Letters

Gas Reactors

I have read Eliot Marshall's article "The gas reactor makes a comeback" (News and Comment, 18 May, p. 699) with obvious interest. For the most part, the article provides a balanced view of the high-temperature gas-cooled reactor (HTGR) program and does acknowledge some of the inherent safety and performance features of the system. I am concerned, however, that in other respects the article may be misleading to readers of *Science* who are not intimately involved with the nuclear industry.

Marshall implies that several members of Congress support the HTGR program mainly on the basis of benefits to their constituencies and industry campaign contributions. This is a poor assumption. These congressmen are most knowledgeable in the field of nuclear energy, and the HTGR program represents an insignificant fraction of the work under way at the national laboratories in their home states.

Marshall also implies that water reactions with graphite are a safety problem for HTGR's that have not been thoroughly scrutinized. He does not mention the obvious fact that accidents of this type have been thoroughly considered by the appropriate licensing authorities for the HTGR's in operation in both the United States and the Federal Republic of Germany. Technically, readers should be aware that the water-gas reaction proceeds at an extremely slow rate at reactor operating temperatures, that the reaction is endothermic, and that such a condition would have to continue for extended periods of time without detection before there would be any meaningful physical damage. Considerable water ingress has occurred at both the Fort St. Vrain reactor in Colorado and the German AVR reactor without damage to the plants, including the graphite core structure and fuel.

Second, Marshall suggests that "air might leak into the [helium-cooled] core and set the hot graphite on fire." No significant amount of air can enter the core unless there are large paths for entry both above and below the core (the equivalent of losing both the top and bottom head of a light water reactor pressure vessel). Even in that incredible case, the amount of air available for combustion is limited to the air in the confinement structure around the vessel. This would limit the burning to less than 1/2 percent of the graphite present and would not lead to a release of fission products from the ceramic coated fuel.

To support the concern about core burning, Marshall attempts to link the fire at the Windscale reactor with an HTGR fire. This is a poorly drawn analogy. The Windscale reactor was an open cycle reactor in which an air coolant was in direct contact with the welded aluminum cans containing the uranium, which was in metallic form. During a periodic heatup (to relieve Wigner energy) the weld on an aluminum cartridge failed, leading to direct air-uranium contact and burning of uranium metal, which further elevated fuel temperatures and created a mechanism for fission product release. As indicated, in no respects are the Windscale and HTGR similar (open cycle air-cooled versus closed cycle helium-cooled, metal-clad uranium fuel versus ceramic-clad oxide fuel, periodic Wigner energy release versus continuous annealing), and no rational parallel can be drawn between the Windscale affair and the HTGR.

Marshall states that "the British likewise abandoned the gas-cooled reactor." The inquiry in the United Kingdom that will determine whether the pressurized water reactor is to be an *option* is expected to continue well into 1985. The outcome of the inquiry is not certain. This is supported by the recent report on energy strategy issued by the House of Lords select committee (*1*) and statements by the South of Scotland Electricity Board (*2*).

HAROLD M. AGNEW
GA Technologies, Inc.,
San Diego, California 92138
THOMAS A. JOHNSTON
Power Reactor Program Development,
GA Technologies, Inc.,
San Diego

References

1. House of Lords Select Committee on the European Communities, *European Community Energy Strategy and Objectives* (Her Majesty's Stationery Office, London, May 1984).
2. D. Fishlock, *Energy Daily*, 4 June 1984, p. 5.

Marshall's interesting article of 18 May states, "And since the gas-cooled reactor does not require water, it certainly would not have to be located near a river, as existing military reactors are." This is a commonly held view, but it is wrong.

One does not take water from a river and run it through a reactor. The coolant in a reactor's primary system—helium in one case and water in the other—is charged once and then retained in the system, so there is no more need to be near a river for water than to be near a gas well for helium (which, by the way, is in much more limited supply than is water). Both gas-cooled reactors and pressurized water reactors have water and steam in the system which drives the steam turbine to generate electricity; even General Atomic does not propose a gas turbine. The river is merely a place to dump waste heat for both reactor types. Alternatively, both reactor types can employ wet- or dry-cooling towers as waste heat dumps, the former having the disadvantage of requiring water makeup (for both gas-cooled and pressurized water reactors), the latter having the disadvantage of lower thermal efficiency (for both reactor types).

As a consequence, gas-cooled reactors have no inherent advantage over pressurized water reactors in a desert environment, and the two must be compared, as they are elsewhere, on the basis of cost, licensability, and demonstrated performance.

Another, more minor point: The article refers to "manufacturers [who] have gone to Congress and lobbied for federal help" and to "workers' exposure at . . . HTGR's in the United States." In fact, there has been only one manufacturer, and there is only one HTGR in the United States.

All in all, however, the article was interesting, informative, and well balanced.

C. A. ANDERSON, JR.
Reactor Projects, Advanced Energy Systems Division, Advanced Power Systems Divisions,
Westinghouse Electric Corporation,
Madison, Pennsylvania 15663-0158

Agnew and Johnston are undoubtedly right that HTGR's are safer than conventional reactors. Nevertheless, a RAND Corporation study in 1980 (*1*) cited both

the steam-leak and air-leak accidents as possibilities in the HTGR, calling the latter "less likely" but "more serious." The RAND study also pointed out, quoting General Atomic, that the company's safety data were " 'based on a best estimate or more realistic evaluation of fission product inventories,' etc., use 'median values and statistical uncertainties,' and 'lead to a more realistic consequence assessment' than the licensing approach." The RAND paper concluded, in other words, that the Nuclear Regulatory Commission would be more conservative in estimating accident risks.

ELIOT MARSHALL

References

1. K. A. Solomon and S. L. Salem, *The High Temperature Gas-Cooled Reactor: Overview of Safety Issues* (prepared for the Gas Cooled Reactor Associates by the RAND Corporation, Santa Monica, Calif., 1980).

Biological Survey

Michael Kosztarab's timely editorial (3 Feb., p. 443) focuses on the pressing need for critical basic information about the U.S. biota. He does not, however, discuss the history of this effort. Next year marks a century of continuous support of biological survey activities by the U.S. government that began in 1885 with the formation of the Economic Ornithology branch in the Division of Entomology, U.S. Department of Agriculture (*1*). Expanded 1 year later as the Division of Economic Ornithology and Mammalogy with the munificent appropriation of $10,000 "for the promotion of economic ornithology and mammalogy; an investigation of the food habits, distribution, and migrations of North American birds and mammals in relation to agriculture, horticulture, and forestry" (*2*), this organization began the formidable task of systematically gathering specimens of the vertebrate fauna of North America. Personnel from the divisions of entomology and botany of the Department of Agriculture accompanied some of the early expeditions.

In 1896, this organization became known as the Division of Biological Survey and in 1905 became a full bureau in the Department of Agriculture. Transferred to the Department of the Interior in 1939, the Bureau of Biological Survey was joined with the Bureau of Fisheries in 1940 to form the Fish and Wildlife Service.

As Kosztarab mentions, the Fish and Wildlife Service publishes the *North American Fauna*, which was established in 1889 as an outlet for the results of work done by the Division of Economic Ornithology and Mammalogy "of use mainly to those engaged in scientific research . . . " (*3*). In 1889 also began the formal relationship between the division and the U.S. National Museum (now the National Museum of Natural History), which continues to this day. Under an agreement between the Department of Agriculture and the National Museum, the collections resulting from the biological surveys were turned over to the National Museum, but were retained under the exclusive control of the survey personnel and kept separate from the other National Museum collections.

In 1910, with completion of the Smithsonian's Natural History Building, survey personnel working with the collections were brought together under one roof. The major museum-oriented work involved research on mammal and bird specimens, which mainly resulted from biological investigations in the United States, Canada, Mexico, Guatemala, Panama, and the West Indies. The impracticality of maintaining research collections separate from those of the National Museum led to the merger of the bird collections in 1945 and the mammal collections in 1953. Up to that time, specimens originating from the Fish and Wildlife Service or its predecessor agencies bore labels identifying them as Biological Survey specimens; that practice continues today.

The Fish and Wildlife Service unit still stationed in the National Museum is the Museum Section of the Denver Wildlife Research Center. The Museum Section has borne several names over the years as wildlife-related activities have proliferated in the old Division of Biological Survey. These include the Division of Biological Investigations, the Section of Wildlife Surveys, the Section of Biological Surveys, the Bird and Mammal Laboratory, and finally the National Fish and Wildlife Laboratory, which merged with the Denver Wildlife Research Center in 1981. Many of the management activities of the Fish and Wildlife Service originated as research functions within the museum-based unit. As the management importance of these functions became established, these activities took on separate identity and were moved out of the museum.

The program proposed by Kosztarab redescribes the focus developed within the first few years of survey activities, which led to adoption of the name Biological Survey in 1896. That first decade also saw a shift from the initial economic emphasis to the scientific. Yet, as was argued with limited success before congressional critics early in this century (*4*), and as Kosztarab makes clear, detailed scientific information is essential for practical informed decisions concerning man's impact on natural habitats. We know considerably more about terrestrial vertebrates than about invertebrates and plants; however, much remains to be done.

A. L. GARDNER

Museum Section, Denver Wildlife Research Center, Fish and Wildlife Service, National Museum of Natural History, Washington, D.C. 20560

References

1. C. V. Riley, *U.S. Dep. Agric., Div. Ent., Circ. 18* (1885); R. D. Fisher, *Assoc. Syst. Coll.* **10**, 29 (1982).
2. C. H. Merriam, *Annu. Rep. Dep. Agric. 1886*, 227 (1887).
3. ———, *North Am. Fauna* **1**, vii (1889).
4. J. Cameron, *The Bureau of Biological Survey* (Johns Hopkins Univ. Press, Baltimore, Md., 1929), pp. 28–42.

Gardner's letter provides valuable information about the history of limited biological surveys in the United States and gives further evidence of the need to continue and broaden the efforts initiated by the U.S. government in 1885. The work of a National Biological Survey should focus on certain urgent needs of this nation: to assess the status of our biota, to establish baseline information for future comparisons, and to monitor future changes. Such a data base is essential for documenting the effects on our animal and plant communities of such things as changing land use, acid rain, changes in the ozone layer, and pollutants generated by man.

We must inventory and monitor our natural resources now, before more habitats are irreversibly altered or lost. The proposed survey project can serve as catalyst for such an important effort.

It is clear that the many administrative changes made in connection with federal survey efforts have hindered their work. With a new start and the aid of a legislative bill authorizing the establishment of a National Biological Survey, this nation can succeed in filling the existing gaps in our knowledge of the biota.

MICHAEL KOSZTARAB

Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg 24061

Erratum: The price of $55 given for *Island Biogeography in the Sea of Cortéz* (T. J. Case and M. L. Cody, Eds.) in the review of the book that appeared in the issue of 18 May, p. 736, and in some announcements distributed by the publisher, is incorrect. The price of the book is $45.