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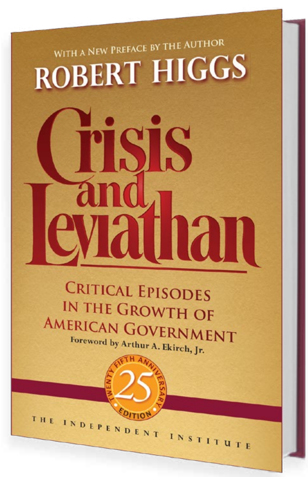

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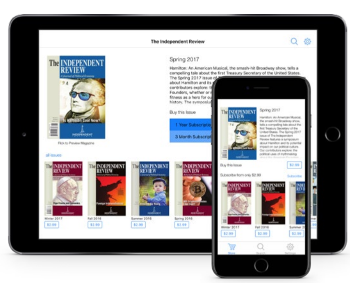

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The Demise of Yucca Mountain

William Beaver

The Obama administration's recent announcement that it would cut funding for the development of a nuclear waste repository at Yucca Mountain, Nevada, may be the beginning of the end for one of the country's longest and most contentious political battles. Although the project was not officially canceled, a spokesperson for the U.S. Department of Energy (DOE) declared that "Yucca Mountain is not an option," and Energy Secretary Steven Chu stated that radioactive wastes can be stored safely in concrete and steel containers at nuclear plants until a new strategy is developed (Vogel 2009). The new policy contrasts sharply with that of the Bush administration, which sought to increase the size of the Yucca Mountain repository significantly to avoid the need for a second storage facility and to have it open by 2017.

The announcement elicited mixed reactions. Senate majority leader Harry Reid of Nevada, who had fought the Yucca Mountain project for years and was instrumental in the funding reductions, was elated. "I'm glad I was able to make these cuts and bring the Yucca Mountain project another step closer to its rightful end," he stated. In contrast, the nuclear industry was frustrated by the decision. An industry spokesperson said, "We continue to ask the federal government to provide a clear solution for what the long-term storage of spent fuel will be" (Hawthorne 2009). The industry frustration was undoubtedly deepened by the fact that the nation's utility companies have paid the government more than $22 billion in fees to help build the repository.

Regardless of one's view about the project, the decision to halt its development represents a significant government failure. Consider that Congress selected Yucca

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Mountain in 1987 and that the government has already spent almost $10 billion on it. In the meantime, nearly 60,000 tons of spent fuel have piled up at the country's 104 commercial nuclear plants, for which the federal government bears ultimate responsibility. Many believe that failure to develop a permanent solution to the waste problem leaves the future of nuclear power up in the air because utilities may be reluctant to order new reactors with so much uncertainty still present. This development comes at a time when estimates indicate that the United States will need to increase electrical output by 25 percent over the next two decades. Just as important, nuclear plants emit no greenhouse gases that contribute to global warming. In fact, several prominent environmentalists have endorsed the technology for that reason (Moore 2006). In any event, the Obama decision raises the questions, Why was this decision taken now, and what comes next? To understand how we arrived at this point, it is important first to examine the policies that produced it.

A Government Responsibility

The Atomic Energy Act of 1954 made the federal government ultimately responsible for disposal of the spent fuel that commercial nuclear plants would generate. The most obvious reason for this assignment of responsibility is that significant dangers are involved. Nuclear reactors have thousands of fuel rods that periodically must be replaced, and they will be radioactive for thousands of years. For this reason alone, long-term on-site storage of the spent fuel was considered unacceptable because power plants are often located near population centers and along waterways, where leaks or acts of terrorism might have disastrous consequences. So the plan was to place the used rods in 40-foot-deep steel-and-concrete swimming pools (each nuclear plant has one), and then the federal government, utilizing its expertise and resources, would at some future point remove them for ultimate disposal elsewhere.

The government also took responsibility for the waste for reasons tied to economics and politics. Put simply, few utilities would have agreed to construct a nuclear plant if they were to be held responsible for dealing with the waste. Nuclear power, particularly in the 1950s and 1960s, made little economic sense. Conventional generating plants met the growing demand as electricity prices declined and utility profits increased. The country had not yet become concerned about the environmental problems associated with burning coal. Therefore, if utilities were going to consider the nuclear option, sloughing off the costs and risks of waste disposal would be necessary. Why then did the government promote nuclear power before the economics of the technology were more favorable for commercial development? In short, the answer is that nuclear power emerged at the height of the Cold War and quickly became part of the ideological struggle between the United States and the Soviet Union. By developing the peaceful atom, the U.S. government hoped to demonstrate its technological superiority over the Soviet Union. Senator John Pastore of Rhode Island expressed a widely held view when he warned, "If we are outdistanced by the Russians in this race it would be catastrophic” (U.S. Congress 1956, 14). In this light, it seemed essential that the United States take the lead in developing civilian reactors, and, in view of the costs and risks, the federal government would have to be the driving force in doing so. Even President Dwight D. Eisenhower, who was always leery of government involvement in technological development, threatened to build “Nuclear TVAs [Tennessee Valley Authorities]” if the nation’s utilities didn’t begin to construct reactors on their own.

Some people fervently believed that nuclear power, beyond winning a significant foreign-policy struggle with the Soviet Union, would usher in a new era of prosperity if urgently pursued. Harnessing the atom’s power would not only provide abundant, inexpensive electricity, but also power our automobiles, planes, and rockets, among other things. This emphasis on developing peaceful uses of atomic energy emerged shortly after World War II and was tied to the idea that something so powerful and potentially destructive should be put to positive use for the benefit of mankind. In December 1953, President Eisenhower echoed these sentiments in his “Atoms for Peace” speech at the United Nations, in which he urged all nations (with U.S. help) to develop peaceful uses of atomic energy (Pilat, Pendler, and Ebinger 1985).

Early Attempts to Dispose of Wastes

In such an atmosphere, the rather mundane subject of waste disposal did not receive much attention. More than 90 percent of government funding in those early years, not surprisingly, was channeled into reactor development. However, the waste problem was not totally ignored, and, at the time, it was not considered to be highly perplexing. The assumption made early on was that radioactive waste could be placed in bullet-shaped canisters and dumped into ocean sediments thousands of feet below the surface. The navy did bury low-level wastes at sea, but this option was eventually ruled out because in such deposits the waste would be difficult, if not impossible, to monitor. The idea of burying wastes at the South Pole was also dropped. Another bizarre plan called for launching the spent fuel into outer space to orbit the sun or Venus. (Shapiro 1980, 228) The problem, of course, is that rocket technology would have to made fail-safe, a perfection never achieved.

A more practical alternative involved storing radioactive wastes in underground salt domes, which tend to be stable and dry. The Atomic Energy Commission did operate a demonstration project in Kansas in the 1970s. Several safety issues were unfortunately not resolved, however, including the effects of radiation on the salt itself, so the project was ended (Kearney and Garey 1982). In addition, other states with salt domes, including Texas, Louisiana, and Mississippi, had the political clout to stall any future development (Wald 1989). Nevertheless, in 1974 the DOE constructed the Waste Isolation Pilot Plant in a New Mexico salt dome to store government-generated waste. The plant’s opening was delayed for almost two decades for fear that water might seep into the chamber 2,100 feet under the ground and corrode the waste containers. Such an event has fortunately not occurred, and since 1999, when the facility was put into use, nearly 35 cubic meters of wastes have been stored there (Munger 2009).

Reprocessing was another option that received considerable attention early on and was thought to hold the most promise. Reprocessing involves chemically dissolving the spent fuel rods and then recovering the uranium and plutonium to make new rods. Recovering one metric ton of spent fuel yields potential energy equivalent to 10,000 tons of oil (Valenti 1995). To spur development, the Atomic Energy Commission funded and performed basic research at the national laboratories, and one of the first reprocessing technologies resulted from these efforts in the 1960s. In addition, the government agreed to purchase the recovered plutonium from the utilities, thereby reducing the utilities' fuel costs and making nuclear power even more attractive.

On the surface, reprocessing made good sense, transforming a waste product into something useful. Nonetheless, after reprocessing, highly radioactive wastes still exist and must be dealt with, although the volume may be reduced by as much as 95 percent (Tucker 2009). Another reprocessing issue involved costs. Could reprocessed fuel be competitive with mined uranium-235, the only naturally occurring material capable of sustaining a chain reaction? Some in the private sector apparently believed that it could. The first commercial reprocessing facility opened in 1966, in West Valley, New York, at which time three more plants were in various stages of development, including one under construction by General Electric in Illinois. Much of the early enthusiasm was based, at least in part, on the assumption that once nuclear power took off, the price of mined uranium would rise, making reprocessed fuel competitive. The government also hoped that competition would not only spur innovation, but drive down costs. On the positive side, the early competition did produce some new reprocessing techniques, but it also convinced the firms involved that they would have a difficult time turning a profit. This expectation, along with the government's lack of power to force continued operations, ended all private ventures by 1975 (Campbell 1987).

In retrospect, these early failures should not be surprising. The technology was new, and costs were difficult to estimate. With the benefit of hindsight, however, it is difficult to make the argument that reprocessing can ever be profitable. A recent study estimates that the price of uranium would have to increase by a factor of ten for reprocessing to be cost effective (Kintisch 2005). In the end, uranium proved to be more abundant than expected and was never in short supply. Hence, any reprocessing efforts had to be government driven. In any event, new White House policies rendered serious discussion of reprocessing moot. In 1976, President Gerald Ford temporarily suspended all reprocessing efforts. In 1977, President Jimmy Carter announced, "We will not enter the plutonium age," and he banned the construction of any reprocessing facilities (Gilinsky 1978). Both presidents feared that reprocessed plutonium might be used to construct a nuclear weapon if rogue nations or terrorists gained access to it.

Today, some nuclear advocates believe that the decision to end reprocessing in the United States is the major reason why the nuclear waste dilemma continues. The fears of nuclear proliferation have proven to be unfounded. Nations that built nuclear weapons found other means to acquire the necessary materials, and, as far as we know, terrorists have not been able to acquire plutonium, although some still believe that terrorists might get their hands on these materials (Inman 2005). Much is also made of the French success in reprocessing spent fuel at La Hague, Normandy, since the 1970s. France, which generates 78 percent of its electricity from nuclear power, reprocesses not only its own spent fuel, but also fuel from several other countries, which has helped offset the costs. To date, few problems have arisen at the 750-acre facility, although environmental groups have protested shipments of spent fuel to La Hague (Rust and Haig 2001).

The French maintain that the plant is one of the most heavily guarded and monitored nuclear facilities in the world. It is also highly automated, with robotic manipulators handling more than 1,000 metric tons of spent fuel each year. The radioactive wastes that remain are then stabilized by a process known as vitrification, in which the waste is first mixed with borosilicate glass and then stored on site in corrosion-resistant, steel alloy containers (Valenti 1995; Cox 2008). The final resting place for the vitrified waste, however, has yet to be determined. During the 1980s, the French government selected possible underground sites without consulting with the local communities involved. A public backlash ensued, and a law was passed in 1991 requiring a fifteen-year moratorium before a final site may be chosen (MacLachlan 2006). Although the moratorium has expired, no site has been selected.

The French reprocessing experience is generally viewed as positive, but Great Britain's is not. The Thorp reprocessing plant, located at Sellafield, opened in 1994 and has had a checkered history of operations, with several accidents reported, including the leakage of thousands of gallons of radioactive waste in 2005. The spill appears to have been contained within the plant. Making matters worse, though, the plant has typically operated at only 50 percent of capacity and has been mired in red ink despite initial predictions of profitability. For these reasons, the facility's future is uncertain (Merrell 2003).

Drawing on the French experience and aware that Yucca Mountain faced major hurdles, the Bush administration attempted to revive interest in reprocessing. In 2006, it announced the formation of the Global Nuclear Energy Partnership. The purpose of the twenty-five-nation organization was to reinvigorate nuclear power and spur interest in reprocessing. The administration accordingly hoped to construct a new reprocessing facility by 2010, but lack of funding stymied these efforts (Hylko 2008). Assuming that the French success can be duplicated, costs will undoubtedly be a major issue. A study by the National Research Council in 1996 estimated that reprocessing all of the existing spent fuel would cost up to $100 billion, whereas finishing the Yucca Mountain facility would run in excess of $90 billion (Kintisch 2005). Another study, by the Boston Consulting Group for Areva, the French nuclear firm that operates La Hague, found that reprocessing "is in an economic range that can be competitive." The report noted specifically that reprocessing can increase the capacity of a repository because the volume of wastes is reduced, thus eliminating the need for a second facility. In addition, spent fuel would not have to be stored on site, so utility costs would be reduced and safety concerns lessened ("New Report" 2006). However, reprocessing is envisioned in conjunction with a repository, not without one. Reprocessing would thus be more costly than a repository alone.

Yucca Mountain

By the early 1980s, it had become clear that salt domes and reprocessing were not realistic possibilities, so the government turned to underground burial as the only viable option remaining. There was also a growing sense of urgency that something needed to be done. As Luther Carter wrote in *Science* at the time, "it is an acute embarrassment that the waste problem has not been solved" (1983, 33). In this vein, Congress passed the National Waste Policy Act in 1982, requiring the DOE to examine potential locations for repositories, one to be located in the East and the other in the West. The president would then make the final selection, opening the facility in 1998. There were two reasons for selecting two repositories. First, it seemed only fair that no single part of the country should have to store all of the waste. The second reason was more practical. It made sense to locate a facility in the East because the bulk of the waste is located there, and a nearby site would both reduce transport distances and lessen safety concerns associated with hauling highly radioactive materials across the country. The idea of an eastern site was eventually dropped, however, in large part for political reasons. It was unlikely that any state would agree to house a repository, and the eastern states' larger congressional delegations have more clout to block pending legislation. The argument can also be made that the West is better suited for a repository because it has a less-concentrated population and a larger land area.

In 1986, the DOE announced that three sites in the West would be considered: one in Texas, one in Washington, and one in Nevada—Yucca Mountain. No eastern site would be developed, at least in the near term. To say the least, western politicians were outraged and demanded a legal justification, but none was forthcoming (Marshall 1986). The legislative process then began to move quickly, spearheaded by Louisiana senator Bennett Johnston, who sold the plan for a Nevada site by arguing that it would be less costly to develop because more was known about it, not to mention that many considered Yucca Mountain the best location. At the same time, states such as Texas and Washington could escape the possibility of getting a repository, and eastern states would no longer have to worry about a second repository because the legislation indefinitely deferred that possibility. As a final sweetener, Johnston attached the legislation to a finance bill that included a number of pork-barrel projects, and the legislation was passed in December 1987. Nevada, with the smallest congressional delegation, was the least able to resist the forces in motion. Harry Reid called the new law "base raw power politics" (Rasky 1987). Senator Johnston felt fairly certain that the waste issue had finally been resolved, but others were not so sure. One DOE aide remarked, "It's a roll of the dice with Yucca Mountain. We have reason to believe it will work out, but if it doesn't . . . man, we're in trouble" (Marshall 1988).

The legislation provided for an intensive study of the Nevada site, which is located about 100 miles northwest of Las Vegas, near the nuclear test range where hundreds of nuclear devices were detonated in the 1950s and 1960s. The area seems to have inherent advantages. It is dry (receiving only about seven inches of rain a year), remote, and geologically stable. Some scientists objected to the selection of Yucca Mountain not because the site is necessarily a bad one, but because they felt that all of the potential locations should have been thoroughly investigated and more experimentation carried out in regard to underground burial before a final selection was made. On balance, however, most technical experts believed that a repository, if built correctly, could store the wastes with minimal risk to the public (Krauskopf 1990). As H. W. Lewis observes in his book *Technological Risk,* "[I]t is embarrassingly easy to solve the technical problems, yet impossible to solve the political problems" (1990, 245–46). Sure enough, the political problems cropped up immediately.

The Struggle

In 1989, Nevada enacted legislation making it illegal to store high-level radioactive waste in the state, and the state refused to issue environmental permits necessary to do a study of the Yucca area. Federal court decisions reversed the permit ban, and the study began after the DOE revamped it (Slovic, Flynn, and Layman 1991). The episode marked the beginning of a twenty-year struggle between the federal government and Nevada, where a prerequisite for election to any statewide office was opposition to the repository. Besides taking various legal actions, the state cited almost every possible technical problem as a reason to end the project. Consider that Nevada recently submitted 229 technical objections to the Nuclear Regulatory Commission (NRC) to explain why the repository should not be built ("Nevada Points Out" 2008). Some of these concerns may be legitimate. For example, a DOE geologist raised early on the possibility that an earthquake might alter the repository so that groundwater might enter the radioactive waste chamber, producing radioactive steam that would eventually find its way to the outside. A scientist at Los Alamos National Laboratory in New Mexico hypothesized that the waste might actually explode in the 300-meter underground chamber. In response, the DOE appointed independent review panels to examine both claims, but in the end the panels did not find them credible, although some still believe that earthquakes can threaten the repository's integrity. More serious perhaps is the danger of volcanic activity. Scientists believe that an eruption occurred approximately one million years ago near Yucca and another perhaps twenty thousand years ago. Nevada governor Robert Miller claimed that such recent activity should immediately disqualify the site. In response, the DOE asked ten experts to estimate the danger of an eruption. The average estimate was a one in ten thousand chance that an eruption would occur in the next ten thousand years, which apparently satisfied the department (Kerr 1998). In 1999, DOE issued a report stating that it had identified "no show stoppers" at Yucca and had confidence that the repository "would protect public health and the environment for thousands of years" (U.S. DOE 1999).

Not all concerned parties were so positive. For example, a U.S. General Accountability Office report stated that the DOE's predictive models are inadequate and that water might still be a problem. Others believed that high humidity might pose potential threats and that not enough is known about the rock formations at Yucca. Hence, delay and further study were needed (Ewing and Macfarlane 2002). Despite everything, the DOE recommended in 2002 that President Bush designate Yucca Mountain as the repository for high-level radioactive waste in the United States. The president did so, and Congress approved the Yucca Mountain site (Wald 2002). Following congressional approval, Nevada continued to fight the repository with every means available, citing environmental, technical, and transportation concerns, along with poor project management by DOE. The state also refused to grant DOE permission to use the water necessary to drill bore holes to study the site ("Gov. Gibbons" 2007). Along the way, the project picked up both supporters and detractors. The National Academy of Sciences came out in favor of Yucca Mountain, but Nevada gained the support of influential senators such as Hilary Clinton, Barack Obama, and Barbara Boxer, all of whom came out against the repository. To some extent, views on Yucca Mountain were divided along party lines, with Republicans in favor and Democrats opposed.

The process continued to drag on. A federal district court had placed a hold on the licensing process for construction, but finally, in June 2008, the DOE submitted an 8,600-page document to the NRC. Shortly thereafter, the U.S. Environmental Protection Agency issued its long-awaited radiation standards for the repository. The million-year standard requires that any person outside the boundaries of the repository receive no more than 15 millirems per year for 10,000 years and 100 millirems per year for the next 990,000 years. The agency maintains that the average person receives about 360 millirems per year from naturally occurring sources. Senator Reid objected to the lowered standard after 10,000 years, stating that it would put people at risk. He also indicated that the Environmental Protection Agency ruling might bring about more litigation (Speckman 2008).

By filing the licensing application before the 2008 presidential election, the Bush administration hoped to make it more difficult for Barack Obama, should he become president, to derail the program (John McCain favored the repository), and it appears that the licensing process will continue. However, it will probably take three or four years, with hundreds of technical challenges being raised by Nevada and other concerned parties. Moreover, budget cutbacks may make it difficult for the NRC to investigate all of the challenges (Rogers and Tetreault 2009). Nevertheless, if the NRC eventually approves the repository, President Obama may feel forced to cancel the program, given his sentiments concerning Yucca Mountain. If he does so, the nation's utilities are likely to file lawsuits to recover the billions of dollars they have paid to the federal government for a repository, on top of the more than four dozen lawsuits they have already filed because of the government's failure to dispose of the waste (Vartabedian 2005; Hughes 2008).

Might It Have Been Different?

The long struggle to construct an underground repository may well end with little to show for it. Let us consider whether things might have been done differently to ensure a repository's construction, keeping in mind that most countries heavily involved with nuclear power believe that some type of underground burial will be required ("Planning" 2005), To answer the question, we must examine the fairness issue. Nevada was selected for a repository that no other state wanted and in this sense was treated unfairly. Perhaps if the DOE had stuck to the original plan and selected both an eastern and western location, a sense of "sharing the burden" would have lessened the sense of injustice. Even without an eastern site, DOE could have extensively studied the three western locations as originally planned, while conducting various experiments on underground burial that might have more clearly resolved some of the remaining environmental and technical issues, as some in the scientific community had urged. If this path had been followed, a greater sense of fairness and objectivity would have been embedded in the selection process. The irony, of course, is that in order to speed construction of a repository, none of these actions was taken.

Another possibility would have been to add enough sweeteners to entice Nevada to accept the repository. Such scenarios are not without precedent. For example, people who live near French nuclear plants receive free electricity. The original legislation that designated Yucca Mountain called for the host state to receive $100 million per year, but the amount was later reduced to $20 million (Marshall 1988). Of course, we cannot know now whether more dollars would have assuaged Nevada's feelings of inequitable treatment. Perhaps the payment's reduction further antagonized the state's congressional delegation. However, once the legislation was passed, and Nevada's political leaders initiated a mission to stop the repository, accepting more federal dollars would have been viewed as a bribe and become more difficult to accept.

In any event, the Yucca Mountain episode clearly demonstrates how difficult building a repository will be—after all, Nevada has less political muscle than other states and possesses a site that many believe is well suited for the project. At this point, one can only conclude that the prospects for a repository are bleak. Part of the problem lies in the federal system itself. Although states may not have veto power over federal policies, they clearly can obstruct them, making objectives difficult, if not impossible, to achieve (Kearney and Garey 1982). Harry Reid's recent accession as Senate majority leader, with more control over the budget process, guaranteed more delays even without Barack Obama's election as president.

Politics aside, perhaps the ultimate impediment to construction of a repository is fear of radiation. In this regard, Nevada is a particularly interesting case because the Yucca Mountain area was the site for tests of atomic weapons both above and below ground beginning in the 1950s. In all, more than nine hundred weapons were detonated, and, at one time, Clark County (where Las Vegas is located) displayed a mushroom cloud on its official seal (Schultz 2009). Thus, one might have expected less opposition to a repository there. Yet surveys indicate that more than 70 percent of Nevadans oppose Yucca Mountain. Beyond the millions spent by the state on advertising to influence public opinion (Zeller 2002), Americans' attitudes toward nuclear power and the wastes it generates have changed over the years. Beginning in the 1970s, the environmental movement and antinuclear activists made the public more aware of the possible dangers and reinforced the fears of radiation. Spencer Weart, in his book *Nuclear Fear* (1988), has traced these feelings to the early decades of the twentieth century, when images of hideous deformities caused by radiation and fears of mass death and destruction first appeared. Such fears became a horrifying reality in the devastation of Hiroshima and Nagasaki, and the accidents at Three Mile Island and Chernobyl only heightened them. In addition, the government's handling of nuclear waste has not always inspired confidence. During the 1970s alone, eighteen spills of radioactive waste occurred at the government's Hanford Reservation in Washington State. Nuclear scientists have always maintained that these fears are irrational. Recent reports indicate that radiation damage at Chernobyl was much less than predicted, and one scientist has urged that construction of a repository at Yucca Mountain merely be delayed in order to allow the fears to subside further ("Science and Technology" 2005). Unfortunately, such attenuation may take decades to occur, if it ever does, because fears of radiation, irrational or not, are deeply etched in the public mind.

Now What?

At this point, the Obama administration has made no specific proposals about the nuclear waste problem besides ruling out Yucca Mountain. The DOE may appoint a blue-ribbon commission to study the options. In this regard, Obama suggested during the presidential campaign that another site might be developed. Of course, the obvious question is, Where? No state is likely to volunteer for the honor, and, if a state is selected, years of haggling and obstruction probably lie ahead because it is unlikely that any site will measure up to the scrutiny to which it will be subjected. If history is not to be repeated, new techniques for dealing with the waste may be required, as Energy Secretary Chu has intimated. What might these techniques be? A process known as transmutation, which has been discussed for years, would reduce the period during which spent fuel would be highly radioactive from ten thousand years to three or four hundred. If this technique were to be developed successfully, some state, given the right incentives, might be persuaded to accept a repository. It is obviously much easier to assure a structure's integrity for hundreds of years rather than thousands. Indeed, one of the disconcerting questions Yucca Mountain has always raised is, Can anything be guaranteed for ten thousand years?

Reprocessing may also be pursued once again. To make the technology more palatable, researchers have been investigating techniques that lessen the chances of terrorists' acquiring plutonium from a reprocessing plant. One way to do so is to mix plutonium with uranium (a form of transmutation), creating what is called MOX fuel, which can then be used in commercial nuclear reactors. A MOX fuel demonstration plant under construction in South Carolina has faced major delays, however, and is not expected to open until 2017 (Henderson 2009). Nonetheless, if the process becomes well established, reprocessing might become more acceptable, allowing a reduction of the amount of waste to be stored. In the end, perhaps a combination of newly developed technologies will emerge that makes the storage of radioactive waste less ominous and the construction of a repository more likely.

Conclusions

More than fifty years after the first commercial nuclear plant opened, the radioactive waste dilemma continues to persist with no end in sight. Americans have enjoyed the benefits of nuclear power but have failed to deal with its major burden. Most scientific experts believed early on that the issue could be resolved, and, in a purely technical sense, it might have been solvable. However, nuclear power and politics have always been intertwined, especially with regard to the disposal of nuclear waste. No single state wants to accept a repository, and under the U.S. federal system, forcing a state to do so is extremely difficult. At present, no one seems to know how to resolve the issue. Hence, for the time being and perhaps for a long time, the spent fuel rods will remain at the power plants by default. Perhaps the answer to dealing with radioactive waste will ultimately require a technological fix that will mitigate the political obstacles. Without a doubt, however, the generations that innovated nuclear power will leave the waste problem for later generations to solve, which is perhaps the innovators' ultimate failure.

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