



Should the United States Stop Planning for Permanent Nuclear Waste Disposal at Yucca Mountain?

YES: U.S. Department of Energy (DOE), from "Motion to Withdraw," filed before the Nuclear Regulatory Commission (March 2, 2010)

NO: Luther J. Carter, Lake H. Barrett, and Kenneth C. Rogers, from "Nuclear Waste Disposal: Showdown at Yucca Mountain," *Issues in Science and Technology* (Fall 2010)

Learning Outcomes

After studying this issue, students will be able to:

- Explain why the Obama administration chose to end support for the Yucca Mountain nuclear waste repository.
- Explain the political difficulties involved in finding an acceptable location for a nuclear waste repository.
- Describe the physical requirements a nuclear waste repository must satisfy.
- Explain how various incentives can affect acceptance of a nuclear waste repository.

ISSUE SUMMARY

YES: The U.S. Department of Energy (DOE) moves to withdraw its application for a license to operate a permanent repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain, Nevada, calling Yucca Mountain "not a workable option" and saying that it has no plans ever to refile the application.

NO: Luther J. Carter, Lake H. Barrett, and Kenneth C. Rogers argue that the decision to withdraw the application for a nuclear waste repository at Yucca Mountain was motivated by politics rather than by evidence. If successful, it will impede future efforts to use nuclear power to combat global warming.

Nuclear waste is generated when uranium and plutonium atoms are split to make energy in nuclear power plants, when uranium and plutonium are purified to make nuclear weapons, when nuclear wastes are reprocessed, and when radioactive isotopes useful in medical diagnosis and treatment are made and used. These wastes are radioactive, meaning that as they break down they emit radiation of several kinds. Those that break down fastest are most radioactive; they are said to have a short half-life (the time needed for half the material to break down). Uranium-238, the most common isotope of uranium, has a half-life of 4.5 billion years and is not very radioactive at all. Plutonium-239 (bomb material) has a half-life of 24,000 years and is radioactive enough to be hazardous to humans.

According to the U.S. Department of Energy, high-level waste includes spent reactor fuel and waste from weapons production. Transuranic waste includes clothing, equipment, and other materials contaminated with plutonium and other radioactive materials, some of which has been buried in the Waste Isolation Pilot Plant (WIPP) salt cavern in New Mexico (WIPP started receiving transuranic waste in 1999). It too was surrounded by controversy, as summarized by Chris Hayhurst in "WIPP Lash: Doubts Linger about a Controversial Underground Nuclear Waste Storage Site," *E Magazine* (January–February 1998). Its Web site is at www.wipp.energy.gov/. Low and mixed-level waste includes waste from hospitals and research labs, remnants of decommissioned nuclear plants, and air filters. The high-level waste is the most hazardous and poses the most severe disposal problems. In general, experts say, such materials must be kept away from people and other living things, with no possibility of contaminating air, water (including ground water), or soil for 10 half-lives.

For a good summary of the nuclear waste problem and the disposal controversy, see Michael E. Long, "Half Life: The Lethal Legacy of America's Nuclear Waste," *National Geographic* (July 2002). Gary Taubes, in "Whose Nuclear Waste?" *Technology Review* (January/February 2002), argues that a whole new approach may be necessary. One such approach is an interim, above-ground storage facility for commercial nuclear waste at Yucca Mountain. This has been urged as a way to create commitment to continue developing the Yucca Mountain site and to meet government responsibilities to deal with commercial waste. Steven Ashley, in "Divide and Vitrify," *Scientific American* (June 2002), describes work on potential methods of separating the most hazardous components of nuclear waste. One such approach is to expose nuclear waste to neutrons from particle accelerators or special nuclear reactors and thereby greatly hasten the process of radioactive decay.

The Nuclear Age began in the 1940s. As nuclear waste accumulated, there also developed a sense of urgency about finding a place to put it where it would not threaten humans or ecosystems for a quarter million years or more. In 1982, the Nuclear Waste Policy Act called for locating candidate disposal sites for high-level wastes and choosing one by 1998. Since no state chosen as a candidate site was happy about being chosen and many sites were for various reasons less than ideal, the schedule proved impossible to meet. In 1987, Congress attempted to settle the matter by designating Yucca Mountain, Nevada, as the one site to

be intensively studied and developed. It would be opened for use in 2010. Risk assessment expert D. Warner North wrote in "Unresolved Problems of Radioactive Waste: Motivation for a New Paradigm," *Physics Today* (June 1997) that the technical and political problems related to nuclear waste disposal remained formidable and a new approach was needed. Luther J. Carter and Thomas H. Pigford wrote in "Getting Yucca Mountain Right," *Bulletin of the Atomic Scientists* (March/April 1998) that those formidable problems could be defeated, given technical and congressional attention, and the Yucca Mountain strategy was both sensible and realistic. However, problems have continued to plague the project, as summarized by Chuck McCutcheon, "High-Level Acrimony in Nuclear Storage Standoff," *Congressional Quarterly Weekly Report* (September 25, 1999), and Sean Paige, "The Fight at the End of the Tunnel," *Insight on the News* (November 15, 1999). Jon Christensen, in "Nuclear Roulette," *Mother Jones* (September/October 2001), argues that one of the most basic problems is that estimates of Yucca Mountain's long-term safety are based on probabilistic computer models that are too uncertain to trust. Per F. Peterson, William E. Kastenber, and Michael Corradini, "Nuclear Waste and the Distant Future," *Issues in Science and Technology* (Summer 2006), argue that the risks of waste disposal have been sensibly addressed by the EPA and we should be focusing more attention on other risks (such as those of global warming).

Even those who favor using Yucca Mountain for high-level nuclear waste disposal admit that in time the site is bound to leak. The intensity of the radioactivity emitted by the waste will decline rapidly as short-half-life materials decay, and by 2300 AD, when the site is expected to be sealed, that intensity will be less than 5 percent of the initial level. After that, however, radiation intensity will decline much more slowly. The nickel-alloy containers for the waste are expected to last at least 10,000 years, but they will not last forever. The U.S. Department of Energy's computer simulations predict that the radiation released to the environment will rise rapidly after about 100,000 years, with a peak annual dose after 400,000 years that is about double the natural background exposure. Whether the site can be protected for any significant fraction of such time periods arouses considerable skepticism among those who point out that 10,000 years is about the same length of time as has passed since humans built their first cities, and 400,000 years is about twice as long as modern *Homo sapiens* has existed.

Despite the controversy, in February 2002, U.S. Secretary of Energy Spencer Abraham recommended to the president that the nation go ahead with development of the Yucca Mountain site. His report argues that a disposal site is necessary, that Yucca Mountain has been thoroughly studied, and that moving ahead with the site best serves "our energy future, our national security, our economy, our environment, and safety." Objections to the site are not serious enough to stop the project. However, that decision hardly settled the matter. Gar Smith, "A Gift to Terrorists?" *Earth Island Journal* (Winter 2002-2003), argues that transporting nuclear waste to Yucca Mountain will expose millions of Americans to risks from accidents and terrorists. Senator Hillary Clinton said in testimony before the Senate Environment and Public Works Committee on October 31, 2007, that she thought it was time to scrap

both the work done so far and the controversy and start over. In February 2008, Senator James Inhofe introduced a bill intended to speed up the licensing process for Yucca Mountain. Journalist Chuck Muth, "Nevada Kids, They Glow in the Dark," *Las Vegas Business Press* (January 7, 2008), says that waste deposited at Yucca Mountain could be very valuable if the nation chooses to reprocess waste and that Nevada could wind up being "the nuclear research and reprocessing capital of the world."

On June 3, 2008, the U.S. Department of Energy (DOE) submitted a license application to the U.S. Nuclear Regulatory Commission, seeking authorization to construct a deep geologic repository for disposal of high-level radioactive waste at Yucca Mountain, Nevada; see www.nrc.gov/waste/hlw-disposal.html. Early in 2010, the DOE, following up on a commitment made by President Obama, moved to withdraw its application. William Beaver, "The Demise of Yucca Mountain," *Independent Review* (Spring 2010), questions the wisdom of the decision, citing future need for nuclear power. Sean Davies, "End of the Road for Yucca Mountain," *Engineering & Technology* (May 14, 2010), argues that we can now begin to look for truly workable alternatives. James M. Hylko and Robert Peltier, "The U.S. Spent Nuclear Fuel Policy: Road to Nowhere," *Power* (May 2010), favor nuclear fuel reprocessing. Matthew L. Wald, "What Now for Nuclear Waste?" *Scientific American* (August 2009), suggests that for now it may be best to do nothing, in part because Yucca Mountain may reenter the picture.

The YES selection is DOE's motion before the Nuclear Regulatory Commission to withdraw its application, calling Yucca Mountain "not a workable option" and saying that it has no plans ever to refile the application. In the NO selection, Luther J. Carter, Lake H. Barrett, and Kenneth C. Rogers argue that the decision to withdraw the application for a nuclear waste repository at Yucca Mountain was motivated by politics rather than by evidence. If successful, it will impede future efforts to use nuclear power to combat global warming.





U.S. Department of Energy

U.S. Department of Energy's Motion to Withdraw

The United States Department of Energy ("DOE") hereby moves . . . to withdraw its pending license application for a permanent geologic repository at Yucca Mountain, Nevada. DOE asks the Board to dismiss its application with prejudice and to impose no additional terms of withdrawal.

While DOE reaffirms its obligation to take possession and dispose of the nation's spent nuclear fuel and high-level nuclear waste, the Secretary of Energy has decided that a geologic repository at Yucca Mountain is not a workable option for long-term disposition of these materials. Additionally, at the direction of the President, the Secretary has established the Blue Ribbon Commission on America's Nuclear Future, which will conduct a comprehensive review and consider alternatives for such disposition. And Congress has already appropriated \$5 million for the Blue Ribbon Commission to evaluate and recommend such "alternatives." . . . In accord with those decisions, and to avoid further expenditure of funds on a licensing proceeding for a project that is being terminated, DOE has decided to discontinue the pending application in this docket, and hereby moves to withdraw that application with prejudice.

Under the Nuclear Waste Policy Act of 1982, as amended, 42 U.S.C. §§ 10101 *et seq.* ("NWPA"), this licensing proceeding must be conducted "in accordance with the laws applicable to such applications. . . ." Those laws necessarily include the NRC's regulations governing license applications. . . .

Thus, applicable Commission regulations empower this Board to regulate the terms and conditions of withdrawal. . . . Any terms imposed for withdrawal must bear a rational relationship to the conduct and legal harm at issue. . . . And the record must support any findings concerning the conduct and harm in question to impose a term. . . .

The Board Should Grant Dismissal With Prejudice

In this instance, the Board should prescribe only one term of withdrawal—that the pending application for a permanent geologic repository at the Yucca Mountain site shall be dismissed with prejudice.¹

That action will provide finality in ending the Yucca Mountain project for a permanent geologic repository and will enable the Blue Ribbon Commission,

as established by the Department and funded by Congress, to focus on alternative methods of meeting the federal government's obligation to take high-level waste and spent nuclear fuel. It is the Secretary of Energy's judgment that scientific and engineering knowledge on issues relevant to disposition of high-level waste and spent nuclear fuel has advanced dramatically over the twenty years since the Yucca Mountain project was initiated. . . . Future proposals for the disposition of such materials should thus be based on a comprehensive and dismissal. The statute simply requires that the Secretary "shall submit . . . an application for a construction authorization." . . . It neither directs nor circumscribes the Secretary's actions on the application after that submission.

Indeed, far from imposing special limitations on DOE after the submission, the NWPA expressly requires that the application be considered "in accordance with the laws applicable to such applications." . . . Those laws include 10 C.F.R. § 2.107, which, as this Board has recognized, authorizes withdrawals on terms the Board prescribes. Congress, when it enacted the NWPA in 1982, could have dictated that special rules applied to this proceeding to prevent withdrawal motions, or could have prescribed duties by DOE with respect to prosecution of the application after filing, but it chose not to do so.

Nor does the structure of the NWPA somehow override the plain textual indication in the statute that ordinary NRC rules govern here or dictate that the Secretary must continue with an application he has decided is contrary to the public interest. The NWPA does not prescribe a step-by-step process that leads inexorably to the opening of a repository at Yucca Mountain. Indeed, even if the NRC granted the pending application today, the Secretary would not have the authority to create an operational repository. That would require further action by DOE, other agencies, and Congress itself, yet none of those actions is either mandated or even mentioned by the NWPA. The NWPA does not require the Secretary to undertake the actions necessary to obtain the license to receive and possess materials that would be necessary to open a repository. . . . Rather, the NWPA refers only to the need for a "construction authorization" . . . —and even there, as discussed, it mandates only the submission of an application. To open a facility, moreover, the Department would be required to obtain water rights, rights of way from the Bureau of Land Management for utilities and access roads, and Clean Water Act § 404 permits for repository construction, as well as all the state and federal approvals necessary for an approximately 300-mile rail line, among many other things. None of those actions is mandated by the NWPA. At least as important, as the prior Administration stressed, *Congress* would need to take further action not contained in the NWPA before any such repository could be opened. In short, there are many acts between the filing of the application and the actual use of the repository that the NWPA does not require.

Where, even if the NRC granted the pending application, Congress has not authorized the Secretary to make the Yucca Mountain site operational, or even mandated that he take the many required steps to make it operational, it would be bizarre to read the statute to impose a non-discretionary duty to continue with any particular intermediate step (here, prosecuting the application), absent clear statutory language mandating that result. More generally,

it has not been the NRC's practice to require any litigant to maintain a license application that the litigant does not wish to pursue. That deference to an applicant's decisions should apply more strongly where a government official has decided not to pursue a license application because he believes that other courses would better serve the public interest.

Finally, the fact that Congress has approved Yucca Mountain as the site of a repository, *see* Pub. L. No. 107-200, 116 Stat. 735 (2002) ("there hereby is approved the site at Yucca Mountain, Nevada, for a repository, with respect to which a notice of disapproval was submitted by the Governor of the State of Nevada on April 8, 2002"), means, in the D.C. Circuit's words, simply that the Secretary is "permitted" to seek authority to open such a site and that challenges to the prior process to select that site are moot. . . . It does *not* require the Secretary to continue with an application proceeding if the Secretary decides that action is contrary to the public interest. . . . That conclusion is even more strongly compelled now, in light of Congress's recent decision to provide funding to a Blue Ribbon Commission, whose explicit purpose is to propose "alternatives" for the disposal of high-level waste and spent nuclear fuel.

Even if there were any ambiguity on these points, the Secretary's interpretation of the NWPA would be entitled to deference. . . . Simply put, the text of the NWPA does not specify actions the Secretary can or must take once the application is filed. Accordingly, while some may disagree with the wisdom of the Secretary's underlying policy decision, the Secretary may fill this statutory "gap." The Secretary's interpretation is a reasonable one that should be given great weight and sustained. . . .

No Conditions Are Necessary as to the Licensing Support Network

Finally, there is no reason to impose conditions relating to the Licensing Support Network ("LSN") as a term of withdrawal. As DOE's prior filings with this Board explain, DOE will, at a minimum, maintain the LSN throughout this proceeding, including any appeals, and then archive the LSN materials in accordance with the Federal Records Act and other relevant law. . . . Thus, DOE will retain the full LSN functionality throughout this proceeding, including appeal, and then follow well established legal requirements that already govern DOE's obligations regarding these documents. DOE is also considering whether sound public and fiscal policy, and the goal of preserving the knowledge gained both inside and outside of this proceeding, suggest going even further than those legal requirements. There is thus no need for this Board to impose additional conditions concerning the preservation of records.

DOE counsel has communicated with counsel for the other parties commencing on February 24, 2010, in an effort to resolve any issues raised by them prior to filing this Motion. . . . The State of Nevada and the State of California have stated that they agree with the relief requested here. The Nuclear Regulatory Commission Staff has stated that it takes no position at

this time. The Nuclear Energy Institute has stated that it does not consent to the relief requested and will file its position in a response. All other parties that have responded have stated that they reserve their positions until they see the final text of the motion.

Note

1. DOE seeks this form of dismissal because it does not intend ever to refile an application to construct a permanent geologic repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain.



Luther J. Carter, Lake H. Barrett,
and Kenneth C. Rogers



Nuclear Waste Disposal: Showdown at Yucca Mountain

If the nation is to seriously confront a growing inventory of highly radioactive waste, a key step is to determine the merits of its geologic repository project at Yucca Mountain in Nevada. A board of the U.S. Nuclear Regulatory Commission (NRC) has for nearly two years been conducting an open and transparent licensing proceeding to accomplish exactly that. Moreover, in its forceful ruling of June 29, 2010, the board rejected as contrary to law a motion by Secretary of Energy Steven Chu to withdraw the licensing application and shut the proceeding down. Yet the administration's attempt to abandon Yucca Mountain continues and in our view poses a significant risk of a major setback for public acceptance of nuclear energy.

The licensing application was filed by the Bush administration under the Nuclear Waste Policy Act (NWPA) of 1982, and the proceeding itself began in October 2008. The NRC staff has almost completed its safety evaluation of repository performance for many tens of thousands of years. With this report in hand, the licensing board (acting for the commission) could begin hearing and adjudicating scores of critical contentions by the state of Nevada and other opposing parties. If the case for licensing is convincing, the granting of a construction license could come in 2012. But the licensing board is a creature of the NRC, and if the commission should order the proceeding terminated in keeping with Secretary Chu's motion, the board must comply.

The attempt by the current administration to withdraw the licensing application and abandon Yucca Mountain follows a commitment made by Barack Obama in early 2008 during the competitive scramble for Nevada delegates to the Democratic National Convention. Hillary Clinton, then the hands-on favorite for the nomination, had long sided with Nevada in its opposition to a repository at Yucca Mountain. Not to be outdone, Senator Obama declared his own categorical opposition to the project. Earlier this year, when President Obama, acting through Secretary Chu, moved to withdraw the licensing application, no scientific justification or showing of alternatives was offered. The project was simply dismissed as "not a workable option."

To cover Obama's political debt to Nevada, repository licensing would be terminated without congressional review and approval despite the fact that

this vital project was sanctioned by Congress in elaborate detail and handsomely funded by a fee imposed on tens of millions of consumers of electricity produced by nuclear reactors. The licensing proceeding marks the culmination of a 25-year site investigation that has cost over \$7 billion for the Nevada project itself and over \$10 billion for the larger national screening of repository sites from which the Yucca Mountain site was chosen.

What's At Stake

To summarily kill the project would cap with still another failure a half-century of frustrated endeavors to site, license, and construct a geologic repository. The roughly 64,000 metric tons of spent reactor fuel that await permanent geologic disposal are now in temporary storage at 120 operating and shut-down commercial nuclear power reactors in 36 states. In addition, there are the thousands of containers of highly radioactive waste arising from the cleanup of nuclear weapons production sites in Washington, South Carolina, and Idaho.

Now pending before the U.S. Circuit Court of Appeals for the District of Columbia are lawsuits brought by Washington, South Carolina, the National Association of Regulatory Utility Commissioners, and several other plaintiffs to stop the licensing withdrawal. Most tellingly, the plaintiffs allege violations of the NWPA of 1982, with its detailed prescriptions for repository site selection, approval, and construction licensing. But also in play is the Administrative Procedure Act, under which agency decisions can be voided as "arbitrary and capricious" and an abuse of discretion.

In its refusal to accede to the Department of Energy's (DOE's) motion to withdraw the licensing, the licensing board questioned why the Congress, in enacting the NWPA, would have set out an elaborate sequence of steps and procedures for the selection and approval of a repository site if in the end the Secretary of Energy could undo everything by withdrawing the licensing application. "Unless Congress directs otherwise, DOE may not single-handedly derail the legislatively mandated decision-making process," the board said.

The Court of Appeals initially called for arguments in the pending litigation to begin this September but has now decided to first await an outcome at the NRC.

Coupled with the attempted withdrawal of the licensing application is a self-evident violation of the Federal Advisory Committee Act of 1972, which is intended to keep advisory committees from being "inappropriately influenced by the appointing authority or any special interest." According to its charter, the Blue Ribbon Commission on America's Nuclear Future (BRC), which Secretary Chu unveiled early this year, is to conduct a "comprehensive review of policies for managing the back end of the nuclear fuel cycle, including all alternatives for the storage, processing, and disposal of civilian and defense used nuclear fuel [and] high-level waste. . . ." Left unstated, to say the least, was the fact that the commission was created in substantial part to show that Yucca Mountain was not being abandoned without identifying a full suite of waste management options—but with no intention to have the repository project serve as a baseline for this review.

In March 2009, Secretary Chu and Nevada's Senator Harry Reid, the Senate's Democratic Majority Leader and a relentless foe of Yucca Mountain, struck a deal wherein Reid would drop his proposed legislation for a blue ribbon commission that Congress would appoint in favor of a commission that the Secretary of Energy would choose. In a press conference announcing the formation of the BRC on January 29, 2010, and later at their first formal meeting, commission members were told by Secretary Chu and White House aide Carol Browner that Yucca Mountain is past history and is not among the waste management options to be considered.

A Blue Ribbon Agenda

The BRC's eminent co-chair, Lee Hamilton, the former Indiana congressman who served as vice chairman of the 9/11 commission, has made the general point that his study group's "recommendations will be ours and ours alone." Indeed, whatever the motivations of those who created it, the BRC is an independent advisory body chartered to provide a comprehensive review of waste management alternatives, and it cannot reasonably and honorably exclude Yucca Mountain from that review. The intellectual gyrations at play with respect to Yucca Mountain may be especially disturbing to those commission members well versed in nuclear energy issues, such as Richard Meserve (a former chair of the NRC), Per Peterson (chair of nuclear engineering at the University of California, Berkeley), and Phil Sharp (head of Resources for the Future and formerly a congressman from Indiana).

In turning its back on Yucca Mountain, the commission would put itself at high risk of failing to produce a report of significant policy impact and of coming across as little more than a fig leaf of respectability for the president's decision to abandon the repository. We don't think it will do that. This body could in fact prove itself enormously useful, not least by an insistence on recognizing and protecting the integrity of the NRC as an independent regulatory agency.

The commission could also emphasize that solid public acceptance of nuclear energy, together with the continued storage of large amounts of spent fuel in temporary surface facilities, may well turn on a credible promise of a geologic repository becoming available within the next few decades. This we see as a fundamental political reality that is accorded too little weight by the utility industry, the Secretary of Energy, and the NRC itself.

The utilities that are generating nuclear energy certainly want a repository, but they do not want their lack of one to stand in the way of public support and federal subsidies for a nuclear expansion. So from this contorted position they argue the safety and acceptability of surface storage of spent fuel for decades into the future while quite properly pressing the government to honor its long-past-due obligation to take custody of most of that fuel.

But the politically critical nexus between reactors and spent fuel disposal has been evident since 1976, when Californians approved a referendum that declared that no more nuclear plants could be built in the state until a means for permanent disposal of spent reactor fuel and high-level waste was achieved.

Waste Confidence

The NRC's successive "waste confidence" rule-makings during the past 25 years have been a milder response to the same issue. A lawsuit begun by the Natural Resources Defense Council in 1977 gave rise to the first such NRC rule-making in 1984. In that ruling, "reasonable assurance" was found on three critical points: that at least one mined geologic repository would be available by the years 2007–2009; that spent fuel from any reactor could go to geologic disposal within 30 years of the expiration of the reactor's operating license; and that during the interim, the spent fuel could be safely kept in surface storage facilities either at the reactor site or elsewhere.

These confidence findings were renewed in 1990, then again in 1999, but with the difference that the latter finding envisioned a geologic repository becoming available "within the first quarter of the twenty-first century." In September 2009, a new confidence proceeding was initiated wherein the NRC expressed reasonable assurance of having a repository within 50 to 60 years of the licensed life of existing reactors, which for some reactors may extend to the year 2060.

In plain English, what this meant was that the commission would be comfortable not having a repository until sometime well beyond the year 2100, when our great-great grandchildren may be left to worry about the disposal of nuclear waste arising from the generation of nuclear electricity from which we benefit today. The NRC, with two vacancies at the time, had but three members to consider this confidence finding and only one was willing to adopt it without receiving public comment on policy changes affecting Yucca Mountain. That one was the commission's new chair, Gregory B. Jaczko, formerly a senior aide and close associate of Senator Reid. President Bush appointed Jaczko to the commission in 2005 and reappointed him in 2008, and last year President Obama named him chairman.

Since then, the NRC has undergone major changes in membership, and whether there is among the five commissioners a legally qualified quorum of three to decide pending Yucca Mountain issues is being challenged. Of the two members who opposed issuance of a confidence finding last year, Commissioner Kristine L. Svinicki continues to serve but her former colleague Dale E. Klein has completed his term and departed.

Meanwhile, three new members—George E. Apostolakis, William D. Magwood IV, and William C. Ostendorff—have come aboard. At their Senate confirmation hearing in February, Senator Barbara Boxer of California asked each of the three this question on behalf of Senator Reid: "If confirmed, would you second guess the DOE decision to withdraw license application for Yucca Mountain from NRC review?" All three answered, no. In the pending litigation, Washington State and South Carolina, plus a few other parties, cite this exchange as compelling grounds why, by law, they should recuse themselves from any decision on the Yucca Mountain licensing issue.

Apostolakis, a professor of nuclear science and engineering at the Massachusetts Institute of Technology (MIT) and a member of the National Academy of Engineering, has in fact since recused himself. But his stated

reason for doing so was not his response to Senator Boxer but the fact that he chaired the Sandia National Laboratory panel that reviewed the Yucca Mountain performance assessment and found it adequate to support submittal of a license application.

Commissioners Magwood and Ostendorff, on the other hand, have now refused to disqualify themselves, contending that Boxer's question was vaguely put and that they were at the time unaware that a White House decision to withdraw the licensing application would be coming up for NRC review. But the DOE had already filed a motion to stay the licensing board proceeding and announced that a motion to withdraw the licensing application would soon follow. Counsel for Washington et al., citing Supreme Court precedents, argue that whether a judge or regulatory official recuses himself should turn not on "the reality of bias or prejudice but its appearance" and on whether a "reasonable man, [knowing] all the circumstances, would harbor doubts about the judge's impartiality."

Of course, in principle there's nothing to keep Magwood and Ostendorff from deciding not to join their chairman, Gregory Jaczko, in overriding the licensing board. This would deny Jaczko a majority on the issue and leave in force the board's refusal to stop the licensing. But however that may be resolved by the commissioners, the matter of the new waste confidence finding is also pending. All five commissioners, including Magwood and Ostendorff, have issued position papers in which, despite differences in detail, there is broad agreement as to strategy. They have studiously avoided recognition of the elephant in the room, Yucca Mountain. The project's fate is either ignored or treated as by no means impeding a confidence finding.

The commissioners are counting on continued surface storage for up to 120 years or even much longer, and on having either a mined geologic repository or some other means of final disposal available "when necessary." The House report that accompanied the Nuclear Waste Policy Act almost 28 years ago noted that "an opiate of confidence" had led to a long trail of paper analyses and plans that had come to nothing. The record of frustration and failure that preceded that 1982 Act may well be extended right up to the present if the commissioners rubber-stamp the administration's withdrawal plans for Yucca Mountain or ignore the implications for waste confidence of the project's being abandoned at the very point of construction licensing.

Whatever happens at the NRC, the BRC must weigh in with its own judgments. A central fact to be recognized is that geologic storage or disposal of highly radioactive waste will not begin within this generation without a renewed commitment to Yucca Mountain. Apart from the continued surface storage of spent fuel, other waste management options that the commission is considering—spent fuel reprocessing, "recycling," and transmutation of dangerously radiotoxic species to more benign forms—have little to offer for the next half century or longer.

This is true for a mix of technical and financial reasons explained at length in studies done by experts at Harvard, MIT, and elsewhere. A primary reference is the National Research Council's Separations Technology and Transmutation Systems report of 1996. For the foreseeable future, waste management systems

resting on such technologies would come at prohibitive cost and could not in any case eliminate all of the dangerously radioactive and long-lived wastes of concern. For final disposal of such waste, geologic containment is the only option, and Yucca Mountain is the one place where this might happen in the next few decades.

Redefining Yucca Mountain

The commission has an opportunity to broadly redefine the Yucca Mountain project to suggest how advantage might be taken of the repository's early potentialities and how uncertainties about its long-term performance might be reduced. Bear in mind that operation of the repository would come in two phases. There is, first, a pre-closure phase of up to several hundreds of years during which spent fuel and high-level waste would be emplaced retrievably. This is followed by a post-closure phase that begins when the repository is sealed.

Built in volcanic rock high above the water table and accessed by gently inclined ramps from the ridge slopes, a Yucca Mountain repository would be ideally situated to serve for monitored geologic storage of spent fuel, which ultimately could be retrieved if, say, fuel recycling should become economically attractive. Regrettably, in 1987, when the investigation of repository sites was narrowed to Yucca Mountain, the Congress, as a concession to Nevada, declared that no "monitored retrievable storage facility" could be built in that state. Here, Congress was, without doubt, referring to the kind of monitored retrievable surface storage facility that some sponsors of the NWPA of 1982 had deemed no less essential than a geologic repository and much more easily achieved.

But DOE officials did not believe that the NRC, under its licensing policies, would permit them to seek a license allowing retrievable emplacement of spent fuel and high-level waste early in the pre-closure phase while work continued on meeting the more stringent standards for permanent emplacement. They knew, too, that to propose such a two-phased strategy would arouse Senator Reid's wrath.

But the BRC could strongly advocate a two-phased approach to licensing, with vigorous pursuit of repository design alternatives to continue in parallel with the program of monitored retrievable geologic storage.

The National Research Council's Board on Radioactive Waste Management has long recommended that repository design be approached in a phased, stepwise manner that allows intensive testing and analysis and a flexible, adaptive response to the setbacks and surprises sure to come. This concept was most recently articulated in the board's 2003 report *One Step at a Time: The Staged Development of Geologic Repositories for High-Level Radioactive Waste*.

In sorting things out, the commission might note with emphasis that commercial spent fuel and defense high-level waste differ greatly in the degree of hazard posed. Because there is relatively little presence of plutonium and other actinides of long half-life in the defense wastes, the period

of hazard for these wastes may be as short as 10,000 years, compared to up to a million years for spent fuel.

A Fair Deal for Nevada

As for Nevada's grievances, the commission doubtless will note that when the Congress, in its 1987 amendment to the NWPA, narrowed the search for a repository site to Yucca Mountain, this came as an abrupt departure from the procedure originally mandated to go to a single candidate site only after an in-depth, in-situ exploration of three candidates. But the volcanic tuff site at Yucca Mountain had emerged from the first round of studies as clearly superior to the other two candidates: the site in volcanic basalt at Hanford, Washington, and the one in deep bedded salt in Deaf Smith County, Texas. A more tentative or contingent congressional choice of Yucca Mountain would almost certainly have survived an impartial technical review, so in our view the hasty adoption of what soon came to be known as the "screw Nevada bill" was as unnecessary as it was politically provocative.

We think Nevada's cause for redress turns chiefly on regional fairness and equity, on having been fingered to take dangerously radioactive and long-lived nuclear waste that probably no other state would willingly accept. A major question for the BRC to consider is what compensation is due the state chosen for the nation's first repository for permanent disposal of spent fuel and high-level waste? The state could, for example, be given preference in the siting of various other new government-sponsored or -encouraged enterprises, civil or military, nuclear or non-nuclear, promising to bring Nevada more high-tech jobs and attract other business.

Even today, Nevada's Nye County (host to Yucca Mountain) and several other rural counties see a duly licensed repository project as a distinct economic asset and quite safe. Also, some of Nevada's more visible Republican politicians openly advocate the project, too, but on condition that the "nuclear dump" many Nevadans envision be made more acceptable by adding other nuclear-related industrial activities. Although Senator Reid surely has had the wind at his back in opposing the repository, the oft-repeated claim that Nevadans are overwhelmingly opposed to the repository is a canard that dies hard.

President Obama, at the Copenhagen climate change summit last December, announced a goal of reducing carbon emissions by 83% by the year 2050. In pondering the nation's nuclear future, the BRC must be aware that a nuclear contribution on a scale truly relevant to that hugely ambitious goal might entail a fivefold expansion of the present suite of 104 large reactors and a fivefold increase in the annual production of spent fuel from 2,000 to 10,000 metric tons. Surely this is not the time to abandon the only currently viable option for very long-term geologic retrievable storage of spent fuel, and possibly final disposal.

But also at stake is the reputation of the NRC as an independent, trustworthy overseer of the civil nuclear enterprise. The NRC has been dealt with abusively by the Obama administration and Senator Reid in the matter of Yucca Mountain. So now will the commissioners acquiesce in the policies of the

senator and the White House, or will they reassert the NRC's dignity and independence by upholding their own Yucca Mountain licensing board? Also, will they see the speciousness of their pending waste confidence finding that would ignore the blatantly political undoing of a sophisticated technical endeavor to build the world's first geologic repository for highly radioactive waste? How the commissioners exercise their great trust will soon be apparent.



EXPLORING THE ISSUE



Should the United States Stop Planning for Permanent Nuclear Waste Disposal at Yucca Mountain?

Critical Thinking and Reflection

1. Why, according to the U.S. Department of Energy, is the DOE free to simply withdraw its license application and in essence abandon the effort to build the Yucca Mountain nuclear waste repository?
2. Why is it politically difficult to find an acceptable location for a nuclear waste repository?
3. It is generally accepted that any nuclear waste repository must be stable for a great many years. What kinds of locations might satisfy this requirement?
4. What kinds of incentives might help persuade people to accept a nearby nuclear waste repository?

Is There Common Ground?

Both sides in this debate agree that nuclear waste already exists and must be dealt with, nuclear power will be with us for many years and more wastes will be generated, and there is a need for either an acceptable location for a nuclear waste repository or an alternative method of dealing with nuclear wastes. One such method is covered in the next issue in this book. Look ahead and answer the following questions:

1. What is nuclear fuel reprocessing?
2. How does it reduce the quantity of nuclear waste?

