waste, about which the above statement was made, one would have to eat 10 pounds.) That makes it less dangerous than many natural rocks (for example, cinnabar) and clearly less dangerous than pesticides and herbicides we keep in our homes and spread on the ground in farmland. Why don't they have to be isolated forever?

The principal hazard scenario for the waste is that it may be contacted by groundwater, leached into solution, and eventually get into food and water supplies; but this process includes many inherent time delays which essentially guarantee that nothing will get out for at least 500 years (*1*). Also, the waste accumulated by a million years of all-nuclear power in the United States would cause less than one fatality per year (*1*). Compare this with the 10,000 fatalities per year from sulfur dioxide due to coal burning.

Carter states in one place and implies throughout that these wastes have a great potential danger, but he gives no indication that it is orders of magnitude less than the potential danger from many other poisonous substances our society constantly deals with (*1*). Also the radioactivity in the waste is many orders of magnitude less than natural radioactivity in the earth at depths shallower than that of the waste burial.

Carter implies that the low-level transuranic waste is also a serious problem, but it is really trivial, and even the most haphazard deep burial would surely suffice. The British simply dump it in the ocean with no ill effects. Until recently, the United States handled it with haphazard shallow burial, and any reasonable analysis shows that there are no ill effects. For example, if all the transuranics thus buried were to leak out and get into rivers, or to become distributed through soil uniformly between the surface and their burial depth, not a single fatality would ever be expected to result.

The statement about friction between the Atomic Energy Commission (AEC) and the National Academy of Sciences (NAS) committee on radioactive waste disposal is somewhat misleading. With the exception of a brief misunderstanding in 1966, the relations between the NAS committee and AEC-ERDA (the Energy Research and Development Administration) have been most cordial for over 20 years. Several thousand copies of the so-called "suppressed" report were distributed by AEC.

The statement that "there have been no known human casualties" from leaking waste storage tanks at ERDA's Savannah River and Hanford installations implies that there may well be some. The leaking material is 40 feet below the surface, which gives a gamma-ray attenuation of something like 10^{-50} for the approximately 10^{24} gamma rays that have been emitted, so there is only 1 chance in 10^{26} that a single gamma ray has ever reached the surface. Compare this with the thousands of gamma rays with which natural radiation bombards each of us every second.

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Cancer Data

Most death certificates do not reflect incontrovertible evidence of cancer when compared to evidence established by autopsy, biopsy, or surgical resection of a malignant tumor as an index of cancer epidemiology (*1*). Reliance upon mortality figures based on death certificates in which autopsy results are reported in establishing the epidemiology of cancer raises serious questions about the validity of subsequent lengthy and costly studies on environmental carcinogens by the Environmental Protection Agency (EPA) (Editorial, 4 Feb., p. 443) or by others.

As a practicing general pathologist I am well acquainted with the low autopsy rate in most hospitals in the United States, and particularly in rural counties. Knowing the frequency with which occult cancers may be encountered at autopsy, the difficulty in deciding whether cancer is the cause of, or even related to, death, and the casual way in which death certificates are filled out by many physicians whether or not an autopsy has been performed adds further skepticism about the epidemiologic value of cancer mortality figures based on death certificate data.

Far more reliable, albeit perhaps a harder initial task, would be a random sampling in every possible county of autopsy and surgical pathology records over a specific time period. Virtually all biopsied, resected, and occult cancers would be found, as well as the patient's age at the time cancer is recognized. Few cancers go unrecognized before death even though they may not cause death. Further, many cancers are successfully treated or recur after a latent period long enough so that death from other

causes may supervene (for example, an elderly woman who has had a "successful" mastectomy, dies of cerebrovascular hemorrhage 3 years later, before clinical evidence of recurrence of the breast cancer has manifested itself).

The College of American Pathologists, in its Inspection and Accreditation Program, requires a cross-indexed surgical pathology and autopsy file of all diseases diagnosed, including cancer. Thus a readily available source of information can be easily tapped for a more comprehensive and reliable index of the incidence of cancer. When seeking to find the relationship of the environment to cancer, what is important is not cancer *mortality* but cancer *incidence*.

With cancer incidence data, EPA could plan a productive program with relevance. Without them, much money and time will be wasted and, worse, invalid conclusions might be reached.

Every county in the country might not be covered by this alternative approach to data gathering, but the data generated would provide opportunities to plan investigations on possible environmental carcinogens that would enthuse even the most pessimistic grantsperson in academia, or in state or federal agencies.

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Nuclear Arsenals

Kearny and Wigner, in their letter concerning Soviet civil defense (21 Jan., p. 243), express alarm at the possibility of a Soviet "plan for evacuation" followed by nuclear blackmail threats. They state that, after such an evacuation, "we could destroy only a small fraction of [their population]" and that Wigner has estimated such Soviet losses to be between 2.75 and 4.5 percent.

They do not point out that these are immediate and short-term losses only. Just as in World War II, the majority of the losses would probably be long-term, resulting from lack of food, shelter, and medical care. There are over 30,000 warheads in the U.S. nuclear arsenal—certainly enough to destroy nearly all the housing, power plants, fuel refineries, storage depots, major factories, and transportation systems in the Soviet Union. Fuel, machinery, and fertilizer would not be available for modern agriculture, nor would there be means of transportation to distribute the food. Only a small fraction of the present population would be able to "live off the land" even in warm months. History has shown that modern man is incapable of surviving the Russian winter without housing, heavy clothing, food, and space heating.

Americans and Russians to whom I have talked about nuclear war have the concept of being "bombed into the Stone Age." Whether they die within 10 seconds or 10 months is not significant. These people find the enormous nuclear arsenals of the United States and the Soviet Union more than an adequate deterrent under any circumstances. I find it inconceivable that the leaders of the Soviet Union would allow their country to be "bombed into the Stone Age," even if the population is evacuated.

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Rocky Mountain Spotted Fever: Occurrence in Massachusetts

McEnroe's statement (Technical Comments, 4 Feb., p. 506) "Preliminary screening of *D[ermacentor] variabilis* from inland Massachusetts has indicated the presence of RMSF [Rocky Mountain spotted fever] rickettsiae . . ." needs clarification. To date, none of the rickettsial strains isolated by us from Massachusetts populations of *D. variabilis* ticks are referable to *Rickettsia rickettsii*, the causal agent of RMSF. Instead, all share a major antigenic component with *R. montana* (*1*). The latter, a distinct member of the spotted fever group, is characteristically an agent of low virulence for laboratory animals and of questionable clinical significance. Obviously, *R. rickettsii* does exist in Massachusetts (*2*). However, in our experience, its frequency of occurrence in *D. variabilis* is lower than that for the milder strains of the RMSF group.

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