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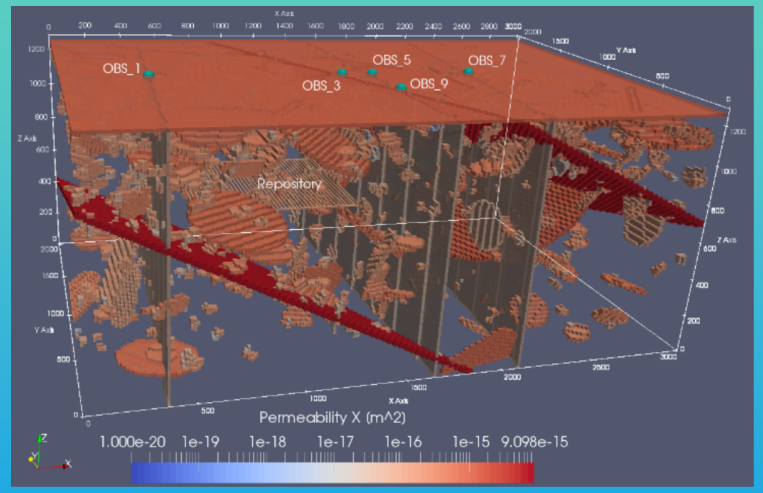
Clean. Reliable. Nuclear.

Spent Fuel and Waste Science and Technology (SFWST)



Concepts of Operations for Advanced Reactor Evaluations

SFWST Working Group Meeting

June 26-28, 2023

Ed Matteo

Sandia National Laboratories

Dept. of Nuclear Waste Disposal Research and Analysis

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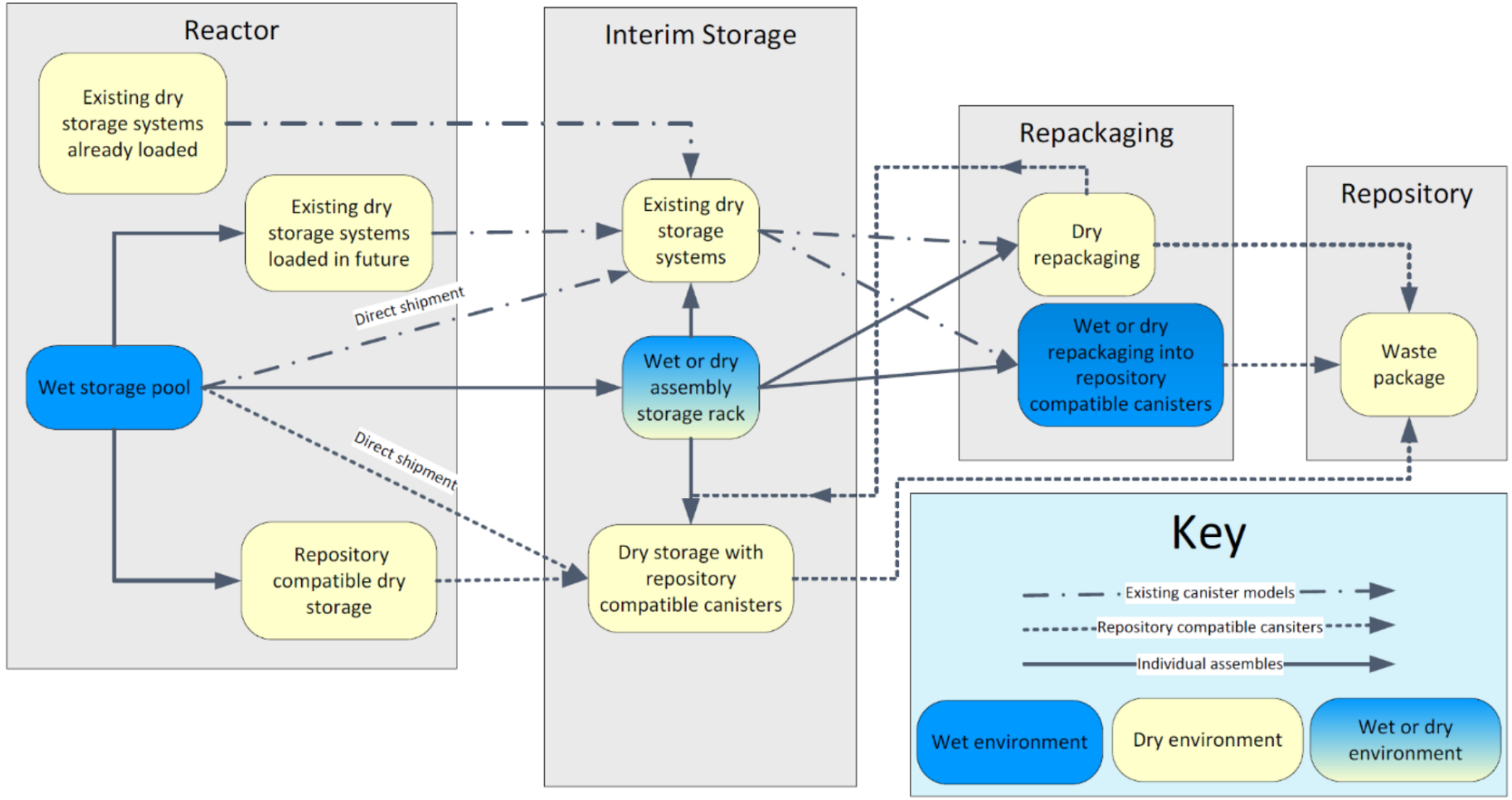
Overview - SNF Disposition Pathways

- The current operational flow for LWR SNF “has multiple options”



Source: Mark Nutt et al., “Used Fuel Management System Architecture Evaluation,” FCRD-NFST-2013-000020 2012.

Fuel Characteristics

- Quantity of SNF generated
- Cladding Integrity
  - Ensures geometric configuration is maintained during dry storage and transportation
  - Specialized procedures for damaged fuel
- Design Characteristics
  - Thermal output
  - Dose Rates
  - Criticality Control limits

Storage

- SNF Storage Equipment
  - Casks, Canisters, and Overpack
  - Cask skids, mating adapters, and ancillary equipment
- Wet Storage Logistics
  - Impact of thermal output and fuel reactivity on logistics of SFP management and capacity
  - SNF loading to canisters (for LWR performed wet)
    - Implications of a dry loading operation?
- Dry Storage Logistics
  - Canister/Overpack Design
    - Storage, Aging, Transportation, Disposal?
  - For LWR, usually onsite
    - Implications for ARs' (esp. SMR's)?
- Transfer Operations

Transportation, 1/2

- Current LWR System
  - Canisters and Overpack
  - Onsite Transportation Equipment
- Intermodal Transportation
    - Heavy-haul truck to RAIL
    - Barge to Heavy-haul truck to RAIL
    - Heavy-haul truck to Barge to RAIL
- Transportation Requirements
  - Thermal
  - Shielding
  - Criticality
  - Structural Integrity of Casks

Transportation, 2/2

- AR transportation system
  - Origin Sites
    - Remote (e.g. SMRs) locations without access to Rail, Heavy-Haul, or Barge transport used for traditional LWR SNF located in industrially-developed locations.
  - Destination Sites
    - Treatment facilities
  - Package Design
    - Smaller AR SNF packages? (e.g. Due to HALEU)
      - Rail may be impractical
      - Truck transport
  - Transport of Other waste forms
    - Technically feasible (for some waste forms) and can be found amongst precedents of other DOE-Managed waste forms

Disposal

- Waste Characteristics
  - Radionuclide Inventory
  - Criticality Control
  - Thermal Output
  - Chemical Characteristics
  - Physical Characteristics
  - Packaging
  - Disposal Safeguards and Security
  - Surface Facilities Considerations