

Preface

The discovery of X-radiation (W. C. Röntgen) and the subsequent discovery of natural radioactivity (A.H. Becquerel) and isolation of individual radioactive elements, particularly radium (M. S. Curie), were followed immediately by the employment of ionizing radiation in medical practice for both diagnostic and therapeutic purposes. At first the risks associated with the use of ionizing radiation were not fully appreciated. As ionizing radiation was more frequently and widely employed, these risks were uncovered and evaluated.

Since the first quarter of the previous century protection from ionizing radiation has been an important concern. As the medical uses of ionizing radiation have increased, the importance of understanding risk versus benefit has also increased. As the twentieth century progressed, advances in nuclear physics led to new applications which could expose the human population to ionizing radiation, e.g., nuclear power plants coupled with spent fuel rod disposal and plant decommissioning; and the manufacture, deployment, use, and disposal of nuclear weapons. Additionally, public consciousness concerning the potential effects of ionizing radiation on the human population increased due to such events as the accident at the Three Mile Island and Chernobyl nuclear power plants, by the dismantling of nuclear weapons, and by the development of medical diagnostic techniques such as ultrasound and nuclear magnetic resonance imaging which are alternatives to procedures involving radiation. This has resulted in the radiologist, health or nuclear physicist, and radiologic technologist frequently being called upon as experts in evaluating risk and protection measures, as well as having to answer questions concerning absorbed dose and its effect on the human body. In addition, as individuals these professionals have a personal interest, as well as professional requirement, to consider radiation safety in their work.

The purpose of this book is to help the reader understand and respect the recommendations relating to the safe use of ionizing radiation. It is intended for courses in an academic or training program for all those who may encounter ionizing radiation. It is directed primarily toward students preparing for a career as a radiologic technologist, medical physicist, health physicist, or radiologist. The practicing physicist, physician, technologist, or nurse will find it a source of material regarding radiation protection standards and techniques. The tables and graphs shown throughout the book are only illustrative and are only to be used for study. For professional practice, the latest primary sources for data should be utilized.

This book begins with a description of the fundamental processes by which ionizing radiation is produced and interacts with matter. It details the operation of radiation detection instruments and their use as survey and personnel monitors; includes the basic biologic effects of ionizing radiation along with the current units, regulations, and recommendations which govern exposure of radiation workers and the general public to ionization radiation; reviews the recommendations regarding the use of medical X-ray generators and radionuclides, and discusses good working habits associated with the use of such sources. This book also delineates the general and specific means used for protection against external ionizing radiation and explicates how to calculate absorbed dose from both internally deposited radionuclides and external sources of radiation. Each chapter contains review questions as well as problems. SI units are used extensively throughout the text as it is necessary to know and understand them. The appendices contain a discussion of units and logarithms. An extensive glossary is provided as well as and a bibliography which includes the relevant publications of national and international organizations. Answers to the problems are provided at the end of the book.

As with any book, the contents reflect criticisms and suggestions from numerous people. We would like to thank in particular the following: the many instructors and students who have used the two editions of the former book entitled *Radiation Protection in the Radiologic and Health Sciences* and the first edition of this book, our colleagues in the Department of Radiology at New York University, the Institute of Medical Radiation Physics at the Karolinska Institute and Stockholm University, and the Department of Communication Systems at the Royal Institute of Technology (KTH) in Stockholm, Sweden.

Marilyn E. Noz
Gerald Q. Maguire, Jr.

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