AbstractID: 8303 Title: Maximum dose angle for oblique incidence on primary beam protective barriers in the design of medical radiation therapy facilities

Purpose:
Shielding design for medical radiation therapy facilities is based on simple empirical equations and the use of conservatively safe assumptions. From a strictly geometric point of view, for primary barrier determination, this condition generally translates into determining the required barrier thickness with normal beam incidence whenever the calculation point is allowed to run along the barrier.

However, when the occupation line (for example, the wall of an adjacent building) runs perpendicular to the barrier (for example roof barrier), then two opposing factors come in to play: increasing obliquity angle with respect to the barrier increases the attenuation, while the distance to the calculation point decreases hence increasing the dose. As a result, there exists an angle (α_{max}) for which the equivalent dose results in a maximum, constituting the most unfavourable geometric condition for that shielding barrier.

Method and Materials:
The usual NCRP Report 151 model has been used to derive a simple formula for obtaining α_{max}, which is a function of the barrier thickness (t_E) and the equilibrium tenth-value layer (TVLe) of the shielding material.

Results:
It can be seen that α_{max} increases for increasing TVLe (hence beam energy) and decreases for increasing t_E, with a range of variation that goes from 13 to 40 degrees for concrete barriers thicknesses in the range of 50 cm to 300 cm and most commercially available teletherapy machines.

Conclusion:
An important shielding design parameter (α_{max}) has been identified and calculated, which gives the most unfavourable condition for a particular barrier. True assessment of shielding adequacy must consider this condition in order to maintain the conservatively safe nature of the design methodologies.

Conflict of Interest (only if applicable):

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