Rulemaking1CEm Resource

From: RulemakingComments Resource
Sent: Thursday, November 19, 2015 9:56 AM
To: Rulemaking1CEm Resource
Subject: FW: Comments on Hormesis Rulemaking

From: Dennis Nelson [mailto:dennis_nelson@att.net]
Sent: Wednesday, November 18, 2015 11:14 AM
To: RulemakingComments Resource <RulemakingComments.Resource@nrc.gov>
Subject: [External_Sender] Comments on Hormesis Rulemaking

Please add these comments from my organization Support and Education for Radiation Victims (SERV) to your Rulemaking agenda on the Hormesis question. These comments concern physiological adaption to environmental changes which the proponents of the "hormesis" theory insist happens with exposure to low levels of radiation. Radiation exposure is **not** physiological adaptation although it may induce some anti-oxidant co-factors and enzymes due to the oxidative damage it causes. Radiation damage is still cumulative and irreversible even though some cells may be repaired. The majority are simply lost and cleared from the body, which represents a depletion of the body's finite reserves of replacement stem cells.

Thank you,

Dennis Nelson, Ph.D.

Comments on NRC Rulemaking: Petition to adopt "hormesis" in their radiation exposure standards.

Physiological Environmental Adaptation

Living organisms derive organizational resources or chemical free energy from their environment in the form of food-stuffs produced from the sun's visible radiation source via photosynthesis. They also dump waste energy in the form of heat and excretions into the environment. Thus they are always in a state of dynamic steady-state equilibrium with their environment. This condition is also known as

homeostasis; and is a requirement for life to exist because in the absence of energy exchange with the environment the organism dies and disintegrates. Because the environment does not always remain constant but varies within certain prescribed parameters, living organisms have developed physiological mechanisms for adapting to these changes. This is usually accomplished by hormone production, enzyme induction or biochemical co-factor synthesis.

A classic example of such adaption occurs when one moves from a low altitude to a high altitude. Initially one experiences shortness of breath, rapid breathing, fatigue and even nausea with physical exertion. After a few days these symptoms disappear because the body adapts to the lower atmospheric partial pressure of oxygen at the higher altitude by making a series of biochemical and physiological adjustments. First, the body releases erythropoetin, a hormone which stimulates erythropoetic stem cells to undergo clonal expansion to increase the number of red blood cells in the body which leads to a higher hematocrit. This helps the blood to carry more oxygen to the tissues. Second, the body produces co-factors, such as 2,3-diphosphoglycerate which bind to hemoglobin in red cells and shift the oxygen saturation curve such that oxygen is delivered to the tissues at lower partial pressures. This condition is temporary, however, and reverses itself when the person moves back to lower altitude where the oxygen concentration is higher.

A similar adaption occurs when the body is exposed to oxidative stress. Oxygen at higher partial pressures is actually toxic. Even atmospheric oxygen concentrations are toxic under certain conditions. Babies who are born prematurely sometimes develop hyaline membrane disease which can be fatal. This is actually a manifestation of oxygen toxicity because the baby has not yet developed the enzymes and co-factors necessary to prevent oxygen damage to the lung tissues by the time of birth. In other words the baby has not yet adapted to the physical world. When a respirator is used for an extended period, pure oxygen can cause lung damage in adults as well. Clearly there is no one level of oxygen which is always toxic since individuals can develop tolerance through a variety of physiological adaptions.

Since some radiation damage is intermediated by reactive oxygen species, adaption to oxidative stress could potentially partially protect the body from certain types of radiation damage such as that associated with oxygen free radicals. Proponents of the “hormesis” theory of radiation protection claim that a small initial primer exposure to ionizing radiation can protect against a later, larger radiation challenge by inducing repair enzymes and generating anti-oxidant molecules. While this adaptation may work, to some extent, at lower exposures, and may help the body recover from some types of radiation damage, it is temporary and only works for certain types of chemically mediated damage and only while the stimulus continues to be applied. It does **not** work for the many other types of mechanical or physical damage caused by the ionization track of radiation. Much of the long-term, accumulated radiation damage to the architecture of the cells is still not prevented. In any event

there are many much more benign ways of inducing anti-oxidant protection in the body than by intentionally exposing oneself to ionizing radiation.

Hearing Identifier: Secy_RuleMaking_comments_Public
Email Number: 1327

Mail Envelope Properties (56d6c30688a84b6180d84040eb47bffe)

Subject: FW: Comments on Hormesis Rulemaking
Sent Date: 11/19/2015 9:56:18 AM
Received Date: 11/19/2015 9:56:19 AM
From: RulemakingComments Resource

Created By: RulemakingComments.Resource@nrc.gov

Recipients:
"Rulemaking1CEm Resource" <Rulemaking1CEm.Resource@nrc.gov>
Tracking Status: None

Post Office: HQPWMSMRS02.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	5342	11/19/2015 9:56:19 AM

Options
Priority: Standard
Return Notification: No
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Sensitivity: Normal
Expiration Date:
Recipients Received: