

Book review

Concrete radiation shielding

M. F. Kaplan

Longman, Harlow, 1989. 234 mm × 156 mm. 448 pp. Illustrated. Hardback. ISBN 0 582 03773 5.

Although concrete is ubiquitous and versatile, specialized applications arise that highlight its uniqueness. In this book, Kaplan presents just such a field of use, in a readable but quantitative and well-structured way that should appeal to the radiation specialist/designer and concrete generalist alike.

Fifteen well-referenced chapters and a good index comprise the volume, which begins with an introduction to atomic and nuclear structure, in particular the origination of radioactivity and its interaction with matter. The first paragraph of the first chapter leaves the reader in no doubt as to the importance of being respectful of ionizing radiation.

However, chapters 9 and 10, comprising about 40% of the book's contents, form its kernel. These chapters are concerned with the bulk and nuclear properties of concrete. Much tabulated information is given on concrete in both specific and general terms—a most useful source of reference. For example, thermal conductivity and expansion are dealt with together with shrinkage properties of a wide range of concrete types with aggregates such as serpentine, limonite, magnetite and barytes, as well as various mixtures.

Concrete has to respond to both obvious and subtle effects. There is an interplay between composition and the ability to shield against radiation. Gamma and X-rays are contained by means of concrete density, but neutron radiation requires low molecular materials such as retained water in order to become attenuated.

Some primary radiations, as a result of being absorbed, can themselves cause secondary high energy radiation. Interesting comments are offered about minimum water contents in relation to neutron shielding. The resulting high temperature causes water loss, therefore a reduction in shielding capacity must be considered when designing real and permanent installations. As well as thermal damage there can be invidious structural/compositional change, i.e. radiation damage. The author admits there is little information on this topic.

I suspect that the materials and concrete technologist will linger on these points, while the engineer will perhaps be more concerned with basic design requirements, costs, and seeking the practical compromise. Such items are dealt with in the two final chapters. Excellent well-worked examples are given.

The book retains its high technical level and consistency throughout, and is difficult to fault. Perhaps the references in chapter 8 are a little dated, and the use of angstrom units somewhat quaint, but these are minor niggles in what will be a standard reference text on this specialized topic. Although written with engineers in mind, this volume has a wider appeal, to scientists and students of concrete. It combines pragmatism with a clearly-presented scientific base. A very good work indeed.

PROFESSOR P. C. HEWLETT
British Board of Agrément