Repackaging Used Fuel at Commercial Nuclear Power Plants

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Major Impacts to Nuclear Operators

- Dose/safety considerations
  - Additional radiation exposure
  - Additional heavy load lifts
- Plant operations
  - Spent fuel pool overhead crane use
  - Radiation protection and security coordination
- Cost considerations
  - Additional support staffing
  - Cask loading costs ($300k - $400k)
Magnitude of the Issue [1]

Dry storage systems at operating units
- 1650 DSCs containing used fuel
- Estimated 2900 DSCs in 2020 [EPRI 2012; 1025206]
- Estimated that all currently operating plants will need dry cask storage by 2025 [EPRI 2012; 1025206]
Magnitude of the Issue [2]

Ten shutdown units – 2813 MTU / 248 DSCs

- Big Rock Point, Connecticut Yankee, Maine Yankee, Yankee Rowe, Rancho Seco, Trojan, Humboldt Bay, LaCrosse, Zion 1&2 (Fort St. Vrain)

- Additional 15 DSCs with greater-than-Class C (GTCC) waste

- No spent fuel pool available on site to execute repackaging operations
Magnitude of the Issue [3]

Additional shutdown units

Crystal River 3, SONGS 1-3, Kewaunee, (Vermont Yankee – 2014, Oyster Creek – 2019)

Evaluations/decisions regarding wet v. dry storage during SAFSTOR in progress

Normal plant retirements begin with Dresden Unit 2 in December 2029 (after 60 years power operation)
What Does Repackaging Involve?

- Return existing DSCs to SFP
- Cut open welded DSC canisters / remove lids from bolted DSCs
- Offload assemblies to SFP
- Place new/smaller DSC in SFP and load SNF
  - 1 PWR / 4 BWR
  - 4 PWR / 9 BWR
  - 12 PWR / 32 BWR
- Return new/smaller DSC to storage or transport
Impact on Nuclear Operators [1]

Example - Schedule for loading DSC at dual-unit BWR with two-year operating cycles

- 1.5 weeks per system
- 2 weeks for mobilization / 2 weeks for demob
- Schedule typically runs 10-12 weeks

Other uses for overhead cranes

- Refueling related activities – 24 weeks
  - Crane preventative maintenance and inspection
  - Fuel receipt
  - Fuel inspect and movement (staging)
  - Pre- and post-outage movement restrictions
Impact on Nuclear Operators [2]

- All other activities then occur in remaining 14-16 weeks including:
  - Scheduled training, vacation and holiday schedules (4-8 weeks)
  - SNM inventory, SFP non-outage operations (moving filters, control rods, discharged assemblies)

- Results in limited availability (approximately 4-5 weeks) to repackage DSCs
Impact on Nuclear Operators [3]

Fuel loading and welding will result in shorter loading duration for smaller system

- Fuel selection and loading
- Canister closure weld, dewatering, drying, helium backfill
- Balance of schedule – placing canister in transfer cask, placing transfer cask in pool, removal transfer cask from pool, transfer canister to DSC overpack, move to storage location

Rather than 1.5 weeks per DSC, estimate 1 week per DSC load
Impact on Nuclear Operators [4]

- BWR typically loads 4-5 DSCs
  - Assume 1 week per smaller system
  - 9-11 systems required (for 32-assembly BWR DSCs), or 31-38 systems (for 9-assembly BWR DSCs)
  - Requires minimum of 9 weeks schedule for 32-assembly systems, with a maximum of 38 weeks schedule for 9-assembly systems

- Results in a significant impact to plant operations: safety, time and cost
From the Utility Perspective – Repackaging DSCs at Reactor Sites

Does repackaging at operating reactor sites holistically improve the US high-level waste management system?

- Yes – allows flexibility of disposal options, but...

Does repackaging at operating reactor sites holistically improve the nuclear fuel cycle?

- No – major impediment to plant operations, likely to result in additional collective worker exposure, safety challenges and crane unavailability (costs)
- Flexibility of disposal options can be introduced after acceptance by DOE for disposal