The Question of Queue: Implications for "Best Practice" in Cross-country Transport of Commercial Spent Nuclear Fuel—9402

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ABSTRACT

The "Standard Contract" authorized by the Nuclear Waste Policy Act of 1982 (Section 302(a)) provides that priority for acceptance of spent nuclear fuel (SNF) shall be based on the date of its discharge from civilian nuclear reactors. Through 2007, about 2,100 discharges of about 58,000 metric tons have created a priority ranking (or "queue") for US DOE spent fuel acceptance and transport. Since 1982, consideration of the task of large-scale, cross-country SNF transport (by the National Academies and others) has led to several recommendations for "best practice" in such an unprecedented campaign. Many of these recommendations, however, are inconsistent with the acceptance priority established by the Standard Contract, and in fact cannot be implemented under its provisions.

This paper considers the SNF acceptance rankings established by the Standard Contract, and the barrier these place on best practice cross-country transport of the nation's inventory of SNF. Using a series of case studies, the paper explores the challenge of best practice transport from selected shipment origins under current arrangements. The case studies support preliminary conclusions regarding the inconsistency between best practice SNF transport and the Standard Contract acceptance queue, with reference to particular origins sites and their utility owners. The paper concludes with a suggestion for resolving the inconsistencies, and recommended next steps in the inquiry.

INTRODUCTION: The NWPA "STANDARD CONTRACT"

The "Standard Contract" authorized by the Nuclear Waste Policy Act (Section 302(a)) lies at the heart of the 1982 agreement between the federal government and the commercial nuclear power industry: nuclear ratepayers pay for the federal program and are responsible for interim storage of commercial spent nuclear fuel (SNF); in return, the federal government (U.S. DOE) is responsible for accepting commercial spent fuel and transporting it to a licensed repository for permanent disposal. Under the contract, priority for acceptance "shall be based on the age of SNF….as calculated from the date of discharge of such material from the civilian nuclear power reactor."[1] From the late 1960s through 2007, discharges of about 58,000 MTU from nuclear reactors have created a priority ranking of about 2,100 slots in a queue for DOE acceptance and transport of SNF.[2]

The NWPA and the Standard Contract simply assumed that DOE could and would transport SNF in manner consistent with the requirements of the Department of Transportation and the Nuclear Regulatory Commission—requirements that apply to occasional short-distance shipments between reactor sites. It did not consider "best practice" in a high-profile 25-30 year campaign for cross-country transport of the nation's entire inventory of highly radioactive wastes.

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[1] 10CFR961.11, Chapter III, Section IV.B.5.a.

[2] These estimates include 77 queue slots (388.9 MTU) not held by commercial power companies: U.S.DOE, General Atomics, GE Uranium Management Corp., General Electric Company. The estimates exclude high-level defense waste now stored at Hanford and other sites in the DOE weapons complex.

"BEST PRACTICE" IN CROSS-COUNTRY TRANSPORT OF SNF

A quarter century after the NWPA, "best practice" in a campaign for cross-country transport of the nation's growing inventory of commercial SNF is still not fully defined or agreed.[3] One possible element involves shipment mode: Considering social as well as technical risk, the National Academies of Sciences concluded that "there are clear operational, safety, security, communications, planning, programmatic, and public preference advantages that favor dedicated trains,"[4] and recommended that DOE should "fully implement" its 2005 dedicated train decision.

A second possible element involves the age of spent fuel transported an average distance of 2300 miles by rail and public highway across the country. Considering radiological risk (incident-free and in accidents), the National Academies recommended[5] that DOE should negotiate with SNF owners to ship older[6] fuel first, except in cases where spent fuel storage risks dictate the need for more immediate shipment of younger fuel. Should these negotiations prove ineffective, the Academies add, Congress should consider legislative remedies.

A third possible element of "best practice" involves prioritization of certain origin sites, rather than (or, in addition to) the priority of their spent fuel discharges. For example, the "SMART Act of 2008" recently introduced by Senator Pete Domenici (R-NM) would prioritize acceptance from shut down power plants over still-operating plants.[7] The motivation appears to be a sense of fairness for utilities that have had to maintain, often for decades, on-site storage at sites where electric power is no longer being produced. Whether this extends to SNF from shut-down reactors on sites at which other reactors continue power production (often with license extensions) is not specified.

A fourth possible element involves concentrated acceptance at transportation origins, a proposal based on the limited capacity of multiple stakeholders to maintain a high-level of coordination, competence and vigilance in a sporadic activity—e.g. dedicated train shipment from sites that require intermodal operations in order to ship cross-country by dedicated train.[8] A concentrated campaign to plan and implement such campaigns over weeks might, it is rather convincingly argued, be much more effective in practice than removal of a like amount of SNF over months or years.

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3 The purpose of the OCRWM/OLM National Transportation Plan is to consider, propose and consult on "best practice" in a national campaign for cross-country transport of SNF and HLRW.

4 "Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Waste in the United States;" National Research Council, Committee on Transportation of Radioactive Waste; 2006; pg. 18.

5 "Going the Distance?", pg. 19-20

6 In referring to the age of SNF "as calculated from the date of discharge," the Standard Contract suggests "oldest." The National Academies, however, advisedly used the term "older," without further specification.

7 S. 3215, Section 6(d).

8 The idea is that concentrated acceptance would facilitate the assembly of attention and resources needed to effectively coordinate the efforts required of plants, carriers, intermodal facilities, and communities. "Over the next six months, we will focus on shipments from (say) Oyster Creek; then we'll be finished there and can turn attention to (say) Point Beach."

So far, these and other elements of best practice[9] have been discussed without explicit attention to their implications for particular Purchasers and sites—i.e. without attention to their feasibility under the Standard Contract.

THE QUESTION OF QUEUE

This paper explores the linkage between selected elements of best practice in a national campaign for SNF transport and the Standard Contract acceptance queue. In its July 19, 2007 "comment response document" on its National Transportation Plan, DOE/OLM indicates that the linkage will not be addressed in the NTP or anytime soon. To a comment asking whether the NTP will provide a schedule for shipping fuels (and suggesting shipment of oldest fuel first), DOE replied "This level of detail will not be provided in the NTP." To a comment advocating that the Standard Contract section of the NTP should address the extent to which utilities can trade their places in the queue with other utilities, DOE replied "This level of detail will not be provided in the NTP, but will be provided in later documents, such as the campaign plans."

DOE's reluctance to grasp this nettle is attributable to its ongoing litigation with nuclear utilities due to its failure to begin acceptance of commercial SNF in January 1998, as required by Section 302(a)(5)(B) of the NWPA. It is reasonable under the circumstances to appreciate that DOE cannot *resolve* the question of queue now. But, neither can DOE ignore the question of queue if it intends to be serious about best practice in a high-profile campaign for cross-country shipment of the nation's entire (growing) inventory of commercial SNF. Until the issue is addressed, major NTP issues will remain frustratingly unformulated and unconvincing. DOE's commitment to "best practice" in such a campaign will remain tentative and uncertain. Though some may argue that a 25-30 year campaign for cross-country SNF shipment may not require full commitment to best practice, this is not a risk that DOE should want to take, especially as there is no evidence that "best practice" is more costly, and substantial evidence that it is less so.[10]

Unless and until the question of queue is addressed, "Purchasers" (nuclear utilities) can be expected to use their queue slots for their own economic and logistical purposes—to provide needed pool capacity, to decommission sites and make them available for new uses, to reduce reactor operations and on-site storage costs. These purposes may or may not be consistent with "best practice" cross-country transport of SNF, a responsibility of DOE, working in consultation with states and other stakeholders, including carriers and, yes, utilities. But, until the value of a queue slot in a best practice campaign can be established, utilities can be expected to focus on their own direct responsibilities, not those of DOE.

CROSS-COUNTRY TRANSPORT UNDER THE STANDARD CONTRACT

A first step in exploring the question of queue considers the results if SNF transport were to occur in accordance with Standard Contract acceptance priority rankings. For the first 500 MT accepted, the shipment campaign might proceed as follows:[11]

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[9] Other elements of best practice involve operational practices or other aspects (e.g. resources for collaborative route identification and assessment) that have no direct implications for the acceptance queue.

[10] This question deserves further inquiry. Arguably "best practice" can reduce the amount of equipment required (e.g. numbers of casks; numbers of advanced rail cars, etc.), increase the efficiency in use of expensive equipment purchased, and increase efficiency and effectiveness in campaign planning.

[11] Assumptions include: a) 77 queue slots (with 389 MT) held by US DOE, General Atomics and other non-utilities are waived; b) Dedicated train is used if the discharged SNF (packaged in Transportation-Aging-Disposal or Dual Purpose canisters) would make up at least one 3-car dedicated train; c) Mixed

1. Two dedicated trains (SNF not necessarily 20+ years old) from Dresden (IL).
2. Two mixed freight cask shipments (SNF 20+ years old) from Haddam Neck (CN).
3. 12 overweight truck shipments (SNF not necessarily 20+ years old) from San Onofre (CA).
4. Two mixed freight cask shipments (SNF 20+ years old) from Haddam Neck (CN).
5. 5 overweight truck shipments (SNF 20+ years old) from Humboldt Bay (CA).
6. Two dedicated trains (SNF not necessarily 20+ years old) from Dresden (IL).
7. Two OWT shipments (SNF not necessarily 20+ years old) from Nine Mile Point (NY).
8. Two OWT shipments (SNF not necessarily 20+ years old) from Oyster Creek (NJ).
9. 13 overweight truck shipments (SNF not necessarily 20+ years old) from San Onofre (CA).
10. 9 overweight truck shipments (SNF 20+ years old) from Yankee Rowe (MA).
11. Four OWT shipments (SNF not necessarily 20+ years old) from Nine Mile Point (NY).
12. Nine OWT shipments (SNF not necessarily 20+ years old) from Ginna (NY).
13. Two dedicated train shipments (SNF not necessarily 20+ years old) from Oyster Creek (NJ).
14. Two mixed freight cask shipments (SNF 20+ years old) from Haddam Neck (CN).
15. One overweight truck shipment (SNF 20+ years old) from LaCrosse (WI).
16. Six overweight truck shipments (SNF 20+ years old) from Humboldt Bay (CA).
17. Three overweight truck shipments (SNF 20+ years old) from Millstone (CN).
18. Eleven OWT shipments (SNF not necessarily 20+ years old) from Point Beach (WI).
19. Twelve OWT shipments (SNF not necessarily 20+ years old) from Ginna (NY).
20. Ten OWT shipments (SNF not necessarily 20+ years old) from Indian Point (NY).
21. One dedicated train (SNF not necessarily 20+ years old) from Dresden (IL).
22. Two OWT shipments (SNF not necessarily 20+ years old) from Monticello (MN).
23. Fourteen OWT shipments (SNF not necessarily 20+ years old) from Robinson (SC).
24. Three overweight truck shipments (SNF 20+ years old) from LaCrosse (WI).
25. Two dedicated train shipments (SNF not necessarily 20+ years old) from Oyster Creek (NJ).
26. 2 dedicated train shipments (SNF not necessarily 20+ years old) from Nine Mile Point (NY).

In is not difficult to point out aspects of such a campaign that are inefficient or undesirable: e.g.

- Though 500 MT can be transported in 18 dedicated train shipments, the “Standard Contract” campaign requires 114 overweight truck, 11 dedicated train, and 6 mixed freight shipments.
- Almost 60% of the overweight truck shipments are from sites with direct rail access.
- DOE pickup and transport resources are deployed first to Illinois, then to Connecticut, then to southern California, then back to Connecticut, then to northern California, etc.
- At each origin site, DOE must coordinate with a different set of state and local, transport carrier, and local utility and business interests. The level of coordination achieved in each case will likely dissipate after each pickup.
- To remove the first 500 MT, DOE must return twice to Dresden, Haddam Neck, Nine Mile Point, and Oyster Creek, and once to Ginna, Humboldt Bay, LaCrosse and San Onofre.
- Though 36,250 MT of SNF 20 years old or over is in the system (as of December 31, 2007) and awaiting shipment, a substantial portion of the first 500 MT shipped could be much younger fuel.

EXPLORING THE QUESTION OF QUEUE

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freight shipment is used if the discharged SNF (packaged in dual purpose canisters) is at a decommissioned site (e.g. Haddam Neck); d) Overweight truck (OWT) shipment is used if the discharged SNF is at a still-operating reactor site but would not make up a dedicated train. SNF currently stored onsite would be reloaded to OWT casks; SNF currently stored in pools would be loaded to OWT casks; e) Similarly, OWT shipment is used if the discharged SNF is at a shutdown site in Safstor; SNF currently stored onsite would be reloaded to OWT casks. Note that several sites now in Safstor are considering full decommissioning: e.g. Humboldt Bay, La Crosse.

SNF transport in strict accordance with Standard Contract priority rankings is sufficiently inefficient and undesirable (not just for DOE, but for its stakeholders) that ad hoc efforts to fix the most egregious difficulties can be anticipated. For example, rather than deal with six mixed freight shipments, Connecticut Yankee Atomic Power Company might waive its second and fourth queue slots, waiting until slot #14 to ship 4 dual purpose canisters by dedicated train. However, more systematic exploration of the question of queue--not just for the first 500 MT removed but for all SNF now held by 54 "Purchaser" nuclear utilities operating 100 nuclear reactors at 75 sites—requires a data resource for considering the circumstances of various utilities regarding best practice transport of various amounts of SNF from various sites at various times. The data resource used in this inquiry is DOE's 2004 Acceptance Priority Ranking report,[12] supplemented with site-specific information on DOE's proposed casks and modes for cross-country transport,[13] reactor-specific information on license extensions, decommissioning status, and on-site storage facilities and plans,[14] and site-specific information on the current inventory in on-site storage.[15]

Using the data resource, several case studies are conducted, to explore the implications of several possible elements of best practice transportation for particular Purchasers and origin sites. What are the Purchaser's options under the Standard Contract? What adjustment in oldest-fuel-first acceptance is required to implement a particular element of "best practice"? Though an initial exploration, the case studies suggest the types and scale of acceptance queue adjustment prerequisite to best transportation practice.[16]

In general, the case studies proceed as follows:

- The researcher posits a best practice shipment from a particular utility site.
- Consulting the data resource, the researcher considers the queue slots held at that site. Usually, best practice shipment requires waiving slots and delaying initial shipment.
- Consulting the data resource, the researcher considers queue slots held by the utility Purchaser at its other sites; could they be applied to advance shipment at the site in question? When such application is possible, the utility could waive fewer slots and delay shipment less, but, of course, it looses slots at its other sites.
- Again considering the data resource, the researcher considers the potential for trade with other utilities. Which other utilities have slots applicable to the posited best practice shipment if there were and an efficient mechanism by which they could be acquired? Often, applicable slots are available.
- Once again consulting the data resource, the researcher considers the likely utility self-interest in the posited best practice shipment.[17] Often, best practice shipment is not clearly contrary to utility self-interest, but neither is the utility self-interest compelling. Often, current arrangements provide no compelling reason why the utility should not decide that it would be simpler and easier to use slots as they come up, and require DOE to chase around the country to pick-up SNF for cross-country shipment in overweight truck.

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[12] DOE/RW-0567, July 2004. The report lists discharges through December 2002.

[13] Presented for each origin site in the Draft Supplemental SEIS (DOE/EIS-0250F-S1D), Tables G-7, 8, 10, and 21.

[14] Nuclear Energy Institute.

[15] StoreFUEL; Vol. 10, #117; May 7, 2008.

[16] Subsequent efforts may extend the case studies, suggest criteria or mechanisms for acceptance queue adjustment, and test their potential effectiveness in facilitating (rather than impeding) best practice transportation.

[17] A useful next step in this inquiry would be to seek review of the case study with utility officials.

CASE STUDIES

The process outlined above has been applied in several case studies, which illustrate the wide variety of circumstances faced by utilities in meshing circumstances at particular sites with best practice transportation:

Dresden (and Exelon)

If so inclined, Exelon could clear all spent fuel stored at its Dresden 1 site (shutdown since 1978) in 5-6 dedicated trains. To do this, it would have to waive 6 earlier queue slots, and wait until slot #202[18] to begin shipment. Since Dresden has direct rail service, dedicated train shipment should be possible.

If Exelon also applied 8 queue slots at Dresden 2 and 3, it could use slot#202 to remove almost 300 MTU now stored at three Dresden reactors in 12-13 dedicated trains. At one dedicated train shipment per week, the 300 MTU could be removed over 3 months.

If Exelon (or DOE) wanted to remove all 20 year-old fuel from the Dresden site in one concentrated campaign, it could do so. But, it would have to waive 32 slots at Dresden and wait until slot#1261 to require removal. It could then remove over 900 MTU of 20 year-old fuel in about 35 dedicated trains. Since both Dresden 2&3 received license extensions in 2004, both Exelon and DOE might have an interest in removal of older fuel, but the wait until slot #1261 could be long.

With 8 reactor sites and 17 reactors (3 shutdown), Exelon is the nation's largest nuclear utility, with plenty of options to address objectives at one site using slots it holds elsewhere, without trading slots with other utilities. But Exelon has objectives, not just at Dresden, but at its other sites as well. For example, instead of waiving 28 slots at Zion (2 reactors, shutdown in 1996 and 1997), Exelon could apply slots for 20 year-old fuel that it holds at Braidwood, Byron, LaSalle, Limerick, Peach Bottom and/or Quad Cities—all of which continue operations. It could then clear the Zion site a lot earlier than at slot #1244.

All of the above courses of action are generally consistent with our posited best practice criteria, but all require waiving earlier slots and some also require internal trading. It may well be in Exelon's interest to implement one or more of these options. But this interest is by no means compelling. At Dresden 1, for example, Exelon need not wait until slot #202. It could call for an overweight truck shipment at slot #1, and then for others at slots #31, #46, # 54, and #70. DOE would be shipping older fuel from a shutdown site, but it would not be in dedicated trains or in concentrated campaigns.

St. Lucie (Florida Power & Light)

Florida Power & Light received a license extension for its two St. Lucie reactors in 2003, but in 2017 it will have 680 MTU of 20 year-old fuel, which could be removed in 9-10 dedicated trains. Unlike Dresden, however, St. Lucie does not have direct rail access. Several intermodal options are potentially available, one of which involves barge shipment 13 miles to the Port of Fort Pierce.

Florida Power v& Light could waive 22 slots at St. Lucie, and wait until slot #1300 to remove its 20 year-old SNF. After barge shipment, 9-10 dedicated trains could remove all 682 MTU of 20 year-old SNF in 9-10 dedicated trains.

Rather than wait until slot #1300, FP&L could use its slots at Turkey Point to advance shipment from St. Lucie. Applying 20 slots at Turkey Point along with 9 slots at St.Lucie, FP&L could require DOE to

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[18] For this exercise, queue slots held by DOE are excluded (assumed to be waived or applied in a separate shipment campaign. In this exercise, we consider the queue slots held by utility Purchasers, resulting from 1629 discharges from commercial reactors through December 2002.

remove almost as much SNF (670 MTU) from St. Lucie at slot #634. This would delay shipment from Turkey Point, of course, but the additional time might be useful in developing an alternative to DOE's current proposal to use hundreds of 3150-mile overweight shipments to remove SNF from Turkey Point.

To remove its 20 year-old SNF from S. Lucie at slot #634 without depleting its slots at Turkey Point, FP&L would need to acquire slots from other utilities. Several other utilities hold such slots, with several thousand MTU of SNF. But how might it strike such a deal? Which of these utilities would be willing to part with its own slots, at what price?

All of the above assumes that FP&L finds it in its interest to delay shipment of 20 year-old fuel from St. Lucie until Slot #1300 (when it could use St. Lucie slots to require removal of 682 MTU) or until slot #634 (when it could use St. Lucie and Turkey Point slots—or slot trades—to remove a similar amount: 670 MTU). Perhaps state-local resistance to 450 overweight truck shipments on local roads would force FP&L to avoid OWT shipment. But there may also be a national interest in best practice transportation, which DOE, as part of its commitment to best practice, must be willing to invest in.

Humboldt Bay (Pacific Gas and Electric)

Pacific Gas and Electric could waive 5 slots at Humboldt Bay, and wait until slot #102 to require removal of 390 BWR assemblies (all of which would be over 40 years old in 2017). As Humboldt Bay is in Safstor, PG&E retains capability to load assemblies into canisters or casks. If the assemblies were loaded to TADs (consistent with current DOE policy), Humboldt Bat SNF could be removed in 9 TADs or 3 dedicated trains.

Since PG&E does not hold queue slots at its Diablo Canyon reactors that could be applied to advance shipment from Humboldt Bay earlier than slot #101. (The first SNF discharge at Diablo Canyon was in August 1986, and received slot #565.)

The distance from Humboldt Bay to Yucca Mountain is 1215 miles, of which 83% (1045 miles) of the route distance would be shared by shipments from the Sacramento Municipal Utility District's Rancho Seco facility. Rancho Seco, which has been shutdown since 1998, has 493 PWR assemblies stored on-site in 21 NUHOMS dual purpose canisters. Should DOE, in consultation with the two utilities and the State of California, wish to clear two the sites in a concentrated campaign involving 15 dedicated train shipments, the parties would have to wait until slot #738, when 36% of Ranco Seco's SNF was discharged. The two utilities would have to acquire earlier slots from other utilities in order to initiate such a campaign earlier than slot #738.

PRELIMINARY CONCLUSIONS

Though the elements of best practice in this unprecedented campaign for SNF transport are not yet defined or agreed, it is reasonably clear that:

a) Strict adherence to oldest-fuel-first acceptance priorities is impractical and in no party's interest, but that

b) Best practice transport involves drastic adjustment of the oldest-fuel-first acceptance priorities, not yet seriously considered. Further,

c) No "system solution" can be imposed to resolve the complicated questions of queue. What is needed is a market by which DOE gives value, and by which utilities can assemble and apply, queue slots required for best practice SNF transport.

Applying the four elements of best practice identified for this inquiry, it appears that *some* utilities are positioned to support *some* best practice transportation from *some* sites. To do so, they would have to waive slots, delay initial shipment, and/or acquire slots from other utilities. Furthermore, the utilities self-interest in making these arrangements is limited and by no means compelling. Under current arrangements, many could choose to require shipment mostly by overweight truck as slots come up in the queue. Furthermore, while some utilities are positioned to support some best practice transportation, others are less well positioned. It seems clear that full DOE commitment to best practice transportation requires modification of current arrangements regarding the queue.

Such modifications must include a process that answers the question: “What’s the value of a queue slot?” the answer will be “it depends” on:

- Circumstances at particular shipment origins (e.g. queue slots held; on-site storage; power plant status and reactor pool capacity);
- Circumstances of the utility Purchaser that owns a particular shipment origins (e.g. queue slot inventory; on-site storage policies; economics and finances);
- Circumstances of *other* utility Purchasers, particularly those that own queue slots needed for a particular best practice transportation campaign;
- DOE commitment (expressed as investment) in best practice transportation.

A PRELIMINARY PROPOSAL

The most obvious way to answer the question “what is the value of a queue slot required for best practice SNF transport?” is to offer money for such queue slots—money that expresses the incremental value that DOE, as agent for the national interest in this case, places on best practice transport, vis-à-vis transport according to Standard Contract acceptance rankings. The most obvious way to distribute the funds is by a market in which utilities sort out among themselves which queue slots are applied where and when, and who thereby receives the money that DOE has offered for best transport practice. For example:

- DOE might offer $100,000 for queue slots required to remove a 30 MT batch[19] of properly packaged[20] SNF from a single nuclear reactor site with direct access to a class 1 railroad.
- DOE might offer a greater per MT amount (say 15% greater) for queue slots required to ship a 30 MT batch of properly packaged SNF from a class 1 railhead near one or more nuclear reactor sites that lack direct access to such a railhead. The greater amount reflects the more complex origin site coordination processes required for intermodal shipment.
- DOE might offer a greater per MT amount (say, 10% greater) for queue slots required to remove SNF from site which no longer have an operating reactor or spent fuel pool. The greater amount reflects the desirability of clearing such sites early and completely.
- DOE might ask the Nuclear Industry Association (or some other association of U.S. nuclear utilities) to receive and assemble utility offers of queue slots meeting the above criteria (and/or other criteria established for best practice transportation), and to properly distribute the funds.

NEXT STEPS

The above inquiry addresses many elements of a question that has received insufficient attention to date. However, the assessment of each element is, in its current status, preliminary. Additional work is required to assess the likely results of cross-country transport under the Standard Contract.[21] The database developed for this inquiry warrants update and development. Additional case study could provide fuller understanding of these issues from the perspective of different utilities and their reactor operators—particularly if the case studies included review and discussion with utility managers. Additional elements of best practice could be identified, and those identified above could be specified in greater detail.

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[19] A single dedicated train can remove about 30 MT in TAD or dual purpose canisters.
[20] “Properly packaged” might refer to undamaged SNF in TADs or dual purpose canisters.
[21] Potential litigation inhibited DOE response to questions posed by the author.

With the basis for inquiry improved as described above, two key elements warrant further consideration. The first, of course, is the preliminary proposal discussed above. Its elements should be examined, alternative approaches considered, and current elements specified in greater detail. The second elements warranting further consideration is the cost to DOE of a campaign for cross-country transport under current and proposed arrangements. How much might the preliminary proposal (or its improved version) cost DOE? How much might DOE save in more efficiently deployed equipment and services, and in less complex and contentious management processes?