



## Summary of NCRP 2019 Annual Meeting, *NCRP Meeting the Challenge at 90: Providing Best Answers to Your Most Pressing Questions About Radiation*

Fred A. Mettler, Jr., Jerrold T. Bushberg, and Richard J. Vetter

The 55<sup>th</sup> Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP) was held April 1–2, 2019 at the Hyatt Regency in Bethesda, Maryland. However, Sunday, March 31 was filled with numerous NCRP committee meetings including the seven program area committees (PACs) which met to discuss progress and to plan future activities. That evening Council members gathered for dinner, to recognize newly elected members of the Council, and to hear President Kathryn D. Held discuss NCRP future plans and address questions from the members.



Above: Army Color Guard  
Right: Kimberly Jordan &  
HN Christopher O'Neill



The Annual Meeting was opened Monday morning with the Presentation of Colors by the Army Color Guard of Washington, DC and the singing of the National Anthem by Kimberly Jordan from the U.S. Nuclear Regulatory Commission (NRC). Dr. Held welcomed all to the meeting, pointing out that this is a special year as it marks the 90<sup>th</sup> Anniversary of the founding of the predecessor organization to the NCRP, U.S. Advisory Committee on X Ray and Radium Protection, and introduced the Chairs and Co-Chairs of the meeting, Fred A. Mettler, Jr. (Chair), University of New Mexico School of Medicine; Jerrold T. Bushberg (Co-Chair), University of California Davis; and Richard J. Vetter (Co-Chair), Mayo Clinic. Casper Sun, NRC, served as the official photographer for the meeting, and Thomas E. Johnson and two of his graduate students from Colorado State University recorded the entire meeting. A DVD of the meeting will be available from NCRP.

Dr. Mettler briefly described that the meeting was designed to explore important and relevant areas of inquiry associated with use of ionizing radiation relevant to radiation protection, addressing frequently asked questions and concerns from both the public and radiation professionals. The meeting was organized into six sessions plus the three honorary lectures and a special presentation. Dr. Held then introduced C. Norman Coleman, the 16<sup>th</sup> Annual Warren K. Sinclair Keynote speaker, who discussed “Frontiers in Medical Radiation Science.” Dr. Coleman is Associate Director of the Radiation Research Program and Senior Investigator in the Radiation Oncology Branch of the National Cancer Institute (NCI) and the Senior Medical Advisor in the Office of the Assistant Secretary for Preparedness and Response in the U.S. Department of Health and Human Services.



Top: Program Chair, Fred A. Mettler, Jr.  
Bottom: NCRP President, Kathryn D. Held

C. Norman Coleman



Dr. Coleman discussed three themes related to the rapidly evolving era of precision medicine: Theme 1, accurate measurement of the physical radiation dose when assessing biological effect; Theme 2, applying scientific knowledge to natural and man-made disasters; and Theme 3, potential careers for molecular radiation epidemiologists who have cancer biology and oncology expertise as well as epidemiology training. He concluded by acknowledging remarkable opportunities for the application of emerging cancer biology and radiation biology to enhance the contribution by NCRP and other radiation related societies and fields.

Janice L. Huff, National Aeronautics and Space Administration (NASA), was Session Chair of the first session “Exploring the Red Planet: A Focus on the Radiation Environment and Crew Health.” Speakers informed the audience that the radiation environment in space poses significant challenges to human health and is a major concern for long duration, manned space missions. Outside the Earth’s protective magnetosphere, interplanetary crews will experience greater levels of radiation exposure from high-energy protons and highly energetic atomic nuclei known as galactic cosmic rays, and from solar particle events. The trip to Mars provides no opportunity to turn around; it will take six months to get there, 1.5 years will be spent exploring Mars, and six months to get back. The session covered key aspects of the space radiation environment, the major health risks of concern, and strategies for risk mitigation for the astronauts. Health issues other than radiation will include zero gravity issues; fluid redistribution; effects on the brain, eyes, cardiovascular system, and bone density; as well as psychological and privacy issues. Presenters were Cary J. Zeitlin, Leidos Innovations Corporation, who discussed the question “Is the Low-Earth Orbit Radiation Environment a Good Proxy for Mars?” He was followed by Eleanor A. Blakely, Lawrence Berkeley National Laboratory, who provided an “Overview of Health Risks Associated with Deep Space Exploration.” Mark Shavers, Wylie Laboratories, discussed “The Sky is the Limit,” and Neal Zapp provided “Perspectives from the Office of the Chief Health and Medical Officer of NASA.”



L to R: Janice L. Huff (Session Chair), Cary J. Zeitlin, Eleanor A. Blakely, Mark Shavers, & Neal Zapp

Roy E. Shore, New York University Langone School of Medicine, chaired the second session titled “Low-Dose Epidemiology and Regulatory Issues.” Speakers for this session started with Eric J. Grant, Radiation Effects Research Foundation, who discussed the question “What is the Life Span Study Telling Us About Cancer Risks at Low to Moderate Doses?” Richard Wakeford, Dalton Nuclear Institute, University of Manchester, England, presented “Risk Estimates from Studies of Low Doses and Low-Dose Rates.” Regulatory issues were addressed by Patricia K. Holahan, NRC, who discussed “NRC Rulemaking Process and Current Regulatory Activities,” and Michael A. Boyd, U.S. Environmental Protection Agency, who addressed the question “Can Radiation Epidemiology Affect Current Radiation Standards?” Speakers in this session pointed out that regulatory constructs for radiation protection began

with guidelines to prevent severe tissue reactions (deterministic effects). Over time, issues of induction of cancer and genetic effects became known, and these “stochastic” effects became the driver for regulatory standards. Several challenges remain including fundamental questions on the relationship of dose to risk and the question of what does “reasonable” mean in the phrase “as low as reasonably achievable” (ALARA). It was pointed out that the excess relative risk per gray from both atomic-bomb mortality and incidence is about 0.5 and that risk estimates at lower doses have less accuracy and precision and are more susceptible to bias. The session explored epidemiologic areas of importance for the radiation protection community and implications for radiation protection recommendations and regulation of alternative models.



L to R: Roy E. Shore (Session Chair), Eric J. Grant, Richard Wakeford, Patricia K. Holahan, & Michael A. Boyd

Lawrence T. Dauer  
(Session Chair)



Mark P. Little



Nobuyuki Hamada



Lawrence T. Dauer, Memorial Sloan-Kettering Cancer Center, chaired the third session on “Tissue Reactions.” Mark P. Little of the National Cancer Institute addressed “Low Dose Radiation and Circulatory Diseases,” and Nobuyuki Hamada from the Central Research Institute of Electric Power Industry in Japan

discussed “Low Dose Radiation and Cataracts.” While not certain, suggestions of elevated risks of both circulatory diseases and cataracts associated with lower levels of radiation have been building over the last decade. Several disparate populations exposed to low doses of ionizing radiation are being studied. This session addressed the following questions: Do currently available data from epidemiology and the developing understanding of the mechanisms of biological effects provide new insights into effects in the lens of the eye or circulatory system, especially at doses below 1 Gy? If so, what are some of the implications? We learned that the etiology of cardiovascular diseases may be inflammatory. Although radiation doses increase some long lasting inflammatory proteins and decrease others, what happens below 0.5 Gy is unclear. Vision impairing cataracts probably have a threshold of approximately 0.5 Gy, but may also occur at protracted doses of less than 0.5 Gy.



L to R: Kenneth L. Miller, John D. Boice, Jr., Jerrold T. Bushberg, & Kathryn D. Held; Dr. Miller’s portrait of Dr. Boice



Just before the lunch break on Day 1, Jerrold Bushberg, Chairman of the NCRP Board of Directors, announced the establishment of the “John D. Boice Jr. Young Investigator Award.”

Accompanying the announcement was a Special Presentation and unveiling of an oil portrait of Dr. Boice created by Kenneth L. Miller, Hershey Medical Center, Pennsylvania State University, and NCRP Distinguished Emeritus Member, who also painted the portrait of Dr. Lauriston S. Taylor which hangs in the headquarters of NCRP. A print of Dr. Taylor's portrait is used by NCRP in many of its announcements and printed materials. Ken pointed out that he was unable to ascertain the design on the necktie in the photograph of John given to him for purposes of painting the portrait, so he painted one of his own ties in the portrait. Since John was not wearing a tie that matched the tie in the portrait, and since Ken was wearing the tie used in the portrait, Ken removed his tie and presented it to John. John was so moved by the entire presentation that he had very few words to share, which is unlike John.



L to R: William E. Irwin (Session Co-Chair), Sara D. DeCair, Benjamin Stevenson, Jessica S. Wieder (Session Co-Chair), Tristan Barr, & Brooke R. Buddemeier (Session Co-Chair)

Following lunch, Brooke R. Buddemeier, Lawrence Livermore National Laboratory; William E. Irwin, Vermont Department of Health; and Jessica S. Wieder, U.S. Environmental Protection Agency (EPA) served as Session Co-Chairs for the fourth session, a panel titled "Emergency Planning, Response and Communications." In addition to the co-chairs, three experts participated in the panel: Sara D. DeCair, EPA; Benjamin Stevenson, U.S. Department of Homeland Security; and Tristan Barr, Canadian Nuclear Safety Commission. Each of the panel members presented formal remarks prior to the panel addressing questions from the audience. Dr. Irwin addressed "Response Issues Identified in the 2017 NCRP Annual Meeting," Ms. DeCair presented "Don't Blame the PAGs," Mr. Stevenson discussed "New Guidance and Tools for Radiological/Nuclear Response: NUSTL Support to State and Local Planning," Ms. Wieder addressed "Communication Issues Identified and Efforts to Close the Gaps," Mr. Barr discussed "Gamma Gear: A video Game to Teach Radiation Detection and Protection to Members of the Public," and Mr. Buddemeier provided conclusions and introduced the Question and Answer panel.

The panel reported that the 2017 NCRP Annual Meeting identified critical gaps in the national preparedness to radiological or nuclear terrorism. The good news is that sound guidance exists, though better ways need to be found to communicate the guidance and incentivize local level planning and support informed response decision making. The panel pointed out that response guidance needs to be combined and not limited to radiation. The complex technical and psychosocial aspects of radiological and nuclear incidents complicate emergency response decision making and can lead to unnecessary cost and/or loss of life. NCRP can play an important role in providing sound science but must understand how to best temper and communicate this science to be operationally relevant and accessible to the people who need it most. Numerous social media messages as well as educational videos have been produced to meet this need. This session reviewed the challenges faced by the emergency response

community for radiological and nuclear events, including the complex needs for radiological dispersal devices and nuclear detonations, and the efforts that are underway in NCRP, the federal government, and academia to address these challenges.



L to R: William E. Kennedy, Jr. (Session Chair), Kent Rosenberger, Casey Gadbury, & Joseph J. Weismann

The fifth session, “Waste Management” was chaired by William E. Kennedy, Jr., WE Kennedy Consulting. Serving on the panel were Kent Rosenberger, Savannah River Remediation LLC, who discussed “High-Level Waste Tank Closure at the Savannah River Site: What is Being Done to Stabilize Liquid Radioactive Waste from the Cold War at Savannah River?” Casey Gadbury, U.S. Department of Energy, who addressed “Contamination Mitigation at the Waste Isolation Pilot Plant in New Mexico: What has Been Done in the Aftermath of the Americium Accident at the Waste Isolation Pilot Plant?” and Joseph J. Weismann, U.S. Ecology, Inc. who addressed “Low-Level Waste Disposal: An Operator’s Perspective: What is the Day-to-Day Reality of “Routine” Low-Level Radioactive Waste Operations?”

The panel reminded the audience that the generation of radioactive waste has been a routine part of industrial activities involving the use of radioactive materials for over a century. The waste classifications, disposal technologies, and regulations for radioactive waste disposal, both nationally and internationally, have changed over time. As technology changes, new wastes are generated and disposal methods and systems are created. This session addressed three important aspects of radioactive waste disposal that our Nation currently faces: treatment of liquid high-level radioactivity for safe disposal; recovery from the accident at the Waste Isolation Pilot Plant in New Mexico, and continuing safe disposal of low-level radioactive waste.

The first day concluded with the 43rd Lauriston S. Taylor Lecture on Radiation Protection and Measurements. Harold L. Beck, U.S. Department of Energy (retired), introduced the lecturer, André Bouville, who headed the Dosimetry Unit of the Radiation Epidemiology Branch at NCI until he retired in 2010. Dr. Bouville’s address was titled “Fallout from Nuclear Weapons Tests: Environmental, Health, Political, and Sociological Considerations.”



Dr. Bouville described that the first occurrence in the history of the world of radioactive debris falling from the atmosphere (now known as “fallout”) from a man-made event occurred in New Mexico in July of 1945 with the culmination of the Manhattan Project and the detonation of the Trinity device. This event was followed three weeks later by the bombings of Hiroshima and Nagasaki, which became two of the most significant events of the 20th century. The bombing of Japan was, in turn,

André Bouville & his wife, Carol

followed by over 500 atmospheric nuclear weapons tests, mainly by the United States and the Soviet Union, creating conditions which are now understood to have blanketed much of the Earth with radioactive fallout debris. This continued until August 5, 1963 when both countries signed the Limited Test Ban Treaty prohibiting the testing of nuclear weapons in the atmosphere, underwater, or in outer space. However, atmospheric nuclear weapons testing by France and China continued until 1980. India and North Korea recently joined the nuclear club that also includes Pakistan and, reportedly, Israel, although they did not conduct any test of their nuclear weapons in the atmosphere. Dr. Bouville reviewed and discussed available information on the doses and health and environmental effects resulting from the nuclear weapons tests that were conducted in the atmosphere. He compared the fallout doses and effects to those from other sources of irradiation, such as natural and medical. He also examined the political and sociological considerations regarding these exposures including the mechanisms and rationales of current compensation programs, the public's perception of risk from radiation, and the public's lack of understanding that fallout radiation is the same as the radiation from other sources.

Fallout-related studies helped certain areas of science to grow, including instrumentation, atmospheric transport (particles, gases), bioassay, environmental surveillance (e.g., milk monitoring), radioecology, and internal dosimetry. From the 1950s until the early 1970s, limited information was available on the radiation exposures and health effects of the local and regional populations, although environmental radiation levels both near and far away from the test sites were monitored and reported in many countries. The situation changed in the 1970s when major studies were conducted in the United States to reconstruct the doses and to estimate the related health effects to the populations affected by the tests that had been conducted at the Nevada Test Site. Because of the devastating effects of nuclear weapons, constant efforts have been made by most governments to limit the number of countries with nuclear weapons, therefore keeping the topic of potential nuclear weapons fallout as a concern in the public and political arena. Public concern regarding past exposures also is still prevalent among the populations near the previous test sites, and monetary compensation programs have been established in some countries to compensate persons suffering from radiation-induced cancer attributable to nuclear testing. Dr. Bouville concluded his lecture with a discussion of the "positive" aspects of fallout, notably its contribution to the development of instrumentation, atmospheric transport, environmental surveillance, radioecology, and dosimetry. Following his lecture, Dr. Bouville was presented with the Taylor Medal and a plaque recognizing his presentation and honored at a reception sponsored by Fluke/RaySafe/Landauer, Inc.



Tuesday, April 2, began with the NCRP Annual Business Meeting where the Treasurer's and Nominating Committee reports were received. Former President Dr. John Boice officially passed the gavel to new President Dr. Kathryn Held, and special presentations were made to Emeritus Senior Vice Presidents Drs. S. James Adelstein and Dr. Kenneth R. Kase to recognize their many years of exemplary service to NCRP. Dr. Held also presented tokens of appreciation to Chairs/Co-Chairs of NCRP scientific committees who completed work in the past year and to the Co-Chairs of the 2017 Annual Meeting and provided the President's Report, including thoughts on the future activities of NCRP.



The Business Meeting was followed by the Third Thomas S. Tenforde Topical Lecture. Richard J. Vetter, Mayo Clinic, introduced the lecturer, Genevieve S. Roessler, "Ask the Expert" Editor for the Health

Top: John D. Boice, Jr. & Kathryn D. Held  
Bottom: Kenneth R. Kase & S. James Adelstein

Physics Society (HPS). The title of Dr. Roessler's talk was "HPS Ask the Experts: Our Most Intriguing Questions and Answers."

Dr. Roessler explained that the HPS developed the idea of an online "Ask the Experts" (ATE) feature in 1999 when it created its official website (<http://hps.org>). ATE features are popular now, but at that time it was a novel idea, so there was some apprehension about its possible success. Early participation by Robert L. Brent, M.D., an NCRP Distinguished Emeritus Member, as an ATE expert helped set the tone for establishing a credible communication venue. Now 20 years later, HPS considers its ATE feature a success and the most valuable service the Society offers for the public. Nearly 13,000 questions have been submitted



Genevieve S. Roessler

to the feature. They come both from members of the public and from health physicists. All have been answered personally by top-notch radiation safety experts. Dr. Roessler pointed out that the far-reaching impact of the feature is due to the body of written material accumulated on the website. This posted material includes frequently asked questions (FAQs), summary topical papers, links to other pertinent information, and answers to questions considered to be of general interest to the public. The catalog of answers is organized on the website in 26 radiation safety categories. Each answered question has a unique title that appears as a link to the answer in web search engine (e.g., Google) results. The feature, managed by one lead editor, 22 topic editors, a technical editor, a webmaster, and approximately 300 experts, draws over one million visitors per year. ATE editors have learned much through the years about effective interaction with questioners, especially members of the public. Most important, answers should show compassion. Dr. Roessler explained that they learned "people want to know that you care before they care what you know," as noted by the World Health Organization. She also stated that the bottom line should be presented first, that answers should be brief, and plain language at the level of the questioner should be used. Heavy reliance on NCRP reports and other peer reviewed documents add to the credibility of the information. Questions from the public, which have remained at a consistent level in recent years, cover a wide range of radiation safety issues; however, by far the most frequent deal with medical exposures, especially computed tomography procedures. Other questions from the public deal with a wide range of concerns including products from Japan, granite countertops, radon, smoke detectors, whole-body scanners, and flying. Dr. Roessler concluded her talk with examples of the most intriguing questions that have come to the ATE feature and the answers provided by the experts.



L to R: Jerrold T. Bushberg (Session Co-Chair), Brooke R. Buddemeier, Randall N. Hyer, Richard J. Vetter (Session Co-Chair), Raymond A. Guilmette, Fred A. Mettler, Jr., & Jessica S. Wieder

The final session titled “Frequently Asked Questions: Medical and Other Topics,” was a seven member panel led by Jerrold T. Bushberg and Richard J. Vetter, Session Co-Chairs. Panel Members were Jerrold T. Bushberg, Brooke R. Buddemeier, Raymond A. Guilmette, Randall N. Hyer, Fred A. Mettler, Jr., Richard J. Vetter, and Jessica S. Wieder.

Exposure to ionizing radiation is a common experience during medical evaluation of patients in hospitals and clinics. While most people are not fearful or simply assume medical personnel would not expose them to harm, some patients experience a range of emotions from slight anxiety to significant fear. Some patients will research their questions by surfing the internet while others will direct their questions to reputable organizations such as NCRP or HPS. In this session individual panel members responded to selected FAQs and misstatements that have appeared in the scientific literature and popular media. The panel presentations were followed by comments and discussion by other panel members offered in response to questions from the audience.

### **Preselected FAQs:**

- Do computed tomography (CT) exams give you cancer?
- Is the linear nonthreshold model still suitable for setting standards for protection against radiation?
- Are the health risks from exposure to internally deposited radionuclides different from those from acute external exposure?
- How much radiation is safe?

### **Preselected Statements:**

- “Low-dose radiation exposure (<100 to 200 mSv) is likely beneficial, not harmful.”
- “DESPITE great strides in prevention and treatment, cancer rates remain stubbornly high and may soon surpass heart disease as the leading cause of death in the United States. Increasingly, we and many other experts believe that an important culprit may be our own medical practices: We are silently irradiating ourselves to death.”
- “A single CT scan exposes a patient to the amount of radiation that epidemiologic evidence shows can be cancer causing.”
- “Radiation safety programs must establish compliance with radiation regulations which continue to be based on the linear nonthreshold (LNT) hypothesis and the ALARA principle, despite overwhelming sound, peer reviewed science that demonstrates the existence of a carcinogenic threshold and/or hormesis at low doses ... Yet despite compelling evidence revealing LNT to be fraudulent, the consistent response taken by regulatory agencies and scientific bodies whose recommendations are cited as the basis of regulatory actions is to deflect or rationalize away the science at best or simply pretend it doesn't exist at worst so as to maintain allegiance to a world view of radiation safety built on ALARA and LNT.”
- “It doesn't matter, we are all dead anyway.” (The most common excuse for not preparing for the consequences of a nuclear detonation)
- “Experience has shown that most people faced with a large-scale disaster will either panic or suffer from psychological incapacitation.”

## Conclusions

### Wrap-Up:

Program Chair, Dr. Mettler, concluded the meeting by providing summary statements for each session of the program.

### NCRP Vision for the Future and Program Area Committee Activities

Kathryn D. Held, President, NCRP, shared her vision for the future of NCRP and the program area committees.

Prior to adjourning the meeting, Dr. Held thanked the 2019 Program Committee: Fred A. Mettler, Jr., Chair, University of New Mexico School of Medicine; Jerrold T. Bushberg, Co-Chair, University of California Davis School of Medicine (retired); Richard J. Vetter, Co-Chair, Mayo Clinic (retired); Brooke R. Buddemeier, Lawrence Livermore National Laboratory; Donald A. Cool, Electric Power Research Institute; Lawrence T. Dauer, Memorial Sloan-Kettering Cancer Center; Raymond A. Guilmette, Lovelace Respiratory Research Institute (retired); Janice L. Huff, National Aeronautics and Space Administration; Randall N. Hyer, Center for Risk Communication; William E. Irwin, Vermont Department of Health; William E. Kennedy, Jr., WE Kennedy Consulting; R. Julian Preston, U.S. Environmental Protection Agency; Roy E. Shore, New York University Langone School of Medicine; and Jessica S. Wieder, U.S. Environmental Protection Agency.

Dr. Held also announced that the title of the 2020 Annual Meeting will be “Radiation and Flight: A Down-to-Earth Look at the Risks,” co-chaired by Jacqueline P. Williams and Cary Zeitlin, and will be held March 23–24, 2020 in Bethesda, Maryland.