a need to optimize radiation protection of patients (clinical dosimetry) and medical personnel (occupational dosimetry). Clinical dosimetry is the cornerstone of any dose optimization attempt. Radiation delivery to cancer patients for radiotherapy could be including leakage and scatter radiation which provides unnecessary additional radiations or dose to other parts of the patient's body [2]. However, it is generally difficult to predict accurately. The difficulty of implementing to take measures to reduce reflection could be reduced with the aid of the Monte Carlo method. It is known that the calculation of incident radiation toward a surface and reemitted toward a certain point of interest is commonly encountered a problem in radiation shielding. Tajudin et al. [3] had calculated backscattered photon spectra from different radioactive sources with concrete material as a scatterer to have reflected photon energy up to ˜200 keV photons.

As in the figure, the photons that enter the shielding material and go out from the region, either backscattered (denoted as reflected) or passed through the concrete region (denoted as transmitted), had been followed in the code. The backscattered photons information such as its photon spectrum and dose that contributed to the tally in the receptor volume or area were scored. As an example, a simple approach is to add some lead to the inner walls to reduce the reflection dose component.

In another example, Tajudin et al. had demonstrated how to reduce reflected photon spectra from the clay material for Am-241 gamma source by using an iron (Fe-26) element.

Whenever necessary, if the added reflected dose is high enough to justify trying to reduce it, then it becomes a matter of cost and convenience in deciding what approach might be best to reduce reflection.

Speakers email

gannyor@yahoo.com

Speakers affiliation

Universiti Sultan Zainal Abidin

Name of Member State/Organization

Malaysia

Primary author: Dr MOHAMAD TAJUDIN, Suffian (Universiti Sultan Zainal Abidin)

Presenter: Dr MOHAMAD TAJUDIN, Suffian (Universiti Sultan Zainal Abidin)

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