BOOK REVIEWS

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

The Technology of Nuclear Reactor Safety, Vol. 2: Reactor Materials and Engineering

Editors	T. J. Thompson and J. G. Beckerley
Publisher	The MIT Press, 1973
Pages	820
Price	$50.00
Reviewer	W. Reed Johnson

Reactor Materials and Engineering is the second volume of a two-volume series on nuclear reactor safety. This series was initiated in the early 1960's as a part of the Safety Information for the Technology of Reactors (SITFOR) Project, sponsored by the U.S. Atomic Energy Commission (USAEC). Volume 1, *Reactor Physics and Control*, was published in 1964. Because most of the material contained in Vol. 2 was prepared in the mid-1960's, with the exception of several chapters that were revised or amended as late as 1969 or 1970, the book relates the materials and engineering technology of reactor safety in existence almost a decade ago.

In the Preface the editors state the two-fold purpose of the series as the organized assembly of reactor safety information and a presentation of safety related problems which require further investigation. They also point out that a primary goal of the books is to provide a mechanism for "cross-fertilization" and understanding between the various technical disciplines whose combined efforts are required to achieve safety of nuclear reactors. The worthiness of the motivations which led to the publication of these books cannot be disputed. However, it is lamentable that financial support was apparently inadequate to ensure timely publication.

Volume 2 extensively reviews the analytical techniques and experimental information existing in the area of reactor materials and engineering technology and provides a complete listing of pertinent references. Each of its 10 chapters (numbered 12 through 21, continuing the scheme established in Vol. 1) is written by a person or group, who is expert and involved in the particular subject area covered. To a great extent the technical fundamentals have not changed since the book was prepared; only the analytical tools by which they are applied and, in some cases, the degree to which emphasis is placed on certain phenomena have changed. Volume 2, of course, does not include experimental results obtained in the last 6 to 8 years, and much space is devoted to techniques, data, and examples related to reactor designs which have now faded from contention. The importance of quality assurance, a subject of much current attention, is highly stressed in a chapter on mechanical design written prior to 1966. On the other hand, the technology of emergency core cooling systems receives only passing consideration.

Chapter 12, "Materials and Metallurgy" by T. O. Ziebold, F. G. Foote, and K. F. Smith, Chap. 15, "Fluid Flow" by S. Levy, and Chap. 16, "Heat Transfer" by H. Fenech and W. M. Rohsenow, briefly review these fundamental engineering science subjects in an analytical manner and present numerous examples taken from reactor designs and problems of the time. There is a detailed presentation of the calculation of hot spots and hot channel factors at the end of Chap. 16. In both Chaps. 15 and 16 much more emphasis is placed on the safe design of reactors for normal operation than is given to the analytical means by which the consequences of grossly abnormal situations (e.g., a major loss-of-coolant accident) are described.

Chapter 13, "Nuclear Fuels" by D. H. Gurinsky and S. Isserow, is a largely narrative description of fuel element types, including a discussion of the various fuel and cladding materials and fabrication techniques. Chapter 14, "Mechanical Design of Components for Reactor Systems" by N. J. Palladino, is perhaps an overly long presentation of both analytical and descriptive material related to each major component type in a power reactor system (reactor vessel, vessel closure, rod drive mechanism, etc.). The author has tried to include too much information and detail in a book of this nature, although readers having special mechanical interests will surely find them adequately covered. The final section of Chap. 14, on nondestructive tests and inspection techniques, provides the uninitiated reader with a good introduction to this important subject and a number of related references.

Chapter 17 "Chemical Reactions" by L. Baker, Jr. and R. C. Liimatainen, presents a nicely balanced, descriptive treatment of the broad range of chemical phenomena (cor-

rosion to detonation) which must be considered in reactor design and safety analysis. Although some new data have been generated, most of this material is as applicable today as when it was written.

Data on fission product generation and properties and a description of release mechanisms are presented in Chap. 18, "Fission Product Release" by G. W. Parker and C. J. Barton. There is much information on the release of fission products from molten fuels, which would receive less emphasis today in the era of "guaranteed" emergency core cooling systems. Chapter 19, "Fission-Product Behavior and Retention in Containment Systems" by L. Silverman, D. L. Morrison, R. L. Ritzman, and T. J. Thompson, discusses the sundry mechanisms, natural and engineered, by which various types of airborne fission products can be removed from the containment atmosphere. Technology and understanding in this area do not seem to have progressed far beyond the treatment in Chap. 19, although these phenomena are today more usually treated by regulatory edict than by fundamental analysis. The material in Chap. 20, "Radioactive Waste Management" by W. A. Roger and S. McLain seems somewhat inappropriate for a volume on reactor safety, but it does yield an informative discussion of waste management techniques and specific systems for various reactor plants. There is no discussion of the ultimate (long-term) disposition of radioactive materials.

The final chapter, "The Concepts of Reactor Containment" by T. J. Thompson and C. R. McCullough, is a somewhat broad and philosophical treatment of reactor containment and reactor safety by two men who made significant contributions to the prevailing commitment to reactor safety in this country. The chapter is relatively up-to-date (*circa* 1969) and provides the reader with an excellent review of the physical phenomena associated with reactor accidents and the design requirements for containment structures.

As already stated, the major problem of Vol. 2 of *The Technology of Nuclear Reactor Safety* is its delay in publication.

For the academician it is long on cost and short on the type of lucidly derived analytical model that can be used in class. However, for the student, or practitioner, of reactor safety, the book is an excellent source of practical information in the several related technical fields, and it does indeed meet the cross-fertilization intentions of the editors.

W. Reed Johnson, who received his DSc from the University of Virginia in 1962, has served on the nuclear engineering faculty there since 1964. In 1953 he took a BS in physics from VMI and was graduated from the Oak Ridge School of Reactor Technology in 1954. He has worked as a shielding engineer for the Electric Boat Division of General Dynamics, and for Alco Products Co. on the design and operations of the Army Package Power Reactor. In 1962 he headed a cooperative project between the University of Virginia and the Philippine Atomic Energy Commission, and in 1969 spent a sabbatical year with the USAEC Directorate of Licensing. He has served on nuclear safety review committees for Babcock & Wilcox and the Virginia Electric and Power Company and was recently nominated to the Atomic Safety and Licensing Appeal Panel.

STATEMENT REQUIRED BY THE ACT OF OCTOBER 23, 1962, SECTION 4369, TITLE 39, UNITED STATES CODE, SHOWING OWNERSHIP, MANAGEMENT AND CIRCULATION OF NUCLEAR TECHNOLOGY. Published monthly at 244 East Ogden Avenue, Hinsdale, Illinois 60521, for September 1974. The general business offices of the Publisher are located at the same address. Publisher: The American Nuclear Society, Incorporated. Publications Production Manager, Siegfried H. Krapp. Address either at 244 East Ogden Avenue, Hinsdale, Illinois 60521. Editor: Roy G. Post, University of Arizona, Tucson, Arizona 85721. Owner: The American Nuclear Society, Incorporated, 244 East Ogden Avenue, Hinsdale, Illinois 60521, a nonprofit membership corporation organized under the laws of the State of New York. It is exempted from federal taxation. Its officers are: PRESIDENT J. Ernest Wilkins, Jr., Howard University, Washington, D.C. 20001; VICE PRESIDENT Melvin J. Feldman, Argonne National Laboratory, Idaho Falls, Idaho 83401; TREASURER Harry Lawroski, Nuclear Services Corporation, Campbell, California 95008; EXECUTIVE DIRECTOR Octave J. Du Temple, American Nuclear Society, Hinsdale, Illinois 60521. Its known bondholders, mortgagees and other security holders owning or holding one percent or more of the total bonds, mortgages or other securities are: none. The average number of copies each issue during the preceding 12 months are: (A) Total number of copies printed (net press run): 3,235; (B) Paid circulation: (1) to term subscribers by mail, carrier delivery, or by other means: 1,894; (2) Sales through agents, news dealers or otherwise: none. (C) Free distribution (including samples) by mail carrier delivery, or by other means: 25. Total number of copies distributed: 1,919. The number of copies single issue nearest to filing date are: (A) Total number of copies printed (net press run): 3,089; (B) Paid circulation: (1) to term subscribers by mail, carrier delivery, or by other means: 2,014; (2) Sales through agents, news dealers, or otherwise: none. (C) Free distribution (including samples) by mail, carrier delivery, or by other means: 29. Total number of copies distributed: 2,043. I certify that the statements made by me above are correct and complete. (Signed) Rosemary Harvey, Circulation Manager.