Dear All:

A couple of questions have been asked about the skyshine problem. Specifically, people are finding the units of EQ17 and EQ 18 confusing. This is a tougher problem (hence, the 20 marks).

The units can be confusing. That is because the value used in the calculation for source neutron strength is an "indexed" value. This point is not all that clearly made in the NCRP Report (unless you read the treatment for X-rays...) and I blame myself for not making this clearer. There - that feels better.

To get the actual fluence rate at a point that is d_s from the target you have to divide the fluence rate from EQ17 or EQ18 by $(d_i)^2$. This is similar to the scatter treatment for irradiator shielding - you are taking the reference(or "index") fluence rate at 1m from the source (ϕ_0) and making a virtual point source at the scattering distance - in the case of skyshine the scattering distance is d_i - the distance to a point 2m over the roof line.

If you find it more satisfactory, you can also modify EQ19 or EQ20 for your needs. It tells you the dose equivalent index transmission required for a given situation to achieve a given dose rate limit. However, you can just as easily use it to calculate the dose rate that will be encountered with the shielding situation circumstances have given you. In this case - nothing. Note that the no-shielding situation does appear on the shielding curve - it is equivalent to a fluence to dose rate conversion (you need this brilliant insight to convert the fluence rate to dose rate even if you use EQ17). I didn't suggest that you use EQ19 and EQ20 because they contain conversion constants that are introduced elsewhere in the publication. If you use them, the dose rate H_m is in mrem/h and the fluence rate is in neutrons/cm2 per s and B_n is in the units given in the graph (rem cm2).

Be careful in identifying your solid angle. Mostly, be careful not to work too hard. If you have an integration sign in your solution for that, you are working too hard. Look at the situation in 3D - if it helps, find a cube to help you visualize things. Now think symmetry.

Hopefully this will help. I've attached a graph of the dose rate vs. distance for UNIT indexed neutron fluence rate to help you check your progress. Don't use it as the basis of your solution, however. I reserve the right to be wrong - if you are getting something different and don't understand why, ask. I have had only a few minutes to get this together.

Dave

P.S. - I am aware that there are treatments published on the good old world-wide-web where they have not understood this indexing approach and so, they are wrong. Imagine that - incorrect information on the internet. Anyway - be careful if you strike out on your own on this.

Neutron Dose Equivalent Rate due to Skyshine

Following NCRP 51 For a 4mx4mx4m Room with Target in Centre