Book Reviews

Planet Earth in Jeopardy: Environmental Consequences of Nuclear War.
Lydia Dotto. Toronto: John Wiley & Sons, 1986.
ISBN 0 471 90908 4 (paper) $12.95. 134 pp.

In 1983 the Scientific Committee on Problems of the Environment (SCOPE) initiated a study at the request of the International Council of Scientific Unions (ICSU) which resulted in a 2 volume report entitled *The Environmental Consequences of Nuclear War: I. Physical and Atmospheric Effects and II. Ecological and Agricultural Effects.* This report was published by John Wiley and Sons in 1985. Lydia Dotto, a well-known Canadian science writer, was commissioned by an international scientific committee to write an overview of the report in less technical style for the benefit of lay readers. She has succeeded admirably.

The book is factual and the author goes to some pains to point out clearly the many areas of uncertainty, the assumptions used, and the need for more knowledge on such things as smoke production and properties, fire and climate modelling, chemistry in the atmosphere, fuel loading in and adjacent to likely targets of nuclear weapons, and the impact of electromagnetic pulses on communications and electronic systems in the midst of an international crisis.

There are approximately 25,000 nuclear weapons in the arsenals of each of the U.S.A. and the U.S.S.R., with much smaller numbers, totalling in the hundreds, in the hands of China, France, and the U.K. The total world inventory amounts to about 12,000 megatons with an explosive content of approximately one million Hiroshima bombs. Various scenarios are possible for a major nuclear war, but one reasonable possibility is that approximately half the total inventory might be detonated with the other half destroyed by accurate targetting.

Separate chapters are devoted to fire, blast, and other immediate effects; smoke and dust; climatic consequences; changes in the chemistry of the atmosphere; radiation and fallout; and the impacts on biology, agriculture, ecosystems, and people. Depending on the time of year the war occurred, an average temperature drop of 15–35° C in the northern hemisphere, due to smoke and dust obscuring the sun, could lead, in a matter of months, to the death by starvation of billions of people. Since as many as 1,100 million people might have been killed in the initial nuclear attacks, the total surviving population in the world could be barely one per cent of present numbers. The infrastructure of trade and modern agriculture would have been destroyed, setting civilization back thousands of years.

The impact of direct hits by nuclear weapons on nuclear power facilities was also evaluated. The immediate (within 48 hours) additional effect on fallout would be small, perhaps an additional 10 per cent. Because reactors and spent fuel bays contain more long-life isotopes, the long-term effect could be much greater, as much as a threefold increase in total fallout.

As the Chernobyl accident demonstrated, fallout knows no national boundaries. Since a major nuclear war would most likely occur in the northern hemisphere, all the major industrial countries would be affected. Declaring oneself a nuclear-free zone would be quite ineffective protection. Whatever one's views on nuclear deterrence, a reading of this book will make it abundantly clear that a major reduction by the superpowers of their enormous stockpiles of nuclear weapons is an essential first step in lifting the spectre of world destruction. Lydia Dotto has performed a valuable service in putting across this message in clear and unemotional form. The book deserves a wide reading and given, the source of its sponsorship, it is to be hoped that this will come about within the scientific and engineering community.

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Understanding Chernobyl
The Uranium Institute, 1986. ISBN 0 946777 09 8

This booklet is made up of seven lectures presented to members of the Uranium Institute in September 1986,

with the objective of assisting Institute members who were not themselves reactor specialists to understand the Chernobyl accident and its implications for the future of the nuclear industry. An introduction to reactor physics is provided by Terence Price (Secretary General, Uranium Institute); the sequence of events at Chernobyl is described by John Gittus (UKAEA's Director of Safety and Reliability); Pierre Tanguy (Inspector General for Nuclear Safety, EdF) discusses the issues raised by Chernobyl and outlines an approach to reactor safety philosophy; John Dunster (Director, National Radiological Protection Board) describes radiation protection policy; and John Wright (Health and Safety Director, CEGB) covers the safety of gas-cooled reactors.

An inevitable problem with this kind of publication, with its diversity of contributors, is the uneveness in the technical level of the various lectures. For example, Price's 'Introduction to reactor physics' is comprehensive and detailed and would be an excellent introduction to the topic for a technically inclined senior high school student – or even a first year undergraduate. In contrast, Gittus, in 'What happened at Chernobyl' adopts an extremely simple approach, perhaps suitable for a non-technical audience of business executives. However, it could be argued that Gittus simplifies to the extent that his readers may form a misleading impression. His opening statement 'The Chernobyl reactor went wrong because it had three design deficiencies: instability, slow shutdown and inadequate automation of safety systems' surely should be preceded by the qualification that what actually brought about the accident was the deliberate violation by the operating crew of a number of operating policies and principles, rather than followed with the comment that, 'Coupled with a maloperation ... these deficiencies' led to the accident.

Pierre Tanguy's two lectures, 'The issues raised by Chernobyl' and 'Reactor safety philosophy' are first rate and would be of interest to any Canadian reader, regardless of technical background. Tanguy places an appropriate degree of emphasis on human and 'institutional' factors, drawing attention to the clear violations of operating regulations (rather than 'errors') and noting that 'At Chernobyl, starting with the superintendant of the plant down to the operator in the control room – and maybe going even higher ... there was not a proper awareness of nuclear risk.' This important point is too often and too easily obscured by detailed technical comparisons of RBMK with other reactor systems. In discussing the safety lessons of the Chernobyl accident, Tanguy issues a salutary reminder to the effect that while 'there is nothing totally new' in reactivity-induced, core disruptive accidents, 'we should not forget one issue. When we look at safety we no longer need to try to imagine new phenomena; but we must verify that already well identified risks are properly taken into account.' One area to which Tanguy could have directed somewhat more attention is that of the definition of 'nuclear safety culture,' a term which made its appearance in the INSAG report issued last year. As yet, the term has not been explicitly defined, yet it is cropping up with increasing frequency in the literature. If it is to be taken into the nuclear safety lexicon, then more rigorous attempts to arrive at an agreed definition should be made.

Tanguy's 'Reactor safety philosophy,' focussing as it does on LWR and GCR, may be of less interest to the Canadian reader – with the possible exception of his discussions of 'human redundancy' in the control room under severe accident conditions, and the use of a form of filtered air discharge system in French 900 MW PWR's to control containment pressure for the long term.

'The safety of gas cooled reactors,' by John Wright, draws attention to some of the attractive features of this kind of reactor, and perhaps lays greater emphasis than is entirely justified on the 'fundamental weakness' of the positive void coefficient in the RBMK design.

'The biological effects of radiation' (Peter Saunders) and 'Radiation protection policy' (John Dunster) are lucid and informative essays which, aimed as they are at the 'intelligent layperson,' will not be unfamiliar in content or argument to a North American reader. Dunster does comment on the actual radiological impact of the Chernobyl accident in Europe and England and has some remarks to make about the quite inappropriate interventions with food supplies made in the three months following the accident – interventions which were costly and 'made on an inadequate technical basis.'

The problem of a less-than-consistent level of technical content, combined with those problems inherent to transferring oral presentations to a written form without extensive emmendation mean that *Understanding Chernobyl* is difficult to recommend in its entirety to any specific audience. It is essentially a 'document of record.' As mentioned above, some sections (particularly those by Tanguy) are interesting reading for specialist and non-specialist alike. But the publication cannot stand alone as a guide for the non-technical person to the Chernobyl accident. For the motivated, intelligent non-specialist, the best introduction to the accident is probably still the INSAG report.

David Mosey