

# Annual Report

# 2019

## Year in Review







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## *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.

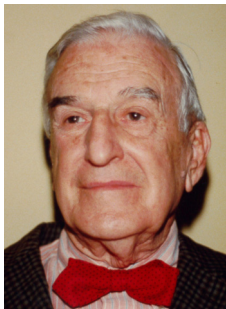
The Council is the successor to the unincorporated association of scientists known as the National Committee on Radiation Protection and Measurements and was formed to carry on the work begun by the Committee in 1929.

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.

## *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



It's hard for me to believe that my first year as President of the National Council on Radiation Protection and Measurements (NCRP) has come to a close, and I'm already writing my second Annual Report Presidential Message. It has been an exciting, sometimes quite challenging, but highly productive year for NCRP. I'd like to sincerely thank you, the many hard-working, dedicated members and supporters of NCRP. The NCRP leadership team could not do what we do without your steadfast support and encouragement.

Over the last year, I had the pleasure and honor of attending a number of meetings to discuss NCRP activities with various groups, national and international—*e.g.*, U.S. Nuclear Regulatory Commission (NRC), International Commission on Radiation Units and Measurements (ICRU), Health Physics Society (HPS), Conference on Radiation Control Program Directors (CRCPD), NORM IX—and I never fail to be impressed with the high esteem with which NCRP is held. It is something you all should be very proud of. We strive to be responsive in radiation protection matters relevant to all of our stakeholders: federal agencies, Congress, members of the public, and, of course, our Council members, program area committee members, and scientific committees. I welcome hearing from you about how we can better serve you and the nation as a whole.

A personal highlight for me this year was a trip arranged by our fine colleagues in the U.S. Navy with whom the NCRP has a long-standing, fruitful relationship. A group of NCRP representatives took an exciting flight on a C-2 Greyhound COD (Carrier on Demand) to the USS John C. Stennis aircraft carrier 100 miles off the coast of North Carolina. We had the opportunity to spend a day with the splendid Navy officers and crew then return on the COD to Norfolk. The commemorative photo from the trip is shown below.



As I look forward to 2020, it is with great pleasure that I reflect back and report on the many accomplishments of NCRP in 2019.



## NCRP Publications completed in 2019:

- **NCRP Report No. 177, *Radiation Protection in Dentistry and Oral & Maxillofacial Imaging*** (Co-Chairs: Alan G. Lurie and Mel L. Kantor), was published in December 2019. This Report provides radiation protection guidance for the use of x rays in dental practice, including the use of cone-beam computed tomography, digital-imaging devices, and handheld x-ray systems.
- **NCRP Report No. 182, *Radiation Safety of Sealed Radioactive Sources*** (Chair: Kathryn H. Pryor), was published in April 2019. This Report provides information on the safe design, acquisition, use and disposition of sealed radioactive sources from “cradle to grave” in a variety of occupational settings. It is of interest to operational radiation safety professionals, regulatory authorities, and users of sealed radioactive sources.
- **NCRP Report No. 183, *Radiation Exposures in Space and the Potential for Central Nervous System Effects (Phase II)*** (Chair: Leslie A. Braby; Vice-Chair: Jacob Raber), was published in November 2019. This critical look at the potential impacts of space radiation on cognitive and behavioral functions in astronauts received financial support from the National Aeronautics and Space Administration (NASA) and was much awaited by that organization and many individuals.
- **NCRP Report No. 184, *Medical Radiation Exposure of Patients in the United States*** (Chair: Fred A. Mettler, Jr.; Co-Chair: Mahadevappa Mahesh), which was published in November 2019, evaluates changes in medical radiation exposure to patients since NCRP Report No. 160, *Ionizing Radiation Exposure of the Population of the United States* (2009). Report No. 184 shows a 15 to 20 % reduction in diagnostic and interventional medical radiation doses to the U.S. population from 2006 to 2016. Except for computed tomography (CT) scans, most medical imaging doses are stable or decreasing. This finding is a contrast to the dramatic rise documented in the 2009 Report. The Centers for Disease Control and Prevention (CDC) sponsored this important Report.
- **NCRP Commentary No. 28, *Implementation Guidance for Emergency Response Dosimetry*** (Co-Chairs: Stephen V. Musolino and Adela Salame-Alfie), was published in May 2019. As a companion to NCRP Report No. 179, *Guidance for Emergency Response Dosimetry* (2017), which defined the emergency worker and provided guidance to bridge the gap in managing dosimetry between trained, fully equipped emergency workers and the remainder responder community during the early response period, this Commentary is a guide for “boots-on-the-ground dosimetry” in the event of a radiological/nuclear incident. Commentary No. 28 was funded by the U.S. Depart-

ment of Homeland Security (DHS) and the New York City Department of Health and Mental Hygiene.

- **Proceedings of the 54th Annual Meeting** of the NCRP, held in March 2018, on “Radiation Protection Responsibility in Medicine” was published in the February 2019 issue of *Health Physics* [116(2):111–294].
- **The Lauriston S. Taylor, Warren K. Sinclair, and Thomas S. Tenforde Lectures and the summary of NCRP 2019 Annual Meeting** on “NCRP Meeting the Challenge at 90: Providing Best Answers to Your Most Pressing Questions About Radiation,” held April 1–2, 2019, are in press in *Health Physics* for the April 2020 issue.

## 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). The Committee writing teams, covering all facets of the radiation sciences, produced a draft commentary which was reviewed by the Program Area Committees (PACs) this year, and they are now revising the draft to address the many comments received.
- **SC 1-26, Approaches for Integrating Radiation Biology and Epidemiology for Enhancing Low-Dose Risk Assessment** (Chair: R. Julian Preston; Vice Chair: Werner Rühm), has completed their thoughtful, comprehensive report, which is now with the NCRP office for final editing and formatting for publication. This is a CDC funded activity.
- **SC 1-27, Evaluation of Sex-Specific Differences in Lung Cancer Radiation Risks and Recommendations for Use in Transfer Models** (Chair: Michael M. Weil), is a NASA-funded initiative of great relevance to astronauts on long-duration missions beyond low-Earth orbit. The commentary being prepared will assess sex-specific differences in radiation-induced lung cancer in human populations and animal models and make recommendations for NASA regarding transfer models to be used in predicting risks for astronauts.
- **SC 2-8, Operational Radiation Safety Program** (Chair: Kathryn H. Pryor), is working diligently on updating NCRP Report No. 127 (1998) with the intent of providing guidance to individuals with responsibility for establishing and implementing operational radiation safety programs. A draft document for review should be ready shortly.
- **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 CDC.
- **SC 4-7, Evaluating and Communicating Radiation Risks for Studies Involving Human Subjects: Guidance for Researchers and Institutional Review Boards** (Chair: Julie E.K. Timins), has completed this report, which is now with the NCRP Managing Editor for editing and formatting for publication. The report is a unique, comprehensive document that provides useful information for the development, evaluation and execution of research involving exposure of human subjects to ionizing radiation. Funding has been received from the American Board of Radiology Foundation to assist in this effort.



- **SC 4-8, Improving Patient Dose Utilization in Computed Tomography** (Co-Chairs: Mannudeep K.S. Kalra and Edwin M. Leidholdt), has completed several draft versions of a commentary and initial PAC review could begin shortly.
- **SC 4-10, Error Prevention in Radiation Therapy** (Chair: Steven G. Sutlief), is preparing a statement which should be ready for initial PAC review later this year.
- **SC 4-11, Gonadal Shielding During Abdominal and Pelvic Radiography** (Chair: Donald P. Frush; Vice Chair: Keith J. Strauss), is preparing a statement that will include a succinct recommendation that is addressing an important issue to radiation protection in medicine. This eagerly awaited document should be ready for review by PAC 4 soon.
- **SC 5-2, Commentary No. 29, Naturally Occurring Radioactive Material (NORM) and Technologically Enhanced NORM (TENORM) from the Oil and Gas Industry** (Chair: William E. Kennedy, Jr.), provides a review of the generation and disposal of NORM/TENORM waste from oil and gas exploration and production. The Commentary addresses radiation protection, legal, and regulatory considerations. This CDC-funded document is about ready to go to the printer.
- **SC 6-11, Dosimetry Guidance for Medical Radiation Workers with a Focus on Lung Dose Reconstruction** (Co-Chairs: Lawrence T. Dauer and R. Crag Yoder), is preparing a commentary evaluating dosimetry, especially for lung, in a large cohort of medical radiation workers. This NASA-funded project has relevance to the studies in progress by SC 1-27 to assess sex-specific differences in lung cancer radiation risks. The commentary has been through all review steps and is being prepared by the Co-Chairs and Staff Consultant for handing over to the NCRP office.
- **SC 6-12**, a U.S. Department of Energy (DOE)-funded effort, has undertaken the project **Development of Models for Brain Dosimetry for Internally Deposited Radionuclides** (Chair: Richard Leggett; Vice Chair: Sergey Tolmachev) as part of the Million Person Study (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.

## Publications:

Members, particularly chairs, of NCRP scientific committees are encouraged to publish papers in peer-reviewed journals summarizing the NCRP reports or commentaries that they worked on. The four such publications from 2019 are listed here.

- Mettler FA. Medical radiation exposure in the United States: 2006–2016 Trends. *Health Phys.* 2019. 116(2):126–128.
- Shore RE, Beck HL, Boice JD Jr, Caffrey EA, Davis S, Grogan HA, Mettler FA Jr, Preston RJ, Till JE, Wakeford R, Walsh L, Dauer LT. Recent epidemiologic studies and the linear no-threshold model for radiation protection – Considerations regarding NCRP Commentary 27. *Health Phys.* 2019. 116(2):235–246 [PMID:30585971].
- Cool D, Kase KR, Boice JD Jr. NCRP Report No. 180 - Management of exposure to ionizing radiation: NCRP radiation protection guidance for the United States. *J Radiol Prot.* 2019. 39(3):966–977 [PMID 30970327].
- Shore RE, Beck HL, Boice JD Jr, Caffrey EA, Davis S, Grogan HA, Mettler FA, Preston RJ, Till JE, Wakeford R, Walsh L, Dauer LT. Reply to Comment on “Implications of recent epidemiologic studies for the linear nonthreshold model and radiation protection.” *J Radiol Prot.* 2019. 39(2):655–659.

At this time, several manuscripts are being prepared, are in review, or are in press from members of SC 4-9 who prepared Report No. 184. We look forward to seeing those papers published in 2020.

2019 publications involving NCRP work, many reporting findings from the MPS, are listed here.

- Boice, JD Jr. NCRP vision for the future and program area committee activities in 2018. *Health Phys.* 2019. 116(2):282–294.
- Boice JD Jr, Ellis ED, Golden AP, Zablotska LB, Mumma MT, Cohen SS. Sex-specific lung cancer risk among radiation workers in the million person study and patients TB-fluoroscopy. *Int J Radiat Biol.* 2019 Jan 7. 1–12 [Epub ahead of print] [PMID 30614747].
- Golden AP, Ellis ED, Cohen SS, Mumma MT, Leggett RW, Wallace PW, Girardi D, Watkins JP, Shore RE, Boice JD. Updated mortality analysis of the Mallinckrodt uranium processing workers, 1942–2012. *Int J Radiat Biol.* 2019 Jan 17. 1–21 [Epub ahead of print].
- Dauer LT, Woods M, Miodownik D, Serencsits B, Quinn B, Bellamy M, Yoder C, Liang X, Boice JD Jr, Bernstein J. Cohort profile – MSK radiation workers: a feasibility study to establish a deceased worker sub-cohort as part of a multicenter medical radiation worker component in the million person study of low-dose radiation health effects. *Int J Radiat Biol.* 2019 Jan 27. 1–7 [Epub ahead of print].
- Boice JD Jr, Cohen SS, Mumma MT, Ellis ED. The Million Person Study, whence it came and why. *Int J Radiat Biol.* 2019 Mar 4. 1–14 [Epub ahead of print] [PMID 30831042].
- Boice JD Jr. The Million Person Study relevance to space exploration and Mars. *Int J Radiat Biol.* 2019 Mar 4. 1–9 [Epub ahead of print].
- Simon SL, Bailey SM, Beck HL, Boice JD, Bouville A, Brill AB, Cornforth MN, Inskip PD, McKenna MJ, Mumma MT, Salazar SI, Ukwuani A. Estimation of radiation doses to U.S. military test participants from nuclear testing: A comparison of historical film-badge measurements, dose reconstruction and retrospective biodosimetry. *Radiat Res.* 2019. 191(4):287–310 [PMID:30789797].
- Boice JD Jr, Held KD, Shore RE. Radiation epidemiology and low dose health effects from low-LET radiation. *J Radiol Prot.* 2019. 39(4):S14–S27. [PMID:31272090]
- Mumma MT, Sirko JL, Boice JD Jr, Blot WJ. Mesothelioma mortality within two radiation monitored occupational cohorts. *Int J Radiat Biol.* 2019 Jul 10. [Epub ahead of print] [PMID:31290725].
- Boice JD Jr. The likelihood of adverse pregnancy outcomes and genetic disease (transgenerational effects) from exposure to radioactive fallout from the 1945 TRINITY atomic bomb test. *Health Phys.* 2019 Jul 22. 1–9 (in press).
- Ansari A, Kleinhans K, Boice JD. Potential health effects of low dose radiation and what it means to the practice of radiation protection. *J Radiol Prot.* 2019. 39(4):E9–E13. [PMID:31756172].

## Presentations:

The work of NCRP is presented at various venues by the officers and chairs/members of PACs and SCs. Presentations of NCRP work in 2019 included:

- John D. Boice, “Sex-Specific Lung Cancer Risks among Radiation Workers in the Million Person Study and Recommendations for Use in Risk Projection Models.” 2019 NASA Human Research Investigators’ Workshop; Human Exploration and Discovery: The Moon, Mars and Beyond. Galveston, Texas, January 22–25, 2019.

- John D. Boice, “Radiation and Cancer Genetics.” Vanderbilt University, Division of Epidemiology, Molecular and Genetic Epidemiology of Cancer (MAGEC), Nashville, Tennessee, February 15, 2019.
- John D. Boice, “Astronauts, Mars and Radiation.” Knollwood Military Retirement Community, Washington, D.C., March 29, 2019.
- John D. Boice, “The Once and Future NCRP.” Herbert M. Parker Lecture. Washington State Universities Tri-Cities, Richland, Washington, April 10, 2019.
- John D. Boice, “Million Person Study, USTUR and Mission Mars.” United States Transuranium and Uranium Registries (USTUR), 2019 Scientific Advisory Committee Meeting, Richland, Washington, April 11, 2019.
- John D. Boice, “The Million Person Study of Low Dose Health Effects – An Update and Focus on DOE Workers.” Department of Energy, Forrestal Bldg., Washington, D.C., April 24, 2019.
- John D. Boice, “Using Terrestrial Epidemiology to Understand Space Radiation Risks – The Million Worker Study.” NASA ASEC 2019 (Applied Space Environments Conference), Los Angeles, California, May 14, 2019.
- John D. Boice, “Radiation-Induced Cancer and the U.S. Million Person Study,” 16th International Congress of Radiation Research (ICRR 2019), Manchester, England, August 2019.
- John D. Boice, “Is this it? What about LNT and the future?,” NCRP Co-Sponsored Session on “A Million Persons, A Million Dreams, A 25 Year Reality” at the 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.
- John D. Boice, “Atomic veteran health studies and compensation schemes with emphasis on long-term implications to health,” 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.
- Jerrold T. Bushberg, “Medical Radiation Exposure of Patients in the United States,” HPS Annual Meeting, Orlando, Florida, July 8, 2019.
- Lawrence T. Dauer, “Leukemia arises – but at what level?,” NCRP Co-Sponsored Session on “A Million Persons, A Million Dreams, A 25 Year Reality” at the 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.
- Lawrence T. Dauer (on behalf of R. Craig Yoder), “The key to harmony is exceptional dosimetry,” NCRP Co-Sponsored Session on “A Million Persons, A Million Dreams, A 25 Year Reality” at the 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.
- Lawrence T. Dauer, “U.S. Million Person Study: Status and Summary Results to Date,” International Dose Effect Alliance (IDEA) Workshop, Charlotte, North Carolina, December 2019.
- Keith F. Eckerman, “Dosimetry: Radiation Protection to Health Effects.” United States Transuranium and Uranium Registries (USTUR), 2019 Scientific Advisory Committee Meeting, Richland, Washington, April 11, 2019.
- Ashley Golden, “Just a heart beat away,” NCRP Co-Sponsored Session on “A Million Persons, A Million Dreams, A 25 Year Reality” at the 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.
- Naomi H. Harley, “Radon Dose NCRP vs. ICRP,” HPS Annual Meeting, Orlando, Florida, July 2019.
- Kathryn D. Held, “Thoughts from NCRP on Doing More With Less in Challenging Times for Radiation Sciences,” Nuclear Regulatory Commission (NRC) Regulatory Information Conference (RIC), March 14, 2019.
- Kathryn D. Held, “NCRP Vision for the Future & PAC Activities,” NCRP Annual Meeting, Bethesda, Maryland, April 2019.

- Kathryn D. Held, panelist, DOE-NCI Basic Research Needs Workshop on Compact Accelerators for Security and Medicine, Tysons, Virginia, May 6–7, 2019.
- Kathryn D. Held, panelist, Session 2: Perspectives on Need for Low-Dose Research Program, NASEM Symposium on “The Future of Low-Dose Radiation Research in the United States,” Washington, D.C., May 8, 2019.
- Kathryn D. Held, “Report on NCRP,” ICRU Annual Meeting, Singapore, June 24, 2019.
- Kathryn D. Held, “Thoughts on Tolerability/Reasonableness from NCRP,” HPS Annual Meeting, Orlando, Florida, July 10, 2019.
- Kathryn D. Held, “NCRP Activities and NORM/TENORM,” Ninth International Symposium on NORM, Denver, Colorado, September 2019.
- Kathryn D. Held, “The Space Radiation Environment and Bystander Effects after Particle Irradiation,” 7th International Symposium of Gunma University Program for Leading Graduate Schools, Maebashi, Japan, October 2019.
- John J. Lanza, “The NCRP: Why You Need to Know about this Organization,” HPS Annual Meeting, Orlando, Florida, July 10, 2019.
- Mahadevappa Mahesh on behalf of Members of NCRP SC 4-9, “Medical Radiation Exposure of Patients in the United States,” 105th Annual Meeting of the RSNA, Chicago, Illinois, December 2019.
- Dale Preston, “Sex, Lungs and Mars: Sex matters when going to the stars/Mars,” NCRP Co-Sponsored Session on “A Million Persons, A Million Dreams, A 25 Year Reality” at the 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.
- Henry D Royal, “NCRP Report 184: Patient Diagnostic And Interventional Radiation Exposures In The U.S,” National Academy of Sciences, Washington, D.C., November 2019.
- Adela Salame-Alfie, “PEP M-5, Considerations for Implementation of NCRP 179, Guidance for Emergency Response Dosimetry,” Health Physics Society (HPS) Annual Meeting, Orlando, Florida, July 8, 2019.
- Adela Salame-Alfie, “Implementation Guidance for Emergency Response Dosimetry,” HPS Annual Meeting, Orlando, Florida, July 11, 2019.
- Adela Salame-Alfie, “Considerations for Implementation of NCRP 179, Guidance for Emergency Response Dosimetry,” mid-year training of the Florida Emergency Preparedness Association, August 2019.
- John E. Till (for Emily Caffrey), “The atomic age and atomic men (Veterans),” NCRP Co-Sponsored Session on “A Million Persons, A Million Dreams, A 25 Year Reality” at the 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.
- Sergei Y. Tolmachev, M Avtandilashvili, RW Leggett and JD Boice Jr. “Plutonium in human brain: Is more biokinetic detail needed for dosimetry?” 3rd International Conference on Dosimetry and its Applications (ICDA-3), Lisbon, Portugal, May 26–31, 2019.
- Sergei Y. Tolmachev, Avtandilashvili M, Leggett RW and Boice JD Jr. “Case Studies in Brain Dosimetry for Internally Deposited Radionuclides,” 64th Annual Meeting of Health Physics Society, Orlando, Florida, July 7–11, 2019.
- Sergei Y. Tolmachev, “From autopsies to synchrotrons to Mars – why the brain matters,” NCRP Co-Sponsored Session on “A Million Persons, A Million Dreams, A 25 Year Reality” at the 65th Annual Meeting of the Radiation Research Society, San Diego, California, November 2019.

Hopefully I have captured all presentations given on behalf of NCRP; I apologize if I've missed anyone! We greatly appreciate the time and effort of our members who beautifully represent NCRP to a variety of stakeholders!

## Funding Support:

In 2019 NCRP received funding support from a number of grant and contract sources. New funding in 2019 included:

- A four-year grant from NASA for a total of \$2,371M to evaluate dementia and neurocognition among workers with alpha-particle dose to brain tissue.
- A grant from the American Board of Radiology (ABR) Foundation for \$81,000 to support work on radiation protection in medicine.

In 2019, NCRP work, including scientific committees and the MPS, continued to be supported through ongoing funding from the following organizations:

- American Board of Radiology (ABR) Foundation (SC 4-7 and SC 4-8);
- CDC (SC 1-26, SC 3-2, SC 4-9, SC 5-2, and SC 6-10);
- NASA (SC 1-24P2, SC 1-27, SC 6-11, and MPS);
- DOE (SC 6-12 and MPS);
- DHS (SC 3-1P2); and
- U.S. Navy (MPS).

We gratefully acknowledge the significant support from these agencies and organizations and thank them for their continued interest in and funding of NCRP. This support is critical to our ability to provide the scientific service to the nation that is NCRP's mission.

## Annual Meetings:

The **55th NCRP Annual Meeting**, on April 1 and 2, 2019, was a special occasion where we celebrated the 90th Anniversary of the Founding of NCRP. The meeting was titled “**NCRP Meeting the Challenge at 90: Providing Best Answers to Your Most Pressing Questions About Radiation,**” and the Program Committee, chaired by Fred A. Mettler, Jr. with Co-Chairs Jerrold T. Bushberg and Richard J. Vetter, organized an enlightening, educational and entertaining meeting. The named lectures included the 43rd Lauriston S. Taylor Lecture by André Bouville on “Fallout from Nuclear Weapons Tests: Environmental, Health, Political & Sociological Considerations”; 16th Warren K. Sinclair Keynote Address by C. Norman Coleman on “Frontiers in Medical Radiation Science,” and the 3rd Thomas S. Tenforde Topical Lecture by Genevieve S. Roessler on “HPS Ask the Experts: Our Most Intriguing Questions & Answers.” There was special recognition of John D. Boice, with the presentation of a lovely portrait painted by Kenneth L. Miller and announcement of the establishment of the John D. Boice Young Investigators Award. We continued the traditional, very special, elements of our meeting, including the presentation of the colors by the Joint Armed Forces Honor Guard from the Military District of Washington, D.C., the singing of the National Anthem by Ms. Kimberly Jordan of NRC, and the recognition of the Radiation Research Society (RRS)/NCRP Scholars.

As we go to press with this Annual Report, we have just had to cancel the 2020 NCRP Annual Meeting because of COVID-19. Since our plan (as of March 10, 2020) is to push forward the previously planned 2020 meeting to 2021, and the 2021 meeting to 2022, we leave the original text here. Our upcoming **56th Annual Meeting** of the NCRP, to be held March 23–24, 2020, on “**Radiation & Flight: A Down-to-Earth Look at Risks**” will be co-chaired by Jacqueline P. Williams and Cary Zeitlin and should be an uplifting experience (pun intended). The Program Committee developed an exciting and informative program that will start off with the 17th Warren K. Sinclair Keynote Address by Astronaut Serena M. Auñón-Chancellor, describing “Space Radiation: Perspective From the Astronaut Office.” The Annual Meeting will also include 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 Lecture by Paul A. Locke entitled “Collision or Cooperation? The Law, Ethics & Science of Personalized Risk Assessments for Space and Air Travel.” We eagerly anticipate the presentation of the first John D. Boice Young Investigators Award.

Save the Date!  
Register for the NCRP 2020 Annual Meeting  
**Radiation & Flight: A Down-to-Earth Look at Risks**  
March 23-24, 2020  
Hyatt Regency Bethesda  
Bethesda, Maryland  
Summary  
Register

Astronaut Serena M. Auñón-Chancellor is the 17th WK Sinclair Keynote Speaker

Distinguished Emeritus Member Robert L. Ullrich, is 44th LS Taylor Lecturer

Council Member Paul A. Locke to present the 4th TS Tenforde Topical Lecture

Planning is underway for the **2021 Annual Meeting** of the NCRP, to be held April 19–20, 2021. The meeting on “**NCRP: The State of the Council**” will be co-chaired by Jessica S. Wieder and Evagelia C. Laiakis. We plan to highlight recent NCRP publications and their impact, discuss our active scientific committees and their significance, and discuss the future of NCRP and radiation science. This will be an important opportunity for all our Council Members, sponsors, and collaborating organizations to get updated on the myriad of activities on-going within NCRP and to provide input to guide NCRP moving forward.

## PAC Work:

The Chairs/Co-Chairs of all our PACs remained the same in 2019. This has been a blessing to me in my first year as President, as I rely on these experienced and steadfast individuals to help and guide me. They all do a wonderful job for NCRP; we could not function without their dedicated service. Thank you to all PAC Chairs/Co-Chairs and all the PAC members.

I would like to highlight some **innovations/improvements** that have been undertaken:

- PAC 7 is continuing to expand our social media presence on Twitter, Facebook, etc., with a regular, monthly social media calendar. Please stay tuned! PAC 7 is always looking for ideas for topics to be included.
- We have been working to update and improve our website (<https://ncrponline.org/>) which highlights NCRP activities, publications, PACs, SCs, and members in the news. There's lots of information so be sure to check it out, and we hope to have more improvements soon.
- With the urging and help of members of PAC 7, especially Angela Shogren and Jessica S. Wieder, we are now sending out a quarterly newsletter, *NCRParticles*, to NCRP members. We hope you all find these regular updates helpful and informative. As with the social media outreach, ideas on content and format would be greatly appreciated.

- Shortly before last year's annual meeting, we sent all Council members an updated “NCRP Council Member Handbook,” something Members had requested and was long overdue. We continued to recognize that more changes and additional information were needed, so the latest revision should be out before the 2020 annual meeting.
- We are also preparing an instruction manual for NCRP Scientific Committees, reflecting all the changes in operations that have occurred since the previous version of that document. It, too, should be available about the time of the 2020 NCRP meeting.
- In 2019, we made a few changes to the format of our “PAC Sunday” and Members' Dinner, and we will have more changes in 2020, reflecting requests from the PACs. Let us know how you like the changes.

## Finances:

**Finances remain one of the biggest challenges for NCRP.** As you will see in the fiscal statements, later in this Annual Report, we have stemmed the loss in NCRP's net assets that had occurred for several years, but difficulties continue as our assets are not at the robust level they once were. In 2019, we made good progress working through the back-log of under-funded/unfunded scientific committee work to get publications out, but we still have a bit further to go, so that effort continues to be a drain on finances. As I pointed out last year, another large drain on NCRP finances is the Annual Meeting, which is largely unfunded. We need to work harder on finding financial support for that critical component of the NCRP mission. The vagaries of the stock market are also an issue, unfortunately one we cannot control. Receipt of the five-year grant from DOE in 2018 and the four-year grant from NASA in 2019 have been a help to the NCRP financial position, but long-term planning remains difficult in light of the current uncertainties of government funding. The Officers, Board of Directors, and Budget and Finance Committee are continuing to pursue multiple activities and explore opportunities to increase funding and improve NCRP's financial position. We are reaching out to potential benefactors and donors, industry, professional societies, and academic institutions. More involvement by the Council is crucial. We continue to encourage Council Members to take advantage of the *AmazonSmile* initiative and/or to remember NCRP with a charitable contribution or as a small percentage beneficiary of an IRA or life insurance policy. Your ideas (and your donations) are welcome!

As you may have noticed from the listings of publications, presentations and funding, the MPS of low-dose health effects, headed by John D. Boice, Jr., NCRP Director of Science, remains a major effort for NCRP. The MPS is designed to study the possible 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. Over the years, the MPS has received critical support (both direct financial support as well as in-kind support), from the NRC, DOE, NASA, U.S. Navy, U.S. Department of Defense, National Cancer Institute, CDC, U.S. Environmental Protection Agency, Fluke/RaySafe/Landauer, national laboratories, and others. At this time, funding for NCRP for this work comes from DOE, NASA, and the U.S. Navy. This important study will provide scientific understanding that can improve guidelines and guidance to protect workers and members of the public.

## Partnership:

In addition to the partnerships with funding agencies that have been described above, NCRP continues numerous active and fruitful partnerships with multiple national and international organizations. Additionally, NCRP officers serve on advisory committees and boards of other groups (*e.g.*, Image Gently, Oak Ridge Associated Universities, Radiation Research Foundation); NCRP organizes sessions and provides members to serve as speakers and session chairs at meetings of other entities (*e.g.*, HPS, RRS) (see list of presentations above); and NCRP officers and members provide educational activities and material for other organizations (*e.g.*, CDC, Vanderbilt, Harvard). These activities are critical to NCRP's mission and help “spread the word” about NCRP. Don't hesitate to let us know if you identify other opportunities for NCRP partnerships, formal or informal.

## Some Final Thoughts:

NCRP always is on the outlook for enthusiastic “new blood”! We are committed to encouraging younger professionals in the radiation sciences to participate on our SCs, PACs, and at our meetings. We are looking to add diversity to our ranks by engaging with qualified junior investigators, women, and minorities. Please encourage your students, post-docs, and junior colleagues to become involved with NCRP.

It is with great sadness that I report the passing of four NCRP Council Members (John Ahearne, Charles Chambers, Thomas Tenforde, and John Villforth) in 2019.



**John F. Ahearne, June 14, 1934 – March 12, 2019**

Dr. Ahearne served as a member of NCRP from 1999 to 2011 and was elected Distinguished Emeritus Member in 2011. He served as Chairman of SC 1-19 on Health Protection Issues Associated with Use of Active Detection Technology Security Systems for Detection of Radioactive Threat Materials; was a member of Program Area Committee 7 on Radiation Education, Risk Communication, and Outreach; and served on the Nominating Committee from 2003 to 2009. John also was a speaker at both the 2005 and 2009 annual meetings and a member of the Advisory Panel on Public Policy.



**Charles E. Chambers, August 20, 1954 – June 9, 2019**

Dr. Chambers was a major scientific contributor to NCRP for more than a decade. He served as a Member of Council from 2007 to 2013 and continued as an active member of PAC 4 on radiation protection in medicine up to and including the 2019 annual meeting. He understood the conflicting requirements of technology and medical necessity and was able to communicate this to Council members and in NCRP reports. Dr. Chambers' experience and expertise as a practicing interventional cardiologist were essential to the writing of Report No. 168, Statement No. 11, and other NCRP documents. At the time of his death, Dr. Chambers was serving on SC 4-9. He provided critical insights into the balance between patient benefits against patient and worker risks in fluoroscopically guided procedures.





**Thomas S. Tenforde, December 15, 1940 – September 6, 2019**

Dr. Tenforde served as President of NCRP from 2002 until his retirement in 2012, and was subsequently recognized as President Emeritus. He was first elected as a Council member in 1988 serving on the Board of Directors from 1991 to 1995 and again when he was elected President in 2002. He chaired SC 1-15 and SC 89-6 and was a Committee member of SC 89-1. Dr. Tenforde also served on the NCRP Nominating Committee from 1990 to 1995, chaired the Annual Meeting Program Committee in 1994, and served on the Program Committee in 2006. In 2016, an endowment from Dr. Tenforde established the Thomas S. Tenforde Topical Lecture to be given at the annual meeting, on the second day immediately following the Annual Business Meeting.



**John C. Villforth, December 28, 1930 – September 14, 2019**

Rear Admiral Villforth was a Council member from 1971 to 1982, elected to NCRP Consociate membership in 1982, and played an important role in the 2013 “Where are the Radiation Professionals (WARP) Workshop.” He took great personal interest in the careers of others. As Director during the formative years of the Bureau of Radiological Health (BRH), he heavily recruited young people from academia through fellowships and other programs, and in so doing, personally nurtured the public health careers of countless numbers of young commissioned officers and civilians. Past NCRP President John D. Boice, Jr. was one of these young officers at BRH.

As we move forward in these exciting times, I eagerly anticipate working with you all. We expect 2020 to be another productive year for NCRP. The challenges are large, but the opportunities are many, and the expected outcomes are important for radiation protection and the radiation sciences. As NCRP moves into the future, I look forward to working with our many partnering organizations and with wonderful scientific and professional colleagues.

Many thanks to the following for help in preparing this President's Report and for assistance in all things NCRP: Laura J. Atwell, Angela Shogren, and Jessica S. Wieder, the NCRP staff and Council Members. A special thanks to Jerry Bushberg and John Boice for all they have done for NCRP over many fruitful years and for their support and guidance to me throughout my first year as President.

Kathryn D. Held  
*President*

## Membership

There are 99 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 2019, 11 new members were elected, and six members were re-elected. The 11 new members were:

Luiz Bertelli	Adam Hutter
Andrew J. Einstein	Ziad N. Kazzi
Eric J. Grant	Evagelia C. Laiakis
Barbara L. Hamrick	Angela Shogren
Lawrence H. Heilbronn	Julie Sullivan
E. Vincent Holahan	

### 2019 Council Membership, Affiliation, and Current Term

Sally A. Amundson	Columbia University Medical Center	2016–2022
Armin Ansari	Centers for Disease Control and Prevention	2015–2021
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
Judith L. Bader	U.S. Department of Health & Human Services	2014–2020
Stephen Balter	Columbia-Presbyterian Medical Center	2019–2025
Daniel J. Barnett	Johns Hopkins Bloomberg School of Public Health	2015–2021
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	2015–2021
Daniel J. Blumenthal	U.S. Department of Energy	2015–2021
John D. Boice, Jr.	National Council on Radiation Protection and Measurements	2018–2024
Wesley E. Bolch	University of Florida	2017–2023
Michael Boyd	U.S. Environmental Protection Agency	2014–2020
Richard R. Brey	Idaho State University	2019–2025
James A. Brink	Massachusetts General Hospital	2017–2023
Brooke R. Buddemeier	Lawrence Livermore National Laboratory	2015–2021
Jerrold T. Bushberg	University of California, Davis	2014–2020
Polly Y. Chang	SRI International	2017–2023
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
Scott Davis	Fred Hutchinson Cancer Research Center	2016–2022
Sara D. DeCair	U.S. Environmental Protection Agency	2017–2023
Christine A. Donahue	CB&I	2015–2021
Joseph R. Dynlacht	Indiana University School of Medicine	2014–2020
Andrew J. Einstein	Columbia University	2019–2025
Cynthia Flannery	U.S. Nuclear Regulatory Commission	2017–2023
Patricia A. Fleming	Saint Mary’s College, Notre Dame	2015–2021
Donald P. Frush	Stanford University School of Medicine	2016–2022
Eric J. Grant	Radiation Effects Research Foundation	2019–2025
Eric M. Goldin	Retired	2015–2021
Helen A. Grogan	Cascade Scientific, Inc.	2014–2020
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	2014–2020
E. Vincent Holahan	U.S. Nuclear Regulatory Commission	2019–2025
Roger W. Howell	Rutgers, The State University of New Jersey	2015–2021
Janice L. Huff	National Aeronautics and Space Administration	2017–2023
Adam Hutter	National Urban Security Technology Laboratory	2019–2025
Randall N. Hyer	Center for Risk Communication	2016–2022
William E. Irwin	Vermont Department of Health	2015–2021
Thomas E. Johnson	Colorado State University	2018–2024

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
Katherine A. Kiel	College of the Holy Cross	2015–2021
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
John J. Lanza	Florida Department of Health	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	2015–2021
Donald M. Mayer	Indian Point Energy Center	2015–2021
Ruth E. McBurney	Conference of Radiation Control Program Directors, Inc.	2019–2025
Donald L. Miller	Food and Drug Administration	2018–2024
Stephen V. Musolino	Brookhaven National Laboratory	2014–2020
Bruce A. Napier	Pacific Northwest National Laboratory	2014–2020
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	2015–2021
Debra M. Scroggs	Retired	2018–2024
J. Anthony Seibert	University of California Davis Medical Center	2014–2020
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	2014–2020
Glenn M. Sturchio	Mayo Clinic	2016–2022
Julie Sullivan	U.S. Food and Drug Administration	2019–2025
Steven G. Sutlief	Landauer Medical Physics	2018–2024
Tammy P. Taylor	Pacific Northwest National Laboratory	2016–2022



Julie K. Timins	New Jersey Commission on Radiation Protection	2016–2022
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	2014–2020
Jessica S. Wieder	U.S. Environmental Protection Agency	2017–2023
John P. Winston	Pennsylvania Bureau of Radiation Protection	2018–2024
Jacqueline P. Williams	University of Rochester Medical College	2018–2024
Gayle E. Woloschak	Northwestern University	2015–2021
X. George Xu	Rensselaer Polytechnic Institute	2014–2020
R. Craig Yoder	Retired	2014–2020
Pat B. Zanzonico	Memorial Sloan-Kettering Cancer Center	2018–2024
Cary Zeitlin	Leidos	2014–2020

## Board of Directors

Jerrold T. Bushberg, <i>Chairman</i>	Lawrence T. Dauer	Donald L. Miller
Armin Ansari	Christine A. Donahue*	Jessica S. Wieder*
Jonine L. Bernstein	William E. Kennedy, Jr.	Gayle E. Woloschak
Wesley E. Bolch*	John J. Lanza	
Michael Boyd*		

\*Elected April 2, 2019

## Officers

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

## Distinguished Emeritus Members

Thomas S. Tenforde, *President Emeritus*<sup>†</sup>  
S. James Adelstein, *Honorary Vice President*  
Kenneth R. Kase, *Honorary Vice President*  
W. Roger Ney, *Executive Director Emeritus*  
David A. Schauer, *Executive Director Emeritus*

John F. Ahearn <sup>†</sup>	Ethel S. Gilbert	David S. Myers
Lynn R. Anspaugh	Ronald E. Goans*	Carl J. Paperiello
Benjamin R. Archer	Joel E. Gray	John W. Poston, Sr.
John A. Auxier	Raymond A. Guilmette	Andrew K. Poznanski
Harold L. Beck	Eric J. Hall	R. Julian Preston
Joel S. Bedford	Naomi H. Harley	Jerome S. Puskin
Eleanor A. Blakely	William R. Hendee	Genevieve S. Roessler
Bruce B. Boecker	F. Owen Hoffman	Marvin Rosenstein
Thomas B. Borak	Bernd Kahn	Lawrence N. Rothenberg
Andre Bouville	Ann R. Kennedy	Henry D. Royal
Leslie A. Braby	David C. Kocher	Michael T. Ryan
Robert L. Brent	Ritsuko Komaki	Stephen M. Seltzer
Antone L. Brooks	Charles E. Land	Roy E. Shore
S.Y. Chen	Susan M. Langhorst	Paul Slovic
J. Donald Cossairt	Martha S. Linet	Daniel J. Strom
Allen G. Croff	Jill A. Lipoti*	John E. Till
Paul M. DeLuca	John B. Little	Richard E. Toohey
Sarah S. Donaldson	Roger O. McClellan	Lawrence W. Townsend
William P. Dornsife	Barbara J. McNeil	Robert L. Ullrich
Keith F. Eckerman	Fred A. Mettler, Jr.	Richard J. Vetter
Thomas S. Ely	Charles W. Miller*	F. Ward Whicker
Stephen A. Feig	Kenneth L. Miller	Chris G. Whipple*
John R. Frazier	A. Alan Moghissi	Susan D. Wiltshire
Thomas F. Gesell		Marvin C. Ziskin

\*Elected to Distinguished Emeritus Membership April 2, 2019.

<sup>†</sup>Deceased during 2019.

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

\*Consociate Membership effective April 2, 2019.

<sup>†</sup>Deceased during 2019.

## *Administrative Committees*

### **Budget & Finance Committee** (appointed by the Board of Directors, April 2, 2019)

William E. Kennedy, Jr., *Chair*

Jerrold T. Bushberg

John J. Lanza

Kathleen L. Shingleton

R. Craig Yoder

### **Nominating Committee** (appointed by the Board of Directors, April 2, 2019)

Adela Salame-Alfie, *Chair*

Michael Boyd

Kathryn H. Pryor

Michael M. Weil

Cary Zeitlin

### **Program Committee for 2020 Annual Meeting**

(appointed by the Board of Directors, April 2, 2019)

Jacqueline P. Williams & Cary Zeitlin, *Co-Chairs*

Jeri Anderson

Janice L. Huff

Evagelia C. Laiakis

M. Kerry O'Banion

Zarana Patel

Mark Shavers

Michael D. Story

Michael M. Weil



## *Scientific & Administrative Staff*

Laura J. Atwell	Director of Operations
Sarah S. Cohen	Technical Staff Consultant
Helen A. Grogan	Technical Staff Consultant
Raymond A. Guilmette	Technical Staff Consultant
Cindy L. O'Brien	Managing Editor
Beverly A. Ottman	Receptionist
Marvin Rosenstein	Technical Staff Consultant
Kathleen L. Shingleton	Technical Staff Consultant
Roy E. Shore	Advisor to Director of Science
James M. Smith	Technical Staff Consultant
Lawrence W. Townsend	Technical Staff Consultant
Richard J. Vetter	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
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### **Program Area Committees and Committee Chairs**

Basic Criteria, Epidemiology, Radiobiology, and Risk	Gayle E. Woloschak Jonine 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	Bruce A. Napier
Radiation Measurements and Dosimetry	Steven L. Simon
Radiation Education, Risk Communication, and Outreach	Randall N. Hyer

### **Advisory Panel**

Nonionizing Radiation	Jerrold T. Bushberg
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## **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

## *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 Tolmachev

Lawrence W. Townsend

Lydia Zablotska

## *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 Bernstein, *Vice Chair*

Sally A. Amundson

Edouard I. Azzam

Joel S. Bedford

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

George Sgouros

Roy E. Shore

Michael D. Story

Michael M. Weil

Jacqueline P. Williams

Lydia Zablotska

### **Active Scientific Committees Under PAC 1**

**SC 1-26 Approaches for Integrating Radiation Biology and Epidemiology for Enhancing Low Dose Risk Assessment**

Status: Revising after Council review

R. Julian Preston, *Chair*  
Werner Rühm, *Vice Chair*  
Edouard I. Azzam  
John D. Boice, Jr.  
Simon Bouffler  
Mark P. Little  
Roy E. Shore  
Igor Shuryak  
Michael M. Weil  
Marvin Rosenstein, *Technical Staff Consultant* (2018 –)

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

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

## **Completed in 2019**

NCRP Report No. 183, *Radiation Exposures in Space and the Potential for Central Nervous System Effects: Phase II*, was issued November 4, 2019. This Report was drafted by Scientific Committee 1-24 Phase 2 chaired by Leslie A. Braby and Jacob Raber. Committee members included: Polly Chang, David F. Dinges, Dudley T. Goodhead, David Herr, John Hopewell, Janice Huff, Kevin Krull, Richard M. Linnehan (2016–2017), Thomas J. MacVittie, M. Kerry O’Banion, Michael Qin, James Root, Susanna Rosi, and Peter Winsauer; Gregory A. Nelson, *NASA Observer* and Lawrence W. Townsend, *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 Harris  
 Michael 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 PAC review

Kathryn H. Pryor, *Chair*  
 Edgar D. Bailey  
 Christine A. Donahue  
 John R. Frazier  
 Eric M. Goldin  
 Barbara L. Hamrick  
 Michael 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

## Completed in 2019

NCRP Report No. 182, *Radiation Safety of Sealed Radioactive Sources*, was issued April 5, 2019. This Report was drafted by Scientific Committee 2-7 chaired by Kathryn H. Pryor. Committee members included: Edgar D. Bailey, Christine A. Donahue, John R. Frazier, Eric M. Goldin, Barbara L. Hamrick, Michael Littleton, David S. Myers, John W. Poston, Sr., Debra M. Scroggs, Kathleen L. Shingleton, Glen M. Sturchio, Joshua Walkowicz, James S. Willison, and James G. Yusko.



## *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  
 C. Norman Coleman  
 Sara DeCair  
 John Donnelly  
 Joseph R. Dynlacht  
 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 Pibida  
 Adela Salame-Alfie  
 Julie Sullivan  
 Benjamin Stevenson, *Consultant*

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

Status: Drafting

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

Richard T. Kouzes, *Advisor / PAC 6 Liaison*

Daryl Fahner, *Advisor*

## Completed in 2019

NCRP Commentary No. 28, *Implementation Guidance for Emergency Response Dosimetry*, was issued May 24, 2019. This Commentary was drafted by Scientific Committee 3-1 Phase II chaired by Stephen V. Musolino and Adela Salame-Alfie. Committee members included: Bobby R. Baker, Jr., Brooke R. Buddemeier, John A. Donnelly, Sr., Helen A. Grogan, William Haley, William E. Irwin, III, David A. Pasquale, Richard K. Schlueck, Jessica S. Wieder; Consultants Craig M. Marianno and Robert C. Whitcomb; and Technical Staff Consultant James M. Smith.

## *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

Charles E. Chambers\*

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.

Wayne D. Newhauser

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

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\*Deceased June 9, 2019

## Active Scientific Committees Under PAC 4

### SC 4-7 **Evaluating and Communicating Radiation Risks for Studies Involving Human Subjects: Guidance for Researchers and Reviewing Bodies**

Status: Preparing for publication

Julie E.K. Timins, *Chair*

Jerrold T. Bushberg

Patricia A. Fleming

Linda A. Kroger

Edwin M. Leidholdt, Jr.

Donald L. Miller

Robert E. Reiman

J. Anthony Seibert

Steven G. Sutlief

Michael P. Grissom, *Technical Staff Consultant*

### SC 4-8 **Improving Patient Dose Utilization in Computed Tomography**

Status: Preparing for PAC review

Mannudeep K.S. Kalra, *Chair*

Edwin M. Leidholdt, Jr., *Co-Chair*

Andrew J. Einstein

Donald P. Frush

Mahadevappa Mahesh

Ehsan Samei

John Boone, *Consultant*

Michael McNitt-Gray, *Consultant*

### SC 4-10 **Error Prevention in Radiation Therapy**

Status: Drafting

Steven G. Sutlief, *Chair*

Edwin M. Leidholdt, Jr.

Lukasz Mazur

Wayne D. Newhauser

Bruce Thomadsen

Shia Y. Woo

### SC 4-11 **Gonadal Shielding During Abdominal and Pelvic Radiography**

Status: Drafting

Donald P. Frush, *Chair*

Keith J. Strauss, *Vice Chair*

Rebecca Milman Marsh

Sarah McKenney

Donald L. Miller

Angela Shogren

Mary Ann Spohrer

Louis K. Wagner

John P. Winston

**Completed in 2019**

NCRP Report No. 177, *Radiation Protection in Dentistry and Oral & Maxillofacial Imaging*, was issued December 19, 2019. This Report was drafted by Scientific Committee 4-5 chaired by Mel L. Kantor and Alan G. Lurie. Committee members included: Mansur Ahmad, Veeratrishul Allareddy, John B. Ludlow, Edwin T. Parks, Eleonore D. Paunovich, Robert J. Pizzutiello, Robert A. Sauer, David C. Spelic; Consultants Edwin M. Leidholdt, Jr., W. Doss McDavid, and Donald L. Miller; Technical Staff Consultant Joel E. Gray.

NCRP Report No. 184, *Medical Radiation Exposure of Patients in the United States*, was issued November 15, 2019. This Report was drafted by Scientific Committee 4-9 chaired by Fred A. Mettler, Jr. and Mahadevappa Mahesh. Committee members included: Mythreyi Bhargavan Chatfield, Charles E. Chambers (deceased), Jennifer G. Elee, Donald P. Frush, Michael T. Milano, Donald L. Miller, Henry D. Royal, David C. Spelic; Advisors Armin Ansari, Wesley E. Bolch, Gary M. Guebert, Robert H. Sherrier, and James M. Smith; and Technical Staff Consultant Richard J. Vetter.

## *Environmental Radiation & Radioactive Waste Issues*

**Vice President, Bruce A. Napier**

### **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**

Bruce A. Napier, *Vice President*  
Michael Boyd  
S.Y. Chen  
Allen G. Croff  
Jonathan D. Edwards (2015 – 2019)  
R. William Field  
Helen A. Grogan  
Kathryn A. Higley  
E. Vincent Holahan  
William E. Kennedy, Jr.  
Katherine A. Kiel  
Jill A. Lipoti  
Ruth E. McBurney  
Brian A. Powell  
Andrew Wallo, III

### **Active Scientific Committees Under PAC 5**

**SC 5-2 Radiation Protection for Naturally Occurring Radioactive Materials (NORM) and Technologically Enhanced NORM (TENORM) from Oil and Gas Recovery**



Status: Preparing for publication

William E. Kennedy, Jr., *Chair*

David J. Allard

Martin D. Barrie

Philip V. Egidi

Gary Forsee

John R. Frazier

Raymond H. Johnson

Andrew J. Lombardo

Ruth E. McBurney

Kathleen L. Shingleton, *Technical Staff Consultant*

## *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 Zeitlin  
Gary H. Zeman

### **Active Scientific Committees Under PAC 6**

#### **SC 6-11 Dosimetry Guidance for Medical Radiation Workers With a Focus on Lung Dose**

##### **Reconstruction**

Status: Revising after Council review

R. Craig Yoder, *Co-Chair*

Lawrence T. Dauer, *Co-Chair*

Stephen Balter

Michael Mumma

Christopher N. Passmore

Lawrence N. Rothenberg

Richard J. Vetter





Helen A. Grogan, *Technical Staff Consultant*

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

Status: Drafting

Richard Leggett, *Chair*

Sergey Y. Tolmachev, *Vice Chair*

Maia Avtandilashvili

Keith F. Eckerman

George Sgouros

Gayle E. Woloschak

Helen A. Grogan, *Technical Staff Consultant*

## *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  
Jerrold T. Bushberg  
Vince Covello  
Ray Johnson  
P. Andrew Karam  
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  
Joseph A. Elder  
Kenneth R. Foster  
David A. Savitz  
Richard A. Tell  
Marvin C. Ziskin

## *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 2019 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 2019 are:

Australian Radiation Protection and Nuclear Safety Agency  
 Bundesamt für 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 à l'Énergie 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 for NCRP's work through contracts and grants:

- American Board of Radiology Foundation
- Centers for Disease Control and Prevention
- National Aeronautics and Space Administration
- New York City Department of Health and Mental Hygiene
- U.S. Department of Energy
- U.S. Department of Homeland Security
- U.S. Navy

## *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 for Radiation Oncology  
American Society of Radiologic Technologists  
Council on Radionuclides and Radiopharmaceuticals  
Exelon Generation, an Exelon Company  
Fluke/RaySafe/Landauer  
Health Physics Society  
Individuals  
Institute of Electrical and Electronics Engineers  
Memorial Sloan-Kettering Cancer Center  
Nuclear Energy Institute  
Radiological Society of North America  
Risk Assessment Corporation  
Society of Pediatric Radiology

### **Giving Tuesday Donations**

Armin Ansari  
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S.Y. Chen  
Lawrence T. Dauer

Willie Harris  
Kathryn D. Held  
Ziad N. Kazzi  
William E. Kennedy, Jr.  
Lawrence N. Rothenberg  
Adela Salame-Alfie  
Julie Sullivan  
Richard A. Tell

## *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 (98), 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 reports on the basis of the comments received follows, with the goal of reaching a scientific consensus on the material included in the report. 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
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 <i>What Ifs</i> , <i>Wows</i> , and <i>Who Cares</i> 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: <i>Unde Venimus Quoque Imus</i>	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
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*

<b>Year</b>	<b>Title</b>	<b>Lecturer</b>
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



*Annual Meetings*

<b>Year</b>	<b>Topic</b>
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

## 2019 Annual Meeting

The Fifty-Fifth Annual Meeting of NCRP was held April 1–2, 2019 at the Hyatt Regency Bethesda in Bethesda, Maryland. The topic of the meeting was “NCRP Meeting the Challenge at 90: Providing Best Answers to Your Most Pressing Questions About Radiation.” The sessions and presentations were as follows:

### **Sixteenth Annual Warren K. Sinclair Keynote Address**

Frontiers in Medical Radiation Science, C. Norman Coleman

### **Exploring the Red Planet: A Focus on the Radiation Environment & Crew Health**

Is the Low-Earth Orbit Radiation Environment a Good Proxy for Mars?, Cary J. Zeitlin  
Overview of Health Risks Associated with Deep Space Exploration, Eleanor A. Blakely  
The Sky is the Limit, Mark Shavers  
Perspectives from the Office of the Chief Health & Medical Officer, Neal Zapp

### **Low-Dose Epidemiology & Regulatory Issues**

What is the Life Span Study Telling Us About Cancer Risks at Low to Moderate Doses?, Eric J. Grant

Risk Estimates from Studies of Low Doses & Low Dose Rates, Richard Wakeford  
NRC Rulemaking Process & Current Regulatory Activities, Patricia K. Holahan  
Can Radiation Epidemiology Affect Current Radiation Standards?, Michael A. Boyd

## **Tissue Reactions**

Low Dose Radiation & Circulatory Diseases, Mark P. Little  
Low Dose Radiation & Cataracts, Nobuyuki Hamada

## **Emergency Planning, Response & Communications**

Response Issues Identified in 2017 NCRP Annual Meeting, William E. Irwin  
Don't Blame the PAGs, Sara D. DeCair  
New Guidance & Tools for Radiological/Nuclear Response; NUSTL Support to State & Local  
Planning, Benjamin Stevenson  
Communication Issues Identified & Efforts to Close the Gaps, Jessica S. Wieder  
Gamma Gear: A Video Game to Teach Radiation Detection & Protection to Members of the  
Public, Tristan Barr  
Conclusions; Introduction of Q&A Panel, Brooke R. Buddemeier

## **Waste Management**

High-Level Waste Tank Closure at the Savannah River Site: What is Being Done to Stabilize  
Liquid Radioactive Waste from the Cold War at Savannah River?, Kent Rosenberger  
Contamination Mitigation at the Waste Isolation Pilot Plant in New Mexico: What has Been Done  
in the Aftermath of the Americium Accident at the Waste Isolation Pilot Plant?, Casey Gadbury  
Low-Level Waste Disposal: An Operator's Perspective, What is the Day-to-Day Reality of  
"Routine" Low-Level Radioactive Waste Operations?, Joseph J. Weismann

## **Forty-Fourth Lauriston S. Taylor Lecture on Radiation Protection and Measurements**

Fallout from Nuclear Weapons Tests: Environmental, Health, Political, & Sociological  
Considerations, André Bouville

## **Third Thomas S. Tenforde Topical Lecture**

HPS Ask the Experts: Our Most Intriguing Questions & Answers, Genevieve S. Roessler

## **Frequently Asked Questions: Medical & Other Topics**

Panelist Presentation & Discussion: Answers to FAQs & Response to Often Heard Statements  
Panel Members: Jerrold T. Bushberg, Brooke R. Buddemeier, Raymond A. Guilmette, Randall N.  
Hyer, Fred A. Mettler, Jr., Richard J. Vetter, and Jessica S. Wieder

## **Conclusions**

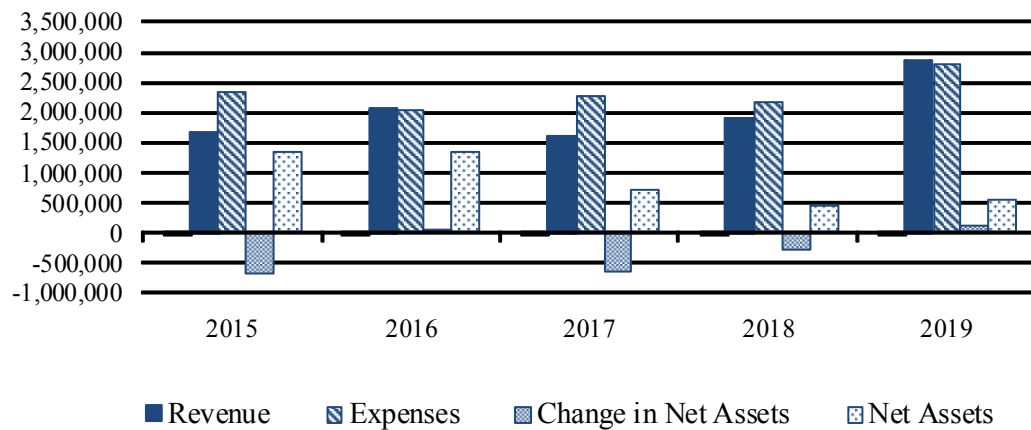
NCRP Vision for the Future & PAC Activities, Kathryn D. Held

Serving on the Program Committee for the 2019 Annual Meeting were: Fred A. Mettler, Jr., Chair and Jerrold T. Bushberg and Richard J. Vetter, Co-Chairs; and Committee members: Brooke R. Budde-meier, Donald A. Cool, Lawrence T. Dauer, Raymond A. Guilmette, Janice L. Huff, Randall N. Hyer, William E. Irwin, William E. Kennedy, Jr., R. Julian Preston, Roy E. Shore, and Jessica S. Wieder. Selected presentations of the 2019 Annual Meeting will be published in *Health Physics*.

## Financial Summary

The table and bar graph presented below exhibit NCRP’s year-end financial data for 2019 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
2015	1,668,085	2,337,573	(669,488)	1,322,089
2016	2,045,362	2,031,142	14,220	1,336,309
2017	1,610,611	2,251,295	(640,684)	695,625
2018	1,905,901	2,152,242	(246,341)	449,284
2019	2,880,147	2,783,918	96,229	545,513



## Appendix 1. Finances

### Exhibit A Statement of Financial Position For the year ended December 31, 2019 (unaudited)

#### Current Assets

Cash and cash equivalents	\$ 62,896
Investments [at market]	1,106,270
Accounts receivable:	
Publications	—
Grants and contracts	325,414
International Commission on Radiation Units and Measurements	486
Other	—
Inventory—publications	51,811
Prepaid expenses and other assets	17,052
Total current assets	<u>1,563,929</u>

#### Property and Equipment [at cost]

Furniture and equipment	189,344
Less accumulated depreciation	(182,779)
Total property and equipment	<u>6,565</u>

#### TOTAL ASSETS

1,570,494

#### Liabilities

Line of credit	263,510
Accounts payable and accrued expenses	519,086
Deferred revenue	—
Total current liabilities	<u>782,596</u>

#### Other Liabilities

Deferred rent liability	30,034
Accrued post-retirement benefits	212,351
Total other liabilities	<u>242,385</u>
<b>TOTAL LIABILITIES</b>	<u><u>1,024,981</u></u>



<b>Net Assets</b>	
Without donor restrictions	219,149
With donor restrictions	326,364
<b>TOTAL NET ASSETS</b>	<u>545,513</u>
<b>TOTAL LIABILITIES AND NET ASSETS</b>	<u><u>1,570,494</u></u>

## Exhibit B Statement of Activities For the year ended December 31, 2019 (unaudited)

	Net Assets without Donor Restrictions	Net Assets with Donor Restrictions	Total
<b>Revenue and Other Increases</b>			
Contracts and grants	\$ 2,190,347	\$ 65,538	\$ 2,255,885
Contributions	155,922	14,839	170,761
Corporate sponsorship	22,000	—	22,000
Contributed professional services	88,125	—	88,125
Sales of publications	161,258	—	161,258
Dividends and interest	36,966	6,861	43,827
Net realized and unrealized gain on investments	144,912	(15,271)	129,641
Professional and administrative services	8,650	—	8,650
Total revenue and other increases	2,808,180	71,967	2,880,147
<b>Expenses and Other Decreases</b>			
Program costs:			
Contracts and grants	1,654,177	—	1,654,177
Publications	48,020	—	48,020
Contributed professional services	88,125	—	88,125
Total program costs	1,790,322	—	1,790,322
Management and general expenses	955,709	—	955,709
Total expenses	2,746,031	—	2,746,031
Investment fees	10,313	—	10,313
Post-retirement benefit change	27,574	—	27,574
	2,783,918	—	2,783,918
<b>Change in Net Assets</b>	24,262	71,967	96,229
<b>Net Assets at Beginning of Year</b>	194,887	254,397	449,284
<b>Net Assets at End of Year</b>	\$ 219,149	\$ 326,364	\$ 545,513



**Exhibit C**  
**Statement of Cash Flow**  
**For the year ended December 31, 2019**  
*(unaudited)*

Cash flows from operating activities:	
Change in net assets	\$ 96,229
Adjustments to reconcile change in net assets to cash provided by operating activities	
Depreciation	3,830
Net realized and unrealized loss on investments	(129,641)
(Increase) decrease in assets:	
Accounts receivable	(103,634)
Inventory—publications	(2,529)
Prepaid expenses and other assets	(1,799)
Increase (decrease) in liabilities:	
Accounts payable and accrued expenses	214,343
Deferred revenue	(35,000)
Deferred rent liability	(33)
Accrued post-retirement benefits	27,645
<b>Net cash provided by operating activities</b>	<u>69,411</u>
Cash flows from investing activities:	
Purchase of equipment	(1,300)
Purchase of investments	(52,922)
Sale of investments	43,329
<b>Net cash used by investing activities</b>	<u>(10,893)</u>
Cash flows from financing activities:	
Net repayments on line of credit	(28,458)
<b>Net increase in cash and cash equivalents</b>	30,060
<b>Cash and cash equivalents at beginning of year</b>	<u>32,836</u>
<b>Cash and cash equivalents at end of year</b>	<u>\$ 62,896</u>

## Schedule 1 Schedule of Contracts and Grants Revenue For the year ended December 31, 2019

*(unaudited)*

### Contracts

U.S. Department of Homeland Security	\$ 54,581
U.S. Navy	104,837
<b>Total contracts</b>	<b>159,418</b>

### Grants

American Board of Radiology	81,000
Centers for Disease Control and Prevention	291,534
National Aeronautics and Space Administration	1,031,052
U.S. Department of Energy	692,881
<b>Total grants</b>	<b>2,096,467</b>

<b>Total contracts and grants revenue</b>	<b>\$ 2,255,885</b>
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**Schedule 2**  
**Schedule of Contributions & Corporate Sponsorship Revenue**  
**For the year ended December 31, 2019**

*(unaudited)*

**Contributions**

American Academy of Health Physics	\$ 1,000
American Association of Physicists in Medicine	15,400
American College of Radiology	25,000
American Registry of Radiologic Technologists	6,000
American Roentgen Ray Society	7,500
American Society for Radiation Oncology	3,000
American Society of Radiologic Technologists	6,000
Council on Radionuclides and Radiopharmaceuticals	2,000
Fluke/RaySafe/Landauer	3,000
Health Physics Society	12,000
Individuals	25,849
In-kind contributions	32,512
Memorial Sloan-Kettering Cancer Center	5,000
Radiological Society of North America	25,000
Risk Assessment Corporation, Inc.	1,000
Society of Pediatric Radiology	500

<b>Total contributions</b>	<b>\$ 170,761</b>
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**Corporate Sponsors**

Exelon Generation, an Exelon Company	\$ 5,000
Fluke/RaySafe/Landauer	10,000
Nuclear Energy Institute	7,000

<b>Total Corporate Sponsors</b>	<b>\$ 22,000</b>
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## Appendix 2. Publications

### Distribution of NCRP Publications

(during the period May 16, 1931 through December 31, 2019)

No.	Title and Year of Publication	Number of Copies Distributed				All Sources Combined
		Government Printing Office <sup>a</sup>	By NCRP Secretariat <sup>b</sup>		Total NCRP Publications <sup>c</sup>	
			2019	Hardcopy		
<b>NCRP Reports</b>						
184	Medical Radiation Exposure of Patients in the United States (2019)	__d	43	28	291	291
183	Radiation Exposure in Space and the Potential for Central Nervous System Effects: Phase II (2019)	__d	31	4	104	104
182	Radiation Safety of Sealed Radioactive Sources (2019)	__d	86	31	332	332
181	Evaluation of the Relative Effectiveness of Low-Energy Photons and Electrons in Inducing Cancer in Humans (2018)	__d	23	41	312	312
180	Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018) (2018)	__d	125	48	446	446
179	Guidance for Emergency Response Dosimetry (2017)	__d	16	25	386	386
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	30	11	195	195
177	Radiation Protection in Dentistry and Oral & Maxillofacial Imaging (2019)	__d	0	0	0	0
176	Radiation Safety Aspects of Nanotechnology (2017)	__d	7	4	253	253
175	Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents (2014)	__d	8	6	662	662
174	Preconception and Prenatal Radiation Exposure: Health Effects and Protective Guidance (2013)	__d	4	10	1,448	1,448
173	Investigation of Radiological Incidents (2012)	__d	10	3	817	817
172	Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States (2012)	__d	0	6	1,510	1,510
171	Uncertainties in the Estimation of Radiation Risks and Probability of Disease Causation (2012)	__d	4	1	837	837

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office <sup>a</sup>	By NCRP Secretariat <sup>b</sup>		Total NCRP Publications <sup>c</sup>	All Sources Combined
			2019			
			Hardcopy	E-Pub		
170	Second Primary Cancers and Cardiovascular Disease After Radiation Therapy (2011)	__d	5	2	767	767
169	Design of Effective Radiological Effluent Monitoring and Environmental Surveillance Programs (2010)	__d	4	2	451	451
168	Radiation Dose Management for Fluoroscopically-Guided Interventional Medical Procedures (2010)	__d	12	15	1,777	1,777
167	Potential Impact of Genetic Susceptibility and Previous Radiation Exposure on Radiation Risk for Astronauts (2010)	__d	2	3	358	358
166	Population Monitoring and Radionuclide Decorporation Following a Radiological or Nuclear Incident (2010)	__d	4	3	624	624
165	Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers (2010)	__d	3	48	1,358	1,358
164	Uncertainties in Internal Radiation Dosimetry (2009)	__d	0	3	516	516
163	Radiation Dose Reconstruction: Principles and Practices (2009)	__d	1	2	872	872
162	Self Assessment of Radiation-Safety Programs (2009)	__d	3	6	1,030	1,030
161	Management of Persons Contaminated with Radionuclides (2009)	__d	4	16	1,874	1,874
160	Ionizing Radiation Exposure of the Population of the United States (2009)	__d	31	17	2,902	2,902
159	Risk to the Thyroid from Ionizing Radiation (2008)	__d	0	2	625	625
158	Uncertainties in the Measurement and Dosimetry of External Radiation (2007)	__d	14	5	1,360	1,360
157	Radiation Protection in Educational Institutions (2007)	__d	3	3	1,135	1,135
156	Development of a Biokinetic Model for Radionuclide-Contaminated Wounds and Procedures for Their Assessment, Dosimetry and Treatment (2006)	__d	2	1	1,004	1,004
155	Management of Radionuclide Therapy Patients (2006)	__d	1	5	2,033	2,033
154	Cesium-137 in the Environment: Radioecology and Approaches to Assessment and Management (2006)	__d	10	0	771	771
153	Information Needed to Make Radiation Protection Recommendations for Space Missions Beyond Low-Earth Orbit (2006)	__d	1	2	930	930
152	Performance Assessment of Near-Surface Facilities for Disposal of Low-Level Radioactive Waste (2005)	__d	0	1	735	735
151	Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities (2005)	__d	12	28	5,814	5,814

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office <sup>a</sup>	By NCRP Secretariat <sup>b</sup>		Total NCRP Publications <sup>c</sup>	All Sources Combined
			2019			
			Hardcopy	E-Pub		
150	Extrapolation of Radiation-Induced Cancer Risks from Nonhuman Experimental Systems to Humans (2005)	__d	12	1	930	930
149	A Guide to Mammography and Other Breast Imaging Procedures (2004)	__d	16	0	1,652	1,652
148	Radiation Protection in Veterinary Medicine (2004)	__d	2	11	1,584	1,584
147	Structural Shielding Design for Medical X-Ray Imaging Facilities (2004)	__d	28	18	6,470	6,470
	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	2	1,265	1,265
145	Radiation Protection in Dentistry (2003)	__d	6	18	3,114	3,114
144	Radiation Protection for Particle Accelerator Facilities (2003)	__d	6	14	2,874	2,874
143	Management Techniques for Laboratories and Other Small Institutional Generators to Minimize Off-Site Disposal of Low-Level Radioactive Waste (2003)	__d	1	1	897	897
142	Operational Radiation Safety Program for Astronauts in Low-Earth Orbit: A Basic Framework (2002)	__d	2	3	1,350	1,350
141	Managing Potentially Radioactive Scrap Metal (2002)	__d	0	1	1,417	1,417
140	Exposure Criteria for Medical Diagnostic Ultrasound: II. Criteria Based on All Known Mechanisms (2002)	__d	1	0	1,104	1,104
139	Risk-Based Classification of Radioactive and Hazardous Chemical Wastes (2002)	__d	1	0	1,149	1,149
138	Management of Terrorist Events Involving Radioactive Material (2001)	__d	0	0	7,876	7,876
137	Fluence-Based and Microdosimetric Event-Based Methods for Radiation Protection in Space (2001)	__d	4	0	962	962
136	Evaluation of the Linear-Nonthreshold Dose-Response Model for Ionizing Radiation (2001)	__d	1	2	1,815	1,815
135	Liver Cancer Risk from Internally-Deposited Radionuclides (2001)	__d	5	0	1,269	1,269
134	Operational Radiation Safety Training (2000)	__d	10	0	1,749	1,749
133	Radiation Protection for Procedures Performed Outside the Radiology Department (2000)	__d	0	7	2,110	2,110
132	Radiation Protection Guidance for Activities in Low-Earth Orbit (2000)	__d	2	3	1,237	1,237
131	Scientific Basis for Evaluating the Risks to Populations from Space Applications of Plutonium (2001)	__d	10	1	948	948

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office <sup>a</sup>	By NCRP Secretariat <sup>b</sup>		Total NCRP Publications <sup>c</sup>	All Sources Combined
			2019			
			Hardcopy	E-Pub		
130	Biological Effects and Exposure Limits for “Hot Particles” (1999)	__d	1	0	1,340	1,340
129	Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies (1999)	__d	0	1	1,859	1,859
128	Radionuclide Exposure of the Embryo/Fetus (1998)	__d	9	1	1,977	1,977
127	Operational Radiation Safety Program (1998)	__d	31	0	2,904	2,904
126	Uncertainties in Fatal Cancer Risk Estimates Used in Radiation Protection (1997)	__d	0	1	2,159	2,159
125	Deposition, Retention and Dosimetry of Inhaled Radioactive Substances (1997)	__d	0	1	2,763	2,763
124	Sources and Magnitude of Occupational and Public Exposures from Nuclear Medicine Procedures (1996)	__d	8	5	3,555	3,555
123	Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground (1996)	__d	0	6	3,418	3,418
122	Use of Personal Monitors to Estimate Effective Dose Equivalent and Effective Dose to Workers for External Exposure to Low-LET Radiation (1995)	__d	3	4	3,781	3,781
121	Principles and Application of Collective Dose in Radiation Protection (1995)	__d	2	2	2,667	2,667
120	Dose Control at Nuclear Power Plants (1994)	__d	0	0	3,145	3,145
119	A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields (1993)	__d	0	5	3,744	3,744
118	Radiation Protection in the Mineral Extraction Industry (1993)	__d	0	0	2,792	2,792
117	Research Needs for Radiation Protection (1993)	__d	0	0	2,125	2,125
116	Limitation of Exposure to Ionizing Radiation (1993)	__d	4	5	8,293	8,293
115	Risk Estimates for Radiation Protection (1993)	__d	0	1	3,570	3,570
114	Maintaining Radiation Protection Records (1992)	__d	1	0	2,679	2,679
113	Exposure Criteria for Medical Diagnostic Ultrasound: I. Criteria Based on Thermal Mechanisms (1992)	__d	1	2	3,468	3,468
112	Calibration of Survey Instruments Used in Radiation Protection for the Assessment of Ionizing Radiation Fields and Radioactive Surface Contamination (1991)	__d	2	4	4,212	4,212
111	Developing Radiation Emergency Plans for Academic, Medical and Industrial Facilities (1991)	__d	0	1	4,299	4,299
110	Some Aspects of Strontium Radiobiology (1991)	__d	0	0	2,725	2,725
109	Effects of Ionizing Radiation on Aquatic Organisms (1991)	__d	24	0	2,383	2,383

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			2019			
			Hardcopy	E-Pub		
108	Conceptual Basis for Calculations of Absorbed-Dose Distributions (1991)	__d	1	1	3,413	3,413
107	Implementation of the Principle of As Low As Reasonably Achievable (ALARA) for Medical and Dental Personnel (1990)	__d	0	0	3,684	3,684
106	Limit for Exposure to “Hot Particles” on the Skin (1990)	__d	0	2	3,038	3,038
105	Radiation Protection for Medical and Allied Health Personnel (1989)	__d	0	4	7,166	7,166
104	The Relative Biological Effectiveness of Radiations of Different Quality (1990)	__d	4	0	2,704	2,704
103	Control of Radon in Houses (1989)	__d	0	0	3,960	3,960
102	Medical X-Ray, Electron Beam and Gamma-Ray Protection for Energies up to 50 MeV (Equipment Design, Performance and Use) (1989)	__d	5	8	8,296	8,296
101	Exposure of the U.S. Population from Occupational Radiation (1989)	__d	1	0	4,358	4,358
100	Exposure of the U.S. Population from Diagnostic Medical Radiation (1989)	__d	0	2	5,181	5,181
99	Quality Assurance for Diagnostic Imaging (1988)	__d	0	1	5,477	5,477
98	Guidance on Radiation Received in Space Activities (1989)	__d	0	2	3,580	3,580
97	Measurement of Radon and Radon Daughters in Air (1988)	__d	0	0	4,429	4,429
96	Comparative Carcinogenicity of Ionizing Radiation and Chemicals (1989)	__d	0	0	4,260	4,260
95	Radiation Exposure of the U.S. Population from Consumer Products and Miscellaneous Sources (1987)	__d	0	1	4,458	4,458
94	Exposure of the Population in the United States and Canada from Natural Background Radiation (1987)	__d	1	1	4,632	4,632
93	Ionizing Radiation Exposure of the Population of the United States (1987)	__d	1	2	7,614	7,614
92	Public Radiation Exposure from Nuclear Power Generation in the United States (1987)	__d	0	0	3,823	3,823
91	Recommendations on Limits for Exposure to Ionizing Radiation (1987)	__d	0	0	8,486	8,486
90	Neptunium: Radiation Protection Guidelines (1988)	__d	1	0	3,030	3,030
89	Genetic Effects from Internally Deposited Radionuclides (1987)	__d	0	0	4,110	4,110
88	Radiation Alarms and Access Control Systems (1986)	__d	3	2	4,980	4,980



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			2019			
			Hardcopy	E-Pub		
87	Use of Bioassay Procedures for Assessment of Internal Radionuclide Deposition (1987)	__d	0	0	4,425	4,425
86	Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields (1986)	__d	2	5	5,533	5,533
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	1	4,440	4,440
83	The Experimental Basis for Absorbed-Dose Calculations in Medical Uses of Radionuclides (1985)	__d	0	0	3,748	3,748
82	SI Units in Radiation Protection and Measurements (1985)	__d	0	3	4,887	4,887
81	Carbon-14 in the Environment (1985)	__d	5	1	4,143	4,143
80	Induction of Thyroid Cancer by Ionizing Radiation (1985)	__d	0	1	4,424	4,424
79	Neutron Contamination from Medical Electron Accelerators (1984)	__d	0	5	5,395	5,395
78	Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States (1984)	__d	1	1	6,626	6,626
77	Exposures from the Uranium Series with Emphasis on Radon and Its Daughters (1984)	__d	0	2	6,789	6,789
76	Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment (1984)	__d	0	1	6,829	6,829
75	Iodine-129: Evaluation of Release from Nuclear Power Generation (1983)	__d	0	0	6,070	6,070
74	Biological Effects of Ultrasound: Mechanisms and Clinical Implications (1983)	__d	0	1	11,425	11,425
73	Protection in Nuclear Medicine and Ultrasound Diagnostic Procedures in Children (1983)	__d	0	0	5,660	5,660
72	Radiation Protection and Measurement for Low-Voltage Neutron Generators (1983)	__d	14	1	4,609	4,609
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	0	5,601	5,601
69	Dosimetry of X-Ray and Gamma-Ray Beams for Radiation Therapy in the Energy Range 10 keV to 50 MeV (1981)	__d	0	0	5,341	5,341
68	Radiation Protection in Pediatric Radiology (1981)	__d	0	0	4,731	4,731
67	Radiofrequency Electromagnetic Fields—Properties, Quantities and Units, Biophysical Interaction and Measurements (1981)	__d	0	0	5,646	5,646
66	Mammography (1980)	__d	0	0	4,598	4,598

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			2019			
			Hardcopy	E-Pub		
65	Management of Persons Accidentally Contaminated with Radionuclides (1980)	__d	0	0	18,656	18,656
64	Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations (1980)	__d	1	0	5,427	5,427
63	Tritium and Other Radionuclide Labeled Organic Compounds Incorporated in Genetic Material (1979)	__d	1	0	4,453	4,453
62	Tritium in the Environment (1979)	__d	0	2	4,110	4,110
61	Radiation Safety Training Criteria for Industrial Radiography (1978)	__d	3	0	6,316	6,316
60	Physical, Chemical and Biological Properties of Radiocerium Relevant to Radiation Protection Guidelines (1979)	__d	2	0	4,168	4,168
59	Operational Radiation Safety Program (1979)	__d	0	0	8,046	8,046
58	A Handbook of Radioactivity Measurements Procedures (1978)	__d	1	2	13,955	13,955
57	Instrumentation and Monitoring Methods for Radiation Protection (1978)	__d	1	2	11,251	11,251
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	1	7,009	7,009
54	Medical Radiation Exposure of Pregnant and Potentially Pregnant Women (1977)	__d	0	1	11,038	11,038
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	0	4,855	4,855
51	Radiation Protection Design Guidelines for 0.1-100 MeV Particle Accelerator Facilities (1977)	__d	0	0	8,514	8,514
50	Environmental Radiation Measurements (1976)	__d	0	0	8,099	8,099
49	Structural Shielding Design and Evaluation for Medical Use of X Rays and Gamma Rays of Energies up to 10 MeV (1976)	__d	0	12	18,650	18,650
	Adjunct to NCRP Report 49 (1976)	__d	0	0	2,797	2,797
48	Radiation Protection for Medical and Allied Health Personnel (1976)	__d	__e	0	14,359	14,359
47	Tritium Measurement Techniques (1976)	__d	0	2	6,531	6,531
46	Alpha-Emitting Particles in Lungs (1975)	__d	0	0	6,234	6,234
45	Natural Background Radiation in the United States (1975)	__d	__e	0	7,296	7,296

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44	Krypton-85 in the Atmosphere—Accumulation, Biological Significance, and Control Technology (1975)	__d	0	0	6,700	6,700
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	0	0	47,404	47,404
41	Specification of Gamma-Ray Brachytherapy Sources (1974)	__d	0	0	5,710	5,710
40	Protection Against Radiation from Brachytherapy Sources (1972)	__d	0	1	10,181	10,181
39	Basic Radiation Protection Criteria (1971)	__d	__e	0	40,393	40,393
38	Protection Against Neutron Radiation (1971)	__d	0	0	9,275	9,275
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	0	0	9,953	34,403
29	Exposure to Radiation in an Emergency	55,705	__e	0	3,678	59,383
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
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

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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
2	Radium Protection (1934)	__g	__e	0	0	0
1	X-Ray Protection (1931)	1,596	__e	0	0	1,596
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41	Environmental Radiation and Life—A Broad View, by F. Ward Whicker (2017), Health Phys. 114(2):192–203 (2018)	__i	__i	__i	__i	
40	Radiation Protection and Regulatory Science, John W. Poston, Sr. (2016), Health Phys. 112(2):193–198 (2017)	__i	__i	__i	__i	
39	Dosimetry of Internal Emitters: Contributions of Radiation Protection Bodies and Radiological Events, Keith F. Eckerman (2015), Health Phys. 110(2):192–200 (2016)	__i	__i	__i	__i	
38	On the Shoulders of Giants: Radiation Protection Over 50 Years, Fred A. Mettler, Jr. (2014), Health Phys. 108(2):102–110 (2015)	__i	__i	__i	__i	
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35	What Makes Particle Radiation So Effective?, Eleanor A. Blakely (2011), Health Phys. 103(5):508–528 (2012)	__i	__i	__i	__i	
34	Radiation Protection and Public Policy in an Uncertain World, Charles E. Land (2010), Health Phys. 101(5):499–508 (2011)	__i	__i	__i	__i	
33	Radiation Epidemiology: The Golden Age and Remaining Challenges, John D. Boice, Jr. (2009), Health Phys. 100(1):59–76 (2011)	__i	__i	__i	__i	
32	Radiation Standards, Dose/Risk Assessments, Public Interactions, and Yucca Mountain: Thinking Outside the Box, Dade W. Moeller (2008) Health Phys. 97:376–391 (2009)	__i	__i	__i	__i	
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28	Radiation Protection in the Aftermath of a Terrorist Attack Involving Exposure to Ionizing Radiation, Abel J. Gonzalez (2004), Health Phys. 89:418–446 (2005)	__i	__i	__i	__i	

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26	Developing Mechanistic Data for Incorporation into Cancer and Genetic Risk Assessments: Old Problems and New Approaches, R. Julian Preston (2002), Health Phys. 85:4–12 (2003)	__i	__i	__i	__i	
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13	Radiobiology and Radiation Protection: The Past Century and Prospects for the Future, Arthur C. Upton (1989)	__d	0	0	580	
12	How Safe is Safe Enough?, Bo Lindell (1988)	__d	0	0	1,010	
11	How to Be Quantitative about Radiation Risk Estimates, Seymour Jablon (1987)	__d	0	0	1,023	
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8	Limitation and Assessment in Radiation Protection, Harald H. Rossi (1984)	__d	0	0	1,530	1,530
7	The Human Environment—Past, Present and Future, Merrill Eisenbud (1983)	__d	0	0	1,034	1,034
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4	From “Quantity of Radiation” and “Dose” to “Exposure” and “Absorbed Dose”—An Historical Review, Harold O. Wyckoff (1980)	__d	0	0	1,852	1,852
3	Radiation Protection—Concepts and Trade Offs, Hymer L. Friedell (1979)	__d	0	0	2,085	2,085
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1	The Squares of the Natural Numbers in Radiation Protection, Herbert M. Parker (1977)	__d	0	__j	1,513	1,513
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<b>NCRP Annual Meeting Proceedings</b>						
40	Radiation Protection Responsibility in Medicine, Proceedings of the Fifty-Fourth Annual Meeting held March 5–6, 2018, Health Phys. 116(2):111–294 (2019)	__i	__i	__i		__i
39	Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism Is There a Need for Realignment to Close Remaining Gaps?, Proceedings of the Fifty-Third Annual Meeting held March 6–7, 2017, Health Phys. 114(2):109–260 (2018)	__i	__i	__i		__i
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
37	Changing Regulations and Radiation Guidance: What Does the Future Hold?, Proceedings of the Fifty-First Annual Meeting held March 16–17, 2015. Health Phys. 110(2):97–237 (2016)	__i	__i	__i		__i
36	NCRP: Achievements of the Past 50 Years and Addressing the Needs of the Future, Proceedings of the Fiftieth Annual Meeting held March 10–11, 2014. Health Phys. 108(2):97–241 (2015)	__i	__i	__i		__i

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35	Radiation Dose and the Impacts on Exposed Populations, Proceedings of the Forty-Ninth Annual Meeting held March 11–12, 2013. Health Phys. 106(2):145–329 (2014)	__i	__i	__i	__i	
34	Emerging Issues in Radiation Protection in Medicine, Emergency Response, and the Nuclear Fuel Cycle, Proceedings of the Forty-Eighth Annual Meeting held March 12–13, 2012. Health Phys. 105(5):401–468 (2013)	__i	__i	__i	__i	
33	Scientific and Policy Challenges of Particle Radiations in Medical Therapy and Space Missions, Proceedings of the Forty-Seventh Annual Meeting held March 7–8, 2011. Health Phys. 103(5):529–684 (2012)	__i	__i	__i	__i	
32	Communication of Radiation Benefits and Risks in Decision Making, Proceedings of the Forty-Sixth Annual Meeting held March 8–9, 2010. Health Phys. 101(5):497–629 (2011)	__i	__i	__i	__i	
31	Future of Nuclear Power Worldwide: Safety, Health and Environment, Proceedings of the Forty-Fifth Annual Meeting held March 2–3, 2009. Health Phys. 100(1):2–112 (2011)	__i	__i	__i	__i	
30	Low Dose and Low Dose-Rate Radiation Effects and Models, Proceedings of the Forty-Fourth Annual Meeting held April 14–15, 2008. Health Phys. 97(5):373–541 (2009)	__i	__i	__i	__i	
29	Advances in Radiation Protection in Medicine, Proceedings of the Forty-Third Annual Meeting held April 16–17, 2007. Health Phys. 95(5):461–686 (2008)	__i	__i	__i	__i	
28	Chernobyl at Twenty, Proceedings of the Forty-Second Annual Meeting held April 3–4, 2006. Health Phys. 93(5):345–595 (2007)	__i	__i	__i	__i	
27	Managing the Disposition of Low-Activity Radioactive Materials, Proceedings of the Forty-First Annual Meeting held March 30–31, 2005. Health Phys. 91(5):413–536 (2006)	__i	__i	__i	3 3	
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	
	Compact disk version of Proceedings No. 26	__i	0	0	102 102	
25	Radiation Protection at the Beginning of the 21st Century—A Look Forward, Proceedings of the Thirty-Ninth Annual Meeting held April 9–10, 2003. Health Phys. 87(3):249–318 (2004)	__i	__i	__i	__i	



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22	Ionizing Radiation Science and Protection in the 21st Century, Proceedings of the Thirty-sixth Annual Meeting held April 5–6, 2000. Health Phys. 80(4):317–402 (2001)	__i	__i	__i	__i	
21	Radiation Protection in Medicine: Contemporary Issues, Proceedings of the Thirty-fifth Annual Meeting held April 7–8, 1999 (1999)	__d	0	0	205	205
	Compact disk version of Proceedings No. 21	__d	0	0	82	82
20	Cosmic Radiation Exposure of Airline Crews, Passengers and Astronauts, Proceedings of the Thirty-fourth Annual Meeting held on April 1–2, 1998, Health Phys. 79(5):466–613 (2000)	__i	__i	__i	0	__i
19	The Effects of Pre- and Postconception Exposure to Radiation, Proceedings of the Thirty-third Annual Meeting held on April 2–3, 1997, Teratology 59(4):181–317 (1999)	__i	__i	__i	0	__i
18	Implications of New Data on Radiation Cancer Risk, Proceedings of the Thirty-second Annual Meeting held April 3–4, 1996 (1997)	__d	0	__j	384	384
17	Environmental Dose Reconstruction and Risk Implications, Proceedings of the Thirty-first Annual Meeting held April 12–13, 1995 (1996)	__d	0	__j	428	428
16	Extremely-Low-Frequency Electromagnetic Fields: Issues in Biological Effects and Public Health, Proceedings of the Thirtieth Annual Meeting held on April 6–7, 1994 [not published]	__d	0	__j	0	0
15	Radiation Science and Societal Decision Making, Proceedings of the Twenty-Ninth Annual Meeting held April 7–8, 1993 (1994)	__d	0	__j	565	565
14	Radiation Protection in Medicine, Proceedings of the Twenty-Eighth Annual Meeting held April 1–2, 1992 (1993)	__d	0	__j	847	847
13	Genes, Cancer and Radiation Protection, Proceedings of the Twenty-Seventh Annual Meeting held April 3–4, 1991 (1992)	__d	0	__j	690	690
12	Health and Ecological Implications of Radioactively Contaminated Environments, Proceedings of the Twenty-Sixth Annual Meeting held April 4–5, 1990 (1991)	__d	0	__j	917	917

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7	Radioactive Waste, Proceedings of the Twenty-First Annual Meeting held April 3–4, 1985 (1986)	__d	0	__j	1,421	1,421
6	Some Issues Important in Developing Basic Radiation Protection Recommendations, Proceedings of the Twentieth Annual Meeting held April 4–5, 1984 (1985)	__d	0	__j	1,537	1,537
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4	Radiation Protection and New Medical Diagnostic Approaches, Proceedings of the Eighteenth Annual Meeting held April 6–7, 1982 (1983)	__d	0	__j	1,210	1,210
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### NCRP Commentaries

28	Implementation Guidance for Emergency Response Dosimetry	__d	99	592	774	774
27	Implications of Recent Epidemiologic Studies for the Linear-Nonthreshold Model and Radiation Protection (2018)	__d	11	26	630	630
26	Guidance on Radiation Dose Limits for the Lens of the Eye (2016)	__d	4	8	547	547
25	Potential for Central Nervous System Effects from Radiation Exposure During Space Activities Phase I: Overview (2016)	__d	1	2	180	180

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24	Health Effects of Low Doses of Radiation: Perspectives on Integrating Radiation Biology and Epidemiology (2015)	__d	1	3	597	597
23	Radiation Protection for Space Activities: Supplement to Previous Recommendations (2014)	__d	1	4	300	300
22	Radiological Health Protection Issues Associated With Use of Active Detection Technology Systems for Detection of Radioactive Threat Materials (2011)	__d	1	1	230	230
21	Radiation Protection in the Application of Active Detection Technologies (2011)	__d	1	1	282	282
20	Radiation Protection and Measurement Issues Related to Cargo Scanning With Accelerator-Produced High-Energy X Rays (2007)	__d	1	1	535	535
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16	Screening of Humans for Security Purposes Using Ionizing Radiation Scanning Systems (2003)	__d	1	2	882	882
15	Evaluating the Reliability of Biokinetic and Dosimetric Models and Parameters Used to Assess Individual Doses for Risk Assessment Purposes (1998)	__d	0	0	826	826
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12	Radiation Exposure and High-Altitude Flight (1995)	__d	0	2	847	847
11	Dose Limits for Individuals Who Receive Exposure from Radionuclide Therapy Patients (1995)	__d	0	1	1,660	1,660
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4	Guidelines for the Release of Waste Water from Nuclear Facilities with Special Reference to the Public Health Significance of the Proposed Release of Treated Waste Waters at Three Mile Island (1987)	__d	0	0	998	998
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2	Preliminary Evaluation of Criteria for the Disposal of Transuranic Contaminated Waste (1982)	__d	0	0	292	292
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3	Acceptability of Risk from Radiation—Application to Human Space Flight, Proceedings of a Symposium held May 29, 1996 (1997)	__d	0	0	655	655
2	Radioactive and Mixed Waste—Risk as a Basis for Waste Classification, Proceedings of a Symposium held November 9, 1994 (1995)	__d	0	0	463	463
1	The Control of Exposure of the Public to Ionizing Radiation in the Event of Accident or Attack, Proceedings of a Symposium held April 27-28, 1981 (1982)	__d	0	0	1,849	1,849
Total Symposia Proceedings Distributed		0	0	0	2,967	2,967
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