

Editorial IJRB Special Issue “Environmental Radiobiology”.

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The development and implementation of a universal, evidence- based radiation protection policy is one of the greatest challenges that we face. While different contexts and unique situations make the implementation of a global policy complex, the idea that there might be a commonly accepted set of principles around which regulation, legislation and monitoring might be built has long been accepted as desirable, if not even essential. Recent developments in radiation protection and in radiobiology have started to suggest that the current, anthropocentric approach may underestimate the impact of radiation on the environment. This through ecosystem perturbations may prove deleterious to humans as well as other species in a way not captured by assessing human cancer risk as the main endpoint under consideration.

Our evolving understanding of other human endpoints such as cardiovascular disease and the impact of multiple stressors such as pesticides and heavy metals have started to broaden our concept of an endpoint for human radiation protection and in doing so start to draw in the importance of the non-radioactive anthropogenic and natural environments. The questions raised by considering non-medical radiation protection as primarily an issue of environmental protection, stimulated a recent discussion and accompanying paper in IJRB (Mothersill et al. 2020) and were the stimulus for this special issue.

Climate change and the terrible recent events in Ukraine, have focused world attention on the vulnerability of the environment and the accompanying risk to human health and safety. Logically this brings the need to reduce dependence on oil and gas into sharp focus and emphasizes the need to work to secure energy supplies which are carbon neutral. Among the alternatives being discussed is the expansion of national nuclear programmes and the proliferation of small modular nuclear reactors (SMR) to serve local needs. This option is particularly favored in remote areas where transportation of energy is difficult and expensive. Implicit in this option is the fact that remote areas are generally environmentally important e.g., wetlands, forests or wilderness where siting an SMR could compromise the ecosystem and bring with it a risk of radiation release into a pristine environment.

Unfortunately while we have considerable knowledge about impacts of medium to high doses of radiation on humans due to its use in radiotherapy and medical diagnostics, we have little information about impacts on non-humans and virtually no information on impacts on ecosystems. In fact we do not even yet know how to assess damage at the ecosystem level.

In this special issue papers cover the resulting environmental and human impacts from the Fukushima TEPCO

reactor disaster, Chalk River leakage incident in 2008, and the impact of low level radiation exposure on the marine environment, and invertebrate species. The consequences of low level exposure for children and transgenerational effects as well as those that influence evolution and adaptation are of critical importance if the consequences of exposure might be seen two three or more generations afterwards. This changes completely the concept of when to measure radiation effects and when to set

endpoints. Cataractogenesis, both in the natural and the industrial environment also provide instances where the mechanisms of radiation action can be investigated in a defined timeframe. We include several papers on the implications of our understanding, or in many cases the realization of our lack of understanding, for public policy and we look to the future where we can fill in some of these gaps in our knowledge from experiment and epidemiology and come to a better understanding of the risks of ionizing and non-ionizing radiations. Whether these challenges result in a mitigation of our concerns, or a wakeup call to consider the wisdom of increasing our reliance on nuclear energy, the consequences for humanity are profound and it is only by questioning our current wisdom in the light of evidence that we can understand where the sustainable boundaries of our activities on the planet might reasonably lie.

This special issue is therefore critically important at this time, to start the process of documenting impacts of radiation on animals, plants and ecosystems. We hope it will serve as a state of the art collection of papers in this field. We hope that it will stimulate further research and interest in environmental impacts of radiation as we move to alternative sources of electricity generation.

Knowledge is power and without objective and unbiased knowledge accumulation, we cannot make informed decisions about risks and benefits of energy alternatives.

Reference

Mothersill CE, Oughton DH, Schofield PN, Abend M, Adam- Guillermin C, Ariyoshi K, Beresford NA, Bonisoli-Alquati A, Cohen J, Dubrova Y, et al. 2020. From tangled banks to toxic bunnies; a reflection on the issues involved in developing an ecosystem approach for environmental radiation protection. *Int J Radiat Biol.* Q1 1–16. doi:10.1080/09553002.2020.1793022