

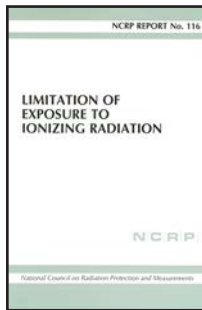
The Boice Report #58



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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 fading](#)"). 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.



NCRP CC 1 on Radiation Protection Guidance for the United States (4–5 April 2017, Bethesda, Maryland). Front row, left to right: John Boice (NCRP), Marvin Rosenstein (NCRP staff consultant), Kathryn Held (NCRP), Fred Mettler (University of New Mexico), Kenneth Kase (Cochair, NCRP), Jerrold Bushberg (NCRP; University of California, Davis); Back row L to R: Darrell Fisher (Versant Medical Physics and Radiation Safety), Ralph Andersen (NEI, Retired), Armin Ansari (Centers for Disease Control and Prevention), R. Julian Preston (U.S. Environmental Protection Agency, Retired), Donald Miller (Food and Drug Administration), Gayle Woloschak (Northwestern University), Donald Cool (Cochair, Electric Power Research Institute), Patricia Fleming (Saint Mary's College); Not in the photo: James Adelstein (Harvard Medical School), Michael Boyd (U.S. Environmental Protection Agency), Lawrence Dauer (Memorial Sloan-Kettering Cancer Center), Kathryn Higley (Oregon State University), Randall Hyer (Center for Risk Communication), William Irwin (Vermont Department of Health), John Till (Risk Assessment Corporation)

Photo courtesy of Beverly Ottman

Paradigm Changes and Engaging Topics (“*There’s a battle outside and it is ragin’.*”). 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.

- NCRP recommends the equivalent dose to the embryo and fetus not exceed 0.5 mSv per month due to occupational exposure of a pregnant worker once the pregnancy is declared.
- Emergency workers engaged in life-saving activities are not subject to any radiation dose limitation. Decisions on emergency worker actions should be based on the totality of the prevailing situation and circumstances, where other hazards may present greater risk than the radiation exposure, and where one person may save many other lives.
- NCRP recommends that radon levels be assessed and mitigation measures be taken when the air concentration of radon in homes and workplaces exceeds 300 Bq m⁻³.

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. *["It'll soon shake your windows and rattle your walls."](#)*