in his many professional honors are the Ernest O. Lawrence Award (1972) and the John Simon Guggenheim Memorial Foundation Fellow (1974 to 1975). He is a member of the American Nuclear Society (Fellow), American Mathematical Society, American Physical Society (Fellow), Federation of American Scientists, and the International Association for Mathematical Physics. Dr. Zweifel is also the editor-in-chief of the journal Transport Theory and Statistical Physics.

Nuclear Power and Its Environmental Effects

Authors Samuel Glasstone and Walter H. Jordan

Publisher American Nuclear Society (1980)

Pages 395

Price $25.95 cloth; $18.95 paper

Reviewer Carolyn Heising-Goodman

Samuel Glasstone and Walter Jordan provide a lucid and technical presentation of the effects of nuclear power on the environment. Addressing a multitude of issues ranging from the biological effects of radiation to nuclear reactor safety and the disposal of waste heat, the 14 chapter outline covers most of the issues relating to nuclear environmental impact. The book also covers the safeguarding of nuclear materials, but does not deal with the nuclear weapons proliferation issue. Written in a classic textbook style, the famous authors carry on their tradition of excellence in the presentation of important factual information. This book provides a background for more in-depth studies into any of the specific areas and, as such, is recommended as a supplemental text for advanced undergraduate or first-year graduate students of nuclear engineering. The text can also bring practitioners of nuclear engineering up to speed in areas that may not be their particular specializations.

As a more advanced textbook, the book does not provide a detailed enough in-depth treatment to qualify for use in this manner. However, as a broad overview of a wide range of material, the text fulfills its mission brilliantly. The specialist in any particular area will find the material presented elementary and introductory in nature and is thus not recommended as a text for use in advanced studies. However, the educated layperson will probably find the material illuminating if not novel, and the book serves well the purpose of educating an often misinformed public. The book is therefore recommended for use in any endeavors directed at public education in these matters.

The book is published by the American Nuclear Society and, therefore, is of utmost publishing quality. The book is written in an informative, textbook style and avoids the use of more emotional or sensational journalistic technique. As such, the reader should find the book quite educational and "to-the-point" factual. This book is highly recommended for those involved with public education projects, for introductory level nuclear engineering courses and courses that deal broadly with energy issues across the spectrum.

Carolyn D. Heising-Goodman received her BS (1974) in applied physics from the University of California at San Diego, and her MS (1975) and PhD (1978) in nuclear engineering from the Department of Mechanical Engineering at Stanford University. She also holds a PhD minor in operations research from Stanford University. Currently, she is an assistant professor of nuclear engineering at the Massachusetts Institute of Technology in the area of reliability and nuclear safety analysis. She is working on contract to the Nuclear Safety Analysis Center with Professor Norman C. Rasmussen on class 9 accident mitigation system analysis and methods for resolution of generic nuclear safety issues.

Formation of Uranium Ore Deposits
(Proceedings of a Symposium, Athens, May 6-10, 1974)

Editors Editorial Staff, International Atomic Energy Agency

Publisher International Atomic Energy Agency (1974)

Pages 748

Price $38.00

Reviewer Arthur L. Reesman

These proceedings contain 42 papers, which were contributed from 23 countries and reports from the six working groups. English dominates (32 of the papers) and all papers have English abstracts. Absent from the volume are papers from the USSR, China, and Eastern Europe, except Yugoslavia and Rumania.

The objective of the symposium was to provide information that will aid in future exploration of uranium ores. Papers are organized into sessions that parallel the "working groups," which were established at a previous meeting sponsored by the International Atomic Energy Agency. The six groups are

I. Chemical and physical mechanisms in the formation of uranium mineralization, geochronology, isotope geology, and mineralogy (8 papers)

II. Sedimentary basins and sandstone-type deposits (three sessions, 21 papers)

III. Uranium in quartz-pebble conglomerates (1 paper)

IV. Vein- and similar-type deposits (6 papers)

V. Other uranium deposits (3 papers)

VI. Relation of metallogenic, tectonic, and zoning factors to the origin of uranium deposits (2 papers).

The number of papers in each category shows an inbalance that does not represent the relative significance of it but the experiences of the authors. The single review paper on quartz-pebble conglomerate deposits is not indicative of the ~40% of low-cost reserves represented by them. The sandstone-type deposits, considered by group II, contain about an equal amount of low-cost and most of the known moderate-cost reserves (the next

generation of ore). Uranium deposits considered by working groups IV and V offer hope for the future, when the minable grade of U_3O_8 decreases. The charges of working groups I and VI transcend individual deposits or types of deposit to help answer the more fundamental problems that ultimately lead to uranium mineralization. Findings in these areas of study are necessary to provide a sound basis for fruitful future exploration.

Although the book was published by photo-offset from manuscript, the quality is very good to excellent. The discussions that follow each paper and reports from the working groups add significantly to the volume.

The symposium was held for uranium exploration geologists and the papers reflect this professionalism. Scientists and engineers with some background or a strong interest in geology will find these papers generally informative, but if you wonder "what geologists do when they dig dirt?," you should pass on this one. This volume should be more digestible if taken after "Short Course in Uranium Deposits: Their Mineralogy and Origin."

Arthur L. Reesman (BS, chemistry, Eureka College; MS and PhD, geology, University of Missouri) is an associate professor of geology at Vanderbilt University. His research interests are in low-temperature geochemistry. Past studies have included the behavior of both major and trace elements during chemical weathering and the genesis of clay minerals. He is currently pursuing studies in stratiform mineral deposits.

Status and Prospects of Thermal Breeders and Their Effect on Fuel Utilization
(International Atomic Energy Agency Technical Report Series No. 195)

Publisher	Unipub
Pages	143
Price	$18.25
Reviewer	Kazys K. Almenas

For the public at large there is still an aura of the exotic about nuclear engineering, but in fact, this over a third of a century old branch of engineering is in danger of becoming one of its most standardized ones. For these days after pressurized water reactors and boiling water reactors, what else is there? Especially in the U.S. This book is a timely reminder that it was not always thus. Far from it. A mere 10 to 15 years ago literally dozens of reactor types were at various stages of development. Many additional applications (like powering rockets and melting steel) were envisioned for nuclear power. The abbreviations of the reactor types around could have filled a few pages. Most of this is passing into history now and unfortunately it is not a very well-recorded history. Much of the information that the various programs generated appeared only in scattered journal articles and in reports having limited distribution. There is a definite need to summarize and preserve this information in a more accessible format. Though this is not the purpose of the book being reviewed, it does an admirable job of discussing four reactor types, for three of which, the molten-salt breeder reactor (MSBR), heavy water suspension reactor (HWSR), and light water breeder reactor (LWBR), information is not generally available. This should broaden the appeal of this book and make it useful as a general reference.

The primary purpose, as the title states, is to review the prospects of thermal breeders. It is the product of a cooperative International Atomic Energy Agency study edited by J. A. Lane, who probably should get more credit than he has received (a line in the Foreword) for the readability and organization of the text. The book does have some weaknesses (these will be noted), which generally accompany group efforts, but readability is not one of them. In an economical 140 pages, the thermal breeder concept is reviewed, compared with liquid-metal fast breeder reactor (LMFBR) performance and four reactor types [the three already noted plus the thorium cycle Canadian deuterium uranium (CANDU) reactor], and summarized. The text is sufficiently clear that the book can be recommended as a supplementary source for courses dealing with fuel cycle analysis. The distinction between thermal breeders and the much more familiar fast breeders is especially well presented. It is appropriately emphasized that the breeding ratio is not an end in itself but merely the means to an end. The goal, after all, is economical utilization of fissile resources. In order to achieve this not only the breeding ratio but also the specific fissile inventory (kg fissile/MW) must be considered. In terms of the breeding ratio alone, thermal breeders cannot compete with fast breeder reactors (FBRs). A glance at a graph displaying neutron energy-dependent η values illustrates this fact convincingly. However, thermal breeders do have significantly lower fissile inventory requirements. For expanding nuclear power programs, this can lead to a situation where a combination of light water reactors (LWRs) plus thermal breeders can have lower cumulative and yearly fissile requirements than a corresponding combination of LWRs and LMFBRs. It must be emphasized that this is dependent on the specific growth scenarios and is quite sensitive to the assumptions regarding out-of-core fissile inventory requirements. The assumptions used in the studies are consistent and reasonable. They are stated clearly and the results of the analysis are displayed in well chosen, informative graphs. In general, studies that deal with fissile resources utilization using LMFBR-LWR scenarios tend to slight the out-of-core inventory problem. This study had to focus on this important aspect and the results are presented in a sufficiently general manner that they are of interest even disregarding the problem of thermal breeders.

As noted, an equally valuable contribution is the presentation of four reactor types in a manner that allows quantitative comparisons between them and comparisons with the more familiar LWRs and FBRs.

The MSBR and HWSR are homogeneous reactors. The word should be qualified somewhat since for the suspension reactor the fuel consists of 5-μm UO_2 fuel particles held in suspension by proper adjustment of flow rates. However, the particles are sufficiently small that the bulk of the fission products escape from the fuel particle and thus can be removed by appropriate chemical processing. This is an important feature since one of the main advantages of homogeneous systems is the ability to reduce neutron absorption in fission products. The other is the possibility