

Annual Report

2018

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.

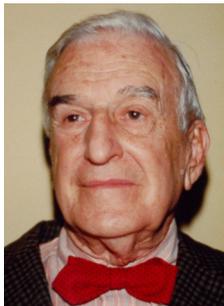
The Council is the successor to the unincorporated association of scientists known as the National Committee on Radiation Protection and Measurements and was formed to carry on the work begun by the Committee in 1929.

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

President's Message



As I write this message in 2019, we are preparing to celebrate the 90th Anniversary of the founding of the National Council on Radiation Protection and Measurements (NCRP) at our 55th Annual Meeting. With excitement and anticipation for the challenging year ahead, it is my duty to provide the President's Message for the NCRP 2018 Annual Report. It is an honor for me to pick up the reins of the NCRP Presidency from Dr. John D. Boice, Jr., who has so ably led this great organization for the past seven years. Dr. Boice stepped down from the Presidency on December 31, 2018, but,

thankfully, he remains very active at NCRP as Director of Science, with special emphasis on the Million Person Study (MPS).

As Dr. Boice has frequently stressed, NCRP is YOUR National Council. We strive to be responsive in radiation protection matters related to all of our stakeholders — federal agencies, Congress, the public, and, of course, Council members, program area committee (PAC) members, and scientific committees (SC). I welcome hearing from you about how we can better serve you and the nation as a whole.

As I look forward to 2019, I am proud to also reflect back and herein report on the many accomplishments of NCRP in 2018.

NCRP Publications completed:

- **NCRP Commentary No. 27, *Implications of Recent Epidemiologic Studies for the Linear-Non-threshold Model and Radiation Protection***, prepared by SC 1-25 (Chair: Roy E. Shore; Co-Chair: Lawrence T. Dauer), was published in April 2018 and since publication has been cited regularly to explain the use of linear-nonthreshold (LNT) for protection of a population. Its preparation was supported by the U.S. Nuclear Regulatory Commission (NRC).
- **NCRP Report No. 181, *Evaluation of the Relative Effectiveness of Low-Energy Photons and Electrons in Inducing Cancer in Humans***, prepared by SC 1-20 (Chair: Steven L. Simon), was published in May 2018. Preparation of this timely evaluation of the biological effectiveness of lower-energy radiations was supported by the Centers for Disease Control and Prevention (CDC).
- **NCRP Report No. 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)***, was published in November 2018. This comprehensive tome prepared by SC 6-9 (Chair: André Bouville; Co-Chair: Richard E. Toohey) recognized that high-quality dosimetry is critical to all radiation sciences. Impressively, this Report was supported by 11 federal agencies, as well as 11 other national laboratory, academic/research institutions, and private-sector collaborators.
- **NCRP Report No. 180, *Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018)***, was skillfully prepared by Council Committee (CC) 1 (Co-Chairs: Kenneth R. Kase and Donald A. Cool). The late December publication of this outstanding report was a major accomplishment and provides an expanded look at radiation protection recommendations for the United States, replacing the classic NCRP Report No. 116 (1993). Report No. 180 goes well beyond the 2007 recommendations from the International Commission on

Radiological Protection (ICRP). This Report is the new standard of radiation protection recommendations for the United States and was made possible by financial support from the NRC and CDC.

- **Proceedings of the 53rd Annual Meeting** of the NCRP, held in March 2017, with the theme “Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism: Is There a Need for Realignment to Close Remaining Gaps?” was published in the February 2018 issue of *Health Physics* [Health Phys 114(2):109–231, 2018].
- **Proceedings of the 54th Annual Meeting of NCRP**, held in March 2018, on “Radiation Protection Responsibility in Medicine” was published in the February 2019 issue of *Health Physics* [Health Phys 116(2):111–294, 2019].

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, have made substantial progress, with a final draft commentary expected for review by PACs and subject matter experts soon.
- **SC 1-24P2, Radiation Exposures in Space and the Potential for Central Nervous System Effects (Phase II)** (Chair: Leslie A. Braby; Vice Chair: Jacob Raber), has completed a report that is undergoing final review in the NCRP office, then formatting, before publication. This critical look at the potential impacts of space radiation on cognitive and behavioral functions in astronauts would not have been possible with the financial support from the National Aeronautics and Space Administration (NASA).
- **SC 1-26, Approaches for Integrating Radiation Biology and Epidemiology for Enhancing Low-Dose Risk Assessment** (Chair: R. Julian Preston; Co-Chair: Werner Rühm), is making steady progress and is planning to send a draft report to PAC 1 and subject matter experts (SME) for review soon. This is a CDC funded activity.
- **SC 2-7, NCRP Report No. 182, Radiation Safety of Sealed Radioactive Sources** (Chair: Kathryn H. Pryor), has been prepared and is in final editing stages for publication, to be sent to the printer shortly.
- **SC 2-8, Operational Radiation Safety Program** (Chair: Kathryn H. Pryor), is updating NCRP Report No. 127 (1998) with the intent of providing guidance to individuals with responsibility for establishing and implementing operational radiation safety programs.
- **SC 3-1P2, NCRP Commentary No. 28, Implementation of Guidance for Emergency Responder Dosimetry** (Co-Chairs: Stephen V. Musolino and Adela Salame-Alfie), is a U.S. Department of Homeland Security-funded guide for “boots-on-the-ground dosimetry” in the event of a radiological/nuclear incident. It is in the final editorial process before publishing.
- **SC 4-5, NCRP Report No. 177, Radiation Protection in Dentistry and Oral & Maxillofacial Imaging** (Co-Chairs: Alan G. Lurie and Mel L. Kantor), is currently being revised and edited for publication after having completed Council review.
- **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), report is in final revision stages after having completed Council review.
- **SC 4-8, Improving Patient Dose Utilization in Computed Tomography** (Chair: Mannudeep K.S. Kalra; Co-Chair: Edwin M. Leidholdt, Jr.), commentary has completed several draft versions and initial PAC review should begin shortly.

- **SC 4-9, Medical Exposure of Patients in the United States** (Chair: Fred A. Mettler, Jr.; Co-Chair: Mahadevappa Mahesh), report evaluates changes in medical radiation exposure to patients since NCRP Report No. 160 (2009). The CDC-sponsored report has completed the Council review process and should start the formatting, final review, and staff editing stages soon.
- **SC 4-10, NCRP statement on Error Prevention in Radiation Therapy** (Chair: Steven G. Sutlief), is being prepared and should be ready for initial PAC review later in 2019.
- **SC 4-11, statement on Gonadal Shielding During Abdominal and Pelvic Radiography** (Chair: Donald P. Frush; Co-Chair: Keith J. Strauss), will be a succinct recommendation that should be available for PAC review soon, then is expected to progress on an accelerated schedule.
- **SC 5-2, Radiation Protection for Naturally Occurring Radioactive Materials (NORM) and Technologically Enhanced NORM (TENORM) from Oil and Gas Recovery** (Chair: William E. Kennedy, Jr.). This CDC-funded commentary has been through PAC and SME review and is being revised in preparation for Council review.
- **SC 6-11, Dosimetry Guidance for Medical Radiation Workers with a Focus on Lung Dose Reconstruction** (Co-Chairs: R. Crag Yoder and Lawrence T. Dauer), will prepare a commentary evaluating dosimetry in a large cohort of medical radiation workers, an effort of critical relevance for the NASA-funded SC 1-27 activity described below.
- **SC 6-12**, in 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 Y. Tolmachev) as part of the MPS. This work may also be applicable to concerns of NASA with regards to high-LET radiation effects on the central nervous system.

Scientific committees to start soon:

- **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.
- **SC 6-10, Occupational Doses of Pilots and Aircrew**, a CDC-funded initiative, is being planned.

Members, particularly chairs, of SCs are encouraged to write and submit **papers** to peer-reviewed journals describing findings from NCRP committee work. In addition to papers published in the meeting proceedings in *Health Physics*, in 2018 such papers included:

- Dauer LT, Bouville A, Toohey RE, Boice JD Jr, Beck HL, Eckerman KF, Hagemeyer D, Leggett RW, Mumma MT, Napier B, et al. Dosimetry and uncertainty approaches for the million-worker study of radiation workers and veterans: overview of the recommendations in NCRP Report No. 178. *Int J Rad Biol*. Nov 19, 2018. [Epub ahead of print].
- Shore RE, Beck HL, Boice JD, Caffrey EA, Davis S, Grogan HA, Mettler FA Jr, Preston RJ, Till JE, Wakeford R, et al. Implications of recent epidemiologic studies for the linear nonthreshold model and radiation protection. *J Radiol Prot*. 38:1217–1233, 2018.

Other NCRP-related **publications** in 2018 included:

- Boice JD Jr, Kronenberg A, Ullrich RL. In memoriam. R.J. (Michael Fry), M.D. 1925–2017. *Radiat Res* 189:1–4, 2018.

- Boice JD Jr, Ellis ED, Golden AP, Girardi DJ, Cohen SS, Chen H, Mumma MT, Shore RE, Leggett RW. The past informs the future: an overview of the Million Worker Study and the Mallinckrodt Chemical Works Cohort. *Health Phys* 114:381–385, 2018.
- Boice JD Jr. Response to letter to the editor by Mortazavi et al. (re: Space the final frontier: research relevant to Mars). *Health Phys* 114:346, 2018.
- Boice JD Jr. (Translation by Yasuhito S, Yoshisada S, Kazuo S.) 放射線防護に用いられる直線しきい値なし (LNT) モデル : NCRP 最新知見 (総説) *Isotope News* 2018 年 4 月号 No. 756, Available at: https://www.jrias.or.jp/books/pdf/201804_HOUSYASENRIJUKU_SASAKI_HOKA_V2.pdf.
- Boice JD Jr, Leggett RW, Eckerman KF, Tolmachev SY, Woloschak GE, Golden AP, Ellis ED. Response to Mortazavi et al. on Detecting bone-seeking radionuclides in brain tissue. *Health Phys* 115:389–390, 2018.
- Cohen SS, Mumma MT, Ellis ED, Boice JD Jr. 2019. Validating the use of census data on education as a measure of socioeconomic status in an occupational cohort. *Int J Rad Biol*. 19 Nov 2018. [Epub ahead of print].
- Ellis ED, Boice JD Jr, Golden AP, Girardi DJ, Cohen SS, Mumma MT, Shore RE, Leggett RW, Kerr G. Dosimetry is key to good epidemiology: workers at Mallinckrodt Chemical Works had seven different source exposures. *Health Phys* 114:386–397, 2018.
- Golden AP, Cohen SS, Chen H, Ellis ED, Boice JD Jr. Evaluation of statistical modeling approaches for epidemiologic studies of low-dose radiation health effects. *Int J Radiat Biol*. 30 Nov 2018 [Epub ahead of print].
- Hagemeyer D, Nichols G, Mumma MT, Boice JD Jr, Brock TA. 50 years of the Radiation Exposure Information and Reporting System and importance to the Million Person Study. *Int J Radiat Biol*. 25 Oct 2018 [Epub ahead of print].
- Leggett RW, Tolmachev SY, Boice JD Jr. 2019. Potential improvements in brain dose estimates for internal emitters. *Int J Rad Biol*. 4 Dec 2018 [Epub ahead of print].
- Mumma MT, Cohen SS, Sirko JL, Ellis ED, Boice JD Jr. Obtaining vital status and cause of death on a million persons. *Int J Radiat Biol*. 9 Nov 2018 [Epub ahead of print].
- Yoder RC, Dauer L, Balter S, Boice JD Jr, Grogan H, Mumma M, Passmore CN, Rothenberg LN, Vetter RJ. Dosimetry for the study of medical radiation workers with a focus on the mean absorbed dose to the lung, brain and other organs. *Int J Radiat Biol*. 19 Nov 2018 [Epub ahead of print].

The work of NCRP is presented at various venues by the officers and chairs/members of PACs and SCs. **Presentations** of NCRP work in 2018 included:

- John D. Boice, “The Million Person Study – Research Relevant to Mars Focusing on CNS Effects.” 2018 NASA Human Research Investigators’ Workshop; The Gateway to Mars. Galveston Texas, 22–25 Jan 2018.
- John D. Boice, “Radiation Epidemiology — The Good, the Bad, and the Ugly.” Centers for Disease Control and Prevention webinar presented by the National Center for Environmental Health, Division of Environmental Health Science and Practice, Emergency Management, Radiation and Chemical Branch. Atlanta, Georgia, 28 Feb 2018.
- John D. Boice, “Military Relationships with the NCRP” — a series of five presentations. Ionizing Radiation Working Group Meeting of the Department of Defense, Falls Church, Virginia, 15 Mar 2018.

- John D. Boice “The Once and Future NCRP.” Baltimore-Washington Chapter of the Health Physics Society, Annual Meeting, Washington, D.C., 11 May 2018.
- John D. Boice, “The Million Person Study – States and Space.” 50th Annual Conference on Radiation Control, Conference of Radiation Control Program Directors, Inc. Charleston, South Carolina, 23 May 2018.
- John D. Boice, “Michael Fry and Radiation Epidemiology Mice to Men and NCRP and Prevention.” A Tribute and Celebration – Michael Fry’s Impact on Radiation Research at the 64th Annual Meeting of the Radiation Research Society, Chicago, Illinois, 24 Sept 2018.
- John D. Boice, “Million Person Study of Low-Dose Health Effects – Focus on DOE Workers and Space.” DOE symposium on International and Domestic Health Studies among Radiation-Exposed at the 64th Annual Meeting of the Radiation Research Society, Chicago, Illinois, 25 Sept 2018.
- John D. Boice, “Your Once and Future NCRP.” Division of Radiological Health – Journal Club, Centers of Devices and Radiological Health, U.S. Food and Drug Administration, White Oak, Maryland, 14 Nov 2018.
- Brooke Buddemeier, “Guidance for Emergency Response Dosimetry,” presentation given to the Federal Emergency Management Agency, National Urban Search and Rescue Response System (US&R) Advisory Meeting, College Station, Texas, 13-14 Dec 2018.
- Donald A. Cool, “NCRP Report 180 – Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018)” presentation to Canadian Radiation Protection Association Annual Meeting, Quebec City, Canada, May 2018.
- Donald A. Cool, “Work of ICRP and NCRP Towards New Recommendations,” presented at CRCPD Annual Meeting, Charleston, South Carolina, May 2018.
- Donald A. Cool, “NCRP Report 180 – Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018),” presentation at the Health Physics Society Annual Meeting, Cleveland, Ohio, July 2018.
- Donald A. Cool, “Translating Science to Recommendations: NCRP Council Committee 1,” presented at the HPS Annual Meeting, Cleveland, Ohio, July 2018.
- Donald A. Cool, “NCRP Report 180 – Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018),” presented at the Nuclear Energy Institute Radiation Protection Forum, Naples, Florida, July 2018.
- Kathryn D. Held, series of four lectures on Radiation Biology for Radiation Oncology, presented at Hospital de Amor, Sao Paulo, Brazil, May 2018.
- Kathryn D. Held for John D. Boice and Roy Shore, “Radiation Epidemiology and Low Dose Health Effects,” presented at the AAHP Special Session at the HPS Annual Meeting, Cleveland, Ohio, July 2018.
- Kathryn D. Held, “Radiation Protection and Your National Council on Radiation Protection and Measurements (NCRP),” presented at the Mid-Atlantic States Radiation Conference, Cockeysville, Maryland, Sept 2018.
- Kathryn D. Held, “National Council on Radiation Protection and Measurements (NCRP),” presented at the International Commission on Radiation Units and Measurements/International Commission on Radiological Protection Joint Session, Stockholm, Sweden, Oct 2018.
- Kathryn D. Held, “Thoughts from the National Council on Radiation Protection and Measurements (NCRP),” presented at the International Commission on Radiological Protection Special Liaison Organizations Meeting, Stockholm, Sweden, Oct 2018.

- Kathryn D. Held, “Roles of Hypofractionation and High-LET in Efficacy of Heavy Ion Radiation Therapy,” invited lecture presented at International Particle Medicine Research Symposium, Takasaki, Japan, Oct 2018.
- Kathryn D. Held, “The Once and Future NCRP,” presented at the meeting of the Interagency Steering Committee on Radiation Standards, Dec 2018.
- Kathryn H. Pryor, “Report No. 182, Radiation Safety of Sealed Radioactive Sources,” presentation given to the Low-Level Radioactive Waste Forum, Inc., Fall 2018 Low-Level Waste Forum Meeting, Richland Washington, 4 Oct 2018.
- Roy E. Shore, “NCRP Commentary 27: Implications of Recent Epidemiologic Studies for the LNT Model of Radiation Protection and for DREF,” presented at ANS/HPS conference on Applicability of Radiation-Response Models to Low-Dose Protection Standards, Pasco, Washington, Sept 2018.

I hope I have reported all presentations given on behalf of NCRP and apologize if I’ve missed talks by anyone. We so appreciate the work of our members who have taken the time and effort to beautifully represent NCRP to a variety of stakeholders!

In 2018, NCRP received **funding support** from a number of grant and contract sources. New in 2018 was a five-year grant from the DOE Office of Environment, Health, Safety and Security, of \$700,000 per year, to support the MPS. In 2018, NCRP work, including scientific committees and the MPS, continued to be supported through ongoing funding from the following organizations:

- Centers for Disease Control and Protection (SC 1-20, SC 1-26, SC 4-9, SC 5-2, SC 6-9, and SC 6-10);
- National Aeronautics and Space Administration (SC 1-24P2, SC 6-11, and MPS);
- New York City Department of Health and Mental Hygiene (SC 3-1P2);
- U.S. Department of Energy (SC 6-12 and MPS);
- U.S. Department of Homeland Security (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.

The **Million Person Study** (MPS) continues to be the primary research effort spearheaded by NCRP with Principal Investigator John Boice. The MPS is recognized around the world as a major investigation needed to fill gaps in understanding the health effects of radiation exposures received gradually over time. Over the years, support to NCRP for the study has been received from many agencies (U.S. Department of Defense, Defense Threat Reduction Agency, U.S. Navy, DOE, U.S. Environmental Protection Agency, NASA, National Cancer Institute, NRC, and in-kind support from the U.S. Department of Veterans Affairs and military services). Unfortunately, in recent times funding has been reduced substantially or eliminated from many of these organizations. Discussions led by Director of Science Boice continue with a number of organizations regarding possible opportunities to continue funding this important effort in radiation protection for NCRP and for the nation.

The **2018 54th NCRP Annual Meeting** was a great success with its timely focus on “Radiation Protection Responsibility in Medicine.” The meeting was ably chaired by Larry Dauer and Don Frush, to whom we extend hearty thanks for a job well done. Highlights of the meeting included: the 15th Annual Warren K. Sinclair Keynote Address by Marvin Rosenstein, entitled “Jus•ti•fied and Com•men•su•rate”; the 42nd Lauriston S. Taylor Lecture by Hans-Georg Menzel on “Radiation Dosimetry Research for Medicine and Protection: A European Journey”; and the 2nd Thomas S.

Tenforde Topical Lecture by Roy E. Shore, entitled “Do the Epidemiologic Data Support Use of the Linear Nonthreshold Model for Radiation Protection?” We continued activities that have become 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 Gaskins of NRC, and welcoming the Radiation Research Society (RRS)/NCRP Scholars.

Our upcoming **55th NCRP Annual Meeting**, on April 1 and 2, 2019, promises to be a special occasion as we celebrate the **90th Anniversary of the Founding of NCRP**. The meeting title is “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 have organized what promises to be an enlightening, educational and entertaining meeting. There will be some special recognitions, in keeping with an anniversary celebration, as well as the named lectures: 43rd Lauriston S. Taylor Lecture by André Bouville on “Fallout from Nuclear Weapons Tests: Environmental, Health, Political and 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 and Answers.”

Planning is underway for the **2020 Annual Meeting of NCRP**, to be held March 23–24, 2020. “Radiation and Flight: A Down-to-Earth Look at the Risks” will be co-chaired by Jacqueline P. Williams and Cary Zeitlin, and should be an uplifting experience.

There was one change in **PAC leadership** in 2018, as James A. Brink stepped down from his long-time role as Chair/Scientific Vice President (SVP) of PAC 4, and Donald L. Miller, who had been Co-Chair, stepped up into the SVP position. Lawrence T. Dauer is the new Co-Chair. Many thanks to Jim for a job well done, and we look forward to working with Don and Larry as they shepherd the activities of the largest NCRP PAC. The chairs/co-chairs remain the same for the other PACs. All these individuals 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:

- Starting in 2018, we are putting unique cover designs on all reports and commentaries.
- PAC 7 is now helping with “roll out” plans for NCRP publications. This includes “snazzier” publication announcements (*e.g.*, first one developed for Commentary No. 27), creation of targeted messaging, and development of expanded and targeted audience contact lists.
- PAC 7 is expanding our social media presence on Twitter®, Facebook®, etc., including a regular, monthly social media calendar. This expanded effort will continue in 2019, so stay tuned! I’ll be the first to admit that I’m a total novice at these social media outreach opportunities, so I am very appreciative of the work being done in this arena by eager PAC 7 members. Please let us know if you have thoughts or ideas for topics to be included.
- With the urging and help of members of PAC 7, especially Angela Shogren and Jessica Wieder, we plan to issue a quarterly newsletter to NCRP members to share NCRP news and activities. My initial letter was sent to Council and Distinguished Emeritus Members in early January 2019, and we will continue with the first quarterly newsletter in April 2019.

Finances remain one of the biggest challenges for NCRP. As you will see in the fiscal statements, below in this Annual Report, NCRP’s net assets continue to decrease, although we have stemmed the tide somewhat. We are working through a back-log of under-funded/unfunded scientific committee

work, to get publications out, but that effort continues to be a drain on finances. Another large drain on NCRP finances is the Annual Meeting, which is largely unfunded. In 2018, we were appreciative of meeting support by sponsors American College of Radiology Foundation, Memorial Sloan Kettering Cancer Center, Philips, Siemens, and GE Healthcare. The vagaries of the stock market are also an issue, unfortunately one we cannot control. Receipt of the five-year grant from DOE, mentioned above, in 2018 has been an important help to the NCRP financial position this year, 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 always welcome!

NCRP continues our active and fruitful **partnerships with multiple national and international organizations**. Partnerships with funding agencies have been described above. Other activities include NCRP officers serving on advisory committees and boards of other groups (e.g., Image Gently®, Oak Ridge Associated Universities, Radiation Research Foundation), NCRP helping to organize sessions and providing members to serve as speakers and session chairs at meetings of other entities (see list of presentations above), and NCRP officers and members providing 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.

Importantly, NCRP continues its commitment 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. We continue the collaboration with RRS to have young investigators attend our annual meeting as RRS/NCRP Scholars. One success of that program that I happily report is that Evagelia C. Laiakis, who was a 2015 RRS/NCRP travel award winner, subsequently became a member of PAC 1, and is currently a nominee for Council membership. Please encourage your students, post-docs, or junior colleagues to become involved with NCRP.

I take this opportunity to remind readers of our website (<https://ncrponline.org/>) that highlights NCRP activities, publications, PACs, SCs and members-in-the-news. There's lots of information there. Also, please follow us on [Twitter®](#) and [Facebook®](#).



It is with great sadness that I report the passing of one NCRP Council Member in 2018: **Randall S. Caswell**. Randy was elected to Council in 1967 and elected Distinguished Emeritus Member in 1991. He served on the Board of Directors from 1976 to 1981, was a member of the Nominating Committee from 1973 to 1977, and chaired the committee that produced NCRP Report No. 82, *SI Units in Radiation Protection and Measurements* (1985). He was a principal founder/driving force behind the Council on Ionizing Radiation Measurements and Standards.

As we move forward in these exciting times, I eagerly anticipate working with you all. We expect 2019 to be a fantastically productive year for NCRP, during which we will proudly celebrate our 90th anniversary. The challenges are large, but the opportunities are many and the expected outcomes are important for the field of radiation protection. In my note to the Members on January 7, 2019, I mentioned that the newly released NCRP Report No. 180, ***Management of Exposure to Ionizing Radiation:***

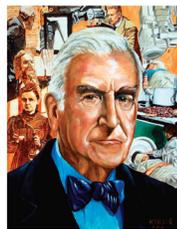
Radiation Protection Guidance for the United States (2018), embodies how NCRP is moving into the future, while recognizing and respecting our great legacy in radiation sciences. The cover and inside cover of that visionary report, reproduced here, are a fitting tribute to the 90 years of NCRP. As NCRP moves into the future, I look forward to working with our many partnering organizations and with wonderful scientific and professional colleagues.

NCRP REPORT No. 180

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



National Council on Radiation Protection and Measurements



“Radiation protection is not only a matter of science. It is a problem of philosophy, and morality, and utmost wisdom.”

Lauriston S. Taylor
Founder of NCRP

Cover: The photos represent some of the diversity of areas within radiation protection that are covered in this Report, including (top, clockwise) medicine; worker safety and naturally occurring radioactive materials; public safety, including sensitive populations; environmental protection; emergency response; and research and industry.

Many thanks to the following for help in preparation of this President’s Report and for assistance in all things NCRP: Laura Atwell, Jerry Bushberg, Angela Shogren, and Jessica Weider, the NCRP staff and Council members. A special thanks to John Boice for all he has done for NCRP over many fruitful years. He will be a hard act to follow!

Kathryn D. Held
President

Membership

There are 96 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 2018, five new members were elected, and 12 members were re-elected. The five new members were:

Thomas E. Johnson	John P. Wilson
Leticia Pibida	Pat B. Zanzonico
Igor Shuryak	

2018 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	2013–2019
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	2013–2019
Daniel J. Barnett	Johns Hopkins Bloomberg School of Public Health	2015–2021
Jonine L. Bernstein	Memorial Sloan-Kettering Cancer Center	2018–2024
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	2013–2019
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	2013–2019
Michael L. Corradini	University of Wisconsin, Madison	2016–2022
Francis A. Cucinotta	University of Nevada, Las Vegas	2013–2019
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
Cynthia Flannery	U.S. Nuclear Regulatory Commission	2017–2023
Patricia A. Fleming	Saint Mary’s College, Notre Dame	2015–2021
Donald P. Frush	Duke University Medical Center	2016–2022
Ronald E. Goans	MJW Corporation	2013–2019
Eric M. Goldin	Retired	2015–2021
Helen A. Grogan	Cascade Scientific, Inc.	2014–2020
Willie O. Harris	Exelon Nuclear	2017–2023
Kathryn D. Held	National Council on Radiation Protection and Measurements & Massachusetts General Hospital	2018–2024
Kathryn A. Higley	Oregon State University	2014–2020
Roger W. Howell	Rutgers, The State University of New Jersey	2015–2021
Janice L. Huff	National Aeronautics and Space Administration	2017–2023
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
Timothy J. Jorgensen	Georgetown University Medical Center	2013–2019
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
Jill A. Lipoti	Rutgers, The State University of New Jersey	2013–2019
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.	2013–2019
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	2013–2019
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
Ehsan Samei	Duke University Medical Center	2013–2019
Debra M. Scroggs	Retired	2018–2024
J. Anthony Seibert	University of California Davis Medical Center	2014–2020
George Sgouros	Johns Hopkins University School of Medicine	2013–2019
Kathleen L. Shingleton	Lawrence Livermore National Laboratory	2017–2023
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
Daniel O. Stram	University of Southern California	2013–2019
Glenn M. Sturchio	Mayo Clinic	2016–2022
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
Chris G. Whipple	Part-time Consultant	2013–2019
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>		
Armin Ansari*	William E. Kennedy, Jr.	Kathryn H. Pryor
Jonine L. Bernstein	John J. Lanza	Tammy P. Taylor
Lawrence T. Dauer	Ruth E. McBurney	Gayle E. Woloschak
Donald P. Frush	Donald L. Miller*	

*Elected March 6, 2018

Officers

President	John D. Boice, Jr.
Senior Vice President	Jerrold T. Bushberg
Secretary and Treasurer	Kathryn D. Held

Distinguished Emeritus Members

Thomas S. Tenforde, *President Emeritus*
 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. Ahearne
 Lynn R. Anspaugh
 Benjamin R. Archer
 John A. Auxier
 Harold L. Beck
 Joel S. Bedford
 Eleanor A. Blakely*
 Bruce B. Boecker
 Thomas B. Borak
 Andre Bouville
 Leslie A. Braby
 Robert L. Brent
 Antone L. Brooks
 Randall S. Caswell†
 S.Y. Chen
 J. Donald Cossairt
 Allen G. Croff
 Paul M. DeLuca
 Sarah S. Donaldson
 William P. Dornsife
 Keith F. Eckerman
 Thomas S. Ely
 Stephen A. Feig

John R. Frazier
 Thomas F. Gesell
 Ethel S. Gilbert
 Joel E. Gray
 Raymond A. Guilmette
 Eric J. Hall
 Naomi H. Harley
 William R. Hendee
 F. Owen Hoffman
 Bernd Kahn
 Ann R. Kennedy
 David C. Kocher
 Ritsuko Komaki
 Charles E. Land
 Susan M. Langhorst
 Martha S. Linet
 John B. Little
 Roger O. McClellan
 Barbara J. McNeil
 Fred A. Mettler, Jr.
 Charles W. Miller*
 Kenneth L. Miller
 A. Alan Moghissi

David S. Myers
 Carl J. Paperiello
 John W. Poston, Sr.
 Andrew K. Poznanski
 R. Julian Preston
 Jerome S. Puskin
 Genevieve S. Roessler
 Marvin Rosenstein
 Lawrence N. Rothenberg
 Henry D. Royal
 Michael T. Ryan
 Stephen M. Seltzer
 Roy E. Shore
 Paul Slovic
 Daniel J. Strom
 John E. Till
 Richard E. Toohey*
 Lawrence W. Townsend
 Robert L. Ullrich
 Richard J. Vetter
 F. Ward Whicker
 Susan D. Wiltshire
 Marvin C. Ziskin

*Elected to Distinguished Emeritus Membership March 6, 2018.

†Deceased during 2018.

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

*Consociate Membership effective March 6, 2018.

Administrative Committees

Budget & Finance Committee (appointed by the Board of Directors, March 6, 2018)

William E. Kennedy, Jr., *Chairman*

Jerrold T. Bushberg

John J. Lanza

Kathleen L. Shingleton

R. Craig Yoder

Nominating Committee (appointed by the Board of Directors, March 6, 2018)

Donald L. Miller, *Chairman*

Kathryn H. Pryor

Adela Salame-Alfie

Michael M. Weil

Cary Zeitlin

Program Committee for 2019 Annual Meeting

(appointed by the Board of Directors, March 6, 2018)

Fred A. Mettler, Jr., *Chair*

Jerrold T. Bushberg & Richard J. Vetter, *Co-Chairs*

Brooke R. Buddemeier

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

Jessica S. Wieder

Scientific & Administrative Staff

Kathryn D. Held	Executive Director
Laura J. Atwell	Office Manager
Sarah S. Cohen	Technical Staff Consultant
Michael P. Grissom	Technical Staff Consultant
Cindy L. O'Brien	Managing Editor
Beverly A. Ottman	Receptionist
R. Julian Preston	Advisor to the President
Jerome S. Puskin	Technical Staff Consultant
Marvin Rosenstein	Technical Staff Consultant & Advisor to the President
Roy E. Shore	Advisor to the President
James M. Smith	Technical Staff Consultant
Richard E. Toohey	Advisor to the President
Lawrence W. Townsend	Technical Staff Consultant
Richard J. Vetter	Technical Staff Consultant
Myrna A. Young	Financial Records Manager

Council Committees, 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 two Council committees, seven program area committees, and an advisory panel. They are:

Council Committees

Radiation Protection Guidance for the United States, Kenneth R. Kase & Donald A. Cool
Meeting the Needs of the Nation for Radiation Protection, Wayne D. Newhauser & Jacqueline P. Williams

Program Area Committees and Committee Chairs

Basic Criteria, Epidemiology, Radiobiology, and Risk	Gayle E. Woloschak Jonine 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

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

Radiation Protection Guidance for the United States

Chair, Kenneth R. Kase

Goals of Council Committee (CC) 1

- Update and expand NCRP Report No. 116 (1993), *Limitation of Exposure to Ionizing Radiation*, with regard to radiation protection as it pertains to the United States.
- Incorporate substantial advances in radiation effects knowledge as well as radiation protection understanding and culture.

Completed in 2018

NCRP Report No. 180, *Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018)*, was issued December 31, 2018. This Report was drafted under the chairmanship of Kenneth R. Kase and Donald A. Cool. Committee members included: Armin Ansari; John D. Boice, Jr.; Jerrold T. Bushberg; Lawrence T. Dauer; Darrell R. Fisher; Patricia A. Fleming; Kathryn A. Higley; Randall N. Hyer; William E. Irwin; Fred A. Mettler, Jr.; Donald L. Miller; R. Julian Preston; and Gayle E. Woloschak. Consultants included: S. James Adelstein, Ralph L. Andersen, and Michael A. Boyd; and Liaison, John E. Till. PAC Advisors were: Gayle E. Woloschak (PAC 1), Kathryn H. Pryor (PAC 2), Tammy P. Taylor (PAC 3), James A. Brink (PAC 4), S.Y. Chen (PAC 5), Steven L. Simon (PAC 6), and Randall N. Hyer (PAC 7).

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

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, *Co-Chair*

Sally A. Amundson

Edouard I. Azzam

Joel S. Bedford

Polly Y. Chang

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

Active Scientific Committees Under PAC 1

SC 1-24 Phase 2: Radiation Exposures in Space and the Potential for Central Nervous System Effects

Status: Revising after Council Review

Leslie A. Braby, *Co-Chair*

Jacob Raber, *Co-Chair*

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
Peter Winsauer
Gregory A. Nelson, *NASA Observer*
Lawrence W. Townsend, *Technical Staff Consultant*

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

Status: Preparing for PAC review

R. Julian Preston, *Chair*
Werner Rühm, *Co-Chair*
Edouard I. Azzam
John D. Boice, Jr.
Simon Bouffler
Mark P. Little
Roy E. Shore
Igor Shuryak
Michael M. Weil
Jerome S. Puskin, *Technical Staff Consultant* (2017–2018)
Marvin Rosenstein, *Technical Staff Consultant* (2018 –)

Completed in 2018

NCRP Report No. 181, *Evaluation of the Relative Effectiveness of Low-Energy Photons and Electrons in Inducing Cancer in Humans*, was issued May 24, 2018. This Report was drafted by Scientific Committee 1-20 under the chairmanship of Steven L. Simon. Committee members included: Leslie A. Braby, Polly Y. Chang, Dudley T. Goodhead, Stephen C. Hora, Kiyohiko Mabuchi, Jerome S. Puskin, David B. Richardson, and James D. Tucker. Consultants included: Keith F. Eckerman, David C. Kocher, and Eliseo Vañó.

NCRP Commentary No. 27, *Implications of Recent Epidemiologic Studies for the Linear-Non-threshold Model and Radiation Protection*, was issued April 13, 2018. This Commentary was drafted by Scientific Committee 1-25 under the chairmanship of Roy E. Shore and Lawrence T. Dauer. Committee members included: Harold L. Beck, Emily A. Caffrey, Scott Davis, Helen A. Grogan, Randall N. Hyer, Fred A. Mettler, Jr., R. Julian Preston, John E. Till, Richard Wakeford, and Linda Walsh.

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
John R. Frazier
Eric M. Goldin
Barbara L. Hamrick
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 2-7 Radiation Safety of Sealed Radioactive Sources

Status: Final review before publication

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
James L. Thompson, *Consultant*

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

Status: Drafting
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

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
 Lawrence L. Chi (2015–2018)
 C. Norman Coleman
 Nicholas Dainiak (2015–2018)
 Sara DeCair
 John Donnelly
 Joseph R. Dynlacht
 Frieda Fisher-Tyler
 Carol J. Iddins
 William E. Irwin
 Gladys A. Klemic
 John J. Lanza
 Stephen V. Musolino
 Michael A. Noska
 Leticia Pibida

Adela Salame-Alfie
Tammy P. Taylor (2007–2018)
James D. Rogers, *Consultant* (2015–2018)
Benjamin Stevenson, *Consultant*

SC 3-1 Phase II Implementation of Guidance for Emergency Responder Dosimetry

Status: Preparing for Council review
Stephen V. Musolino, *Co-Chair*
Adela Salame-Alfie, *Co-Chair*
Bobby R. Baker, Jr.
Brooke R. Buddemeier
John Donnelly, Sr.
Helen A. Grogan
William Haley
William E. Irwin
David Pasquale
Richard Schlueck
Jessica S. Wieder
Craig M. Marianno, *Consultant*
Robert C. Whitcomb, *Consultant*
James M. Smith, *Technical Staff Consultant*

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
 Jerrold T. Bushberg (2002–2018)
 Charles E. Chambers
 Andrew J. Einstein
 Donald P. Frush
 Ronald E. Goans (2015–2018)
 Joel E. Gray
 Mannudeep K.S. Kalra (2013–2018)
 Linda A. Kroger
 Edwin M. Leidholdt, Jr.
 Alan G. Lurie
 Mahadevappa Mahesh
 Fred A. Mettler, Jr.
 Wayne D. Newhauser
 Mark J. Rivard
 Ehsan Samei (2012–2018)
 J. Anthony Seibert
 David C. Spelic
 Steven G. Sutlief
 Julie E.K. Timins
 Louis K. Wagner (2014–2018)
 Stuart C. White (2005–2018)
 John P. Winston

Shiao Y. Woo
Pat B. Zanzonico

Active Scientific Committees Under PAC 4

SC 4-5 **Radiation Protection in Dentistry Supplement: Cone Beam Computed Tomography, Digital Imaging, and Handheld Dental Imaging**

Status: Final review before publication

Mel L. Kantor, *Co-Chair*

Alan G. Lurie, *Co-Chair*

Mansur Ahmad

Veeratrishul Allareddy

John B. Ludlow

Edwin T. Parks

Eleonore D. Paunovich

Robert J. Pizzutiello

Robert Sauer

David C. Spelic

Edwin M. Leidholdt, Jr., *Consultant*

W. Doss McDavid, *Consultant*

Donald L. Miller, *Consultant*

Joel E. Gray, *Technical Staff Consultant*

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

Status: Final review before 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 4-9 Medical Exposure of Patients in the United States

Status: Preparing for Council review

Fred A. Mettler, Jr., *Chair*
Mahadevappa Mahesh, *Co-Chair*
Charles E. Chambers
Mythreyi Bhargavan Chatfield
Jennifer G. Elee
Donald P. Frush
Michael T. Milano
Donald L. Miller
Henry D. Royal
David C. Spelic
Armin Ansari, *Advisor*
Wesley E. Bolch, *Advisor*
Gary M. Guebert, *Advisor*
Robert H. Sherrier, *Advisor*
James M. Smith, *Advisor*
Richard J. Vetter, *Technical Staff 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: Committee formed

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

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*
S.Y. Chen
Allen G. Croff
Jonathan D. Edwards
R. William Field
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: Revising after PAC review

William E. Kennedy, Jr., *Chair*



David J. Allard
Martin Barrie
Philip Egidi
Gary Forsee
Ray Johnson
Andrew J. Lombardo
Ruth E. McBurney
John R. Frazier, *Technical Staff Consultant* (2016 – 2018)

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: Drafting

R. Craig Yoder, *Co-Chair*

Lawrence T. Dauer, *Co-Chair*

Stephen Balter

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

Gayle E. Woloschak

Raymond A. Guilmette, *Technical Staff Consultant*

Completed in 2018

NCRP Report No. 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)*, was issued November 20, 2018. This Report was drafted by Scientific Committee 6-9 under the chairmanship of André Bouville and Richard E. Toohey. Committee members included: Harold L. Beck, Lawrence T. Dauer, Keith F. Eckerman, Derek Hagemeyer, Donald L. Miller, Bruce A. Napier, Kathryn H. Pryor, David A. Schauer, Daniel O. Stram, James L. Thompson, John E. Till, R. Craig Yoder, and Cary J. Zeitlin. Consultants included: Stephen Balter, Terry A. Brock, Richard W. Leggett, and Sami Sherbini.

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; and
- 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 2018 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 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 2018 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 Safety Commission 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 government entities have provided support for NCRP's work through contracts and grants:

- 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
Conference of Radiation Control Program Directors, Inc.
Council on Radionuclides and Radiopharmaceuticals
Fluke/RaySafe/Landauer
GE Healthcare
Health Physics Society
Individuals
Institute of Electrical and Electronics Engineers
Memorial Sloan-Kettering Cancer Center
Nuclear Energy Institute
Philips Healthcare
Radiological Society of North America
Siemens Medical Solutions USA, Inc.
Society of Pediatric Radiology

Giving Tuesday Donations

Armin J. Ansari	David S. Myers
Jonine L. Bernstein	Marvin Rosenstein
William F. Blakely	Adela Salame-Alfie
John D. Boice, Jr.	J. Anthony Seibert
Jerrold T. Bushberg	Richard A. Tell
S. Y. Chen	Michael M. Weil
Willie Harris	F. Ward Whicker
Kathryn D. Held	Chris G. Whipple
William E. Kennedy, Jr.	Jacqueline P. Williams

Review Process

The review process for draft publications is elaborate and comprehensive. It begins with a review by a group of critical reviewers designated by the appropriate 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 (96), 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 to an extent dependent on the time available. 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
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
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 Lecture

Year	Title	Lecturer
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

Year	Topic
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

2018 Annual Meeting

The Fifty-Fourth Annual Meeting of NCRP was held March 5–6, 2018 at the Hyatt Regency Bethesda in Bethesda, Maryland. The topic of the meeting was “Radiation Protection Responsibility in Medicine.” The sessions and presentations were as follows:

A Radiation Wish List from Jennifer: Gadgets, Radiation Statements, and Insta-Reports, Kate Niehaus

Fifteenth Annual Warren K. Sinclair Keynote Address

Jus•ti•fied and Com•men•su•rate, Marvin Rosenstein

Dose, Benefit, Risk and Safety

Radiation in Medicine: Current and Future Trends, Fred A. Mettler, Jr.

Effective Dose and Alternatives, Jerrold T. Bushberg

Benefit and Risks, Pat B. Zanzonico

Quality and Safety Initiatives, Mythreyi Chatfield

Diagnostic X-Ray Imaging

Projection X-Ray Imaging (Radiography, Mammography, Fluoroscopy), J. Anthony Seibert
Computed Tomography Technology – and Dose – in the 21st Century, Cynthia H. McCollough
Doses, Benefits, Risks and Safety in Oral and Maxillofacial Diagnostic Imaging, Alan G. Lurie

Nuclear Medicine & Radiation Oncology

Radiopharmaceutical Therapy, George Sgouros
Dose Optimization of Hybrid Imaging, Frederic H. Fahey
Radiation Oncology: External Beam Radiation Therapy, Melissa C. Martin
Radiation Protection Responsibility in Brachytherapy, Bruce Thomadsen

Dialogue and Shared Decision Making

Effective Stakeholder Communications Methods: The Power of Planned Persuasive Messaging,
Jessica S. Wieder
Patient Perspectives on Dialogue and Shared Decision Making, Lawrence T. Dauer
Optimizing Patient Informed Decision Making: Examples from Pediatric and Emergency Care,
Kimberly E. Applegate
Radiation Protection Responsibility in Medicine Dialogue and Shared Decision Making in
Pediatric Healthcare, María del Rosario Pérez

Forty-Second Lauriston S. Taylor Lecture on Radiation Protection and Measurements

Radiation Dosimetry Research for Medicine and Protection: A European Journey, Hans-Georg
Menzel

Second Thomas S. Tenforde Topical Lecture

Do the Epidemiologic Data Support Use of the Linear Nonthreshold Model for Radiation
Protection?, Roy E. Shore

Fostering Innovations

Medical Physics 3.0 to Ensure Quality and Safety in Radiation Medicine, Ehsan Samei
Advancing Safety: Role of Equipment Design and Configuration Change, Keith J. Strauss
How Innovations in Computer Technologies Have Impacted Radiation Dosimetry Through
Anatomically Realistic Phantoms and Fast Monte-Carlo Simulations, X. George Xu

Conclusions and Path Forward

Radiation Protection Responsibility in Medicine: A Wrap Up, Donald P. Frush
NCRP Vision for the Future and Program Area Committee Activities, John D. Boice, Jr.

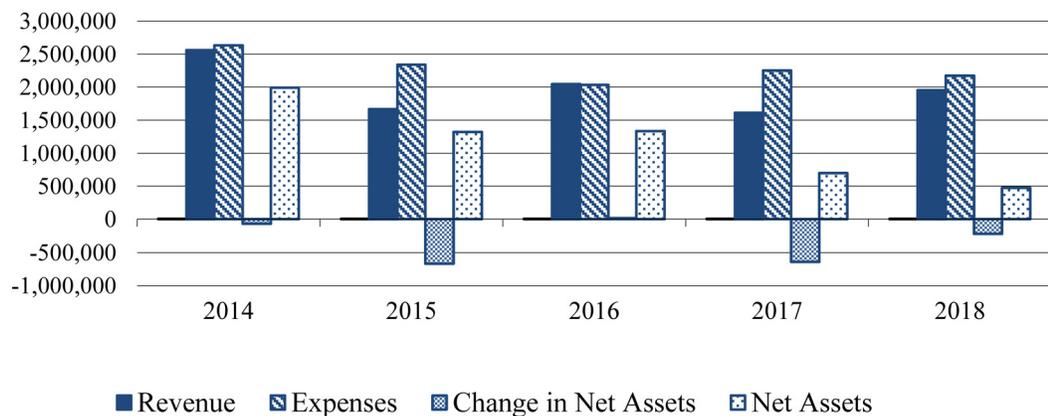


Serving on the Program Committee for the 2018 Annual Meeting were: *Co-Chairs*, Lawrence T. Dauer and Donald P. Frush; and Committee members, Linda A. Kroger; Fred A. Mettler, Jr.; Donald L. Miller; Julie E.K. Timinis; and Pat B. Zanzonico. The proceedings of the 2018 Annual Meeting will be published in *Health Physics*.

Financial Summary

The table and bar graph presented below exhibit NCRP’s year-end financial data for 2018 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
2014	2,558,691	2,629,610	(70,919)	1,991,577
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	1,950,778	2,171,260	(220,482)	475,143



Appendix 1. Finances

Exhibit A Statement of Financial Position For the year ended December 31, 2018 (unaudited)

Current Assets

Cash and cash equivalents	\$	32,836
Investments [at market]		967,036
Accounts receivable:		
Publications		2,367
Grants and contracts		219,346
International Commission on Radiation Units and Measurements		553
Other		—
Inventory—publications		41,294
Prepaid expenses and other assets		15,254
Total current assets		<u>1,278,686</u>

Property and Equipment [at cost]

Furniture and equipment		188,044
Less accumulated depreciation		(178,949)
Total property and equipment		<u>9,095</u>

TOTAL ASSETS

1,287,781

Liabilities

Line of credit		291,968
Accounts payable and accrued expenses		305,897
Deferred revenue		—
Total current liabilities		<u>597,865</u>

Other Liabilities

Deferred rent liability		30,067
Accrued post-retirement benefits		184,706
Total other liabilities		<u>214,773</u>
TOTAL LIABILITIES		<u><u>812,638</u></u>



Net Assets	
Without donor restrictions	217,342
With donor restrictions	257,801
TOTAL NET ASSETS	<u>475,143</u>
TOTAL LIABILITIES AND NET ASSETS	<u><u>1,287,781</u></u>

Exhibit B

Statement of Activities

For the year ended December 31, 2018

(unaudited)

	Net Assets without Donor Restrictions	Net Assets with Donor Restrictions	Total
Revenue and Other Increases			
Contracts and grants	\$ 1,418,625	\$ —	\$ 1,418,625
Contributions	166,169	—	166,169
Corporate sponsorship	19,000	—	19,000
Contributed professional services	205,550	—	205,550
Sales of publications	200,186	—	200,186
Dividends and interest	35,563	4,404	39,967
Net realized and unrealized gain on investments	(96,240)	(11,569)	(107,809)
Professional and administrative services	9,090	—	9,090
Total revenue and other increases	1,957,943	(7,165)	1,950,778
Expenses and Other Decreases			
Program costs:			
Contracts and grants	850,911	—	850,911
Publications	63,569	—	63,569
Contributed professional services	205,550	—	205,550
Total program costs	1,120,030	—	1,120,030
Management and general expenses	1,030,806	—	1,030,806
Total expenses	2,150,836	—	2,150,836
Investment fees	9,878	—	9,878
Post-retirement benefit change	10,546	—	10,546
	2,171,260	—	2,171,260
Change in Net Assets	(213,317)	(7,165)	(220,482)
Net Assets at Beginning of Year	430,659	264,966	695,625
Net Assets at End of Year	\$ 217,342	\$ 257,801	\$ 475,143



Exhibit C
Statement of Cash Flow
For the year ended December 31, 2018
(unaudited)

Cash flows from operating activities:	
Change in net assets	\$ (220,482)
Adjustments to reconcile change in net assets to cash provided by operating activities	
Depreciation	3,576
Net realized and unrealized loss on investments	107,809
(Increase) decrease in assets:	
Accounts receivable	(146,246)
Inventory—publications	8,103
Prepaid expenses and other assets	2,450
Increase (decrease) in liabilities:	
Accounts payable and accrued expenses	45,151
Deferred rent liability	4,917
Accrued post-retirement benefits	8,761
Net cash used by operating activities	<u>(185,961)</u>
Cash flows from investing activities:	
Purchase of equipment	(5,317)
Purchase of investments	(96,728)
Sale of investments	136,891
Net cash provided by investing activities	<u>34,846</u>
Cash flows from financing activities:	
Net borrowings on line of credit	169,891
Net increase in cash and cash equivalents	18,776
Cash and cash equivalents at beginning of year	<u>14,060</u>
Cash and cash equivalents at end of year	<u>\$ 32,836</u>

Schedule 1 Schedule of Contracts and Grants Revenue For the year ended December 31, 2018

(unaudited)

Contracts

New York City Department of Health and Mental Hygiene	\$ 74,994
U.S. Department of Homeland Security	56,120
U.S. Navy	96,392

Total contracts	227,506
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Grants

Centers for Disease Control and Prevention	278,260
National Aeronautics and Space Administration	550,107
U.S. Department of Energy	362,752

Total grants	1,191,119
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Total contracts and grants revenue	\$ 1,418,625
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Schedule 2
Schedule of Contributions & Corporate Sponsorship Revenue
For the year ended December 31, 2018

(unaudited)

Contributions

American Academy of Health Physics	\$ 1,000
American Association of Physicists in Medicine	5,400
American College of Radiology	35,000
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
Conference of Radiation Control Program Directors, Inc.	2,000
Council on Radionuclides and Radiopharmaceuticals	2,000
General Electric	2,500
Health Physics Society	12,000
Individuals	16,703
Institute of Electrical and Electronics Engineers	6,000
Landauer, Inc.	3,000
Memorial Sloan-Kettering Cancer Center	5,000
Philips Healthcare	4,825
Radiological Society of North America	25,000
Siemens Medical Solutions USA, Inc.	5,000
Society of Pediatric Radiology	500

Total contributions	\$ 148,428
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Corporate Sponsors

Landauer, Inc.	\$ 10,000
Nuclear Energy Institute	9,000

Total Corporate Sponsors	\$ 19,000
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Appendix 2. Publications

Distribution of NCRP Publications

(during the period May 16, 1931 through December 31, 2018)

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018	Hardcopy		
NCRP Reports						
181	Evaluation of the Relative Effectiveness of Low-Energy Photons and Electrons in Inducing Cancer in Humans (2018)	__d	56	13	69	69
180	Management of Exposure to Ionizing Radiation: Radiation Protection Guidance for the United States (2018) (2018)	__d	0	0	0	0
179	Guidance for Emergency Response Dosimetry (2017)	__d	32	24	152	152
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	28	2	30	30
176	Radiation Safety Aspects of Nanotechnology (2017)	__d	12	5	83	83
175	Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents (2014)	__d	8	7	355	355
174	Preconception and Prenatal Radiation Exposure: Health Effects and Protective Guidance (2013)	__d	5	8	437	437
173	Investigation of Radiological Incidents (2012)	__d	8	3	328	328
172	Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States (2012)	__d	0	11	679	679
171	Uncertainties in the Estimation of Radiation Risks and Probability of Disease Causation (2012)	__d	6	5	348	348
170	Second Primary Cancers and Cardiovascular Disease After Radiation Therapy (2011)	__d	4	3	277	277
169	Design of Effective Radiological Effluent Monitoring and Environmental Surveillance Programs (2010)	__d	7	6	257	257
168	Radiation Dose Management for Fluoroscopically-Guided Interventional Medical Procedures (2010)	__d	11	17	893	893

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
167	Potential Impact of Genetic Susceptibility and Previous Radiation Exposure on Radiation Risk for Astronauts (2010)	__d	3	1	185	185
166	Population Monitoring and Radionuclide Decorporation Following a Radiological or Nuclear Incident (2010)	__d	7	2	399	399
165	Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers (2010)	__d	5	27	1,023	1,023
164	Uncertainties in Internal Radiation Dosimetry (2009)	__d	0	7	215	215
163	Radiation Dose Reconstruction: Principles and Practices (2009)	__d	2	2	396	396
162	Self Assessment of Radiation-Safety Programs (2009)	__d	3	3	594	594
161	Management of Persons Contaminated with Radionuclides (2009)	__d	2	23	1,457	1,457
160	Ionizing Radiation Exposure of the Population of the United States (2009)	__d	2	16	1,867	1,867
159	Risk to the Thyroid from Ionizing Radiation (2008)	__d	3	1	320	320
158	Uncertainties in the Measurement and Dosimetry of External Radiation (2007)	__d	1	2	740	740
157	Radiation Protection in Educational Institutions (2007)	__d	2	1	920	920
156	Development of a Biokinetic Model for Radionuclide-Contaminated Wounds and Procedures for Their Assessment, Dosimetry and Treatment (2006)	__d	5	6	831	831
155	Management of Radionuclide Therapy Patients (2006)	__d	3	5	1,233	1,233
154	Cesium-137 in the Environment: Radioecology and Approaches to Assessment and Management (2006)	__d	4	1	612	612
153	Information Needed to Make Radiation Protection Recommendations for Space Missions Beyond Low-Earth Orbit (2006)	__d	2	3	741	741
152	Performance Assessment of Near-Surface Facilities for Disposal of Low-Level Radioactive Waste (2005)	__d	3	1	602	602
151	Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities (2005)	__d	22	29	3,810	3,810
150	Extrapolation of Radiation-Induced Cancer Risks from Nonhuman Experimental Systems to Humans (2005)	__d	3	2	732	732
149	A Guide to Mammography and Other Breast Imaging Procedures (2004)	__d	3	1	1,188	1,188
148	Radiation Protection in Veterinary Medicine (2004)	__d	2	4	1,302	1,302

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
147	Structural Shielding Design for Medical X-Ray Imaging Facilities (2004)	__d	18	38	4,799	4,799
	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	3	3	1,126	1,126
145	Radiation Protection in Dentistry (2003)	__d	3	17	2,534	2,534
144	Radiation Protection for Particle Accelerator Facilities (2003)	__d	3	9	2,344	2,344
143	Management Techniques for Laboratories and Other Small Institutional Generators to Minimize Off-Site Disposal of Low-Level Radioactive Waste (2003)	__d	2	1	744	744
142	Operational Radiation Safety Program for Astronauts in Low-Earth Orbit: A Basic Framework (2002)	__d	1	1	1,186	1,186
141	Managing Potentially Radioactive Scrap Metal (2002)	__d	1	2	1,272	1,272
140	Exposure Criteria for Medical Diagnostic Ultrasound: II. Criteria Based on All Known Mechanisms (2002)	__d	2	1	834	834
139	Risk-Based Classification of Radioactive and Hazardous Chemical Wastes (2002)	__d	1	2	1,007	1,007
138	Management of Terrorist Events Involving Radioactive Material (2001)	__d	3	6	7,636	7,636
137	Fluence-Based and Microdosimetric Event-Based Methods for Radiation Protection in Space (2001)	__d	1	2	807	807
136	Evaluation of the Linear-Nonthreshold Dose-Response Model for Ionizing Radiation (2001)	__d	3	1	1,430	1,430
135	Liver Cancer Risk from Internally-Deposited Radionuclides (2001)	__d	1	1	1,124	1,124
134	Operational Radiation Safety Training (2000)	__d	2	2	1,381	1,381
133	Radiation Protection for Procedures Performed Outside the Radiology Department (2000)	__d	3	7	1,747	1,747
132	Radiation Protection Guidance for Activities in Low-Earth Orbit (2000)	__d	2	2	1,068	1,068
131	Scientific Basis for Evaluating the Risks to Populations from Space Applications of Plutonium (2001)	__d	2	2	810	810
130	Biological Effects and Exposure Limits for "Hot Particles" (1999)	__d	1	1	1,176	1,176
129	Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies (1999)	__d	1	3	1,726	1,726
128	Radionuclide Exposure of the Embryo/Fetus (1998)	__d	1	2	1,627	1,627

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
127	Operational Radiation Safety Program (1998)	__d	32	10	2,582	2,582
126	Uncertainties in Fatal Cancer Risk Estimates Used in Radiation Protection (1997)	__d	1	1	1,928	1,928
125	Deposition, Retention and Dosimetry of Inhaled Radioactive Substances (1997)	__d	1	3	2,587	2,587
124	Sources and Magnitude of Occupational and Public Exposures from Nuclear Medicine Procedures (1996)	__d	1	3	3,229	3,229
123	Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground (1996)	__d	2	6	3,259	3,259
122	Use of Personal Monitors to Estimate Effective Dose Equivalent and Effective Dose to Workers for External Exposure to Low-LET Radiation (1995)	__d	1	3	3,408	3,408
121	Principles and Application of Collective Dose in Radiation Protection (1995)	__d	1	2	2,475	2,475
120	Dose Control at Nuclear Power Plants (1994)	__d	1	1	3,012	3,012
119	A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields (1993)	__d	3	4	3,543	3,543
118	Radiation Protection in the Mineral Extraction Industry (1993)	__d	1	2	2,665	2,665
117	Research Needs for Radiation Protection (1993)	__d	2	1	1,976	1,976
116	Limitation of Exposure to Ionizing Radiation (1993)	__d	6	7	7,397	7,397
115	Risk Estimates for Radiation Protection (1993)	__d	1	2	3,197	3,197
114	Maintaining Radiation Protection Records (1992)	__d	2	1	2,480	2,480
113	Exposure Criteria for Medical Diagnostic Ultrasound: I. Criteria Based on Thermal Mechanisms (1992)	__d	1	2	3,293	3,293
112	Calibration of Survey Instruments Used in Radiation Protection for the Assessment of Ionizing Radiation Fields and Radioactive Surface Contamination (1991)	__d	1	3	3,896	3,896
111	Developing Radiation Emergency Plans for Academic, Medical and Industrial Facilities (1991)	__d	1	1	4,094	4,094
110	Some Aspects of Strontium Radiobiology (1991)	__d	2	2	2,579	2,579
109	Effects of Ionizing Radiation on Aquatic Organisms (1991)	__d	1	1	2,231	2,231
108	Conceptual Basis for Calculations of Absorbed-Dose Distributions (1991)	__d	1	1	3,143	3,143
107	Implementation of the Principle of As Low As Reasonably Achievable (ALARA) for Medical and Dental Personnel (1990)	__d	2	1	3,409	3,409
106	Limit for Exposure to "Hot Particles" on the Skin (1990)	__d	1	1	2,894	2,894

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
105	Radiation Protection for Medical and Allied Health Personnel (1989)	__d	2	4	6,865	6,865
104	The Relative Biological Effectiveness of Radiations of Different Quality (1990)	__d	2	1	2,424	2,424
103	Control of Radon in Houses (1989)	__d	1	3	3,774	3,774
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	7,870	7,870
101	Exposure of the U.S. Population from Occupational Radiation (1989)	__d	0	1	4,167	4,167
100	Exposure of the U.S. Population from Diagnostic Medical Radiation (1989)	__d	0	1	4,985	4,985
99	Quality Assurance for Diagnostic Imaging (1988)	__d	0	2	4,878	4,878
98	Guidance on Radiation Received in Space Activities (1989)	__d	0	2	3,416	3,416
97	Measurement of Radon and Radon Daughters in Air (1988)	__d	0	1	4,259	4,259
96	Comparative Carcinogenicity of Ionizing Radiation and Chemicals (1989)	__d	2	2	4,102	4,102
95	Radiation Exposure of the U.S. Population from Consumer Products and Miscellaneous Sources (1987)	__d	0	4	4,293	4,293
94	Exposure of the Population in the United States and Canada from Natural Background Radiation (1987)	__d	2	3	4,441	4,441
93	Ionizing Radiation Exposure of the Population of the United States (1987)	__d	0	1	7,396	7,396
92	Public Radiation Exposure from Nuclear Power Generation in the United States (1987)	__d	0	1	3,692	3,692
91	Recommendations on Limits for Exposure to Ionizing Radiation (1987)	__d	0	0	8,486	8,486
90	Neptunium: Radiation Protection Guidelines (1988)	__d	0	1	2,910	2,910
89	Genetic Effects from Internally Deposited Radionuclides (1987)	__d	1	1	3,970	3,970
88	Radiation Alarms and Access Control Systems (1986)	__d	1	2	4,823	4,823
87	Use of Bioassay Procedures for Assessment of Internal Radionuclide Deposition (1987)	__d	2	2	4,270	4,270
86	Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields (1986)	__d	0	5	5,327	5,327
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	4,265	4,265

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
83	The Experimental Basis for Absorbed-Dose Calculations in Medical Uses of Radionuclides (1985)	__d	0	1	3,553	3,553
82	SI Units in Radiation Protection and Measurements (1985)	__d	1	1	4,594	4,594
81	Carbon-14 in the Environment (1985)	__d	1	2	4,005	4,005
80	Induction of Thyroid Cancer by Ionizing Radiation (1985)	__d	0	1	4,273	4,273
79	Neutron Contamination from Medical Electron Accelerators (1984)	__d	0	5	4,864	4,864
78	Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States (1984)	__d	0	1	6,481	6,481
77	Exposures from the Uranium Series with Emphasis on Radon and Its Daughters (1984)	__d	0	2	6,658	6,658
76	Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment (1984)	__d	2	3	6,699	6,699
75	Iodine-129: Evaluation of Release from Nuclear Power Generation (1983)	__d	2	1	5,953	5,953
74	Biological Effects of Ultrasound: Mechanisms and Clinical Implications (1983)	__d	0	1	11,236	11,236
73	Protection in Nuclear Medicine and Ultrasound Diagnostic Procedures in Children (1983)	__d	1	1	5,506	5,506
72	Radiation Protection and Measurement for Low-Voltage Neutron Generators (1983)	__d	0	2	4,456	4,456
71	Operational Radiation Safety—Training (1983)	__d	0	1	5,075	5,075
70	Nuclear Medicine—Factors Influencing the Choice and Use of Radionuclides in Diagnosis and Therapy (1982)	__d	1	1	5,420	5,420
69	Dosimetry of X-Ray and Gamma-Ray Beams for Radiation Therapy in the Energy Range 10 keV to 50 MeV (1981)	__d	0	2	5,032	5,032
68	Radiation Protection in Pediatric Radiology (1981)	__d	0	1	4,510	4,510
67	Radiofrequency Electromagnetic Fields—Properties, Quantities and Units, Biophysical Interaction and Measurements (1981)	__d	0	3	5,463	5,463
66	Mammography (1980)	__d	0	0	4,598	4,598
65	Management of Persons Accidentally Contaminated with Radionuclides (1980)	__d	0	1	18,451	18,451
64	Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations (1980)	__d	2	1	5,255	5,255
63	Tritium and Other Radionuclide Labeled Organic Compounds Incorporated in Genetic Material (1979)	__d	0	1	4,332	4,332
62	Tritium in the Environment (1979)	__d	0	1	3,973	3,973

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
61	Radiation Safety Training Criteria for Industrial Radiography (1978)	__d	1	1	6,179	6,179
60	Physical, Chemical and Biological Properties of Radiocerium Relevant to Radiation Protection Guidelines (1979)	__d	0	1	4,039	4,039
59	Operational Radiation Safety Program (1979)	__d	0	0	8,046	8,046
58	A Handbook of Radioactivity Measurements Procedures (1978)	__d	0	2	13,647	13,647
57	Instrumentation and Monitoring Methods for Radiation Protection (1978)	__d	0	4	11,004	11,004
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	6,848	6,848
54	Medical Radiation Exposure of Pregnant and Potentially Pregnant Women (1977)	__d	1	4	10,616	10,616
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	2	4,716	4,716
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	1	7,930	7,930
49	Structural Shielding Design and Evaluation for Medical Use of X Rays and Gamma Rays of Energies up to 10 MeV (1976)	__d	0	11	17,754	17,754
	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	6,397	6,397
46	Alpha-Emitting Particles in Lungs (1975)	__d	0	1	6,091	6,091
45	Natural Background Radiation in the United States (1975)	__d	__e	0	7,296	7,296
44	Krypton-85 in the Atmosphere—Accumulation, Biological Significance, and Control Technology (1975)	__d	0	1	6,576	6,576
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	1	47,252	47,252

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
41	Specification of Gamma-Ray Brachytherapy Sources (1974)	__d	0	1	5,477	5,477
40	Protection Against Radiation from Brachytherapy Sources (1972)	__d	0	1	9,810	9,810
39	Basic Radiation Protection Criteria (1971)	__d	__e	0	40,393	40,393
38	Protection Against Neutron Radiation (1971)	__d	1	4	9,003	9,003
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
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

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
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
Total NCRP Reports Distributed		959,448	404	519	959,393	1,918,841

Lauriston S. Taylor Lectures

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

No.	Title and Year of Publication	Number of Copies Distributed				
		Government Printing Office ^a	NCRP Publications ^b		Total NCRP Publications ^c	All Sources Combined
			2018			
			Hardcopy	E-Pub		
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	
37	When Does Risk Assessment Get Fuzzy?, John E. Till (2013), Health Phys. 106(2):148–161 (2014)	__i	__i	__i	__i	
36	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 (2012), Health Phys. 105(5):407–421 (2013)	__i	__i	__i	__i	
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	
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