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Some inconsistencies in the present system of radiation protection quantities

The system of radiation protection quantities has been developing for years, beginning with the introduction of the roentgen to assess the exposure to X-rays and gamma rays at the end of the 1920s. In the beginning, there was no clear distinction between the unit and the quantity and between what we now refer to as stochastic and deterministic effects. The unit roentgen was redefined several times and later attributed to the quantity of exposure. Since this quantity was limited to the quantification of only photons, later on, a universal quantity - absorbed dose - was introduced as a fundamental physical radiation quantity. Based on the dose, such radiation protection quantities as dose equivalent, equivalent dose, effective dose, and relevant operational quantities have been defined. During the years, the system of radiation protection quantities has been modified many times to reflect stochastic effects better, while not so much attention was paid to the quantification of deterministic effects. Problems appeared with multiple quantities used simultaneously and the continuous attempt to improve the relationship between physical quantities and biological effects. This situation resulted in too many quantities used today, many of which cannot be measured or monitored directly.
The paper discusses inconsistencies arising from too many different quantities currently used in radiation protection. Some problems related to the concept of the effective dose and equivalent dose on the one side, and the RBE-weighted dose on the other side, are outlined. Special attention is paid to the use of these quantities to assess the risk caused by the stochastic and deterministic effects taking into account specific conditions in the case of internal exposure and exposure due to high energy radiation. Some suggestions aimed at reducing the number of the present radiation protection quantities are presented.

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