Centralized Interim Storage Past, Present, and Future

Summarizing the history of centralized interim storage in the United States and examining the potential for future implementation of the concept.

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Until 2010, the United States was on a very slow path toward developing a geologic repository at Yucca Mountain for the direct disposal of used nuclear fuel from commercial nuclear power plants, as well as vitrified high-level radioactive waste from defense activities.[1] The Obama administration changed that with its decision to terminate the Yucca Mountain Project and convene a "Blue Ribbon Commission" (BRC) to develop alternatives to Yucca Mountain.[2] In early 2012, the BRC issued a report with a new proposed strategy for used fuel and HLW management.[3] The strategy incorporated eight elements, one of which was centralized interim storage of used nuclear fuel.

Currently, after multiple cycles of use, nuclear fuel assemblies are discharged from reactors for storage in large, secure onsite pools of water. At most reactors, used fuel assemblies are periodically removed from the pools for dry storage in shielded containers on the reactor site. This action provides sufficient empty space in the fuel pools for continued safe reactor operation. With centralized interim storage, fuel assemblies and/or dry storage systems would be transported to a central interim storage facility (CISF) away from the reactor site to await further processing or geologic disposal. Centralized interim storage would not eliminate the ultimate need for a geologic repository, however.

Centralized interim storage is not a new concept. It has been implemented to a very small extent domestically and to a much larger extent overseas. Past attempts to site, construct, and license a CISF have foundered due in large part to opposition from local communities or the states in which the CISF would be located.

Here we summarize the history of centralized interim storage in the United States and examine the potential for future implementation of the concept. Benefits would arise from the operation of a CISF in the United States, but the obstacles to putting such a facility into operation are considerable. We evaluate the benefits and obstacles, and the resulting recommendation is to attempt, once again, to place a CISF into operation to address specific near-term needs, provided a governance structure can be established that has the capability to successfully carry out the project.

History of Centralized Interim Storage in the United States

There are 104 operating nuclear power reactors in the United States, producing approximately 20 percent of the nation's electricity. Another 29 power reactors were operated but are now shut down.[4] Each plant has a large pool of water for the primary purpose of storing used fuel assemblies during refueling operations and upon final discharge from the reactor. Initially it was anticipated that discharged fuel would be stored in the pool for some years and then shipped offsite for reprocessing, thus freeing up space for more used fuel. In the 1970s, however, the policy of the federal government executive branch changed to one of opposition to the reprocessing of used fuel. This policy change arose from the concern that reprocessing produces separated plutonium, which could be diverted for the production of nuclear weapons.[5] Instead of reprocessing, the focus shifted to onsite storage of used fuel until it could be shipped to a geologic repository for permanent disposal.

Government Programs

The Nuclear Waste Policy Act of 1982 (NWPA) established the federal government's responsibility for removing used fuel from nuclear power plant sites. This transfer was to begin no later than 1998.[6] The intent of the NWPA was for the government to dispose of used fuel and HLW by emplacing it in stable geologic formations for long-term isolation from the environment, i.e., in a mined geologic repository.

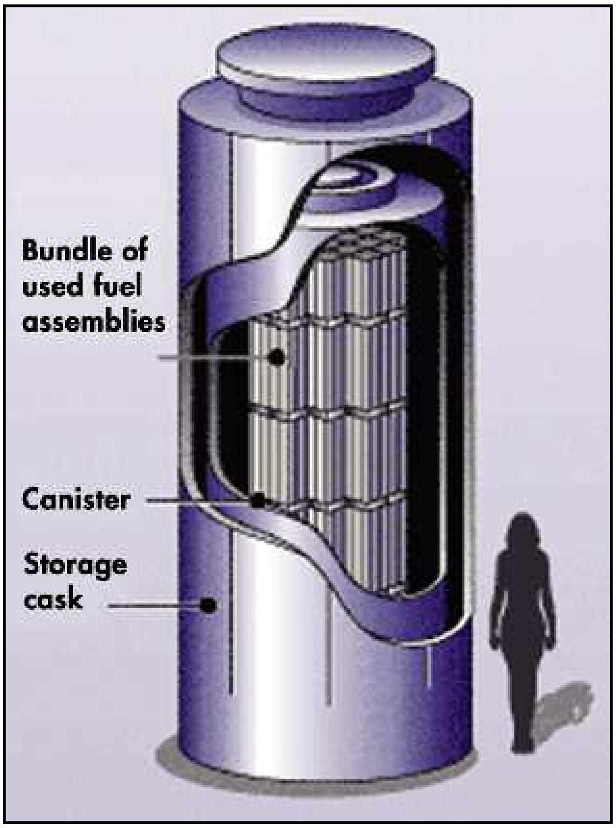

Fig. 1. Dry storage system.

When the NWPA was enacted, the time horizon for onsite used fuel storage had already extended significantly. No repository existed; in fact, no repository site had been selected. It was apparent that operators of nuclear power plants would need either to develop new approaches to storing used fuel or shut down the plants because they ran out of space in their used fuel pools. Initially, a common approach was to employ higher density storage racks to increase pool storage. This measure provided substantial, but finite, additional capacity. In a few instances utilities transported used fuel from older plants with pools approaching capacity to pools at newer plants with more available fuel storage space[1]. Pilot programs of fuel rod consolidation were carried out to gain more pool space, but consolidation was not implemented on a significant scale. Ultimately, additional storage outside of the pools was required, and the general solution in the United States has been to store used fuel in dry storage systems at an onsite independent spent fuel storage installation (ISFSI). These dry storage systems consist of thick-walled metal casks or thin-walled metal canisters surrounded by concrete overpacks for shielding and protection. Each system can hold a substantial number of fuel assemblies, e.g., 32 pressurized water reactor fuel assemblies or 68 of the smaller boiling water reactor fuel assemblies (see Fig. 1).

In fact, Sec. 218 of the NWPA included provisions for a demonstration program for onsite dry storage. Successful cooperative programs between the U.S. Department of Energy and the industry were initiated during the 1980s at the Surry, H. B. Robinson, and Point Beach nuclear power plants. These programs led to more extensive use of dry storage technology, both at operating and shutdown plants. During the 1990s, 10 more U.S. nuclear plants began deploying onsite dry storage to alleviate a lack of used fuel pool storage capacity.[7] There are now 58 ISFSIs at operating nuclear power plants sites serving 87 operating power reactors (see Fig. 2). By 2020, it is projected that all but six operating U.S. power reactors will have established onsite dry storage facilities.[8]

In the early 1980s, policy makers recognized the potential desirability of establishing a centralized facility for temporary storage of used fuel away from reactor sites. Subtitle C of the NWPA included provisions for studying monitored retrievable storage (MRS) of used nuclear fuel. Opposition to hosting such a facility, however, was also significant. The DOE attempted to implement the MRS option but was never able to overcome political opposition among potential host states.

By 1987, the program to establish geologic repositories for used nuclear fuel had progressed more slowly and at a greater cost than intended. Congress enacted amendments to the NWPA in an attempt to streamline the program and move it forward. Recognizing that it was increasingly unlikely that a repository would be in place to enable the DOE to meet the government's statutory obligation to begin removing used fuel from reactor sites in 1998, in 1987 Congress amended the NWPA[9] to add provisions intended to spur development of a MRS facility.


Fig. 2. Nuclear power plant onsite dry storage facility.

While the federal government has made little concrete progress with centralized interim storage of used nuclear fuel, private industry has had mixed success over the years.

This included the establishment of the Office of the Nuclear Waste Negotiator, who would attempt to broker an agreement for a state or Indian tribe to host an MRS facility in return for appropriate benefits and impact assistance. Some key limitations on the MRS facility underscore its role as a "bridge" between the then-current situation (no repository, reactors running out of pool storage space, and a looming deadline for removing used fuel) and a future state in which a repository was sited, licensed, and placed into operation:

- The MRS facility could not be located in a potential repository host state.
- Construction of an MRS facility could not begin until the NRC had issued a license for construction of a repository.
- The MRS facility capacity was limited to 10 000 metric tons heavy metal (MTHM) until a repository began to accept used nuclear fuel or HLW, and 15 000 MTHM thereafter.

Notwithstanding the good intentions of the U.S. Congress, the Nuclear Waste Negotiator was unable to find a suitable and willing site, and the effort to site an MRS facility was discontinued in the early 1990s.

On the heels of the failure to make progress with a site-specific MRS, in 1996 the DOE initiated the design of a generic CISF. The design would accommodate a number of existing dry storage system designs that were certified for both storage and transportation. In addition, the generic CISF used enveloping environmental design criteria, so the facility could be located at large number of sites in the continental United States. The intent of the generic CISF was to obtain as much advance regulatory approval from the U.S. Nuclear Regulatory Commission as possible, so if the political issue of siting could be solved, the facility could be deployed in relatively short order. Among other things, this would enable the government to meet its obligation to begin accepting waste in 1998 or at least ameliorate somewhat the monetary damages that might result from the inability to move fuel to a repository in accordance with the deadline. A topical safety analysis report describing the CISF design was submitted to the NRC for review, but the review was not completed. The politics of siting were never resolved, and the government became embroiled in dozens of lawsuits over its failure to accept waste. The DOE dropped the CISF initiative and continued to pursue development of a geologic repository at Yucca Mountain as the solution to the used nuclear fuel conundrum.

Commercial Programs

While the federal government has made little concrete progress with centralized interim storage of used nuclear fuel, private industry has had mixed success over the years. There is one privately owned and operated NRC-licensed CISF in the United States: the General Electric Morris Facility in Illinois. The Morris facility was originally intended to be a fuel reprocessing plant. In 1972, however, GE halted construction and applied for a license to store used fuel.[5] The facility received its original operating license in 1982, and it is the only away-from-reactor spent fuel pool licensed by the NRC.[10] There are no plans to increase its capacity.

In response to challenges with establishing and expanding onsite fuel storage and the continued failure of the federal government to make substantial progress toward meeting its obligation to begin removing used fuel from nuclear power plant sites, a group of eight utilities formed Private Fuel Storage LLC (PFS) to develop a CISF on the reservation of the Skull Valley Band of Goshute Indians in Utah (see Fig. 3). PFS applied to the NRC for an ISFSI license in June 1997. Opposition from the state of Utah and others dragged out the NRC licensing process, but it culminated in February 2006 with the issuance of a conditional license for construction of the facility.[11] Issues arose pertaining to the federal permits necessary for transportation access to the facility, however, and those issues have not been resolved. Given those unresolved issues, along with the cost of developing the proposed facility, the current availability of reactor onsite storage, and the overall uncertainty in the used nuclear fuel arena, it is unlikely that PFS will move forward to the construction phase in the near future.

Potential Benefits of Centralized Interim Storage

A CISF offers a number of potential benefits to parties involved in used fuel management.

Fulfill the Government Obligation to Remove Used Fuel from Reactor Sites

The federal government's obligation to begin removing used fuel from the sites of nuclear power reactors by January 31, 1998, comes from the NWPA and the Standard Contracts signed by utilities pursuant to the NWPA. Utilities filed 72 lawsuits seeking damages stemming from the government's failure to act. The federal courts have ruled consistently that the government is liable for damages. As of October 2011, the federal government had paid more than $1.6 billion in damages to utilities as a result of court awards and settlements. The government projected its liability for used fuel damages to be a total of $20.8 billion, including the monies already paid.[12] The Obama administration's efforts to terminate the Yucca Mountain Project (see Fig. 4), whether or not they are ultimately suc-

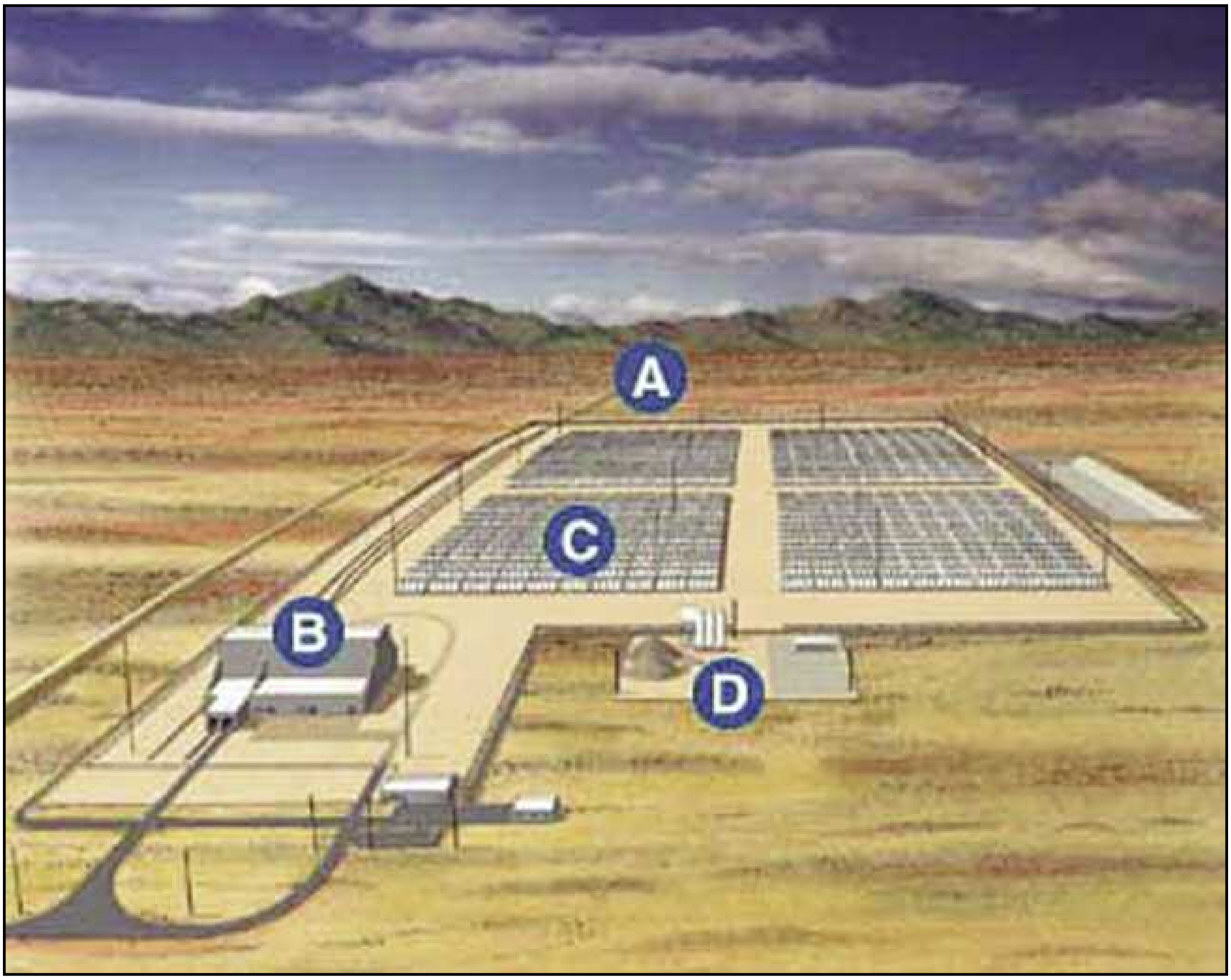

Fig. 3. Diagram of PFS facility proposed for Skull Valley, Utah. (A — rail line; B — cask transfer building; C — concrete pads; D — batch plant for concrete overpacks.)

cessful, have certainly delayed by years, if not decades, the prospect of having a repository available to accept used fuel. It would clearly be advantageous for the government to begin to fulfill its obligation to remove used fuel and thereby mitigate its mounting financial liabilities.

Preclude the Need to Begin or Expand Reactor Onsite Storage

Most U.S. nuclear power plants have reached the limit of available fuel storage in onsite used fuel pools. Therefore, continued operation requires the development or expansion of onsite dry storage. The costs for dry storage are borne by the ratepayers or the plant owners, depending on the regulatory cost recovery system under which the plant operates. As discussed previously, it is expected that most of the onsite dry storage costs will eventually be recovered from the federal government as damages. Unless a utility is one that has settled its litigation with the govern-

Fig. 4. Proposed repository site at Yucca Mountain, Nevada.

ment, however, the costs must be accrued and then recovered through periodic lawsuits. Moreover, aside from the financial issue, the continual expansion of onsite used fuel storage is burdensome to the utility and plant staff because it requires procuring, loading, emplacing, monitoring, and securing the storage systems. Shipping used fuel to a CISF could obviate the need for expansion of an onsite storage facility.

Prevent Reactor Shutdowns Due to Lack of Storage Space

At the present time, the 104 operating nuclear power plants are dealing adequately with the need to provide onsite storage of used nuclear fuel for the indefinite future. Some plants have experienced problems obtaining the necessary governmental approvals for new or additional onsite dry storage, however, and that could again be the case in the future. In addition, no plants possess unlimited land inside their protected areas, so dry storage expansion will prove to be problematical for some. This will be a particular concern for plants that extend their operating lifetimes to 80 years, as is now being studied for some currently operating reactors. Of course, utilities can establish away-from-reactor storage sites on an individual plant basis, but a CISF for numerous utilities would be expected to have economic and security advantages over the single-plant away-from-reactor storage option. Also, having available used fuel storage offsite would be desirable in the event of an unexpected short-term disruption in onsite storage.

The BRC made no recommendation about a specific preferred fuel cycle for the United States to pursue. Instead, it noted that its recommendations to develop a geologic repository and CISF would be appropriate for the current once-through cycle, as well as for one incorporating fuel recycle.

Eliminate ISFSIs for Shutdown Reactors

There are currently nine shutdown reactor sites with used fuel in onsite dry storage. In many cases, the presence of the fuel is the only thing preventing the completion of site decommissioning and the release of the site for other uses. In addition, as long as there is used fuel onsite, the plant owner is obligated to maintain the plant license and provide monitoring and security for the facility. This represents an unnecessary expense and burden that is attributable to the federal government's failure to carry out its responsibility to remove used fuel from reactor sites. Moreover, an operating nuclear power plant has an existing security infrastructure that can be extended to cover an ISFSI. Meeting NRC *Code of Federal Regulations* Title 10, Part 73, security requirements at a stand-alone storage facility is a more challenging matter.

Over the coming decades, the number of shutdown reactors in the United States will grow. Having many relatively small stand-alone used fuel storage facilities is not a desirable situation from a security perspective. A CISF could address that concern.

Provide a Buffer and Staging Area for Other Used Fuel Management Facilities

If sited in conjunction with another used fuel management facility, a CISF can provide a useful buffer and staging area for operations at that facility. For example, the proposed repository at Yucca Mountain was designed with a substantial fuel receipt and storage area, helping ensure there would be adequate fuel at the repository so that emplacement operations would not have to await the next shipment of used fuel. In addition, a storage area adjacent to a repository would allow for more efficient blending of newer, hotter fuel with older, cooler fuel in the event the spatial distribution of the repository decay heat load is an important parameter for repository performance.

Many people have suggested that the United States should move away from the once-through fuel cycle that has been the practice for decades. In the once-through fuel cycle, uranium is mined, enriched, and fabricated into fuel; then, after use, it is thrown away. Reprocessing technology would enable the recovery of nuclear material (primarily uranium and plutonium) for future use, while concentrating the shorter-lived radioactive fission products in the form of vitrified HLW. Reprocessing facilities have been operated at La Hague in France and at Sellafield in the United Kingdom for many years. Plutonium recovered at the plants is recycled in European and Japanese light water reactors. The pool storage facility at La Hague is the largest CISF in the world, providing a buffer and staging area for the associated reprocessing facility. A U.S. CISF could perform the same function; it could be a ready source of feed material for a colocated reprocessing facility, should U.S. fuel-cycle policy change to one of recycle and reuse.

The BRC made no recommendation about a specific preferred fuel cycle for the United States to pursue. Instead, it noted that its recommendations to develop a geologic repository and CISF would be appropriate for the current once-through cycle, as well as for one incorporating fuel recycle. The BRC did recommend that the United States keep its future fuel-cycle options open.[3] One means of doing so would be to develop demonstration recycling facilities. Such facilities would generate long-term, high-paying professional and craft jobs, an attractive attribute for many communities. Colocating a CISF with other fuel-cycle facilities might, therefore, encourage local and regional acceptance of a CISF.

The NRC stated that it would continue reviews of new and renewed reactor operating licenses but will not take final action (issuing or denying new or renewed reactor operating license) until the Waste Confidence Decision remand is addressed. Thus, the federal government's lack of progress in managing used fuel has had a direct and adverse impact on the country's ability to generate emissions-free electricity from nuclear power.

Demonstrate Progress in Used Fuel Management

The government has been grappling with the issue of how to manage and dispose of used fuel and HLW since the 1950s. The Obama administration's decision to walk away from the Yucca Mountain Project, if allowed by Congress and the courts to stand, means that the United States is as far from achieving an ultimate disposal solution as it was in 1982 when the NWPA was first enacted.

It is generally acknowledged that the barriers to used fuel management and disposal are political, not technical. This is borne out by the successful siting and operation of a geologic repository at the Waste Isolation Pilot Plant in New Mexico and by repository development that is proceeding apace in Sweden and Finland.[13]

The recent U.S. Court of Appeals remand[14] of the NRC's Waste Confidence Decision (WCD),[15] an NRC rulemaking related to used fuel storage and disposal that was first promulgated in 1984 and most recently revised in 2010, underscored the potential for adverse consequences associated with lack of progress in used fuel management. The WCD found that safe disposal of used fuel in a geologic repository is technically feasible, a repository will be available when required, and, until then, fuel can be safely stored on reactor sites, either wet (in pools) or in dry storage. A number of parties challenged the 2010 revision, and the court found in favor of the plaintiffs, stating as follows:

> . . . the rulemaking at issue here constitutes a major federal action necessitating either an environmental impact statement or a finding of no significant environmental impact. We further hold that the Commission's evaluation of the risks of spent nuclear fuel is deficient in two ways: First, in concluding that permanent storage will be available "when necessary," the Commission did not calculate the environmental effects of failing to secure permanent storage—a possibility that cannot be ignored. Second, in determining that spent fuel can safely be stored on site at nuclear plants for sixty years after the expiration of a plant's license, the Commission failed to properly examine future dangers and key consequences.

In response to the court ruling, the NRC stated that it would continue reviews of new and renewed reactor operating licenses (the two types of licensing actions that depend clearly on the WCD to underpin the assessment of environmental impacts). However, the NRC will not take final action (issuing or denying new or renewed reactor operating licenses) until the WCD remand is addressed.[16] Thus, the federal government's lack of progress managing used fuel has had a direct and adverse impact on the country's ability to generate emissions-free electricity from nuclear power.

Unlike a successful repository program, deployment of a CISF would not directly address the deficiencies found by the courts in the WCD. However, siting, licensing, constructing, and operating a new geologic repository will take decades to accomplish. The Electric Power Research Institute (EPRI) has estimated a CISF could be put into operation in as little as six years.[7] Doing so could be a valuable demonstration that the U.S. government is capable of managing used commercial nuclear fuel (an ability that has heretofore been most conspicuous in its absence).

Issues and Challenges

As noted before, a number of efforts to establish a CISF have been undertaken in the United States, and only the Morris facility (a limited undertaking) has succeeded. Moreover, as times change, so does the utility of a CISF. In the following, we address key issues facing centralized interim storage. This is not intended to be a complete list of all potential problems, but to highlight issues that are expected to prove most challenging.

In addition to standard NIMBY concerns, the CISF will face the additional burden of explaining why an "interim" storage facility will not be a de facto permanent storage site. Actions by the Obama administration to end the Yucca Mountain Project after billions of dollars of investment have greatly exacerbated this problem. Concrete and reliable assurances will be essential to counter the "interim equals permanent" argument.

Siting and Public Acceptance

History indicates it is very difficult to obtain the sustained local, state, and federal support necessary for a CISF. Unanimous acceptance is neither possible nor required, but support from government officials and a lack of concerted, adamant opposition among the public, particularly local residents, help make a project feasible. Otherwise, the regulatory processes will be delayed, making it problematic to sustain the support needed to carry the project to implementation.

"Not in my backyard"—or, NIMBY—has been the rallying cry against many nuclear projects in the past. As an example, following the enactment of the original NWPA, the DOE proposed siting a CISF at Oak Ridge, Tennessee. State opposition led to the inclusion of specific language in the amendments to the NWPA to annul that Oak Ridge CISF proposal.[8] In addition to standard NIMBY concerns, the CISF will face the additional burden of explaining why an "interim" storage facility will not be a *de facto* permanent storage site. Actions by the Obama administration to end the Yucca Mountain Project after billions of dollars of investment have greatly exacerbated this problem. Concrete and reliable assurances will be essential to counter the "interim equals permanent" argument.

There are essentially three siting options for a CISF: private land, a federal site, and a sovereign Indian nation. Community and state support are essential for a nuclear project on private land. Urenco began its efforts to develop a new uranium enrichment plant in the United States in the early 1990s. The enrichment facility began operations in 2010 on private land in New Mexico, after two other sites in Louisiana and Tennessee did not work out. With respect to a federal site, there are many attractive elements in putting a CISF on a DOE site with past nuclear project experience and ongoing nuclear projects. Past environmental issues arising from defense nuclear activities, however, have created opposition to additional nuclear projects among some in the communities around DOE sites. Moreover, at some DOE sites, the federal government has made cleanup and waste removal commitments, some of which are already in jeopardy due to the Obama administration's decision to stop the Yucca Mountain Project. Given all these factors, locating a CISF for commercial nuclear fuel at an existing DOE site would be challenging. With respect to the option of siting a CISF on Indian land, PFS entered into an agreement with the Goshute Indian Tribe in Utah for its planned CISF. This approach largely removes the local community (other than the Indian tribe) from the equation but not the host state, and it requires a sustained commitment to the project from the Indian tribe.

U.S. public opinion about nuclear power is significantly more positive today than it was during some of the past government attempts to site a CISF. Those favoring nuclear energy have increased from 49 percent in 1983 to 64 percent today.[17] It is not clear whether the improved public opinion will make local and state acceptance of a CISF any easier. It did not appear to smooth the way for PFS.

The BRC recommended a new, consent-based approach to siting future nuclear waste management facilities, including a CISF.[3] The BRC cited repository programs in Sweden and Finland for success in achieving acceptance using a consent-based approach. However, state governments have been the sticking points in past attempts to site waste facilities in the United States, and neither Sweden nor Finland has a governmental entity analogous to a state government in America. The BRC offered no concrete approach for addressing the issue of state opposition.

Cost

How much will it cost, and who will pay? These are key questions in determining the value of the CISF concept. EPRI has estimated costs for a 40 000-metric-ton-uranium (MTU) dry storage CISF receiving fuel for 20 years and shipping it offsite over the next 20 years[18] (see Table I).The costs listed in Table I do not include the canisters containing the fuel or the loading equipment for the reactor sites. Canister costs were estimated at another $150 million per year. The inventory of used fuel in storage at nuclear power plants as of January 2010 was 63 000 MTU, and the currently operating plants generate approximately 2000 MTU of used fuel each year.[4] Therefore, this 40 000-MTU CISF would be able to store about half of

Table I Estimated CISF Costs (2009 Dollars)	
Type of Cost	**Cost Estimate**
Capital (CISF and transportation infrastructure, transportation casks, and associated equipment)	$490 million
Startup (CISF design and licensing)	$67 million
Operations (storage overpacks, transportation, and labor)	$100 million per year
Decommissioning	$225 million

the U.S. inventory of used fuel that will exist in 2030.

The obvious alternative to a CISF is to continue to store used fuel at the reactor sites. Where additional onsite storage is feasible, it is certainly the near-term, least-cost alternative because it removes the cost of offsite transportation, as well as the infrastructure and operating cost of the CISF. In addition, some fuel currently in onsite dry storage is in systems that are not certified for transportation. To ship such fuel to the CISF, the dry storage systems must be unloaded in used fuel pools so that the fuel can be reloaded into new transportable canisters—causing a disruption in plant operations and significant expense. As noted previously, however, onsite storage may not be indefinitely feasible at all sites, and continued onsite storage allows the government's financial liability to mount. Moreover, continued onsite storage does not allow the realization of other potential benefits of centralized storage.

The source of payment is an interesting question. At the present time, for utilities that have entered into settlements over the government's failure to remove used fuel from reactor sites, the costs of onsite storage are being paid out of the federal government's judgment fund (i.e., from general revenues and borrowings). At this point, it appears that all utilities will eventually obtain covered damages through litigation or enter into similar settlements with the government. This means taxpayers will indefinitely be responsible for onsite storage costs. With changes to federal law, however, a CISF could be paid for out of the Nuclear Waste Fund (NWF), which is funded by a fee assessed on nuclear power plant operators (currently $0.001 per kilowatt-hour generated). Once operational, the CISF could reduce the need to further expand onsite storage and, thereby, lower the damages owed to utilities (and the resultant financial burden on the taxpayer). The balance of the NWF at the end of fiscal year 2011 was $26.7 billion.[19] The annual income of the fund is approximately $1.75 billion (fees plus interest).[20] Whether or not the NWF will be big enough to cover centralized interim storage as well as other obligations (e.g., ultimate disposal) is an open question.

Handling and Transportation of Used Fuel

Historically, transportation of used fuel has been carried out safely, without harming the public.[21] Despite this record, it is unquestionably a major public relations issue because transportation raises public concerns, and it involves many more people than nuclear power plant and CISF neighbors. Operation of a CISF will require a significant ongoing used fuel transportation campaign, while leaving the fuel at reactor sites postpones the need to transport the fuel. Moreover, as noted previously, some fuel currently in dry storage will require unloading and reloading into a transportable system before it can be moved to a CISF. Additional transportation will ultimately be required to recycle or dispose of the used fuel unless the CISF is colocated with a repository or reprocessing plant. The cost of fuel handling and transportation, both monetary and in the area of public relations, should be fully considered in any decision to deploy a CISF.

Governance

The DOE has been roundly criticized by many parties for ineffective management of the used fuel and HLW program. In addition, the Yucca Mountain Project suffered through many years of uncertain and unsteady appropriations from Congress. Political manipulation has been the bane of the HLW program, most recently and egregiously when the Obama administration unilaterally stopped the Yucca Mountain project in an action that was clearly contrary to the intent of the NWPA. It would be the height of folly to expect that the DOE, if given the assignment of developing and operating a CISF, would achieve better success than it has with prior attempts at centralized storage or, for that matter, with any other elements of the HLW program. To address this concern, the BRC recommended establishing a new organization dedicated to implementing the waste management program.[3]

Integration with Other Program Elements

There are multiple elements in the back end of the fuel cycle, including storage, transportation, and disposal. Until a fuel-cycle approach for the United States is determined and a geologic disposal site is selected, it will be impossible to confidently integrate centralized interim storage into an overall used fuel management approach. With respect to onsite storage, ideally the CISF storage systems would be the same as (or compatible with) the dry storage systems currently in use at nuclear plants. In practice, that is not possible because of the range of designs currently in use, some of which are certified or can be certified for transportation and some of which are storage-only. In addition, the design criteria (e.g., seismic) for the different storage systems vary; as a result, some systems may be unsuitable for a CISF site or sites. In the past, the DOE attempted to achieve some integration of program elements through waste package design, first with the Multipurpose Canister program in the 1990s and more recently with the Transportation and Disposal System concept. Neither attempt was successful, but given the scope of used fuel generation in the coming decades, it would be extremely wasteful in the long run if some level of integration is not achieved going forward.

The Waste Queue

Standard Contracts signed by utilities and the DOE call for used fuel to be picked up based on an "oldest fuel first" system. Much of the oldest fuel is now in dry storage at reactor sites, either operating or shutdown. The storage systems containing the old fuel are not necessarily transportable. The newest fuel being placed in dry storage is going into the most modern storage systems, most of which are or can be certified for transportation. It will be extremely problematic to follow the waste queue for shipments to a CISF, and such an approach would not address the most pressing existing storage needs first. Under the Standard Contracts, the DOE has the right to give first priority to fuel from shutdown plants. Before unilaterally doing so, it may be advisable for the DOE to enter into discussions with the dozens of entities that are parties to the Standard Contracts to obtain a consensus about reordering the queue. This may be complicated by the ongoing litigation and because the waste queue determines the timing and amount of damages arising from that litigation.

Evaluation and Recommendations

It should first be recognized that the situation facing nuclear power reactor operators has changed markedly since attempts to implement a CISF foundered in the 1980s and 1990s. At that time, dry storage had been used at only a few sites in the United States, and the ability to implement it broadly was unproven. Now, most sites have onsite dry storage facilities, and virtually all reactors will have one by the earliest time a CISF could be developed and made available. The startup cost of onsite dry storage is significant, but once the startup has been accomplished, the ongoing cost consists largely of procurement of additional storage systems. Such costs must be incurred whether or not the storage occurs onsite or at a centralized facility. Unlike the 1990s, a CISF today would not allow the avoidance of major new onsite storage costs.

Siting is arguably the major obstacle to putting a CISF into operation. As noted earlier, the recent actions of the Obama administration will make it even more difficult to overcome community opposition arising from the concern that an interim facility will in fact be a permanent one. Moreover, siting is not simply a matter of finding a willing host community, however desirable that may be. The site must be geologically and environmentally suitable and, preferably, in a location that will be used for complementary used fuel management activities like reprocessing or disposal. Without this type of integration, the CISF will result in additional fuel handling and transportation beyond that occurring if fuel were shipped directly from reactor sites to a reprocessing or disposal location. Given the current state of the used fuel management program, it will realistically be years before complementary siting of a CISF with other facilities will be possible.

The challenges are considerable, but they do not justify doing nothing. The potential benefits arising from centralized interim storage are substantial. One near-term mission argues for a limited deployment of centralized interim storage as soon as practical—the consolidation of used fuel from shutdown plants. A concerted attempt should be made to overcome the formidable obstacles and put in service a CISF that addresses this need. As the CISF project develops, it is hoped that an integrated national used fuel management policy will be coalescing. Down the road, it may make sense to expand the original CISF or develop one or more additional CISFs consistent with other used fuel management developments and activities. If so, the experience gained putting a CISF into service in the relatively near future will be useful in addressing potential future needs.

The challenges are considerable, but they do not justify doing nothing. The potential benefits arising from centralized interim storage are substantial. One near-term mission argues for a limited deployment of centralized interim storage as soon as practical—the consolidation of used fuel from shutdown plants.

Is it reasonable to expect that the DOE can site, license, construct, and operate a CISF? Based on the experience of the past 30 years, the answer is clearly no. For a few years during the past decade, with a supportive Congress and president, the DOE was able to develop and submit a Yucca Mountain license application to the NRC. Otherwise, the DOE's track record in HLW management is consistently disappointing, to put it charitably. Numerous parties, including the Nuclear Energy Institute, have recommended establishing a public corporation to handle used fuel and HLW matters on the behalf of the federal government.[22] The public corporation would incorporate best practices from private industry and effective stakeholder oversight. For such a public corporation to be successful, however, the sensitivity to political manipulation and the unreliable funding that plagued the DOE also must be addressed. If a credible management entity can be established to carry out the federal government's statutory responsibilities in the area of used fuel and HLW, then it may be possible to develop a CISF as part of an overall integrated used fuel management system in the United States.

Is it reasonable to expect that the DOE can site, license, construct, and operate a CISF? Based on the experience of the past 30 years, the answer is clearly no.

Developments on the governance front, however, are not encouraging. Since the publication of the BRC report, one significant piece of legislation has been proposed to address the issue. The Nuclear Waste Administration Act of 2012,[23] introduced by Sen.[2] Jeff Bingaman (D-N.M.), would set up a new government agency called the Nuclear Waste Administration (NWA) to carry out those HLW functions that are now the responsibility of the DOE. The senior managers of the NWA would be nominated by the president and approved by the U.S. Senate. Another new government body, the Nuclear Waste Oversight Board, would oversee the activities of the NWA. It is not at all clear that the Bingaman proposal offers any significant improvement over DOE management, either in efficiency or in isolation from undue political influence.

Both of these recommendations—establishing a new management entity for waste management and developing a CISF—are key elements of the new strategy recommended by the BRC for waste management. So far, however, no substantive action has been taken by either the executive or legislative branches of the federal government to implement effectively any of the BRC recommendations.

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