# NEW GAMMA-RAY BUILDUP FACTORS INCLUDING THE EFFECT OF BREMSSTRAHLUNG

M. Abou Mandour and E.Ghanem
Dept. of Nuclear Engineering, Faculty of Engineering,
Alexandria University, Alexandria, Egypt

## ABSTRACT

Despite the simple manner by which the transport equation can be derived, the solution of this equation is, however, difficult to obtain on an exact form unless certain restrictions are to be applied, which may consequently lead to unefficient solutions. This reason, together with the complicated calculations to be done every time the transport equation is to be solved, led to the development of the concept of the buildup factors. Applying the concept of the buildup factors, the radiation transport calculations can be easily reduced to the use of the buildup factors for the nuclear responses being calculated.

The concept of the buildup factors has been considered since 1951 and a large set of buildup factors was obtained. In most of those calculations, an important process in the Gamma-ray transport through media, which is the bremsstrahlung process through which secondary photons are emitted by energetic electrons, was neglected.

The effect of the bremsstrahlung on the buildup factors was investigated in a somewhat approximated manner through a few papers. Nearly, in all of them, the process was considered as the average of multi-collision processes between the electron and the medium atoms. However, because of the importance of this effect, especially at high photon energies and for heavy materials, a more exact treatment is developed in this paper.

In this treatment, the bremsstrahlung is treated as a single-collision process. The calculations are carried out using the Monte Carlo method, in which the complete photon-electron-photon cascade is considered. The dose-buildup factors are calculated for different source geometeries: Point isotropic, plane normal and plane inclined sources and with photon energies of 6.0, 8.0 and 10.0-Mev. Two media are selected, lead and tungesten, as irradiation media.

The results show that the values of the buildup factors are increased by a factor ranging from 120% to more than 200% depending on the initial photon energy, the medium material, and the depth inside the medium. Good agreement is achieved in comparing the results with the experiments.