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NUCLEAR WASTE POLICY STATUS AND PROSPECTS IN 2021

By Steven P. Nesbit

Sooner or later, any discussion of the future of the role of nuclear power leads to the question, "What are you going to do with the waste?" Nuclear technology professionals recognize that there are good solutions available for the management and disposal of nuclear waste, but implementing them requires overcoming societal and political barriers that have proven daunting in this country. Currently, the United States has a nuclear waste policy, but the federal government lacks the will to implement it or change it. The past decade has been extremely frustrating to those dedicated to addressing waste issues here and now, rather than kicking them down the road. Prospects for the next decade are uncertain, at best.

BACKGROUND

Nuclear fission produces abundant, carbon emissions–free electricity around the clock—a tremendous benefit for our energy-intensive society. However, the same nuclear reactions that release energy produce fission products and heavy elements that must be isolated from the environment to protect public safety. Those radioactive materials exist in several forms. There is a large and growing inventory of used fuel at commercial nuclear power reactor sites—more than 80,000 metric tons heavy metal (MTHM) as of the end of 2019. Approximately 2,300 MTHM of non-commercial used fuel is stored at Department of Energy sites and at non-DOE research reactors. Finally, high-level waste—the fission products separated from used fuel by reprocessing—is stored in solid and liquid form at the DOE's Hanford, Idaho, and Savannah River sites. There is also a relatively small quantity of vitrified HLW stored at the commercial reprocessing facility at West Valley, N.Y., which discontinued operations around 1970.[1]

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The underground Exploratory Studies Facility at Yucca Mountain in Nevada built by the Department of Energy to determine whether the location was suitable as a deep geological nuclear waste repository. Photo: DOE

The Nuclear Waste Policy Act of 1982 (NWPA) established a legislative, economic, and social framework for the management of both commercial and government used fuel and HLW in the United States. It was the product of years of study and negotiation and was passed with bipartisan support. The NWPA contains many provisions, but the focal point of the act was establishing mined geologic repositories for the disposal of the material. The NWPA assigned the responsibility for used fuel and HLW storage and disposal to the DOE and established the Nuclear Waste Fund, to which commercial nuclear power operators were required to contribute to pay for the DOE's work. In 1987, the Nuclear Waste Policy Amendments Act focused repository development solely on a site at Yucca Mountain in Nevada. Since that time, the state of Nevada has worked assiduously to stop the project, even though the host county (Nye County) and some other Nevada counties support the project, provided it meets safety and environmental requirements. In 2002, the secretary of energy recommended Yucca Mountain as the site for repository development, and both houses of Congress overrode the subsequent veto of that recommendation by the Nevada governor.

In 2008, the DOE submitted an application to the Nuclear Regulatory Commission seeking authorization to construct a repository at Yucca Mountain. The NRC staff review was well advanced in March 2010 and on its way to a favorable safety evaluation when the Obama administration stopped work on the Yucca Mountain project. The administration also eliminated the Office of Civilian Radioactive Waste Management, the office within the DOE responsible for managing and disposing of commercial and DOE used nuclear fuel and HLW. The cited basis for these actions was a determination by then energy secretary Steven Chu that the Yucca Mountain repository was "unworkable" in the face of opposition from the state of Nevada.

The ensuing decade was characterized by activity in all three branches of government—executive, legislative, and judicial—and in private industry as all parties attempted to deal with the fallout from the cancellation of the Yucca Mountain project. The details are not cataloged here, but for more information, the reader may refer to the U.S. Nuclear Industry Council's June 2020 *USNIC Backend Working Group Policy Brief*[2] and the NRC's HLW disposal web page (nrc.gov/waste/hlw-disposal).

As the decade of the 2010s drew to a close, the situation

The Class A low-level waste trench at the commercial low-level waste Hanford site near Richland, Wash. Photo: NRC

A load of high-activity waste contaminated with transuranics, elements resulting from a nuclear chain reaction. This photo shows an RH72-B cask, certified by the NRC to transport waste requiring remote handling, en route for disposal at the Waste Isolation Pilot Plant, a deep geologic repository near Carlsbad, N.M. Photo: DOE

can be summarized as follows:

■ Despite the expenditure of more than $11 billion,[3] the federal government has not fulfilled its obligation to dispose of commercial used nuclear fuel, DOE-owned used fuel, or HLW generated by defense activities.

■ Because of the federal government's failure to manage and dispose of used fuel, the courts have required it to pay commercial nuclear plant operators billions of dollars to continue to store used fuel. Future government financial obligations to commercial nuclear power plant operators are conservatively estimated at more than $30 billion.[3]

■ The implications of the lack of a geologic repository extend beyond the commercial nuclear power industry. DOE sites store DOE-owned used fuel and HLW, and cleanup activities cannot be completed until there is a disposal path for that material. Without a repository, the DOE will not be able to fulfill its commitments to communities around a number of DOE sites. Ultimately, activities crucial to national defense (e.g., naval propulsion) could be at risk.

■ Since fiscal year 2010, appropriations for used fuel have been relatively modest and general in nature, with no funding for specific projects such as Yucca Mountain. The FY 2021 Omnibus Appropriations Act included $62.5 million for used nuclear fuel disposition, an increase of $2.5 million over last year, and $18 million for an integrated waste management system, down $7 million from FY 2020. The funding has historically covered generic repository studies and evaluations, research and development on used fuel dry storage and transportation, and program management.*

■ The likelihood of restarting the Yucca Mountain project is currently low. The project is authorized by current law (the NWPA), and there is considerable support for it in Congress. Moreover, in 2015, the NRC issued a safety evaluation that found that the repository design meets the stringent standards for protection of public health and safety. Nevertheless, it has become increasingly clear that Congress as a whole is not willing to appropriate funds to finish the project over the objections of the state of Nevada.

■ There is no government effort under way to identify an alternative site or sites for a geologic repository, and, in fact, the NWPA precludes such an effort while Yucca Mountain is the designated national site.

■ There is no government effort under way to implement a consolidated interim storage (CIS) program. Such a program would collect used fuel at one or more sites for storage until a repository is available, thereby saving money through economies of scale and allowing shut-down plants

* These DOE appropriations do not include the hundreds of millions of dollars the government pays nuclear power plant operators each year in reimbursement for used fuel storage costs.

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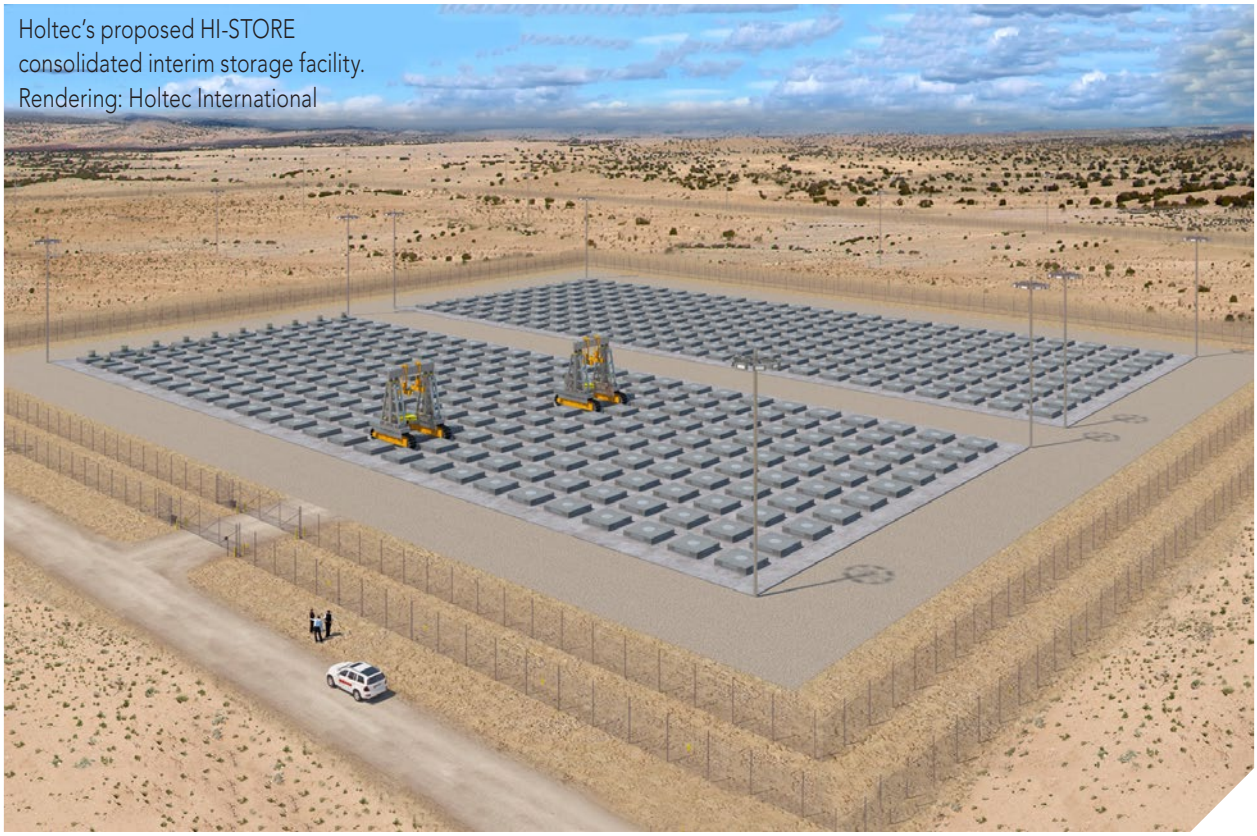

Holtec's proposed HI-STORE consolidated interim storage facility. Rendering: Holtec International

to be repurposed for other uses. In addition to the $80.5 million for used fuel research and development discussed above, the FY 2021 Omnibus Appropriations Act included a new line item of $27.5 million, $20 million of which is for interim storage and the remainder for Nuclear Waste Fund oversight activities. However, Congress provided no further guidance, and it is not clear how the DOE plans to use the funding to advance CIS.

■ Private companies Holtec and Interim Storage Partners have applied for NRC licenses to construct and operate CIS facilities in New Mexico and Texas, respectively. It appears likely that both will receive their licenses in 2021. However, the governors of both states oppose the facilities, despite the fact that they have strong local support. It remains to be seen if the companies will be able to put the facilities into operation in the face of state opposition. The track record is not encouraging—previous CIS initiatives foundered due to state opposition.

■ Deep Isolation, a private company, is developing horizontal drillhole technology as an alternative to a mined geological repository system for the disposal of HLW. The technology appears promising for some applications, but it should be recognized that community or state opposition may arise once specific sites are under consideration.

■ The reprocessing of nuclear fuel has been touted as an alternative to direct disposal of used fuel in a repository. However, at current uranium prices, reprocessing is not economical, and a repository would still be needed to dispose of the HLW produced by reprocessing.

THE NEWS IS NOT ALL BAD

It is exceedingly easy to be frustrated by the political roadblocks that spring up whenever a nuclear waste management solution is pursued. However, it is important to remember that the commercial nuclear industry has safely and efficiently managed its used fuel since its inception and will continue to do so. Government and industry research has shown that used fuel dry storage can be carried out safely for a very long time, perhaps extending into the hundreds of years. Nevertheless, indefinite storage is not an acceptable solution for an industry that aspires to be an important part of the country's clean energy future. Used fuel disposal is moving forward in other countries. A geologic repository is under construction in Finland, and Sweden, France, Switzerland, and Canada are making good progress toward repository development. Technological innovations (e.g., horizontal drillholes and advanced fast spectrum reactors that use some waste as fuel) hold promise for helping address the waste issue.

WHAT WILL THE FUTURE BRING?

Proposals for fixing the United States' nuclear waste program abound. The 2012 report by the Blue Ribbon Commission on America's Nuclear Future[4] made a series of recommendations, none of which has been implemented. American Nuclear Society position statements make recommendations about Yucca Mountain licensing,[5] interim storage of used nuclear fuel,[6] and program governance.[7]

At some point, the federal government must make a fundamental decision—either carry out the current policy (complete the Yucca Mountain project) or establish and carry out a new policy. Some potential aspects of a new policy are summarized below.

Repository: A "consent-based" siting program for a repository is a popular proposal. With this approach, the government would pursue a repository site only if all affected units of government for the site, including the state, agree to allow it, presumably in exchange for a package of mutually agreed-upon benefits and other considerations. The details of a consent-based process have yet to be fleshed out, and the ability to implement it successfully is an open question, given the history of vehement state opposition to radioactive waste facilities.

CIS: There are considerable advantages to consolidating the storage of used fuel at a few centralized locations as opposed to dozens of shut-down and operating reactor sites around the country. Many in Congress look to CIS as a means of removing used fuel from reactor sites and mitigating the government's financial liabilities for failing to dispose of used fuel. However, CIS may not be a realistic approach absent a viable repository program or some other means of ultimate disposal of used fuel. States have shown themselves to be reluctant to accept storage facilities when there is no "path out" for the material. Moreover, CIS does not address the issue of non-commercial used fuel and HLW on DOE sites.

Governance reform: The management of the waste program could be moved out of the DOE to an independent federal agency or a government-owned corporation. The motivations for such a change include more efficient and effective operations and less political influence over operations.

Funding reform: The management entity would be provided freer access to the Nuclear Waste Fund to carry out its responsibilities. Currently, all funding is subject to the annual federal government appropriations process, which has proven to be very unreliable.

The new year—2021—brings a new Congress and a new administration. The extent to which either intends to work toward real solutions in the area of nuclear waste is still unclear. The Biden administration's proposed budget for FY 2022 will likely give an initial indication of its plans for nuclear waste management.

In 2020, ANS developed a set of recommendations for near-term technical, regulatory, and programmatic actions that would enable progress in waste management, irrespective of the policy direction eventually adopted by the government.[8] Acting on some or all of those recommendations would be a good first step toward reconstituting an effective used fuel and HLW management program.

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ENDNOTES

1 FCRD-NFST-2013-000263, Rev. 7, *Spent Nuclear Fuel and Reprocessing Waste Inventory*, Savannah River National Laboratory, September 2020.

2 *USNIC Backend Working Group Policy Brief: Charting a Path Forward for U.S. Nuclear Waste Management*, U.S. Nuclear Industry Council, June 2020 (usnic.org/back-end).

3 DOE-IG-21-02, *Department of Energy Nuclear Waste Fund's Fiscal Year 2020 Financial Statement Audit*, November 2020. (www.energy.gov/ig/downloads/financial-statement-audit-report-doe-oig-21-02)

4 *Blue Ribbon Commission on America's Nuclear Future: Report to the Secretary of Energy*, January 2012. (www.energy.gov/ne/downloads/blue-ribbon-commission-americas-nuclear-future-report-secretary-energy)

5 Position Statement #80, *Licensing of Yucca Mountain as a Geological Repository for Used Nuclear Fuel and High-Level Radioactive Waste*, American Nuclear Society, February 2017.

6 Position Statement #76, *Interim Storage of Used or Spent Nuclear Fuel,* American Nuclear Society, February 2017.

7 Position Statement #22, *Creation of an Independent Entity to Manage U.S. Used Nuclear Fuel*, American Nuclear Society, July 2015.

8 *Issue Brief: A Proposal for Progress on Nuclear Waste Management*, American Nuclear Society, February 2020.