

## Converting absorbed dose to medium to absorbed dose to water for Monte Carlo based dose calculations

Current clinical experience in radiation therapy is based upon dose computations that report the absorbed dose to water. While Monte Carlo dose calculation algorithms have the potential for higher dose accuracy, by default they compute the absorbed dose to the patient medium such as tissue, lung, or bone. Therefore, for dose calculation algorithm comparisons, or to report dose to water or tissue contained within a bone matrix, a method to convert dose to the medium to dose to water is required. This conversion was developed by applying Bragg-Gray cavity theory. The dose ratio was determined by two methods: (a) computing the stopping power ratio averaged over the secondary electron spectrum in the voxel and (b) by scoring the dose to water in addition to the dose to material on an energy-deposition event by energy-deposition event basis. For soft tissue, the difference between dose to material and dose to water is less than 0.5%, for lung, about 1%, while for cortical bone the dose difference exceeds 10%. The variation in the dose ratio as a function of depth and position in the field indicates that a single correction factor can be used for each material throughout the field for a given photon beam energy.