LETTERS

Browsing

Methods for "disposing of excess military plutonium" are advocated. A writer from Chile suggests how his nation might better "channel the scientific creativity of talented scientists." Researchers find that "weather and climate" are important forces "driving" plant disease. Interactions "between carbon dioxide and nitrogen enrichment" in grassland ecosystems are discussed. And are "wayward" grizzlies facing a threat from politics?

RALPH REINHOLD/ANIMALS ANIMALS

Disposing of Plutonium

Wolfgang K. H. Panofsky has recently written (Letters, 3 Jan., p. 11) in support of the decision by the Department of Energy (DOE) to "pursue two technologies for disposing of excess military plutonium." He describes the technologies as (i) the "throw away" vitrification into glass logs option, and (ii) the "burn-up" in a mixed oxide fuel option. This does not seem to be an accurate or complete description of the Administration's two options. It is correct that one option is to burn up the surplus plutonium as mixed oxide fuel, with subsequent disposal of the spent fuel in a geologic repository. However, the other option is not restricted to vitrification, but includes immobilization of plutonium in "glass or ceramic material" (*1*).

The "ceramic" option includes the possibility of developing durable, crystalline materials for disposing of dangerous, long-lived, fissile materials, particularly if DOE decides to immobilize all of the surplus plutonium. The National Research Council's committee (chaired by Panofsky) which assessed the options for disposing of plutonium gave the ceramic option only cursory consideration (*2*). However, research on ceramics as waste forms already has a long history (*3*). The disposal of fissile materials with long half-lives may well benefit from strategies that capitalize on the benefits of using highly durable materials that can retain both the fissile nuclides and the required neutron absorbers for hundreds of millions of years (*4*).

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2. *Management and Disposition of Excess Weapons Plutonium* (National Academy Press, Washington, DC, 1994).
3. W. Lutze and R. C. Ewing, Eds., *Radioactive Waste Forms for the Future* (North-Holland, Amsterdam, 1988); R. C. Ewing, W. Lutze, W. J. Weber, *J. Mater. Res.* **10**, 243 (1995); R. C. Ewing, W. J. Weber, W. Lutze, in *Disposal of Weapons Plutonium*, E. Merz and C. E. Walter, Eds. (Kluwer Academic, Dordrecht, Netherlands, 1996), pp. 65–83; E. R. Vance *et al.*, in *Scientific Basis for Nuclear Waste Management XIX*, W. M. Murphy and D. A. Knecht, Eds. (Materials Research Society, Pittsburgh, PA, 1996), pp. 41–47.
4. W. J. Weber, R. C. Ewing, W. Lutze, in *Scientific Basis for Nuclear Waste Management XIX*, W. M. Murphy and D. A. Knecht, Eds. (Materials Research Society, Pittsburgh, PA, 1996), pp. 25–32.

I agree with Panofsky's logic with regard to the dual approach of DOE in disposing of excess weapons plutonium. He strongly counsels against reprocessing spent fuel for recycling plutonium to recover its energy, which is in accordance with the Nonproliferation Act of 1976. However, this does not prevent Great Britain, France, or Japan from reprocessing spent fuel for recovery and use of the plutonium in their own or other foreign reactors. The ban against reprocessing spent fuel in the United States has outlived its usefulness. As long as there is no production of separated plutonium, there should be no difference between using weapons plutonium

or using civilian reactor plutonium as fuel. A processing scheme that keeps the uranium and plutonium together while removing fission products and making up the required fissile fuel with weapons plutonium or enriched uranium or building in plutonium in spent fuel with accelerator-generated spallation neutrons (*1*) would provide a safe and safeguarded nuclear fuel cycle.

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Science in Chile

Science is essential for developing countries. It contributes to their cultural growth and quality of life and permits the transfer of creative applications of knowledge to solve major problems that prevent the global development of these countries. Indicators reveal that Chile is in a leading position in terms of scientific productivity per capita in Latin America (Science in Latin America, 10 Feb. 1995, p. 819). Part of this growth can be explained by an 8.7% increase in gross industrial product invested in science and the effects of the National Fund for Scientific and Technological Development established in the early 1980s by the National Commission for Scientific and Technological Research (CONICYT). This system guarantees the maintenance of basic research activity. However, several outstanding laboratories have research programs that generate most of the Chilean research contribution recognized worldwide, and they require additional stimulus if they are to have any impact on Chile's development.

The main problem has been how to channel the scientific creativity of talented scientists so they can express their full potential. A ray of hope emerged 2 years ago when CONICYT proposed a plan to add renewed energy to the gradually growing process to open up possibilities for a more significant participation of Chilean scientists in the world. Unfortunately, this plan did not succeed because the interests of particular groups prevailed. The idea of stimulating the strongest research teams was transformed into a "presidential chair" system emanating from the presidential office instead of CONICYT.

CONICYT is the only national agency for science in Chile, with a structure and organization that have led to a long-standing record of peer-reviewing proposals and tracking investigators' accomplishments. But with decisions in the hands of a study section made up of members of a presidential advisory committee (with the help of a panel of one representative foreign scientist per area), the "presidential chairs" in most cases were not awarded to Chile's most talented scientists.

An obvious strategy to foster scientific growth in countries like Chile is to stimulate those groups of investigators and laboratories that have demonstrated that they are highly competitive in their fields and that they have surmounted the difficulties of carrying out science in Latin America. The "presidential chairs" system, however, is an example of how a significant investment in science can fail to reach its objective when inappropriate evaluation systems are in place and scientific quality is not considered a major goal.

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