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Nuclear Waste Disposal

Showdown at Yucca Mountain

The administration's decision to withdraw the application for a nuclear waste repository at Yucca Mountain, Nevada, lacks scientific justification and could hamper the nation's effort to use nuclear energy to reduce emissions of greenhouse gases.

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 NWSA 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 NWSA, 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 identi-

fying 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

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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 Moun-

tain) 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.

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