REVIEWS

A Serious But Not Ponderous Book About Nuclear Energy
By Walter Scheider, Cavendish Press, Ann Arbor, MI, 2001, 275 pages, $22.95 hard back, $14.95 paperback. Order from www.cavendishscience.org

Walter Scheider has a PhD in biophysics from Harvard, was a research scientist in biophysics at the University of Michigan for 17 years and a physics and math teacher in the Ann Arbor public schools for 20 years. He has won several awards for teaching and published educational material, including a previous book "A Serious But Not Ponderous Book About Relativity."

Scheider writes well and is clear in explaining the basic concepts of fission, reactors, and radioactivity. His approach to nuclear forces is to use analogies to chemical bonds. Avoiding quantum mechanics, he does get across the basic concept of energy release in fission and fusion. It is difficult to conclude whether he is for or against nuclear power, a characteristic valuable in dealing with students. However, I suspect he leans against, since 54 pages are from descriptions of the Three Mile Island accident events as recorded in the 1979 Kemeny Commission's Report on the Accident at Three Mile Island. He writes that this description was read aloud in a high school class for eighteen years to open a discussion on whether it could happen again. Nevertheless, there are few, if any, books that introduce pre-college students to nuclear energy. Given his many years of teaching high school students, Dr. Scheider knows how to present material to get across basic understanding. As debates on global warming have rekindled interest in and discussion of nuclear power, this is a useful text for high school science teachers to use to educate today's students.

Explaining these topics to pre-college students can be difficult. When used by someone who understands the concepts, this could be a useful text. There are several points that would need qualification: plutonium is consumed in a normal reactor since U238 does capture some neutrons; it no longer is "quite normal for a reactor to experience several SCRAMs each year"; France has not sold breeder reactors to other countries, but has sold pressurized water reactors (PWRs); the Department of Energy would be delighted if the cleanup of nuclear waste "will cost billions and take upwards of 20 years to clean up" since current estimates are for more than one hundred billion dollars and up to 70 years; and his concept that photons have mass needs explaining (he uses the mass equivalence of the photon's energy).

In response to my inquiry, Dr. Scheider said he was interested in getting his students to understand "that there is much more to being intelligent about policy than to make a decision to be for or against the whole thing." His students were fortunate. This is useful book for introduction to nuclear energy at the pre-college level and I enjoyed reading it.

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Risk and Reason: Safety law and the Environment.
By Cass R. Sunstein, Cambridge University Press. 2002. 346pp. ISBN 0 521 79199 5 (hard-cover $24.00 at www.bn.com)

This book is not what I expected. The "other" book I have on my shelves on the subject has 9 chapters on basic models, risk statistics, and specific quantitative analyses applied to a variety

of problems, and one final chapter on the translation of analysis to decision making. Sunstein's book has no mathematical analyses, and is devoted largely to the material in the final chapter of my other book. Those with a mathematical mind may find this disappointing, and laborious to read. On the other hand it is an education to become aware of the complications involved in applying the technical analysis to the decision making process, to the political process and to the formulation of laws. These are the aspects with which this book is mainly concerned.

In Britain in 2000 a train crashed at Hatfield, injuring dozens of passengers and killing several of them. After the crash, railway travel suddenly became "unsafe" to many people and one third of the rail travelers started using the highway instead, despite the fact that Britain's roads are ten times more dangerous than its railways. This illustrates many of the problems studied in this book, including the public over-reaction to dramatic events, the over-reaction to small risks, and the failure of public intuitions as a basis for action. It also illustrates the need for understanding and dealing with the psychology of the public mind which is an essential part of this book. The author considers cost/benefit analysis as the better but imperfect basis for policy decisions. But the analysis must be complete, taking into account the myriad of consequences of a given line of action. For example, the effort to regulate a risk should not produce other more serious risks. Such an analysis involves very difficult decisions on how the various costs and benefits can be quantified--for example, how do you put a value on human life?

The first six chapters explore the history of the treatment of risks since the inception of modern-day environmentalism in the 1970s, and the general understanding of the background problems, particularly those involving the public misconceptions of risks. The author believes that if cost/benefit balancing is done well, regulation is likely to be more sensible than it is now, but he also admits and carefully explores its limitations.

With this background, the author examines in some detail the controversial suspension by the Bush Administration of the Clinton Administration's Arsenic in Drinking Water regulation. In this case, an analysis taking into account the uncertainties accompanying the quantification of basic costs and benefits produce such a wide uncertainty in the final result, that there is no precise answer to what the optimum allowable value of the arsenic concentration should be--only a broad range of possibilities. One of the important perennial uncertainties which physicists will recognize is the presence or absence of a threshold in the concentration of arsenic versus poisonous affect (dose-response) curve. In contrast, it seems that benefits clearly surpass the costs of the Clean Air Act. Decisive or not, the cost benefit analysis is valuable in clearly "putting on the screen" all the consequences of a line of action.

The resulting complexity can be mind boggling. Indeed, at weak moments I even develop some sympathy with the EPA (Environmental Protection Agency) and its administrator over the problem they face in deciding appropriate allowable levels of contamination. And that is not all. The EPA, the NHTSA (National Highway Safety Administration), OSHA (Occupational Safety and Health Administration) etc. have their mandates from Congress. The interpretation of these mandates can result in numerous court actions. A full chapter is devoted to the legal problems and what might be expected from reviewing courts.

This leads in the final chapter to the author urging a large scale shift in the law of risk reduction away from rigid government command and control regulations towards alternative strategies which allow for some flexibility on the part of the companies involved. In part, the rationale for using these strategies is that the same risk reduction can frequently be achieved at a much lower cost, potentially saving billions of dollars. These strategies include more effective communication to the public of risk information; economic incentives like emissions trading in the area of global warming; risk reduction contracts, and free market environmentalism.

The book is heavily documented throughout with footnotes. A series of four appendices give some useful and illustrative statistics and an interesting collection of dose response curves for a variety of systems.

In conclusion this book is basically concerned with the appropriate evolution of policy with respect to risk management. The technicalities dealing with the mathematics and statistics of risk are implied but not studied as such. The book is very highly detailed making it very significant reading for those interested in policy matters. The " technician" who does not normally work in these fields may feel that the book delivers more detail than he/she wants to know, but the book will be an eye-opener to those who persevere in their reading.

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