



Joint Meeting of the Atlanta and Alabama Chapters of
the Health Physics Society
October 20, 2018



The LNT Landscape and the Role of Radiation Protection Professionals

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A MUSING COLUMN TUNE

Marvin Rosenstein

THOSE LINEAR NO-THRESHOLD BLUES

Published in HPS Newsletter between Feb '95 and Aug '96

- Director (Retired), Office of Health Physics
FDA Center for Devices and Radiological
Health
- Distinguished Emeritus Member of NCRP
- Emeritus member of ICRP Committee 3



A MUSING COLUMNTUNE

Marvin Rosenstein

*Since the human data left us
Without any low-dose facts
We're lost on how to deal with
The less than 10-rad whacks.*



*We've got those linear ... those
linear no-threshold blues.*



*The theories all have key flaws
The experiments often vary
The explanations are not solid
And the science is quite hairy*

*We've got those low-down
linear ... those low-down linear
no-threshold blues.*

A MUSING COLUMNTUNE

Marvin Rosenstein

*Some people cry hormesis
Some people yell repair
Most people moan we don't know
So let's pretend it's there*



*We've got those very-low-down
linear ... those very-low-down
linear no-threshold blues.*



*The profession gets more vocal
The government more staid
What should we really do about
Millirads in which we bathe*

*We've got those linear ... those
linear no-threshold blues.*

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Marvin Rosenstein

*The Council and Commission
Sound caution and constraint
But folks are spending big bucks
On risks for which there ain't.*



*We've got those low-down linear
... those low-down linear no-
threshold blues.*



*Science and perception
May forever disagree
Even if it's clarified
By mi.cro.do.sim.e.try.*

*We've got those very-low-down
linear ... those very-low-down
linear no-threshold blues.*

A MUSING COLUMNTUNE

Marvin Rosenstein

*A dialogue has started up
Opinions are prolific
Everyone has got the chance
To claim they're scientific*



*We've got those linear ... those
linear no-threshold blues.*



*That discourse is ongoing
A debate that's fully staged
Day by day and year by year
The question stays engaged.*

*We've got those low-down
linear ... those low-down linear
no-threshold blues.*

A MUSING COLUMNTUNE

Marvin Rosenstein

*Those “for” have a point of view
Those “not for” have another
A magic link is needed
To join one to the other.*



*We’ve got those very-low-down
linear ... those very-low-down
linear no-threshold blues.*



Those low-down blues.

My Daughter's Room



You Should Say

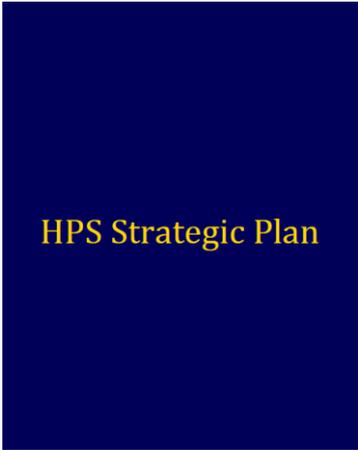


<https://www.youtube.com/watch?v=qB8JDTiNHQs>



HPS is a professional organization whose mission is:

“Excellence in the science and practice of radiation safety”

A dark blue rectangular box representing the cover of the HPS Strategic Plan document. The text 'HPS Strategic Plan' is centered in the box in a gold, serif font.

HPS Strategic Plan

<https://hps.org/documents/strategicplan.pdf>

Once I Asked a Few Colleagues What a Safe Dose of Radiation Is

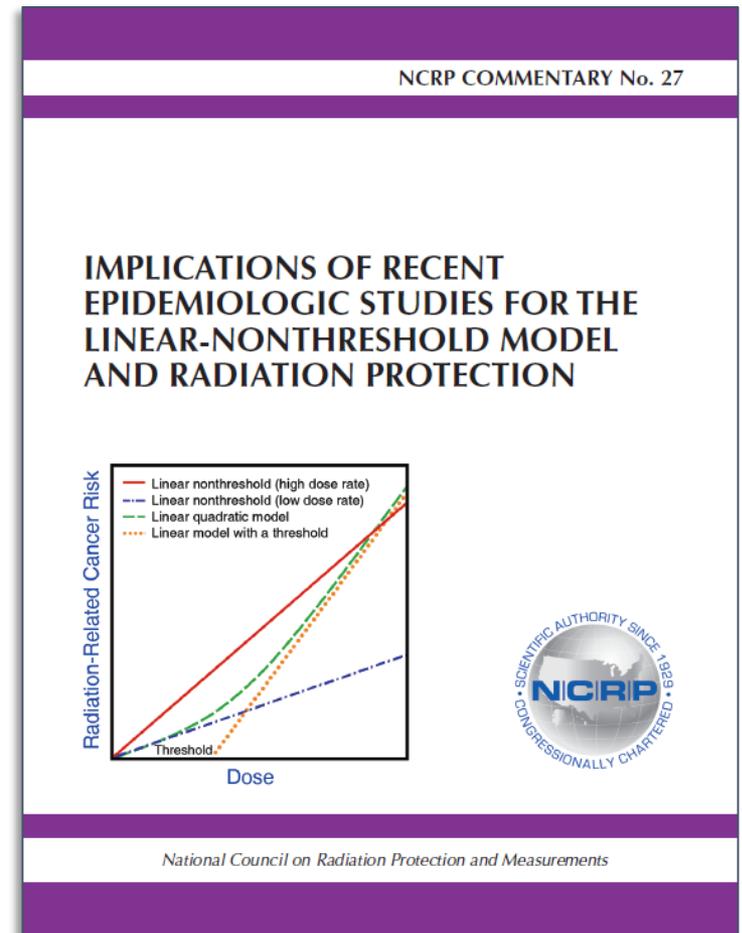
(Data presented during my HPS president-elect chapter tour, 2011-12)

- All radiation professionals
 - 41 HPS members (87%)
 - 21 CHP (45%)
 - 16 PhD (34%)
 - 10 PhD/CHP
 - 3 MD
- Range of responses spanned **three orders of magnitude!**
 - For adults: 1 mSV to 1000 mSV
 - For children: 0.3 mSV to 250 mSV

NCRP COMMENTARY No. 27

(2018)

- The LNT model ... should continue to be used for radiation protection purposes.
- This is in accord with judgments by other national and international scientific committees ... that no alternative dose-response relationship appears more **pragmatic or prudent** for radiation protection purposes than the LNT model.





ICRP 103 (2007)

- [Use of the LNT model] is considered by the Commission to be the best **practical approach** to managing risk from radiation exposure.

Annals of the ICRP

PUBLICATION 103

The 2007 Recommendations of the International
Commission on Radiological Protection

Editor
J. VALENTIN

PUBLISHED FOR
The International Commission on Radiological Protection

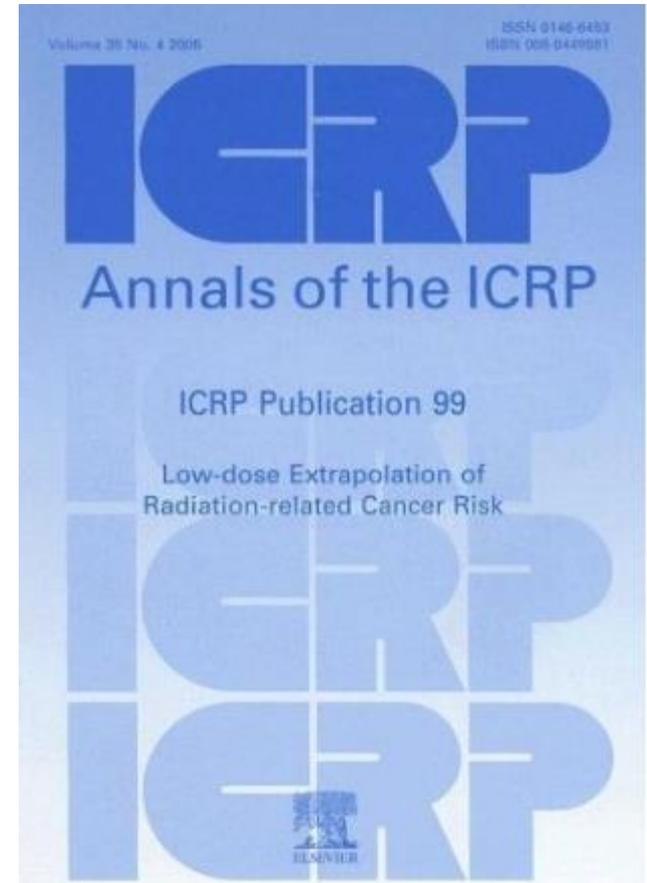
by



ICRP Publication 99 (2005)

Low-dose Extrapolation of Radiation-related Cancer Risk

- While existence of a low-dose threshold does not seem to be unlikely for radiation-related cancers of certain tissues, **the evidence does not favor the existence of a universal threshold.**
- The LNT hypothesis, combined with an uncertain DDREF for extrapolation from high doses, remains a **prudent** basis for radiation protection at low doses and low dose rates



Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII Phase 2 (2006)

- Current scientific evidence is consistent with the hypothesis that there is a linear, no-threshold dose-response relationship between exposure to ionizing radiation and the development of cancer in humans.
- The assumption that any stimulatory hormetic effects from low doses of ionizing radiation will have a significant health benefit to humans that exceeds potential detrimental effects from the radiation exposure is unwarranted at this time.

*The National
Academies of*

SCIENCES
ENGINEERING
MEDICINE

HEALTH RISKS
FROM EXPOSURE TO
LOW LEVELS OF
IONIZING
RADIATION
BEIR VII PHASE 2

NATIONAL RESEARCH COUNCIL
ON BIOLOGICAL EFFECTS OF IONIZING RADIATION



Dose-effect relationships and estimation of the carcinogenic effects of low doses of ionizing radiation (2005)

- “On the basis of our present knowledge, it is **not possible to define the threshold level** ... or to provide the evidence for it.”
- “[LNT] should be considered as a **tool which is useful for regulatory purposes** because it simplifies the administrative task.”
- “LNT relationship is often **applied incorrectly** to large numbers of people ... These calculations based on collective doses do not have any meaning, as UNSCEAR and ICRP have pointed out. Nevertheless, some people are still applying them.”
- “Without any scientific justification, these calculations propagate the idea that even a very small dose of radiation is dangerous.”



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, DC 20555 - 0001

ACNWR-0258

January 11, 2007

Mike Ryan was
ACNW&M
Chair.

The Honorable Dale E. Klein
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT OF THE FRENCH ACADEMY OF SCIENCES, "THE DOSE-EFFECT RELATIONSHIP AND ESTIMATING THE CARCINOGENIC EFFECTS OF LOW DOSES OF IONIZING RADIATION"

- “The French Academy of Sciences presenters pointed out that the LNT theory of radiation damage can be appropriately used as a risk management tool but not as a risk assessment tool.”
- “Based on the Committee’s review of the French Academy report and the BEIR VII report, the Committee finds the current state of knowledge does not warrant any change to current NRC radiation protection standards or limits.”



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Eidgenössische Kommission für Strahlenschutz und
Überwachung der Radioaktivität
Commission fédérale de protection contre les radiations et de
surveillance de la radioactivité
Commissione federale della radioprotezione e della
sorveglianza della radioattività

Swiss Commission for Radiation Protection and Surveillance of Radioactivity

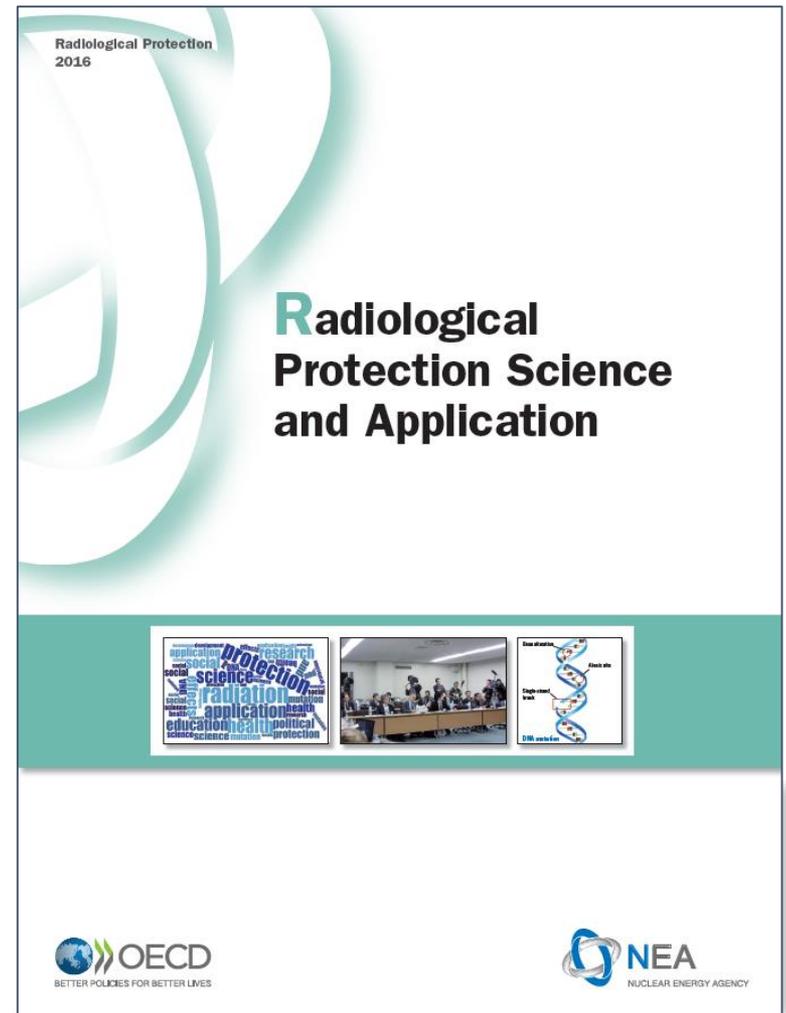
Prise de position de la CPR concernant le modèle linéaire sans seuil

Version: 14.11.2013

“The KSR/CPR considers that the LNT model remains the best tool to manage the risk of radiation exposure.”

OECD Nuclear Energy Agency (2016)

- “Despite inherent limitations, the LNT model is, in regulation and practice, the most widely used and **recommended approach for prospectively managing radiation risks.**”
- “It should be underlined that the radiological protection system remains very effective, and there is no need for a prompt revision.”



The Current System of Radiation Protection

- **Although not perfect, it has worked.**
 - A culture of safety is in place.
 - Unnecessary exposures to workers and the public have been reduced.
- **It does need improvement.**
 - We face serious challenges in the age of communication.
 - More cleanup of terminology and concepts is needed.
- **It can be misused ... and it often is!**
 - Exaggerated risks, misplaced priorities and expenditures
 - **Radiation safety professionals can play a constructive role here.**

Undermining Our National and the International System of Radiation Protection

- **Erodes** public confidence
- **Disillusions** young RP professionals
- **Hurts** our profession

Let's remember:

“Excellence in the science and practice of radiation safety”



Thank you!

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- The findings, conclusions, or statements in this presentation are those of the author and do not necessarily represent the official position of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry.