An Alternate Approach Towards Addressing the Technical Issues for Long-Term On-Site Storage of Used Nuclear Fuel

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DOE-NE’s UFDC

- Office of Civilian Radioactive Waste has been disbanded
- DOE-NE has established the Used Fuel Disposition Campaign (UFDC)
  - To conduct scientific research and development to enable storage, transportation and disposal of Used Nuclear Fuel (UNF) for current and future nuclear fuel cycles
  - Among the UFDC tasks – to facilitate all options for disposition and to maintain retrievability and normal back-end operations, the program will evaluate the likelihood that UNF remains undamaged after extended storage.
  - This should not preclude options, from a total systems performance perspective which result in an overall benefit to nuclear waste management.
Where Do We Want to Be?

Through research and development, the gap analysis to support UNF management should:

- Provide assurance that systems containing UNF will meet their intended extended storage safety functions and regulatory requirements
  - Thermal performance
  - Radiological protection
  - Confinement
  - Sub-criticality
  - Retrievability for normal and off-normal conditions
- Provide similar assurance for subsequent transportation

- Transparent and collaborative process with EPRI, Industry and NRC, with opportunity for public comment
What Deserves Our Consideration? (1)

- Existing NRC regulations and the DOE Standard Contracts address/require the waste form as the fuel assembly
  - Definitions of “INTACT” and “DAMAGED” fuel and how canister designs are affected by the mechanical state of the assembly and cladding
  - Standard Contract requirements specific to fuel assemblies and components which are an integral part of the assembly (BWR channels, PWR inserts, etc.)

- Is it time to consider a new regulatory framework for long-term management of UNF?
What Deserves Our Consideration? (2)

- Other options we might consider
  - Modify NRC regulations and amend the DOE Standard Contract
    - Welded canister or existing transport casks become the waste form
    - Has the potential to simplify technology development necessary to meet long-term storage and transportation requirements
    - Accelerate the process of moving UNF away from reactor sites
    - Amending Standard Contract is problematic
  - Canning all UNF – provide an additional fission product boundary, removing reliance on fuel cladding
    - Expensive – up to $1,000,000 per canister
    - Not ALARA considering the number of already loaded systems, which would require repackaging
    - Opportunity for fuel damage moving each assembly several additional times, increased occupational exposure
# Research and Development Required

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Canister/Cask as a Waste Form (1)

- Technology development begins with assumptions:
  - Since UNF is no longer a waste form, must assume debris configuration inside canister/cask for long-term storage, transportation and disposal (may not be necessary for all UNF)
  - Canister/cask becomes the confinement boundary
  - Criticality control – moderator exclusion, burn-up credit methodology including fission product poisons
  - Canister/cask becomes the retrievable component

- Expand upon EPRI work which has already produced reports addressing:
  - Disposal of intact canisters at Yucca Mountain, and
  - Criticality analysis including burnup credit and fission product poisons
Canister/Cask as a Waste Form (2)

- Research on cladding properties and fuel structural material becomes limited, and possibly unnecessary.
- Monitoring and inspections at utility sites will begin from the exterior of the canisters, rather than inside.
- Focus will remain on integrity of canisters/casks and overpacks, and in some respects, these SSC may have to perform to higher standards.