LETTERS

Equivalent Megatons

R. Jeffrey Smith's article "They have more EMT than we" (News and Comment, 2 Apr., p. 32) is pertinent when one considers President Reagan's stated concerns with respect to the alleged Soviet nuclear superiority. I certainly agree that nuclear superiority lost virtually all significance many years ago, when both superpowers passed the 200 to 400 equivalent megaton (EMT) level.

However, Smith's estimate of our equivalent megatonnage appears low by a factor of 6. By my estimation, we have more than 6000 EMT, compared to Smith's 1000.

Even 1000 EMT constitute overwhelming deterrence, but an examination of our nuclear arsenal shows that each leg of our strategic triad by itself could deter Soviet attack. In particular, the submarine leg has more than 800 EMT and will grow larger as the Trident submarines are added. Thus the invulnerable, highly mobile submarine force could provide all of our deterrence capability. Sole reliance on our submarine-launched ballistic missiles would also remove the nuclear military targets from the U.S. landmass.

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A 1979 report by the Office of Technology Assessment, relying on a 1978 study by the Congressional Budget Office, estimates that the United States has 4894 "equivalent megatons" in its present arsenal. Submarines *alone* possess roughly 1000 EMT, the bulk of which would survive a preemptive Soviet attack. Even without the MX and the B-1, the United States has more than enough EMT to destroy the Soviet Union in a retaliatory strike, by the standard set by the Pentagon itself.—R. JEFFREY SMITH

Reactor Decommissioning

In his article "A long-term problem for the nuclear industry" (News and Comment, 22 Jan., p. 376), Colin Norman identifies but ignores the most likely and most promising option for reactor decommissioning: safe storage. This is perhaps understandable when one considers that reactor decommissioning is today pertinent primarily to small, isolated reactors that represent early federal government initiative: Elk River, Shippingport, Big Rock Point, and Yankee Rowe. These federal demonstrations are not viable in the long run. But they also do not typify the nuclear utility industry. For the most part, the utility industry has established nuclear operations at robust sites that are unlikely to be decommissioned in the foreseeable future. How long these sites will be needed by society is unknown, but certainly it is for several generations and almost certainly it is for as long as U.S. society requires thermally generated electricity. More than three-fourths of the nuclear sites being established by the utilities are scheduled for more than one reactor (*1*). When a reactor is no longer serviceable, its replacement is likely to be located at the same site. In these circumstances, "safe storage and surveillance" of decommissioned reactors is a small additional burden to the utilities' main purpose of power generation at that site. Indeed, the decommissioned structures are likely to be used as on-site repositories ready-made for low-level radioactive wastes produced during operation of the replacement reactor.

"Safe storage" on an operating site *may* not be the final solution for decommissioning, but for the next several decades it is clearly preferable to a mindless policy of early dismantlement and transport of the unneeded facility when it is still quite radioactive. The cost comparison reported by Norman seemingly to favor early dismantlement is misleading because the major cost for deferred dismantlement occurs 30 years in the future, and therefore its present worth is much smaller than he implies.

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Reference

1. C. C. Burwell, M. J. Ohanian, A. M. Weinberg, *Science* **204**, 1043 (1979).

Nonrandom Bubbles

M. Mitchell Waldrop must not have spent much time in well-lit pubs. For if he had he would not have said about Gott's bubbles (Research News, 26 Feb., p. 1082) that "[they] form just like bubbles in a glass of beer—randomly." Bubbles do not form randomly in beer; they emanate from a small number of definite nucleation sites: cracks in the glass and bits of foreign matter. Moreover, strings of bubbles in which the bubble spacing increases regularly with height above these nucleation sites are easily observed in any glass of light (colored), gaseous American beer. For discussions of the finer points of the physics of bubbles in beer I refer Waldrop to articles by Bohren and Brown (*1*) and by Walker (*2*).

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References and Notes

1. C. F. Bohren and G. M. Brown, *Weatherwise* **34**, 221 (1981).
2. J. Walker, *Sci. Am.* **245**, 172 (December 1981).

Animals in the Laboratory

Constance Holden, in her article "New focus on replacing animals in the lab" (News and Comment, 1 Jan., p. 35), states "The fact is . . . a massive shift away from the use of animals in research will not be possible in the foreseeable future. . . . Far more knowledge gained from basic research will be required before any quantum gains can be made in replacing animals." This perspective, apparently endorsed by the House Science and Technology Committee, is inconsistent with the trend in animal use over the past decade. The specter painted by animal rights activists of an inexorable increase in the numbers of animals sacrificed at the altar of science is simply false.

The Institute of Laboratory Animal Resources of the National Academy of Sciences reported (*1*) a 35 percent decline in the number of laboratory animals acquired by U.S. research organizations between 1968 and 1978. If one considers the species most frequently cited by animal welfare organizations as objects of ethical concern, one finds that the use of cats and dogs decreased by 32 percent and the use of nonhuman primates by 47 percent. The U.S. Department of Commerce and the Department of the Interior reported (*2*) a spectacular 79 percent decrease in the number of primates imported between 1969 and 1980. Are these not massive reductions? Are they not quantum gains? Is there not every reason to expect that they will continue?

According to present projections (*3*), the proportion of scientifically approved competing projects that the National Institutes of Health are able to fund will