

Consolidated Storage Facilities: Camel's Nose or Shared Burden? – 13112

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ABSTRACT

The Blue Ribbon Commission (BRC) made a strong argument *why* the reformulated nuclear waste program should make prompt efforts to develop one or more consolidated storage facilities (CSFs), and recommended the amendment of NWSA Section 145(b)² (linking “monitored retrievable storage” to repository development) as an essential means to that end. However, other than recommending that the siting of CSFs should be “consent-based” and that spent nuclear fuel (SNF) at stranded sites should be first-in-line for removal, the Commission made few recommendations regarding *how* CSF development should proceed.

Working with three other key Senators, Jeff Bingaman attempted in the 112th Congress to craft legislation (S. 3469) to put the BRC recommendations into legislative language. The key reason why the Nuclear Waste Administration Act of 2012 did not proceed was the inability of the four senators to agree on whether and how to amend NWSA Section 145(b).

A brief review of efforts to site consolidated storage since the Nuclear Waste Policy Amendments Act of 1987 suggests a strong and consistent motivation to shift the burden to someone (anyone) else. This paper argues that modification of NWSA Section 145(b) should be accompanied by guidelines for regional development and operation of CSFs. After review of the BRC recommendations regarding CSFs, and the “camel’s nose” prospects if implementation is not accompanied by further guidelines, the paper outlines a proposal for implementation of CSFs on a regional basis, including priorities for removal from reactor sites and subsequently from CSFs to repositories.

Rather than allowing repository siting to be prejudiced by the location of a single remote CSF, the regional approach limits transport for off-site acceptance and storage, increases the efficiency

¹ In this paper, Williams speaks for himself, not for the Western Interstate Energy Board.

² NWSA Subsection C, Section 145(b) is a key limitation in site selection of Monitored Retrievable Storage: “The Secretary may not select a site under subsection (a) until the Secretary recommends to the President the approval of a site for development as a repository under Section 114(a).” The NWPA of 1987, Part B, Section 48(d) includes greater detail: A Nuclear Regulatory Commission license for a Monitored Retrievable Storage (MRS) facility shall provide that “construction of such a facility may not begin until the Commission has issued a license for construction of a repository under Section 115(d).” If repository construction ceases, the MRS must stop receiving SNF; MRS receipts are limited to 10,000 MTU until the repository first accepts SNF or HLW. The amount of SNF and HLW in storage may not exceed 15,000 at any one time.

of removal operations, provides a useful basis for compensation to states and communities that accept CSFs, and gives states with shared circumstances a shared stake in storage and disposal in an integrated national program.

THE RECOMMENDATIONS OF THE BLUE RIBBON COMMISSION

Addressing the nuclear waste issue after shutdown of the Yucca Mountain Project in 2009, the Blue Ribbon Commission on America's Nuclear Future (BRC) made a strong argument *why* a reformulated nuclear waste program should make prompt efforts to develop one or more consolidated storage facilities (CSFs), "de-linking" CSF siting and development from a patient, deliberative search for sites for permanent disposal. The BRC's arguments for CSFs focus on both federal liability and system operations, and include several suggestions regarding CSF design.

- The Blue Ribbon Commission was alarmed at the mounting federal liability stemming from the federal government's failure to begin acceptance in January 1998, as required under the Nuclear Waste Policy Act of 1982. Previous assessments, such as the 2007 assessment of the American Physical Society³, found "no compelling cost savings to the Federal government associated with consolidated interim storage, so long as Yucca Mountain is not delayed beyond its currently planned opening." Regarding the federal government's failure to begin acceptance of SNF at shutdown sites, the BRC asserted (without detailed analysis) that "the savings achievable by consolidating stranded fuel at a centralized facility would be enough to pay for that facility"⁴
- But the BRC also envisions (also without detailed analysis) system operation benefits of consolidated storage. "A consolidated storage facility would allow federal acceptance of spent fuel to proceed at a predictable, adequate and steady rate", maximizing "operational efficiency at the system level" and the ability "to respond to unforeseen events or changes in management strategy."⁵ At the same time, a "consolidated storage facility with pool capacity.....would allow nuclear plant operators to.....reduce the heat load in reactor pools."⁶
- Though the BRC recommended "prompt efforts to develop one *or more* consolidated storage facilities" (emphasis added), it implied that it would be quite satisfied with just one: "A consolidated storage facility would ideally be incrementally expandible....in terms of its total storage capacity and fuel handling and management capabilities."⁷

³ Nuclear Energy Study Group of the American Physical Society, "Consolidated Interim Storage of Commercial Spent Nuclear Fuel: A Technical and Programmatic Assessment", February 2007. The Study Group included two persons (Richard Meserve and Earnest Monitz) who also served on the Blue Ribbon Commission.

⁴ Blue Ribbon Commission on America's Nuclear Future, "Report to the Secretary of Energy", January 2012, pg. 35. See Figure 1 for references to these and other key arguments of the BRC.

⁵ BRC Report, pages 39, 35, and 32.

⁶ BRC Report, page 38.

⁷ BRC Report, page 39.

Figure 1: BRC Arguments for CSF Development

Arguments re Federal Liability and Program Costs

- CSFs are needed to “address immediate and growing financial and legal liabilities stemming from the federal government’s failure to meet its waste acceptance obligations in a timely manner.” (pg. 32L)
- “Simply ‘taking title’ (at reactor sites) would not change the ongoing taxpayer liability under DOE’s contracts with utilities.....Paying for at-reactor storage costs is not an allowed use of the Fund under the NWPA and under DOE’s existing contracts with utilities.....For the same reason, the Fund cannot be used to cover damage payments... (pg. 37L)
- “Direct cost considerations alone provide a compelling reason to move stranded spent fuel as quickly as possible to a consolidated storage facility.....the savings achievable by consolidating stranded spent fuel at a centralized facility would be enough to pay for that facility.” (pg. 35R)

Arguments Focused on Nuclear Waste Management System Operations

- “Without one or more CSFs, the federal government will have essentially no physical capacity to accept spent fuel for emergency or any other purposes until a permanent repository is in operation.” (pg. 32R) “At present, the US lacks any capability to receive spent fuel in emergency situations (e.g. TMI), although DOE’s standard contract.....would theoretically allow for the waste acceptance ‘queue’ to be re-prioritized in such situations.” (pg. 38L)
- “The storage arrangements in place today were not designed to maximize operational efficiency at a system level or to respond to unforeseen events or changes in management strategy.” (pg. 35L)
- The federal government should proceed to develop one or more CSFs as a way to begin the orderly transfer of the fuel to federal control pending its ultimate disposition through reuse or disposal. (pg. 35L) “A CSF would allow federal acceptance of spent fuel to proceed at a predictable, adequate and steady rate.” (pg. 39L)
- “A consolidated storage facility with pool capacity....would allow nuclear plant operators toreduce the heat load in reactor pools by preferentially removing the hotter spent fuel. (pg. 38L)
- “Shutdown reactor sites no longer have the capability to remove SNF from storage canisters for inspection if long-term degradation problems emerge that might affect the ability to transfer the canisters.” (pg. 35R)
- The costs and potential worker exposures associated with handling and transporting spent fuel twice....are outweighed, in our view, by the increased flexibility, handling advantages, and potential cost savings that consolidated storage capability would provide.” (pg. 40L)
- The NAS should analyze “the advantages and disadvantages of moving spent fuel from densely packed pools to on-site dry cask storage casks to facilitate low-density packing in the pools.”

BRC Suggestions Regarding CSF Facility Design:

- “A CSF would ideally be incrementally expandable (with the acceptance of the host community) in terms of its total storage capacity and fuel handling and management capabilities.” (pg. 39L)
- “A storage facility or system of facilities can be developed in a stepwise manner.....All of the capabilities that would ultimately be desirable do not have to be developed at once.....The initial cost to site, design, and license a storage facility is relatively low (less than \$100 million).” (pg. 40R) Assuming that a repository begins operation in 2030 and receives 3000 MTU/year, the O&M costs of stranded spent fuel range from \$2.8B (if shutdown reactors have shipment priority) to \$9.2B (OFF shipment priorities). (pg. 43L)

Note: Page references are to the BRC’s January 2012 Report. “L” and “R” refer to the left and right columns in that report.

No Guidelines For CSF Development

However, other than recommending that the siting of CSFs should be “consent-based” and that spent fuel at stranded sites should be “first-in-line for removal”, the Commission made few recommendations regarding *how* CSF development should proceed:

- One CSF or how many more?

- Generally where: only west of the 100th meridian?
- With what waste handling facilities?
- Accepting spent fuel from whom, on what bases? Accepting High-Level Defense Waste as well as SNF?
- With what linkages to subsequent disposal?
- Involving what scale of transportation?

The Key Political Impediment: Consolidated Storage as De-Facto Disposal

The BRC did, however, identify the key political impediment to CSF development: “The most important objection (to CSFs).....is the concern that any CSF could become a de-facto disposal facility...by reducing the pressure to find a long-term solution” “This is why the 1987 NWPAA Amendments explicitly tied the construction of an MRS facility to progress on a first repository and set capacity limits for the MRS facility so that it could not accommodate all the spent fuel in need of disposal.” “Many states and communities will be far less willing to be considered for a CSF if they fear they will become the de-facto hosts of a disposal site.”⁸

THE NUCLEAR WASTE ADMINISTRATION ACT OF 2012 (S.3469)

Through most of 2012, Senate Energy Committee Chairman Jeff Bingaman, in consultation with Senators Murkowski, Feinstein and Alexander, worked to “put the commission’s recommendations into legislative language.”⁹ In introducing the bill, Senator Bingaman discussed the group’s choice of a single administrator, rather than the government corporation recommended by the BRC. He discussed the group’s agreement on “a consent-based approach for temporary storage facilities and permanent repositories”¹⁰, their agreement on “the need to establish interim storage facilities pending completion of a repository”, and on several criteria for siting storage facilities.¹¹

However, Bingaman acknowledged that “we were unable to agree on the “linkage between storage facilities and the repository”¹² That is, Bingaman and his Senate colleagues were unable to agree whether or how NWPAA Section 145(b) should be amended or repealed. Without such

⁸ BRC Report, pages 39 and 40.

⁹ Quotes in this section refer to Senator Bingaman’s August 1, 2012 Statement on Introducing S.3469 in Congress, found in the Congressional Record-112th Congress (2011-2012) pages S5872-S5880. This quote is found on page 4 of 43.

¹⁰ Section 304(a)(1): “The Administrator shall employ a process that...allows affected communities to decide whether, and on what terms, the affected communities will host a nuclear facility.”

¹¹ Criteria not included the NWPAA or the NWPAA. See Section 304(b)(3)(B): “In siting nuclear waste facilities under this Act, the Administrator (shall) take into account the extent to which a storage facility would;

- i. Enhance the reliability and flexibility of the system for the disposal of nuclear waste;
- ii. Minimize the impacts of transportation and handling of nuclear waste; or
- iii. Unduly burden a State in which significant volumes of defense wastes are stored or transuranic wastes are disposed.”

¹² Page 5 of 43.

agreement, Bingaman chose not to submit S.3469 for committee review. In effect, legislation to put the commission's recommendations into legislative language was postponed for consideration, without Senator Bingaman, in the 113th Congress.

SITING CONSOLIDATED STORAGE SINCE 1987

The Nuclear Waste Policy Amendments Act of 1987 established a “nuclear waste negotiator” charged with siting one or more consolidated storage facilities.¹³ Since the Nuclear Waste negotiator provision was abandoned in 1992, it has been left to a privately-funded effort (Private Fuel Storage) to site consolidated storage. These efforts have generally shared several common characteristics:

- Location as distant as possible from the spent fuel needing removal;
- Location in a state with no nuclear power.
- Location west of the 100th meridian, on federal land or in an impoverished community.
- No state consent in siting.
- No contribution from origin states, who expect the federal government to solve this problem without their involvement.

This approach has predictable consequences for a national nuclear waste program:

- Likely only one (large) consolidated storage facility, expandable in capacity and extended in license term.
- Likely location west of the 100th meridian, on federal land or on an impoverished Indian reservation, in a state that has had no nuclear power.
- Likely no receiving-state consent.
- No sending state involvement, except to pressure the federal government to remove their SNF, transferring the burden to someone else.
- Regional politics focuses on shifting the burden rather than sharing it.
- Location maximizes transportation impacts for removal of SNF now stored at reactor sites, and dramatically reduces the potential efficiency of SNF removal operations.
- CSF location prejudices the siting of permanent disposal facilities. Having maximized transportation impacts for removal to consolidated storage, regional politics work to avoid consideration of permanent disposal sites distant from consolidated storage.
- CSF siting exacerbates the concern of a receiving state that the consolidated storage will be de-facto permanent.

Perhaps this is the best that the nation can do. Perhaps a state can be convinced to accept the burden of SNF storage and disposal, finding it in its interest to take on these burdens for other states and the nation. But perhaps there are good reasons why the approach of the past has not worked. Perhaps an approach that aims to more fairly share the burden rather than to simply shift it should be considered.

¹³ The Nuclear Waste Policy Act, as Amended, Title IV.

THE GEOGRAPHY OF NUCLEAR WASTE: A REGIONAL PERSPECTIVE

Figure 2 depicts the regional distribution of operating and shutdown reactor sites.¹⁴ Made up of states in proximity to one another, regions have differing current and prospective needs for off-site (consolidated) storage. The current burden of on-site storage also varies among regions,¹⁵ as does the contribution of nuclear power to regional economies.¹⁶ Consider five regions, roughly based on those established by the Nuclear Regulatory Commission:

The Northeast

Reactors in nine northeastern states¹⁷ have about 18,000 metric tons of SNF, of which about 4,800 metric tons (27%) is in dry storage.¹⁸ Of the SNF in dry storage, about 1,080 MT (42%) is at shutdown sites in three of the nine states (Maine, Massachusetts, Connecticut). SNF awaiting removal totals about 300 MT per million residents, a measure of “burden” slightly lower than but comparable to that in the South and Midwest. At 2011 prices, the average annual value of electricity generated by northeastern nuclear reactors over past twenty-one years is \$23.8 billion. Cumulative payments to the Nuclear Waste Fund are about \$4.5 billion, about 0.9% of 1990-2010 revenues.

The South

Reactors in seven southern states¹⁹ have about 14,500 metric tons of SNF, of which about 5,900 metric tons (29%) is in dry storage.²⁰ None of these states have shutdown reactor sites. SNF awaiting removal totals about 333 MT per million residents, a measure of “burden” somewhat higher than that in the Northeast and Midwest. At 2011 prices, the average annual value of electricity generated by southern nuclear reactors generation over the past twenty-one years is \$19.8 billion. Cumulative payments to the Nuclear Waste Fund are about \$5.8 billion, about 1.4% of 1990-2010 revenues.

The Midwest

Reactors in six mid-western states²¹ have about 115,400 metric tons of SNF, of which about 3,500 metric tons (23%) is in dry storage. Of the SNF in *wet* storage, about 1,115 MT (9%) is at shutdown sites in two states (Illinois and Wisconsin). SNF awaiting removal totals about 318 MT per million residents, a measure of “burden” between the measures for the South and the Northeast. At 2011 prices, the average annual value of electricity generated by mid-western

¹⁴ Useful maps can be found in the BRC report, (Figures 9 and 10, page 17), and in NRC Information Digest: 2006-2007 (Figure 16, page 33). Figure 2 is based on the NRC map.

¹⁵ For example, two regions currently have no SNF at shutdown reactor sites.

¹⁶ Table 1 presents relevant measures and sources.

¹⁷ CT, MA, MD, ME, NH, NJ, NY, PA, VT,

¹⁸ The Northeast also includes the West Valley Demonstration Project, which contains less than 1% (by volume) of the nation’s high-level defense waste.

¹⁹ AL, FL, GA, NC, SC, TN, VA.

²⁰ The south also includes the Savannah River Site (southeast of Augusta, GA), which contains about 33% (by volume) of the nation’s high-level defense waste.

²¹ IA, IL, MI, MN, OH, WI.

nuclear reactors over the past twenty-one years is \$13.8 billion. Cumulative payments to the Nuclear Waste Fund are about \$3.7 billion, about 1.3% of 1990-2010 revenues.

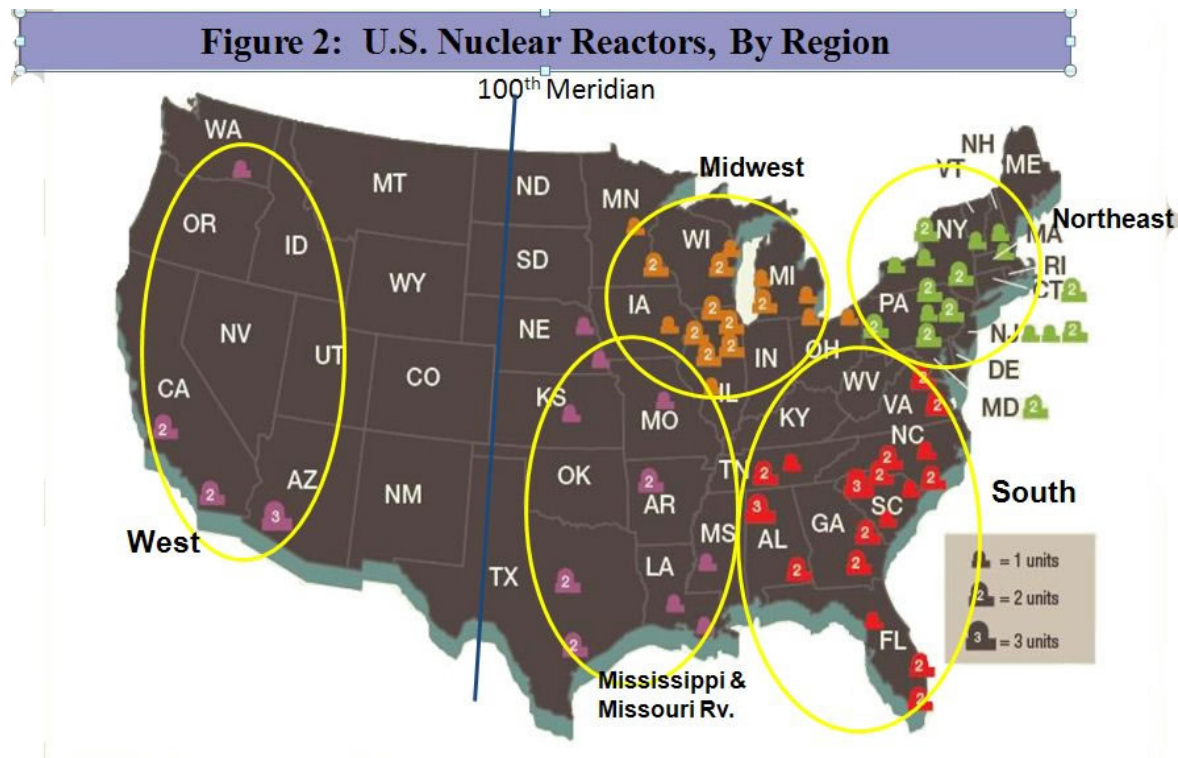


Table 1: The Geography of Nuclear Waste: A Regional Perspective:
Spent Fuel Distributions; SNF Burdens/Nuclear Power Benefits; Nuclear Waste Fund Contributions

Region:	SNF: 000 MT (Dec.'11) (1)	In Dry Strg: 000 MT(%) (1)	At Shtdn Sites: 000 MT(%) (2)	SNF (MT)/ mil Pop (3)	Avg Ann. Val. : Bil\$ (4)	Cumul. NWF Pmts: Bil\$ (5)
Northeast	17.97	4.8 (26.6%)	1.1 (41.6%)	300	\$23.8	\$4.5
South	20.37	5.9 (28.8%)	0 (0.0%)	333	\$19.8	\$5.8
Midwest	15.38	15.4 (22.7%)	1.1 (42.9%)	318	\$13.8	\$3.7
MS/MO Val.	7.69	7.7 (17.8%)	0 (0.0%)	184	\$8.3	\$2.3
West	6.02	6.0 (42.9%)	0.4 (15.5%)	99	\$7.5	\$1.7
Total	67.43	18.1 (26.4)	2.6 (100%)	248	\$73.2	\$18.0

1. Cong. Research Svc. (James D. Werner), "U.S. Spent Nuclear Fuel Storage" (May 24, 2012), Tbl.1 (pg. 36).
2. Blue Ribbon Commission Report (Jan. 2012), Table 1 (pg. 36).
3. 2009 population in states with nuclear reactors
4. Average annual value of nuclear power: 1990-2010, based on 2011 state electricity prices.
Based on a) U.S. EIA, Electricity Generation by state and energy source (nuclear): 1990-2010;
b) U.S. EIS Electricity Prices, by state (2011)
5. NEI: "State by State Payments to the Nuclear Waste Fund" (through March 2012):
Cumulative payments, w/o escalation to current \$, plus one-time-fees not yet paid.

The Mississippi and Missouri River Valleys

Reactors in seven states in the Mississippi and Missouri River valleys²² (the portion of NRC Region IV east of the 100th Meridian) have about 7,700 metric tons of SNF, of which about 1,400 metric tons (18%) is in dry storage. None of these states have shutdown reactor sites. SNF awaiting removal totals about 184 MT per million residents, a measure of “burden” significantly lower than that in the Northeast, South or Midwest. At 2011 prices, the average annual value of electricity generated by Mississippi/Missouri River Valley nuclear reactors over the past twenty-one years is \$8.3 billion. Cumulative payments to the Nuclear Waste Fund are about \$1.3 billion, about 1.3% of 1990-2010 revenues.

The West

Reactors in four states in the west²³ (the portion of NRC Region IV within 300 miles of the Pacific Ocean) have about 6,000 metric tons of SNF, of which about 2,600 metric tons (43%) is in dry storage.²⁴ Of the SNF in dry storage, about 400 MT (16%) is at shutdown sites in two of the six states (California and Oregon). SNF awaiting removal totals about 99 MT per million residents, a measure of “burden” about half that in the Mississippi and Missouri River valleys, and about one-third that in the Northeast, South or Midwest. At 2011 prices, the average annual value of electricity generated by western nuclear reactors over the past twenty-one years is \$7.5 billion. Cumulative payments to the Nuclear Waste Fund are about \$1.7 billion, about 1.1% of 1990-2010 revenues.

REGIONAL DEVELOPMENT AND OPERATION OF CONSOLIDATED STORAGE

Regional development of consolidated storage requires amendment of existing legislation, common sense siting criteria, and priorities for removal from reactor sites to CSFs, and from CFSs (or reactor sites) to permanent disposal.

Amendment of NWPA Section 145(b).

The key elements include:

- NWPA Section 145(b) should be revised to permit a consolidated storage facility of up to 25,000 MT capacity in a region whose states agree to its development and operation by the federal government.
- Such a CSF should be developed and operated under an enforceable agreement between the federal government and the host state and community.
- The provision for “pilot” storage facilities in Senator Bingaman’s proposed legislation should be removed.²⁵

²² AR, KS, LA, MO, MS, NE, TX.

²³ AZ, CA, OR, WA.

²⁴ The west also includes the Hanford Site (in eastern Washington), which contains 64% (by volume) of the nation’s high-level defense waste, the Idaho National Laboratory, which contains about 3% of the nation’s high-level waste, and DOE-owned SNF in Idaho and Colorado.

²⁵ The provision (Section 301(2) and Section 306(b) is borrowed from Senator Feinstein’s Energy and Water Appropriations bill (S. 2464, Section 312(b), which authorized one or more “pilot” (i.e. private

- Spent nuclear fuel that has been packaged for disposal (requiring a spent fuel pool at the consolidated storage) is first-in-line for removal to a permanent disposal facility, when available. (See guidelines, below.)

In combination with the siting criteria and guidelines discussed below, the proposal has several advantages:

- States are encouraged to work together to work together to on arrangements to provide a CSF within the region, and to provide that CSF with the facilities needed to qualify it for first-in-line removal to permanent disposal, when available.
- The prospect for five such consolidated storage facilities provides a multi-state constituency to encourage the federal government to move promptly but deliberately to seek sites for permanent disposal.
- The location of a CSF within a region helps to minimize transportation impacts, and maximize efficiency in removal of SNF from sites within the region. With round-trip travel distances about one-quarter those for recent CSF proposals, transportation impacts could be greatly reduced, and the efficiency of removal processes greatly increased—generating substantial cost savings.
- Consolidated storage can be provided when needed in the region, with the active support of the states that feel the most urgent need.
- The search for permanent disposal sites is not prejudiced by the location of a single large consolidated storage facility in a remote location that has not benefitted from nuclear power.

CSF Siting Criteria and Guidelines for Removal To/From CSFs

Siting Criteria: In S.3469 Section 304(b)(3)(B), Senator Bingaman and his colleagues recommended several siting criteria for consolidated storage facilities: “In siting nuclear waste facilities under this Act, the Administrator (shall) take into account the extent to which a storage facility would:

- i. Enhance the reliability and flexibility of the system for the disposal of nuclear waste;
- ii. Minimize the impacts of transportation and handling of nuclear waste; or
- iii. Unduly burden a State in which significant volumes of defense wastes are stored or transuranic wastes are disposed.”

Provided that the “consent” provision of S. 3469²⁶ is retained, criterion “iii” might be removed, as it is viewed as a “poison pill” by the nuclear industry. However, criteria “i” and “ii” should be retained, and considered more systematically than they have been in the past—noting, however,

sector) storage facilities of 10,000 MT, under cooperative agreement:“ Notwithstanding any provision of the Nuclear Waste Policy Act of 1982, the Secretary is authorized, in the current fiscal year and subsequent fiscal years, to conduct a pilot program, through 1 or more private sector partners, to license, construct, and operate one or more government or privately owned consolidated storage facilities to provide interim storage as needed for spent nuclear fuel and high-level radioactive waste, with priority for storage given to spent nuclear fuel located on sites without an operating nuclear reactor.”

²⁶ Section 304(c)(4).

that they could be competing, at least to some degree: “Reliability and flexibility” of the system for disposal might be enhanced by a single large-capacity CSF with full waste handling and repackaging facilities. On the other hand, “minimization of transportation impacts” (a criterion that has been disregarded in the nuclear waste program heretofore²⁷) is likely to be greatly enhanced by the current proposal. The two most straightforward ways to “minimize transportation impacts” are:

- To minimize the number of shipments through use of dedicated trains,²⁸ and
- To minimize shipment miles required for removal to consolidated storage, at least until a permanent disposal site(s) is available.

In the legislation or separately, the S. 3469 criteria should be augmented by several other common sense criteria for consolidated storage facilities:

- Low seismic and flood risk;
- Access to Class 1 rail;
- Sufficient land to provide a reliable security perimeter.

In combination, these criteria enable states (and their communities) to offer multiple sites, which enables the federal government to conduct a bidding process in site selection.

Removal from a reactor site to a regional CSF. Regarding removal to a CSF, the priorities are:

1. Shutdown Sites:
 - a) SNF from shutdown sites in the CSF host state;
 - b) SNF from shutdown sites in other states within the region.
2. Operating Reactor Sites:
 - a) SNF from operating sites in the CSF host state;
 - b) SNF from operating sites in other states within the region.
3. High-Level Waste: “Road-ready” HLW generated within the region, after the applicable federal-state agreement date has expired.
4. Special request shipments (limited quantities) from adjacent regions.

The above priorities are contingent on the ability of the parties at origin sites (the federal agency, the reactor owner, the carrier(s), the host state and community) to negotiate arrangements for safe and efficient removal of SNF/HLW. These arrangements may include “concentrated removal” of a significant amount of SNF of specified characteristics (e.g. age; packaging), by dedicated train from an on-site or nearby rail-head. If the parties cannot agree to such arrangements, the priority for removal at that site drops to level #3.

²⁷ For example, the 1957 National Research Council report “Disposal of Radioactive Waste on Land” (Publication 519) stated that “.....site selectionmust be based on....a disposal area within economic transportation distance”. See: William Boyle, “Siting Criteria in the US”, presentation to the Nuclear Waste Technical Review Board, March 7, 2012.

²⁸ A single three-cask dedicated train replaces 18 heavy-haul (GA 4/9) truck shipments. The National Academies 2006 report “Going the Distance” (pg. 18-19) found that “there are clear operational, safety, security, communications, planning, programmatic, and public preference advantages that favor dedicated trains”.

Removal to a permanent disposal site. Regarding priorities for removal to permanent disposal, the priorities are:

1. SNF/HLW stored at CSFs:
 - a) SNF appropriately packaged for disposal at the closer of two repositories.
 - b) SNF not yet appropriately packaged for disposal at the more distant of two repositories.
 - c) SNF appropriately packaged for disposal at the more distant of two repositories.
 - d) SNF not yet appropriately packaged for disposal at the more distant of two repositories.
2. SNF/HLW not yet transferred to a regional CSF:
 - a) SNF for disposal at the closer of two repositories.
 - b) SNF for disposal at the closer of two repositories

The above priorities assume that all shipments from CSFs are by dedicated train. The priorities encourage the development of CSFs with the capability to package SNF for permanent disposal, and give priority for disposal at the closer of two disposal sites.

Other CSF Considerations: The Standard Contract “Queue” and Costs

The Standard Contract “Queue”: Efficient removal from reactor sites and efficient deployment and use of expensive state-of-the art transportation equipment requires drastic reordering of the NWPAs Standard Contract “queue”, in which reactors owners receive acceptance slots based on the dates assemblies are discharged from reactors, but may use these slots to prioritize DOE acceptance of other SNF from other locations. This provision seemed reasonable in 1982, when it was expected that DOE would begin acceptance in 1998, when on-site dry storage was not envisioned, when the main transportation mode was assumed to be legal-weight truck, and when the critical role of transportation in an integrated nuclear waste management program was not appreciated.

Thirty years later, the goals of reactor owners are more greatly tied to efficient removal of SNF to CSFs than to the specific application of the slots in its queue. Further, without modification of this aspect of the NWPAs, a market mechanism can be created to resolve mismatches and enable the federal government to assemble the slots needed for efficient removal from reactor sites.

CSF Costs and Economies of Scale. How do the costs of, say, five regional CSFs, as suggested here, compare with the costs of a single CSF of equal capacity? The answer appears to be that five regional CSFs would cost more, but not dramatically so:²⁹

²⁹ The following estimates are based on estimates presented in the Electric Power Research Institute report “Cost Estimate for an Away-From-Reactor Generic Interim Storage Facility (GISF) for Spent Nuclear Fuel”, EPRI, Palo Alto, CA: 2009, 1018722” Principal Investigator: E. Supke; EPRI Project Manager: John Kessler. The study considered the costs of 20,000 MTU, 40,000 MTU, and 60,000 MTU GISFs. Estimates for the 40,000 MTU GISF compared costs of using 10 MTU-capacity DPCs with those using 13 MTU DPCs. J. Williams is responsible for the comparison of costs on a per MTU basis.

- About 19% more in capital costs, including transportation infrastructure, CSF infrastructure, CSF fuel storage facilities, and transportation casks and equipment.
- About 12% more in operations costs, including administrative costs, concrete overpacks, and other operating costs (e.g. railroad fees, state inspection fees. etc.
- About 88% more in labor costs (depending on assumptions regarding the time periods for SNF receipt, caretaking, and removal for permanent disposal.
- About 19% more overall.
- The additional costs of five regional CSFs would be fully offset by a federal policy choice to use 13 MTU-capacity Dual Purpose Canisters rather than 10 MTU capacity DPCs.

Several factors, not directly considered in the EPRI analysis could increase or decrease relative costs:

- Travel distances for five regional CSFs could be 20% those for a single CSF of equal capacity. The much lower turn-around times and the more efficient deployment of transport casks and equipment could reduce costs, compared to a single CSF.
- Staging. As noted above, 85% of the SNF at shutdown sites is in the Northeast and Midwest, while the South and the Mississippi/Missouri Valley regions currently have no SNF at shutdown sites. Thus, the imperative to remove SNF from shutdown sites is greater in the Northeast and the Midwest. Under this proposal these regions could establish regional CSFs without concern that they would thereby inevitably become national CSFs. The staging of regional CSFs could smooth out capital costs over time and make possible efficiencies in the deployment of equipment and personnel.
- The need for more robust waste handling facilities (pools or hot cells) at regional CSFs could increase costs over those considered in ESRI's "generic" facility.

SUMMARY

The BRC Report provided eight important recommendations, which provide a sound basis for a reformulated national nuclear waste program, and which warrant implementation. Regarding consolidated off-site storage, the BRC made strong arguments why such facilities are needed, and recommended amendment of NWPA Section 145(b)—which links the development of consolidated storage with disposal facilities—to make possible CSF development in advance of disposal. During the 112th Congress, four key Senators worked to “put the BRC recommendations into legislative language”, but were unable to agree on terms under which the Section 145(b) linkage might be removed.

Taking one step back, this paper reviews the history of consolidated storage facility siting since 1987, considers the regional geography of U.S. nuclear waste, offers an integrated set of terms under which consolidated storage facilities in advance of permanent disposal might be authorized in legislation, and how such legislation might be implemented with CSF siting criteria and guidelines for removing SNF to CSFs and subsequently from CSFs for permanent disposal. The paper also addresses related issues of the

(Another useful cost estimate is provided by US GAO: “Nuclear Waste Management: Key Attributes, Challenges, and Costs for the Yucca Mountain repository and Two Potential Alternatives, GAO-10-48, November 2009.)

SNF acceptance queue and costs. In addition to those cited above, the “regional CFS” proposal” has important potential advantages for a reformulated national nuclear waste program, including:

- State involvement in addressing the national need for consolidated storage, efficient-effective SNF removal and transport, and coordination of consolidated storage and disposal;
- States that share the current on-site storage burden share the burden of consolidated storage, rather than simply demanding that the federal government shift this burden to someone (anyone) else.
- The regional CSF proposal creates a more effective state constituency for patient, deliberative siting of facilities for permanent disposal.
- The regional CSF proposal makes possible more efficient-effective SNF removal and transport, and better coordination of consolidated storage and disposal.

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