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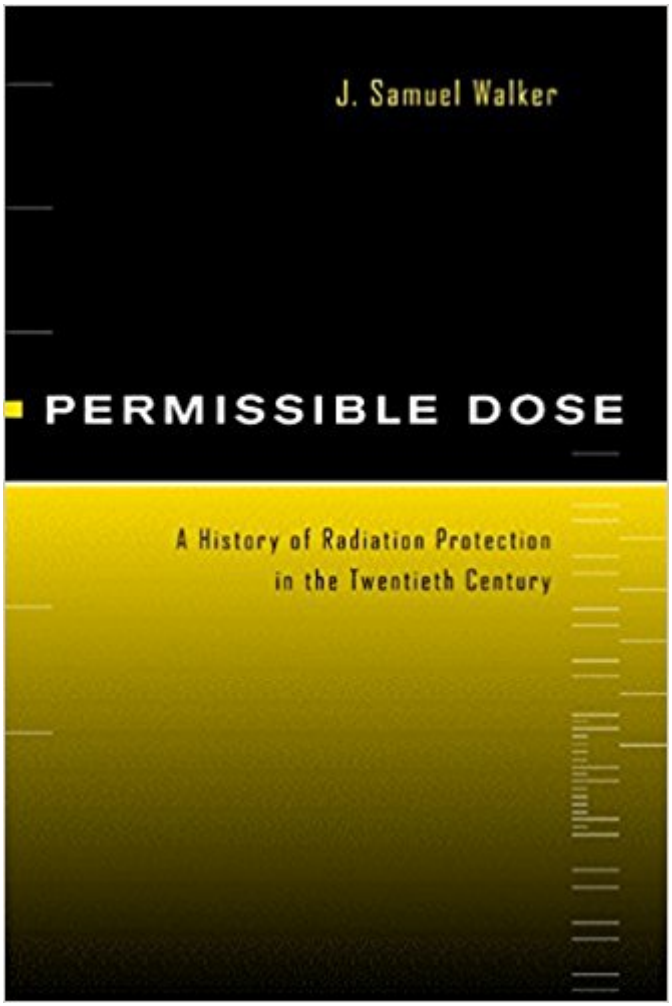
Permissible Dose: A History Of Radiation Protection In The Twentieth Century



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Synopsis

How much radiation is too much? J. Samuel Walker examines the evolution, over more than a hundred years, of radiation protection standards and efforts to ensure radiation safety for nuclear workers and for the general public. The risks of radiation—caused by fallout from nuclear bomb testing, exposure from medical or manufacturing procedures, effluents from nuclear power, or radioactivity from other sources—have aroused more sustained controversy and public fear than any other comparable industrial or environmental hazard. Walker clarifies the entire radiation debate, showing that permissible dose levels are a key to the principles and practices that have prevailed in the field of radiation protection since the 1930s, and to their highly charged political and scientific history as well.

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The importance of radiation to national security, energy policy, and environmental health has always made the determination of the effects of low-dose radiation on health a difficult problem. To establish regulations for the safe use of radiation, federal agencies had to balance the uncertain health consequences of radiation against the government's interest in nuclear weapons and nuclear power. Walker, the historian of the United States Nuclear Regulatory Commission (NRC), provides a fascinating account of these dilemmas. Using extensive archives of the Atomic Energy Commission (AEC), its successor, the NRC, and the Environmental Protection Agency (EPA), Walker traces the subtle interactions among the scientific establishment, businesses, the government, and the public that produced the federal regulatory policy. Walker begins by showing

how the excitement sparked by the discovery of radioactivity in the 1890s dimmed as researchers came to recognize the harmful effects of x-rays and radium. By 1934, the Advisory Committee on X-Ray and Radium Protection had proposed the first tentative guidelines about "tolerance doses" of radiation. The Manhattan Project introduced new forms of radiation and exposed unprecedented numbers of people to them. Established in 1946, the AEC regulated military, industrial, and medical uses of radiation. It established the upper limit of exposure -- the "maximum permissible dose" -- below which the risk was deemed acceptable. After providing this background information, Walker focuses on the period from 1950 to 1990. During this time, physicians and scientists struggled to establish consensus about the health effects of radiation. Studies of survivors of the bombing of Hiroshima, power-plant epidemiology, and the atomic-bomb testing program produced a considerable amount of data, but uncertainty remained about the dose-response effects of low levels of radiation. This uncertainty created an eager audience for scientists who were airing their disputes in publications ranging from Science to Esquire. The extreme positions articulated in these debates, rather than the efforts to establish consensus, often drove public and political responses. Each new crisis captured the public imagination and shifted the focus of the controversy. Concern about fallout from weapons testing in the 1950s and 1960s gave way to fears about effluents from the atomic-power industry in the 1970s. The disasters at Three Mile Island and Chernobyl brought these fears to life. In the 1990s, evidence of radon in homes and revelations of radiation experiments in humans during the Cold War provoked new anxieties. Moreover, the AEC lost credibility for attempting to balance public health against the needs of the weapons-testing program, and the NRC had to weigh fears of atomic energy against the energy crisis of the early 1970s. Regulatory efforts were frequently mired in bureaucratic infighting, especially given the overlapping jurisdictions of the NRC and EPA over environmental radiation. Walker shows how competing interests changed standards from the "maximum permissible dose" to "as low as practical," "as low as reasonably achievable," and "below regulatory concern." Each change generated protests from the public and from industries. Although Walker focuses on policy, his analysis raises many important issues for medicine and public health. Concern about threats to health, from x-ray burns and infertility to leukemia in workers exposed to radiation and inadvertent overdoses of radiation, motivated every effort at regulation and kept the health risks of radiation in the headlines. The mixture of hope and fear also generated embarrassing episodes for the medical profession. Physicians, for instance, resisted regulations requiring them to notify the NRC and affected patients about the misadministration of radioactive substances. Walker’s overly detailed analysis of federal regulation is the book’s only flaw. At times Permissible Dose becomes an exhaustive narrative of

committees, debates, and radiation policies that will interest few physicians outside the fields of radiology, radiation oncology, and environmental health. The book would appeal to a broader audience if its scope extended beyond these efforts to the impact of regulations on those who used and suffered from radiation. Strict control might have hindered the deployment of radiation technology (e.g., nuclear power and radiation medicine), but it also provided the aura of safety and legitimacy those forms of technology needed to survive. Regulatory agencies might have acted "responsibly and judiciously" to protect the public from harm, but workers, soldiers, and patients still suffered from exposure to radiation. Walker could have addressed these questions more thoroughly, but his analysis does succeed in raising crucial questions about regulatory policy. With regard to radiation, it is impossible to live in a risk-free society. Even the most judicious protections allow some people to be exposed to dangerous levels of radiation. Science, politics, and the fears of the public about the invisible effects of radiation interact to create the principles and practices of radiation safety. If looming fears of energy crises reinvigorate nuclear power, Walker's lessons may find wide application in the future. David S. Jones, M.A. Copyright Â© 2001 Massachusetts Medical Society. All rights reserved. The New England Journal of Medicine is a registered trademark of the MMS. (From the New England Journal of Medicine, May 31, 2001)

"A crisp and compelling assessment of the issues surrounding radiation protection. . . . Walker has a remarkable ability to make complicated issues clear and easy to understand. "—Allan M. Winkler, author of Life under a Cloud"This concise and readable guide to the historical development of radiation protection standards by the federal government is exceptionally even-handed in discussing often controversial issues."—Barton C. Hacker, author of Elements of Controversy

I have to start with the assumption that the reader has some interest in public health, regulation, environmentalism, health physics, or nuclear power since "Permissible Dose" is focused specifically on the evolution of radiation protection standards in the United States in the past century. This is not a book for a beginner looking to understand the biological effects of radiation.That said, "Permissible Dose" by J. Samuel Walker is a solid and readable history of a very specific topic. Well referenced, it is a surprisingly fast read, detailing the history of the Atomic Energy Commission (AEC) and it's successor, the Nuclear Regulatory Commission (NRC), in its role to protect the health and safety of workers and the public. Walker is the historian of the NRC and he does an admirable job presenting the conflicts within the agency and without. Although the book was written in 2000, most of the major controversies in radiation protection had been been settled by that time, save the

linear no-threshold theory which gets ample coverage in "Permissible Dose"To those familiar with regulation, it is not surprising to find most of the controversies in radiation protection are based more on intergovernmental turf battles and anti-nuclear politics rather than on evidence. Bitter feuds within the ICRP, for example, were over whether low-level radiation risk was "negligible or less-than-negligible".Important issues such as the dose received by temporary power plant workers are well represented in this history, showing that regulatory agencies were acutely aware of potential problems during the early growth period of nuclear power. Similarly, they were in conflict in the wake of the Three Mile Island accident, trying to balance the risk to the public from theoretical accidents with the risk to workers from actual exposure from increased maintenance and inspection activities.A very interesting conundrum is raised in the book regarding radiation protection for fertile and pregnant women. Due to rapid cell division an embryo or fetus is more susceptible to radiation damage than an adult, so there is a strong incentive to limit occupational radiation exposure for women who are or intend to become pregnant. On the other hand, limiting occupational exposure for women may keep them out of certain work, prevent promotion, or otherwise put a limit their ability to earn a living, a limit that is not applied to men. It took nearly three decades for regulators to sort out a fair balance between women's reproductive health and fair workplace treatment. In such cases, employers are left in a quandary, exposed to lawsuits and bad PR even if they try to do what they think is the right thing. This shows the importance of clear, well-conceived regulation. Walker does an admirable job showing the difficulties faced by regulators in the midst of technical and political controversy.Overall, despite the public furor, industrial complaints, and inter-agency battles, Walker illustrates how both the regulators and the regulated industries acted responsibly to protect workers and the public.Given the limited audience for Walker's book, I found "Permissible Dose" balanced, well-documented, and very readable. I feel he achieved his intent in this work. This is a solid history and I recommend it to anyone interested in the subject of radiation protection.

OK

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