CEP WORKSHOP: Safe Used Fuel Solutions for SONGS

AREVA TN
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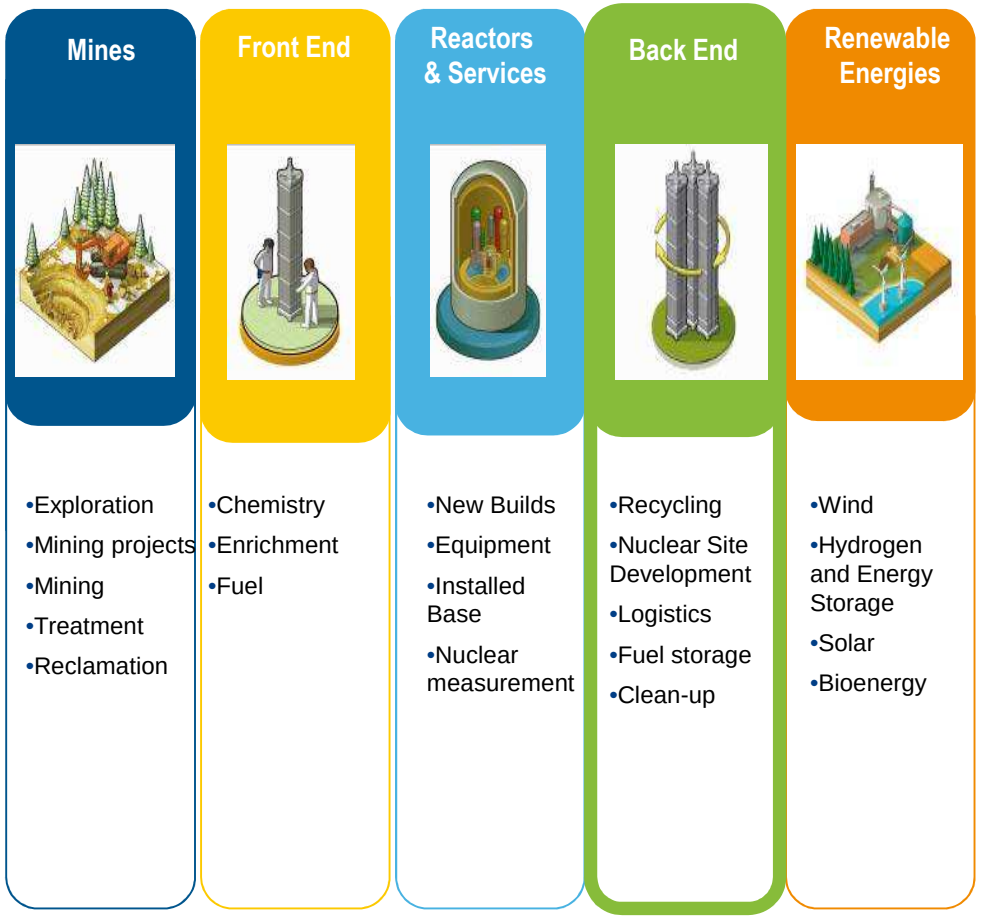
Who is AREVA?

- AREVA TN is a division of AREVA Inc., more than 5000 employees in the USA
- Transporting nuclear fuel for more than 40 years worldwide
- Leader in dry fuel storage since 1985
- AREVA has safely transported more than 10,000 casks loaded with used fuel worldwide
- AREVA has safely transported more than 13,000 high burnup fuel assemblies worldwide
- NUHOMS® is NRC-approved for storage and transportation of high burnup fuel
- The first NUHOMS® systems loaded at SONGS were loaded in October 2003 – 50 systems in total



The NUHOMS® System

- **Four primary NUHOMS® components**

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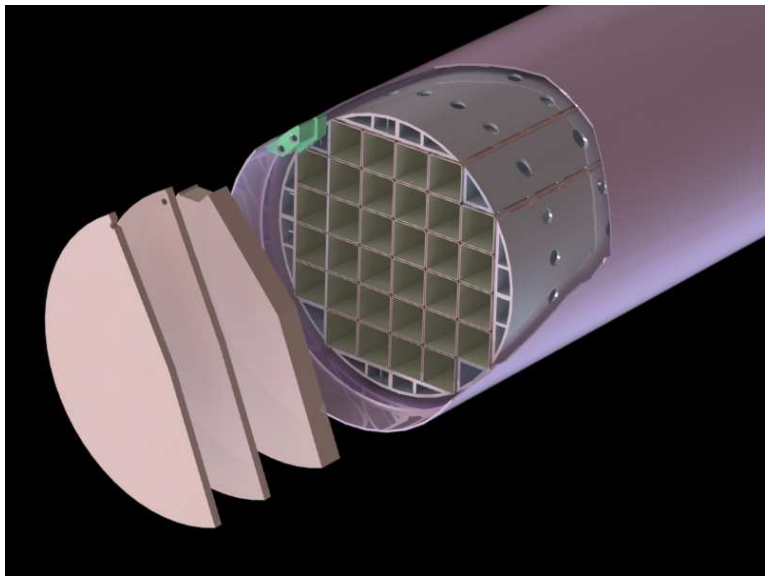

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Dry Shielded Canister (DSC)

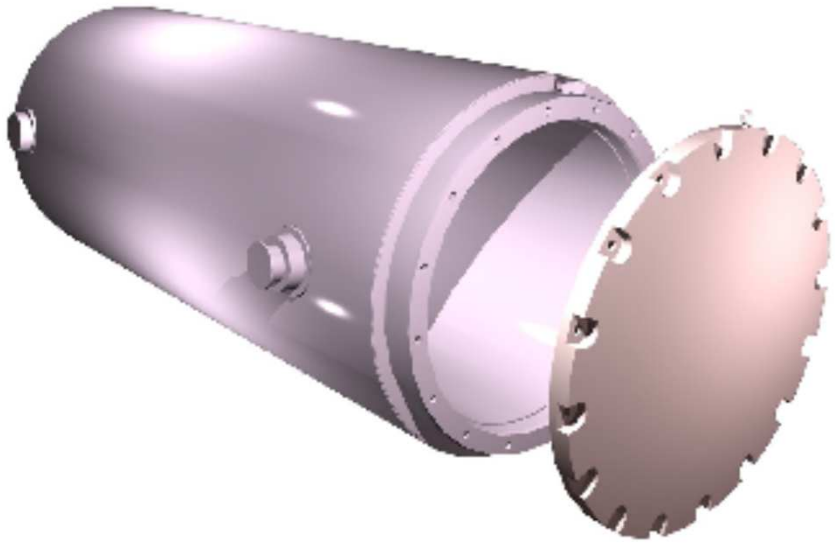
The primary criticality control and storage container for the used fuel assemblies

Horizontal Storage Module (HSM)

AHSM / AHSM-HS (High Seismic)
Provides the structural support, heat removal, shielding and environmental protection to the DSC

The NUHOMS® System

3



Transfer Cask (TC)

Assures safe loading and transfer of the DSC from the Spent Fuel Pool to the HSM

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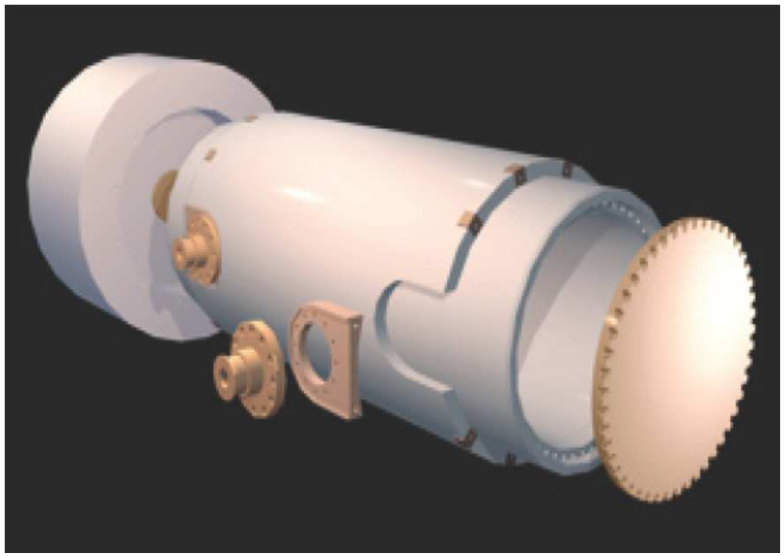


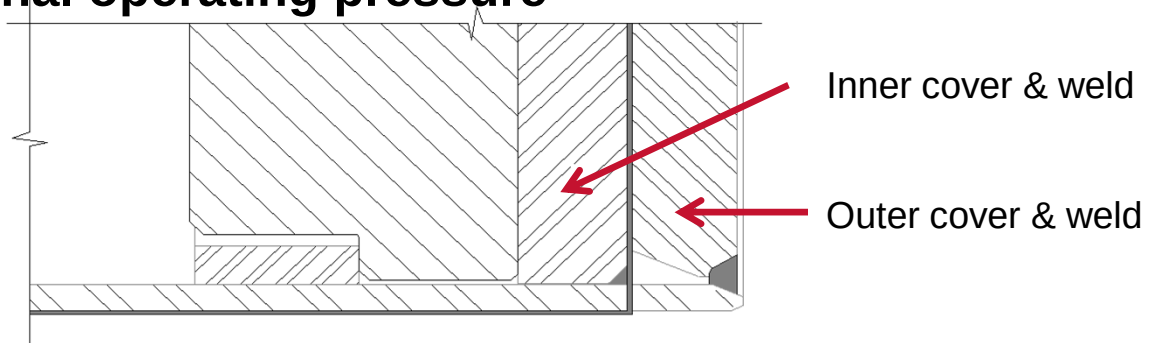
Transport Cask

MP197HB

Licensed for high burnup fuel, the Transport Cask consists of a containment boundary, structural shell, gamma shielding material, and solid neutron shield

Have any NUHOMS® Systems leaked Radioactive Material?

- **NO AREVA dry fuel storage systems have ever leaked radioactive material**
  - **879 casks/canisters loaded with some in operation for 25 + years…NO leaks**
  - **There are no known instances of commercial used nuclear fuel dry storage canisters leaking radioactive materials**
  - **NUHOMS® systems are sealed with redundant closures (two independently-welded lids)**
  - **The confinement boundary welds are tested to ensure leak tightness**
  - **The Independent Spent Fuel Storage Installations (ISFSIs) are continuously monitored for radiation**
  - **Low Cask internal operating pressure**



NUHOMS® Canister Redundant Closure

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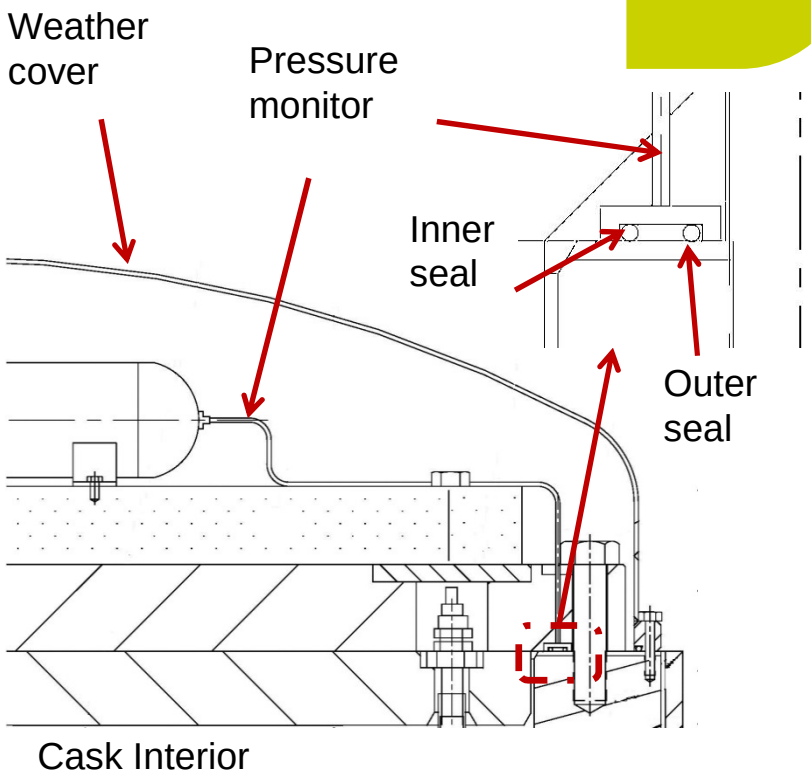
Industry Experience with other AREVA TN Products

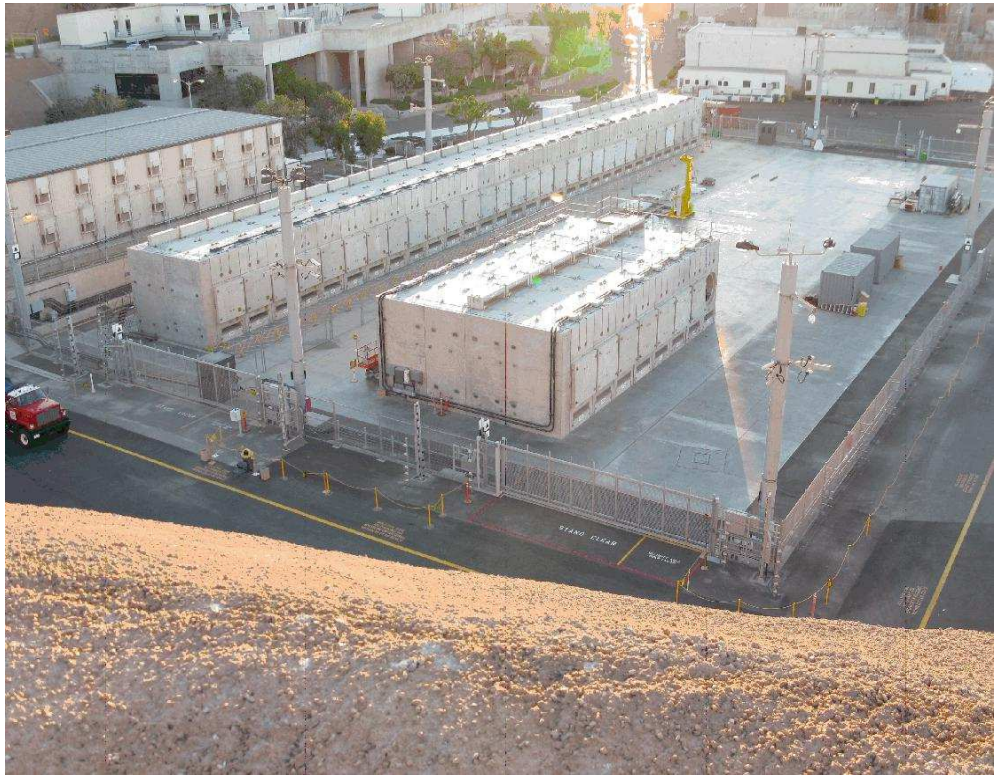
- **Secondary seal leak: Peach Bottom (TN-68) and Surry (TN-32) Metal Casks**
  - **AREVA has never experienced any failure of a system leading to radioactive material leakage**
  - **Release of helium from the monitoring system due to water intrusion at outer aluminum seal; inner seal intact**
  - **Pressure between inner and outer seals continuously monitored; reduction in pressure gave operators plenty of time to correct the problem.**
  - **NUHOMS® canisters are sealed by welds, not by bolts and seals.**



- **Idaho Nat'l Lab – NUHOMS® storage of Three Mile Island core material**
  - **Water collected in hole for roof attachment bolt, then froze, cracking the concrete; damage repaired and hole re-designed to prevent freeze damage**
  - **Cracks in the concrete roof, no impact on the canister: no leakage, no reduction of physical protection or shielding; no generalized concrete deterioration**

Dose Performance

- The robust SONGS HSMs provides exceptional radiation shielding
- The exposure is not measurable beyond the immediate area of the ISFSI and is well below regulatory limits
- Close spacing of the HSMs maximizes self-shielding
- The Advanced NUHOMS® Storage Modules at SONGS have surface dose rates 2 to 3 times lower than other NUHOMS® models and site dose rates 10 times lower



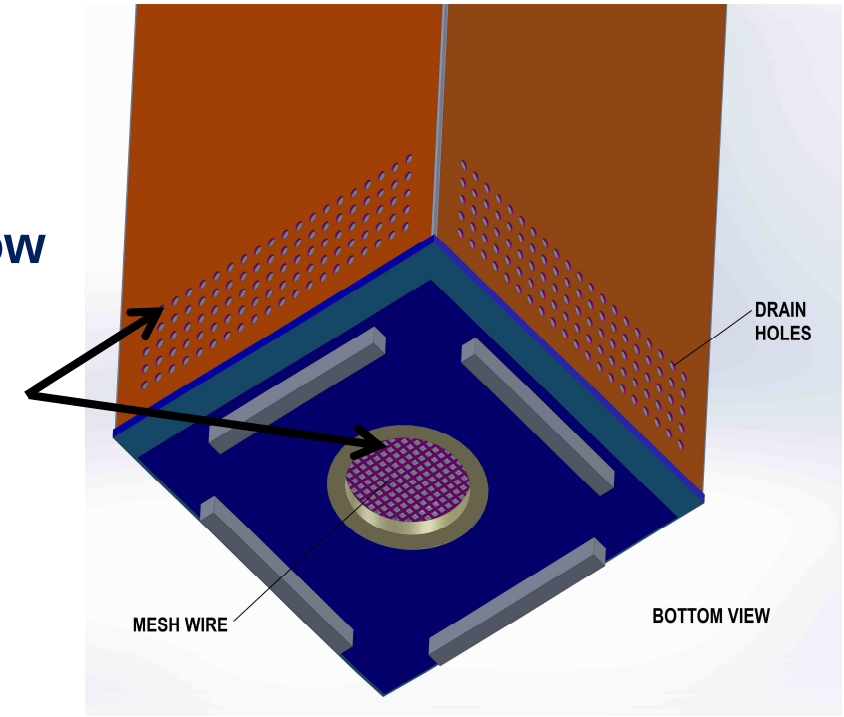
Dose to public below measurable detection limits

What is Canning?

- Function of canning is to facilitate handling of used fuel assemblies at some future date; used for damaged fuel
- "Cans" are not leak tight and therefore will not contain the release of radioactive gases; they do not provide an additional layer of protection
- All known damaged fuel has already been canned and stored in NUHOMS® systems at SONGS

Fuel Assembly

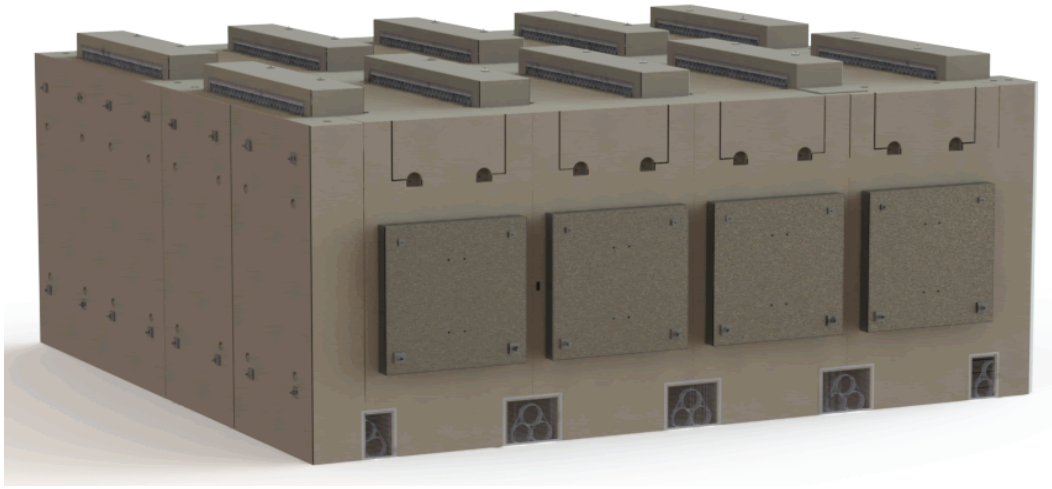
Failed Fuel containers are not sealed. There are small holes that allow the water in the containers to be removed during drying operations



There is no additional safety benefit from canning intact high burnup fuel

Superior Seismic Performance

- **SONGS NUHOMS® is engineered for 1.5g horizontal acceleration and 1.0g vertical acceleration**
- **The seismic design basis of the SONGS NUHOMS® system is more than double than that of the SONGS plant**
- **Large footprint in a horizontal position, ensures stability**



The NUHOMS® system at SONGS is the highest seismically qualified dry fuel storage system in the world

Flood/Tornado/Aircraft Robustness

- **Flood**
  - **NUHOMS® horizontal storage system is ideally suited to deal with flooding events including a partial flood that blocks the inlets to the HSM**
  - **NUHOMS® is qualified for a flood height more than 40' higher than the SONGS site design basis flood height**
- **Tornado**
  - **Intrinsically stable horizontal orientation**
  - **NUHOMS® has successfully and safely operated through two tornado events**
  - **Impact design analysis criteria examples include:**
    - 13.5" diameter, 276 pound wooden utility pole traveling more than 200 MPH
    - 12" diameter, 30' long, 1500 pound steel pipe traveling more than 140 MPH
    - 4000 pound automobile traveling more than 195 MPH
- **Aircraft Impact**
  - **AREVA TN Calculation demonstrates no release of radioactive material for aircraft impact**

NUHOMS® steel reinforced concrete structure provides robust protection against external hazards

When can SONGS used fuel placed in dry storage?

- Cooling time in the spent fuel pool before dry storage is typically 5 to 7 years after last operation in the reactor core
- U1 fuel already in dry storage (with some U2/U3 Fuel)

When can SONGS used fuel be transported?

- First DSCs eligible to ship now; the final DSCs will be eligible for shipment in 2030
- These shipping dates will occur before DOE has the capability to accept the fuel

All SONGS fuel will be eligible for shipment before the DOE will be capable of receipt of the fuel

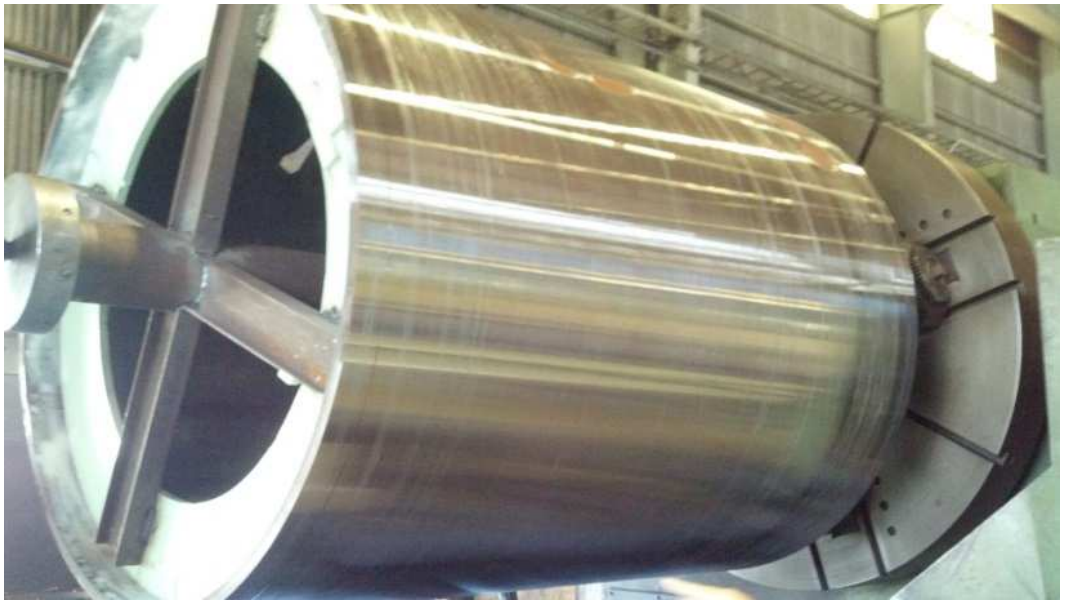
Transportation of High Burnup Fuel

- **NUHOMS® systems currently deployed at SONGS are designed and licensed to store and transport high burnup fuel**
- **AREVA has the most experience when it comes to the storage and transport of high burnup fuel**
- **No used fuel assemblies transported by AREVA have ever developed leaks due to damage during transport**
- **AREVA TN is part of the EPRI/DOE study on high burnup fuel**
  - **Analyzing fuel cladding properties and collecting cask performance data during storage**
  - **Determining fuel cladding properties to support transportation licensing analyses**

AREVA has safely transported more than 10,000 loaded casks (including 13,000 high burnup fuel assemblies) thousands of miles worldwide with no leaks

MP197HB High Burnup Transport Cask

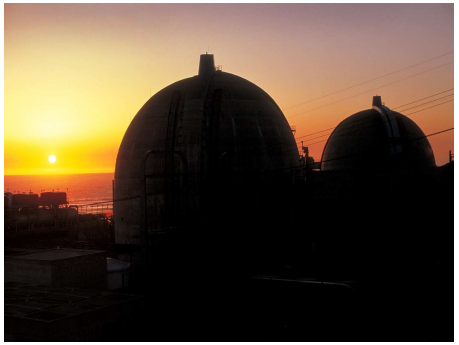
- **MP197HB Transport Cask**
  - Currently under fabrication
  - Licensed for transportation of high burnup fuel
  - Designed to interface directly with SONGS NUHOMS® systems
    - Simple transfer of canisters into the transportation cask
    - No vertical lift of canister



MP197HB is already in fabrication

MP197HB Cask is the first and only Transport Cask approved for high burnup fuel assemblies stored in Canister Based Systems

Main steps of Used Fuel Transport



Reactor site

After cask loading, transfer onto transport equipment

Transport to nearest spur and then rail transport

Design Life vs. Effective Life vs. License Duration of Components

- Design life of the storage equipment is 100+ years with an aging management program
- Effective product life may be extended almost indefinitely through inspections, aging management programs, and maintenance
- License duration: The NRC issued the initial licenses for components for 20 years, and will reissue them in up to 40 year increments
  - The NRC does not place a limit on the number of 40-year renewals that can be obtained.
- NUHOMS® system allows for:
  - Easy Inspection
  - Easy retrieval for inspection or shipment
  - Easy access for potential mitigating action (e.g. cleaning, repair)

AREVA TN has led the way with a first of a kind inspection system for dry storage systems

Conclusion

- AREVA has safely and successfully transported and stored used fuel, including high burnup fuel, for more than 40 years
- NUHOMS® systems are NRC-approved for storage and transport of high burnup fuel
- 879 AREVA TN systems have been loaded in the US and have never leaked radioactive material
- The robust NUHOMS® system ensures dose to the public is below measurable detection limits
- Canning of intact high burnup fuel assemblies does not provide any additional safety benefit
- The NUHOMS® system at SONGS is the highest seismically qualified dry storage system in the world
- NUHOMS® steel-reinforced concrete structure provides robust and proven protection against external hazards

AREVA TN…Committed to providing Safe Used Fuel Solutions for SONGS