Recognizing Interdependencies in the Design of the Nuclear Fuel Cycle and the Transportation of SNF and HLW

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Background

- SNF and HLW are typically stored at their generation sites, often for prolonged periods of time.
- Eventually these materials must be transported off-site, destined for:
  - interim storage facility
  - reprocessing plant
  - deep geologic repository
- This presentation considers the interdependencies between nuclear fuel cycle options and the transportation system, arguing that both must be addressed as part of an integrated system.

Transportation Interdependencies – Two Cases

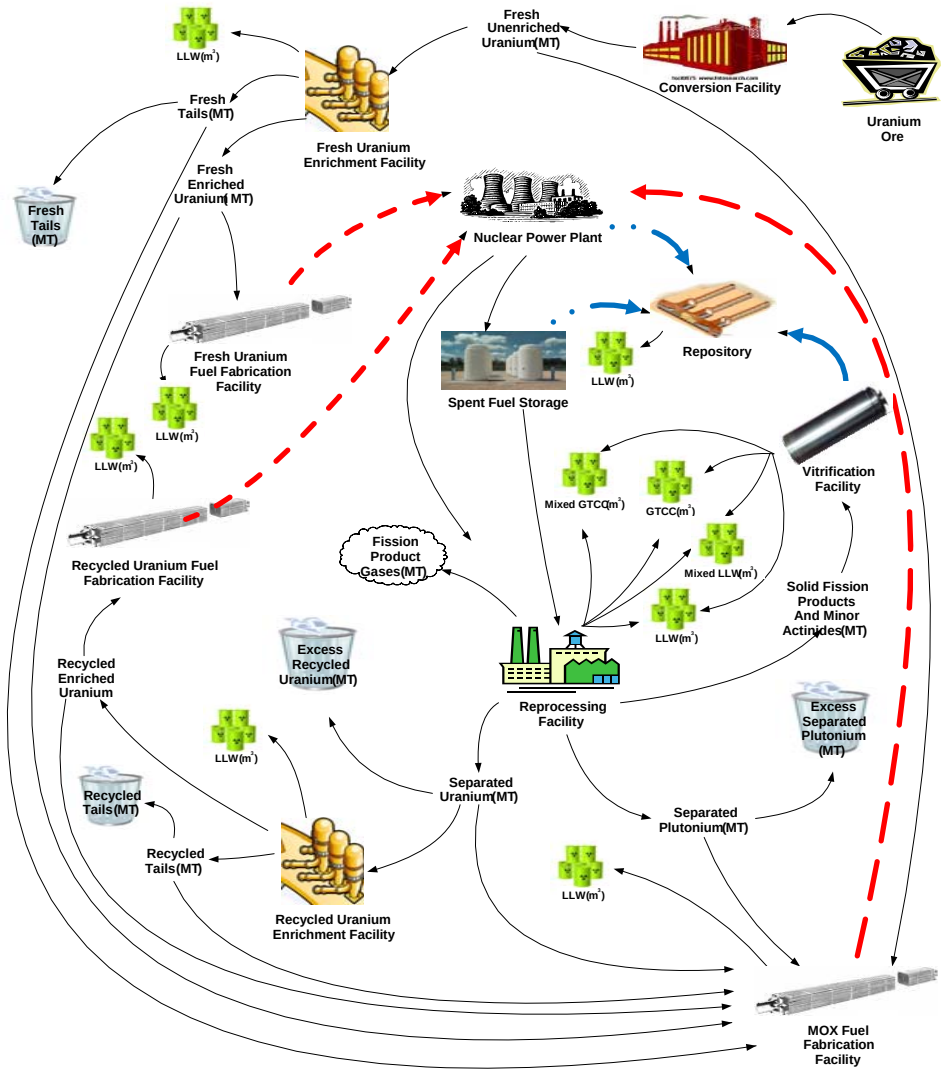
- Case 1 - U.S. Repository Program Experience: Yucca Mountain
  - Retrospective m2
  - Focus on challenges that arise when a system is not analyzed and managed in an integrated manner
- Case 2 – Long Term Storage and Higher Burn-Ups
  - Prospective
  - Focus on early recognition of system interdependencies to avoid types of problems experienced in Case 1

Slide 3

m2 You need to say something about the effort to withdraw the license. Those comments may need to be updated before the presentation is given.

metlay, 29/09/2010

Nuclear Fuel Cycle Process Flow Options



U.S. Repository Program Experience - Yucca Mountain

- DOE required to demonstrate that waste management system design meets health and safety standards.
- System design heavily focused on underground repository and its surface facility for receipt and handling.
- To minimize handling and repackaging of SNF at surface facility, in 2005 DOE adopted the transportation, aging and disposal (TAD) waste package concept.
- Weight of the TAD configuration meant that DOE could only move loaded TADs to YM by rail.
- In developing TAD to address disposal concerns, transportation considerations were discounted.
- This potentially threatened the viability of the entire system operation.

Shipment Origin – Lifting Capacity

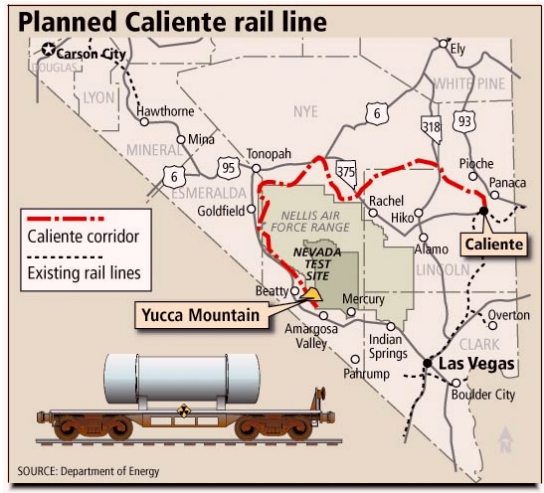
- Loading of TADs would require nuclear power plants to have handling systems with a minimum 100-ton lifting capacity.
- Current equipment configurations at many sites would not meet this threshold.
- Upgrades would require significant expense, perhaps cost-prohibitive.
- Thus other arrangements would be necessary, including possibly moving the SNF from one facility to another for loading into TADs.

Access/Egress – Modal Access Options

- At many sites, locally and regionally owned railroads would be used to transport TADs to a mainline railroad transfer point.
- Many of these railroads would require significant upgrades to meet DOE's minimum track quality standards.
- If these railroads could not afford to upgrade, other more logistically complicated routes would have to be used, possibly including heavy haul vehicles and intermodal transfer operations.

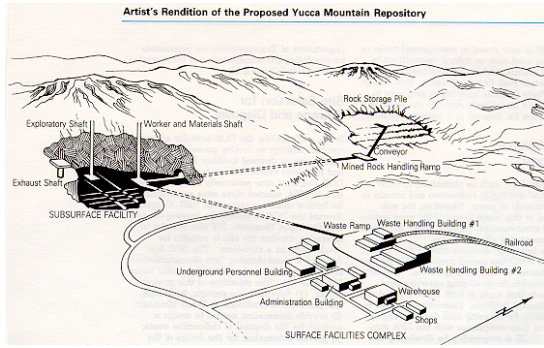
Line Haul – Moving From Mainline Railhead to YM

- YM site is not presently connected to the national railroad infrastructure.
- Connection would require a new 330-mile railroad at an estimated $3 billion.
- Significant construction delays would:
  - reduce efficiency of the repository construction project
  - push back the start of repository operations
  - potentially change the characteristics of the waste stream arriving at YM
- If railroad construction not completed, the entire YM project would be at risk.



Shipment Destination – Surface Facility Interface

- DOE assumed that 90 percent of CSNF would arrive at YM in TADs.
- Remainder would require fuel assembly transfer to TADs at surface facility.
- This assumption was considered highly questionable.
- If less than 90 percent arrived in TADs, backlogs would have been created, forcing:
  - construction of additional handling facilities
  - placing more CSNF on aging pads
- May also have impacted the number and types of casks needed for storage and required extra cask handling equipment & maintenance.



Long Term Storage and Higher Burn-ups

- It is expected that fuel burn-ups of over 60 GWd/MTU will be routine in the future.
- Little experience has been gained in storing high burn-up fuel for prolonged periods.
- Moreover, the length of time during which CSNF will likely need to be stored prior to processing or disposal may be 100 years or more.
- The impact on the fuel and containment system of storage over long periods and subsequently in transportation is not known:
  - Cladding integrity
  - Criticality safety
  - Offsite radiation dose limits (normal & off-normal conditions)

Cause for Optimism

- Affected parties are now recognizing the importance of interdependencies among storage, transportation, disposal operations, and (potentially) reprocessing.
- Resulted in formation of the Extended Storage Collaboration Program, which includes a long-term cask demonstration with monitoring and evaluation of aging effects.
- Individual organizations are also developing their own initiatives, with system integration in mind.
- Utilities urged to consider in the design of new fuel types that a small penalty in fuel performance may be offset by benefits to storage, transport and disposition of CSNF.

Conclusions

- The nuclear fuel cycle includes a waste management system comprised of many interrelated components.
- Transportation is the “glue that holds the system together”.
- It is imperative that the system be analyzed and evaluated as an integrated whole.
- This is essential to harmonizing cask design, fleet acquisition, handling, access/egress and line-haul operations.
- Transportation stakeholders must be vigilant that these interdependencies are recognized and acted upon as part of system design and implementation.