

ly accepted method. "The implications of what we do are so large," says Ronald Scott, a civil engineer from the California Institute of Technology, adding: "The potential for disaster, dam failures and so on, [is] the reason for the conservatism."

There is also another reason the newer, more sophisticated methods don't win immediate acceptance: barriers to communication between members of different disciplines. Soil scientists and hydrologists working on toxic wastes may be intimidated by geophysical techniques they don't understand and may not read broadly enough outside their area to be aware the techniques exist, says Olhoeft. His point was underscored by the fact that few participants in the workshop knew of an "expert system" program for personal computers, designed and published in 1988 by Olhoeft, that asks questions about the site to be investigated and then recommends the best evaluation methods for the specific job at hand. Most workshop participants were also unaware of several facilities operated by the Environmental Protection Agency and the USGS, where researchers can compare and validate site evaluation techniques.

Part of the communication problem stems from the number of different disciplines that overlap in the area of site evaluation, including geology; geophysics; physics; environmental, civil, chemical and geotechnical engineering; hydrology; and soil science, to name a few. "All [these disciplines] have got to talk to each other about the various methods and philosophies they have, if we are going to come up with unified systems which will be effectively utilized," Arulanandan says.

Arulanandan has another solution to some of the inertia in the field. He would like to see a national committee formed, and perhaps a national research center, to choose and develop the most promising site evaluation methods. This would not only serve to inform disparate disciplines but it would take the pressure off someone using a new technique to show later that it was accepted in the profession. But as a first step in that direction, the workshop provided mixed results. Though the discussion was lively and fruitful among the handful who stayed the 2 days, many other participants turned down the option to listen to perspectives from other fields, attending only the sessions in their own discipline. So the task of improving communication may be a tough one. But unless all those engineers and soil scientists can lay down their differences and establish a new, legally acceptable state of the art, it may be a long time before the blow count yields to methods that are better suited to the 1990s. ■ **MARCIA BARINAGA**

Academy Dumps on Waste Rules

Figuring out how to store the high-level radioactive waste produced by civilian power reactors may be a relatively straightforward engineering problem, but for policy-makers it's a political nightmare. Two and a half years ago, Congress selected Yucca Mountain in Nevada as the site for a long-term disposal facility. But Nevada, which is not keen to house this particular federal project, has so far declined to issue permits for the necessary geological characterization of the proposed site. The result: the project is now stalled. And Nevada's foot-dragging—if a committee of the National Academy of Science is to be believed—is only the first of many problems that will dog the waste disposal program.

On its own initiative, the academy's Radioactive Waste Management Board released a position paper on 17 July describing the government's current process for choosing a disposal site as so "rigid" and "unrealistic" that it could prevent underground disposal of nuclear waste indefinitely. That's because the Department of Energy is presently required by Congress to design a repository that will hold waste securely—regardless of unforeseen problems or developments—for a period of 10,000 years. "It's a demand for scientific certainty without any chance for ongoing evaluation," says board member Glenn Paulson, a hazardous waste expert at the Illinois Institute of Technology. "The current process demands perfect foresight."

In particular, this approach—in which DOE's design must conform to Environmental Protection Agency regulations in order to meet Nuclear Regulatory Commission licensing requirements—assumes that preliminary geological assessments will suffice for the repository's lifetime, precluding the possibility of design changes once construction begins. "[T]his use of geological information—to pretend to be able to make very accurate predictions of long-term site behavior—is scientifically unsound," the academy report states.

Regulators should opt for a more flexible approach to repository design and operation, the report adds. Such a strategy would mean that "we design the best facility we can with our present understanding, so if problems develop we can catch them and fix them," Paulson says. Canada and Sweden now both follow a similar approach, combining the information obtained at each step of the construction process with that taken from other underground construction projects so that engineers can modify the repository design if necessary.

Because the current process of repository licensing is virtually doomed to fail, the report states, federal officials must realize that their choice is not between an "ideal" underground site and a less perfect one, but between storing high-level waste underground and leaving it in surface storage, where public health risks are much higher.

EPA's waste disposal standards are now under review and open for public comment, so the statement's timing is "fortuitous," says academy board vice-chairman Charles Fairhurst of the University of Minnesota. The report recommends that in setting safety standards EPA use a "dose requirement"—a probabilistic estimate of radiation release—instead of its current qualitative requirement that the repository cause no more than 1000 cancer deaths in the next 10,000 years. In a similar vein, the report calls upon the NRC to consider relaxing its prescriptive design requirements in order to create regulatory space for design changes that might become necessary as construction proceeds.

Such recommendations are "a little naïve and ivory-towerish" because an open-ended design process would probably make the public uncomfortable, says Floyd Galspin, chief of the EPA's waste management standards branch. Although unanticipated problems will probably arise, "that's not a justification for not having goals and criteria from the beginning." Similarly, a DOE official in the civilian waste disposal program said the board is almost "too scientific" in its thinking. "They're challenging the regulatory process, saying that decisions of this sort should be in the hands of scientists and engineers and not in an adjudicatory framework." An NRC spokesperson said relevant officials "haven't read the report" and thus had no response.

Why did the committee feel the need to issue its statement? "My sense is that the board has become increasingly frustrated with the system we have here that almost sets itself up to fail," says Paulson. "We'd like to think that the paralysis in the system has led to such frustration that a call for fresh thinking might find fertile ground."

■ **DAVID P. HAMILTON**