

Yucca Mountain Nuclear Waste Containment Standard a Hot Topic

I find it amusing in a morbid sort of way that political posturing overrides the simple fact that nuclear waste isn't going to go away. Ten thousand years or a million makes no difference. The goals are to consolidate the material; make sound policies regarding security, safety, and health; and monitor the site for a very long time.

The tack that both proponents and opponents of a nuclear waste repository at Yucca Mountain have taken is disturbing in that the focus has now been shifted from the reality to the abstract (see *PHYSICS TODAY*, September 2004, page 29). No location on this planet is perfect in every way to house this legacy. We need to get used to that and start making real plans to deal with that material in the best way we know how. Technology will change drastically before the waste reaches radioactive equilibrium. How we handle it today will be so obsolete in 100 years—never mind 10 000—that we will wonder how we got away with it. Let's get on the stick and get this project done.

Dick Schmidt

(*rschmidt@ci.portland.or.us*)
Portland, Oregon

Can the US successfully license a nuclear waste repository at Yucca Mountain—or anywhere else?

After the US Court of Appeals remanded the Environmental Protection Agency's (EPA's) 10 000-year radionuclide release standard on 9 July, the issue is joined. What is the appropriate length of time that a repository needs to perform? Furthermore, how can the government prove that it will perform as advertised?

The National Academy of Sciences recommended to the EPA that the

period of repository performance extend to 100 millennia and more because, based on performance modeling, peak radionuclide dosage to the environment tends to occur then. There are two good reasons, however, that the 10 000-year figure was maintained as the regulatory limit for waste isolation. First, the EPA has experience and legal precedence using a 10 000-year containment requirement. One example is the operating permit for the Waste Isolation Pilot Project in New Mexico, which calls for a 10 000-year containment period for nuclear and hazardous wastes. Other examples are deep-well injection permits that specify no migration of hazardous wastes over 10 000 years. Second, to make courtroom arguments about compliance beyond 10 000 years challenges credulity. Most regulators simply have a hard time placing confidence in mathematical models that claim to project the performance of natural systems beyond that threshold.

Irrespective of how long a repository is required to perform, the Department of Energy's ability to prove that it does perform is still the elephant in the room. The current standard of proof for repository licensing is like that used in a criminal trial: reasonable doubt. The Nuclear Regulatory Commission calls it "reasonable assurance," which they use for licensing nuclear reactors. Is reasonable assurance appropriate for what will be a heat-perturbed geologic system—that is, a system not designed to specification? The reasonable assurance standard can make geologic disposal fail whether a 10 000-year performance period is used or 10 to 20 times that.

Geology is a postdictive science; it explains what has already happened. When one attempts to use geology to project how a perturbed natural system will behave, uncertainties in data and interpretations multiply and assumptions necessarily are substituted. Mathematical models of future performance are only as good as those assumptions. In contrast to the hubris the US Congress codified by requiring reasonable assurance for geologic disposal, the standard of

proof scientists use is preponderance of evidence. Applying reasonable assurance to geologic projections is a human contrivance that gives a false sense of certainty.

On 3 September, the Appeals Court refused to reconsider vacating the 10 000-year performance standard for Yucca Mountain, so it appears that the EPA must create a new one or Congress must weigh in on the subject. If the 10 000-year period is affirmed by legislation, geologic disposal can still fail if the licensing and legal system requires a certainty that geoscience cannot demonstrate.

Let us not jeopardize the societal benefit of geologic disposal by perpetuating the illusion that science can provide a greater level of safety to regulators than it is capable of proving. Geoscience is incapable of predicting with confidence the performance of a geologic repository system over 100 millennia or more. Furthermore, geoscientific predictions cannot be demonstrated in court with any standard other than preponderance of evidence. A repository system is supposed to compensate for uncertainty in data or performance models with an in-depth defense strategy that includes multiple barriers to limit the release of radioactivity into the environment over time. If the repository program goes to licensing, regulators will need to recalibrate their expectations about what geoscience can prove. Unfortunately, it is probably too late to lower expectations. Over the years, the program countenanced an overreach for certainty, and the result is a very precarious program.

Thomas Bjerstedt

(*bjerstedt@sprintmail.com*)
Mandeville, Louisiana

Jim Dawson asserts that "none of the parties involved [in Yucca Mountain] is advocating a radiation standard based on containment for hundreds of thousands of years or more." As one of those parties, I can say that this statement is incorrect.

The groups involved specifically advocated for an Environmental Protection Agency (EPA) standard most protective of public health and

Letters and opinions are encouraged and should be sent to Letters, *PHYSICS TODAY*, American Center for Physics, One Physics Ellipse, College Park, MD 20740-3842 or by e-mail to ptletter@aip.org (using your surname as "Subject"). Please include your affiliation, mailing address, and daytime phone number. We reserve the right to edit submissions.