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NUCLEAR REGULATORY COMMISSION
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October 8, 2021

Ourania Kosti, Ph.D.
National Academies of Sciences,
Engineering, and Medicine
Nuclear and Radiation Studies Board
500 Fifth Street NW
Washington, DC 20001

SUBJECT: QUESTIONS ON DEVELOPING A LONG-TERM STRATEGY FOR
LOW-DOSE RADIATION RESEARCH IN THE UNITED STATES: STAFF
REPLY

Dear Dr. Kosti:

As requested, I am providing responses to several questions posed by the Nuclear and Radiation Studies Board on the new congressionally requested study¹, "Developing a Long-Term Strategy for Low-Dose Radiation Research in the United States."

1. *Please describe the process your agency follows to translate health impacts due to radiation exposure into monetary units. What are the main challenges in this process?*

The NRC uses a monetary value per averted collective dose conversion factor in the cost-benefit analyses to evaluate potential changes in health risks associated with radiological exposure. This "dollar per person-rem" conversion factor is specified in NUREG-1530 (1995), "Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy" (Agencywide Documents Access and Management System (ADAMS) Accession No. [ML063470485](#)), at \$2,000. This number results from the multiplication of the value of a statistical life (VSL) (\$3 million) by a risk coefficient for stochastic health effects (7.3×10^{-4} per person-rem). The VSL is an economic value used in the cost-benefit analysis to approximate society's willingness-to-pay for small reductions in mortality risks. The risk coefficient applied in NUREG-1530 is the total health detriment coefficient from International Commission on Radiological Protection Publication (ICRP) 60. This coefficient considers fatal and nonfatal cancers, and hereditary effects by capturing both the probability of occurrence of the harmful effect and a judgment of the severity of the effect.

The NRC staff is in the process of updating NUREG-1530 and reevaluating the use of the ICRP's risk coefficient. In the draft revision to NUREG-1530, Revision 1 (ADAMS Accession No. [ML16147A393](#)), the NRC staff is proposing to adopt the U.S. Environmental Protection Agency's cancer mortality risk coefficient, which is based on the 2006 National Academy of Sciences Biological Effects of Ionizing Radiation VII report, "Health Risks From Exposure to Low Levels of Ionizing Radiation," specific to the U.S. population. Adopting this value would

¹ See <https://www.nationalacademies.org/our-work/developing-a-long-term-strategy-for-low-dose-radiation-research-in-the-united-states>.

necessitate that health impacts other than cancer deaths, such as cancer morbidity and heritable effects, be quantified and monetized separately.

While the monetary valuation of changes in acute fatality risks has been well-studied and a singular metric defined as the VSL, the valuation of chronic nonfatal illnesses has proven challenging given the infinite number of health states, each with their own illness profile and impact on quality of life. A recent literature review discussed in the NRC's Valuing Morbidity White Paper (ADAMS Accession No. [ML20058C225](#)) found significant variation across Federal agencies in the approach to valuing nonfatal health risks for cost-benefit analysis. Additionally, while the VSL typically is derived from labor market data of wage-risk tradeoffs, these estimates are often applied to all risks of death, regardless of the cause of death or the risk context. Some studies have indicated that a cancer premium should be applied to VSL for those policies that attempt to reduce cancer mortality risks. Thus, performing an uncertainty analysis using these values can be challenging.

- 2. What health impacts, other than death from cancer due to radiation exposure, are considered in economic analyses by your agency? What are some challenges with considering impacts other than death from cancer?*

In addition to cancer mortality, the NRC considers morbidity impacts from radiogenic cancer. Unlike mortality effects, which are defined by a single endpoint (i.e., death), morbidity effects can vary by the extent of severity, duration, and the perceived dread associated with symptoms and treatment. There is a scarcity of willingness-to-pay estimates for many chronic illnesses, including cancer. Furthermore, there is no consensus among Federal agencies or academia on valuing nonfatal health risks in the absence of existing estimates, which makes the task of monetizing morbidity risks challenging. The NRC staff is considering developing monetary values for nonfatal cancer risks using proxy approaches (such as monetized quality-adjusted life years.)

- 3. Please provide examples of radiation research topics that could better inform cost-benefit or cost effectiveness analyses in radiation protection.*

The NRC does not have any current radiation research that could better inform cost-benefit or cost effectiveness analyses in radiation protection. Given the limited research estimating society's willingness-to-pay for radiogenic cancer risk reductions, particularly cancer morbidity, there is the potential for large uncertainties surrounding the monetary values placed on radiation risk reductions in regulatory analyses. Future cost-benefit analyses involving nuclear safety and radiation protection measures would benefit from research efforts focused on directly eliciting individual willingness-to-pay for cancer morbidity risk reductions.

- 4. Please describe radiation protection guidance that in your view/your agency's view is in need of revised/improved economic analysis. What are the specific issues that are not currently fully addressed?*

The NRC has not identified any agency radiation protection guidance that is in need of revised or improved economic analysis.

- 5. What is the process for incorporating revised economic analysis in radiation protection guidance?*

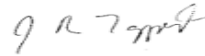
The NRC staff performs a regulatory analysis to inform any decision regarding the need to create or revise the agency's radiation protection guidance.

6. *Please provide any other information not requested by the Committee that you see is relevant with its task.*

Given the limited research estimating society's willingness-to-pay for radiogenic cancer risk reductions, particularly cancer morbidity, there is the potential for large uncertainties surrounding the monetary values placed on radiation risk reductions in regulatory analyses. Future cost-benefit analyses involving nuclear safety and radiation protection measures would benefit from research efforts focused on directly eliciting individual willingness-to-pay for cancer morbidity risk reductions.

The NRC is grateful for the opportunity to provide input to the Board. If you have any questions regarding this correspondence, please contact Pamela Noto of the Office of Nuclear Material Safety and Safeguards at (301) 415-6795 or Pamela.Noto@nrc.gov.

Sincerely,



Signed by Tappert, John
on 10/08/21

John R. Tappert, Director
Division of Rulemaking, Environmental,
and Financial Support
Office of Nuclear Material Safety
and Safeguards

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