Book Reviews

Nuclear Energy in Industry. By J. G. CROWTHER. Newnes, London, 1956. 168 pp., $3.95, 17s.6d.

This book is basically a digest for the layman of the Proceedings of the First International Conference on the Peaceful Uses of Atomic Energy, and the only information available regarding the author is that he attended the Conference as a representative of George Newnes Ltd. After emphasizing the impending shortage of cheap fossil fuels, Mr. Crowther explains the fission process, describes the various types of reactors—particularly, power reactors—discusses the industrial applications of isotopes, and summarizes the mining, processing and metallurgy of uranium and other reactor materials.

Insofar as imparting the spirit of nuclear energy to the layman, the author has done an acceptable job. Chapter II, "What is Nuclear Energy?" gently leads the reader through the early scientific discoveries of radiation and the fundamental particles, to a simple explanation of the chain reaction and the principles of a reactor. If anything the discussion is oversimplified. The chapters on actual research and power reactors are replete with interesting photographs and design data, but are heavily oriented toward British practice. Mr. Crowther devotes 8½ pages to the USSR power reactor, 15 pages to Calder Hall, but only 15 pages to *all* the US power reactors combined (PWR, BWR, SGR, SRE, LMFR, HRT, etc.)

As a general reference, the book suffers from obsolesence (mid-1955) and from some inaccuracies, such as the following:

The recent McKinney Report estimates world energy resources higher than Crowther by a factor of 4 and the total world energy consumption in the year 2000 higher by a factor of 2. There are some loose statements like, "Millions of millions of neutrons may cross each centimetre of the core every second, forming a neutron gas or neutron flame within the core in which the fissile material is burnt up, like the coal-dust burnt in the flame inside the furnace of a coal-fired boiler." The reason for selecting gas cooling for Calder Hall is quoted as: "for in case of accident, should the gas escape, the reactivity in the core would die down, like the collapse of a tyre after being punctured."

This reviewer thinks the chapter on isotopes is by far the outstanding feature of the book, one which covers the subject adequately and interestingly and best befits the title of the book.

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(Editor's Note: Mr. LeClair has long been known as a leader in the development of nuclear power for central station generation of electricity. Formerly Manager of Research and Development at Commonwealth Edison and operating chairman of the Nuclear Power Group, Inc., which co-sponsored the Dresden nuclear power plant at Joliet, Illinois, he has also served in advisory capacities to the Atomic Energy Commission and Joint Congressional Committee on Atomic Energy. Mr. LeClair is presently Manager of Nuclear Power Applications for General Dynamics' General Atomic Division and is responsible for the commercial applications of its advanced power reactor systems.)

Radiation Hazards and Protection. By D. E. BAINES AND DENIS TAYLOR. Newnes, London, 1958. 178 pp., 51 figs., 30 shillings.

The authors have attempted a somewhat condensed presentation of the problem of radiation hazard and protection. In an endeavor to provide some background for the specialist, as well as the nonspecialist, and particularly the latter, the book appears to reach its objective.

Many people in technical administration find themselves confronted with the necessity of having to cope with a radiation management problem that appears to be quite separate from the other normal objectives of the organization. There is an inclination toward intolerance on the part of some of the individuals toward the seemingly large number of detailed matters that have to be considered. For such individuals this book is good medicine.

The first six chapters deal primarily with the biomedical aspects of the radiation problem. Enough detail is given to develop the nature of the problem and to point out the many facets involved in shielding man from radiation. One would hardly be able to set up a protection program on the basis of this information but he would certainly obtain a good idea of the problem.

Much of the remainder of the book deals with the various aspects of radiation measurement and instrumentation. The chapter on Radiation Output presents some useful formulation for computing dose rates for different geometries and for radioactive material deposited in tissue. This provides a useful introduction to the broad problem. Laboratory and shielding design information has been given. This appears to relate particularly to larger installations, such as those in which the authors have had experience. There is no need for such information for the small user. General discussions of instruments by type and purpose have been presented.

The discussion of instrumentation could not possibly be complete and the authors' selection has been a reasonable one. It is natural that the instrumentation discussion relates largely to British equipment. Reference is made, however, to sources of similar information in other countries.

It is unfortunate that in a few spots the book is already dated. In 1958 when it was first published, present day concepts regarding radiation dosimetry and units were already available. These do not appear anywhere in the book. Similarly, at that time some rather radical changes had been made in the concepts of radiation protection standards and these also do not seem to be reflected. It makes one wonder whether some other parts of the material discussed, but with which the writer is less familiar, may also be some-

what out-of-date. In spite of this criticism it is still felt that the book will be useful to many people.

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[Editor's Note: Lauriston S. Taylor is currently Chief of the Radiation Physics Division of the National Bureau of Standards. He is probably best known for his activity on the National Committee for Radiation Protection (NCRP), the International Commission for Radiation Protection (ICRP), and the International Commission for Radiological Units (ICRU). He has been chairman of NCRP continuously from 1929 to the present; a member of ICRP since 1928 and secretary from 1937 to 1950; and a member of the ICRU since 1928 and chairman since 1953.]

Resonance Absorption in Nuclear Reactors. By LAWRENCE DRESNER. Pergamon, New York, 131 pp., $6.00.

Resonance Absorption in Nuclear Reactors by Lawrence Dresner is well written, concise, and logically developed. This book could form the basis for a one term course for either college seniors or first year graduate students who are primarily interested in reactor theory. It could also be profitably read by reactor physicists who are not familiar with all of the literature on the resonance absorption of neutrons.

Starting with the resonance absorption of neutrons in infinite media and ending with lumped absorbers, Dresner considers essentially all the problems whose solutions may be expressed analytically. Of special value is his development of standard approximation methods and the discussion of their validity. For example, when considering the infinite medium problem, he derives the Hurwitz adiabatic approximation and subsequently the Wigner and Goertzel-Greuling approximations. The discussion of the accuracy of the approximations is clearly and completely presented. Another approximation is often made in the calculation of resonance capture of lumped systems. In this approximation method of calculation, the capture rate of the lump is a function of its surface-to-volume ratio. The theoretical foundation of this approximate model is developed and its accuracy is discussed quantitatively.

When the nuclear resonance is either wide or narrow compared with the average energy lost by a neutron in one collision with any moderating atom, Dresner demonstrates the equivalence of the capture in an absorbing lump and the infinite medium problem.

The dependence of the resonance capture on the thermal excitation of the absorber is calculated assuming that the absorber is a free gas. The limitations of this model and the more sophisticated Lamb calculation are considered briefly.

In spite of the relative conciseness of this book, it is not intended to present isolated formulas suitable for the calculation of any one specific reactor resonance capture problem. Rather, by analytical calculations and physical arguments, it sets a firm foundation for the understanding of all the phenomena on which the resonance capture of neutrons depends.

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(Editor's Note: Norman Francis received his Ph.D. in theoretical physics from Rochester in 1952. He joined KAPL in 1955 and has been active in nuclear and reactor theory. He is currently so engaged and is, in addition, a member of the ACRP Subcommittee on Cross Section Priorities.)

Nuclear Data Tables, Part 3; Nuclear Reaction Graphs. By J. B. MARION. U. S. Government Printing Office, Washington, D. C., 1960, $1.25.

The compilation of the Nuclear Data Tables is an effort to collect the more important tabular and graphical material contained within the enormous entity of low-energy nuclear physics. The seven sections of this particular volume represent a competent portion of this work. They will be of most interest to the experimentalist.

The first two sections deal with charged particle range, energy and scattering relations. The selection of material is good and well presented. The third topic deals with proton- and deuteron-induced neutron sources at zero degrees only. Notably absent are data at other angles and information regarding natural γ-n and α-n neutron sources often used as standards. The fourth section pertains largely to gamma ray detection with NaI crystals and includes an excellent set of crystal efficiency curves along with a number of graphs of angular correlation geometric correction factors. The general utility of the latter may be questionable. Sections five and six deal with penetrability and shift functions and radiology and shielding. The remaining three sections deal with a wide range of miscellaneous formulas, tables, and graphs. They contain possibly the best and worst of the compilation. For example, a handy list of gamma ray and accelerator energy calibration points is given and a nice graphical and algebraic outline of classical kinematics is presented. Not so useful is a semilog plot of function e^{-x}, something for which the reviewer would tend to use a slide rule. The bibliography throughout the compilation is largely limited to review articles or texts and the references are generally, though not universally, correct.

In the preparation of any compilation of this type the major problem is the selection of material. For the student and for the worker in fields other than experimental nuclear physics the information contained in this compilation should be very useful. The physicist actively involved in experimental nuclear work will probably find the review articles and reference volumes available in his personal library a more useful, handy, and certainly, more complete source of information. One should not, of course, lose sight of the fact that a few good reference volumes will cost some orders of magnitude more than this summary compilation.

A foremost requirement of any graphical presentation is legibility. In this respect this compilation is one of the best ever seen by the reviewer. The graphs are exceptionally clear and utilize well-chosen grid and coordinate systems.

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[Editor's Note: Mr. Smith is an experimental nuclear physicist at Argonne National Laboratory. His principal fields of interest are fast neutron and fission physics. Currently he is head of the Applied Nuclear Physics Section of the Reactor Engineering Division.]