

## **BOOK REVIEW**

**Malcolm Joyce, *Nuclear Engineering: A Conceptual Introduction to Nuclear Power* (second edition). Butterworth-Heinemann, 2026, £82.95**

*Review by Stephen Tromans KC, 39 Essex Chambers, London.*

You may wonder why a book written principally for would-be nuclear engineers at the end of their first degree is being reviewed by a nuclear lawyer at the other end of their career path. The short answer is that anyone concerned with the nuclear energy sector, whether as an engineer or in any other capacity, will greatly benefit from reading this informative and engaging text. Professor Malcolm Joyce comes at the topic from both an academic perspective, as Distinguished Professor of Nuclear Engineering at Lancaster University and with significant industrial experience, including at BNFL plc. He is also a member of the government's expert advisory Committee on Radioactive Waste Management.

Whilst the book contains technical material, case studies, revision guides and problems intended for its post graduate engineering readers, these are in no way essential for general readers to benefit from the very clear and non-technical text. This takes the reader from the fundamental concepts underlying nuclear reactors, introducing the basic building blocks of fuel, cladding, coolant, moderator and the reactor circuit, which are unpacked in succeeding chapters. A historical chapter explains how different reactor designs have developed, and provides an excellent explanation of the sometimes confused issue of classification of reactors by generations. Without necessarily needing to understand the equations, the reader can gain a good basic understanding of the fission process, including the key isotopes, fission products and their properties and hazards. Also illuminating is the chapter on thermal hydraulics, which sets out clearly the importance of integrated performance of coolant behaviour and reactors response and the challenges presented by some advanced reactors in this regard.

One attractive feature of the book which helps to bring it to life is that each chapter has a short "historical context" section focusing on an important figure from nuclear research and development. In the case of the chapter on Elementary Reactor Principles, this is Hyman George Rickover (1900-86) who led the development of the compact pressurised water reactor used in US nuclear powered submarines and the

later development of the Shippingport nuclear power station, the first in the US. Subsequent nuclear practice owes a lot to Admiral Rickover, as Malcolm Joyce states:

*“Rickover was renowned for his tenacity, his capacity for hard work, and his stringent requirements for the highest standards of safety, quality and design integrity. These themes remain important elements of the philosophy at the heart of nuclear engineering today.”*

Many notable quotes of Rickover survive, including the following: *“Require rising standards of adequacy. Be technically self-sufficient. Face the facts. Respect even small amounts of radiation. Require adherence to the concept of total responsibility. Develop the capacity to learn from experience.”* Others have some resonance for dealing with the long term waste management consequences of current decisions: *“Act as if you are going to live for ever and cast your plans way ahead. You must feel responsible without time limitations, and the consideration of whether you may or may not be around to see the results should never enter your thoughts.”* Also, *“Optimism and stupidity are nearly synonymous.”*

For the non-mathematically literate (in which I include myself), there are of course some pages which are not readily intelligible, but there are also real nuggets of narrative information which will help to explain how reactors of different types work and their associated fuel cycles (nuclear fuel manufacture is addressed in chapter 12 and reprocessing in chapter 13) and to set in context approaches to the regulation of nuclear safety (discussed in chapter 14). At the present time, chapter 11 dealing with “advanced reactors and future concepts” is particularly valuable in understanding what is a rapidly evolving technological arena and some of the possible pitfalls.

This is a well-balanced book, presenting a wealth of objective information, without expressing personal views. Even read at a relatively superficial level by non-engineers, it will provide a sound basis for understanding the nuclear industry and its component technologies and also offers opportunities for a deeper dive into particular topics. It can be highly commended to anyone wanting to go beyond the basics of the law and politics of nuclear energy and to equip themselves to be more informed and more effective in their professional or academic role. Having worked with and advised nuclear operators for over 30 years, I still learned a lot myself.