Framers of the Future of Radiation Protection

Not only are the times a-changin’, they have changed! In 1993, when the National Council on Radiation Protection and Measurements (NCRP) made its last recommendations (Report No. 116), Bill Clinton was president, the World Trade Center was bombed, North Korea began its nuclear weapons program, a nuclear accident occurred at Tomsk 7 in Russia, the Holocaust Museum was dedicated, the Chicago Bulls won its third consecutive National Basketball Association championship, Unforgiven was the best movie, Andrew Wiles proved Fermat’s Last Theorem, China performed a nuclear test and ended the worldwide de facto moratorium, the European Union was established, and Czechoslovakia (my grandfather’s birthplace) ceased to exist.

Since 1993, the world of radiation protection has changed. Radiation effects at low doses have been further refined. Noncancer effects such as cardiovascular disease and cataracts are of greater interest. Ethics, the environment, and societal values have gained greater influence. Medical radiographic imaging has increased dramatically. Decommissioning of nuclear reactors is accelerating. Waste management is unresolved. Hydraulic fracturing produces low-level radioactive waste. Terrorist attacks are contemplated and guidance for emergency workers is needed. Planning for major nuclear reactor incidents continues.

NCRP began revising recommendations for the United States in 2015 and created its first-ever Council Committee (CC 1) to handle this enormous task (photo below). The report, soon to go out for expert review, contains notable updates in the NCRP approach to radiation protection. The framers may very well be recognized as establishing influential and important recommendations for the United States (“As the present now will later be past”). Of course the report has to withstand the extensive NCRP review process, including Task Group 100 established by the International Commission on Radiological Protection (ICRP). Please review when the opportunity arises this year (“The chance won’t come again.”).

CC 1 recognized the importance of the 2007 recommendations of the ICRP. However, NCRP also recognizes its responsibility to provide recommendations that best serve the United States. Deviations from international recommendations are made in light of this responsibility.

What’s New? (“And admit that the waters around you have grown.”) New inclusions include:

• Patients exposed to medical radiation.
• Comforters and caregivers for patients treated with radioactive materials.
• Workers and the general public exposed to elevated levels of naturally occurring radioactive materials.
• Emergency workers (definition, training, and dose considerations).
• The environment—nonhuman biota (e.g., plants and animals).
• Ethical foundations for radiation protection.
• Stakeholder involvement in decision making.

Setting the Stage (“The order is rapidly fadin’.”). CC 1 relied on two subcommittees for explicit guidance on the lens of the eye (NCRP Commentary No. 26) and on whether the linear no-threshold (LNT) model should continue to be used for radiation protection purposes. Scientific Committee 1-25 evaluated recent epidemiologic studies for evidence supporting the use of the LNT model and its commentary is under review. The proceedings of the 2015 NCRP Annual Meeting—“Changing Regulations and Radiation Guidance: What Does the Future Hold?”—published in 2016, helped set the stage.
Paradigm Changes and Engaging Topics ("There's a battle outside and it is raging."). NCRP radiation protection principles remain as justification, the "as low as reasonably achievable" (ALARA) principle (optimization of protection), and control of dose to an individual. Changes or reaffirmations recommended in the new report include:

- NCRP recommends five categories of exposure: occupational, public, medical, emergency worker, and nonhuman biota.
- NCRP adopts the use of the four ethical principles of do good, avoid harm, be just, and respect the autonomy of individuals.
- The ethical approach of NCRP for the environment (e.g., plants and animals) is an extended anthropocentrism (human-centered philosophy), which places protection of humans as a priority but recognizes the importance of protecting nonhuman biota because of the benefit derived by humans.
- The ALARA principle is always to be applied.
- NCRP does not use terms such as "constraint" or "reference level."
- NCRP does not define exposure situations as planned, existing, and emergency.
- Dose recommendations will depend upon the prevailing situation and circumstances and can be considered as "limits" only in specific circumstances in which the source is well characterized, stable, and predictable, and preplanned controls are exercised on the source.
- Dose recommendations for medical circumstances do not apply to the patient. The ALARA principle would take into account both patient dose and clinical utility.
- Diagnostic reference levels (and achievable doses) are not limits, but use should be encouraged.
- Quantitative assessment of risk from radiation exposure of an individual or population is not inferred from the effective dose. Effective dose is a nominal (in name only) quantity for radiation protection purposes.
- NCRP continues to recommend a dose and dose-rate effectiveness factor (DDREF) of two for radiation protection purposes.
- NCRP reviewed all recent and high-quality epidemiologic studies and reaffirms that the LNT model should continue to be used for managing potential radiation risks at low doses (<100 mGy).
- NCRP recommends the annual absorbed dose to the lens of the eye for occupational exposure not exceed 50 mGy.
- NCRP continues to recommend that the cumulative lifetime effective dose for an individual from occupational exposure not exceed 10 mSv multiplied by the individual's age in years.
John P. Witherspoon, Jr., age 85, died on 4 February 2017. He was born 28 February 1931 in Hamlet, North Carolina. He attended elementary school in Jacksonville, Florida, and high school at Porter Military Academy, a boarding school in Charleston, South Carolina, from which he graduated in 1949. As a result of his years there, John had a lifelong appreciation for Charleston and Porter and the surrounding area, to which he always enjoyed returning.

John met his future wife, Ulilla (“Lil”) Treon, while he was at Porter. They became high school sweethearts and dated for several years before they wed. The marriage lasted nearly 63 years, ending only with Ulilla’s death in 2015.

John received both his BS and MS from Emory University in Georgia, the latter in 1954. He then served in the Army for two years in Maryland. After that, he embarked on his PhD in 1957 at the University of Maryland, where he accepted employment at Oak Ridge National Laboratory (ORNL), where he spent the rest of his professional career.

At ORNL, John’s research focused on understanding the natural uptake mechanisms of radionuclides released to the environment, particularly forest ecosystems. A major contribution involved radiocesium uptake and cycling in tulip poplar trees, a common species in the southeastern United States. He also used his broad knowledge of natural environmental systems to evaluate and predict environmental impacts from nuclear operations.

John supervised many students during his time at ORNL, often bringing them home for barbecues with his family, and he was an adjunct professor at the University of Tennessee for many years. John was Sherri Cotter’s supervisor from 1977 until he retired. Sherri said she found John to be incredibly smart and a very thoughtful and fair boss. She recalled that he could do dose assessments in his head. Although Sherri worked mostly on atmospheric doses with computer programs, John had the ability to estimate the dose from all pathways in his head—an incredible feat! Sherri believes that his true work-related “love” was botany, since most of his work in the Environmental Sciences Division (pre-1977) dealt with trees and plants. Sherri observed that John was a “regular” kind of guy—no pretense or big ego. She said he loved his wife Lil and his kids and was super crazy about his grandchildren.

John was a plenary member of the Health Physics Society from 1966 until 1991. He also was a member of the Society of Nuclear Scientists and Engineers (SNSE).

I believe this report will be of substantial importance to the nation and the future of radiation protection in the United States and in other countries. “I’ll soon shake your windows and rattle your walls.”