

The Boice Report #42



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Human Health Studies and Radiation Protection

Human studies of radiation health effects substantially influence the committees that provide guidance on radiation protection. This is in contrast to other environmental and occupational exposures, such as chemical carcinogens, where human data are sparse and protection guidance is based mainly on cellular or animal studies and a healthy dose of judgment.

Radiation is unique in having standing committees and organizations continually reviewing and assessing the health effects literature, including the United Nations Scientific Committee on the Effects of Atomic Radiation ([UNSCEAR](#)), the International Commission on Radiological Protection ([ICRP](#)), the National Council on Radiation Protection and Measurements ([NCRP](#)), and the National Academy of Sciences Committee on the Biological Effects of Ionizing Radiation ([BEIR](#)). NCRP has embarked upon a new review and Scientific Committee (SC) 1-25 (photo on next page) will address "Recent Epidemiologic Studies and Implications for the Linear Nonthreshold Model" as used in radiation protection.

Purpose. The aim of SC 1-25 is to prepare a commentary reviewing recent epidemiologic studies and to evaluate whether the new observations are strong enough to support, modify, or alter the linear no-threshold (LNT) model as used in radiation protection today. The major recent studies, within the past two or three years, will be reviewed and strengths and limitations discussed. The approach will follow generally the patterns of the recent [UNSCEAR 2013](#) Annex B coverage of childhood exposures to computed tomography (CT) exams and risks, as well as the [UNSCEAR 2006](#) coverage of radiation and cancer that provides a format for systematically reviewing, describing, evaluating, and concluding. The NCRP commentary will be in support of the ongoing Council Committee (CC) 1 report being developed, "[Radiation Protection Guidance for the United States.](#)" A comprehensive evaluation of LNT is not envisioned but just an evaluation of the recent health studies. There will be only a brief summary of current understanding of new radiation biology, recognizing that NCRP will soon publish the commentary "[Health Effects of Low Doses of Radiation: Integrating Radiation Biology and Epidemiology](#)" (SC 1-21).

Background. The LNT model as currently used in radiation protection relies heavily on human epidemiology, with support from radiobiology. There is a need to carefully review the recent studies on workers, patients, children, atomic bomb survivors, and environmental circumstances. The scientific underpinnings of the LNT model were briefly reviewed in my [September 2015 Health Physics News Boice Report](#)—which incidentally received more comments than any column I've written! [NCRP Report No. 136](#) provides a comprehensive evaluation of the LNT model as used in radiation protection. The U.S. Nuclear Regulatory Commission has requested [public comment](#) on three petitions that recommend a new look at radiation guidance, including suggestions that threshold models be considered. The review of recent epidemiology will address dose response models in general, including threshold.

So what will be considered? We do not plan to re-review studies that have been comprehensively evaluated in previous NCRP ([Report No. 171](#), 2012), UNSCEAR (2006), BEIR VII (2006), or other reports, but to focus on relatively recent studies that have methodological and statistical strengths. These will include, *but will not be limited to*, studies of: [atomic bomb survivors](#), [Chernobyl cleanup workers](#), [CT exams](#) of children, international workers ([INWORKS](#)), Massachusetts [tuberculosis-fluoroscopy](#) patients, [Mayak workers](#) in Russia, [atomic veterans](#), populations on the [Techa River](#), [U.S. radiological technologists](#), and [U.S. radiation workers](#). In addition, recent com-

mentaries, editorials, and reviews will be considered and [circulatory disease](#) will be touched upon. One of the committee charges will be the comparison of exposures with high and low dose rate (for similar doses) to evaluate the so-called dose-rate effectiveness factor ([DREF](#)). It is not entirely clear whether the risk at low doses depends strongly or at all on dose rate. [Dose uncertainties](#) are important and studies will be evaluated with regard to their approaches to measurement error.

Path forward. The committee plans to meet initially this December and to complete its report within 15 months. A concise but informative document of approximately 100 pages is envisioned. It will be considered by CC-1 members who will be recommending guidance on radiation protection issues for the United States within the next few years. Stay tuned!



SC 1-25 on Recent Epidemiologic Studies and Implications for LNT

Row 1, left to right: John D. Boice, Jr., cochair (NCRP), Lawrence T. Dauer, cochair (Memorial Sloan Kettering Cancer Center), and Scott Davis (Fred Hutchinson Cancer Research Center)

Row 2, left to right: Fred A. Mettler, Jr. (University of New Mexico), R. Julian Preston (U.S. Environmental Protection Agency, retired), and Roy E. Shore, cochair (Radiation Effects Research Foundation, retired)

Row 3, left to right: John E. Till (Risk Assessment Corporation), Richard J. Vetter, staff consultant (Mayo Clinic), and Richard Wakeford (University of Manchester)