



Radiation and Public Health Project

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U.S. Nuclear Regulatory Commission

By email - ed.Miller@nrc.gov and david.Garmon-Candelaria@nrc.gov

Re: Written comment on Executive Order 14300 Section 5(b) on radiation dose-response

July 23, 2025

Dear Mr. Miller and Mr. Garmon-Candelaria:

Please accept the following written comments on Executive Order 14300 Section 5(b), and consider them in any future discussion and policy decisions by the Nuclear Regulatory Commission (NRC) about models used for the association of radiation dose and health risk.

I am an epidemiologist, and the director of a non-profit research and education organization, the Radiation and Public Health Project. Since the late 1980s, RPHP researchers have conducted numerous studies on the association between exposure to nuclear power reactor emissions and risk of cancer and other disorders in local populations. I am author or co-author of 43 peer-reviewed journal articles, along with numerous other reports.

For decades, the NRC has consistently supported the linear no-threshold (LNT) model as a basis for the association between exposure and health risk. This model is accepted by a large majority of scientists and public health professionals, and is based on substantial research published in the peer-reviewed literature.

A summary of evidence supporting the LNT model follows.

Studies of Pelvic X-rays to Pregnant Women in the mid-1950s. In 1956, a team led by Oxford University physician Alice Stewart found a single diagnostic pelvic X-ray to a pregnant woman would nearly double the risk of the child dying of cancer or leukemia by age ten (1). Prior to that time, the small amount of radiation generated by these X-rays were considered too low to pose any harm to health. Stewart's findings were challenged, but were upheld in larger studies in the United Kingdom (2) and the United States (3). Eventually, the practice of pelvic X-rays to pregnant women for diagnostic purposes was discontinued in favor of ultrasound, which does not generate radiation.

The findings of Stewart and colleagues are still considered to be among the earliest to recognize that even very small doses of radioactivity can be harmful.

BEIR V, 1990. A 17-member blue-ribbon panel, chaired by former National Cancer Institute director Dr. Arthur Upton, published a review of health effects of low levels of ionizing radiation in 1990. The panel, known as the Committee on the Biological Effects of Ionizing Radiation (BEIR V), included over 900 references from the professional

literature and other official reports, concluding that relatively new data did not “contradict the hypothesis, at least with respect to cancer induction and hereditary genetic effects, that the frequency of such effects increases with low-level radiation as a linear, non-threshold function of the dose.” (4) The Committee based its conclusions on consistent findings among various types of radiation exposure.

BEIR VII, 2005. In 2005, the BEIR committee issued another report on health risk from low-level radiation, employing hundreds of additional references published since the 1990 report. The report, known as BEIR VII, supported prior risk estimates for the risk low-dose radiation exposure posed to risk of cancer and leukemia, which bolstered confidence in earlier estimates (5).

Studies After BEIR VII. Studies that assess the dose-response relationship link between radiation and cancer continued to appear in the medical literature after the BEIR VII report. One systematic review published in 2020 included 26 studies published since BEIR VII that included 91,000 persons with solid cancers and 13,000 with leukemias, each of which had an estimated radiation dose. The review documented excess relative risk at 100 milligrays (mGy) – a low dose – in 16 of 22 solid cancer studies and 17 of 20 leukemia studies, upholding the LNT dose-response model (6).

Example of Most Recent Study. A 2023 journal article on risk of dying of solid cancer among 309,932 workers at nuclear plants in France, the United Kingdom, and the United States, each followed for an average of 35 years, was one of the largest of its kind. Of 28,089 of these workers who died of solid cancers, the study found a higher excess per-dose risk of cancer death among workers exposed to occupational doses well below the exposures to survivors of the Hiroshima and Nagasaki atomic bombs (7) – suggesting the LNT model may underestimate effects of protracted low radiation doses.

The studies mentioned above represent the consensus of numerous researchers studying the radiation-health risk association from various nations, including the U.S., over decades. While future studies should be conducted, the current body of knowledge represents solid support for the LNT model. Any reconsideration by the NRC should be evidence-based, to offer maximum safety and health guidelines affecting those exposed to radiation from nuclear power reactors.

Please let me know if I can provide further information.

Sincerely yours,

A handwritten signature in black ink that reads "Joseph Mangano". The signature is written in a cursive, flowing style.

Joseph Mangano MPH MBA

REFERENCES

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7. Richardson DB, Leuraud K, Laurier D, et al. Cancer mortality after low dose exposure to ionising radiation in workers in France, the United Kingdom, and the United States (INWORKS): cohort study. *BMJ*. 2023;382:e074520.