chief value of the book as a point of reference.

A substantial portion of the book is concerned with the probable direction of future advances, both in nuclear and desalting technology. In the nuclear field, papers are included on the water-cooled, graphite-moderated reactor, the organic-cooled, heavy-water-moderated reactor, the fast breeder, and the helium-cooled, graphite-moderated reactors. With regard to the last three, which share a common characteristic in typically producing high temperature and high pressure steam, unfortunately no consideration is given to the higher power-to-water production ratio inherent in such systems when used in dual-purpose (water and power) plants. This fact could be crucial in the selection of heat sources in dual-purpose applications in many parts of the world.

In the desalting field, advanced concepts are outlined in the paper by Hammond. The principal thesis is that improvements may be coming in the performance of heat exchangers in distillation plants by improved methods of scale control. There is no question that present methods represent a substantial expense and should be capable of improvement. This is an active field of research, and many concepts are receiving attention.

The book contains its share of typographical errors. These are both obvious and relatively infrequent. More serious are some errors in concept or understanding. For example, on page 64 (fourth complete paragraph), in discussing the MWD project, the statement is made: "the 3.5 per cent interest rate was used in calculating the capital costs of the *entire* combination power and water plant–not just the water features." This is not true, and is refuted on page 381, numbered paragraph 2.

On page 108, fifth complete paragraph, the MWD project is stated to "provide just over 1.5 million acre feet of high quality water per year." The correct number is 150 000–not 1.5 million.

On page 128, the MSF design is criticized as having maximum efficiency at design thruput and a reduced efficiency at part load, in contrast to the LTV which has a high efficiency over a broad range of production rate. This is misleading. If we are talking about thermodynamic efficiency, this is solely a function of the temperatures at the hot and cold ends of the plant, and approach of the reject and product streams to the sink temperature, and this statement is equally true of both types. The MSF and LTV designs can both maintain the top and bottom temperatures over a wide range of production rate by manipulation of controls.

The description of the Buckeye, Arizona electrodialysis unit is excellent. An unfortunate omission is any reference to the actual capital cost of the facility or of the interest rate on borrowed capital.

The paper on "Problems and Potentials of Concentrated Brines" agrees in the main with most of the analyses of the value of brines as chemical sources, at least those that this reviewer has read. One facet that did not receive consideration is the fact that brines from distillation plants, and probably electrodialysis plants as well, where acid treatment of feed seawater is used, will have essentially zero residual alkalinity. This should be of direct benefit in the recovery of chemicals that require neutralization of alkalinity as a pretreatment. An example is bromine. Since the cost of acid is in the range of 10 to 15% of the cost of product water, the effect of sharing acid cost between a desalting plant and a bromine recovery facility would not be negligible.

One of the most interesting concepts presented at the symposium is contained in the final paper entitled "The Texcoco Project." This paper describes the serious problem facing Mexico City and the imaginative concept being pursued. If successfully concluded, this approach might not only provide Mexico City with needed water during its dry season, but also solve the critical subsidence being encountered in some areas of the city.

L. S. Galstaun is Manager of Process Engineering for Bechtel Associates, New York City. Previously he was Manager of Applied Technology for Bechtel Corporation's Scientific Development Department in San Francisco where his duties included management of projects in desalting, particularly the desalting portion of the Metropolitan Water District Study. His PhD is in physical chemistry (MIT, 1936).

A LITTLE NAIVE?

Title Irradiation Damage to Solids

Author B. T. Kelly

Publisher Pergamon Press, 1966

Pages xix + 232

Price $4.50 (paperback)

Reviewer James H. Crawford, Jr.

From its starting point as a series of rather pragmatic investigations of the effect of prolonged exposure to nuclear radiation on the physical behavior of solids, radiation damage as a field of research has taken a number of interesting twists and turns. It has progressed somewhat erratically from its initial preoccupation with "practical" nuclear materials, such as uranium and its alloys on the one hand and graphite on the other, to encompass nearly every class of crystalline solids, as well as some which are not crystalline. In the process, investigations employing energetic radiation as a tool with which to introduce lattice imperfections have had a profound impact upon our understanding of defects in solids and the interrelationships between these and physical properties. Matters as diverse as the nature of the dimensional changes and lattice expansion (and contraction) occurring in graphite, the nature of defect-energy levels which profoundly influence the electronic behavior of semiconductors and effects of radiation defects upon the superconducting transition fall within the bounds of this field of research. Indeed, the recent discovery that high-energy particles become channeled, i.e., move through very large distances with very little energy loss along open directions in crystals, has opened a wide area of delicate and sophisticated experimentation and has had some rather important consequences for nuclear physics as well as for solid state.

In the book under our scrutiny, Kelly has prepared a survey of the field with primary emphasis upon the quantitative aspects of the displacement of atoms and the stable configurations such defects take in crystalline solids. These two topics occupy one-half of the book, all other aspects of the topic being crowded into the remainder. As he makes perfectly clear, the author is not interested in setting forth in detail the behavior of various types of solids during, or subsequent to, irradiation. Instead, he is quite content to emphasize the concepts and mechanisms of defect creation by the incident radiation, touching only the high spots of the actual radiation response as reflected in altered physical properties. Only those aspects of the topic that are common to radiation effects in a wide variety of materials are treated in any degree of detail. One chapter is devoted to annealing of damage, and a description of recently developed techniques for direct observation of lattice damage is included. Obviously, in a work of this size much of the detail must be left out, and it is largely a matter of taste as to what is included and what is excluded.

Kelly has given us a very thorough treatment of the quantitative theory of the displacement of atoms in solids. Most of the attention is focused upon what is now called simple damage theory in which the number of defects created in a displacement cascade are estimated without reference to the ordered arrangement of atoms on a lattice. Refinements required to allow for extraneous losses such as those due to ionization induced by the primary recoil are clearly set forth near the end of the chapter. Those mechanisms such as focusing and channeling which take account of the crystalline lattice are briefly treated. In view of the recent rapid progress in channeling studies and the importance which replacement sequences (focusing) have assumed in the interpretation of radiation damage in ionic crystals, this emphasis rather dates the book. It is unfortunate that some of the experimental channeling results obtained over the last several years could not have been mentioned. In addition, recent experimental results of the quantitative aspects of damage production strongly suggest that the criteria employed in setting the ionization limit L_c employed by the simple theory may be much too naive to be effective. Hence, these recent developments tend to undermine the quantitative results of the simple theory. This point could have been stressed more strongly in the book. Another difficulty is the lack of a clear-cut confrontation of theory with experimental results in these quantitative estimates of defect yields.

Aside from this deficiency, the book should be a valuable one to the uninitiated; in particular, the young reactor engineer, since it presents in a concise way those factors necessary for a quick assessment of the radiation response of the more common metals and alloys. The last chapter in particular should be consulted by those who use reactors to carry out radiation damage experiments. If such a reasoned discussion of the neutron spectra and damaging flux had been carefully studied and digested over the past decade, much of the confusion and apparent inconsistencies among results that have plagued neutron bombardment experiments could have been avoided.

Since February, J. H. Crawford has been chairman of the Physics Department of the University of North Carolina at Chapel Hill. Prior to that time, for a period of 18 years, he conducted and directed research at Oak Ridge National Laboratory in the field of radiation damage in solids with major emphasis upon semiconductors and insulators. He received his PhD in Physical Chemistry from the University of North Carolina in 1949.

CAPABLY EDITED

Title Clinical Uses of Whole-Body Counting

Editor Stanton H. Cohn

Publisher International Atomic Energy Agency, 1966

Pages 291

Price $6.00

Reviewer C. R. Richmond

This book is from the *Panel Proceedings Series* of the International Atomic Energy Agency (IAEA). It represents the combined efforts of a panel of physicists and clinicians from six countries who convened in Vienna from June 28 to July 2, 1965, at the invitation of the IAEA. Two general goals of the meeting are apparent: a consideration by the physicists of optimal physical requirements of whole-body counters for metabolic tracer studies, and an evaluation by the clinicians of medical experience gained from whole-body counters. This volume updates the state-of-the-art for instrument development and clinical applications since the IAEA-sponsored Symposium on Whole-Body Counting held in Vienna in 1961. The duality of interests is very significant, as efficient design, operation, and utilization of a clinical whole-body measuring facility are virtually impossible without close cooperation among and communication between physicists and clinicians. Although the book acknowledges no individual authors or editors, the discussion sections were capably edited by Dr. Stanton H. Cohn of the Brookhaven National Laboratory.

The format comprises eight chapters under the general heading of "Physical Aspects of Whole-Body Radioactivity Counters," and six chapters under "Clinical Applications of Whole-Body Radioactivity Counting." Dr. E. Oberhausen of the Federal Republic of Germany provides a sound introduction to liquid scintillation counters by discussing the Los Alamos 4π models (HUMCO-I and HUMCO-II) and the Landstuhl 2π counter. Problems of energy calibration and counting geometry are introduced in an understandable form for the nonexpert. Liquid scintillator systems are compared with NaI (Tl) crystal systems as to relative geometry and efficiency. An important point introduced at the onset is that isotope identification is rarely important in clinical applications and, therefore, the system that is most efficient and less dependent upon counting geometry is the system of choice. However, this does not consider those cases in which spatial localization of the activity is of importance to the clinician. Also covered in the first section are plastic scintillation counters, analytical methods, counting geometries, calibration problems for NaI (Tl) systems,