NCRP Activities and NORM/TENORM

Kathryn D. Held
National Council on Radiation Protection and Measurements (NCRP)
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)
Mission of the NCRP

To support radiation protection by providing independent scientific analysis, information, and recommendations that represent the consensus of leading scientists.
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 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.

DOSE RECONSTRUCTION FOR THE MILLION WORKER STUDY: STATUS AND GUIDELINES

NCRP Publications

182 Reports
28 Commentaries
12 Statements
Meeting Proceedings
Named Lectures (Taylor, Sinclair, Tenforde)
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-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?)
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 1-27 – Sex-specific Lung Cancer Risks
• SC 2-8 – Operational Radiation Safety Program
• SC 3-2 – Recommendations for Instrument Response Verification and Calibration for Use in Radiation Emergencies
• 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 4-11 – Gonadal Shielding During Abdominal and Pelvic Radiography
• SC 5-2 – Radiation Protection for NORM/TENORM
• SC 6-11 – Medical Worker Dosimetry
• SC 6-12 – Brain Dosimetry for Internal Radionuclides
Recently Completed Committee Documents (2018-2019)

- SC 6-9 – Deriving Organ Doses and their Uncertainties
- SC 2-7 – Radiation Safety of Sealed Radioactive Sources
- SC 3-1P2 – Implementation Guidance for Emergency Response Dosimetry
Council Committees, PACs and (Selected) Scientific Committees
Report No. 180: Radiation Protection Guidance for the United States

Council Committee (CC)-1

K.R. Kase, Co-Chair
D.A. Cool, Co-Chair
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S.J. Adelstein, Consultant
R.L. Anderson, Consultant
M. Boyd, Consultant
M. Rosenstein, Staff Consultant

Thanks to NRC & CDC 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. 23, 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 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, 2016; BPS, 2013; NANSIC, 2013).

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. Attendees 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 areas. Radiation biology has already been critically depleted and other specialties are following the same downward spiral. All radiation professionals share the same goal 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 occupational, 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 unfulfilled 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 attack. 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.

Thanks to CDC for funding
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
E.I. Azzam
J.S. Bedford
P. Chang
N. Hamada
A.R. Kennedy
A. Kronenberg
E.C. Laiakis
M.P. Little
G.A. Nelson
H. Paganetti
D.J. Pawel
G. Sgouros
R.E. Shore
M.D. Story
M.M. Weil
J.P. Williams
SC 1-24P2: Radiation Exposures in Space and the Potential for CNS Effects

Human Exploration Research Analog (HERA), JSC

Thanks to NASA for funding

Les Braby  Jacob Raber
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: Evaluation of Sex-Specific Differences in Lung Cancer Radiation Risks & Recommendations for Use in Transfer Models

M.M. Weil, Chair
J.D. Boice D.L. Preston
L.T. Dauer M. Sokolnikov
E.J. Grant M.D. Story
D.G. Hoel R. Wakeford
J.L. Huff L. Walsh
D.J. Pawel L. Zablotska
S. Blattning, NASA Technical Advisor
R.J. Preston, Advisor
W. Rühm, Advisor
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Thanks to NASA for funding
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PAC 3: Nuclear and Radiological Security and Safety

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W. E. Irwin
G. A. Klemic
J. J. Lanza
S. V. Musolino
M. A. Noska
L. Pibida
A. Salame-Alfie
B. Stevenson, Consultant
SC 3-1: (1) Guidance for Emergency Responder Dosimetry and (2) Implementation Guidance for Responder Dosimetry in an Emergency

Thanks to DHS, CDC, and NYC for financial support

S. V. Musolino, A. Salame-Alfie, Co-Chairs
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
J.E. Gray
L.A. Kroger
E.G. Leidholdt
A.G. Lurie
M. Mahesh
F.A. Mettler, Jr.
W.D. Newhauser
M.J. Rivard
J.A. Seibert
D.C. Spelic
S.G. Sutlief
J.E.K. Timins
J.P. Winston
S.Y. Woo
P.B. Zanzonico
SC 4-9: Medical Exposure of Patients in the United States

F.A. Mettler, Chair
M. Mahesh, Co-Chair

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

Thanks to CDC for funding
Other PAC 4 Current Activities

• SC 4-5: Radiation Protection in Dentistry (Report)
• SC 4-7: Evaluating and Communicating Radiation Risks for Studies Involving Human Subjects: Guidance for Researchers and Reviewing Bodies (Report)
• SC 4-8: Improving Patient Dose Utilization in Computed Tomography (Commentary)
• SC 4-10: Program Components for Error Prevention in Radiation Therapy (Statement)
• SC 4-11: Gonadal Shielding During Abdominal and Pelvic Radiography (Statement)

+ 4 other activities under consideration
PAC 5: Environmental Radiation and Radioactive Waste Issues

The membership of PAC 5 is:
B.A. Napier, Vice President
M. Boyd
S.Y. Chen
A.G. Croff
R.W. Field
K.A. Higley
E.V. Holahan
W.E. Kennedy
K.A. Kiel
J.A. Lipoti
R.E. McBurney
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:
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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
PAC 6 Active Committees

1) SC 6-11 Dosimetry Guidance for Medical Radiation Workers with a focus on Lung Dose Reconstruction (Commentary)

2) SC 6-12 Development of Models for Brain Dosimetry for Internally Deposited Radionuclides (Commentary)
PAC 7: Radiation Education, Risk Communication, and Outreach

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

“People don't care how much you know until they know how much you care”
PAC 7: Communications Efforts/Improvements

- Improved “Roll-outs” of documents
- Social media
  - Twitter, Facebook, TEDEd, etc.
  - Social media calendar
  - Social media policy
- Quarterly Newsletter
NCRP Annual Meetings
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
Chair, Fred A. Mettler, Jr.
Co-Chairs, Jerrold T. Bushberg & Richard J. Vetter

Fifty-Fifth Annual Meeting Program

NCRP Meeting the Challenge at 90:
Providing Best Answers to Your Most Pressing Questions About Radiation

April 1–2, 2019

Hyatt Regency Bethesda
One Bethesda Metro Center
7400 Wisconsin Avenue
Bethesda, MD 20814
2020 Annual Meeting
March 23-24, 2020

Radiation & Flight:
A Down-to-Earth Look at Risks

Jacqueline P. Williams & Cary Zeitlin, Co-Chairs
NCRP Partnerships and Participation in Meetings of Other Organizations
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

Eight 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 Participation in Health Physics Society Mid-year Meetings

2016 – Austin
2017 – Bethesda
2018 – Denver
2019 – San Diego

2020: NCRP Symposium on Radiation Protection in Medicine
HPS Mid-Year Meeting, 26–29 January 2020; Bethesda, MD
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

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

- 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

Study Population = 168,601

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Federal Government Sponsors (Past & Present)
• An activity emphasized in CDC grant to NCRP

• Commentary nearing completion: SC 5-2: Overview of NORM/TENORM from the Contemporary Oil and Gas Industry

• Underlying principles in NCRP Report No. 180
Report No. 180: Radiation Protection Guidance for the United States

Thanks to NRC & CDC for financial support

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J.E. Till, Liaison
S.J. Adelstein, Consultant
R.L. Anderson, Consultant
M. Boyd, Consultant
M. Rosenstein, Staff Consultant
NCRP Report No. 180

- Recommendations integrate:
  - Knowledge of human biological effects of ionizing radiation
  - Established ethical principles
  - Experience with use and management of radioactivity and radiation-producing devices
  - Experience with radiation protection approaches
NCRP Report No. 180

- Explicitly covers workers and members of the public who may be exposed to elevated levels of NORM/TENORM

- 3 Radiation Protection Principles
  - Justification
  - Optimization (ALARA)
  - Numeric protection criteria for management of dose to an individual

  - Only suitable to be a regulatory dose limit when the source is stable, characterized, and an appropriate radiation control program is established in advance
• ALARA, taking into account societal, economic and environmental factors
  – Maximizing benefit over harm
  – Not just driving doses lower and lower
• Applies to all exposure situations to manage doses well below numeric protection criteria
• Each situation, circumstance could be unique, so each outcome might be unique
• To be considered within “All Hazards”
SC 5-2: Radiation Protection for NORM & TENORM from Oil & Gas Recovery

Thanks to CRCPD and CDC for financial support
SC 5-2: Background

- New technologies like hydraulic fracturing and horizontal drilling (unconventional oil and gas exploration and production) are increasingly in use.
- NORM/TENORM regulation falls to the States, resulting in inconsistent regulations.
- **Purpose of SC 5-2**: Conduct a scientific evaluation of potential radiation protection and waste management issues from contemporary oil and gas exploration and production.
SC 5-2: Topics

- Introduction: Need for Guidance
- Natural Background
- Oil and Gas Operations that Generate TENORM
- TENORM Management and Disposition Options
- Other Factors that May Affect TENORM Safety Decisions
- Historical and Current Regulatory Framework
- Disposal Modeling Considerations
- Legal Considerations
- Summary and Recommendations
NCRP SC 5-2

- More on NCRP Scientific Committee 5-2 to be presented by Bill Kennedy in Workshop sponsored by CRCPD and CDC on Wednesday, September 25, 1:30-5:00 pm
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.

• NCRP’s SC 5-2 is preparing a Commentary on “Overview of NORM/TENORM form the Contemporary Oil and Gas Industry”.