Annual Report

2021

Year in Review

NCRP

Contents

Charter

The National Council on Radiation Protection and Measurements is a nonprofit corporation chartered by Congress in 1964 to:

1. Collect, analyze, develop and disseminate in the public interest information and recommendations about (a) protection against radiation and (b) radiation measurements, quantities and units, particularly those concerned with radiation protection.
2. Provide a means by which organizations concerned with the scientific and related aspects of radiation protection and of radiation quantities, units and measurements may cooperate for effective utilization of their combined resources, and to stimulate the work of such organizations.
3. Develop basic concepts about radiation quantities, units and measurements, about the application of these concepts, and about radiation protection.
4. Cooperate with the International Commission on Radiological Protection, the International Commission on Radiation Units and Measurements, and other national and international organizations, governmental and private, concerned with radiation quantities, units and measurements and with radiation protection.

The Council is the successor to the unincorporated association of scientists known as the National Committee on Radiation Protection and Measurements and was formed to carry on the work begun by the Committee in 1929.

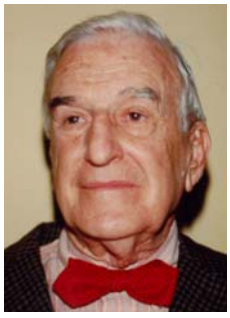
Participants in the Council's work are the Council members and members of scientific, advisory and administrative committees. Council members are selected on the basis of their scientific expertise and serve as individuals, not as representatives of any particular organization. The scientific committees, composed of experts having detailed knowledge and competence in the particular area of the committees' interests, draft reports, commentaries and statements. These are then submitted to the full membership of the Council for careful review and approval before being published.

NCRP

Mission

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

Presidents



Lauriston S. Taylor
1929 – 1977

Warren K. Sinclair
1977 – 1991

Charles B. Meinhold
1991 – 2002

Thomas S. Tenforde
2002 – 2012

John D. Boice, Jr.
2012 –2018

Kathryn D. Held
2019 –

President's Message

Here I am writing my second President's Message from my home office, working, as many of you have this past year, from home. As I reported for 2020, NCRP has coped well with the challenges of 2021, with some of our dedicated, hard-working staff and most of the important cadre of volunteers on committees, the Board, etc. doing all they do for NCRP virtually.

We've all become pretty adept at Teams®/Zoom® meetings and new ways to carry on the work of NCRP. All in all, it has been a productive and fulfilling, albeit at times hectic, year. I use this report to reflect on our accomplishments and several exciting new activities in 2021, as well as opportunities and challenges for the future.

Highlights of 2021 include:

- A high point for NCRP was the hugely successful Annual Meeting held virtually in April. Due to the hard work of Jacqueline P. Williams and Cary J. Zeitlin, Program Co-Chairs, and their Program Committee, the meeting had wonderful, cutting-edge presentations on "Radiation and Flight: A Down-to-Earth Look at Risks," and the online access for all went smoothly thanks to A Meeting By Design, who handled the IT side of the meeting. Now, months later, I'm still receiving comments from others about what a superb meeting that was. Kudos to everyone involved.
- We had a good year from a grant funding perspective, receiving:
  - a new grant from the Conference of Radiation Control Program Directors (CRCPD) to help fund Scientific Committee (SC) 4-10 and SC 4-12.
  - a new grant from the Centers for Disease Control and Prevention (CDC) for several initiatives, but especially to help fund informational efforts about health effects of wireless technology, including new SC 8-1 (more below).
  - expanded funding from the National Aeronautics and Space Administration (NASA) for the Million Person Study (MPS) (more below).
  - a new grant from the Food and Drug Administration (FDA) to help fund SC 4-12.
- Three new scientific committees were initiated in 2021 (more details below):
  - SC 4-12 on "Risk Management Stratification of Equipment and Training for Fluoroscopy" (Chair: Stephen Balter; Vice-Chair: Donald L. Miller) to prepare a statement.
  - SC 6-13 on "Methods and Models for Estimating Organ Doses from Intakes of Radium" (Chair: Derek W. Jokisch; Vice-Chair: Nicole E. Martinez) to prepare a commentary.
  - SC 8-1 on "Development of NCRP Informational Webpages to Provide Authoritative Information About the Use of Wireless Technology and Current Evidence on Health Effects" (Chair: David A. Savitz).
- In May, we held the first ever (as far as I know) Welcome Webinar for new Council members. Since we didn't have an in-person annual meeting in 2021, this was an important opportunity to welcome our newly-elected members, introduce them to each other and to several senior members of Council, and explain to them more about NCRP and some of our processes. The session was well-received by all attendees, and we plan to make it a regular annual event.
- Another new initiative is related to "formal" internship and mentoring efforts. In June, NCRP signed a Memorandum of Understanding with University of Alabama Birmingham to provide opportunities for

interns in their Health Physics Masters' Program to work with NCRP. Our first intern, Kendall Williams, started in August, working with the Nonionizing Radiation Advisory Panel to start to develop an informational webpage on fifth-generation technology radiation for our website. We were very pleased to have her on board, and she did an excellent job. We have set up an ad hoc committee on Internships and Mentoring to make suggestions on other approaches to expand our efforts in this area, and we welcome any thoughts or suggestions.

- With several NCRP statements planned in the near future as the products of scientific committees, the need for standardization of statements was readily apparent. Hence, we convened an ad hoc NCRP committee to make recommendations regarding format of NCRP statements. The Committee reported to the Board in September, their recommendations were accepted, and you will see in the several statements that will be published in 2022, a new, standard format.
- Because our new CDC grant includes substantial emphasis on work on health effects of wireless technology, in December the Board elevated the Advisory Panel on Nonionizing Radiation to a Program Area Committee (PAC), now PAC 8, currently chaired by Jerrold T. Bushberg. SC 8-1, described below, is the first activity under this new PAC.
- NCRP officers, chairs of scientific committees, and other members gave (virtual) presentations at multiple meetings of other organizations and in diverse venues (see list below). A highlight was the John C. Villforth Lecture, given by Dr. John D. Boice, Jr., NCRP's Director of Science, on "NCRP's Recent Accomplishments and Visionary Approach to Radiation Protection: What the Future Holds," at the CRCPD's 53rd National Conference on Radiation Control in May.
- The awardee selected to receive the 2nd John D. Boice Young Investigator Award at the 2022 Annual Meeting is Sara Dumit, who works at Los Alamos National Laboratory (see the NCRP home page for more info: https://ncrponline.org). Congratulations to Sara!

NCRP Publications Completed in 2021:

- **NCRP Statement No. 13,** ***NCRP Recommendations for Ending Routine Gonadal Shielding During Abdominal and Pelvic Radiography***, prepared by SC 4-11 (Chair: Donald P. Frush; Vice Chair: Keith J. Strauss), was released on the NCRP website in January 2021 along with a companion document, ***Implementation Guidance for Ending Routine Gonadal Shielding During Abdominal and Pelvic Radiography*** and a trifold brochure explaining the recommended change for members of the general public. This trio of documents has received wide-spread attention. All three documents were translated into Japanese by Nobuyuki Hamada, PAC 1, and published under the kind auspices of the Japan Health Physics Society. We've also had requests for others to translate the brochure into Spanish. I want to especially commend Angela Shogren, PAC 7, who designed the trifold brochure, a new approach for NCRP to get information out to members of the general public. NCRP acknowledges support by the American Association of Physicists in Medicine, American Board of Radiology (ABR) Foundation, American College of Radiology, American Society of Radiologic Technologists, Image Gently®, and Society for Pediatric Radiology.

Committees at Work:

- **CC 2, Meeting the Needs of the Nation for Radiation Protection** (Chair: Wayne D. Newhauser; Co-Chair: Jacqueline P. Williams), is expanding on our "Where are the Radiation Professionals

(WARP)?" initiative, NCRP Statement No. 12 (2015). Although there have been delays, and challenges because of some paucity of quantitative workforce data, the Committee writing teams, covering all facets of the radiation sciences, are continuing work to revise the PAC-reviewed draft to address the many thoughtful comments received and produce an updated revision of the draft commentary for Council review.

- **SC 1-27, Evaluation of Sex-Specific Differences in Lung Cancer Radiation Risks and Recommendations for Use in Transfer Models** (Co-Chairs: Michael M. Weil and David J. Pawel), is a NASA-funded initiative of great relevance to astronauts on long-duration missions beyond low-Earth orbit. The commentary will contain an assessment of sex-specific differences in radiation-induced lung cancer in human populations and animal models and make recommendations for NASA regarding models to be used in predicting radiation risks for astronauts. The draft commentary has undergone PAC review and is being revised to be sent out for Council review soon.
- **SC 2-8, Operational Radiation Safety Program** (Chair: Kathryn H. Pryor), is updating NCRP Report No. 127 (1998) providing guidance to individuals with responsibility for establishing and implementing operational radiation safety programs. This is a long-awaited update. The report has been through PAC and Council review, revised, and is now being prepared for printing.
- **SC 3-2, Recommendations for Instrument Response Verification and Calibration for Use in Radiation Emergencies** (Co-Chairs: Leticia S. Pibida and Gladys A. Klemic), is preparing an NCRP statement on recommendations for periodic functionality checks of radiation detection instruments for emergency response in lieu of periodic, and typically cost-prohibitive, manufacturer-recommended recalibrations. This activity is funded by CRCPD and CDC. Having been through Council review, the draft statement is now being revised, then will be finalized for release.
- **SC 3-3, Respiratory Protection for Emergency Workers Responding to a Nuclear/Radiological Emergency** (Co-Chairs: Armin Ansari and Adela Salame-Alfie), is preparing an NCRP statement, with funding from CDC, to address respiratory protection for a category of ancillary emergency workers who would be involved in responding to a nuclear or radiological emergency who are neither first responders nor first receivers and are not already part of a respiratory protection program. The draft statement has been through PAC review and will be out for Council review soon.
- **SC 4-10, Error Prevention in Radiation Therapy** (Co-Chairs: Steven G. Sutlief and Michael T. Milano), is preparing a statement to enumerate the necessary program components for error prevention in radiation therapy and to delineate objective characteristics of a safety-focused radiotherapy department. Funded by FDA and the ABR Foundation, a draft document is nearing being sent for PAC review and final publication is anticipated by fall.
- **SC 4-12, Risk Management Stratification of Equipment and Training for Fluoroscopy** (Chair: Stephen Balter; Vice Chair: Donald L. Miller), is preparing a statement to provide guidance that can be used by facilities to select fluoroscopic equipment that conforms to the appropriate the International Electrotechnical Commission standard for the facility's intended uses of that particular fluoroscope and to outline a risk-based training program for all individuals privileged to perform or assist with fluoroscopic procedures in a facility. This activity is partly funded by the ABR Foundation. The draft statement is nearly ready for PAC review.
- **SC 6-12**, in a U.S. Department of Energy (DOE)-funded effort, has prepared a commentary on ***Development of Kinetic and Anatomical Models for Brain Dosimetry for Internally Deposited Radionuclides*** (Chair: Richard Leggett; Vice Chair: Sergey Y. Tolmachev) as part of the MPS. This work may also be applicable to concerns of NASA with regards to high linear-energy transfer (LET) radiation effects on the central nervous system. The commentary is nearly ready for printing and should be available in March.
- **SC 6-13, Methods and Models for Estimating Organ Doses from Intakes of Radium** (Chair: Derek W. Jokisch; Vice Chair: Nicole E. Martinez), is DOE-funded to prepare a commentary describing

new and contemporary approaches for obtaining organ doses following intakes of radium. The new work will meet several deliverables associated with the MPS. The scientific committee is in the early stages of preparing a draft document.

- **SC 8-1, NCRP Webpages on the Use of Wireless Technology and Evidence on Health Effects** (Chair: David A. Savitz), funded by CDC, is a somewhat new, and exciting, type of activity for NCRP as the goal is to create NCRP authoritative, science-based, informational webpages that can serve as a primary resource to which CDC and other federal health agencies can refer members of the public seeking additional information about the use of wireless technology and its known health effects. The committee has only recently begun work, but we hope to see some new web-based information later this year.

Other Publications:

Members, particularly chairs, of NCRP scientific committees are encouraged to publish papers in peer-reviewed journals summarizing the NCRP reports or commentaries on which they worked. The two such publications in 2021 are listed here:

- Preston RJ, Rühm W, Azzam EI, Boice JD, Bouffler S, Held KD, Little MP, Shore RE, Shuryak I, Weil MM. 2021. Adverse outcome pathways, key events, and radiation risk assessment. Int J Radiat Biol. 97(6):804-814.
- Yoder C, Balter S, Boice Jr JD, Grogan H, Mumma M, Rothenberg LN, Passmore C, Vetter RJ, Dauer LT. 2021. Using personal monitoring data to derive organ doses for medical radiation workers in the Million Person Study-considerations regarding NCRP Commentary no. 30. J. Radiol. Prot. 41:118-128.

2021 publications involving NCRP work, including those reporting findings from the MPS, are listed here:

- Martinez NE, Jokisch DW, Dauer LT, Eckerman KF, Goans RE, Brockman JD, Tolmachev SY, Avtandilashvili M, Mumma MT, Boice Jr JD, Leggett RW. 2021. Radium dial workers: back to the future, Int J Radiat Biol. Online ahead of print, 2021 26 Apr.
- Boice JD Jr, Cohen SS, Mumma MT, Golden AP, Howard S, Girardi DJ, Dupree Ellis ED, Bellamy M, Dauer LT, Samuels C, Eckerman KF, Leggett R. 2021. Mortality among workers at the Los Alamos National Laboratory, 1943-2017. Int J Radiat Biol. Online ahead of print, 2021 May 28.
- Boice JD Jr, Bouville A, Dauer LT, Golden AP, Wakeford R. 2021. Introduction to the special issue on the US Million Person Study of health effects from low-level exposure to radiation. Int J Radiat Biol. Online ahead of print, 2021 Oct 26.
- Boice JD Jr, Quinn B, Al-Nabulsi I, Ansari A, Blake PK, Blattnig SR, Caffrey EA, Cohen SS, Golden AP, Held KD, Jokisch DW, Leggett RW, Mumma MT, Samuels C, Till JE, Tolmachev SY, Yoder RC, Zhou JY, Dauer LT. 2021. A million persons, a million dreams: a vision for a national center of radiation epidemiology and biology. Int J Radiat Biol. Online ahead of print, 2021 Nov 3.
- Boice JD Jr, Cohen SS, Mumma MT, Howard SC, Yoder RC, Dauer LT. 2021. Mortality among Medical Radiation Workers in the United States, 1965-2016. Int J Radiat Biol. Online ahead of print, 2021 Nov 3.
- Bushberg JT. 2021. National Council on Radiation Protection (NCRP). NPSS News, Issue 4, 2021 Dec.

Presentations:

The work of NCRP, including MPS efforts funded through NCRP, is presented at various venues by NCRP officers, chairs/members of PACs and scientific committees and others involved in the projects. Presentations in 2021 included:

- John D. Boice, Jr., "Evaluation of Sex-Specific Differences in Lung Cancer Radiation Risks and Recommendations for Use in Transfer Models," 2021 NASA Human Research Program Investigators'

Workshop; Breaking Boundaries: Advancing Human Space Flight Research Through Innovation and Collaboration. Virtual Meeting, 2021 Feb 1-4.

- Kathryn D. Held, "NCRP: Who We Are and What We Do," Baltimore Washington Chapter of the Health Physics Society monthly meeting, 2021 Mar 18.
- Kathryn D. Held, "Radiation Chemistry; Effects of Radiation on DNA and Chromosomes," Lecture in Radiation Biology Course, AFRRI, 2021 Mar 31.
- Kathryn D. Held, Journal Club and Career Discussion with Graduate Students, Oregon Health Sciences University, Virtual Session, 2021 Mar 31.
- Kathryn D. Held, "Update on NCI/NCRP - Radiation Low-Dose Therapy to Treat COVID-19," ISCORS Spring Virtual Meeting, 2021 Apr 1.
- John D. Boice, Jr., "John C. Villforth Lecture: NCRP's Recent Accomplishments and Visionary Approach to Radiation Protection: What the Future Holds," 53rd National Conference on Radiation Control (virtual), CRCPD, 2021 May 17 - 21.
- Joel E. Gray, "NCRP Report on Radiation Protection in Dentistry and Oral and Maxillofacial Imaging," CRCPD Annual Meeting (virtual), 2021 May.
- Adela Salame-Alfie, "NCRP Commentary 28," presentation at CRCPD Annual Meeting, 2021 May.
- Adela Salame-Alfie, "NCRP Update: Scientific Committee 3-3 Respiratory Protection for Emergency Workers Responding to a Nuclear/Radiological Emergency," Presentation for ROSS training, CRCPD meeting, 2021 May.
- William E. Irwin, "Upcoming Draft National Council on Radiation Protection and Measurements (NCRP) Statements," Presentation for ROSS training, CRCPD meeting, 2021 May.
- Lawrence T. Dauer and John D. Boice, Jr., "The Million Person Study of Low-Level and Low-Dose-Rate Health Effects," Virtual presentation at the 2021 Health Physics Society Midyear Workshop, 2021 May 24.
- Michael B. Bellamy, Richard W. Leggett, Caleigh E. Samuels, Keith F. Eckerman, John D. Boice, Jr., Lawrence T. Dauer, "An Overview of the Dosimetry Approaches for the Million Person Study," Virtual presentation at the 2021 Health Physics Society Midyear Workshop, 2021 May 24.
- Nicole E. Martinez, Derek W. Jokisch, Richard W. Leggett, Keith F. Eckerman, Sergei Tolmachev, Michael M. Mumma, Lawrence T. Dauer, John D. Boice, Jr., "Radium Dial Painters: An Overview," Presentation at the 2021 Health Physics Society Midyear Workshop, 2021 May 24.
- Derek W. Jokisch, Nicole E. Martinez, Richard W. Leggett, Keith F. Eckerman, Lawrence T. Dauer, Sergei Tolmachev, Michael M. Mumma, John D. Boice, Jr., "Dosimetry for a Radium Dial Painter Cohort - Past Approaches and Improvements," Presentation at the 2021 Health Physics Society Midyear Workshop, 2021 May 24.
- Lawrence T. Dauer, "The U.S. Million Person Study - Medical Worker Cohort," Presentation at the 2021 Robert Forrest Memorial Medical Health Physics Symposium, Delaware Valley Society for Radiation Safety, 2021 Jun 9.
- Kathryn D. Held, "Low Dose Radiation Therapy for COCID-19: Benefits or Risks? Update for MSKCC Medical Physics," Grand Rounds presentation for MSKCC Medical Physics Department, 2021 Sep 7.
- Armin Ansari, "Overview of the Recent Radiological/Nuclear Preparedness Guidance from the National Council on Radiation Protection and Measurements," Presentation for the Mid-Atlantic States Radiation Control Programs Conference (virtual), 2021 Sep 21-22.
- Mahadevappa Mahesh, "To Shield, or Not to Shield? Perspectives on Changes to Gonadal Shielding, Practical Implications, Views from ACR, AAPM, NCRP, ASRT," Presentation for the Mid-Atlantic States Radiation Control Programs Conference (virtual), 2021 Sep 21.
- John D. Boice, Jr, "Health Risks among Nuclear Power Plant Workers and Industrial Radiographers," virtual Nuclear Regulatory Commission RES Technical Seminar, 2021 Sep 29.

- John D. Boice, Jr, "Radiation, Cognition, and Parkinson's Disease," Symposium presentation at the 67th Annual Meeting of the Radiation Research Society (virtual), 2021 Oct.
- Michael B. Bellamy, "An Overview of the Dosimetry Approaches for the Million Person Study," Symposium presentation at the 67th Annual Meeting of the Radiation Research Society (virtual), 2021 Oct.
- Lawrence T. Dauer. "Cardiovascular Risk Following Fractionated Low-Dose Radiation in Occupational Cohorts: An Update from the Million Person Study," Symposium presentation at the 67th Annual Meeting of the Radiation Research Society (virtual), 2021 Oct.
- Ashley P. Golden, "Sex-Specific Lung Cancer Risk Following Fractionated Low-Dose Radiation in Occupational Cohorts: An Update from the Million Person Study," Symposium presentation at the 67th Annual Meeting of the Radiation Research Society (virtual), 2021 Oct.
- Lawrence T. Dauer, "The U.S. Million Person Study of Low-Level and Low-Dose-Rate Health Effects: Status, Results, Expansion and Vision," Virtual presentation for GNYCHPS' Ginny's Chips Rad Café, 2021 Nov 9.
- Lawrence T. Dauer and John D. Boice, Jr., "U.S. Million Person Study of Low-Level and Low-Dose-Rate Health Effects: Status, Results, Expansion and Vision," EPRI Internal Dose Effect Alliance (IDEA) Virtual Workshop, 2021 Nov 30.
- John D. Boice, Jr, and Lawrence T. Dauer, "Million Person Study of Low-Dose Radiation Health Effects," 2021 ANS Winter Meeting and Technology Expo. Radiation Protection and Shielding: General (virtual), 2021 Dec 1.

I hope that we have captured all the presentations given on behalf of NCRP. I apologize if we've missed any; please let me know about them. We thank all the individuals who have given of their time and effort to represent NCRP so well to a variety of stakeholders.

Funding Support:

In 2021 NCRP received new grants from the CRCPD (SC 4-10 and 4-12), CDC (SC 8-1), and FDA (SC 4-12) (listed above), and we received a large addition to an existing grant from NASA to expand the MPS-related study of the effects of alpha particles on the central nervous system to low-LET radiations (see below re MPS).

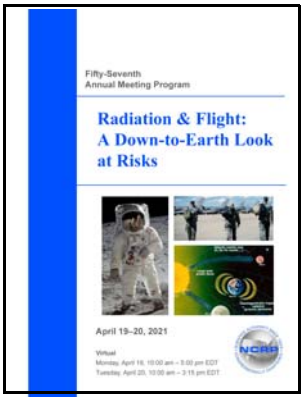
In 2021 NCRP work continued with grants and contracts funded by a number of sources including (active SCs during 2021 supported by each in parentheses):

- ABR Foundation (SC 4-10 and SC 4-11)
- CDC (SC 3-2, SC 3-3, and SC 8-1)
- CRCPD (SC 3-2)
- DOE (SC 6-12, SC 6-13, and MPS)
- NASA (SC 1-27, SC 6-11, and MPS)
- U.S. Navy (MPS)

We are so very grateful for the significant monetary and programmatic support from these agencies and organizations and thank them for their continued interest in and funding of NCRP and our programs. This support is vital to our ability to provide the scientific service to the nation that is NCRP's mission.

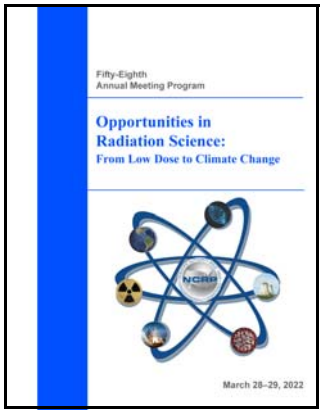
Annual Meetings:

Because of the COVID-19 pandemic, the **57th Annual Meeting** of the NCRP on "**Radiation and Flight: A Down-to-Earth Look at Risks**" was held virtually on April 19-20, 2021, for the scientific program and our Council Business Meeting was held virtually on April 21, 2021. The scientific program started off with an inspiring special message from Astronaut Shannon Walker on board the International Space Station, followed by the 17th Warren K. Sinclair Keynote Address by Astronaut Serena M. Auñón-Chancellor, a fascinating discussion on "Perception of Radiation Risk from the Astronaut Office." The Annual Meeting



also included the 44th Lauriston S. Taylor Lecture by Robert L. Ullrich on "Taking Up Space: The Path to Understanding Radiation Risks" and the 4th Thomas S. Tenforde Topical Lecture by Paul A. Locke entitled "Collision or Cooperation? The Law, Ethics and Science of Personalized Risk Assessments for Space and Air Travel." Although we greatly missed seeing everyone in person, one advantage of a virtual meeting was that many individuals who would not normally have been able to join us for a meeting in Bethesda were able to join virtually, so we had a high meeting attendance and the meeting received rave reviews. Kudos to the Program Committee Co-Chairs and members for putting together such an exciting and interesting meeting.

The **58th Annual Meeting**, on "**Opportunities in Radiation Science: From Low Dose to Climate Change"** will be held March 28-29, 2022, unfortunately also virtually. The Program Committee, led by Co-Chairs Jessica S. Wieder and Evagelia C. Laiakis, has planned an innovative, interactive meeting to highlight the work of NCRP and its impact and to discuss the future of radiation protection, radiation sciences and NCRP's role and opportunities in that future. A wide range of topics will be presented, and it will be an honor to have distinguished speakers including the 45th Lauriston Taylor Lecturer, Gayle E. Woloschak, discussing "Long-Term Radiation Animal Studies: A Story Continues," the 18th Annual Sinclair Keynote Address by Joe W. Gray on "Developing a Long-Term Strategy for Low-Dose Radiation Research in the United States," and the 5th Tenforde Topical Lecture by Jill A. Lipoti on "Opportunities in Radiation Science: Applying Our Collective Knowledge to the Challenges of Our Time." We are looking forward to a stimulating meeting.



We are in early stages of planning the 2023 Annual Meeting, which will be held on March 27-28, 2023. The meeting topic is "**Integration of Physics, Biology and Epidemiology in Radiation Risk Assessment**," and the Program Committee will be chaired by Eric Grant. More information to come.

PAC Work:

As COVID-19 has continued to impede the ability of the PACs to meet face-to-face, the PAC chairs/co-chairs have done a great job facing the challenges. The PACs all met at least once virtually in 2021, around the time of the annual meeting, and several PACs met virtually more frequently to discuss PAC business and have scientific presentations and discussions. Some of the meetings have been combined activities of two or three PACs meeting jointly. I continue to meet every few months with the PAC chairs and find the sessions very helpful as they provide some great ideas for new activities for NCRP and important insight about ongoings in the radiation community and potential funding discussions.

Much of the valuable work done by the PACs involves their oversight of and assistance to NCRP scientific committees, described above. A few noteworthy items about the PACs include:

- As mentioned above, the former Advisory Panel on Nonionizing Radiation has been changed to PAC 8 and is currently chaired by Jerrold T. Bushberg. This "upgrade" was a result of our new CDC grant including substantial emphasis on work on health effects of wireless technology, so it was felt that a PAC designation was needed for the oversight group. We anticipate changes in the membership of PAC 8 over the next few months so it will incorporate all the expertise now needed.
- Although impeded somewhat by COVID, PAC 7, working with other PACs, is continuing to plan a revamp of the NCRP website (https://ncrponline.org) to improve its usability and increase our content that could be useful to many stakeholders, including our supporting and collaborating organizations,

educators, and members of the general public. In addition, website information is being developed by SC 8-1 regarding health effects of wireless technology.

Finances:

As mentioned above, we received several new grants and additional funding from NASA in 2021, so NCRP's finances improved somewhat. Furthermore, not having a face-to-face annual meeting in 2021 helped the bottom line as that is a large financial drain that is unfunded. However, finances remain our biggest challenge in the long run. You can see details in the financial statements later in this Annual Report, but I have a few comments here. The value of our net assets has increased slightly, mostly in sync with the stock market, but our net assets are still well below levels some years back. As in 2020, our expenses, but also our income, for 2021 were below the levels we had projected going into the year because of the lack of face-to-face scientific committee meetings, staff and staff consultant travel and time on meetings in the office, etc. through the year due to COVID, which impacted those bottom lines negatively. These are all activities that cost money, but also bring in overhead from our grants. As discussed above, we learned how to get work done well by virtual meetings and work from home, but with an impact on finances. Some of that decrease was offset by the expanded funding from NASA for the MPS component on cognition.

The Board and Budget and Finance Committee have struggled for the last several years with the issue of the outlay of funds needed to finance the annual meeting (which can be substantial when the meeting is in-person), since sources of funding for the meeting have been scarce. After much debate, it was decided to initiate a modest registration fee for the 2022 annual meeting. NCRP members, meeting speakers and session chairs are exempt from the fee, and any others who find it difficult to pay can register without paying the fee. We do not want a fee to discourage anyone from attending our Annual Meeting, so the latter category is designed to be especially mindful of early career individuals and those in positions where obtaining funding to attend the meeting is difficult. This is an experiment that we will assess after the meeting to determine whether to continue in the future.

The ongoing grants from DOE, NASA, CDC, the U.S. Navy, CRCPD, and ABR are vital to our work and are described above, as well as the new grants from CRCPD, CDC, FDA, and expansion from NASA. We continue to seek other sources of revenue in this challenging environment, but, at the risk of sounding like a broken record, we need to seek ways to increase funding and secure NCRP's long-term financial position. We thank all the Council members and others who have made donations to NCRP directly or took advantage of the AmazonSmile initiative, and we encourage you to remember NCRP with a charitable contribution or as a small percentage beneficiary of an individual retirement account or life insurance policy. Your ideas regarding potential fundraising opportunities are welcome!

Millon Person Study:

The MPS of low-dose radiation health effects remains a major effort under the auspices NCRP. This important project is headed by John D. Boice, Jr., NCRP Director of Science and past President, with Lawrence T. Dauer playing a key leadership role, also. The MPS is designed to study the range of health effects from prolonged radiation exposures in healthy American workers and veterans who are more representative of today's population than are the Japanese atomic-bomb survivors, exposed briefly to radiation in 1945, the population typically used as the epidemiological basis for many evaluations of radiation risk. As you can see from the lists of publications, presentations and funding above, the MPS had great productivity in 2021. Of note is that the NASA grant originally funded to assess impacts of high-LET radiations on the central nervous system, including such possible adverse outcomes as cognitive dysfunction, Alzheimer's Disease and Parkinson's Disease, has been expanded to include low-LET radiation exposures. This is a unique study that will make use of outcomes data from the Centers for Medicare and Medicaid Services, combined with the impressive dosimetry efforts from those involved in the MPS to obtain new insights on risk assessment. Over the years, the MPS has received critical support (financial and in-kind) from the U.S.

Nuclear Regulatory Commission, DOE, NASA, U.S. Department of Defense, National Cancer Institute, CDC, U.S. Environmental Protection Agency, Landauer, and national laboratories. Currently, funding to NCRP for the MPS comes from DOE, NASA, and the U.S. Navy. This important study will increase scientific understanding that can improve guidelines and guidance to protect workers and members of the public. We look forward to the continuing outstanding productivity and valuable new data and insights from the hard-working MPS team.

Partnerships:

In addition to the partnerships with funding agencies described above, NCRP continues numerous active and fruitful partnerships with multiple national and international organizations that are listed on the NCRP website. Additionally, NCRP officers serve on advisory committees and boards and review panels of other groups (*e.g.*, Image Gently®, ABR Test Assembly, National Institutes of Health, International Radiation Protection Association); NCRP organizes sessions and provides members to serve as speakers and session chairs at meetings of other entities (*e.g.*, Health Physics Society, Radiation Research Society) (see list of presentations above); and NCRP officers and Board/scientific committee members provide NCRP-related educational activities and material for other organizations (*e.g.*, CDC, NASA, Vanderbilt, Harvard, University of California Davis, University of Maryland, Armed Forces Radiobiology Research Institute). These activities are critical to NCRP's mission and help "spread the word" about NCRP. Don't hesitate to let us know if you can recommend other opportunities for NCRP partnerships, formal or informal, and we're always available to give presentations to other groups who are interested in NCRP's work.

Final Thoughts:

NCRP leadership is committed to encouraging more junior professionals in the radiation sciences and more diversity in our scientific committees, PACs, at our meetings, and as Council members. We strive to add diversity to our ranks by engaging qualified junior investigators, women, and minorities. We hope that our new efforts in internships and mentoring will help with that goal and look forward to increasing the efforts. Please encourage your junior and minority colleagues to become involved with NCRP and let us know of talented individuals that we should include in our activities.

It is with great sadness that I report the passing of four Council members in 2021.

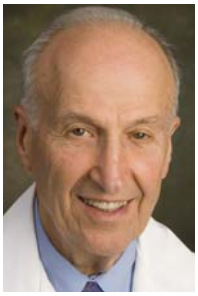
Bruce B. Boecker, July 9, 1932 - December 1, 2021

Dr. Boecker was first elected to NCRP in 1987 and became a Distinguished Emeritus Member in 1999. However, Bruce's first formal involvement with NCRP began in 1976 when he became a member of SC 54 on Bioassay for Assessment of Control of Intake of Radionuclides. Soon thereafter (1977), Bruce became Chairman of Task Group 3 of SC 57 on Metabolic Models for Internally Deposited Radionuclides. During the period 1985 to 1999, Dr. Boecker became a full member of SC 57 on Dosimetry and Metabolism of Radionuclides and served as Chair for the last 5 y of that umbrella and program area committee. Bruce's contributions to the science of internal emitter dosimetry and health effects, plus his superior management skills led to the publication of several important and impressive NCRP reports, most of which have not been superseded despite their varied vintages (Report No. 89 - *Genetic Effects from Internally Deposited Radionuclides*; Report No. 90 - *Neptunium: Radiation Protection Guidelines*; Report No. 110 - *Some Aspects of Strontium Radiobiology*; Report No. 117 - *Research Needs for Radiation Protection*; Report No. 128 - *Radionuclide exposure of the Embryo/Fetus*; Report

No. 135 - L*iver Cancer Risk from Internally-Deposited Radionuclides*; Report No. 156 - *Development of a Biokinetic Model for Radionuclide- Contaminated Wounds and Procedures for their Assessment, Dosimetry and Treatment*).

Thomas B. Borak, August 2, 1942-January 25, 2021

Dr. Borak was first elected to NCRP in 2001 and became a Distinguished Emeritus Member in 2013. During his tenure, he served as a Member of SC 6-2 that published NCRP Report No. 160, *Ionizing Radiation Exposure of the Population of the United States* (2009) and SC 46-15 that published NCRP Report No. 142, *Operational Radiation Safety Program for Astronauts in Low-Earth Orbit: A Basic Framework* (2002). Dr. Borak also served as a Session Chair during the 2011 NCRP Annual Meeting on "Scientific and Policy Challenges of Particle Radiations in Medical Therapy and Space Missions."



Robert L. Brent, October 6, 1927 - February 24, 2021

Dr. Brent was first elected to NCRP in 1973 and became a Distinguished Emeritus Member in 1997. He was a member of the 1992 Budget and Finance Committee and served as Chair from 1993 to 1996. Dr. Brent was Chair of the 1997 Annual Meeting Program Committee, an Annual Meeting speaker in 2014, and in 2006 presented the 30th Lauriston S. Taylor Lecture entitled "Fifty Years of Scientific Investigation: The Importance of Scholarship and the Influence of Politics and Controversy."

Dr. Brent was Chair of NCRP SC 4-4 that published Report No. 174, *Preconception and Prenatal Radiation Exposure: Health Effects and Protective Guidance* in 2013; and a member of SC 76 that published NCRP Report No. 54, *Medical Radiation Exposure of Pregnant and Potentially Pregnant Women* in 1977.

John P. Winston, July 30, 1961 - February 27, 2021

Mr. Winston was first elected to NCRP in 2018. He served as a Member of Program Area Committee 4 on Radiation Protection in Medicine, on SC 4-6 that published NCRP Statement No. 11, *Outline of Administrative Policies for Quality Assurance and Peer Review of Tissue Reactions Associated with Fluoroscopically-Guided Interventions* (2014), and SC 4-11 that published Statement No. 13 on *NCRP Recommendations for Ending Routine Gonadal Shielding During Abdominal and Pelvic Radiography* (2021).

2021 was a unique year, following on the challenging 2020. We've all had to continue to learn new ways to accomplish the NCRP mission and do our jobs. But, as you can see from the above, 2021 was also a productive year for NCRP. We look forward to another productive year in 2022, and hope that we'll be able to interact in person much more. Despite challenges, there are plentiful opportunities, and it will be wonderful to continue working with all the many terrific scientific and professional colleagues and partnering organizations who work so hard to support NCRP in our mission to serve our great nation.

Many thanks to the NCRP staff, Board of Directors, and Council members for assistance in all NCRP work. Special thanks to Laura J. Atwell, John D. Boice, Jr., Jerrold T. Bushberg, and Lawrence T. Dauer for all they have done for NCRP over many productive years and for their dedication and tireless support and sage advice to me throughout the last several years.

Kathryn D. Held
President

Membership

There are up to 100 Council Members serving six-year terms. There are normally 15 to 19 vacancies each year. Election of Council Members is based on nominations made by committee chairmen, current and Distinguished Emeritus Council members, and the Nominating Committee. New members are nominated and elected based primarily on the scientific contributions they have made to the work of the Council and/or recognized interest and scientific or professional competence in some aspect of radiation protection and measurements. In addition, the Board of Directors recommends that candidates with specific areas of expertise be sought based on the needs of the Council. The Council is comprised of specialists in biophysics, dentistry, dosimetry, environmental transport, epidemiology, genetics, health physics, medical physics, molecular and cellular biology, nuclear energy, nuclear engineering, nuclear medicine, pathology, physics, public health, public policy, radiation measurements, radiation therapy, radiobiology, radiology, risk analysis and communication, statistics, and waste management. In 2021, five new members were elected, and 11 members were re-elected. The five new members were:

Emily A. Caffrey
Jeffrey A. Chapman
Carol J. Iddins
Derek W. Jokisch
Dörthe Schaue

2021 Council Membership, Affiliation, and Current Term

Sally A. Amundson	Columbia University Medical Center	2016–2022
Jeri L. Anderson	National Institute for Occupational Safety and Health	2020–2026
Armin Ansari	Centers for Disease Control and Prevention	2021–2027
A. Iulian Apostoaei	Oak Ridge Center for Risk Analysis, Inc.	2018–2024
Kimberly E. Applegate	University of Kentucky	2019–2025
Edouard I. Azzam	Rutgers, The State University of New Jersey	2018–2024
Jonine L. Bernstein	Memorial Sloan-Kettering Cancer Center	2018–2024
Luiz Bertelli	Los Alamos National Laboratory	2019–2025
William F. Blakely	Armed Forces Radiobiology Research Institute	2021–2027
Daniel J. Blumenthal	U.S. Department of Energy	2021–2027
John D. Boice, Jr.	National Council on Radiation Protection and Measurements	2018–2024

Wesley E. Bolch	University of Florida	2017–2023
Michael A. Boyd	U.S. Environmental Protection Agency	2020–2026
Richard R. Brey	Idaho State University	2019–2025
Brooke R. Buddemeier	Lawrence Livermore National Laboratory	2021–2027
Jerrold T. Bushberg	University of California, Davis	2020–2026
Emily A. Caffrey	Radian Scientific	2021–2027
Polly Y. Chang	SRI International	2017–2023
Jeffrey A. Chapman	Oak Ridge National Laboratory	2021–2027
C. Norman Coleman	National Cancer Institute	2016–2022
Donald A. Cool	Electric Power Research Institute	2019–2025
Michael L. Corradini	University of Wisconsin, Madison	2016–2022
Lawrence T. Dauer	Memorial Sloan-Kettering Cancer Center	2018–2024
Sara D. DeCair	U.S. Environmental Protection Agency	2017–2023
Christine A. Donahue	Weiss Associates	2021–2027
Joseph R. Dynlacht	Indiana University School of Medicine	2020–2026
Andrew J. Einstein	Columbia University	2019–2025
K. Frieda Fisher-Tyler	State of Delaware	2020–2026
Cynthia Flannery	U.S. Nuclear Regulatory Commission	2017–2023
Patricia A. Fleming	Retired	2021–2027
Donald P. Frush	Stanford University School of Medicine	2016–2022
Eric M. Goldin	Retired	2021–2027
Eric J. Grant	Radiation Effects Research Foundation	2019–2025
Helen A. Grogan	Cascade Scientific, Inc.	2020–2026
Barbara L. Hamrick	University of California, Irvine Health	2019–2025
Willie O. Harris	Exelon Nuclear	2017–2023
Lawrence H. Heilbronn	University of Tennessee	2019–2025
Kathryn D. Held	National Council on Radiation Protection and Measurements & Massachusetts General Hospital	2018–2024
Kathryn A. Higley	Oregon State University	2020–2026
E. Vincent Holahan	U.S. Nuclear Regulatory Commission	2019–2025
Janice L. Huff	National Aeronautics and Space Administration	2017–2023
Adam R. Hutter	National Urban Security Technology Laboratory	2019–2025
Randall N. Hyer	Center for Risk Communication	2016–2022
Carol J. Iddins	Radiation Emergency Assistance Center/Training Site	2021–2027
William E. Irwin	Vermont Department of Health	2021–2027
Thomas E. Johnson	Colorado State University	2018–2024
Derek W. Jokisch	Francis Manon University	2021–2027
Cynthia G. Jones	U.S. Nuclear Regulatory Commission	2017–2023
Ziad N. Kazzi	Emory University	2019–2025
William E. Kennedy, Jr.	WE Kennedy Consulting	2016–2022

Gladys A. Klemic	U.S. Department of Homeland Security	2016–2022
Linda A. Kroger	University of California Davis School of Medicine	2016–2022
Amy Kronenberg	Lawrence Berkeley National Laboratory	2017–2023
Evagelia C. Laiakis	Georgetown University	2019–2025
John J. Lanza	Community Health Northwest Florida	2016–2022
Edwin M. Leidholdt, Jr.	U.S. Department of Veterans Affairs	2018–2024
Mark P. Little	National Cancer Institute	2016–2022
Paul A. Locke	Johns Hopkins University	2016–2022
Alan G. Lurie	University of Connecticut School of Dental Medicine	2016–2022
Mahadevappa Mahesh	Johns Hopkins Hospital	2021–2027
Ruth E. McBurney	Conference of Radiation Control Program Directors, Inc.	2019–2025
Michael T. Milano	University of Rochester Medical Center	2020–2026
Donald L. Miller	Food and Drug Administration	2018–2024
Stephen V. Musolino	Brookhaven National Laboratory	2020–2026
Wayne D. Newhauser	Louisiana State University	2019–2025
Michael A. Noska	U.S. Food and Drug Administration	2017–2023
Harald Paganetti	Massachusetts General Hospital	2018–2024
Christopher N. Passmore	Landauer, Inc.	2017–2023
David J. Pawel	U.S. Environmental Protection Agency	2017–2023
Leticia S. Pibida	National Institute of Standards and Technology	2018–2024
Kathryn H. Pryor	Retired	2016–2022
Mark J. Rivard	Tufts Medical Center	2017–2023
Adela Salame-Alfie	Centers for Disease Control and Prevention	2021–2027
Dörthe Schaue	University of California, Los Angeles	2021–2027
Debra M. Scroggs	Retired	2018–2024
J. Anthony Seibert	University of California Davis Medical Center	2020–2026
Kathleen L. Shingleton	Retired	2017–2023
Angela Shogren	U.S. Environmental Protection Agency	2019–2025
Igor Shuryak	Columbia University Medical Center	2018–2024
Steven L. Simon	National Cancer Institute	2016–2022
David C. Spelic	Center for Devices and Radiological Health, FDA	2016–2022
Michael D. Story	University of Texas, Southwestern Medical Center at Dallas	2020–2026
Glenn M. Sturchio	Mayo Clinic	2016–2022
Julie M. Sullivan	U.S. Food and Drug Administration	2019–2025
Steven G. Sutlief	Banner MD Anderson Cancer Center	2018–2024
Tammy P. Taylor	Savannah River National Laboratory	2016–2022
Julie K. Timins	New Jersey Commission on Radiation Protection	2016–2022
Sergei Tolmachev	Washington State University	2020–2026
Michael M. Weil	Colorado State University	2017–2023

Jeffrey J. Whicker	Los Alamos National Laboratory	2017–2023
Robert C. Whitcomb, Jr.	Centers for Disease Control and Prevention	2020–2026
Jessica S. Wieder	U.S. Environmental Protection Agency	2017–2023
Jacqueline P. Williams	University of Rochester Medical College	2018–2024
John P. Winston*	Pennsylvania Department of Environmental Protection	2018–2024
Gayle E. Woloschak	Northwestern University	2021–2027
X. George Xu	Renesselaer Polytechnic Institute	2020–2026
R. Craig Yoder	Retired	2020–2026
Lydia B. Zablotska	University of California, San Francisco	2020–2026
Pat B. Zanzonico	Memorial Sloan-Kettering Cancer Center	2018–2024
Cary J. Zeitlin	Leidos	2020–2026

*Deceased in 2021

Board of Directors

Jerrold T. Bushberg, *Chairman*

Armin Ansari	Christine A. Donahue	Michael D. Story
Wesley E. Bolch	John J. Lanza	Jeffrey J. Whicker
Michael A. Boyd	Donald L. Miller	Jessica S. Wieder
Polly Y. Chang	J. Anthony Seibert	

*Elected April 20, 2021.

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Senior Vice President	Jerrold T. Bushberg
Secretary	Laura J. Atwell
Treasurer	Myrna A. Young

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Kenneth R. Kase, *Honorary Vice President*
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S.Y. Chen
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Raymond A. Guilmette
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R. Julian Preston
Jerome S. Puskin
Genevieve S. Roessler
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Henry D. Royal
Stephen M. Seltzer
Roy E. Shore
Paul Slovic
Daniel J. Strom
John E. Till
Richard E. Toohey
Lawrence W. Townsend
Robert L. Ullrich
Richard J. Vetter
F. Ward Whicker
Chris G. Whipple
Susan D. Wiltshire
Marvin C. Ziskin

*Elected to Distinguished Emeritus Membership April 20, 2021.
†Deceased during 2021.

Consociate Members

Full members of the Council become Consociate Members at the end of their terms provided they are not re-elected to another term on the Council or are not appointed to Distinguished Emeritus membership.

Peter R. Almond
E. Stephen Amis, Jr.
Larry E. Anderson
Mary M. Austin-Seymour
Judith L. Bader
Daniel J. Barnett*
John W. Baum
Steven M. Becker
Merrill A. Bender
Mythreyi Bhargavan-Chatfield
Frederick J. Bonte
Harold S. Boyne
John W. Brand
David J. Brenner
A. Bertrand Brill
Thomas F. Budinger
John F. Cardella
Stephanie K. Carlson
Paul L. Carson
Donald K. Chadwick
Lawrence L. Chi
Chung-Kwang Chou
Kelly L. Classic
Stephen F. Cleary
James E. Cleaver
Fred T. Cross
Francis A. Cucinotta
Stanley B. Curtis
John F. Dicello
Richard L. Doan
Carl H. Durney
David A. Eastmond
Marc Edwards
Charles M. Eisenhauer
Joe A. Elder
Edward R. Epp†
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H. Keith Florig
Norman C. Fost
Kenneth R. Foster
Everett G. Fuller
Barry B. Goldberg
Robert L. Goldberg
Marvin Goldman
John D. Graham
Douglas Grahn
Andrew J. Grosovsky
Milton G. Guiberteau
Ellis M. Hall
Roger W. Harms
Robert J. Hasterlik
Martin Hauer-Jensen
John M. Heslep
John W. Hirshfeld, Jr.
David G. Hoel
Roger W. Howell*
George B. Hutchison
Hank C. Jenkins-Smith
John R. Johnson
Timothy J. Jorgensen
Katherine A. Kiel*
H. William Koch
Harold L. Kundel
Richard W. Leggett
George R. Leopold
Howard L. Liber
James C. Lin
Thomas A. Lincoln
Jonathan M. Links
David I. Livermore
Richard A. Luben
Jay H. Lubin
Arthur C. Lucas
Harry R. Maxon
Donald M. Mayer
C. Douglas Maynard
Claire M. Mays
Cynthia H. McCollough
Jack Miller
William H. Miller
John E. Moulder
Gregory A. Nelson
Andrea K. Ng
Peter C. Nowell
Eugene F. Oakberg
Gilbert S. Omenn
Frank L. Parker
Terry C. Pellmar
Lester J. Peters
Abram Recht
Allan C.B. Richardson
Robert Robbins
Sara Rockwell
Lester Rogers
Robert E. Rowland
Ehsan Samei
Jonathan M. Samet
Keith J. Schiager
Robert A. Schlenker
Beth A. Schueler
Thomas M. Seed
George Sgouros
Ferdinand J. Shore
Edward A. Sickles
Kenneth W. Skrable
David H. Sliney
Christopher G. Soares
Michael G. Stabin
Daniel O. Stram
Louise C. Strong
Herman D. Suit
Richard A. Tell
Joop W. Thiessen
Elizabeth L. Travis
Lois B. Travis
Fong Y. Tsai
Louis K. Wagner
Stuart C. White
J. Frank Wilson
Shaio Y. Woo
Andrew J. Wyrobek
Marco A. Zaider
Gary H. Zeman

*Consociate Membership effective April 20, 2021.
†Deceased during 2021.

Administrative Committees

Budget & Finance Committee (appointed by the Board of Directors, April 20, 2021)

William E. Kennedy, Jr., *Chair*

Willie O. Harris
John J. Lanza
Kathleen L. Shingleton
R. Craig Yoder

Nominating Committee (appointed by the Board of Directors, April 20, 2021)

Adela Salame-Alfie, *Chair*

Jonine L. Bernstein
Michael Boyd
J. Anthony Seibert
Cary Zeitlin

Program Committee for 2022 Annual Meeting

(appointed by the Board of Directors, April 20, 2021)

Evagelia C. Laiakis & Jessica S. Wieder, *Co-Chairs*

Sara D. DeCair
Nobuyuki Hamada
Willie O. Harris
Brian A. Powell
Angela Shogren
Jeffrey J. Whicker
Pat B. Zanzonico

Scientific & Administrative Staff

Laura J. Atwell	Director of Operations
John D. Boice, Jr.	Director of Science
Emily A. Caffrey	Technical Staff Consultant
Sarah S. Cohen	Technical Staff Consultant
Lawrence T. Dauer	Advisor to President
Laura Finger	Technical Staff Consultant
Helen A. Grogan	Technical Staff Consultant
Julie Lima	Technical Staff Consultant
Cindy L. O'Brien	Consultant
Beverly A. Ottman	Receptionist
Marvin Rosenstein	Technical Staff Consultant
Roy E. Shore	Advisor to Director of Science
Kali Thomas	Technical Staff Consultant
Lawrence W. Townsend	Technical Staff Consultant
Linda Walsh	Technical Staff Consultant
Myrna A. Young	Financial Records Manager

Council Committee, Program Area Committees, & Advisory Panel

The program area and advisory committees advise the NCRP President and Board of Directors on issues specific to their expertise. They have responsibility for evaluating the need for new NCRP activities related to the philosophy and the basic principles and requirements in their subject areas.

The work of the Council is supported by a Council committee, seven program area committees, and an advisory panel. They are:

Council Committee

Meeting the Needs of the Nation for Radiation Protection	Wayne D. Newhauser Jacqueline P. Williams

Program Area Committees and Committee Chairs

Basic Criteria, Epidemiology, Radiobiology, and Risk	Gayle E. Woloschak Jonine L. Bernstein
Operational Radiation Safety	Kathryn H. Pryor
Nuclear and Radiological Security and Safety	Armin Ansari Brooke R. Buddemeier
Radiation Protection in Medicine	Donald L. Miller Lawrence T. Dauer
Environmental Radiation and Radioactive Waste Issues	William E. Kennedy, Jr.
Radiation Measurements and Dosimetry	Steven L. Simon
Radiation Education, Risk Communication, and Outreach	Randall N. Hyer

Advisory Panel

Nonionizing Radiation	Jerrold T. Bushberg

Vice Presidents

Each scientific program area committee is chaired by a Vice President. The Vice Presidents:

- Chair their program area committee
- Provide recommendations for new work in their area

- Represent NCRP to federal agencies and other potential supporters
- Represent NCRP at scientific meetings
- Advise on membership of their program area committee
- Assist NCRP President and chairmen of new scientific committees with selection of potential committee or advisory members
- Assist in management of scientific committee efforts
- Provide the chairman of the nominating committee with potential candidates for Council membership
- Review all draft publications within their program area committee prior to Council review

NCRP

Meeting the Needs of the Nation for Radiation Protection

Chair, Wayne D. Newhauser

Goals of Council Committee (CC) 2

- Monitor graduation and employment statistics for radiation professionals, including but not limited to health physicists, radiobiologists, radioecologists, radiologists, radiation oncologists, nuclear medicine physicians, radiochemists, radiation protection engineers, and allied disciplines.
- Continually assess, revise and renew the comprehensive plan initiated with Where Are the Radiation Professionals? (WARP).
- Promote a government led initiative to develop and strengthen human capital in radiation science and radiation protection.

Members of CC 2

Status: Revising after PAC review

Wayne D. Newhauser, *Chair*
Jacqueline P. Williams, *Co-Chair*
Writing Team Leaders:
Edward I. Bluth
Michael A. Noska
Sergei Y. Tolmachev
Lawrence W. Townsend
Lydia B. Zablotska

NCRP

Basic Criteria, Epidemiology, Radiobiology, & Risk

Vice President, Gayle E.Woloschak

Goals of Program Area Committee (PAC) 1

- Evaluate and approve all scientific committee draft recommendations on exposure limits.
- Evaluate new epidemiological and radiobiological data and determine their potential effect on human risk coefficients for radiation protection.

Members of PAC 1

Gayle E.Woloschak, *Vice President*
Jonine L. Bernstein, *Vice Chair*
Sally A. Amundson
A. Iulian Apostoaei
Edouard I. Azzam
Joel S. Bedford
Marjan Boerma
John D. Boice, Jr.
Polly Y. Chang
Eric J. Grant
Nobuyuki Hamada
Ann R. Kennedy
Amy Kronenberg
Evagelia C. Laiakis
Mark P. Little
Gregory A. Nelson
Harald Paganetti
David J. Pawel
Dörthe Schaue
George Sgouros
Roy E. Shore
Brock Sishc
Michael D. Story
Michael M. Weil
Jacqueline P. Williams
Lydia B. Zablotska

Active Scientific Committees Under PAC 1

SC 1-27 Evaluation of Sex-Specific Differences in Lung Cancer Radiation Risks and Recommendations for Use in Transfer and Projection Models

Status: Preparing for Council review

Michael M Weil, *Co-Chair*
David J. Pawel, *Co-Chair*
John D. Boice, Jr.
Lawrence T. Dauer
Eric J. Grant
David G. Hoel
Janice L. Huff
Dale L. Preston
Mikhail Sokolnikov
Michael D. Story
Richard Wakeford
Linda Walsh
Lydia B. Zablotska
Steve R. Blattnig, *NASA Technical Advisor*
R. Julian Preston, *Advisor*
Werner Rühm, *Advisor*
Marvin Rosenstein, *Technical Staff Consultant*

Operational Radiation Safety

Vice President, Kathryn H. Pryor

Goals of Program Area Committee (PAC) 2

- Serve as a national resource for information on operational radiation safety.
- Formulate guidance regarding the application of operational radiation safety principles.

Members of PAC 2

Kathryn H. Pryor, *Vice President*
Edgar D. Bailey
Christine A. Donahue
Eric M. Goldin
Barbara L. Hamrick
Willie O. Harris
Michael Lewandowski
Michael L. Littleton
David S. Myers
John W. Poston, Sr.
Debra M. Scroggs
Kathleen L. Shingleton
Glenn M. Sturchio
Joshua Walkowicz
James S. Willison
James G. Yusko

Active Scientific Committees Under PAC 2

SC 2-8 Operational Radiation Safety Program — Revision to Report No. 127 (1998)

Status: Preparing for publication
Kathryn H. Pryor, *Chair*
Edgar D. Bailey
Christine A. Donahue
John R. Frazier
Eric M. Goldin
Barbara L. Hamrick
Willie O. Harris

Michael Lewandowski
Michael L. Littleton
David S. Myers
John W. Poston, Sr.
Debra M. Scroggs
Kathleen L. Shingleton
Glen M. Sturchio
Joshua Walkowicz
James S. Willison
James G. Yusko
Elizabeth M. Brackett, *Technical Advisor*
Frazier Bronson, *Technical Advisor*
J. Donald Cossairt, *Technical Advisor*

Nuclear & Radiological Security & Safety

Vice President, Armin Ansari

Goals of Program Area Committee (PAC) 3

- Identify important steps to be taken in the interdiction of, preparedness for, and effective responses to possible acts of nuclear or radiological terrorism.
- Define performance requirements, instrumentation, and testing criteria for security surveillance systems.
- Develop operational strategies and optimization procedures for early, intermediate and late-phase responses to a nuclear or radiological terrorism incident.
- Recommend effective methods for protecting against, mitigating, and treating traumatic injuries and long-term health and psychological effects of radiation exposure and other immediate stress effects such as thermal burns, shock, and contaminated shrapnel wounds resulting from nuclear or radiological explosions or possible acts of nuclear or radiological terrorism.
- Analyze methods for optimizing the cleanup, site restoration, and disposition of contaminated materials resulting from a nuclear or radiological terrorism incident.

Members of PAC 3

Armin Ansari, *Vice President*
Brooke R. Buddemeier, *Co-Chair*
Judith L. Bader
Daniel J. Blumenthal
Thomas W. Chenworth
C. Norman Coleman
Sara D. DeCair
Joseph R. Dynlacht
K. Frieda Fisher-Tyler
Carol J. Iddins
William E. Irwin
Ziad N. Kazzi
Gladys A. Klemic
John J. Lanza
Stephen V. Musolino
Michael A. Noska
Leticia S. Pibida
Adela Salame-Alfie
Julie M. Sullivan

Robert C. Whitcomb, Jr.
Sean M. Crawford, *Consultant*

SC 3-2 Recommendations for Instrument Response Verification and Calibration for Use in Radiation Emergencies

Status: Revising after Council review
Gladys A. Klemic, *Co-Chair*
Leticia S. Pibida, *Co-Chair*
Armin Ansari
Brooke R. Buddemeier
William E. Irwin
Michael Iwatschenko-Borho
P. Andrew Karam
Adela Salame-Alfie
Jeffrey A. Chapman, *Technical Advisor*
Daryl Fahner, *Advisor*
Richard T. Kouzes, *Advisor / PAC 6 Liaison*
Helen A. Grogan, *Staff Consultant*

SC 3-3 Respiratory Protection for Emergency Workers Responding to a Nuclear/ Radiological Emergency

Status: Preparing for Council review
Armin Ansari, Co-Chair
Adela Salame-Alfie, Co-Chair
Jeffrey A. Chapman
K. Frieda Fisher-Tyler
Ken Yale
Sean M. Crawford, *Technical Advisor*
Luis Garcia, *Technical Advisor*
Jeffrey Lodwick, *Technical Advisor*
Ryan A. Schwartz, *Technical Advisor*
Jonathan Szalajda, *Technical Advisor*
Trae Windham, *Techincal Advisor*
Emily A. Caffrey, *Staff Consultant*

NCRP

Radiation Protection in Medicine

Vice President, Donald L. Miller

Goals of Program Area Committee (PAC) 4

- Identify areas with which NCRP should be concerned in radiation protection of patients in medical, dental and chiropractic practice.
- Examine and evaluate techniques and procedures to eliminate unnecessary radiation exposure to the patient.
- Examine and evaluate training of medical personnel in radiation protection.

Members of PAC 4

Donald L. Miller, *Vice President*
Lawrence T. Dauer, *Co-Chair*
Kimberly E. Applegate
Stephen Balter
Edward I. Bluth
Andrew J. Einstein
Donald P. Frush
Joel E. Gray
Linda A. Kroger
Edwin M. Leidholdt, Jr.
Alan G. Lurie
Mahadevappa Mahesh
Fred A. Mettler, Jr.
Michael T. Milano
Rebecca Milman Marsh
Wayne D. Newhauser
Madan M. Rehani
Mark J. Rivard
J. Anthony Seibert
David C. Spelic
Steven G. Sutlief
Julie E.K. Timins
John P. Winston*
Shiao Y. Woo
Pat B. Zanzonico
Angela Shogren, *PAC 7 Liaison*

*Deceased in 2021

Active Scientific Committees Under PAC 4

SC 4-10 Error Prevention in Radiation Therapy
Status: Drafting
Steven G. Sutlief, *Co-Chair*
Michael T. Milano, *Co-Chair*
Edwin M. Leidholdt, Jr.
Lukasz Mazur
Jean Moran
Wayne D. Newhauser
Bruce Thomadsen
Shia Y. Woo
Laura Finger, *Staff Consultant*

SC 4-12 Risk Management Stratification of Equipment and Training for Fluoroscopy
Status: Drafting
Stephen Balter, *Co-Chair*
Donald L. Miller, *Co-Chair*
Kimberly E. Applegate
Lisa Bruedigan
George D. Dangas
Dustin A. Gress
Andrew Kuhis-Gilcrist
Andy Rogers
Kevin A. Wunderle

Completed in 2021

NCRP Statement No. 13, *NCRP Recommendations for Ending Routine Gonadal Shielding During Abdominal and Pelvic Radiography*, was issued January 12, 2021. At the same time, a companion piece was issued along with the *NCRP Gonadal Shielding Trifold Flyer*. The Statement was drafted by Scientific Committee 4-11 Chaired by Donald P. Frush and Vice Chair, Keith J. Strauss. Committee members included Eric M. Goldin, Rebecca Milman Marsh, Sarah McKenney, Donald L. Miller, Angela Shogren, Mary Ann Spohrer, Louis K. Wagner, and John P. Winston.

NCRP

Environmental Radiation & Radioactive Waste Issues

Vice President, William E. Kennedy, Jr.

Goals of Program Area Committee (PAC) 5

- Serve as a national resource for environmental radiation and radioactive waste information and data.
- Prepare scientific reports, commentaries and statements that can be used as fundamental scientific references dealing with radionuclides in the environment.
- Help formulate NCRP recommendations on disposal of radioactive and mixed wastes.
- Encourage scientific and technical discourse on the disposal of radioactive and mixed wastes including environmental and human risk from disposal.
- Encourage scientific and technical discourse on the cost-benefit of activities generating radioactive and mixed wastes.

Members of PAC 5

William E. Kennedy, Jr., *Vice President*
Michael A. Boyd
S.Y. Chen
Allen G. Croff
R. William Field
Patricia A. Fleming
Helen A. Grogan
Kathryn A. Higley
E. Vincent Holahan
Katherine A. Kiel
Jill A. Lipoti
Ruth E. McBurney
Bruce A. Napier
Brian A. Powell
Andrew Wallo, III

NCRP

Radiation Measurements & Dosimetry

Vice President, Steven L. Simon

Goals of Program Area Committee (PAC) 6

- Evaluate the field of radiation measurements and dosimetry.
- Serve as a source of information to scientific committees preparing reports that include radiation measurements and dosimetry.
- Maintain liaison with other organizations and professional societies that have similar interests.

Members of PAC 6

Steven L. Simon, *Vice President*
Luiz Bertelli
William F. Blakely
Wesley E. Bolch
Leslie A. Braby
Richard R. Brey
Raymond A. Guilmette
Richard T. Kouzes
Jeffrey J. Whicker
R. Craig Yoder
Cary J. Zeitlin
Gary H. Zeman

Active Scientific Committees Under PAC 6

SC 6-12 Development of Models for Brain Dosimetry for Internally Deposited Radionuclides

Status: Preparing for publication
Richard W. Leggett, *Chair*
Sergei Y. Tolmachev, *Vice Chair*
Maia Avtandilashvili
Keith F. Eckerman
George Sgouros
Gayle E. Woloschak
Helen A. Grogan, *Technical Staff Consultant*

SC 6-13 Methods and Models for Estimating Organ Doses from Intakes of Radium

Status: Drafting

Derek W. Jokisch, *Chair*
Nicole Martinez, *Vice Chair*
Maia Avtandilashvili
Luiz Bertelli
Elizabeth M. Brackett
Emily A. Caffrey
Sara Dumit
Richard Leggett
Caleigh Samuels

NCRP

Radiation Education, Risk Communication, & Outreach

Vice President, Randall N. Hyer

Goals of Program Area Committee (PAC) 7

- Identify the policy implications of NCRP publications, meetings and other events, and seek to communicate those implications in a credible and comprehensible manner to policy makers and the public.
- Suggest members or serve as members of new NCRP scientific committees whose topics relate to education, risk communication, policy, and outreach.
- Provide advice, wording, and strategic outreach options to policy makers and the public for NCRP reports.
- Ensure that NCRP communications and outreach emphasize NCRP's paramount role in providing scientific information and develop communications and outreach strategies so that recommendations are of maximum assistance to policy makers.
- Bolster educational efforts aimed at recruiting, training and retaining radiation health professionals.

Members of PAC 7

Randall N. Hyer, *Vice President*
Steven M. Becker
Manuela Buonanno
Jerrold T. Bushberg
Donald A. Cool
Vince Covello
Thomas E. Johnson
Paul A. Locke
M. Carol McCurley
Charles W. Miller
Miles O'Brien
Judith F. Rader
Angela Shogren
John E. Till
Jessica S. Wieder
Vivi Siegel, *Consultant*

Nonionizing Radiation

Goals of Nonionizing Radiation Panel

- Analyze mechanisms of interaction of nonionizing radiation with biological systems, including humans.
- Identify biological responses and potential human health effects.
- Evaluate theoretical and applied aspects of dosimetry and exposure assessment of humans to nonionizing radiation.
- Provide recommendations on acceptable exposure levels for nonionizing radiation in occupational, medical and public environments.
- Analyze procedures for mitigating exposure in public and occupational settings.

Members of Advisory Panel

Jerrold T. Bushberg, *Chairman*
Chung-Kwang Chou
Kenneth R. Foster
Michael D. O'Hara
David A. Savitz
Richard A. Tell
Vijayalaxmi
Marvin C. Ziskin
Matthew J. Butcher, *Staff Consultant*

Collaborating Organizations

Organizations or groups of organizations that are national in interest and are concerned with scientific problems involving radiation quantities, units, measurements and effects, or radiation protection may be granted collaborating status by NCRP. Collaborating Organizations provide a means by which NCRP can gain input into its activities from a wider segment of society. At the same time, the relationships with the Collaborating Organizations facilitate wider dissemination of information about the Council's activities, interests and concerns. Collaborating Organizations have the opportunity to comment on draft documents at the time that drafts are submitted to the members of the Council. This is intended to capitalize on the fact that Collaborating Organizations are in an excellent position to both contribute to the identification of what needs to be treated in NCRP documents and to identify problems that might result from proposed recommendations. The Collaborating Organizations for the year 2021 are:

American Academy for Dermatology

American Academy of Environmental Engineers

American Academy of Health Physics

American Academy of Orthopaedic Surgeons

American Association of Physicists in Medicine

American Brachytherapy Society

American College of Cardiology

American College of Nuclear Physicians

American College of Occupational and Environmental Medicine

American College of Radiology

American Conference of Governmental Industrial Hygienists

American Dental Association

American Industrial Hygiene Association

American Institute of Ultrasound in Medicine

American Medical Association

American Nuclear Society

American Pharmacists Association

American Podiatric Medical Association

American Public Health Association
American Radium Society
American Roentgen Ray Society
American Society for Radiation Oncology
American Society of Emergency Radiology
American Society of Health-System Pharmacists
American Society of Nuclear Cardiology
American Society of Radiologic Technologists
American Thyroid Association
Association of Educators in Imaging and Radiological Sciences
Association of University Radiologists
Bioelectromagnetics Society
College of American Pathologists
Conference of Radiation Control Program Directors, Inc.
Council on Radionuclides and Radiopharmaceuticals
Defense Threat Reduction Agency
Electric Power Research Institute
Federal Aviation Administration
Federal Communications Commission
Federal Emergency Management Agency
Genetics Society of America
Health Physics Society
Institute of Electrical and Electronics Engineers, Inc.
Institute of Nuclear Power Operations
International Brotherhood of Electrical Workers
International Society of Exposure Science
National Aeronautics and Space Administration
National Association of Environmental Professionals
National Center for Environmental Health / Agency for Toxic Substances and Disease Registry
National Electrical Manufacturers Association
National Institute for Occupational Safety and Health
National Institute of Standards and Technology
Nuclear Energy Institute

Office of Science and Technology
Product Stewardship Institute
Radiation Research Society
Radiological Society of North America
Society for Cardiovascular Angiography and Interventions
Society for Pediatric Radiology
Society for Risk Analysis
Society of Cardiovascular Computed Tomography
Society of Chairs of Academic Radiology Departments
Society of Interventional Radiology
Society of Nuclear Medicine and Molecular Imaging
Society of Radiologists in Ultrasound
Society of Skeletal Radiology
U.S. Air Force
U.S. Army
U.S. Coast Guard
U.S. Department of Energy
U.S. Department of Homeland Security
U.S. Department of Housing and Urban Development
U.S. Department of Labor
U.S. Department of Transportation
U.S. Environmental Protection Agency
U.S. Navy
U.S. Nuclear Regulatory Commission
U.S. Public Health Service
Utility Workers Union of America

Special Liaison Organizations

Special Liaison relationships are established with various organizations outside of the United States that have an interest in radiation protection and measurements. This relationship provides: (1) an opportunity for participating organizations to designate an individual to provide liaison between the organization and NCRP; (2) that the individual designated will receive copies of draft NCRP publications (at the time that these are submitted to the members of the Council) with an invitation to comment but not vote; and (3) that new NCRP efforts might be discussed with liaison individuals as appropriate, so that they might have an opportunity to make suggestions on new studies and related matters. The Special Liaison Organizations for 2021 are:

Australian Radiation Protection and Nuclear Safety Agency

Bundesamt fur Strahlenschutz (Germany)
(Federal Office for Radiation Protection)

Canadian Association of Medical Radiation Technologists

Canadian Nuclear Safety Commission

Central Laboratory for Radiological Protection (Poland)

China Institute for Radiation Protection

Commissariat a l'Energie Atomique (France)

Commonwealth Scientific Instrumentation Research
Organization (Australia)

European Commission

Heads of the European Radiological Protection Competent
Authorities

Health Council of the Netherlands

International Commission on Non-Ionizing Radiation
Protection

International Commission on Radiation Units and
Measurements

International Commission on Radiological Protection

International Radiation Protection Association

Japan Radiation Council

Korea Institute of Nuclear Safety

Nuclear Regulation Authority of Japan

Public Health England

Russian Scientific Commission on Radiation Protection

South African Forum for Radiation Protection

World Association for Nuclear Operators

World Health Organization, Unit of Radiation and Environmental Health

Contracts & Grants

The following entities have provided support in 2021 for NCRP's work through contracts and grants:

American Board of Radiology Foundation
Centers for Disease Control and Prevention
Conference of Radiation Control Program Directors, Inc.
National Aeronautics and Space Administration
U.S. Department of Energy
U.S. Food and Drug Administration
U.S. Navy

NCRP

Contributors & Corporate Sponsors

American Academy of Health Physics
American Association of Physicists in Medicine
American College of Radiology Foundation
American Registry of Radiologic Technologists
American Roentgen Ray Society
American Society of Radiologic Technologists
Council on Radionuclides and Radiopharmaceuticals
Fluke/RaySafe/Landauer
Health Physics Society
Individuals
Institute of Electrical and Electronics Engineers
Nuclear Energy Institute
Radiological Society of North America
Society of Pediatric Radiology

Giving Tuesday Donations

S. James Adelstein
Armin Ansari
John D. Boice, Jr.
Michael A. Boyd
Jerrold T. Bushberg
S. Y. Chen
Keith F. Eckerman
Donald P. Frush
Naomi H. Harley
Willie Harris
Lawrence H. Heilbronn
Kathryn D. Held
William E. Kennedy
John J. Lanza
Donald L. Miller
Kenneth L. Miller
Adela Salame-Alfie
J. Anthony Seibert
Richard J. Vetter

Review Process

The review process for draft publications is elaborate and comprehensive. It begins with a review by members of the appropriate Program Area Committee and other critical reviewers designated by the Program Area Committee Vice President and the NCRP Secretariat. Second, following modification of the draft on the basis of the comments of the critical reviewers, the publication is submitted for review to the full Council membership (100), Distinguished Emeritus Members (73), Collaborating Organizations (77), and Special Liaison Organizations (23). At the time a draft is submitted for Council review it is also placed on NCRP's website for public comment (http://NCRPonline.org). Further modification of draft documents on the basis of the comments received follows, with the goal of reaching a scientific consensus on the material included in the document. An NCRP report can be released for publication by the President only if there are no more than two remaining disapprovals by members of the Council after resolution of review comments.

In addition to full reports, NCRP also produces commentaries, statements, and presidential reports. NCRP commentaries are documents that provide preliminary evaluations, critiques, reviews and results of exploratory studies, or extensions of previously published NCRP reports on an accelerated schedule when time for the normal review process is not available. Approval is by the Board of Directors with involvement by other Council members as needed. Statements are brief documents that succinctly address topics of contemporary interest and importance for radiation protection. The review and approval process for statements is the same as for reports. Presidential reports are documents on specific issues in radiation health protection that are developed by a scientific committee, reviewed by members of Council and other subject-area experts as needed, and approved for publication by the Board of Directors and the President.

Lauriston S. Taylor Lectures

Year	Title	Lecturer
2021	Taking Up Space: The Path to Understanding Radiation Risks	Robert L. Ullrich
2019	Fallout from Nuclear Weapons Tests: Environmental, Health, Political, & Sociological Considerations	André Bouville
2018	Radiation Dosimetry Research for Medicine and Protection: A European Journey	Hans-Georg Menzel
2017	Environmental Radiation and Life: A Broad View	F. Ward Whicker
2016	Radiation Protection and Regulatory Science	John W. Poston, Sr.
2015	Dosimetry of Internal Emitters: Contributions of Radiation Protection Bodies and Radiological Events	Keith F. Eckerman
2014	On the Shoulders of Giants: Radiation Protection Over 50 Years	Fred A. Mettler, Jr.
2013	When Does Risk Assessment Get Fuzzy?	John E. Till
2012	From the Field to the Laboratory and Back: The *What If*s, *Wow*s, and *Who Cares* of Radiation Biology	Antone L. Brooks
2011	What Makes Particle Radiation so Effective?	Eleanor A. Blakely
2010	Radiation Protection and Public Policy in an Uncertain World	Charles E. Land
2009	Radiation Epidemiology: The Golden Age and Remaining Challenges	John D. Boice, Jr.
2008	Radiation Standards, Dose/Risk Assessments, Public Interactions, and Yucca Mountain: Thinking Outside the Box	Dade W. Moeller
2007	The Quest for Therapeutic Actinide Chelators	Patricia W. Durbin
2006	Fifty Years of Scientific Investigation: The Importance of Scholarship and the Influence of Politics and Controversy	Robert L. Brent

2005	Nontargeted Effects of Radiation: Implications for Low-Dose Exposures	John B. Little
2004	Radiation Protection in the Aftermath of a Terrorist Attack Involving Exposure to Ionizing Radiation	Abel J. Gonzalez
2003	The Evolution of Radiation Protection—From Erythema to Genetic Risks to Risks of Cancer to ?	Charles B. Meinhold
2002	Developing Mechanistic Data for Incorporation into Cancer Risk Assessment: Old Problems and New Approaches	R. Julian Preston
2001	Assuring the Safety of Medical Diagnostic Ultrasound	Wesley L. Nyborg
2000	Administered Radioactivity: *Unde Venimus Quoque Imus*	S. James Adelstein
1999	Back to Background	Naomi H. Harley
1998	From Chimney Sweeps to Astronauts: Cancer Risks in the Work Place	Eric J. Hall
1997	Radionuclides in the Body: Meeting the Challenge	William J. Bair
1996	70 Years of Radiation Genetics: Fruit Flies, Mice and Humans	Seymour Abrahamson
1995	Certainty and Uncertainty in Radiation Research	Albrecht M. Kellerer
1994	Mice, Myths, and Men	R.J. Michael Fry
1993	Science, Radiation Protection and the NCRP	Warren K. Sinclair
1992	Dose and Risk in Diagnostic Radiology: How Big? How Little?	Edward W. Webster
1991	When is a Dose Not a Dose?	Victor P. Bond
1990	Radiation Protection and the Internal Emitter Saga	J. Newell Stannard
1989	Radiobiology and Radiation Protection: The Past Century and Prospects for the Future	Arthur C. Upton
1988	How Safe is Safe Enough?	Bo Lindell
1987	How to be Quantitative about Radiation Risk Estimates	Seymour Jablon
1986	Biological Effects of Non-Ionizing Radiations: Cellular Properties and Interactions	Herman P. Schwan
1985	Truth (and Beauty) in Radiation Measurements	John H. Harley
1984	Limitation and Assessment in Radiation Protection	Harald H. Rossi

1983	The Human Environment—Past, Present and Future	Merril Eisenbud
1982	Ethics, Trade-Offs and Medical Radiation	Eugene L. Saenger
1981	How Well Can We Assess Genetic Risk? Not Very	James F. Crow
1980	From "Quantity of Radiation" and "Dose" to "Exposure" and "Absorbed Dose"—An Historical Review	Harold O. Wyckoff
1979	Radiation Protection—Concepts and Trade Offs	Hymer L. Friedell
1978	Why be Quantitative About Radiation Risk Estimates?	Sir Edward Pochin
1977	The Squares of the Natural Numbers in Radiation Protection	Herbert M. Parker

Warren K. Sinclair Keynote Addresses

Year	Title	Lecturer
2021	Perception of Radiation Risk from the Astronaut Office	Serena M. Auñón-Chancellor
2019	Frontiers in Medical Radiation Science	C. Norman Coleman
2018	Jus·ti·fied and Com·men·su·rate	Marvin Rosenstein
2017	Aren't We Ready Yet? Closing the Planning, Response and Recovery Gaps for Radiological Terrorism	Jack Herrmann
2016	WARP: Where are the Radiation Professionals?	Richard E. Toohey
2015	Influence of NCRP on Radiation Protection in the United States: Guidance and Regulation	Kenneth R. Kase
2014	Science, Radiation Protection, and the NCRP: Building on the Past, Looking to the Future	Jerrold T. Bushberg
2013	Fukushima Nuclear Power Plant Accident and Comprehensive Health Risk Management	Shunichi Yamashita
2012	Childhood Exposure: An Issue from Computed Tomography Scans to Fukushima	Fred A. Mettler, Jr.
2011	Heavy Ions in Therapy and Space: Benefits and Risks	Marco Durante
2010	Effective Risk Communication Before, During and After a Radiological Emergency: Challenges, Guidelines, Strategies and Tools	Vincent T. Covello
2009	The Role of a Strong Regulator in Safe and Secure Nuclear Energy	Peter B. Lyons
2008	Issues in Quantifying the Effects of Low-Level Radiation	Dudley T. Goodhead
2007	Use and Misuse of Radiation in Medicine	James A. Brink
2006	Retrospective Analysis of Impacts of the Chernobyl Accident	Mikhail Balonov

2005	Contemporary Issues in Risk-Informed Decision Making on Waste Disposition	B. John Garrick
2004	Current Challenges in Countering Radiological Terrorism	John W. Poston, Sr.

Thomas S. Tenforde Topical Lectures

Year	Title	Lecturer
2021	Collision or Cooperation? The Law, Ethics & Science of Personalized Risk Assessments for Space & Air Travel	Paul A. Locke
2019	HPS Ask the Experts: Our Most Intriguing Questions & Answers	Genevieve S. Roessler
2018	Recent Epidemiologic Studies and the Linear Nonthreshold Model for Radiation Protection – Considerations Regarding NCRP Commentary No. 27	Roy E. Shore
2015	Ethics and Radiation Protection	Jacques Lochard

NCRP

Annual Meetings

Year	Topic
2021	Radiation & Flight: A Down-to-Earth Look at Risks
2019	NCRP Meeting the Challenge at 90: Providing Best Answers to Your Most Pressing Questions About Radiation
2018	Radiation Protection Responsibility in Medicine
2017	Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism
2016	Meeting the Needs of the Nation for Radiation Protection
2015	Changing Regulations and Radiation Guidance: What Does the Future Hold?
2014	NCRP: Achievements of the Past 50 Years and Addressing the Needs of the Future
2013	Radiation Dose and the Impacts on Exposed Populations
2012	Emerging Issues in Radiation Protection in Medicine, Emergency Response, and the Nuclear Fuel Cycle
2011	Scientific and Policy Challenges of Particle Radiations in Medical Therapy and Space Missions
2010	Communication of Radiation Benefits and Risks in Decision Making
2009	Future of Nuclear Power Worldwide: Safety, Health and Environment
2008	Low Dose and Low Dose-Rate Radiation Effects and Models
2007	Advances in Radiation Protection in Medicine
2006	Chernobyl at Twenty
2005	Managing the Disposition of Low-Activity Radioactive Materials
2004	Advances in Consequence Management for Radiological Terrorism Events
2003	Radiation Protection at the Beginning of the 21st Century—A Look Forward
2002	Where the New Biology Meets Epidemiology: Impact on Radiation Risk Estimates
2001	Fallout from Atmospheric Nuclear Tests—Impact on Science and Society
2000	Ionizing Radiation Science and Protection in the 21st Century
1999	Radiation Protection in Medicine: Contemporary Issues
1998	Cosmic Radiation Exposure of Airline Crews, Passengers and Astronauts
1997	The Effects of Pre- and Postconception Exposure to Radiation

1996	Implications of New Data on Radiation Cancer Risk
1995	Environmental Dose Reconstruction and Risk Implications
1994	Extremely-Low-Frequency Electromagnetic Fields: Issues in Biological Effects and Public Health
1993	Radiation Science and Societal Decision Making
1992	Radiation Protection in Medicine
1991	Genes, Cancer and Radiation Protection
1990	Health and Ecological Implications of Radioactively Contaminated Environments
1989	Radiation Protection Today—The NCRP at Sixty Years
1988	Radon
1987	New Dosimetry at Hiroshima and Nagasaki and Its Implications for Risk Estimates
1986	Nonionizing Electromagnetic Radiations and Ultrasound
1985	Radioactive Waste
1984	Some Issues Important in Developing Basic Radiation Protection Recommendations
1983	Environmental Radioactivity
1982	Radiation Protection and New Medical Diagnostic Approaches
1981	Critical Issues in Setting Radiation Dose Limits
1980	Quantitative Risk in Standards Setting
1979	Perceptions of Risk

2021 Annual Meeting

The Virtual Fifty-Seventh Annual Meeting of NCRP was held April 19–20, 2021. The topic of the meeting was "Radiation & Flight: A Down-to-Earth Look at Risks." The sessions and presentations were as follows:

Seventeenth Annual Warren K. Sinclair Keynote Address

Perception of Radiation Risk from the Astronaut Office, Serena M. Auñón-Chancellor

Flight Environments & Combined Stressors

NASA Space Radiation Laboratory Galactic Cosmic Ray Simulator, Lisa C. Simonsen

Characterization & Prediction of the Aircraft Ionizing Radiation Environment, Christopher J. Mertens

Flight Doses & Associated Health Implications at Civil, Commercial & Military Altitudes, Kyle Copeland

It's Not Just Radiation: Other Environmental Factors Affecting Space Flight Health Risks, Marianne B. Sowa

Cancer Risks

Cancer Risk Assessment for Astronauts Participating in Deep-Space Missions, Tony Slaba
Space Radiation Cancer Biology: Individualizing Risk, Michael M. Weil
Radiation Dose & Risks to Flight Crews: The European Perspective, Werner Rühm
Cancer in U.S. Pilots & Flight Attendants: NIOSH Aircrew Studies, Lynne Pinkerton

Noncancer Risks

Radiation in the Context of Human System Risks in Exploration Spaceflight, Erik L. Antonsen
Long-Term Effects of Space Radiation on Cognition, Antiño R. Allen
Cosmic Radiation & Human Health: Evidence from Aircrews & Astronauts, Robert J. Reynolds
Effects of the Space Flight Environment on Bone Health, Jeffrey Willey

Forty-Fourth Lauriston S. Taylor Lecture on Radiation Protection & Measurements

Taking Up Space: The Path to Understanding Radiation Risks, Robert L. Ullrich

Noncancer Risks (continued)

Fight-or-Flight: Immune Status & Radiation Resilience, Dörthe Schaue
Reproductive Hazards in Flight Crew: Radiation & Beyond, Candice Johnson
Cardiovascular Effects of Low-Dose Ionizing Radiation, Marjan Boerma
Sleep, Circadian Rhythms, and Workload in Spaceflight, Ajitkumar Mulavara & Alexandra Whitmire

Fourth Thomas S. Tenforde Topical Lecture

Collision or Cooperation? The Law, Ethics & Science of Personalized Risk Assessments for Space & Air Travel, Paul A. Locke

Biomarkers & Countermeasures

Hibernation & Radioprotection: Reduced Tissue Damage in Rats Under Synthetic Torpor, Walter Tinganelli
Strategy for Maturing Active Radiation Shielding Concepts, Dan Fry
Using DNA Damage to Investigate the Individual Variability of Human & Mouse Sensitivity to Ionizing Radiation, Sylvain Costes
Mitigating Space Radiation Health Risks: Challenges and Opportunities, Janice L. Huff

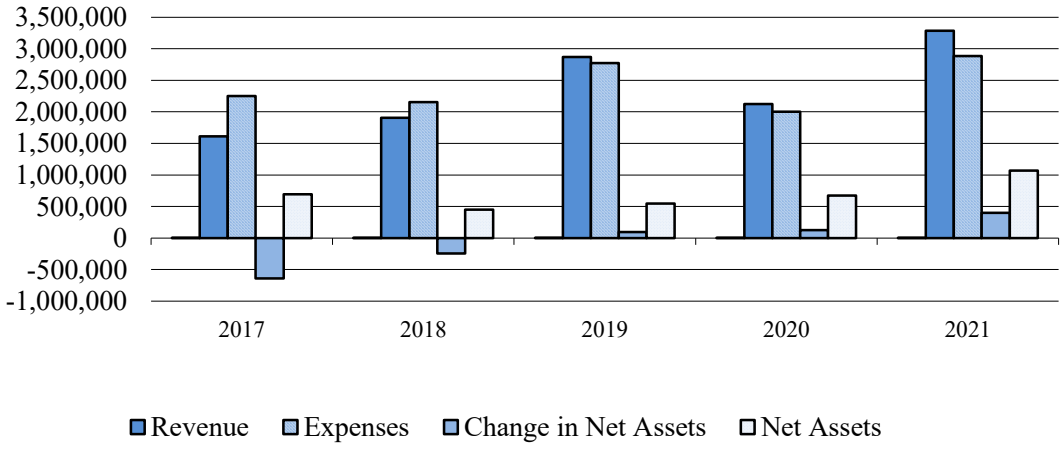
Conclusions

Flying High - Program Wrap-Up, Jacqueline P. Williams & Cary J. Zeitlin
NCRP Vision for the Future & PAC Activities, Kathryn D. Held

Financial Summary

The table and bar graph presented below exhibit NCRP's year-end financial data for 2021 and the four preceding years in the categories: (1) total revenue from grants, contracts, contributions, corporate sponsorships, contributed professional services, administrative services, sales of publications, and investments; (2) total operating and investment expenses; (3) change in net assets of the corporation; and (4) net assets.

Year	Revenue	Expenses	Change in Net Assets	Net Assets
2017	1,610,611	2,251,295	(640,684)	695,625
2018	1,905,901	2,152,242	(246,341)	449,284
2019	2,869,835	2,773,607	96,228	545,512
2020	2,124,812	1,999,497	125,315	670,827
2021	3,283,312	2,884,426	398,886	1,069,716



Appendix 1. Finances

Exhibit A
Statement of Financial Position
For the year ended December 31, 2021

(unaudited)

Current Assets		
Cash and cash equivalents	$	228,072
Investments [at market]		1,349,763
Accounts receivable:		
Publications		3,609
Grants and contracts		641,379
International Commission on Radiation Units and Measurements		971
Inventory—publications		52,010
Prepaid expenses and other assets		17,888
Total current assets		2,293,692
Property and Equipment [at cost]		
Furniture and equipment		191,578
Less accumulated depreciation		(188,082)
Total property and equipment		3,496
TOTAL ASSETS		2,297,188
Liabilities		
Line of credit		250,165
Accounts payable and accrued expenses		690,070
Deferred revenue		40,000
Total current liabilities		980,235
Other Liabilities		
Deferred rent liability		14,319
Accrued post-retirement benefits		232,918
Total other liabilities		247,237
TOTAL LIABILITIES		1,227,472

Net Assets	
Without donor restrictions	700,918
With donor restrictions	368,798
TOTAL NET ASSETS	1,069,716
TOTAL LIABILITIES AND NET ASSETS	$ 2,297,188

Exhibit B
Statement of Activities
For the year ended December 31, 2021
(unaudited)

	Net Assets without Donor Restrictions	Net Assets with Donor Restrictions	Total
Revenue and Other Increases			
Contracts and grants	$ 2,688,222	$ —	$ 2,688,222
Contributions	102,578	2,000	104,578
Corporate sponsorship	15,000	—	15,000
Contributed professional services	148,050	—	148,050
Sales of publications	140,857	—	140,857
Dividends and interest	33,232	—	33,232
Net realized and unrealized gain on investments	147,111	—	147,111
Professional and administrative services	6,262	—	6,262
Total revenue and other increases	3,281,312	2,000	3,283,312
Expenses and Other Decreases			
Program costs:			
Contracts and grants	1,979,950	—	1,979,950
Publications	42,887	—	42,887
Contributed professional services	148,050	—	148,050
Total program costs	2,170,887	—	2,170,887
Management and general expenses	708,178	500	708,678
Total expenses	2,879,065	500	2,879,565
Investment fees	12,684	—	12,684
Post-retirement benefit change	(7,823)	—	(7,823)
	2,883,926	500	2,884,426
Change in Net Assets	397,386	1,500	398,886
Net Assets at Beginning of Year	303,532	367,298	670,830
Net Assets at End of Year	$ 700,918	$ 368,798	$ 1,069,716

Exhibit C
Statement of Cash Flow
For the year ended December 31, 2021

(unaudited)

Cash flows from operating activities:	
Change in net assets	$ 398,886
Adjustments to reconcile change in net assets to cash provided by operating activities	
Depreciation	2,052
Net realized and unrealized gain on investments	(147,111)
(Increase) decrease in assets:	
Accounts receivable	(395,527)
Inventory—publications	2,591
Prepaid expenses and other assets	(2,419)
Increase (decrease) in liabilities:	
Accounts payable and accrued expenses	345,171
Deferred revenue	—
Deferred rent liability	(10,535)
Accrued post-retirement benefits	(10,916)
Net cash provided by operating activities	182,192
Cash flows from investing activities:	
Purchase of equipment	(1,431)
Purchase of investments	(110,409)
Sale of investments	88,373
Net cash used by investing activities	(23,467)
Cash flows from financing activities:	
Net borrowings on line of credit	6,249
Net increase in cash and cash equivalents	164,974
Cash and cash equivalents at beginning of year	63,098
Cash and cash equivalents at end of year	$ 228,072

Schedule 1
Schedule of Contracts and Grants Revenue
For the year ended December 31, 2021

(unaudited)

Contracts	
Conference of Radiation Control Program Directors	$ 31,872
U.S. Navy	87,395
Total contracts	**119,267**
Grants	
Centers for Disease Control and Prevention	185,547
National Aeronautics and Space Administration	1,607,101
U.S. Department of Energy	768,853
U.S. Food and Drug Administration	7,454
Total grants	**2,568,955**
Total contracts and grants revenue	**$ 2,688,222**

Schedule 2
Schedule of Contributions & Corporate Sponsorship Revenue
For the year ended December 31, 2021

(unaudited)

Contributions	
American Academy of Health Physics	$ 1,000
American Association of Physicists in Medicine	5,400
American College of Radiology	25,000
American Registry of Radiologic Technologists	6,000
American Roentgen Ray Society	7,500
American Society of Radiologic Technologists	6,000
Council on Radionuclides and Radiopharmaceuticals	2,000
Health Physics Society	10,000
Individuals	11,178
Institute of Electrical and Electronics Engineers	5,000
Radiological Society of North America	25,000
Society of Pediatric Radiology	500
Total contributions	**$ 104,578**
Corporate Sponsors	
Fluke/RaySafe/Landauer, Inc.	$ 10,000
Nuclear Energy Institute	5,000
Total Corporate Sponsors	**$ 15,000**

Appendix 2. Publications

Distribution of NCRP Publications

(during the period May 16, 1931 through December 31, 2021)

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office[a]	By NCRP Secretariat[b] 2021		Total NCRP Publications[c]	All Sources Combined
			Hardcopy	E-Pub		
NCRP Reports						
186	Approaches for Integrating Information from Radiation Biology and Epidemiology to Enhance Low-Dose Health Risk Assessment (2020)	__d	13	71	293	293
185	Evaluating and Communicating Radiation Risks for Studies Involving Human Subjects: Guidance for Researchers and Institutional Review Boards (2020)	__d	16	105	455	455
184	Medical Radiation Exposure of Patients in the United States (2019)	__d	13	177	819	819
183	Radiation Exposure in Space and the Potential for Central Nervous System Effects: Phase II (2019)	__d	6	31	236	236
182	Radiation Safety of Sealed Radioactive Sources (2019)	__d	1	61	475	475
181	Evaluation of the Relative Effectiveness of Low-Energy Photons and Electrons in Inducing Cancer in Humans (2018)	__d	2	26	386	386
180	Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018) (2018)	__d	5	91	672	672
179	Guidance for Emergency Response Dosimetry (2017)	__d	7	30	463	463
178	Deriving Organ Doses and Their Uncertainty for Epidemiologic Studies (with a Focus on the One Million U.S. Workers and Veterans Study of Low-Dose Radiation Health Effects) (2018)	__d	2	21	260	260
177	Radiation Protection in Dentistry and Oral & Maxillofacial Imaging (2019)	__d	27	159	741	741
176	Radiation Safety Aspects of Nanotechnology (2017)	__d	0	15	290	290
175	Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents (2014)	__d	5	16	704	704
174	Preconception and Prenatal Radiation Exposure: Health Effects and Protective Guidance (2013)	__d	1	141	1,710	1,710
173	Investigation of Radiological Incidents (2012)	__d	4	22	873	873

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		Government Printing Office[a]	By NCRP Secretariat[b]		Total NCRP Publications[c]	All Sources Combined
			2021			
			Hardcopy	E-Pub		
172	Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States (2012)	__d	0	110	1,712	1,712
171	Uncertainties in the Estimation of Radiation Risks and Probability of Disease Causation (2012)	__d	1	26	909	909
170	Second Primary Cancers and Cardiovascular Disease After Radiation Therapy (2011)	__d	0	23	815	815
169	Design of Effective Radiological Effluent Monitoring and Environmental Surveillance Programs (2010)	__d	2	11	480	480
168	Radiation Dose Management for Fluoroscopically-Guided Interventional Medical Procedures (2010)	__d	2	170	2,142	2,142
167	Potential Impact of Genetic Susceptibility and Previous Radiation Exposure on Radiation Risk for Astronauts (2010)	__d	0	7	374	374
166	Population Monitoring and Radionuclide Decorporation Following a Radiological or Nuclear Incident (2010)	__d	0	11	650	650
165	Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers (2010)	__d	6	79	1,493	1,493
164	Uncertainties in Internal Radiation Dosimetry (2009)	__d	0	27	566	566
163	Radiation Dose Reconstruction: Principles and Practices (2009)	__d	1	27	943	943
162	Self Assessment of Radiation-Safety Programs (2009)	__d	1	29	1,098	1,098
161	Management of Persons Contaminated with Radionuclides (2009)	__d	2	46	1,993	1,993
160	Ionizing Radiation Exposure of the Population of the United States (2009)	__d	2	130	3,198	3,198
159	Risk to the Thyroid from Ionizing Radiation (2008)	__d	0	13	659	659
158	Uncertainties in the Measurement and Dosimetry of External Radiation (2007)	__d	2	25	1,428	1,428
157	Radiation Protection in Educational Institutions (2007)	__d	1	17	1,172	1,172
156	Development of a Biokinetic Model for Radionuclide-Contaminated Wounds and Procedures for Their Assessment, Dosimetry and Treatment (2006)	__d	3	14	1,033	1,033
155	Management of Radionuclide Therapy Patients (2006)	__d	1	141	2,309	2,309
154	Cesium-137 in the Environment: Radioecology and Approaches to Assessment and Management (2006)	__d	1	6	785	785
153	Information Needed to Make Radiation Protection Recommendations for Space Missions Beyond Low-Earth Orbit (2006)	__d	0	10	955	955

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		Government Printing Office[a]	By NCRP Secretariat[b]		Total NCRP Publications[c]	All Sources Combined
			2021			
			Hardcopy	E-Pub		
152	Performance Assessment of Near-Surface Facilities for Disposal of Low-Level Radioactive Waste (2005)	__d	0	6	747	747
151	Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities (2005)	__d	0	810	7,192	7,192
150	Extrapolation of Radiation-Induced Cancer Risks from Nonhuman Experimental Systems to Humans (2005)	__d	0	9	947	947
149	A Guide to Mammography and Other Breast Imaging Procedures (2004)	__d	1	26	1,716	1,716
148	Radiation Protection in Veterinary Medicine (2004)	__d	1	36	1,668	1,668
147	Structural Shielding Design for Medical X-Ray Imaging Facilities (2004)	__d	23	455	7,433	7,433
	Compact disk version of Report No. 147	__d	0	0	143	143
146	Approaches to Risk Management in Remediation of Radioactively Contaminated Sites (2004)	__d	0	7	1,278	1,278
145	Radiation Protection in Dentistry (2003)	__d	0	75	3,261	3,261
144	Radiation Protection for Particle Accelerator Facilities (2003)	__d	5	73	3,052	3,052
143	Management Techniques for Laboratories and Other Small Institutional Generators to Minimize Off-Site Disposal of Low-Level Radioactive Waste (2003)	__d	0	5	913	913
142	Operational Radiation Safety Program for Astronauts in Low-Earth Orbit: A Basic Framework (2002)	__d	1	11	1,369	1,369
141	Managing Potentially Radioactive Scrap Metal (2002)	__d	0	7	1,435	1,435
140	Exposure Criteria for Medical Diagnostic Ultrasound: II. Criteria Based on All Known Mechanisms (2002)	__d	0	11	1,129	1,129
139	Risk-Based Classification of Radioactive and Hazardous Chemical Wastes (2002)	__d	0	8	1,163	1,163
138	Management of Terrorist Events Involving Radioactive Material (2001)	__d	4	14	7,913	7,913
137	Fluence-Based and Microdosimetric Event-Based Methods for Radiation Protection in Space (2001)	__d	0	9	976	976
136	Evaluation of the Linear-Nonthreshold Dose-Response Model for Ionizing Radiation (2001)	__d	0	17	1,856	1,856
135	Liver Cancer Risk from Internally-Deposited Radionuclides (2001)	__d	0	8	1,283	1,283
134	Operational Radiation Safety Training (2000)	__d	2	18	1,818	1,818
133	Radiation Protection for Procedures Performed Outside the Radiology Department (2000)	__d	0	39	2,196	2,196

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		Government Printing Office[a]	By NCRP Secretariat[b]		Total NCRP Publications[c]	All Sources Combined
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132	Radiation Protection Guidance for Activities in Low-Earth Orbit (2000)	__d	0	8	1,257	1,257
131	Scientific Basis for Evaluating the Risks to Populations from Space Applications of Plutonium (2001)	__d	0	5	958	958
130	Biological Effects and Exposure Limits for "Hot Particles" (1999)	__d	0	10	1,367	1,367
129	Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies (1999)	__d	0	13	1,879	1,879
128	Radionuclide Exposure of the Embryo/Fetus (1998)	__d	0	24	2,022	2,022
127	Operational Radiation Safety Program (1998)	__d	1	74	3,035	3,035
126	Uncertainties in Fatal Cancer Risk Estimates Used in Radiation Protection (1997)	__d	0	12	2,181	2,181
125	Deposition, Retention and Dosimetry of Inhaled Radioactive Substances (1997)	__d	0	7	2,776	2,776
124	Sources and Magnitude of Occupational and Public Exposures from Nuclear Medicine Procedures (1996)	__d	0	29	3,616	3,616
123	Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground (1996)	__d	8	38	3,490	3,490
122	Use of Personal Monitors to Estimate Effective Dose Equivalent and Effective Dose to Workers for External Exposure to Low-LET Radiation (1995)	__d	2	60	3,890	3,890
121	Principles and Application of Collective Dose in Radiation Protection (1995)	__d	0	10	2,686	2,686
120	Dose Control at Nuclear Power Plants (1994)	__d	0	6	3,186	3,186
119	A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields (1993)	__d	2	9	3,770	3,770
118	Radiation Protection in the Mineral Extraction Industry (1993)	__d	0	5	2,801	2,801
117	Research Needs for Radiation Protection (1993)	__d	0	5	2,138	2,138
116	Limitation of Exposure to Ionizing Radiation (1993)	__d	1	187	8,681	8,681
115	Risk Estimates for Radiation Protection (1993)	__d	2	16	3,610	3,610
114	Maintaining Radiation Protection Records (1992)	__d	1	9	2,723	2,723
113	Exposure Criteria for Medical Diagnostic Ultrasound: I. Criteria Based on Thermal Mechanisms (1992)	__d	1	10	3,482	3,482
112	Calibration of Survey Instruments Used in Radiation Protection for the Assessment of Ionizing Radiation Fields and Radioactive Surface Contamination (1991)	__d	2	30	4,294	4,294

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		Government Printing Office[a]	By NCRP Secretariat[b]		Total NCRP Publications[c]	All Sources Combined
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			Hardcopy	E-Pub		
111	Developing Radiation Emergency Plans for Academic, Medical and Industrial Facilities (1991)	__d	1	15	4,322	4,322
110	Some Aspects of Strontium Radiobiology (1991)	__d	1	4	2,732	2,732
109	Effects of Ionizing Radiation on Aquatic Organisms (1991)	__d	0	4	2,389	2,389
108	Conceptual Basis for Calculations of Absorbed-Dose Distributions (1991)	__d	0	18	3,447	3,447
107	Implementation of the Principle of As Low As Reasonably Achievable (ALARA) for Medical and Dental Personnel (1990)	__d	0	13	3,714	3,714
106	Limit for Exposure to "Hot Particles" on the Skin (1990)	__d	0	7	3,077	3,077
105	Radiation Protection for Medical and Allied Health Personnel (1989)	__d	0	24	7,210	7,210
104	The Relative Biological Effectiveness of Radiations of Different Quality (1990)	__d	0	10	2,730	2,730
103	Control of Radon in Houses (1989)	__d	0	7	3,980	3,980
102	Medical X-Ray, Electron Beam and Gamma-Ray Protection for Energies up to 50 MeV (Equipment Design, Performance and Use) (1989)	__d	0	38	8,381	8,381
101	Exposure of the U.S. Population from Occupational Radiation (1989)	__d	0	9	4,378	4,378
100	Exposure of the U.S. Population from Diagnostic Medical Radiation (1989)	__d	0	7	5,196	5,196
99	Quality Assurance for Diagnostic Imaging (1988)	__d	1	57	5,590	5,590
98	Guidance on Radiation Received in Space Activities (1989)	__d	0	6	3,595	3,595
97	Measurement of Radon and Radon Daughters in Air (1988)	__d	0	12	4,450	4,450
96	Comparative Carcinogenicity of Ionizing Radiation and Chemicals (1989)	__d	0	9	4,274	4,274
95	Radiation Exposure of the U.S. Population from Consumer Products and Miscellaneous Sources (1987)	__d	0	11	4,484	4,484
94	Exposure of the Population in the United States and Canada from Natural Background Radiation (1987)	__d	0	10	4,656	4,656
93	Ionizing Radiation Exposure of the Population of the United States (1987)	__d	0	17	7,645	7,645
92	Public Radiation Exposure from Nuclear Power Generation in the United States (1987)	__d	1	9	3,841	3,841
91	Recommendations on Limits for Exposure to Ionizing Radiation (1987)	__d	0	0	8,486	8,486
90	Neptunium: Radiation Protection Guidelines (1988)	__d	0	4	3,037	3,037

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			Hardcopy	E-Pub		
89	Genetic Effects from Internally Deposited Radionuclides (1987)	__d	0	4	4,117	4,117
88	Radiation Alarms and Access Control Systems (1986)	__d	0	8	4,997	4,997
87	Use of Bioassay Procedures for Assessment of Internal Radionuclide Deposition (1987)	__d	0	11	4,441	4,441
86	Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields (1986)	__d	2	12	5,562	5,562
85	Mammography—A User's Guide (1986)	__d	0	0	32,655	32,655
84	General Concepts for the Dosimetry of Internally Deposited Radionuclides (1985)	__d	0	8	4,454	4,454
83	The Experimental Basis for Absorbed-Dose Calculations in Medical Uses of Radionuclides (1985)	__d	0	8	3,762	3,762
82	SI Units in Radiation Protection and Measurements (1985)	__d	0	16	4,918	4,918
81	Carbon-14 in the Environment (1985)	__d	0	9	4,154	4,154
80	Induction of Thyroid Cancer by Ionizing Radiation (1985)	__d	0	9	4,437	4,437
79	Neutron Contamination from Medical Electron Accelerators (1984)	__d	0	43	5,491	5,491
78	Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States (1984)	__d	0	5	6,636	6,636
77	Exposures from the Uranium Series with Emphasis on Radon and Its Daughters (1984)	__d	0	6	6,800	6,800
76	Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment (1984)	__d	1	6	6,839	6,839
75	Iodine-129: Evaluation of Release from Nuclear Power Generation (1983)	__d	0	4	6,079	6,079
74	Biological Effects of Ultrasound: Mechanisms and Clinical Implications (1983)	__d	0	10	11,440	11,440
73	Protection in Nuclear Medicine and Ultrasound Diagnostic Procedures in Children (1983)	__d	0	5	5,684	5,684
72	Radiation Protection and Measurement for Low-Voltage Neutron Generators (1983)	__d	0	4	4,618	4,618
71	Operational Radiation Safety—Training (1983)	__d	0	0	5,075	5,075
70	Nuclear Medicine—Factors Influencing the Choice and Use of Radionuclides in Diagnosis and Therapy (1982)	__d	0	8	5,619	5,619
69	Dosimetry of X-Ray and Gamma-Ray Beams for Radiation Therapy in the Energy Range 10 keV to 50 MeV (1981)	__d	0	23	5,383	5,383
68	Radiation Protection in Pediatric Radiology (1981)	__d	0	11	4,754	4,754

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			Hardcopy	E-Pub		
67	Radiofrequency Electromagnetic Fields—Properties, Quantities and Units, Biophysical Interaction and Measurements (1981)	__d	1	9	5,667	5,667
66	Mammography (1980)	__d	0	0	4,598	4,598
65	Management of Persons Accidentally Contaminated with Radionuclides (1980)	__d	0	17	18,683	18,683
64	Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations (1980)	__d	0	4	5,435	5,435
63	Tritium and Other Radionuclide Labeled Organic Compounds Incorporated in Genetic Material (1979)	__d	0	5	4,463	4,463
62	Tritium in the Environment (1979)	__d	0	7	4,121	4,121
61	Radiation Safety Training Criteria for Industrial Radiography (1978)	__d	0	6	6,325	6,325
60	Physical, Chemical and Biological Properties of Radiocerium Relevant to Radiation Protection Guidelines (1979)	__d	0	5	4,176	4,176
59	Operational Radiation Safety Program (1979)	__d	0	0	8,046	8,046
58	A Handbook of Radioactivity Measurements Procedures (1978)	__d	10	26	14,021	14,021
57	Instrumentation and Monitoring Methods for Radiation Protection (1978)	__d	0	9	11,279	11,279
56	Radiation Exposure from Consumer Products and Miscellaneous Sources (1977)	__d	__e	0	5,905	5,905
55	Protection of the Thyroid Gland in the Event of Releases of Radioiodine (1977)	__d	0	7	7,021	7,021
54	Medical Radiation Exposure of Pregnant and Potentially Pregnant Women (1977)	__d	0	27	11,099	11,099
53	Review of NCRP Radiation Dose Limit for Embryo and Fetus in Occupationally Exposed Women (1977)	__d	__e	0	9,289	9,289
52	Cesium-137 from the Environment to Man: Metabolism and Dose (1977)	__d	0	6	4,866	4,866
51	Radiation Protection Design Guidelines for 0.1-100 MeV Particle Accelerator Facilities (1977)	__d	0	1	8,515	8,515
50	Environmental Radiation Measurements (1976)	__d	0	7	8,113	8,113
49	Structural Shielding Design and Evaluation for Medical Use of X Rays and Gamma Rays of Energies up to 10 MeV (1976)	__d	0	147	18,948	18,948
	Adjunct to NCRP Report 49 (1976)	__d	0	0	2,797	2,797

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48	Radiation Protection for Medical and Allied Health Personnel (1976)	__d	__e	0	14,359	14,359
47	Tritium Measurement Techniques (1976)	__d	0	6	6,543	6,543
46	Alpha-Emitting Particles in Lungs (1975)	__d	0	5	6,243	6,243
45	Natural Background Radiation in the United States (1975)	__d	__e	0	7,296	7,296
44	Krypton-85 in the Atmosphere—Accumulation, Biological Significance, and Control Technology (1975)	__d	0	5	6,708	6,708
43	Review of the Current State of Radiation Protection Philosophy (1975)	__d	__e	0	9,722	9,722
42	Radiological Factors Affecting Decision-Making in a Nuclear Attack (1974)	__d	2	5	47,417	47,417
41	Specification of Gamma-Ray Brachytherapy Sources (1974)	__d	1	10	5,735	5,735
40	Protection Against Radiation from Brachytherapy Sources (1972)	__d	0	45	10,271	10,271
39	Basic Radiation Protection Criteria (1971)	__d	__e	0	40,393	40,393
38	Protection Against Neutron Radiation (1971)	__d	2	20	9,314	9,314
37	Precautions in the Management of Patients who have Received Therapeutic Amounts of Radionuclides (1970)	__d	0	0	17,402	17,402
36	Radiation Protection in Veterinary Medicine (1970)	__d	0	0	7,620	7,620
35	Dental X-Ray Protection (1970)	__d	0	0	28,559	28,559
34	Medical X-Ray and Gamma-Ray Protection for Energies up to 10 MeV—Structural Shielding Design and Evaluation (1970)	__d	__e	0	17,662	17,662
33	Medical X-Ray and Gamma-Ray Protection for Energies up to 10 MeV—Equipment Design and Use (1968)	__d	__e	0	98,134	98,134
32	Radiation Protection in Educational Institutions (1966)	__d	0	0	22,363	22,363
31	Shielding for High Energy Electron Accelerator Installations (1964)	3,700	__e	0	2,697	6,397
30	Safe Handling of Radioactive Materials (1964)	24,450	2	0	9,955	34,405
29	Exposure to Radiation in an Emergency	55,705	__e	1	3,679	59,384
28	A Manual of Radioactivity Procedures (1961)	22,892	__e	0	3,665	26,557
27	Stopping Powers for Use with Cavity Chambers (1961)	4,144	0	0	3,836	7,980
26	Medical X-Ray Protection Up to Three Million Volts (1961)	75,894	__e	0	27,154	103,048
25	Measurement of Absorbed Dose of Neutrons and Mixtures of Neutrons and Gamma Rays (1961)	10,790	0	0	4,083	14,873

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		Government Printing Office[a]	By NCRP Secretariat[b]		Total NCRP Publications[c]	All Sources Combined
			2021			
			Hardcopy	E-Pub		
24	Protection Against Radiations from Sealed Gamma Sources (1960)	35,710	__e	0	953	36,663
23	Measurement of Neutron Flux and Spectra for Physical and Biological Applications (1960)	11,849	0	0	3,073	14,922
22	Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure (1959)	52,526	0	0	7,450	59,976
21	Safe Handling of Bodies Containing Radioactive Isotopes (1958)	29,304	__e	0	2,352	31,656
20	Protection Against Neutron Radiation up to 30 Million Electron Volts (1957)	16,989	__e	0	353	17,342
19	Regulation of Radiation Exposure by Legislative Means (1955)	15,140	__e	0	0	15,140
18	X-Ray Protection (1955)	98,713	__e	0	0	98,713
17	Permissible Dose from External Sources of Ionizing Radiation (1954)	60,530	__e	0	2,038	62,568
16	Radioactive Waste Disposal in the Ocean (1954)	16,203	__e	0	2,664	18,867
15	Safe Handling of Cadavers Containing Radioactive Isotopes (1953)	14,486	__e	0	0	14,486
14	Protection Against Betatron-Synchrotron Radiations up to 100 Million Electron Volts (1954)	27,190	__e	0	1,710	28,900
13	Protection Against Radiation from Radium, Cobalt-60 and Cesium-137 (1954)	22,785	__e	0	0	22,785
12	Recommendations for the Disposal of Carbon-14 Wastes (1953)	23,506	__e	0	2,571	26,077
11	Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water (1953)	32,494	__e	0	0	32,494
10	Radiological Monitoring Methods and Instruments (1952)	59,651	__e	0	3,894	63,545
9	Recommendations for Waste Disposal of Phosphorus-32 and Iodine-131 for Medical Users (1951)	28,810	__e	0	5,682	34,492
8	Control and Removal of Radioactive Contamination in Laboratories (1951)	50,500	0	0	7,659	58,159
7	Safe Handling of Radioactive Isotopes (1949)	60,867	__e	0	0	60,867
6	Medical X-Ray Protection up to Two Million Volts (1949)	70,261	__e	0	0	70,261
5	Safe Handling of Radioactive Luminous Compounds (1941)	6,187	__e	0	0	6,187
4	Radium Protection (1938)	10,086	__e	0	0	10,086
3	X-Ray Protection (1936)	16,490	__e	0	0	16,490

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1	X-Ray Protection (1931)	1,596	__e	0	0	1,596
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11	How to Be Quantitative about Radiation Risk Estimates, Seymour Jablon (1987)	__d	0	0	1,023	1,023
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	Total Lectures Distributed	0	0	0	21,673	21,673
NCRP Annual Meeting Proceedings						
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38	Meeting the Needs of the Nation for Radiation Protection: How Did We Get Here?, Proceedings of the Fifty-Second Annual Meeting held April 11–12, 2016. Health Phys. 112(2):111–234 (2017)	__i	__i	__i		__i

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26	Advances in Consequence Management for Radiological Terrorism Events, Proceedings of the Fortieth Annual Meeting held April 14–15, 2004. Health Phys. 89(5):415–588 (2005)	__i	__i	__i	1	1
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10	Radon, Proceedings of the Twenty-Fourth Annual Meeting held March 30–31, 1988 (1989)	__d	0	__j	1,454	1,454
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