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Submitter Information

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General Comment

Why hormesis benefits are imaginary -Regarding docket ID NRC-2015-0057
Studies that purport to show the hormetic effect of radiation were conducted on rats, not human beings.

No studies have been done on humans, and the data from the rat studies is not applicable to humans for a very good reason:
Rats are much more radioresistant than humans. The LD50 for a human is 4.5 (1Piccard) Gray, whereas the LD50 for a rat is 7.5 Gray (2 Choppin). This means that rats are more than 1.5 times more radioresistant than humans.

Because the rat studies are not applicable to humans, much work would have to be done to establish the correct hormetic doses, provided that immune response to radiation is found to be 100% beneficial. What doses would be acceptable if the NRC were to adapt higher acceptable radiation limits based on some unproven hormetic effect?

Taking into consideration that the most rapidly growing organism is the most radiosensitive, the following questions must be answered before the new hormetic radiation dose limits can be set:
1. What dose is hormetic for a human blastocyst?
2. What dose is hormetic for a human fetus?
3. What dose is hormetic for newborn humans?
4. What dose is hormetic for toddlers?
5. What dose is hormetic for rapidly growing teenagers?
6. What dose is hormetic for pregnant women?
7. Given that female humans are more radiosensitive at all life stages than male humans, what doses would be

hormetic for females?
8. What dose would be hormetic for the elderly?
9. What dose is hormetic for the chronically ill, taking into consideration the nature of each type of chronic illness?
10. And last, but not least, what dose would provide but not exceed the beneficial hormetic effect for every type of other living organism, at all life stages, that inhabits the same biosphere being subjected to the increased doses of radiation?

To further our understanding, let us go back to the definition of hormesis: hormesis is the immune system response to radiation damage. The petitioners claim that hormesis is beneficial. However, if radiation does cause an organism to undergo an immune system response, there is no guarantee that the immune response will be favorable to the health of the organism. Statistically, the very opposite is the most likely outcome.

Because random radiation impacts cause random changes in complex DNA, the chances of a random mutation causing a beneficial change are astronomical. Imagine lifting the hood of your car, then throwing in random parts and pulling on random wires and hoses. No one would expect a car to run more smoothly after such treatment. DNA is the code used to construct an organism, much like a blueprint for the organism. Randomly damaging and changing a blueprint is not going to result in a beneficial outcome.

Simply put, the structure of DNA tells the body how to make proteins. When radiation damages DNA, the altered DNA codes for an altered protein. These altered or unusual proteins can cause an organism to display an immune response, AKA a hormetic response.
Strange, foreign proteins are the triggers for the immune system to attack the invaders, which are usually viruses, bacteria, fungi, and other foreign bodies. Virologists use the body's ability to recognize infection via proteins to formulate vaccines based on the immune response to the proteins of an invader.
In this case, the immune response would be directed against the organisms own proteins, because they have been changed in such a way as to make them appear to be foreign proteins. Immune responses of this type would result in autoimmune disorders, some of which could be disabling or even lethal. Some examples of the 80+ types of debilitating autoimmune disorders are Hashimoto's disease, rheumatoid arthritis, lupus, and type 1 diabetes.
When an organism's immune system is compromised by autoimmune disorders, the organism is also left vulnerable to common infections.
The impact of radiation on the human immune system is well-documented in post-Chernobyl Belarus, Ukraine, and Russia (3 Yablokov).

In addition, when the dose limits have been established, Environmental Impact Statements and Economic Impact Statements would have to be prepared.

Thank you for considering these comments,

Lisa Kasenow

(1) Picard, Richard Dickson,"Notes on Physics and Ionizing Radiation", 2003, http://www.ohio.edu/people/piccard/radnotes/dose.html Retrieved Sept. 10, 2015.

(2) G. Choppin, J-O. Liljenzin and J. Rydberg, Radiochemistry and Nuclear Chemistry, edition three, page

481, ISBN 0-7506-7463-6

(3) Yablokov, Alexey, et al. Chernobyl: The Consequences of the Catastrophe for People and the Environment, New York Academy of Sciences, 2009. p.87-96