HEALTH PHYSICS SOCIETY

Specialists in Radiation Safety

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To Ana María Bomben, IRPA Executive Officer

Subject: Research suggestions to IRPA for the ICRP Workshop on the "Research to support the application/implementation of the System of Radiological Protection¨

As an Associate Society of IRPA, the Health Physics Society[1] (HPS) appreciates the opportunity to provide suggestions to IRPA for the ICRP Workshop on the "Research to support the application/implementation of the System of Radiological Protection" to be held on October 10, 2022. We sought input from members within our Society through our various Committees and Sections. I also would like to refer IRPA to our previous comments on the IRPA Statement on 'Reasonableness' in Optimisation of Protection.[2, 3]

After reviewing "Areas of research to support the system of radiological protection" (Laurier et al., 2021), we wish to provide additional suggestions to supplement those mentioned in this article. Two over-arching themes are (1) that the radiation protection (RP) establishment (ICRP, IRPA, UNSCEAR, NCRP, etc.) should acknowledge the potential beneficial effects from low-dose exposures (also called hormesis) and (2) the RP establishment should conduct research to produce practical guidance that can be easily implemented in a regulatory framework, especially for environmental cleanup efforts.

Define Low-Dose Rate: The RP establishment should define and reach consensus on defining this term that is applicable to real-world scenarios. For example, a low dose rate arbitrarily defined as less than 0.01 mGy per hour, represents 50 to 100 times natural background levels (excluding radon). The recent National Academy of Sciences report "Leveraging Advances in Modern Science to Revitalize Low-Dose Radiation Research in the United States"[4] defined low dose-rate as 5 mGy per hour. This dose rate is five times the definition for a high radiation area

[1] The HPS is a nonprofit scientific professional organization whose mission is excellence in the science and practice of radiation safety. Since its formation in 1956, the Society has represented the largest radiation safety society in the world, with a membership that includes scientists, safety professionals, physicists, engineers, attorneys, and other professionals from academia, industry, medical institutions, state and federal government, the national laboratories, the military, and other organizations. Society activities include encouraging research in radiation science, developing standards, and disseminating radiation safety information. Society members are involved in understanding, evaluating, and controlling the potential risks from radiation relative to the benefits.
[2] https://hps.org/govtrelations/documents/hps_irpa_response_to_r_in_alara_9-11-2020.pdf
[3] https://hps.org/govtrelations/documents/hps_reasonableness_comments_to_IRPA_FINAL.pdf
[4] https://nap.nationalacademies.org/download/26434#

(1 mGy per hour) within the Unite States and is 250 to 500 times natural background (excluding radon). A value of 0.01 mGy per hour is more likely to be encountered following a large-scale radiological or nuclear incident that impacts enormous land space and creating a residual (long-term) low-level exposure to humans, non-human species, and other plant species (e.g., Fukushima). It is these environments and exposure scenarios that research is most needed to determine if a real risk is present in this scenario.

Research health effects below 1 mSy per year: Research is needed to practically implement environmental cleanup guidance which is currently based on the Linear no-threshold (LNT) model and As Low As Reasonably Achievable (ALARA) or Precautionary Principle philosophies. A more biologically-based protection philosophy should be considered. Research to understand health effects below 1 mSv per year may demonstrate that there is a threshold below which further cleanup activities produces no benefit to society. It may even demonstrate a beneficial health effect from low dose radiation. ICRP's low level exposure range between 1 mS/yr to 20 mSv/yr is reasonable for environmental applications. If environmental cleanup efforts cease at 1 mSv per year this could result in profound economic and societal benefits (e.g., UK cleanup guidance following the murder of Alexander Litvinenko using Polonium-210). HPS notes that this approach conflicts with the current US cleanup policies which are based on a literal interpretation of the LNT risk-model and result in enormous costs to society with no tangible clear benefits to society.

The unintended consequences of the Fukushima response cast doubt on the "prudent" application of radiation protection based on the LNT risk-model. Research should be pursued to develop a RP system with a *de minimis* dose threshold (e.g. 1 mSv/y). Further, what kind of rational cost/benefit analysis can be conducted to compare these options?

Cost-Benefits Analyses: The Committee from recent National Academy of Sciences (NAS) report was unable to quantify the economic impacts associated with a low-dose research program because "comprehensive estimates of overall costs to comply with current radiation standards were unavailable." This is an area where the RP establishment could do more research. The NAS report also states any changes to the current estimates will depend on new information on "adverse health effects" that will be generated by the U.S. low-dose radiation research program. HPS notes that low dose (<1 mS/y) or low dose rate (<0.01 mGy/h) research findings may also demonstrate a "threshold response" or even a "beneficial health effect", both of which would result in more practical cleanup guidelines. It is imperative that research efforts allow for the possibility that adverse health effects may not be caused by low dose radiation. The focus needs to be on learning about any health effects, be they adverse, non-existent/detectable, or beneficial.

Effects on the eye and setting protection factors: From an operational health physics perspective, more research is needed on the effects of radiation on the eye; specifically, cataract formation. The RP establishments should consider developing standards for ionizing radiation protection factors for protective eye wear.

Finally, I want to thank IRPA and the RP establishment for the opportunity to share these research needs during the 2022 ICRP workshop. I respectfully request that IRPA share the link on the recent HPS video documentary on the historical evolution of the linear no-threshold model: https://hps.org/hpspublications/historylnt/index.html or mention that it can be found by Googling "HPS History of the LNT". To understand science, one must know its history. These videos are part of the HPS contribution to the ICRP efforts in reviewing the entire system of radiation protection.

Warm Regards,

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Reference:

Laurier, D., Ruhm, W., Paquet, F., Applegate, K., Cool, D., Clement, C., & International Commission on Radiological, P. (2021). Areas of research to support the system of radiological protection. *Radiat Environ Biophys, 60*(4), 519-530. doi:10.1007/s00411-021-00947-1