book on ion exchange, the subject of this review, has been ably compiled by L. A. Emelity, of the University of California's Los Alamos Scientific Laboratory.

At a bargain price, this booklet provides a valuable source of basic information. No knowledge of ion exchange and only a rudimentary acquaintance with physical chemistry and chemical and nuclear engineering is expected of the reader. An introduction and a brief historical review outline the problem of disposal of wastes from various types of reactors (7 pages). In a lucid manner, the principles of ion exchange, the structure and synthesis of ion-exchange materials (including membranes), and the limitations of such materials are surveyed (19 pages). The main chapters deal with application to waste processing (26 pages) and operating procedures and experiences (13 pages). A short chapter on cost calculations follows (6 pages). The presentation is supported by 65 pages of appendices and tables, 101 literature references, and an additional bibliography of 93 entries.

The treatment of the basic facets of ion exchange follows standard texts. The author skillfully manages to convey, in a well-organized and logical manner, the most significant aspects without burdening the reader with too much detail. The approach to applications of waste treatment is less systematic but equally informative. The discussion of methods—batch, fixed-bed, moving-bed, electrodialysis, and centrifuge operations—is relatively brief but well done and is abundantly supplemented by detailed examples of technical installations. The copious tabular material includes: a table of properties of ~300 ion-exchange materials from clay minerals to resins of Czech and Hungarian manufacture, properties of the principal radionuclides in waste solutions, and lists of reactors using ion-exchange processes. The enchanted reader will also find conversions, e.g., of degree Baumé to other concentration units, of atmospheres to feet of H_2O at 60°F, of ounces (British fluid) to cubic inches, and of dollars to Jordanian dinars or Cambodian riels. Should he not have known before, the glossary defines for him "radioactivity" and "electrolyte."

The only shortcoming somewhat impairing the value of this commendable treatise is the lack of an index. A few minor weaknesses are: the treatment of kinetics (pp. 15-16) fails to provide a feeling of how long it will take to approach equilibrium in given cases; the structural formula for zirconium phosphate (p. 24) is incorrectly reproduced and outdated; most column experts will take issue with the peremptory pronouncement that, universally, the optimum flow rate is 0.27 bedvolumes/min (p. 52); the explanation of what happens in counterflow regeneration (p. 59) is incorrect; misprints, otherwise remarkably rare, have sneaked into some calculations and equations (e.g., pp. 56 and 60); the example of cost calculation (pp. 80-84) is too complex to be of value for the casual reader, yet too crude to meet process-engineering standards. The bibliography, apparently intended as a list of recommended reading, is slightly haphazard; thus, Kitchener's and Salmon and Hale's eminently readable short monographs are not listed whereas Orborn's obsolete one is, and a fair number of the papers and agency reports are too specialized for the expected readership of this book.

These critical comments on minor points should not detract from the value of the book. The aim of providing basic guidance for the relative newcomer has been admirably achieved by the author. At its bargain price, the book can also be recommended as supplementary reading for the more experienced nuclear engineer.

Friedrich G. Helfferich, a native of Germany, received degrees in chemistry from the Universities of Hamburg and Goettingen. His scientific career includes research positions at Max Planck Institute, MIT, and Caltech., and lecturing at U of C, Berkeley. With Shell Development Company since 1958, he supervises the Industrial Chemicals Division's long-range process-engineering group. His specialty is quantitative chemical kinetics and its application to process design. Inventor of the ligand-exchange separation method and the tracer-pulse technique for chromatographic determination of multicomponent phase equilibria, he had developed a general theory for chromatographic behavior of interfering solutes. He is best known, however, for his earlier work on ion exchange and as the author of a standard text on this subject.

ISODOSE ATLAS

Title Atlas of Radiation Dose Distributions, Vol. III, Moving Field Isodose Charts

Authors K. E. Tsien, Jr., J. R. Cunningham, D. J. Wright, D. E. A. Jones, and P. M. Pfalzner

Publisher International Atomic Energy Agency, 1967

Pages iii + 57, 168 charts

Price $15.00

Reviewer Harold L. Atkins

This volume is the third of four planned publications by the International Atomic Energy Agency in the field of radiation therapy isodose charts. The two previously-issued volumes dealt with single-field and multiple-field isodose charts. The projected fourth volume is to deal with brachytherapy. A number of institutions and individuals have cooperated in assembling the data. The effects of field size, penumbra, locus of axis of rotation, angle of rotation, body size, and radiation energy are all considered.

With the increasing utilization of high-energy radiation sources throughout the world, particularly ^{60}Co teletherapy sources, the data presented in this volume should be especially useful. Physical data related to moving-field therapy are needed, particularly in those institutions where adequate consultation with radiologic physicists is not possible. While the material included in this volume cannot be applied directly, it should serve very well as a reference for checking dose distribution calculations in a particular problem. The loose-leaf format is especially useful in this regard.

An authoritative discussion of the principles involved in moving-beam therapy, as well as a moderately extensive list of references, should

be helpful to trainees in radiotherapy. The material is clearly presented and covers the subject rather completely. The charts are very clear and easy to use. Almost all the charts are based on dose distribution from ^{60}Co, but the effects of radiations of other qualities are also discussed, and several charts at the end of the volume consider the effects of various megavoltage x rays on the resulting patterns of dose distribution.

This volume is highly recommended as a reference source and teaching manual for every radiotherapy department.

Harold Atkins is a member of the staff of the Medical Department at Brookhaven National Laboratory, where, since 1963, he has specialized in neutron radiography, neutron-capture therapy, and the development of scanning techniques for mapping in vivo *radioisotope distributions. He received his radiology training at the hospital of the University of Pennsylvania and practiced radiotherapy and nuclear medicine at Yale University School of Medicine and at Columbia University College of Physicians and Surgeons. His MD degree (1952) is from Harvard Medical School.*

RECOMMENDED FOR NONSPECIALISTS

Title Handbook of X-Rays

Editor Emmett F. Kaelble

Publisher McGraw-Hill Book Company, 1967

Pages x + 1028

Price $35.00

Reviewer Benjamin Post

In recent years, the rapid growth of interest in x-ray diffraction and related techniques has been accompanied by a corresponding increase in the number of texts that deal with a wide variety of subjects in this general area. These volumes are designed primarily to meet the needs of specialists. Unfortunately, little attention has been paid to the requirements of nonspecialists, of chemists, physicists, or metallurgists, who wish to use x-ray methods as an auxiliary tool in their work and who also wish to understand what they are doing. It is this latter audience at which the *Handbook of X-Rays*, edited by Kaelbe, is aimed.

An impressively wide range of topics is covered in 48 chapters written by specialists in various fields. Clearly, where so many authors are involved, it is inevitable that the level of treatment will vary. In general it appears to be good, and in many instances it is excellent.

The *Handbook of X-Rays* brings together in one convenient volume a mass of information about scientific areas where x-ray techniques are used. This information is generally not available to the nonspecialist or could be made available only after very long and tedious search through the literature. The book is divided into six parts. Part 1 deals with what are designated as "Fundamentals."

Part 2 deals with "Diffraction of X-Rays by Polycrystalline and Amorphous Materials." This is by far the largest section in the volume and includes 17 chapters covering a wide variety of topics related to powder diffraction methods

In Part 3, "Determination of Crystal Structure," the editor appears to have a peculiar understanding of what constitutes "determination of crystal structure." For example, the inclusion of Chapter 28, entitled "Indexing of Powder Patterns," in this part appears to be stretching the meaning of plain words a good deal. It clearly belongs in Part 2 and its inclusion in Part 3 appears to reflect an unfortunate attitude of the editor toward crystal structure analysis.

Parts 4, 5, and 6 deal with "X-Ray Emission Spectroscopy," "X-Ray Absorption Methods," and "Microradiography and X-Ray Microscopy." Most attention is paid, as might be expected, to emission methods. The treatment of fluorescence analysis techniques appears to be adequate.

One important omission does characterize the entire volume. In the past ten years, theoretical and practical interest in methods of investigating crystal perfection by x-ray diffraction techniques, lumped together in the broad category of "x-ray topography," has grown to the point where at the present time there are probably as many investigators working in this area as in any other branch of the field. Yet nowhere in this handbook is there any serious discussion of crystal perfection studies by x rays. This oversight represents a serious shortcoming in the volume. Nevertheless, I recommend the volume highly, particularly to nonspecialists working with x rays.

Benjamin Post (PhD, Chemistry, Polytechnic Institute of Brooklyn, 1949) is a Professor in the Department of Physics at Brooklyn Polytech. Among his many research interests are chemical crystallography, low temperature x-ray diffraction, lattice vibrations, crystal structure analysis, and ultra high pressure methods. He was president of the American Crystallographic Association in 1966.

WASTE TREATMENT TREATED

Title Treatment of Low- and Intermediate-Level Radioactive Waste Concentrates

Publisher International Atomic Energy Agency, 1968

Pages 110

Price U.S. $2.50

Reviewer Lee Gemmell

The general subject of treatment of radioactive waste concentrates had been discussed briefly at two symposiums sponsored by the IAEA in 1959 and 1965. To give an opportunity for further international discussion, the Agency convened a panel of thirteen experts from eight countries. The panel studied the problem in depth by reviewing operating practices and experiences and developing cost data on typical operations in various countries. The resulting document is an interesting recital of the methods used by many atomic energy sites in various parts of the world for handling and processing their low- and intermediate-level radioactive wastes.