BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Nuclear Reactor Shielding

Editors	Robert W. Roussin, Lorraine S. Abbott, and David E. Bartine
Publisher	Science Press, Inc. (1977)
Pages	930
Price	Around $60.00
Reviewer	Clarence E. Lee

The *Proceedings of the Fifth International Conference on Reactor Shielding*, held in April 1977 in Knoxville, Tennessee, contains about 105 papers presented in nine areas: Overview: Methods and Design, Sensitivity Analysis, Design Experience, Radiation Damage and Sensitivity, Occupation Exposure, Corrosion and Fission Products, Information Resources and Standards, Fusion and Advanced Reactors, Methods, and Integral Experiments. There were ten invited papers, which are summarized here.

F. C. Maeinschein, Oak Ridge National Laboratory (ORNL), in "Where Are We and Where Are We Going in Reactor Shielding," the keynote of the opening session, reviews the status of nuclear data for shielding calculations, analysis methods, streaming in water-cooled reactors, liquid-metal fast breeder reactors (LMFBRs), and gas-cooled reactors. Key problems for tokamaks are discussed and a set of possible challenges in reactor shielding is given.

J. Butler, U.K. Atomic Energy Authority (UKAEA), in "The Evolution of Shielding Methods and Data–A Continuing Process of Adjustment to Changing Project Needs," discusses the role of the Radiation Shielding Information Center codes and developments outside the U.S., design methods for cavity streaming, and future developments possible in transport codes, shield optimization, and experimental validation.

F. R. Mynatt, ORNL, in "Shielding Methods Developments in the United States," presents a systems view of shielding methods and discusses LMFBR shielding capabilities and problem areas, radiation streaming methods, typical configurations, inadequacies, and needs. Recent progress in cross-section processing, sensitivity analysis, and radiation transport methods is reviewed.

H. Goldstein, Columbia University, in "A Survey of Cross Section Sensitivity Analysis as Applied to Radiation Shielding," reviews the principal methodologies for obtaining sensitivity profiles including formulation of the methodology, applications of cross-section sensitivity analysis, and model building. The problem dependency of sensitivity analysis and potential pitfalls is discussed.

R. K. Disney, Westinghouse Advanced Reactor Division, in "Radiation Protection/Shield Design–A Need for a Systems Approach," discusses the interdisciplinary systems approach necessary in design to satisfy regulation requirements for licensing and to limit exposure to on-site personnel. The Clinch River Breeder Reactor Plant radiation protection program implementation is described. The principal shielding design problems and solutions of the LMFBR are compared to the light water reactor (LWR) shielding designs, and experimental verifications of designs and methods are reviewed.

A. F. Avery, UKAEA Atomic Energy Establishment, in "Radiation Streaming–The Continuing Problem in Shield Design," reviews the practicalities of shield design wherein the dominant difficulties are streaming problems. Problems in gas-cooled, light water, pressure tube, fast, and fusion reactors are reviewed, illustrating the importance of the interaction of shielding and reactor engineering, and, as well, the potential and penalties of an incomplete solution.

L. D. Blackburn and R. L. Knecht, Westinghouse Hanford Company, in "Irradiation Effects and Design of LMFBR Permanent Reactor Structures," review the design approach for permanent structures relative to restrictions on radiation damage effects exhibited by mechanical material behavior. Designing for radiation damage, when neutron exposures exceed fluence limits, is discussed for Type 304 stainless steel in the LMFBR in terms of plastic flow, fatigue life, rupture life, fatigue crack propagation, and swelling.

B. J. Verna, Nuclear Power Experience, Inc., in "Radiation Exposure and Protection Problems in Nuclear Power Plants," reviews exposure limits and experience with respect to the as low as reasonably achievable (ALARA) criteria on individual and collective group doses for LWR, boiling water reactor, and pressurized water reactor (PWR) maintenance personnel. Overexposures and steam generator testing and repair experience are discussed. Exposure reduction techniques are summarized.

T. D. Murphy, U.S. Nuclear Regulatory Commission (NRC), in "An Overview of the Activated Corrosion Product Reduction Program for U.S. Power Reactors," discusses radiation level and personnel exposures and then concentrates on reduction of corrosion product radioactivity in reactor coolant plant systems and minimization of the formation of activated corrosion products. The NRC guide on crud control is reviewed.

P. Beslu et al., Commissariat à l'Energie Atomique, France, in "Prediction of Primary Circuit Contamination in Power Reactors," review the mathematical models used and the experimental verification obtained in the prediction of power reactor coolant circuit contamination levels. For high temperature gas-cooled reactors (HTGRs), the SURVEY code (including CIGOGNE/A2, FIPER, TRAFIC, RAD, SOPHIE, PAD, IDYLLE, and CPL) is used. The

analysis and comparisons for LMFBRs are performed with the CORONA code, and for PWRs the PACTOLE code is used.

There is no space here to comment individually about all the papers, most of good to excellent quality. Extensive, complicated analyses and computation involving Monte Carlo, discrete ordinates S_n methods, and progeny were performed, reported, and discussed. The potential development of better competitive and implemented transport methods, vitally needed in shielding problems, should be encouraged.

There are a few misprints, mistakes, and omissions, but nothing terribly serious. The editors, all the teams and committees, and the authors are to be congratulated on a good job well done.

The proceedings of this conference should be of vital interest to the entire American Nuclear Society community, especially since it delineates where future efforts need be directed in solving streaming and damage problems.

Clarence E. Lee is a professor in the Department of Nuclear Engineering at Texas A&M University. He is currently doing research on analytical and numerical methods in diffusion and transport theory, charged particle transport, HTGRs (prismatic and pebble bed), fission product migration, and fast reactor accident analysis.

Nuclear Safeguards Analysis, Nondestructive and Analytical Chemical Techniques

Editor	E. Arnold Hakkila
Publisher	American Chemical Society, Washington, D.C. (1978)
Pages	213
Price	$22.00
Reviewer	L. B. Church

This book is the proceedings of an American Chemical Society (ACS) symposium held in March 1978. The 12 chapters commence with an overview as perceived by the U.S. Department of Energy (DOE) Office of Safeguards and Security. This excellent review chapter outlines the nature of the safeguards problem and reviews recent history in regard to the roles of the U.S. Atomic Energy Commission, U.S. Energy Research and Development Administration, U.S. Nuclear Regulatory Commission, DOE, and International Atomic Energy Agency (IAEA). Although the title of the book suggests that the book would be of interest to only analytical scientists working in the realms of reprocessing special nuclear materials (SNM) and safeguards, this clearly written first chapter is valuable reading for any scientist with a concern for the long-term role of nuclear power in our society.

The next six chapters show the need for two different types of analytical techniques: rapid or on-line analyses (often with relatively large uncertainties), to detect large and sudden diversions of SNM, and more refined, usually slower analyses (always with less uncertainty), to detect small diversions and/or losses. A key element in the safeguards problem (especially in dealing with the nonscientific public) is the role of uncertainties. To ensure accurate and reliable detection of diverted materials, the extent of the uncertainties of each measurement must be known.

There are four rather technical chapters each devoted to a separate analytical technique. Specifically, these techniques are x-ray absorption edge spectrometry, alpha-particle spectrometry, gamma-ray spectrometry, and calorimetry.

The book concludes with a chapter describing the accountability of a working on-line fuel reprocessing plant. Although this work was not given at the original ACS symposium, its inclusion provides the opportunity to see how safeguards analysis is accomplished at a working facility.

The major criticism of this reviewer has to do with the lack of international input to the book. Only one of the 12 chapters is by authors who do not work directly or indirectly (via a government funded lab) for the U.S. Government. Certainly safeguard experts are available in Canada, Great Britain, France, and through the IAEA. To read this book, one would get the impression (with the exception of the above-mentioned German authors) that the safeguards analysis problem is being researched only in the U.S.

Nevertheless, this volume has much to be said on its behalf. This reviewer found it to be well edited, clearly written, and a nice compromise between the technical and nontechnical aspects of the problem. Several chapters are valuable reading for scientists speaking before lay audiences, on behalf of or against nuclear power. The current state-of-the-art and science of analytical analysis as applied to safeguarding SNM is well presented.

L. B. Church received his PhD in nuclear chemistry at Carnegie Institute of Technology in 1966. Following 14 years of academic pursuits, he joined the Materials Analysis Laboratory of Tektronix, Inc. His current research interests involve the role of trace impurities in semiconductor materials.

Editor's Note: The following two reviews came to us by different routes, but since they have somewhat different perspectives, we decided to publish both together.

Nuclear Power: Technology on Trial

Author	James J. Duderstadt and Chihiro Kikuchi
Publisher	The University of Michigan Press, Ann Arbor, Michigan (1979)
Pages	228
Price	$16.00 hardcover; $8.50 in paperback
Reviewer	John M. Carpenter

These are days of crucial decision making with regard to U.S. national and worldwide energy policy. It is most