

are involved in nuclear fuel strategies and their relationship to nuclear nonproliferation. The role of the book as a text for a nuclear fuel cycle course would be limited, however, to that of a supplement. The book complements *Reactor Core Fuel Management* written by the same author.

Chapter 1, entitled "Nuclear Fuel Cycle," provides a very brief overview of the nuclear fuel cycle. I do not agree with the author when he subtracts enriched fuel (P) from uranium feed (F) to obtain savings of natural uranium (p. 12, Eq. 1.18). Natural uranium and enriched uranium cannot be subtracted because they are related: $F = FF \times P$, where FF = feed factor. I liked Chap. 2 most of all. It provides a very lucid analysis of "Uranium Supply and Demand." Chapter 3, a "Basic Model of the LWR Fuel Cycle," gives me difficulty with its computer-type notation. Equations 3.26 and 3.28 should be multiplied by the factor $1/y_2$.

"Resolution of Uncertainties" (Chap. 4) presents a method of obtaining the probability density function for any cost component of the fuel cycle. Although the methodology is standard, it is the first time, to my knowledge, that it is presented in a text on nuclear fuel.

Chapter 5, entitled "Assessment of Proliferation Risks," describes a method of obtaining the value of relative proliferation risks. It is a very nice theory, but in practice, other criteria are used for nonproliferation issues.

"Multigoal Optimization," Chap. 6, takes into account, in addition to economic, other criteria as well, when optimization is attempted. It is a difficult if not impossible task, since the economic criteria are the prime concern of the utility, and other objectives, such as nonproliferation, will have to be imposed by the government through the regulatory process.

Chapters 7 and 8 present fuel cycle models that utilize plutonium in a symbiotic world of light water reactor (LWR)/fast breeder reactor and LWR/high-temperature gas-cooled reactor. Not surprisingly, the results of the single case study mentioned show that a nuclear power industry with only LWRs will be costlier than either of the other two combinations. Of course, the reader should remember that, depending on the assumptions used, one could arrive at a different conclusion.

I like the inclusion of the last chapter (Chap. 9) entitled "Interface with Energy Strategy." Although a single utility will never be concerned with global energy strategies, a nuclear fuel analyst working for a national or, in particular, international agency should be aware of the limitations of our planet. Since nuclear power has an international character, much more than the other modes of generating electricity, problems of supply and demand of uranium and of nuclear services will have to be discussed at the international level. My only hope is that the uranium suppliers behave more rationally and the world does not have to cope with an OUEC in addition to OPEC!

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Reviewer Gerald A. Schlapper

This publication contains papers presented at the Second Special Symposium on the Natural Radiation Environment held at Bombay, India, in January 1981. Invited and contributed papers address the topics of high natural background radiation areas, environmental natural radioactivity, measurement techniques, technologically enhanced natural radiation, the indoor radiation environment, radon and daughter products in ambient air, and applications in geosciences. The majority of the papers deal with high interest areas, such as areas having high background levels, current thought regarding indoor radon exposure, and detailed questions relative to technologically enhanced natural radiation. The presentations answer many commonly asked questions and also highlight those areas where additional research is justified.

The symposium was sponsored by the Indian Department of Atomic Energy and the Indian Association for Radiation Protection. Countries other than India were well represented at the conference and this is reflected in the fact that a majority of the papers are authored by attendees from abroad. Four invited talks and eight review lectures serve to inform the reader and allow one to better understand the other 82 contributed papers. The editors of this volume, which contains over 650 pages of text, note that it was necessary to reduce the length of some of the presentations. They have done an admirable job of editing. The papers presented contain a wealth of figures and tables to enhance understanding.

This volume can serve as a reference for those who are attempting to educate the common man on the effects of low levels of radiation exposure. Exposures from nuclear power plants are compared with those due to natural sources. A fine example of the presentations is the review paper by Adams, which examines and updates the threshold hypothesis and clearly emphasizes one of the most important aspects of radiation protection efforts: that specialists in this area have a responsibility to accurately describe radiation environments and to report findings in terms that cannot be misunderstood. The problem of making decisions with imperfect and possibly conflicting data bases is addressed in this and other papers from the symposium.

This book provides a wealth of interesting reading. The division of the volume by area of interest allows one to selectively review the data presented. Rather complete references are provided for each paper, and questions asked of the authors are also included. These discussions provide additional insight into problems experienced by the researchers. A panel discussion recorded at the end of the text summarizes the presentations and points out areas

where further research is required. Emphasis on the problems associated with indoor radon exposure is suggested in this informative discussion session.

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