

To: Rocky Flats Stewardship Council  
From: LeRoy Moore  
Date: January 22, 1019

RE: Effects of Low-Dose Exposure to Ionizing Radiation

David Abelson recently circulated this question: “Do Low Doses of Ionizing Radiation Increase Lifespans?” The question was linked to a Japanese study claiming that low doses of ionizing radiation are beneficial, not harmful. This is an old idea. In the 1980s a Rocky Flats worker who was a member of the Citizens Advisory Board said a little radiation is good for you. He called this view “hormesis.”

After production ended at Rocky Flats, New Mexico Senator Pete Dominici pushed DOE to relax exposure standards, because it would reduce the cost of cleanup at Rocky Flats and other sites. I followed his arguments closely, even attended a week-long conference in Washington. I soon published an article in the *Bulletin of the Atomic Scientists* on this topic (on line at [http://docs.wixstatic.com/ugd/cff93e\\_0d1d35fb8d8140698e530f1095352eb3.pdf](http://docs.wixstatic.com/ugd/cff93e_0d1d35fb8d8140698e530f1095352eb3.pdf))

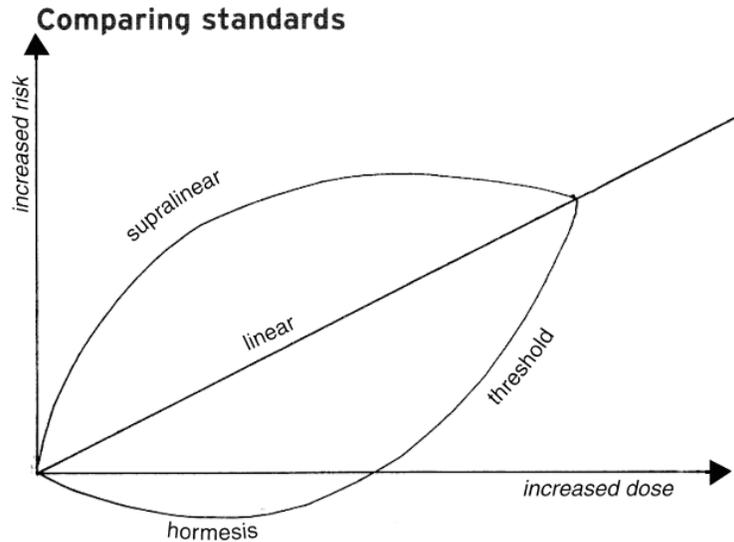
Soon I was invited to join two committees of the National Council on Radiation Protection and Measurements (NCRP), the principal U.S. organization studying radiation health effects and recommending exposure standards. Though these standards are often called “standards for permissible exposure,” permission has never been requested from or given by the exposed. In 2004 two colleagues and I made a presentation before the NCRP annual meeting. We urged them to include affected parties in studying radiation health effects and setting exposure standards. Our appeal was published in *Health Physics*,<sup>1</sup> but it was rejected by the NCRP . I had worked with them for six years, 1999-2004

During the Manhattan Project no radiation exposure standards existed. In 1943 Karl Z. Morgan, known as “the father of health physics,” was assigned the task of finding out how much ionizing radiation exposure nuclear weapons workers could endure without harming their health. A laboratory at Oak Ridge was his headquarters. . He and those he was working with had, in his words, “a serious misconception, in that we adhered universally at that time to the so-called ‘threshold hypothesis,’ meaning that if a dose were low enough, cell repair would take place . . . and there would be no resultant damage. In other words, we believed there was a safe level of radiation.” By 1949, however, “the majority of us realized that there really wasn’t a so-called safe level of exposure.”<sup>2</sup> He and his colleagues rejected the threshold model in favor of the “linear no-threshold” (LNT) hypothesis.

Once the NCRP began to propose exposure standards, the LNT approach was the orthodoxy of the nuclear establishment nationally and internationally. Morgan said that with the LNT model “you can predict the amount of cancers you will get from a given amount of radiation – and it doesn’t matter whether you get the radiation over a short time, in high doses, or over a longer time in smaller doses.”

Morgan eventually rejected the LNT model for the more stringent “supralinear” approach, because it “fits the data more appropriately.” In words that directly refute the hormesis of the Japanese study, he said that “down at the low doses you actually get more cancers per person-rem than you do at the high doses. . . . [D]amage per unit dose is greater at these low levels. And that’s true in part because the high levels will more often kill cells outright, whereas low levels of exposure tend to injure cells rather than kill them and it is the surviving injured cells that are cause for concern.”

“If it can be established that the damage per unit dose at very low levels is greater than at high levels, there’s no question that the effects of fallout, the effects of handling radioactive material, and the effects of even a small medical exposure will be much more severe than had been anticipated.” Morgan did not stand alone. His views were shared by Thomas Mancuso and Ira Sternglass of Pittsburgh, Alice Stewart and George Kneale in England, “and maybe fifty or so other people.”<sup>3</sup>



Conclusion: Approaches to setting standards for exposure to radiation. For the linear, risk increases as dose increases. The supralinear means that harm at low doses increases more rapidly than the dose itself. Both threshold and hormesis advocates believe no harm occurs below a certain threshold, while hormesis holds that exposure below the threshold is beneficial. Only the supralinear provides maximum protection for any exposure.

## Notes

<sup>1</sup> Lisa Ledwidge, LeRoy Moore and Lisa Crawford, "Stakeholder Perspectives on Radiation Protection," *Health Physics*, vol. 87, no. 3 (Sept. 2004).

<sup>2</sup> Morgan, in Robert Del Tredici, *At Work in the Fields of the Bomb* (New York: Harper & Row, 1987), p. 132.

<sup>3</sup> *Ibid.*, p. 133.