Book Review

Radiation Shielding and Dosimetry. By A. Edward Profio. John Wiley & Sons, Inc., New York (1979). 547 pp. $29.95.

This book can be used as a textbook, a reference text, or as an interesting and informative text to be read carefully by graduate students preparing to take their preliminary examinations in health physics or nuclear engineering. As a textbook, it covers the broad fields of radiation sources, interaction of radiation with matter, transport and shielding of radiation, dosimetry of neutron and gamma radiation, practical problems of nuclear engineering, somatic and genetic effects of ionizing radiation, as well as damage to materials; the closing chapter is on radiology. Each chapter is carefully referenced (total of 249 references) and is followed by a list of carefully selected problems (total of 55) for students to determine how well they grasped the important concepts and can put them to practical use in solving problems. The text can probably be used best as a graduate course for nuclear engineers who do not intend to specialize in health physics or radiology but who require a course offering a broad coverage of these fields and a good summary of engineering concepts covered in more detail in other courses, or it could be used as a course for college seniors to provide knowledge and interest in subjects that might tempt them to choose nuclear engineering, health physics, or medical physics as a profession. The reader is not distracted by tedious derivations, and he need not have a knowledge of mathematics and physics beyond the sophomore level. The book contains numerous tables (total of 84) and figures (total of 228), which makes it a valuable reference. The text does not go into sufficient depth in subjects of shielding, dosimetry, effects of radiation on humans, etc., to provide specialized training in these areas for the graduate student, but even the specialist or the student majoring in one of the branches of nuclear engineering or health physics would be well advised to read through this text carefully because each of the eight chapters provides a wealth of interesting information that a well-trained scientist and engineer should have well organized in his memory bank and that he might wish to have at his fingertips when taking examinations for an advanced degree.

The style of writing is very clear and is that of a good professor talking to his students. There are very few errors (of fact or typing), and the few errors are those of omission of fact, lack of clarity, or incomplete explanation. For example, it is stated that x rays are generated by bremsstrahlung on "deceleration of electrons," when it would have been more factual if the wording had been "acceleration (+ and −) of the electrons." In another example, it is stated that "for radiation protection $N = 1$." Perhaps it would have been better to have added that this is true in all cases except for bone-seeking alpha or beta emitting radionuclides when radium is not the parent element. The authoritative body that defines radiation units, the International Commission on Radiological Units, seems confused in some of its publications when it discusses relative biological effectiveness and quality factor (Q), so it is not surprising that this text confuses these two quantities.

From the standpoint of the health physicist and the medical physicist, the weakest chapters probably are those dealing with effects of radiation on humans and radiology, and in this case the principal shortcoming is its overlooking of some of the data from recent publications. For example, it is correctly stated that "no increase in leukemia incidence can be definitely established for absorbed doses under 50 rad." It would have been much more informative if studies of Alice Stewart, T. Najarion and T. Colton, J. L. Lyon, T. Mancuso, E. D. J. Bross, etc., had been mentioned, as these show an increase of statistical significance in leukemia incidence in populations exposed to doses much less than 50 rad. In some cases, it would be preferable if the subjunctive mood had been used rather than stating that the doubling dose for leukemia deaths in adults "is" 50 rem or the risk of lung cancer "is" 1.2 case/yr·10^6 rem. Another example is the statement "The most serious risk to society 'is' the genetic effect. . . ." No mention is made of overkill, although, for example, in the case of thyroid carcinoma, linear plots are made by the International Commission on Radiological Protection and the National Council on Radiation Protection and Mesurements from the high-dose overkill region down to zero dose in estimating the risk of low doses to the thyroid. The discussion on radiation standards is rather incomplete and in some cases out-of-date, e.g., use of the old limit of $5(N\text{-}18)$ rem to a radiation worker. In the discussion of internal dose, it is stated that the "occupational MPC is the concentration that would give a maximum permissible occupational *dose* to the critical organ"; it should have been *dose rate* instead of *dose*. In another example, reasons are given for the variability of f_a in inhalation, yet no mention is made of the principal reason for this variability, namely, the mean particle size distribution. The statement is made that "the physician is free to decide whether an x-ray picture is needed and this is good." This sounds a bit naive when one realizes the average physician knows almost nothing about the effects of ionizing radiation on humans.

In spite of the faults in this text, as listed above, it should be emphasized that they are few and far between. One has to be a very critical and careful reader to find these errors, and none is serious. This reviewer found this to be one of the best recent texts in this subject area and one that he recommends for all serious students in nuclear engineering, health physics, and medical physics. It is an excellent companion to a previous well-received text by this author, *Experimental Reactor Physics*.

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About the reviewer: We again welcome to these columns Karl Morgan, widely known for devotion and contribution to health physics since its conception. He is currently the Neely Professor in the School of Nuclear Engineering at Georgia Institute of Technology, an appointment he has held since his retirement from the Oak Ridge National Laboratory. Dr. Morgan's graduate studies were at Duke and North Carolina.