Book review: “Radiation and Reason” by Wade Allison

Keith Baverstock
Department of Environmental Science
University of Eastern Finland
Kuopio
Finland

Hooshang Nikjoo
Department of Radiation Physics
Karolinska Institute
Stockholm
Sweden

“Radiation and Reason” published by Wade Allison© debates whether it is reasonable to keep to the principle of exposure of public and workers to “as low as is reasonably achievable” as far as the dangers of nuclear radiation are concerned and advocates relaxing the present radiological protection standards by a factor of 1200. Professor Allison is a particle physicist at Keble College, Oxford. Prior to the publication of his book he has not, to our knowledge, published any research papers in the field of radiation protection or the biological effects of ionizing radiation. The book starts with the warning that the human race is threatened by economic instability and climate change. To this end Allison advocates the solution to climate change as switching to nuclear power and financial stability will follow. But it is ironic that the private industry in USA has shied away from investing in renewed construction of new nuclear power plants unwilling to accept the cost of insurance. Throughout the book, the author accuses the international bodies such as the ICRP and the IAEA of bias towards setting a higher safety standard than is needed, thereby making safety provision the major reason for the high cost of nuclear power. However, no analysis is offered to show how much saving will be made by lowering the safety standards.

The risks of exposure to ionising radiation have been hotly debated over decades from both ends of a wide spectrum of opinion but in our experience there have been few really extreme claims. One in the 1970s claimed that plutonium was 213,000 times more dangerous than the then current standards suggested and it was rebutted by the Medical Research Council (1975). A second is the claim made by the book under review here, namely that radiation is 1200 times less dangerous (and this is a “conservative” estimate) than the current standards imply. With a combined seventy years experience in the subject and being largely in agreement with current standards, how can we have got it so wrong?

The book divides neatly into three sections; an introduction to the physics of ionising radiation followed by an extensive section to justify, from the biological viewpoint, why radiation is so much less dangerous than the regulatory authorities say it is and finally a justification for the extension of nuclear power to offset the greater risk of climate change.

Let us say at the outset that the book is entertainingly written with an imaginative use of analogy. The problem is that not all the analogies are apt and some are truly inept, especially in the middle section. For example, Allison proposes that the human exposed to radiation events could be equated to bridge exposed to weather events. The bridge, he argues, will not suffer fatal damage as long as the severity of the weather is below a threshold and the bridge

is routinely maintained, including with a lick of paint. According to Allison we are “self-maintaining bridges” and we will only “fall over” if we receive doses of several Gy in a short time, hence the startling factor of 1200.

The first section ends with a serious error: apparently, according to Allison, due to a lack of any better ideas as to how radiation interacts with biological systems the “rule of thumb” linear no-threshold (LNT) model was introduced. This it seems is the root of all evil now propagated by the regulatory authorities. In fact, LNT is and always has been, grounded in physics (so it is the correct part of the book) and it recognises that due to the importance of cells in biology it will be the number of cells affected at low doses that will dominate biological effect, whereas at higher doses it will be the number of times a cell is hit by radiation events. Thus, up to doses where the average hit rate is 1 event per cell (typically a few mGy), the dose response will be linear. So the diagram on page 81, where a linear interpolation (labelled LNT) from zero dose to the 50% mortality point on the lethality curve for rats (7000 mSv) is shown, is a total misunderstanding of the concept.

The book’s arguments with respect to risk from ionising radiation fall on this serious fallacy and the associated bogus “bridge model” biology. The fact is that in biological systems the equivalent of one “loose nut” on a bridge, a single cell transformed to a pre-malignant state, can eventually kill the organism. Of course, if the threat of climate change is so great that it is worth acquiring, as members of the public, ~1 Sv per year (that would be between a 5 and 10% lifetime excess cancer risk per year of exposure) then we will not all be dead in a couple of months but life expectancy would be considerably reduced.

During and immediately after the WWII young women were employed to luminise aircraft instruments with radium-226 containing paint. As well as alpha particles radium emits energetic gamma-rays and these women received whole-body doses of the order of 0.2Sv/year. An occupational physician noted reduced blood counts in these women and measures were taken to reduce the dose rate. In the 1970s an excess of breast cancer was observed. (Baverstock et al., 1981)

In our view the book contains material which is scientifically flawed and therefore highly misleading: the eminence of the source from whence it comes is sadly no guarantee as to its quality. As the adverse effects of radiation do not manifest for a long time, and we still do not fully understand the risks of exposures to low doses of radiation we believe it is wise to keep to the principle of “as low as reasonably achievable” in respect of exposure to ionising radiation.

Reference

Baverstock, K. F., Papworth, D. and Vennart, J. (1981) Risks of radiation at low dose rates. *Lancet* **1,** 430-3.
Medical Research Council (1975) The Toxicity of Plutonium. HMSO.

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