The Once and Future NCRP

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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

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 in government, industry, and universities, the National Council on Radiation Protection and Measurements (NCRP) convened a panel of experts to evaluate the current status of radiation professionals and to recommend steps for the future to support the various radiologic sciences. The panel included representatives from various professional societies.

DOSE RECONSTRUCTION FOR THE MILLION WORKER STUDY: STATUS AND GUIDELINES

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

Scientific Committees under PACs

- CC-2 – Meeting the Needs of the Nation for Radiation Protection (WARP: Where Are the Radiation Professionals?)
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 6-11 – 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
Committees Coming Soon

- SC 1-27 – Sex Differences in Lung Cancer (with Relevance to Astronauts)
- SC 6-10 – Doses to Air Crew
Highlighting Council Committees
CC-1/Report no. 180: Radiation Protection Guidance for the United States (will be available soon)

K.R. Kase, Co-Chair
D.A. Cool, Co-Chair
A. Ansari
J.D. Boice, Jr.
J.T. Bushberg
L.T. Dauer
D.R. Fisher
P.A. Fleming
K.A. Higley
R.N. Hyer
W.E. Irwin

F.A. Mettler, Jr.
D.L. Miller
R.J. Preston
G.E. Woloschak
J.E. Till, Liaison
S.J. Adelstein, Consultant
R.L. Anderson, Consultant
M. Boyd, Consultant
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)

Where are the Radiation Professionals (WARP)?

NCRP Statement No. 12, December 17, 2015.

Since the discovery of a ray 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 radiological safety of workers, members of the public, and the environment, radiation professionals have been trained in the management of radiation hazards, in the identification, control, and prevention of exposure to ionizing radiation. In recent years, the radiation protection profession has faced unprecedented challenges. The number of radiation professionals in the United States has decreased by more than 20% since 2000, with the largest declines occurring in the public sector. The radiation protection profession is essential to ensuring the safety of workers, members of the public, and the environment.

The Radiation Protection Professionals (WARP) program was created to address the challenges facing the radiation protection profession. The program aims to increase the number of radiation professionals and to improve the quality of radiation protection training and education. The program is supported by the National Council on Radiation Protection and Measurements (NCRP) and is funded by the Centers for Disease Control and Prevention (CDC).

The WARP program is designed to attract new professionals to the radiation protection field, and to retain existing professionals. The program includes a range of activities, including scholarships, grants, and fellowships. The program also includes a range of educational activities, including workshops, conferences, and training programs.

The WARP program is a collaborative effort, involving a range of stakeholders, including radiation professionals, educators, and government agencies. The program is designed to be flexible and responsive to the needs of the radiation protection profession.

The WARP program is a critical component of the effort to ensure the continued safety of workers, members of the public, and the environment. The program is designed to help radiation professionals to meet the challenges of the 21st century.
PACs and (Selected) Scientific Committees
PAC 1: Basic Criteria, Epidemiology, Radiobiology, and Risk

The membership of PAC 1 is:
G.E. Woloschak, Vice President
J. Bernstein, Co-Chair

S.A. Amundson          G.A. Nelson
E.I. Azzam             H. Paganetti
J.S. Bedford           D.J. Pawel
P. Chang               G. Sgouros
N. Hamada              R.E. Shore
A.R. Kennedy           M.D. Story
A. Kronenberg          M.M. Weil
E.C. Laiakis           J.P. Williams
M.P. Little
SC 1-25: Recent Epidemiologic Studies and Implications for the Linear-Nonthreshold Model

R.E. Shore, Chair
L.T. Dauer, Co-Chair
H.L. Beck
E.A. Caffrey
S. Davis
H.A. Grogan
R.N. Hyer
F.A. Mettler, Jr.
R.J. Preston
J.E. Till
R. Wakeford
L. Walsh
R. Vetter, Staff Consultant

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

Thanks to NRC for financial support
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

(from Parihar et al. 2015)

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.

(from Parihar et al. 2015)
Going to Mars – Alzheimer’s?

Galactic Cosmic Radiation Leads to Cognitive Impairment and Increased Aβ 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. Olchowka³, M. Kerry O’Banion⁴.

Cognitive Neuroscience
What happens to your brain on the way to Mars
Vipan K. Parihar,¹ Barrett Allen,¹ Katherine K. Tran,¹ Trisha G. Macaraeg,¹ Esther M. Chu,¹ Stephanie F. Kwok,¹ Nicole N. Chmielewski,¹ Brianna M. Craver,¹ Janet E. Baulch,¹ Munjal M. Acharya,¹ Francis A. Cucinotta,² Charles L. Limoli¹.

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?
SC 1-26: Approaches for Integrating Radiation Biology & Epidemiology for Enhancing Low Dose Risk Assessment

R.J. Preston, Chair
W. Rühm, Co-Chair
E.I. Azzam
S. Bouffler
M.P. Little
R.E. Shore
I. Shuryak
M.M. Weil
M. Rosenstein, Staff Consultant

Thanks to CDC for financial support
SC 1-27 (*this year*): Evaluation of Sex-Specific Differences in Lung Cancer Radiation Risks & Recommendations for Use in Transfer Models

M.M. Weil, *Chair*
D.L. Preston
W. Rühm
Others TBD
TBD, *Staff Consultant*

Thanks to NASA for funding
PAC 2: Operational Radiation Safety

K.H. Pryor, Vice President
E.D. Bailey
C.A. Donahue
J.R. Frazier
E.M. Goldin
B.L. Hamrick
M. Littleton
D.S. Myers
J.W. Poston
D.M. Scroggs
K. L. Shingleton
G.M. Sturchio
J. Walkowicz
J.S. Willison
J.G. Yusko
SC 2-7: Radiation Safety of Sealed Radioactive Sources

“Cradle to Grave”

K.H. Pryor, Chair
E.D. Bailey  J.W. Poston, Sr.
C. Donahue  K.L. Shingleton
J.R. Frazier  G.M. Sturchio
E.M. Goldin  J. Walkowicz
B.L. Hamrick  J. Willison
M. Littleton  J. Yusko
D.S. Myers  J.L. Thompson, Consultant
PAC 3: Nuclear and Radiological Security and Safety

A. Ansari, Vice President
B.R. Buddemeier, Co-Chair
J.L. Bader
D.J. Blumenthal
L.L. Chi
C.N. Coleman
N. Dainiak
S. DeCair
J. Donnelly
J.R. Dynlacht
F. Fisher-Tyler
W.E. Irwin
G.A. Klemic
J.J. Lanza
S.V. Musolino
M.A. Noska
A. Salame-Alfie
T.P. Taylor
J.D. Rogers, Consultant
B. Stevenson, Consultant
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
PAC 4: Radiation Protection in Medicine

The membership of PAC 4 is:
- D.L. Miller, Vice President
- L.T. Dauer, Co-Chair

K.E. Applegate
S. Balter
E.I. Bluth
C.E. Chambers
A.J. Einstein
D.P. Frush
R.E. Goans
J.E. Gray
M.K. Kalra
L.A. Kroger
E.G. Leidholdt

A.G. Lurie
M. Mahesh
F.A. Mettler, Jr.
W.D. Newhauser
E. Samei
J.A. Seibert
D.C. Spelic
S.G. Sutlief
J.E.K. Timins
S.Y. Woo
P.B. Zanzonico
Radiation Exposure in the US

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
Figure 2. Estimated Number of CT Scans Performed Annually in the United States.

The most recent estimate of 62 million CT scans in 2006 is from an IMV CT Market Summary Report.³
PAC 5: Environmental Radiation and Radioactive Waste Issues

The membership of PAC 5 is:
B.A. Napier, Vice President
S.Y. Chen
A.G. Croff
J.D. Edwards
R.W. Field
K.A. Higley
E.V. Holahan
W.E. Kennedy
K.A. Kiel
J.A. Lipoti
R.E. McBurney
M.A. Noska
B.A. Powell
A. Wallo
SC 5-2: Radiation Protection for NORM & TENORM from Oil & Gas Recovery

WE Kennedy, Chair

D Allard

M Barrie

P Egidi

G Forsee

R Johnson

A Lombardo

R McBurney

J Frazier

Thanks to CRCPD and CDC for financial support
PAC 6: Radiation Measurements and Dosimetry

The membership of PAC 6 is:
S.L. Simon, *Vice President*
L. Bertelli
W.F. Blakely
W.E. Bolch
L.A. Braby
R.R. Brey
R.A. Guilmette
R.T. Kouzes
J.J. Whicker
R.C. Yoder
C. Zeitlin
G.H. Zeman
SC 6-9: U.S. Radiation Workers & Nuclear Weapons Test Participants Radiation Dose Assessment

A. Bouville, Chair
R.E. Toohey, Co-Chair

- DOE Manhattan Project
- NRC Nuclear Utility Workers
- NRC Industrial Radiographers
- DOD Atomic Veterans
- Medical Radiation Workers
Collective Doses for Aircrew are a Main Contributor to Collective Occupational Dose (New SC 6-10 planned)
PAC 7: Radiation Education, Risk Communication, and Outreach

R.N. Hyer, Vice President
S.M. Becker
J.T. Bushberg
R. Johnson
P.A. Karam
P. Locke
C. McClurey
C.W. Miller
M. O’Brien
J. Rader
A. Shogren
J. Till
J. Wieder
V. Siegel, Consultant

“People don't care how much you know until they know how much you care”
Improved “Roll Outs”
Getting the Message Out

NCRP Commentary No. 27:
Implications of Recent Epidemiologic Studies for the
Linear-Nonthreshold Model and Radiation Protection

National Council on Radiation Protection and Measurements

Overview

In May 2018, the National Council on Radiation Protection and Measurements (NCRP) published Commentary No. 27, *Implications of Recent Epidemiologic Studies for the Linear-Nonthreshold Model and Radiation Protection*.

For over 40 years, the linear-nonthreshold (LNT) dose-response model has been used to develop practical and prudent guidance on ways to protect workers and members of the public from the potential for harmful effects of ionizing radiation, specifically, from low linear-energy transfer* (low-LET) radiation.
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
7600 Wisconsin Avenue
Bethesda, MD 20814

Armin Ansari & Adela Salame-Alfie, Co-Chairs
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
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!
NCRP Active Partnerships

- Image Gently Alliance
- Conference of Radiation Control Program Directors
- Health Physics Society
- Radiation Research Society
Partnering with International Organizations

- Two Council Members are on the Main Commission
- NCRP is a Liaison Organization

Seven Council Members are on the U.S. Delegation to the United Nations Scientific Committees on the Effects of Atomic Radiation (UNSCEAR)

One Council Member is on the International Commission on Radiation Units and Measurements (ICRU)
NCRP Conducts Health Effects Research – The Million Person Study
National Study of One Million U.S. Radiation Workers and Veterans

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

- 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, CDC
Medical Radiation Workers – Focus on Sex Differences in Lung Cancer Risk

- Largest Individual Cohort – 170,000
- Half women, half men
- Radiologists, Nuclear Medicine, Oncologist, Technologists, Interventionalists
- Challenging Dosimetry

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26 Peer-Reviewed Articles

I2 - The Million Person Study, Whence it Came

I4 - Relevance to NASA and Space Exploration

E1 - Leukemia Among Nuclear Power Plant Workers

E3 - Updated Mortality Analysis of the Mallinckrodt Uranium Processing Workers, 1942-2012

E4 - Sex-Specific Lung Cancer Risks among MPS Cohorts

E5 - Mortality among Atomic Veterans

E7 - Heart Disease within the Million Person Study
Sponsors (Past & Present)
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.
Acknowledgments

• Dr. John Boice, Staff at NCRP and NCRP Council Members and Members of our PACs and SCs

THANK YOU