IS NON-HUMAN SPECIES RADIOSENSIVITY IN THE LAB A GOOD INDICATOR OF RADIOSENSITIVITY IN THE WILD?

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Abstract

Ecological risk assessment has globally become the basis for environmental decision-making within government and industry for chemical substances. Regarding radioactive substances, recently revised International[1] and European[2] Basic Safety Standards are pushing the development and/or the application of member state policy on environmental regulation in the field of radiological protection. Within this framework, existing derived effect benchmarks for ionising radiation and non-human species need to be more challenged in order to reinforce their credibility when used as levels of exposure considered to be safe for the environment. Actually, the derivation of such benchmarks has mainly relied on laboratory studies from a limited number of species[3]. Moreover a first comparison with field data from the Chernobyl Exclusion Zone evidenced a significant discrepancy between laboratory and field data on wildlife chronically exposed to ionising radiation[4]. This was done by comparing the range of variation of radiosensitivity of species from the Chernobyl Exclusion Zone with the statistical distribution of sensitivity established for terrestrial species chronically exposed to purely gamma external irradiation. The conclusion evidenced an apparent higher sensitivity of wildlife in the Chernobyl Exclusion Zone suggesting that organisms in their natural environmental were more sensitive to radiation (by *ca.* a factor of 8)[4]. This comparison highlighted the lack of mechanistic understanding and the potential confusion coming from sampling strategies in the field, including biased dosimetry and inadequate design to deal properly with confounding factors. An additional way to challenge benchmarks is to improve the quality/quantity of radiotoxicity data constituting the basis for a statistically-based comparison. This will be the major focus of this talk where we will demonstrate how to make the comparison more robust (i) by extending the knowledge making use of acute radiotoxicity data, (ii) by analysing the discrepancy between lab and field at the taxonomic level rather than at the ecosystem level, (iii) by identifying environmental factors modifying radiological dose-effect relationship in the field. Illustrations will be chosen for each item, the two first being in progress in the framework of an ICRP task group[5], the third one dealing with a recent meta-analysis on radiation effects on bird abundance in Fukushima[6].

References

[1] IAEA (2014). Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards. General Safety Requirements Part 3. No. GSR Part 3. International Atomic Energy Agency, Vienna, Austria; [2] COUNCIL DIRECTIVE 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom; [3] Andersson et al. (2009). Protection of the environment from ionising radiation in a regulatory context (protect): proposed numerical benchmark values. J. Environ. Radioact., 100, 1100-1108; [4] Garnier-Laplace et al. (2013) Are radiosensitivity data derived from natural field conditions consistent with data from controlled exposures? A case study of Chernobyl wildlife chronically exposed to low dose rates. Journal of Environmental Radioactivity 121: 12-21 ; [5] Task Group 99, ICRP Committee 5, established in 2015, proposing a work programme to gather and update basic data and guidance for the best use and practices of RAPs in support of the application of the system of radiological protection of the environment in planned, emergency and existing exposure situations; [6] Garnier-Laplace et al. (2015). Radiological dose reconstruction for birds reconciles outcomes of Fukushima with knowledge of dose-effect relationships. Sci. Rep. 5, art. no. 16594.