letters

continued from page 15

I hope that this proposal will be fully discussed by the physics community, and that it will be adopted in time for the first evaluation to take place in 1985.

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1/83

Energy risk standards

In the PHYSICS TODAY debate on radioactive-waste disposal (December, page 37) R. O. Pohl observed that "the criterion for proper waste disposal must be a protection of future generations equal to that required for themselves by those who produce it." This seemingly reasonable criterion is unfortunately difficult to apply because of the disingenuousness of current attitudes toward protecting the public from ionizing radiation from different sources such as energy generation and energy conservation. It has become national policy to ignore the incremental public exposure to ionizing radiation attributable to energy conservation, while viewing the smaller plausible individual exposures from nuclear power plants, nuclear wastes, and even severe nuclear meltdowns, with great alarm.

R. L. Fleischer detailed the lack of attention to incremental public radiological exposures from energy conservation in his August guest comment (page 9). Since that time, both the magnitude of the problem and the determination of society to take no meaningful mitigative action have been further confirmed.[1] Pohl spoke of the radon decay product lung dose of 30 rem per year in a hypothetical future home embedded in an abandoned uranium tailing pile, but did not mention the 2- to 120-rems-per-year lung dose resulting from actually measured indoor radon levels reported at the 1982 APS Fall Meeting.[2] (It has now been repeatedly demonstrated that, while indoor radon levels depend on the highly variable radon source term, they can be further increased by energy-conserving home characteristics such as tightened construction and improperly designed heat reservoirs.) The bottom line is that incremental public exposures attributable to routine energy conservation measures in normal homes can far exceed standards for nuclear facilities such as waste repositories, and when the radon source term is high or when extensive reductions in air infiltration are made, the incremental doses can reach or exceed the levels associated with the Utah fallout litigation, or even from an uncontained nuclear meltdown.[3]

There is some possibility that utilities, fearing future litigation, will revise their present practice of encouraging and subsidizing potentially hazardous energy-conservation measures without warning the public and determining the existing radon levels. But it seems unlikely, and perhaps not even desirable, that indoor radon standards will every be based on an imputed incremental lifetime risk of less than about 1000 premature deaths per million people exposed. This, is my opinion, is far more meaningful indicator of the level of protection that the present generation is willing to provide for itself than the rhetoric of activist groups that demand levels of protection far beyond the capacity and willingness of society to provide on any uniform basis.

I hope that we will someday acknowledge the necessity of establishing tenable and consistent criteria for the protection of public health. Such criteria would remove the artificial barriers to providing the resources needed by this generation without doing injustice to generations of the future.

References

1. The Final Environmental Impact Statement of the New York State Energy Master Plan II (9 February 1982).
2. C. T. Hess "Radon concentration in Maine houses due to use of radon rich water," Bull. APS, October 1982, Abstract EC 3, page 877.
3. H. L. Beck, P. W. Krey "External radiation exposure of the population of Utah from Nevada Weapons Tests" Report of the APS study group on lightwater reactor safety, Rev. Mod. Phys. **47**, Suppl. 1, 1975, page S108.

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12/82

THE AUTHOR REPLIES: While I, together with many scientists[1], share the concern expressed by Henry Hurwitz about the lack of a public policy on indoor air pollution, I disagree with his belief that once such a policy has been formulated for indoor radon concentration, disposal criteria for uranium mill tailings will be relaxed. If, as has been found by C. T. Hess[2], houses built on normal ground (that is, not on an uranium ore body) and with normal building material can experience high radon concentrations, how much higher must these radon concentrations be if these houses were built on highly porous mill-tailings sand containing the very high radon concentrations characteristic for uranium ore? (Note that the radiation dose I had quoted in my article, 30 rem/year, which Hurwitz repeats in his letter, was a theoretical estimate.) Hess was presented evidence that the high radon concentrations in the houses he studied resulted from ground water transport. As I had pointed out in my article (December, page 43), no estimates appear to exist for the role ground water plays in carrying radioactivity from mill tailings into houses. Hess' work clearly demonstrates the urgent need that this question be studied.

References

1. See, for example, J. D. Spengler, Bull. Am. Phys. Soc. Ser. II, **27**, No. 8 (I), (1982) page 876.
2. Reference 4 in letter by Hurwitz.

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1/83

Critical review criticized

In his review of *The Cosmic Code* by H. R. Pagels (December, page 60), David Layzer strongly criticizes the book because of its "inaccuracies" and "lack of proper historical content." His criticism of the book consists totally in proving these two points. He fails to say anything positive about the book. In all fairness to the readers of PHYSICS TODAY, I believe an alternate viewpoint is needed.

David Layzer obviously understands the physics, philosophy and mathematics the book sets out to explain, but I wonder how well he understands the reader for whom the book is written. Trained physicists tend to forget the many struggles great scientists had in formulating their theories. Similar struggles are encountered by the intelligent man in grasping their ideas.

Some general notions initially must be developed in learning new theories. At that stage, everything is not clear; everything has not been spelled out. And, if too much time is spent on details (sometimes on mathematical precision), the ideas become obscured. The depicting of general ideas is the goal of my primary scientific explanation and this is what Heinz Pagels has sought to do in his book. He does it successfully.

But let us examine the "inaccuracies" that wrought the strong criticism of the book. They are underlined below, followed by David Layzer's comment and then by some refuting remarks.

▶ *Einstein's general theory of relativity is needed to resolve the twin paradox.* David Layzer states the general theory isn't needed. If the general theory isn't needed to resolve the twin paradox, then what theory is used during the accelerating and decelerating period of the twin? Einstein formulated the general theory to deal with accelerating systems. Is there a new way of dealing with this problem?

▶ *That gravity is the curvature of space and that the round-trip time for a light beam grazing the Sun is increased because "the beam has to bend slight-*