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# Characterization of the phantom material virtual water in high-energy photon and electron beams.

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## Abstract

The material Virtual Water has been characterized in photon and electron beams. Range-scaling factors and fluence correction factors were obtained, the latter with an uncertainty of around 0.2%. This level of uncertainty means that it may be possible to perform dosimetry in a solid phantom with an accuracy approaching that of measurements in water. Two formulations of Virtual Water were investigated with nominally the same elemental composition but differing densities. For photon beams neither formulation showed exact water equivalence-the water/Virtual Water dose ratio varied with the depth of measurement with a difference of over 1% at 10 cm depth. However, by using a density (range) scaling factor very good agreement (<0.2%) between water and Virtual Water at all depths was obtained. In the case of electron beams a range-scaling factor was also required to match the shapes of the depth dose curves in water and Virtual Water. However, there remained a difference in the measured fluence in the two phantoms after this scaling factor had been applied. For measurements around the peak of the depth-dose curve and the reference depth this difference showed some small energy dependence but was in the range 0.1%-0.4%. Perturbation measurements have indicated that small slabs of material upstream of a detector have a small (<0.1% effect) on the chamber reading but material behind the detector can have a larger effect. This has consequences for the design of experiments and in the comparison of measurements and Monte Carlo-derived values.

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