



NUCLEAR CONTROL  
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August 28, 1996

The Honorable Shirley Ann Jackson  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Dear Chairman Jackson:

I am writing to you with regard to a recent letter report sent to you by the Advisory Committee on Nuclear Waste (ACNW) on the subject "Health Effects of Low Levels of Ionizing Radiation." The letter contains several inaccurate and potentially misleading statements that suggest that members of the Committee have been misinformed on this issue. I would like to take this opportunity to clarify these points.

The letter gives the impression that mounting scientific evidence indicates that low doses of radiation exposure are harmless or even beneficial, in contradiction to the generally accepted linear no threshold (LNT) theory. This is not correct, as recent reviews of the available evidence by several authoritative radiation protection organizations have made clear.

The ACNW letter refers to a 1994 report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and claims that it contains an "extensive appendix detailing cellular repair mechanisms ... that could contribute to an explanation of a [low dose] threshold or ... to an explanation of beneficial effects [hormesis]." However, the UNSCEAR appendix concludes that "extensive data from animal experiments and limited human data provide no evidence to support the view that the adaptive response in cells decreases the incidence of late effects such as cancer induction in humans after low doses."<sup>1</sup> The report merely recommends that further experimental studies be conducted.

The letter also implies that epidemiological studies of human populations exposed to low-level ionizing radiation clearly indicate health benefits as a result of exposure. It cites as a "notable example" a study of U.S. nuclear shipyard workers, which supposedly shows

<sup>1</sup> United Nations Scientific Committee On the Effects of Ionizing Radiation (UNSCEAR), *Sources and Effects of Ionizing Radiation (UNSCEAR 1994 Report to the General Assembly)*, United Nations Publications, New York, paragraph 33.

that nuclear workers had "lower mortality" and "no increase in malignancies" compared to unexposed workers. A closer look at the actual results of that study,<sup>2</sup> however, reveals two things: one, the ACNW letter partially misrepresents them; and two, they are inconclusive and possibly inconsistent.

The study examined one subgroup unexposed to occupational radiation and two exposed subgroups, one with total average exposures of more than 5 milliSievert (mSv) and the other with less than 5 mSv. The only statistically significant result was a lower mortality from all causes in the exposed groups, though results on cancer were inconclusive. With regard to leukemia, for example, the 95% confidence intervals are wide enough to accommodate either a linearly increasing or linearly decreasing variation of risk with dose. The result with respect to overall mortality is interesting, but could easily be explained by a version of the "healthy worker effect," such as the possibility that radiation workers received more intensive health screening than those not occupationally exposed to radiation. On the other hand, it is hard to interpret such a result in terms of a beneficial effect of ionizing radiation, since one would have to explain why radiation would have a protective effect on fatal illnesses not associated with genetic damage.

One striking result of the shipyard worker study, which the ACNW fails to mention, is the more than two-fold (but also not statistically significant) increase in mortality from mesothelioma among the subgroups exposed to radiation. One would not expect that mortality from mesothelioma, which is associated with asbestos exposure, should vary appreciably between groups exposed and unexposed to external radiation (assuming that there are no synergistic effects). This puzzling result is another indication that there are confounding variables in the study which are not understood. Thus to cite this study as a compelling basis for rejecting the LNT model is clearly unwarranted.

Again, what UNSCEAR has to say about this study and the others it evaluated is instructive: "the human epidemiological studies following exposures at doses and low dose rates ... do not at present provide evidence of an adaptive response ... this is not surprising in view of the low statistical power of these studies."<sup>3</sup>

The overall intent of the ACNW letter seems to be to exploit the uncertainties in current data to overturn the prudent and conservative application of the LNT model in radiation protection regulations. When the letter tries to deny this by implying that failure to account for this information in regulatory decision-making puts people at risk by withholding from them the positive health effects of chronic low-level radiation exposure, it clearly makes an absurd point. Even if one assumes that the informed judgment of authorities such as the International Commission on Radiological Protection (ICRP) is wrong and low-level radiation does have a protective effect, society can probably afford to

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<sup>2</sup> *Ibid.*, para. 243-245.

<sup>3</sup> *Ibid.*, para. 259.

forgo this modest benefit unless it can be conclusively demonstrated. In this matter, the burden of proof fully resides with the advocates of hormesis.

NRC should decline the curious recommendation of ACNW that the NRC-funded study of the LNT issue by the National Council on Radiation Protection and Measurements (NCRP) "... include scientists other than those who are 'recognized experts' with a reputation built on the LNT model." The implication here is that the LNT model predominates only because of a scientific orthodoxy that refuses to allow alternative views to be heard in order to protect their positions, an unfair and unsupportable allegation. It is more reasonable to assume that the scientific community at large has rejected the age-old notions of radiation thresholds and hormesis effects because the weight of the evidence clearly points in the other direction.

In summary, NRC should exercise great caution when considering whether to raise the profile of studies which appear largely to be motivated by a desire to discredit the LNT model. Such a move would likely lead to a serious erosion of the credibility of NRC in the eyes of the public, both nationally and internationally. I would greatly appreciate it if you would request that ACNW prepare a reply that responds to the technical points raised in this letter. Furthermore, in view of the far-reaching implications of this issue for the general public, I request that ACNW make available to the Public Document Room all the background material upon which its letter is based. I look forward to receiving a reply to these requests.

Sincerely yours,



Edwin S. Lyman, PhD  
Scientific Director

cc: Paul W. Pomeroy, Chairman, ACNW