BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Management, Stabilisation and Environmental Impact of Uranium Mill Tailings

(Proceedings of the Nuclear Energy Agency Seminar, Albuquerque, New Mexico, July 1978)

Publisher	Organization for Economic Cooperation and Development Nuclear Energy Agency (1978)
Pages	498
Price	$20.00
Reviewer	John W. McKlveen

From licensing through decommissioning, the management, stabilization, and environmental impact of uranium mill tailings are perhaps the most important and difficult societal aspects of the front end of the fuel cycle. Considerable planning, environmental assessment and radiological impact studies are now required as part of the U.S. NEPA licensing process. A draft U.S. GEIS on mill tailings was recently released.

Once operational, the tailings must be carefully scrutinized to ensure normal and expected behavior with minimal releases. Decommissioning efforts require the residual waste form be placed in a configuration that is stable and as safe as reasonably achievable with minimal or no caretaker responsibility. In the U.S., typical mills are expected to produce on the order of 13 million tons of tailings during a lifetime; ~140 million tons are in existence already and ~10 to 15 million tons are being generated annually. In the midst of all the changing requirements and regulations, one finds scientists and engineers who must address the problems and provide answers to the numerous regulatory agencies. Therefore, it is imperative that the professionals be cognizant of the latest technological developments and have an opportunity to assess the current status of knowledge, contribute to solving problems, and establish a basis for international cooperation on uranium mill tailings technical matters. Toward that end the Nuclear Energy Agency seminar was convened.

The proceedings follow the topical sessions, which included source terms, environmental aspects, management and stabilization policies, and regulatory aspects. Considerable effort was devoted to leaching problems, stabilization of tailings, and uranium progeny (i.e., radon exhalation and ^{226}Ra leaching), and several papers discussed methods used to address problems at specific plants. Numerous foreign contributors discussed their problems and regulatory practices.

The proceedings are certainly useful to individuals responsible for uranium tailings. In addition, those interested in the environmental aspects of tailings and ^{226}Ra scavaging by various barium-precipitation schemes would find the information useful. Those interested in licensing and the latest information on environmental impacts would be better off obtaining the GEIS on Mill Tailings [NUREG 0511, U.S. Nuclear Regulatory Commission (1979)] and a recently released document that describes the Uranium Dispersion and Dosimetry Code [NUREG/CR-0533, U.S. Nuclear Regulatory Commission (1979)].

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Thermionic Converters and Low-Temperature Plasma

Author	F. G. Baksht et al.
Publisher	National Technical Information Service (1978)
Pages	484
Price	$15.00
Reviewer	David T. Shaw

The authors of this book are experimentalists and theoreticians from the Institute of Semiconductors of the USSR Academy of Sciences, Leningrad, and have been recognized for their important contributions to the field of thermionic plasma research. The book brings together an impressive collection of information on the subject and represents the first comprehensive discussion devoted exclusively to the low-temperature plasma aspect of the converter research.

There is an introductory chapter, then thermionic emission, cesium evaporation, ionization, and adsorption on electrodes are discussed in Chap. 2. This is followed by four excellent chapters on the kinetic processes of the non-LTE (local thermodynamic equilibrium) plasma in the interelectrode spacing. Special emphasis is placed on the preelectrode phenomena near the emitter, where most of the spontaneous ionization is taking place. The understandings developed in this region at the time the book was written (1972) have not changed significantly since then. Chapter 7 discusses the electrostatic probe and spectroscopic measurements of plasma temperature and density distribution in the thermionic plasma. Chapters 8, 9, and 10 discuss the plasma properties for various modes of thermionic converter operations. Topics such as the effects of magnetic field, the inert gas additives, and transient operation are also included.

Miscellaneous engineering problems such as the thermionic reactor and space application, the use of hot pipes, isotope-heating thermionic converters, and thermionic topping power plants are discussed in the last chapter.

Extensive reference lists at the end of each chapter include not only the Russian work but also a relatively complete listing from the West.

The English translation was edited by Lorin K. Hansen, who did a commendable job in unifying the nomenclature and symbols used in the international thermionic community.

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Dr. Shaw is best known for his work on particulate emission control for advanced coal-fired power plants and the transport and control of radioactive aerosols related to light water reactor and liquid-metal fast breeder reactor plants. He is the editor of Fundamentals of Aerosol Science *and* Recent Developments in Aerosol Science *and a coeditor of a book series on energy and environment.*

MHD Instabilities

Author	Glenn Bateman
Publisher	MIT Press (1978)
Pages	264
Price	$22.50
Reviewer	F. L. Cochran

Glenn Bateman's book *MHD Instabilities* is a welcome addition to the books now available in the nuclear fusion field. The MHD (or magnetohydrodynamics) model is the simplest fluid model that can be used to study plasmas, and as such, it can be used to study macroscopic instabilities in complicated geometries. This book also serves as an excellent introduction to tokamak physics, and there are several instances where tokamak phenomena are discussed in detail. Tokamaks are toroidal magnetic fusion devices, which have enjoyed a certain amount of success in recent years and are currently among the most promising methods of achieving scientific breakeven in the near future. From a mathematical point of view, the level of the book is not very high and concentrates on the physical aspects of the problems discussed. One of the nicest features of the book is the many fine questions scattered throughout the text. References are also generously given at the end of each chapter.

The book begins with an introduction that explains basic tokamak principles and some of the phenomena that occur in these devices. These include the disruptive instability, Mirnov oscillations, and sawtooth oscillations. The MHD model is next introduced, and is followed by a general discussion of the validity and usefulness of this sytem of equations.

As is true throughout the entire book, the emphasis is placed on tokamak-like configurations. Chapter 3 presents a discussion of the Rayleigh-Taylor instability. Since this instability is simpler to understand than some of the more complex modes covered later in the book, this section serves as a good introduction to the concept of instability and the mathematical methods used to study them.

The equilibrium state of magnetically confined plasmas is left until Chapter 4. Here the notion of flux surfaces and their importance are introduced. Again, emphasis is placed on toroidal devices that have at least one ignorable coordinate. A derivation of the Grad-Shafranov partial differential equation in one unknown is also given. This important result is used to describe equilibria of axisymmetric toroidal systems.

The linearized MHD equations and the energy principle are presented next. This chapter and the following two chapters (on circular cylindrical instabilities) form the major substance of the book. In these chapters the reader is introduced to the basic methods and nomenclature involved in the study of MHD instabilities. There is a particularly good section in the chapter on cylindrical instabilities that gives a physical picture of the current driven instabilities. Chapter 7 also provides a section that discusses flux coordinate systems. These coordinate systems are an important tool that must be mastered if one is to be able to study the stability of toroidal systems.

High-beta tokamaks are currently of intense interest and an entire chapter is devoted to them. The final section of this chapter concentrates on the important ballooning instabilities. These modes are similar in nature to the Rayleigh-Taylor instability and may be the most important MHD instabilities that occur in tokamaks in the context of reactor design. While a good physical picture of this instability is given, this portion of the book could have been expanded with more mathematical detail.

There is a brief chapter on nonlinear instabilities, which for the most part consists of a general discussion with little mathematics. The final two chapters are concerned with resistive instabilities and comparison with experiments. The last chapter on comparisons is well presented and makes use of results from earlier chapters to explain various tokamak phenomena.

Overall, this book provides an excellent introduction to