training of research personnel and students.

The active AUI Board of Trustees, which oversees AUI and the laboratory, has been drawn almost exclusively from university scientists and administrators. At present, the board includes two Nobel Laureates, four National Medal of Science awardees, and many scientists who have received prestigious awards for their research. The members of this distinguished group have given freely of their time and energy because of the high quality of the scientific work being carried out at the laboratory. Also, AUI reaches out to a broad community of active scientists to review (on an annual basis) the quality and progress of its programs at BNL.

BNL, of all the multidisciplinary national laboratories funded by the U.S. Department of Energy, has an unmatched history of interactions with, and service to, the university research community. At present there are more than 4250 research guest users and collaborators associated with the laboratory.

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Nuclear Waste Storage at Yucca Mountain

Regarding the News & Comment article "Blowup at Yucca Mountain" by Gary Taubes (30 June, p. 1836), geologic storage originally was conceived for the storage of wastes from the fission process, not for the fissile material itself. In most of the world this is still the envisaged goal for geologic storage. However, in the 1970s, the United States decided to put not just the remnants of the fission process underground but also the spent fuel, which contained plutonium. Geologic storage also is being considered for the permanent disposition of large amounts of highly enriched spent uranium fuel from research reactors and national defense reactors. More recently, the Department of Energy (DOE) has been considering geologic storage of the many tons of weapons plutonium from the weapons stockpile reductions as well. Our paper, discussed in Taubes's article, does not attack the geologic storage of all types of nuclear waste at a site such as Yucca Mountain; it addresses the criticality safety of storing fissile material that originally was not intended to be present.

Upon finishing the first draft of our paper, we felt the need for external feedback. After five external copies had been sent out and the report had been circulated internally and at high DOE levels in early December 1994, concern arose about the political sensitivity of the work, and an internal review was organized at Los Alamos. We authors were not allowed to participate in these proceedings. We were only to be present at a final discussion, where we could respond if called upon. We prepared a 27-page point-by-point rebuttal to the review, but for the most part it was ignored.

The usual scientific process of presentation at technical meetings and refereed journal publication has gone forward in spite of this episode. Our paper has been accepted for publication by *Science and Global Security*. We were satisfied with its reception at a special plenary session of the annual summer meeting of the American Nuclear Society arranged for its exposition and criticism.

As for James Mercer-Smith's taking offense at the idea of nature being able to make a bomb, we note that nature has never had plutonium or highly enriched uranium in 1000-ton quantities at one site to work with, at least not for the past several billion years. The first step in nature's process would be dispersion from the initial emplacement site after the containment is breached. It seems to us that repository designers are acknowledging the possibility of dispersion by including heavy metallic containment around the waste and by debating its thickness in the context of required containment time. Containment breaching followed by dispersion is one of nature's inevitable steps, which Art Forster referred to as "miraculous."

The article includes a statement by National Academy of Sciences staffer Matthew Bunn implying that the validity of our paper probably cannot be proved one way or the other, but that the paper nevertheless does political damage. We believe that the possibility of positive feedback for wet and dry systems is readily amenable to analysis and definitive conclusions and that the yield from such systems also can be calculated to at least a factor of 10 and probably a factor of 3. If consensus cannot be reached by analysis, experiments to resolve the issues also are possible.

The position of Los Alamos and Livermore that the study of low-probability underground supercriticality incidents with substantial yield is irrelevant and unimportant contradicts the process of establishing standard practice criteria for dealing with low-probability accidents involving nuclear material in other contexts. An important, well-established criticality requirement for nuclear weapons design is that of one-point safety. This means that if an implosion were to be initiated at a single point rather than uniformly around the fissile material, the nuclear yield would be negligible. For nuclear reactors, we have the requirements of negative reactivity temperature coefficient and negative reactivity coolant void coefficient. All modern reactor designs and most operating reactors adhere to these criteria. An exception is the Chernobyl reactor design, for which the negative coolant void coefficient criterion was ignored. For geologic storage, we have no such criticality guidelines. Because our paper identifies criticality dangers not recognized before, such as dry and wet positive reactivity underground, and points out the substantial nuclear yield possible, we believe it should become part of the basis for establishing the criticality criteria which would be required for geologic storage of fissile material.

At present, the only criteria are that the k_{eff} [effective operating constant (*1*)] at emplacement must be held below 0.95 (compared with 1.0 for an operating reactor) and that there need be no concern for criticality beyond 10,000 years. We expect that (i) the k_{eff} criterion will be lowered considerably, (ii) that the possibility of positive feedback will not be acceptable, (iii) that the 10,000-year limit will be removed, and (iv) that the addition of neutron poisons to control criticality will only be employed with caution because of the possibility of separation of poison and fissile material as different chemical species.

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Notes

1. The effective operating constant (k_{eff}) is 1 for a continuous chain reaction, as in an operating reactor. For k_{eff} less than 1, the chain reaction decays away and is not sustained. For k_{eff} = 0.95, about 20 fissions occur before the chain terminates.

Malathion and Alternatives

The opening paragraph of the article "New compounds make light of insects" by Robert F. Service (Research News, 12 May, p. 806) describes spraying in Califor-