

Potential Issues
Implications of Repackaging SNF for Transportation or Disposal

Horizontal Evaluation

From Cell	To Cell	Potential Issue
A1	B2	<ul style="list-style-type: none"> • 1 and 2. For a shutdown plant, if there is no spent fuel pool, repackaging in existing canister. Nigel, In the case of no repository, assuming dry cask to dry cask. Experience in the world about packaging fuel into dry casks. Experience in Iraq. Maybe use mobile repackaging. (Move to another spot.) Areva, three dry transfer options. • 4. Don't assume that fuel can be directly transferred. Only one vendor is reloading damaged fuel. Bob-NRC. • 5. On chart, multiple loading and unloading functions shown. Issue on lack of standardization of canister and casks. Options at the backend make it more complicated.
	C3	<ul style="list-style-type: none"> • 31. Rob ORNL, need to define the storage system if you're going to move bare fuel, will have implications for other steps.
	D4	•
	E5	•
	F6	•
	G7	•
	H8	•
	I9	•
	J10	•
	K11	•
B2	C3	•
	D4	•
	E5	•
	F6	•
	G7	•
	H8	•
	I9	•
	J10	•
	K11	•
C3	D4	•
	E5	•
	F6	•
	G7	•
	H8	•
	I9	•
	J10	•
	K11	•
D4	E5	•

	F6	•
	G7	•
	H8	•
	I9	•
	J10	•
	K11	•
E5	F6	<ul style="list-style-type: none"> • 8. Earl, do the regulations determine who has to do the repackaging. • 9. Marvin, what is in the standard contract regarding repackaging. Utilities have one motivation towards larger canisters, where smaller canisters may be preferable for other steps. • 28. Areva, retrievability after transportation and what constitutes failed fuel and its implications, and implications after dry storage.
	G7	•
	H8	•
	I9	•
	J10	•
F6	K11	•
	G7	•
	H8	•
	I9	•
	J10	•
G7	K11	•
	H8	•
	I9	•
	J10	•
H8	K11	•
	J10	•
	I9	•
I9	K11	•
	J10	•
J10	K11	•

Vertical Evaluation

From Cell	To Cell	Potential Issue
K11	J10	•
	I9	•
	H8	•
	G7	•
	F6	•
	E5	•
	D4	•
	C3	<ul style="list-style-type: none"> • 10. Arjun, do we need to have a site before we can solve some of these earlier questions. First determine the repository and its characteristics which would dictate some of the answers to the earlier questions. • 11. Peter Swift, some of the questions can be addressed, such as designing a generic disposal canister now, work underway. • 12. Diane, can you have a standardized canister for all disposal sites. Peter Swift, might be possible to design a canister that goes to a disposal canister that is then put in something else. Design for the widest range of possibilities. Nigel, it would be nice to know the geology for current design activities, but now consider broad range, but there is a disconnect with what the utilities are doing.
	B2	<ul style="list-style-type: none"> • 6. What are disposal requirements, and how they impact earlier packaging steps? Possibility of repackaging more than once. Would like to avoid.
A1	•	
J10	I9	•
	H8	•
	G7	•
	F6	•
	E5	•
	D4	•
	C3	•
	B2	<ul style="list-style-type: none"> • 7. Diane, what about damaged fuel, and implications for repackaging?
A1	•	
I9	H8	•
	G7	•
	F6	•
	E5	•
	D4	•
	C3	•
	B2	•
A1	•	
H8	G7	•
	F6	•
	E5	•

	D4	•
	C3	•
	B2	•
	A1	•
G7	F6	•
	E5	•
	D4	•
	C3	•
	B2	•
	A1	•
F6	E5	•
	D4	•
	C3	•
	B2	• Bob, NRC Damage fuel can be shipped now. Must meet criticality and heat transfer. Retrievalability not a requirement in part 71. But what happens at the next steps.
	A1	•
E5	D4	•
	C3	•
	B2	•
	A1	•
D4	C3	•
	B2	•
	A1	•
C3	B2	•
	A1	•
B2	A1	•

Additional notes:

3. Question on what is known and where information is known. Answer (Bob-NRC) spent fuel is dangerous stuff. Need dangerous stuff. Need a fixed or mobile hot cell. Will need sufficient shielding. Will a mobile facility be adequate? Cost is high. Dry to dry transfer never demonstrated, except for canisterized system.

13. GAO, missing cost and time, need to be involved in discussions. Security question not shown, especially as fuel cools down. Liability, major driver, must be considered.

15. Southern, need to make decisions and move forward quickly, actual implementation is important, don't have years to amortize, will have all shutdown sites.

16. NAC, what are obligations on utilities, Nigel, DOE is only obligated to pick up spent fuel. How will it be taken away. Fuel to be taken away from the site as other than spent fuel, there will have to be modifications to the standard contract.

17. ANL, likelihood that it will be shipped to the storage site, but the longer we wait, more go into storage. 40,000 tonnes in the pools, as bare fuel, store as bare fuel. Everything going into canisters and stored as bare canisters. Can another approach be identified. Can we do anything to minimize the magnitude of the problem to stop the hemorrhaging, use opportunities.
18. Judy, any overarching regulations, every transfer deals with older, more degrading fuel. At the disposal site, want smaller canisters. Talking about the freedom of the utilities. Can regulations drive what the utilities can do to make the process better for the longer term. Nigel, how do you look at the national interest as a whole in which one component is industry and the other is government responsibility. Gene, entity responsibility and disposal, and has no influence on how the utilities load canisters and do dry storage.
19. NEI, objective of utilities is safety in all operations. Larger casks are most cost effective and better safety capabilities. Utilities have taken it upon themselves to take the most cost effective and safest route. If a repository was known, might change the approach. But now the question is what is the safest thing that can be done with what is known.
20. Diane, how does the nuclear waste policy act impact what DOE can dictate to utilities. How does the nuclear waste policy act affect what the NRC can do? Gene, NRC focuses on safety. Diane, The NRC focus could be on a broader safety perspective. Nigel, does what extent the existing legislation constrain an optimum approach to the problem and safety.
21. NRC Waters, the question of safety does transcend across lines. NRC does not have a policy on this.
22. Arjun, all regulations have impact on repackaging. But the decisions impact all aspects of entire process.
23. Arjun, question to ANL, European designs all much smaller. Will require repackaging. Direct disposal avoids this. Otherwise repackaging needed.
24. Arjun, looking at French approach, boreholes not well suited. Looking down the line, impacts on dose affected by choices. Issue based on what utilities are doing there is an implication on worker dose. But if you don't want to repackage, constrains site selection.
25. Juan, Objective is to ship the fuel offsite. If you triple the number of canisters offsite, security costs. If repackaging is the decision, do this at the receiving site. Moving to higher capacity systems, fewer handlings.
26. Steve Becker, what needs to be done to incorporate public into decisions.
27. Judy, is the assumption that all transportation rail, or is truck or barge possible. Nigel, All options must be considered. Judy, If so, drives to smaller packages. Nigel, transportation affected on decisions at the various steps. Currently keep options open. Judy, some access can't take waste away by barge or rail. Nigel, transportation limitations constrain options at some sites.

29. Diane, what are the most critical safety factors in repackaging, and are there overriding safety factors, and what factors inhibit standardization.
30. Marvin, different heat requirements between storage and transportation, e.g. max load 34 kw, but during transportation 20 kw. Larger casks have to sit on the pad longer to be transferred.
32. GAO, how does DOE take fuel, what assemblies would be taken first (hot fuel from pool rather than older dry stored fuel), what is required in standard contract?
33. NIRS, Nigel, bare fuel assemblies can be handled separately, but in a sealed canister different operation. Bolted canister retains flexibility.
34. DOE-NE DOE office of lawyers dealing with standard contract.
35. Thilo, Nigel, assemblies have not gone into a sealed cask. Thilo, size of cask, can transport heavy casks on streets. It's slow. But an issue at repository site, creates other casks. Need ways to receive handle and store various kinds of casks. In terms of handling and storage, many implications for handling at one site.
36. NEI, other than thermal requirements, also criticality requirements, especially for PWRs and boron credit. Risk of a transportation accident leading to criticality is low, so does it make sense to have this limitation on the transportation, NRC have certified for welded cask. Difference on criticality requirements. Gene, different criticality requirements for disposal also different.
37. Jim Williams, issue on monitoring on what's going on in a sealed canister, currently limited, introduces uncertainty of what's happening to the fuel over time and what it means for transportation as it is shaken. Waste confidence seems to indicate long term storage will be acceptable, but not much known over the longer time. How do you monitor the long term or how do you make decisions about the content when you can't monitor, especially for high burn up fuel.

After the break:

38. Gene, example using the matrix, canister loading B2 to K11, other similar examples, to boil it down to a simple issue, if you want to do repackaging for disposal, the disposal requirements need to be defined.
39. Thilo, suggest that you develop the various requirements at the same time. Gene, you should design the repository for the waste stream and not design the waste stream for the repository.
40. Bob NRC, haven't heard intermediate steps, eg coming out of storage and going into intermediate storage, must meet all transportation requirements, then have issue of meeting all requirements of part 72, then into another transportation canister. No questions on the intermediate steps. You can't look at just one leg but must take into account of all the steps. Rick, what issues on.... Gene, going from ISFI to another site, how to meet 71 requirements, how to verify what's in the cask, going from C3 to E5 how

do you meet the requirements. Then to consolidated storage for a length of time, then to rep E5 to F6 how do you meet those requirements.

41. Peter Swift, SNL, don't have regulatory standard for disposal, EPA responsibility, are there additional standards, uncertainty about the standard for disposal.

42. Bob NRC, tried to harmonize requirements among the various steps, this document might be useful.

43. Judy, if you do repackage, is there someone who guarantees what is in the package when it reaches disposal? Is there an entity that assures and audit trail? What's the plan for cradle to grave monitoring, inventory tracking, auditing

44. Arjun, more than inventory tracking. In Germany, CASTOR can indirectly monitor helium pressure. Here after sealed, after 40 or 60 years, don't know if there has been air ingress and degradation. When you reopen, don't know what you will be finding. Gene, separate casks from canisters. US has a double seal. Casks are monitored, canisters are not. Arjun, do you have data inside canister? Do not know helium pressure after four decades, and if there has been air ingress.

45. Question about a site where they don't have a spent fuel pool. Rob ORNL, Jeff Williams, 308 canisters. At stranded sites have capabilities.

46. Nigel, no packages at stranded sites that can't be transported. After more shutdowns, will be increasing number of canisters that can't be transported, what are discontinuities when flexibility of options will be lost.

47. Bob NRC how do you chang

48. GAO some factors, loss of flexibility, and consent based siting approach, what are communities willing to accepts. These issues may not be insurmountable technical issues, matter of costs and time, but it will be a matter of what stakeholders are willing to accept, loss of flexibility may become an issue. If you did have a pool, what are options on dry transfer versus wet transfer, costs seem to be about the same. Came down to a matter of choice. Don't leave out consent based approach on each of these steps. May have as big an impact as the engineering.

49. NEI, ability of repackaging in part 72, sites that don't have a part 50 license. One issue what changes need to be made to 72 for interim storage. Do we have the currently regulatory framework for repackaging at an interim storage site? Eg a fuel drop. Gene, expand to sites that no longer have a facility. Does the regulatory framework exist to allow repackaging under part 50?

50. Bob NRC does this include requirements coming in or going out? May be different. Gene, technically there are issues. Regulatory the same. Bob, you may have to change the canister, but coming out may not have to change for transportation.

51. Nigel, does what extent to the repackaging on receipt and dispatch. These requirements different.

52. Rob ORNL, storage-packaging-storage. Pool for decades, pad for decades, then move it.

53. Mark ANL looked at all this. Design of facility will affect what the functions are. If you take bare fuel it will impact what this will look like. Huge decisions on what happens up front. Currently you just don't know.

54. Diane, NIRC, definitions for disposal criteria, don't have it. Fuel coming out of reactors. Storing at the site. Must look at indefinite repackaging, do every 100 years. Must look at possibility of then going directly to disposal with out having interim storage. Nigel, issue is what happens at each stage if the subsequent stage delayed. Diane, technical concerns with major transportation schemes, who is looking at the option of recontainerized at the utility site. Safety of transport raises concern, minimize transport. Store at onsite IFSFI. Indefinite delay for storage, indefinite delay at disposal. What is the safest way to store for the long term. 100 year repackaging. Potential for long term for delay at reactor interim storage without transport. Look at onsite options. May in fact have

Look at the technical requirements for indefinite long term onsite storage at utility sites.

55. Bob NRC, don't license for indefinite storage, but for 40 years, what if a utility comes up for relicensing and don't meet the requirements. What do you don.

56. Bob, requirements on seals, inspection, replacement.

Peter, criticality and thermal limits. Because you would seal before going underground. Would have to pick current criticality limits.

57. Earl, transportation regulations written earlier assuming transport, storage based on Yucca Mountain. Time to do a new look at regulations, eg seals. Shipping based on food stuffs. Go back and look at underpinings of regulations and see what make sense and what don't make sense. Two types of issues—technical and regulatory.

58. Diane, Nevada could be transportation site. What about cats and dogs, variety of issues. Would Eureka County have trouble planning for em

Local government planning is difficult with understanding technical designs of casks and transportation, and contents so that the risks would vary depending on contents. More the nature of the problem is variable and difficult to anticipate.

59. Arjun, two sets of regulations. EPA to be done early. Other is NRC on performance of casks. This is related to nature of site. What kind of canisters. Absent of NRC regulations is more critical to the problems discussed here. Question, in 2001 petition Prairie Island transfer damaged fuel. If observe damage fuel, put it back in, then figure it out. Much more critical now. Failed fuel management critical for repackaging. Needs to be addressed.

60. Bob NRC agree, issue of looking at requirements in 71 and 72. NRC is doing an ongoing look, how to homogenize and harmonize. Don't know how to do this for the repository since the design is not yet known.

61. Rick, intermediate storage facility and transportation. What issues? Rob ORNL, one issue are there changes in the material in going from storage, how does it affect transport. Does it affect intermediates steps. Bob NRC all guidance has been based on the fuel not going back into the pool. Make sure there is not thermal strain to not fail the fuel. Rewetting not considered, subsequent. Gene, what issues associated with rewetting and subsequent drying the fuel, how does the impact the integrity of the fuel?

60. Areva, study on reuse or repurpose. Did a study. Dry transfer at LaHague far less low level waste. Gene, YMP emptying canisters, are they low level waste. Failed fuel may not make it LLW. How do you assure that empty canister are LLW.

61. NAC, shutdown sites have GTCC waster. Have to be addressed.

62. Arjun, at LaHague, do you transfer spent fuel? Areva failed fuel transferred only in pools.

63. Bob, NRC in US, pinholes and tight cracks can be handled as part of normal population. In France, put into special containers.

64. GAO, canister loading in one cell. How will it be impacted as part of upcoming as part of retirements. Pools full? Would utilities unload? Provisions available to do this. Fall on vendors?

65. CBNI, offload into dry storage into as soon as possible.

66. Nigel, disposal cell has a multitude of aspects. Disposal as implacement followed by 100,000 years. How does the location of repackaging relate. If repackaged at storage site, long term 100 years then to repository. But repackage at disposal site, occurs at a different stage. Relation to retrievability. Repackage twice because of different reasons. Time dependence of repackaging.

67. Peter Swift, SNL issue consider now how it relates to the waste form, the fuel itself. What we do now, the choices on storage, handling over the next 50 years could affect it when it goes into long term storage,

The issue we should be considering is that we should be doing that now and how it relates to its fuel assembly over 100,000 and how do different disposals concepts depend on this. Some do and some don't.

Nigel, to what extent do operations on the surface correlate to the long term disposal performance, and how this relates to repacking.

68. NAC, as plants shutdown, lose capability. Timing issue to how to best use transportation systems.

69. Rick, once in disposal, retrievability. Means something different at different stages. Current regulations require waste be retrievable during operation of repository. Part 191 may require for some time after closure. Don't yet storage. Judy, may not want to retrieve because it impacts the isolation. Thilo, during operation and for 500 years. Get the waste back somehow.