Preface

This book aims to summarize many years of experience in the field of external dosimetry and protection against ionizing radiation, in the industrial, research, and medical field. It recalls physical concepts and treats a large part of the dosimetry concepts to finally offer a number of tools, for professionals and students, engineers, and technicians to assess radiological risks and to protect themselves in particular by calculating appropriate shielding. It is based on the theory related to the interaction of radiation with matter, empirical formulas, and tables and illustrated by various numerical applications. In addition, it refers continually to the state of the art and particularly in the field of computer codes for external exposure as for a number of medical projects and recent research. Furthermore, it compiles data scattered in many reference works, some of which are hardly available.

The idea came from the authors, involved in the field of radiation protection, which found a lack in terms of practical books and full enough to treat the whole issue of external exposure to ionizing radiation (photons, neutrons, charged particles—electrons, ions etc.).

This book is largely based on a French book by Antoni and Bourgois [1] in which some parts have been added.

This book is dedicated to professionals of radiation protection, dosimetry, and nuclear measurement but also allows to complete the curriculum for students (technician and engineer).

The authors are professionals who have acquired 10 and 20 years of experience in CEA (French Atomic Energy Commission) in different fields of radiation protection: accelerators, X-ray generators, sealed sources, dosimetry, Monte Carlo calculation, etc. They also teach dosimetry and protection against the external radiation exposure in bachelor of science at Cadarache and European Master in radiation protection at Grenoble.

This book is based on two levels of reading: the first affordable by the whole of readers for which elementary physical concepts leading to the understanding of phenomena related to external exposure are supported by simple numerical applications and the second through additional information, available at the end of each chapter, detailing the more complex problems requiring appropriate mathematical

developments. This second level of reading, subsidiary, however, is optional and is for readers eager to deepen aspects of the field.

Regarding the arrangement of the contents, Chap. 1 deals with the definition of fundamental radiometric and dosimetric quantities, for addressing the radiation–matter interaction following an approach dedicated at the dose deposited in biological tissue through Chap. 2 to finally define and apply "protection and operational quantities" related to radiation protection in Chap. 3.

A particular emphasis was placed, in the following Chaps. 4 and 5, on the definition of risk and countermeasures (i.e., biological protection) for sources of conventional radiation: radionuclides, X-ray generators, accelerators (electrons, ions) … but also for "exotic" facility like power laser accelerators … for an energy range that can be classed as medium (0–200 MeV).

The final chapter of the book is entirely devoted to particle transport calculation codes with the Monte Carlo method. The general principles are explained with a specific orientation towards the estimated radiometric and dosimetric quantities described in previous chapters. This part is still littered with numerical applications to enhance understanding. Most of calculation codes used in the radiation protection field are nowadays implemented with algorithms based on this method.

We thank for their various contributions: Nicolas Comte, Laurent Ferreux, Christian Passard, and Murielle Nerbusson.

Arpajon, France

Rodolphe Antoni
Laurent Bourgois

Reference

[1] Antoni, R. & Bourgois, L. (2013). Physique Appliquée à l'exposition externe: Dosimetrie et radioprotection. Springer. ISBN:978-2-8178-0310-4.

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