Book Review

Installations nucléaires. By Jacques Ligou, Presses polytechniques romandes, Publishers, Lausanne, Switzerland (1982). 430 pp.

Clear, well-balanced, practical, intellectually pleasant, and informative—these are some of the adjectives that come to mind while reading Professor Ligou's valuable textbook on nuclear installations. The author has distilled into this fine book the manifold experiences of a varied career as a practicing engineer, a research scientist, and a teacher, in France, Italy, and Switzerland. The catholicity of his interests and the steady judgment exercised in the selection of his subject matter have defined a product that should reach a fairly wide audience, not only in French-language countries where there is a paucity of works on nuclear technology, but also, hopefully, in translation. For the thoroughness and the objectivity with which competing approaches are reviewed in this book are too seldom exemplified.

While the book is primarily written neither for specialists nor postgraduate students, it is considerably deeper than a standard introductory survey and will bring to the informed reader a lucid and useful update. The thoughtfully planned structure unequivocally identifies the various categories of the intended readership.

Out of the ten densely packed chapters, only two—spanning 150 pages—cover the core subjects of fission reactor physics and power plant technology. Together with the first three, treating respectively the fundamentals of nuclear physics, thermonuclear fusion, and nuclear fission, these should provide the hurried reader, e.g., the experienced conventional engineer entering the nuclear field, with the broad technical knowledge required for the competent performance of his functions. Adding again Chaps. 6 and 7 on environmental protection and the fuel cycle will constitute the bulk of a one-semester course on nuclear installations. Finally, three more chapters dealing with mathematically more advanced subjects are included as appendixes. Chapters 3, 4, 8, and 9 can be used together for a first course on reactor physics, while Chap. 10 supplies a complementary presentation of isotope separation analysis.

Throughout the book, the author rigorously keeps away from topics and developments of purely academic interest and looks for worked-out applications of practical value. Similarly, the illustrations are consistently clear and directly related to the surrounding text. This pedagogical attitude leads to easy, unidirectional reading, unimpeded by extraneous or unnecessary considerations.

Thermonuclear fusion, although limited to a single chapter, is reviewed early in the text so that the reader can obtain a good grasp both of the physical principles involved in current experiments and of the engineering difficulties to be met before this energy source is effectively harnessed. Whereas the subject is relatively self-contained, advantage is also taken in subsequent chapters of the similarities and differences with the fission process and its utilizations.

A significant departure from the traditional presentation of reactor physics is the voluntary omission of two-group theory, which is considered on the one hand as a needlessly complex teaching tool and on the other hand as too schematic to be of practical use in actual calculations. Multigroup theory is, in both respects, deemed preferable.

In the study of reactor types, the author again adopts a pragmatic viewpoint. He may regret that, for historical reasons, such concepts as the molten-salt reactor have not been given commercial expression, but the realities of the market are such that, at the present time, only four reactor types deserve detailed consideration. Only two of them are currently competing on the international scene: the light water reactor, in its pressurized and boiling variants, and the heavy water reactor, particularly the CANDU system. In addition, only two more have reached the stage of development where concrete projects may realistically be envisaged: the liquid-metal-cooled fast breeder reactor and the high-temperature gas-cooled reactor. The main components and characteristics of each of these four generic categories are described and compared in sufficient detail to convey a good understanding of the more positive aspects and principal drawbacks.

A systematic and level-headed examination of environmental protection and safety problems, relying on recent documentation, attempts to place in true perspective the many interrogations and the appropriately nuanced replies pertaining to these controversial aspects. The Three Mile Island accident is considered as an illustration of principles; one might perhaps wish that the author had dwelt a little more on its analysis.

Linking safety-related and technological considerations, Professor Ligou refers to the larger context of the history of techniques to explain the fact that the fuel cycle in its entirety was not earlier recognized and used as the proper basis for the selection of reactor types. The almost independent evolution of various phases of the fuel cycle in the hands of traditionally different economic agents is offered as the most likely reason. One often tends to forget that global awareness of the energy/environment issue was not very widespread before the early 1970s.

Isotopic enrichment and spent fuel recycling are the two sectors of the nuclear industry to which most attention is devoted in the survey of the fuel cycle. Both gaseous diffusion and centrifugation are analyzed in some detail, the tentative indication as to their prospective shares of the enrichment market being that centrifugation will probably prove to be competitive only in the lower range of plant capacities. A common shortcoming appears at the back end of the fuel cycle: The question of power plant dismantling is ignored completely.

The appendixes follow a more or less classical pattern, but the last chapter produces a welcome and particularly clear derivation of the separating work unit concept.

All in all, the book is a highly commendable piece of work, both for its contents and mode of presentation. From

a formal point of view, a desirable improvement would be the eventual addition of problems at the end of each chapter to help the reader along in his progression.

Laurent Amyot

Atomic Energy of Canada
Montreal, Quebec H3H 1P9
Canada

January 27, 1983

About the Reviewer: Following a decade as the director of the Nuclear Engineering Institute of the Ecole Polytechnique, Montreal, Laurent Amyot is now corporate vice-president of the Quebec Operations of Atomic Energy of Canada, Limited. His academic training was at Ecole Polytechnique and at Birmingham University in the United Kingdom. He began his nuclear career at the Chalk River Laboratories and was a member of the Atomic Energy Control Board during most of the seventies. Mr. Amyot has had, as well, extensive experience in industry.