concrete to be buried on site. But it would also greatly increase the total volume of high-level waste in storage, perhaps by a factor of 30. It would require a much bigger process operation of no less complexity. The final product—powder—would be more dangerous than glass or concrete, du Pont researchers say, because it could be widely dispersed from a broken canister and inhaled.

Glass is versatile and well understood, and in South Carolina it seems to have beat out competing waste forms, including the less studied but tougher ceramics. The big unanswered questions are where to put it, and how long it can be expected to stay intact.

The radioisotopes of concern at Savannah River are strontium-90 and cesium-137, with half-lives of 28 and 30 years, respectively. Each canister will contain strontium (44,000 curies) and cesium (41,000 curies), which will make up 40% of the radioactive material at the outset. Other isotopes will be present, including a small amount of plutonium. A canister will emit around 6300 rads per hour at the surface, enough to give someone embracing it a lethal (LD_{50}) dose in 5 minutes. Obviously, these packages will have to be handled with care. Du Pont officials say the plant will store the first 5 years' output (2300 canisters) in a building on site. Because of uncertainty about the deep repository, plans are being made for two additional buildings, so that the Savannah River Plant could retain this deadly cargo indefinitely. That amounts to a promise to police the area indefinitely.

Preliminary lab tests indicate that the glass can be safely stored in any of the three types of western geologic formation under consideration. According to N. E. Bibler of du Pont, radioactive glass exposed to water and stress appears to meet the leaching requirements set by the Nuclear Regulatory Commission, with a good margin of safety. But more research is needed on the effects of iron in repository water and the ways radiation may affect leaching by various types of ground water in each formation.

In contrast to the well-studied problems of glass, relatively little is known about radioactive concrete. Du Pont officials see "saltstone" (concrete made from radioactive salt solution) as a logistical, and not a safety, problem. There has been only one outside regulatory review of this massive addition to the waste burial complex at Savannah River. It came when du Pont obtained an ordinary solid waste permit (number 217) from the state of South Carolina in October. The plant escaped federal environmental review because concrete, as a solid, does not fit the legal terms of "hazardous waste." For this reason, du Pont does not plan to follow the federal rules for burial of hazardous waste, which require that the burial pit be lined with a double layer of impermeable plastic and surrounded with special monitoring wells prescribed by the Environmental Protection Agency.

The concrete will contain 75 nanocuries of radioactive material per gram, including small quantities of such long-lived isotopes as iodine-129 and technetium-99. Although du Pont originally had planned to bury the concrete, this idea proved unworkable because of the probable effects of chemical leaching by water. The new plan calls for the concrete to be poured above ground in blocks 25 feet thick and 100 feet wide by 600 feet long. One block will be set each year for 15 years. Wells will be installed at the perimeter of the concrete field to monitor chemical and radiation leakage. Du Pont intends to have ground water around the beds meet drinking water standards. The Environmental Protection Agency and state officials have given the nod to these plans, conceding that they have no reason to doubt du Pont's promises and little legal basis to interfere even if they did.

The waste program in South Carolina is moving ahead on schedule and apparently within budget. The machinery is new and shiny, and local observers expect it to work as promised. The upbeat mood makes sense, given the nightmares the state hopes to put to rest. But promises made for nuclear technology have gone sour in the past, and it may be best to temper new expectations with some skepticism. ■

ELIOT MARSHALL

ERAB Sets Priorities for Energy Department's Physics Research

Support for basic physics research must increase substantially by 1992 to meet new research facility needs and to upgrade instrumentation at universities, says a Department of Energy (DOE) advisory group. The Energy Research Advisory Board (ERAB) is recommending a 50% increase in real funding above 1986 levels, but this does not include the Superconducting Super Collider (SSC).

The massive new particle accelerator should not be allowed to preempt other R&D priorities in physics, says the advisory board. While supportive of the SSC in concept, ERAB contends that "... The magnitude of this project ... means that it cannot be undertaken without a multibillion dollar incremental commitment to basic science over the next decade."

The findings are part of ERAB's review* of the National Research Council's eight-volume 1986 report, *Physics Through the 1990's*, which outlined the needs of the American physics community (*Science*, 11 April 1986, p. 156). The advisory body also recommends that existing physics research facilities, many of which are underutilized, be given adequate funding to operate at a "scientifically optimal" level—40 to 50 weeks a year.

Four new physics facilities have been identified by ERAB as priority projects that should be started between 1988 and 1991. The priority construction projects spotlighted by the advisory group include:

- The Compact Ignition Tokamak, which would begin construction in FY 1988—probably at Princeton. The $375-million machine would advance research in magnetic confinement fusion.
- The 6- to 7-billion-electron-volt (GeV) Advanced Photon Source at Argonne National Laboratory. The proposed starting date is FY 1988 and projected cost is $425 million.
- The $333-million Relativistic Heavy-Ion Collider at Brookhaven National Laboratory. Target date for construction is FY 1989.
- The advanced neutron source (Center for Neutron Research) at Oak Ridge National Laboratory. The estimated cost of this device is $400 million and construction is proposed for 1991. It would replace the aging High Flux Isotope Reactor.

Of particular concern to ERAB, which completed its review of NRC's work on 19 February, is the need to train physicists for major U.S. research efforts that lie ahead. ERAB suggests that DOE address the imbalance of supply and demand in part by starting new fellowship programs at the doctoral and postdoctoral level. Citing the "unsatisfactory condition of basic research in universities," ERAB concurs in the NRC's call for providing a small number of academic research groups with additional funding to augment ongoing research and to purchase new instruments. ■

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**Review of the National Research Council Report: Physics Through the 1990's*, Energy Research Advisory Board for the Department of Energy, March 1987. For copies write: Sarah Goldman, Department of Energy, ER-6, Room 3F043, 1000 Independence Ave., SW, Washington, DC 20585.