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What To Do With Nuclear Waste

After Yucca Mountain

By ROBERT ALVAREZ

President Barack Obama's Blue Ribbon Commission on America's Nuclear Future will have its first meeting this week. The commission, formed after Obama cancelled the Yucca Mountain spent nuclear fuel repository in January, is tasked with rebooting the country's five-decade-plus effort to manage its high-level radioactive waste.

The problems the commission will consider are far from new. In 1957 the National Academy of Sciences warned that "[t]he hazard related to radioactive waste is so great that no element of doubt should be allowed to exist regarding safety." In that same year the academy recommended that the U.S. government establish deep geologic disposal as the best solution to the problem. In 1982, after embarrassing failures by the Atomic Energy Commission (the predecessor of the Nuclear Regulatory Commission (NRC) and the Energy Department) to select a waste site on its own, Congress enacted the Nuclear Waste Policy Act, which began the selection process for multiple sites throughout the United States. This process was scrapped five years later due to eastern states derailing the selection process. At that time Congress voted to make Yucca Mountain the only site to be considered. Yet Yucca's proposed opening date slipped by more than 20 years as the project encountered major technical hurdles and fierce local and state opposition.

The 15-member commission includes representatives from industry, government, and academia and is co-chaired by former National Security Advisor Brent Scowcroft and former Indiana Democratic Cong. Lee Hamilton. It's scheduled to provide interim recommendations in 18 months and a final report within the next 24 months. It will review the government's management of the nuclear fuel cycle and consider all alternatives for the storage, processing, and disposal of used nuclear fuel, high-level waste, and materials derived from nuclear activities.

The questions they likely will consider (listed below) have been around since the advent of the nuclear age. Here's what I believe the answers should be:

What should U.S. policy be for civilian spent fuel storage?

For nearly 30 years, NRC waste-storage requirements have been contingent on the timely opening of a permanent waste repository. This has allowed plant operators to legally store spent fuel in onsite cooling ponds much longer, and at higher densities (on average four times higher), than was originally intended. In 2004, a National Academy of Sciences panel warned that such densely packed reactor ponds were vulnerable to terrorist attack and catastrophic radiological fire. On March 9, NRC Chairman Gregory Jaczko told industry officials at an NRC-sponsored conference that spent fuel should be primarily stored in dry, hardened, and air-cooled casks that met

safety and security standards for several centuries. Yet today only 14 percent of the 65,000 metric tons of domestic spent fuel is stored in such casks.

Obviously, we need a new policy that takes into account the likelihood of indefinite reactor spent fuel storage in the age of terrorism. In this regard, in 2003 several of my colleagues and I recommended PDF that all U.S. spent fuel older than five years should be placed in dry, hardened storage containers, greatly reducing the fire risk if water was drained from reactor cooling ponds. Casks should be placed in either thick-walled structures or in earthen berms capable of withstanding plane and missile impacts. We estimated this could be accomplished with existing cask technology in 10 years at a cost of \$3 billion-\$7 billion. Moreover, future reactors should be designed so that temporary cooling ponds are encased in heavy concrete containment. Such steps were taken by Germany 25 years ago in response to the threats posed by accidental fighter jet crashes and terrorist attacks.

How should waste left at decommissioned reactors be secured?

Currently there are eight decommissioned U.S. nuclear plants where the spent fuel has been left behind under reduced safeguards. Another 13 reactors are in the process of being decommissioned. The country can't afford to rely on plant operators to safeguard waste left at these sites, given that this material may be there indefinitely. Therefore, it makes sense to consolidate these commercial dry spent fuel casks at one federal site, such as the Energy Department's Idaho National Laboratory, which is already storing commercial spent fuel.

Where should military high-level waste be disposed?

Since World War II, the production of plutonium and other nuclear material has generated about 100 million gallons of high-level radioactive waste that is stored in 237 gigantic underground tanks in South Carolina, Washington, Idaho, and New York. In 1985 the government mandated that such wastes be commingled and stored with civilian spent fuel at Yucca Mountain. With Yucca closed, community and political leaders near Washington's Hanford and South Carolina's Savannah River nuclear weapon sites are now suing to reopen Yucca and force the government to take the material. There is growing interest in placing the waste in the Waste Isolation Pilot Project (WIPP), a geologic disposal site in a salt formation near Carlsbad, New Mexico that opened in 1998 for plutonium-contaminated military waste. Predictably, New Mexico's elected officials are not supportive of the idea.

Despite local political opposition, there may be merit to exploring the potential for defense high-level waste disposal at WIPP. Unlike commercial spent fuel, more than 98 percent of the long-lived radioactive material in defense wastes, such as plutonium, has been removed. It's also roughly 10 times less radioactive and thus produces less decay heat than commercial reactor spent fuel--an important factor because decay heat can corrode waste containers and impact the geological stability of the site. That said, more research is necessary to determine if placing wastes in WIPP is a viable option.

Should Washington reconsider reprocessing?

For 30 years the United States has refrained from reprocessing commercial spent fuel to separate plutonium for reuse in its power plants because of proliferation

concerns. But, the Obama administration's long-term goal is to fund research to develop "proliferation-resistant" reprocessing and waste-disposal reduction technologies. To a large extent the academy has already covered much of this ground in 1996 and 2007, but such an option remains attractive to members of Congress who can support a long-term research program that promises to solve the problem without reopening a disposal site-selection process guaranteed to anger their constituents.

Still, putting off a hard decision--while politically expedient--isn't an actual solution. And the economic and technological hurdles, as outlined in reports by the National Academy of Sciences, are formidable to put it mildly. Reprocessing plants release about 15,000 times more radioactivity into the environment than nuclear power plants and generate wastes with high decay heat. Other efforts to build what is called a "closed fuel cycle," where waste is recycled and reused in reactors have failed for 50 years. Such failure has left about 250 tons of excess plutonium stored at reprocessing plants around the world--enough for some 30,000 nuclear weapons.

It's time to accept that a once-through nuclear fuel cycle, where spent fuel is put into permanent geologic storage, is the only sensible option.

Should a new site for geological disposal be selected?

Regardless of what futuristic reprocessing or other waste-reduction technologies may offer someday, geological disposal always will be required for the highly radioactive fission products that can't be reused in reactors. While Yucca Mountain's geology violates repository siting criteria of the International Atomic Energy Agency (IAEA) since its located in an earthquake prone area and oxidizing environment, which could corrode waste containers over time, several geological formations that would meet the IAEA's repository criteria are located in the eastern United States.

The commission's charter makes it clear that it isn't charged with recommending new disposal sites. But it should clearly articulate what the best attributes would be for a site in the United States. The most difficult, but essential task is to lay the groundwork for site selection that takes into account the public and the states. There should be no rush to select a repository to allow for scientific thoroughness and public participation. Any selection process also should incorporate lessons learned from positive experiences in other countries. Additionally, more time will allow for other promising disposal options to be explored, such as burying waste in 2-3 mile-deep boreholes using existing drilling technology.

Should the Energy Department continue to be responsible for the country's nuclear waste? This question underlies all else. Energy's history and the legacy of the Atomic Energy Commission don't inspire much confidence (e.g., accident and leak cover-ups, secrecy about nuclear fallout, and sick nuclear workers). In fact, the United States is left with one of the planet's most toxic environmental legacies. According to Energy, the treatment and disposal PDF of all U.S. high-level waste will cost more than \$125 billion. Because of the department's lack of credibility, there is interest in creating a new government entity to deal with the issue.

The creation of a new government entity would provide an opportunity to start with a clean slate, discarding the endemic secrecy, isolation, and lack of accountability that has corrupted the process for decades. However, no amount of simple government

reshuffling will restore the public's trust. To succeed, the governance of such a new organization must include meaningful involvement and early engagement by states, Native American tribes, and locally affected citizens.

The tasks facing the commission are daunting, given the renewed pressure to build new nuclear power reactors, maintain a large and antiquated federal nuclear infrastructure, and placate U.S. voters opposed to nuclear waste sites in their backyards. Hopefully the Blue Ribbon Commission will live up to its name and credibly define the safe storage and disposal of one of the most hazardous materials on the planet.

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