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Loaded Dice

Unfortunately, though doubtless inevitably, the question of the effects of radiation upon human health has become a subject for partisan political debate and has become linked with questions of national power and prestige. Thus, the great debate about the effects of radiation cannot readily be conducted in the dispassionate atmosphere of a scientific discussion. In this issue of *Science,* E. B. Lewis has taken an important step in bringing us the kind of information we need to conduct such a discussion.

But first a few reminders of the debate. Albert Schweitzer recently called for a halt to weapons testing and said that the tests were "creating danger for the human race." Willard F. Libby, commissioner of the U.S. Atomic Energy Commission, replied that the current radiation exposures from fallout are "very much smaller than those which would be required to produce observable effects in the population." Linus Pauling, professor of chemistry at California Institute of Technology, contended that at least 1000 persons would die as a result of the forthcoming British tests of thermonuclear weapons. In rebuttal, the Earl of Home, leader of the House of Lords, said, "We have no information that any deaths have been caused by the Russian and American explosions during 1956–1957."

The hazard—and no one denies that there is some hazard—comes not only from weapons testing. As Bentley Glass has recently emphasized, the hazard from nuclear reactors for power production is a greater potential threat than that from weapons testing. This threat will increase as a result of the greatly enlarged programs now planned. The United Kingdom is now planning to triple the program for power production within the next decade, and the Euratom nations have recently announced plans for a program to produce 15-million kilowatts of power by nuclear means. These developments will pose enormous difficulties in the safe disposal of radioactive wastes.

We urgently need to have quantitative information about the effect of radiation on human health. Much is already known about the effect of radiation upon health and longevity in the fruit fly and the mouse, but it is obviously unwise to rely on extrapolation of these data to man. Man is, as has often been remarked, a difficult experimental object. But much can be learned about his biological reactions by appropriate statistical and epidemiological studies.

E. B. Lewis (p. 965) shows that there is a direct linear relation between the dose of radiation and the occurrence of leukemia, a fatal disease characterized by increases in the numbers of white blood cells. The meaning of such findings is that any amount of radiation takes its toll of the population and any increase takes a greater toll.

Thanks to Lewis, it is now possible to calculate—within narrow limits—how many deaths from leukemia will result in any population from any increase in fallout or other source of radiation. And for the individual it is possible to calculate the probability of death from leukemia as a result of any particular dose of radiation. We are approaching the point at which it will be possible to make the phrase "calculated risk" for radiation mean something a good deal more precise than the "best guess."

It is apparent that the atomic dice are loaded. The percentages are against us and we ought not play unless we must to assure other victories.
—G. DUS.