

Mid-Atlantic States Radiation Conference
September 20, 2018

Radiation Protection and Your National Council on Radiation Protection and Measurements (NCRP)

Kathryn D. Held, Ph.D.

National Council on Radiation Protection and Measurements
Massachusetts General Hospital/Harvard Medical School



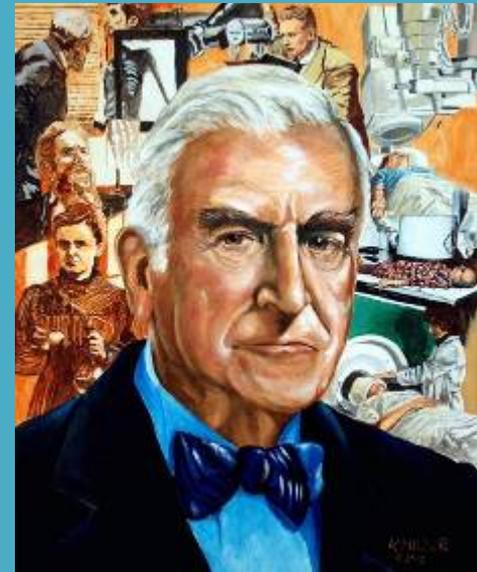
NCRP – A Council of 100 Radiation Professionals



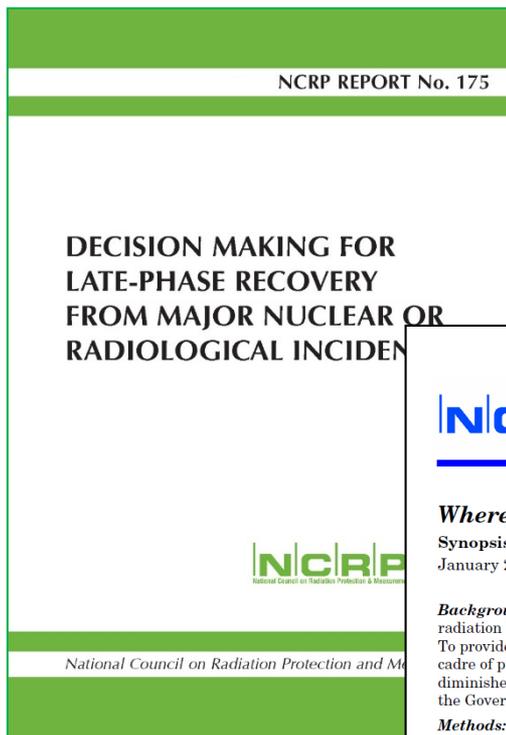
1929: U.S. Advisory
Committee on X-Ray and
Radium Protection

1946: U.S. National Committee
on Radiation Protection

1964: National Council on
Radiation Protection and
Measurements **chartered by
Congress** (Public Law 88-376)



Advice, Reports, Research



National Council on Radiation Protection and Measurements
7910 Woodmont Avenue / Suite 400 / Bethesda, MD 20814-3095
<http://ncrponline.org> / <http://ncrppublications.org>

Where Are the Radiation Professionals (WARP)?

Synopsis of NCRP Statement No. 12
January 23, 2015

Background: Since the discovery of x rays and radioactivity in the late 1800s, sources of ionizing radiation have been employed in medicine, academia, industry, power generation, and national defense. To provide for the safe and beneficial use of these sources of radiation, the United States developed a cadre of professionals with the requisite education and experience. Unfortunately, their numbers have diminished alarmingly, as assessed by the National Research Council, the Health Physics Society, and the Government Accountability Office.

Methods: To study the decline in radiation professionals, the National Council on Radiation Protection and Measurements held a workshop in Arlington, Virginia to evaluate whether the future to support the various radiation professions. This workshop included professionals from various societies.



John Boice

Paper

DOSE RECONSTRUCTION FOR THE MILLION WORKER STUDY: STATUS AND GUIDELINES

André Bouville,* Richard E. Toohey,† John D. Boice, Jr.,‡ Harold L. Beck,§ Larry T. Dauer,** Keith F. Eckerman,†† Derek Hagemeyer,‡‡ Richard W. Leggett,†† Michael T. Mumma,§§ Bruce Napier,*** Kathy H. Pryor,*** Marvin Rosenstein,††† David A. Schauer,‡ Sami Sherbini,‡‡‡ Daniel O. Stram,§§§ James L. Thompson,**** John E. Till,†††† Craig Yoder,‡‡‡‡ and Cary Zeitlin§§§§



Seven Program Area Committees (PACs) and Two Council Committees (CCs)

- PAC 1 - Epidemiology & Biology
- PAC 2 - Operational Radiation Safety
- PAC 3 - Security & Safety
- PAC 4 - Medicine
- PAC 5 - Environment & Waste
- PAC 6 - Dosimetry & Measurements
- PAC 7 - Risk Communication & Outreach
- CC-1 – Radiation Protection Guidance for the US (Report no.180; 2018)
- CC-2 – Meeting the Needs of the Nation for Radiation Protection (WARP: Where Are the Radiation Professionals?)

Scientific Committees
under PACs





14 (more or less) Active Committees Under PACs

- SC 1-24P2 – Radiation Exposures in Space/CNS Effects
- SC 1-26 – Integrating Radiation Biology and Epidemiology for Low Dose Risks
- SC 2-7 – Radiation Safety of Sealed Radioactive Sources (Report 182; 2018)
- SC 2-8 – Operational Radiation Safety Program
- SC 3-1P2 – Implementation of Guidance for Radiation Responder Dosimetry
- SC 4-5 – Radiation Protection in Dentistry
- SC 4-7 – Evaluating and Communicating Risks for Human Studies
- SC 4-8 – Improving Patient Dose Utilization in CT
- SC 4-9 – Medical Exposures of Patients in the US
- SC 4-10 – Error Prevention in Radiation Safety
- SC 5-2 – Radiation Protection for NORM/TENORM
- SC 6-9 – US Radiation Workers & Atomic Vets Dose Assessment (Report 178; 2018)
- SC 6-11 – Medical Worker Dosimetry
- SC 6-12 – Brain Dosimetry for Internal Radionuclides



Recently Completed Committees (2017-2018)

- SC 2-6 – Radiation Safety Aspects of Nanotechnology
- SC 3-1 – Guidance for Emergency Responder Dosimetry
- SC 1-25 – Recent Epidemiologic Studies and Implications for LNT
- SC 1-20 – Biological Effectiveness of Low-LET Radiations

NCRP REPORT No. 176

RADIATION SAFETY ASPECTS OF NANOTECHNOLOGY



National Council on Radiation Protection and Measurements

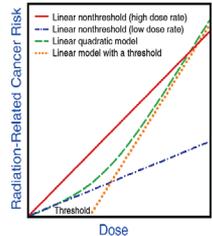
NCRP REPORT No. 179

GUIDANCE FOR EMERGENCY RESPONSE DOSIMETRY

National Council on Radiation Protection and Measurements

NCRP COMMENTARY No. 27

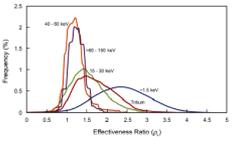
IMPLICATIONS OF RECENT EPIDEMIOLOGIC STUDIES FOR THE LINEAR-NONTHRESHOLD MODEL AND RADIATION PROTECTION



National Council on Radiation Protection and Measurements

NCRP REPORT No. 181

EVALUATION OF THE RELATIVE EFFECTIVENESS OF LOW-ENERGY PHOTONS AND ELECTRONS IN INDUCING CANCER IN HUMANS

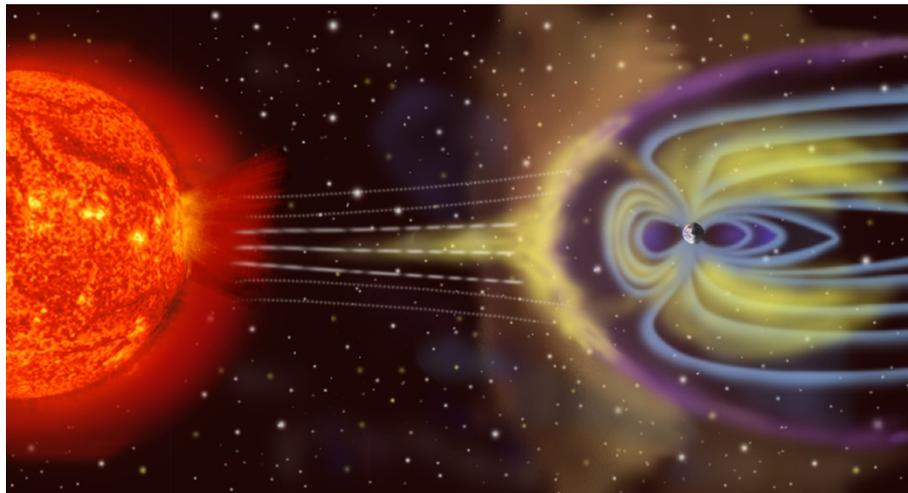


National Council on Radiation Protection and Measurements



Committees Coming Soon

- SC 1-27 – Sex Differences in Lung Cancer (with Relevance to Astronauts)
- SC 6-10 – Doses to Air Crew





Highlighting Selected Committees



CC-1/Report no. 180: Radiation Protection Guidance for the United States (will be available soon)

NCRP REPORT No. 180

MANAGEMENT OF EXPOSURE
TO IONIZING RADIATION:
RADIATION PROTECTION
GUIDANCE FOR THE UNITED
STATES (2018)



National Council on Radiation Protection and Measurements



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M. Boyd, *Consultant*

W.E. Irwin

M. Rosenstein, *Staff Consultant*



Thanks to CDC & NRC for financial support



CC 2: Meeting the Needs of the Nation for Radiation Protection – WARP



W.D. Newhauser (Med Phys), *Co-Chair*
J.P. Williams (Rad Bio), *Co-Chair*

Preparing Commentary *Writing Team Leaders:*



- Edward I. Bluth (Med)
- Michael A. Noska (HP)
- Sergei Tolmachev (Chem)
- Lawrence Townsend (N Engr)
- Lydia Zablotska (Epi)

Thanks to CDC for funding



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Where are the Radiation Professionals (WARP)?

NCRP Statement No. 12, December 17, 2015

Since the discovery of x rays and radioactivity in the 1890s, sources of ionizing radiation have been employed in medicine, academia, industry, power generation, and national defense. To provide for the safe and beneficial use of these sources of radiation, the United States developed a cadre of professionals with the requisite education and experience. Unfortunately, their numbers have diminished alarmingly (AAAS, 2014; GAO, 2014; HPS, 2013; NANRC, 2012).

Methods

To study the decline in radiation professionals and potential national crisis, the National Council on Radiation Protection and Measurements (NCRP) sponsored a workshop in June 2013 in Arlington, Virginia to evaluate whether a sufficient number of radiation professionals exist now and into the future to support the various radiation disciplines essential to meet national needs. Attendance at this workshop included professionals from government, industry, academia, medicine, and professional societies. Presentations from over 30 groups (NCRP, 2013) resulted in the recommendations found in this Statement.

Findings

Evidence presented at the workshop revealed that the country is on the verge of a severe shortfall of radiation professionals such that urgent national needs will not be met. Factors contributing to the downturn include the economy, attrition, redirected national priorities, and decreased public funding. The magnitude of this shortfall varies with radiation disciplines and practice area. Radiation biology has already been critically depleted and other specialties are following the same downward spiral. All radiation professionals share the same goals to develop or implement scientific knowledge to protect workers, members of the public, and the environment from harmful effects of exposure to ionizing radiation. Accordingly, the workshop concluded that the current and projected shortfall will adversely affect the public health, radiation occupations, emergency preparedness, and the environment. Major shortfalls have already been observed in day-to-day operations, leaving policy development, regulatory compliance, research and development, environmental monitoring, emergency management, and military applications as unfunded and under-supported mandates.

The dwindling number of professionals will be of particular concern in mounting a response to a catastrophic nuclear or radiological incident, including terrorist attacks. The current concept of operations for response includes surge support from the existing body of radiation professionals to serve as technical subject matter experts to aid in the management of the consequences of such an event. However, as the number of radiation professionals decreases, the nation's resilience and ability to cope and manage a catastrophic nuclear or radiological event is severely degraded.



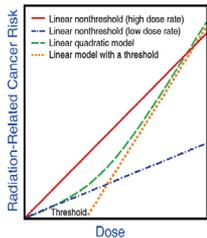
...ploy radiation professionals in broad and diverse areas such as research and development, environmental monitoring and restoration and response, nuclear medicine, radiation therapy, diagnostic (GAO, 2014) estimates that 31 % of the federal workforce will be percentage of engineering and technical professionals eligible 41 %. Similarly, a survey of the Conference of Radiation Control as that regulate the use of radioactive materials and radiation that over 50 % of the technical staff in the states' radiation he next 10 y. essed concern about the future supply of radiochemists (NANRC, cal expertise within government will result in an inability to significant adverse effect on the ability to manage the consequences r power plant accident in the United States. The basic radiation part of a vast enterprise that directly and materially benefits the



SC 1-25: Recent Epidemiologic Studies and Implications for the Linear-Nonthreshold Model

NCRP COMMENTARY No. 27

IMPLICATIONS OF RECENT EPIDEMIOLOGIC STUDIES FOR THE LINEAR-NONTHRESHOLD MODEL AND RADIATION PROTECTION

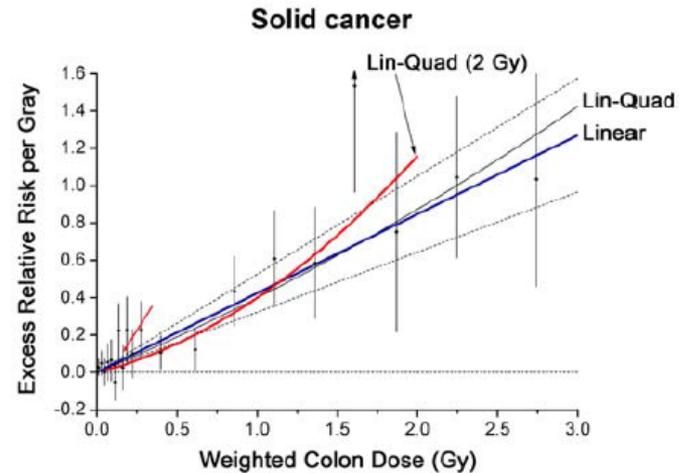


National Council on Radiation Protection and Measurements

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R. Vetter, *Staff Consultant*



Thanks to NRC for financial support



Graph used with permission of K. Ozasa and *Radiation Research*

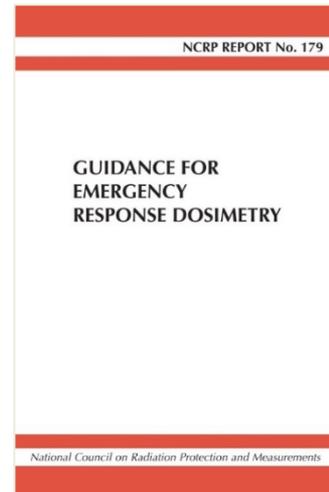
Conclusion:
Based on current epidemiologic data, **no notably different alternative to the LNT model appears more practical and prudent for radiation protection purposes.**



SC 3-1: (1) Guidance for Emergency Responder Dosimetry and (2) Implementation Guidance for Responder Dosimetry in an Emergency



S. V. Musolino
A. Salame-Alfie
Co-Chairs



Thanks to DHS, CDC, and NYC
for financial support



SC 5-2: Radiation Protection for NORM & TENORM from Oil & Gas Recovery



WE Kennedy,
Chair



D Allard



M Barrie



P Egid



G Forsee



R Johnson



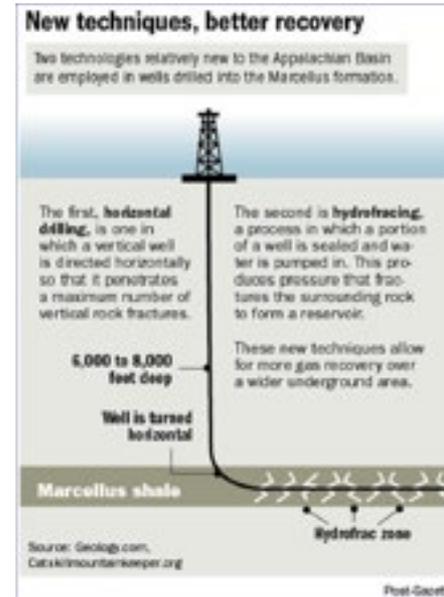
A Lombardo



R McBurney



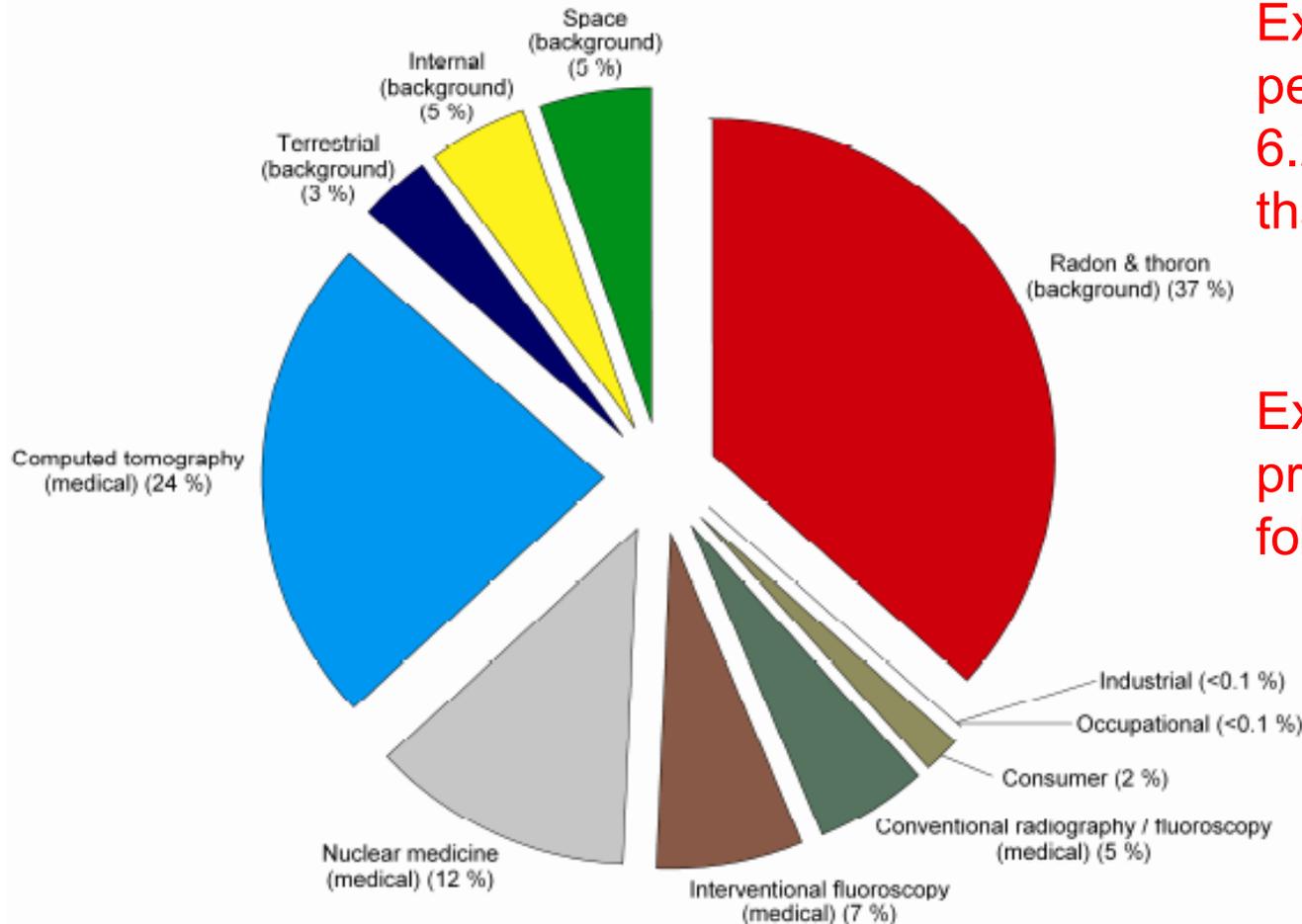
J Frazier



Thanks to CRCPD and CDC for financial support

Radiation Exposure in the US

All Exposure Categories
Collective Effective Dose (percent), 2006



Total Average Exposure per Person in US: 6.2 mSv/yr (2x higher than 25 years earlier)

Exposures from medical procedures increased 6-fold in ~25 years

From NCRP Report No. 160, 2009

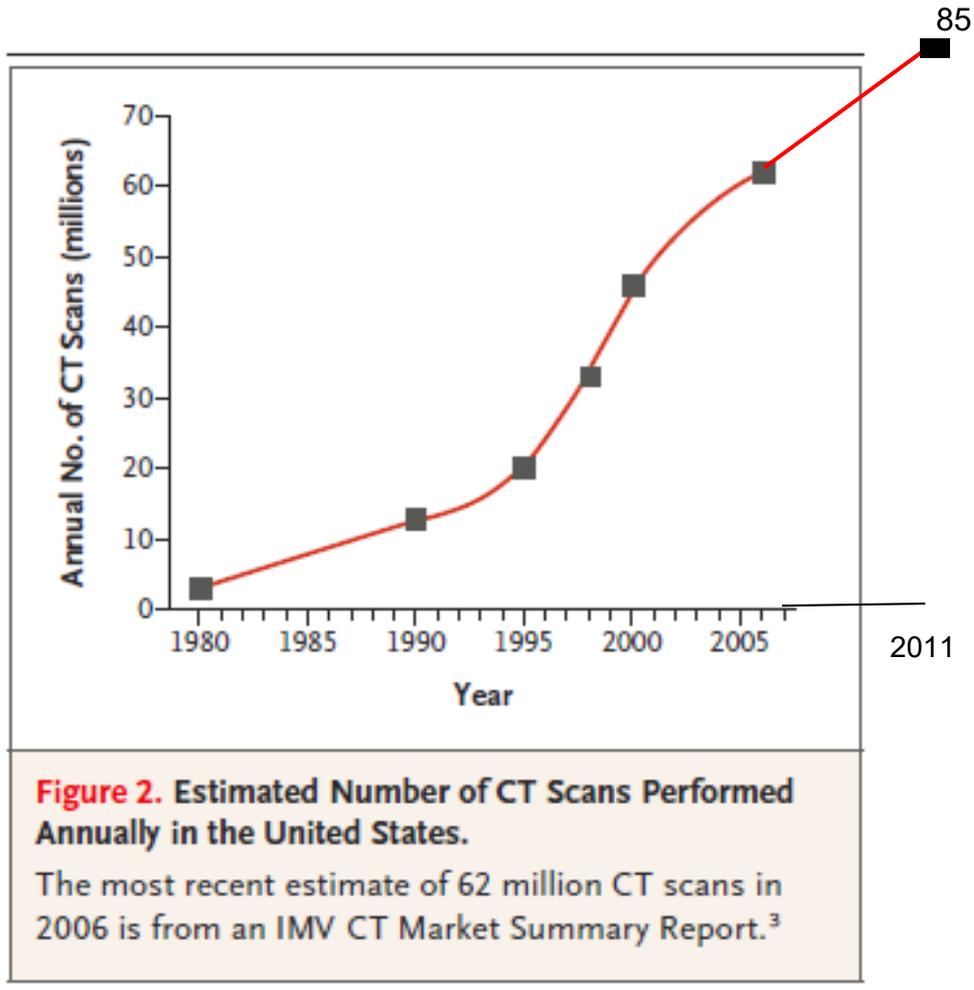
SC 4-9: Medical Exposure of Patients in the United States



F.A. Mettler, *Chair*



M. Mahesh, *Co-Chair*



SC 1-24 Continuation: Radiation Exposures in Space and the Potential for CNS Effects – Phase II Report



Human Exploration Research *Analog* (HERA), JSC



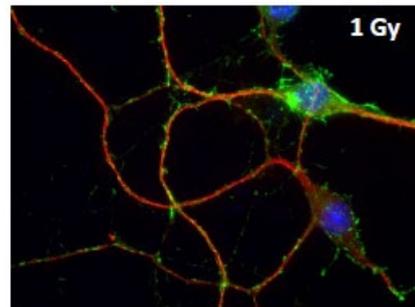
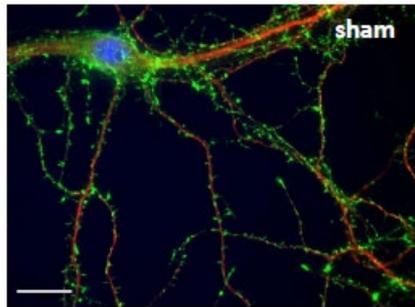
Les Braby



Jacob Raber

Thanks to NASA for funding

Radiation Effects on Dendritic Spines of Neurons Correlates with Behavior Changes



Scale bar: 20 μm
 Drebrin/ MAP2/ DAPI

(from Puspitisari, Held, *et al.*, unpublished)

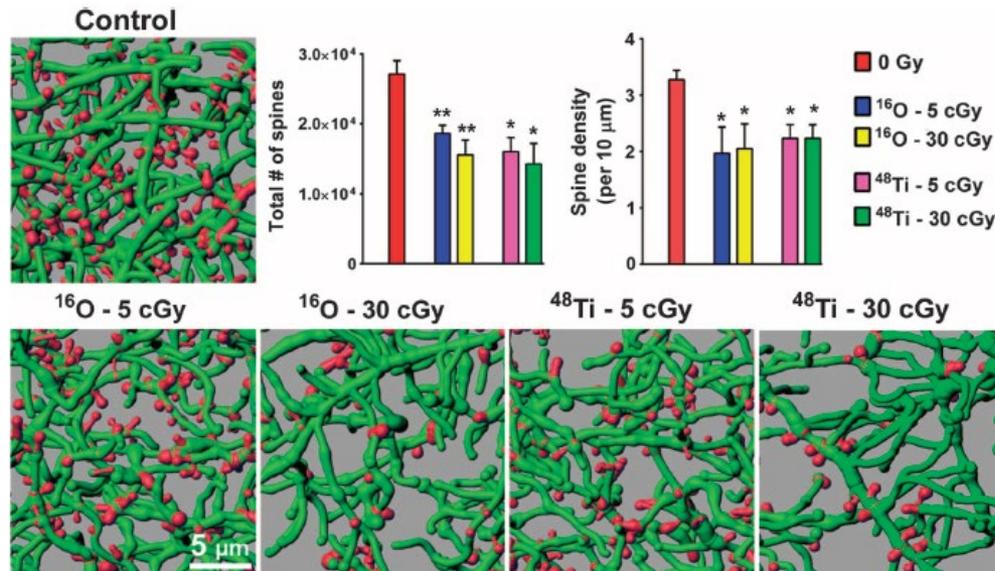


Fig. 3. Reductions in dendritic spine density in the mPFC after HZE particle exposure. Representative digital images of 3D reconstructed dendritic segments (green) containing spines (red) in unirradiated (top left panel) and irradiated (bottom panels) brains. Dendritic spine number (left bar chart) and density (right bar chart) are quantified in charged particle-exposed animals 8 weeks after exposure. * $P = 0.05$, ** $P = 0.01$, ANOVA.

Going to Mars – Alzheimer's?

OPEN ACCESS Freely available online

PLOS ONE

Galactic Cosmic Radiation Leads to Cognitive Impairment and Increased A β Plaque Accumulation in a Mouse Model of Alzheimer's Disease

Jonathan D. Cherry¹, Bin Liu², Jeffrey L. Frost², Cynthia A. Lemere², Jacqueline P. Williams³, John A. Olschowka⁴, M. Kerry O'Banion^{4*}

COGNITIVE NEUROSCIENCE

What happens to your brain on the way to Mars

Vipan K. Parihar¹, Barrett Allen¹, Katherine K. Tran¹, Trisha G. Macaraeg¹, Esther M. Chu¹, Stephanie F. Kwok¹, Nicole N. Chmielewski¹, Brianna M. Craver¹, Janet E. Baulch¹, Munjal M. Acharya¹, Francis A. Cucinotta², Charles L. Limoli^{1*}

Study: Deep-Space Radiation Could Damage Astronauts' Brains

Cosmic rays could leave travelers to Mars confused, forgetful and slow to react

Can Epidemiology Studies Help?

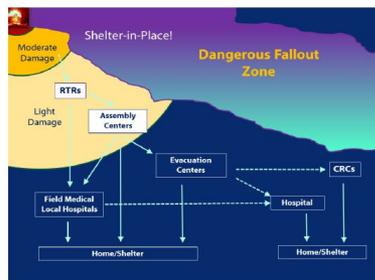


NCRP Annual Meetings



Fifty-Third
Annual Meeting Program

Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism: Is There a Need for Realignment to Close Remaining Gaps?



March 6–7, 2017

Hyatt Regency Bethesda
One Bethesda Metro Center
7400 Wisconsin Avenue
Bethesda, MD 20814



Armin Ansari &
Adela Salame-Alfie,
Co-Chairs



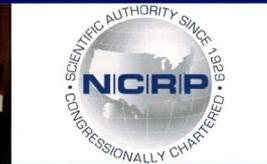
VOL. 114, NO. 2, FEBRUARY 2018

HEALTH PHYSICS

THE RADIATION SAFETY JOURNAL



The Official Journal of
the Health Physics Society



SPECIAL ISSUE:
PROCEEDINGS OF THE 53RD ANNUAL MEETING
OF THE NATIONAL COUNCIL ON RADIATION PROTECTION
AND MEASUREMENTS, MARCH 2017

www.health-physics.com

Wolters Kluwer



Fifty-Fourth
Annual Meeting Program

Radiation Protection
Responsibility in Medicine



March 5–6, 2018

Hyatt Regency Bethesda
One Bethesda Metro Center
7400 Wisconsin Avenue
Bethesda, MD 20814



D Frush
L Dauer,
Co-Chairs

Proceedings to be published
in *Health Physics*, early
2019



2019 Annual Meeting:

April 1-2, 2019

NCRP at Ninety: Our Best Answers to Frequently Asked Questions



**Fred A. Mettler, Jr., *Chair*, &
Jerrold T. Bushberg & Richard J. Vetter,
*Co-Chairs***

See You There!



Other NCRP Activities

- Research – Million Person Study (MPS, MWS)
- Partnerships (to name a few)
 - CRCPD
 - Image Gently Alliance
 - Health Physics Society
 - ICRP
 - UNSCEAR
 - IRPA



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National Study of One Million U.S. Radiation Workers and Veterans



Robert Oppenheimer,
General Leslie Groves,
Enrico Fermi, Hans Bethe,
Theodore Hall

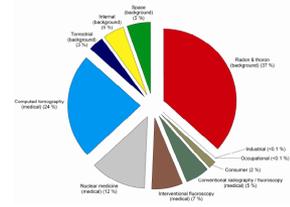
■ Manhattan Project	360,000
■ Atomic Veterans	115,000
■ Nuclear Utility Workers	150,000
■ Industrial Radiographers	115,000
■ Medical & other	>250,000

- **GAO** Report on Low Dose Radiation Needs, 2017
- Low-Dose Radiation Research Act of 2018 – **HR 4675**
- **HR 589** DOE OS “shall carry out a low-dose radiation research program” ...

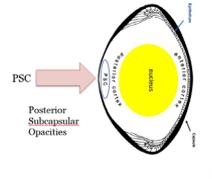


Funding from DOE, DOD, NRC, NASA

Summary

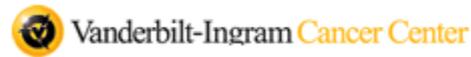
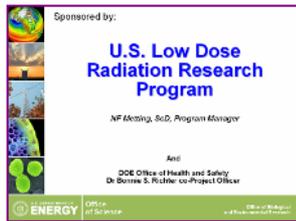
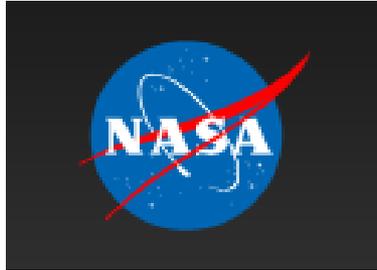


- NCRP chartered by US Congress to provide independent scientific advice on matters related to radiation protection and measurements.
- Numerous documents on topics such as dose to lens of the eye, nanotechnology, emergency preparedness, dosimetry for epidemiology, LNT and low dose effects, space radiation, medical radiation, etc.
- Other activities include annual meetings, research, partnerships with numerous organizations.





Sponsors (Past & Present)





Acknowledgments

- Dr. John Boice, Staff at NCRP and Members of NCRP PACs and SCs

THANK YOU

