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Is a Little Dose of Radiation So Bad?

A new initiative aims to change the scientific stance that any amount of radiation increases someone's cancer risk

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Nuclear radiation is dangerous. It can cause cancer, birth defects and (in the sci-fi-movie world) 50-foot-tall humans and man-eating insects the size of buses.

Such a dark view of radiation has shaped public fears, and for decades it has been part of the foundation of nuclear policies. It has been accepted by an alphabet soup of federal agencies as well as national and international scientific bodies. It has affected how old atomic-weapons sites are cleaned up, nuclear power plants operated and radiation used in medicine.

The scientific basis for this view is known as the linear no-threshold model, or LNT, which holds that any amount of radiation increases someone's cancer risk, with the danger rising along with the dose.

But Carol Marcus scoffs at the LNT model. As science, it's "baloney," she said, essentially in the same category as "the Earth is flat." The white-haired, 77-year-old professor of nuclear medicine at the University of California, Los Angeles, with both an M.D. and Ph.D., is on a campaign to change the way America treats radiation.

In a pending petition, she is asking the Nuclear Regulatory Commission to abandon the LNT model, which her filing, quoting another critic, calls "the greatest scientific scandal of the 20th century." Two similar petitions, signed by about two dozen academics and others, are also under NRC review.

Dr. Marcus advocates an approach that holds that low radiation doses aren't harmful and could even benefit people's health—a phenomenon known as "hormesis," possibly reducing cancer rates by stimulating the body's protective systems. Among other things, she wants the NRC to raise by 50-fold its allowable annual radiation dose to the public.

A typical NRC rule-making petition attracts fewer than two dozen public comments, said an agency spokeswoman. A few draw up to about 200. More than 600 comments have come in on the LNT matter, the most ever. An NRC staff recommendation on the petitions isn't expected until next year.

One comment came from the U.S. Environmental Protection Agency, an LNT adherent. Radiation's link to cancer is "particularly strong," it said, and warned against "basing radiation protection on poorly supported and highly speculative proposals."

Most of the comments are against her initiative, said Dr. Marcus. At least, she said, her petition is intended "to get this ball rolling" and force regulators to deal with evidence she believes contradicts the LNT model.

In a sense, LNT critics are asking the NRC to turn back the clock to a time when officials believed that below a certain level, known as the "tolerance dose," radiation wasn't harmful. By 1960, however, the Federal Radiation Council wrote of "an increasing reluctance" among scientists to embrace exposure standards "on the basis of the existence of a threshold for radiation damage."

By the 1970s, the LNT model was rising to the fore.

LNT supporters and critics say that large bodies of scientific evidence support their respective positions. They debate the biologic research regarding damage done to cells by radiation and the body's ability to repair such injuries. Sometimes, the two sides point to the same research to bolster their arguments.

The dispute largely involves annual radiation exposures below 10 rem, or 10,000 millirems. A rem is a measure of radiation absorbed by a person.

The average American gets about 300 millirems a year from background sources, such as the sun. A medical procedure can add anywhere from a few millirems for a chest X-ray to more than 1,000 for certain CT scans or other procedures. A cross-country airplane flight provides about 5 millirems of extra solar radiation. Under the LNT model, even one millirem would raise someone's cancer risk by a small amount.

As a precaution, regulators try to limit the amount of extra radiation the public gets from nuclear activities. The NRC requires its licensees, such as nuclear power plants, to ensure that no member of the public gets more than an additional 100 millirems a year from the facility's operations.

In her petition, Dr. Marcus said that the public-exposure level could safely be raised to the same limit as for nuclear-industry workers, currently 5,000 millirems a year.

Moving from the LNT model could greatly reduce the costs of cleaning up contaminated sites, said Edward Calabrese, a toxicology professor at the University of Massachusetts in Amherst. He has written that in the 1940s and 1950s, an influential group of scientists pushed the LNT model using actions that were "ideologically driven and deliberately and deceptively misleading"—a position that others dispute.

A more benign view of radiation, said Dr. Marcus, would have helped avoid what she believes was the unnecessary evacuation in 2011 of tens of thousands of people in Japan after the Fukushima nuclear complex, damaged by an earthquake and tsunami, released radiation.

Jan Beyea, a physicist who served on a National Academy of Sciences panel that studied the accident, defended the prudence of the evacuation given the circumstances but added that "the social and mental distress caused by the fear of radiation is probably the biggest public health effect from these releases." Dr. Beyea, an LNT supporter, estimated that the radiation could cause about 500 cancer cases over the next 50 years. However, he said, the stress and chaotic evacuation conditions contributed to the deaths of several hundred elderly people.

In the U.S., 36% of respondents in a [2013 Rasmussen poll](#) felt that it was at least somewhat likely that Fukushima-related radiation had done significant harm to this country—despite federal assurances to the contrary.

Radiation fears also crop up in medicine. A report earlier this year by researchers from Memorial Sloan Kettering Cancer Center and Hofstra University found that of some 3,500 people surveyed, nearly two-thirds expressed some level of concern about getting radiation from medical imaging procedures, such as CT scans.

Congress could jump into the radiation debate. The House has passed a bill by Rep. Randy Hultgren, an Illinois Republican, to push further research into the effects of low-dose radiation. The bill is pending in the Senate.

In a statement, Rep. Hultgren said the official thinking on radiation "is akin to saying that jumping down one step in a flight of stairs is harmful to your health because we already know the harm caused by jumping down a full flight of stairs." However, he added, the LNT approach "shouldn't be changed until we know more."



A worker measured radiation in the air at Japan's Fukushima Daiichi nuclear power plant, July 9, 2014. *PHOTO: BLOOMBERG NEWS*