

Fukushima and the Misunderstood Effects of Radiation

September 23, 2013



JERRY M. CUTTLER, D.SC.

Dr. Cuttler's 50-year career in research into nuclear sciences and engineering of many Canadian and... (read full bio)



More than two years have passed since a major earthquake and devastating tsunami damaged the Fukushima Daiichi nuclear power plant, and still not a single case of radiation illness or death occurred as a result. How many people in the United States are aware of this? The answer is very few, as the media failed to follow up their breathless warnings of nuclear doom and gloom with the reassuring facts.

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Precautionary Deaths

Approximately 160,000 people evacuated the area around the Fukushima nuclear power plant shortly after it was damaged by the March 11, 2011 earthquake and tsunami. An evacuation order forced 70,000 people to leave the area, while an additional 90,000 left voluntarily and returned soon afterward. The 70,000 forced evacuees are now just beginning to return to their homes.

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Approximately 1,600 people died in the Fukushima evacuation process. This is more people than died in the Fukushima area from the earthquake and tsunami. The lesson learned is this "precautionary" evacuation action, taken in response to hypothetical but minimal health risks, was more harmful than the asserted risks themselves.

Closing the Books on Fukushima

Despite the breathless media reports of radiation threats issued in the immediate wake of the earthquake and tsunami – and still repeated to this day – United Nations health experts have closed the books on any asserted risks due to the nuclear power plant damage. The United Nations Scientific Committee on the

Effects of Atomic Radiation finally issued a press release on May 31, 2013 stating, "Radiation exposure following the nuclear accident at Fukushima-Daiichi did not cause any immediate health effects. It is unlikely to be able to attribute any health effects in the

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future among the general public and the vast majority of workers" (UNSCEAR 2013).

UNSCEAR explained, "To date, there have been no health effects attributed to radiation exposure observed among workers, the people with the highest radiation exposures" (UNSCEAR 2012a, Chapter IIB, Section 9(a)).

Hiding Radiation Benefits

A previous UNSCEAR report (2012b) reviews the mechanisms of radiation and highlights major advances in the field. The executive summary states "that understanding of the mechanisms of so-called non-targeted and delayed effects is improving and that there is some evidence for differential responses in gene and protein expression for high- and low-dose radiation, but there is a lack of consistency and coherence among reports. There is as yet no indication of a causal association of those phenomena with radiation-related disease. With regard to the immune response and inflammatory reactions, there is a clearer association with disease, but there is no consensus on the impact of radiation exposure, particularly at low doses on those physiological processes."

How can there be so much asserted uncertainty about the effects of low radiation that a more positive statement cannot be made about the observed lack of long-term effects? All living organisms have been in a sea of radiation since their first appearance, and radiation has been affecting their genes all of this time. Approximately 15,000 gamma rays or particles hit the average person every second. And after more than 115 years of extensive health effect studies, we know more about ionizing radiation than we do about any other stressor.

Lauriston Taylor, a founder of the International Commission on Radiological Protection (ICRP) observed in 1980:

"No one has been identifiably injured by radiation while working within the first numerical standards (0.2 r/day) set by the NCRP and then the ICRP in 1934."

Taylor added:

"An equally mischievous use of the numbers game is that of calculating the number of people who will die as a result of having been subjected to diagnostic X-ray procedures. An example of such calculations are those based on a literal application of the linear, non-threshold (LNT), dose-effect relationship, treating the concept as a fact rather than a theory. ... These are deeply immoral uses of our scientific knowledge." (Taylor 1980)

We know all organisms have very powerful protection systems that prevent, repair, remove and replace damaged cells and tissues. Scientists have known for more than 25 years that human DNA is not as stable as we assume. More than 0.1 double-strand breaks (DSBs) naturally occur on average in each cell per day. Background radiation causes merely an average of 1 DSB per 10,000 cells per day, which is about 1,000 times less than naturally occurring DSBs.

Scientists also know radiation up-regulates adaptive protection systems, more than 150 genes, at high and low doses. Some are active only in low-dose stress responses, while others are modulated only after high doses (Feinendegen et al. 2012). These adaptive protection systems cannot distinguish between natural and radiation-induced damage. So for all kinds of damage, radiation increases the rate of cell and tissue repair/replacement and increases the rate of removal of pathogens, including cancer cells.

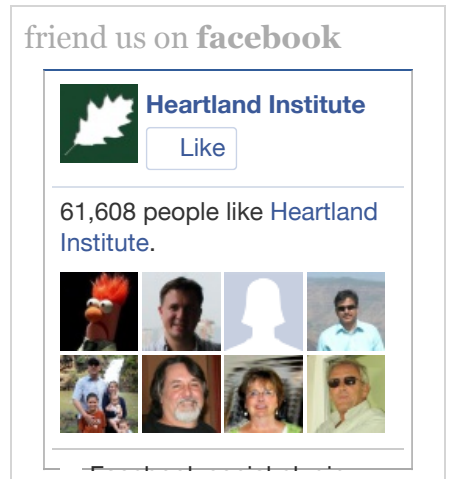
Importance Differences Between Doses

Immediately after the discovery of x-rays and radioactivity almost 120 years ago, thousands of medical practitioners began testing and using the penetrating radiations to examine internal injuries and illnesses, reducing the guesswork in diagnosing diseases.

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It's Only Natural – to Sue People

Long-time followers of abusive lawsuits may recall the Nutella case, a California class action brought in 2012 against an

They discovered radiation produces remarkable beneficial effects (Cuttler 2013). However, high-level short-term exposures cause surface and internal burns and scarring. After more than 20 years of learning from many painful experiences, scientists prepared procedures to limit exposures to a safe level. In 1934, the ICRP issued a standard that recommended a "tolerance dose" of 0.2 roentgen per day. A 1981 study of British radiologists revealed those radiologists who entered the profession prior to 1921 had a higher cancer mortality than expected. However, those who entered the profession after 1920 not only had a lower cancer mortality, but also lower mortality from all causes (Smith and Doll 1981). All research designed to identify both positive and negative radiation health effects generally found beneficial effects following a low acute dose or a low dose rate. For example, a recent mouse study to determine the effects of low gamma radiation on type II diabetes discovered suppression of nephropathy and prolongation of life span, (Nomura et al. 2011). The book *Radiation and Health* by Henriksen et al. (2012) has an excellent history for non-specialists.

Problems with the Linear Model

So why is there a perceived radiation problem? What is the reason for the fear, uncertainty, and doubt (FUD) regarding the effects of radiation? Why is there no consensus in UNSCEAR on radiation exposure's beneficial impacts on human health? To understand the barriers since the 1950s, we need to consider the origin of the linear no-threshold (LNT) dose-response concept which forms the basis for radiation protection activities and cancer risk calculations.

The LNT model was proposed after Hermann Muller publicized it in 1927 his work, which demonstrated that very high x-ray doses induced mutations in fruit flies. By 1935, this model became mechanistically framed within the context of a single-hit hypothesis based on target theory—a collaboration between leading theoretical physicists and radiation geneticists. It served to explain the cause of genetic change in the mechanism of evolution. At the highest dose tested (in the lethal range for insects) Muller had increased the mutation rate to 150 times the natural mutation rate. Several other studies carried out at high dose rates (lowest exposure level ~ 285 r) suggested a linear relationship between dose and mutation rate. However, Muller and others did not address studies (especially a study by Caspari and Stern (1948)) showing linearity does not occur at low dose rates.

The invention and use of atomic bombs in 1945, the nuclear arms race, and the rise of the antinuclear movement likely induced many concerned scientists to disregard the 60 years of research and experience on the use of radiation to stimulate the protection systems of living organisms. Many scientists instead accepted the new fearful LNT concept—a risk of cancer and genetic disease that increases linearly with radiation dose.

The ICRP rejected its 1934 standard that was based on the tolerance dose and issued recommendations based on use of the LNT model to evaluate the stochastic risk of cancer from any radiation exposure. This is the basis of our radiation scare.

As reported by Calabrese (Calabrese 2013), "In 1956, the US National Academy of Sciences Committee on Biological Effects of Atomic Radiation Genetics Panel issued the most far reaching recommendation in the history of risk assessment that genomic risks associated with exposure to ionizing radiation should be evaluated with a linear dose-response model, no longer via the threshold dose-response model that had long been the 'gold' standard for medicine and physiology. The Genetics Panel members believed that there was no safe exposure to ionizing radiation for reproductive cells with the mutation risk being increased even with a single ionization. In 1958, the LNT concept was generalized to somatic cells and cancer risk assessment by the National Committee for Radiation Protection and Measurement."

A great deal of radiobiology research since the 1950s reaffirms what was known about the beneficial health effects of radiation. There is a good understanding of the real

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mechanisms. Health effects are not determined by the single-hit, LNT hypothesis, but instead by a flood of many events.

Renowned radiobiologist Gunnar Walinder stated, “The LNT hypothesis is a primitive, unscientific idea that cannot be justified by current scientific understanding.”

“As practiced by the modern radiation protection community, the LNT hypothesis is one of the greatest scientific scandals of our time,” Walinder explained. (Walinder 2000)

Time to Rethink Policy

It is essential to revert to the ICRP standard of 1934 and the tolerance dose concept for radiation protection. This standard was wisely based on 30 years of observations and experience. This change would remove many constraints on the use of x-rays, CT-scans, and nuclear medicine techniques for the diagnosis of many illnesses. It would also pave the way for clinical studies on many potential applications for low radiation to treat very important diseases, such as Alzheimer's and Parkinson's, by up-regulating adaptive protection systems. (Doss 2013)

The urgent justification for this change in concept is the divergence between fear and facts regarding Fukushima. Radiophobia has erupted around the world despite the encouraging but scientifically expected lack of any serious radiation harms. Indeed, Germany decided to phase out nuclear energy, other countries are considering similar courses of action, and the prospects of life-saving radiation medical applications are unjustifiably being put on long-term hold.

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JERRY M. CUTTLER, D.SC.

Dr. Cuttler's 50-year career in research into nuclear sciences and engineering of many Canadian and...

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Leslie Corrice · Cleveland State University

Excellent article, Jerry. I'm going to post a link to this in my next Fukushima Updates on Thursday, Sept. 26.

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Donald E Jose · University of Iowa College of Law

I knew Lauriston Taylor, discussed this subject with him and you represent his views correctly. Perhaps some day the BEIR or UNSCEAR committees will see fit to abandon an excessive adherence to LNT down to zero dose.

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dangerous bullshit

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Christina Macpherson · Top Commenter

United Nations have not "closed the books" on Fukushima's health effects. It is well known that the World Health Organisation has unpublished reports that are far more thorough, (one to be released in October). The reports quoted above were unofficial. WHO has a dilemma. It is bound by its 1959 agreement with International Atomic Energy Agency, meaning that the IAEA must vet all WHO reports – and they may not impede the progress of the nuclear industry. When the WHO finally breaks free of the IAEA it will be able to tell the full story. The Director General of the WHO has recently stated "there is no safe level of ionising radiation".

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Chris Davey · Safety Specialist – Radiation & Laser at KAUST

I for one would be happy to go and live in the exclusion zone around Fukushima – the scenery is beautiful and the extra radiation I would get each year would be much less than if I moved from here (KAUST, Saudi Arabia) to Cornwall, UK.

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Keith Woodward · Arizona State University

Jerry Cuttler, Thank you for the work you have done to put this piece together, my hope is that many people will read this and some real change can happen.

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Christopher O'Loughlin

Jerry,

Nice article about risk. What are the risks to ground water of melted reactor cores leaving the safety of containment building and sinking. I ask because your science degree may empower you to characterize the risk for the three melted reactor cores in Fukushima that have like Elvis "Left the Building".

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Burke Painter · University of Arizona '69 '70

LOL "have left the building."

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Vince Bishop · [Follow](#) · Logistics Chief at National Disaster Medical System (NDMS)

Interesting article on the Fukushima Daiichi nuclear power plant comparing the 1600 people who died evacuating the area to the zero number of people who died as a result of the damaged reactor. And no, my phone is not in "beer mode".

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