



SONGS Dry Cask Storage System

Defense in Depth

a generation ahead by design

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By:

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- **SCE, HOLTEC, and Industry Partnership:**
 - SCE and Holtec have partnered to expand the existing SONGS Independent Spent Fuel Storage Installation (ISFSI)
 - Holtec collaborating with SCE to develop an Aging Management Program (AMP) as part of 'Defense in Depth' (DiD) for the Dry Storage Canister (DSC) systems
 - SCE and Holtec efforts are for both the NUHOMS and HI-STORM type DSCs
 - SCE and Holtec will implement the AMP well in advance of regulatory requirements

- **Defense In Depth:**
 - Designing and operating facilities in a way that prevents and mitigates accidents
 - Creating multiple independent and redundant layers of defense
 - Minimizing the reliance on any single feature
- **Three Principal Functions of DiD for Dry Storage:**
 - Maintain sub-criticality
 - Prevent radiation exposure from exceeding regulatory limits
 - Prevent release of radioactive materials from exceeding regulatory limits

- **Defense In Depth Includes:**
 - Engineered Controls (design / material)
 - Programmatic Controls (fabrication)
 - Mitigating Controls (AMP: testing, inspection, surveillance)

- **Chloride Induced Stress Corrosion Cracking (CISCC):**
 - Chloride Atmosphere with High Relative Humidity
 - High Stress
 - Susceptible Material

Engineered and Programmatic Controls



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■ Engineered Controls:

- Design features
 - Warm surface of canister shell helps prevent dissolved salts in the air from condensing
 - Vertical orientation allows for easy access to 100 percent of the surface for sample collection, options being developed for NUHOMS horizontal canisters
- Identify and introduce CISCC resistant design features in the new canisters such as the use of corrosion resistant 316L stainless steel
- Thickness increased from 1/2 to 5/8-inch
- Additional foundation strength with concrete fill by replacing engineered fill with 3,000-PSI concrete for entire foundation
- Use of stainless steel in lieu of carbon steel for the cavity enclosure canister (CEC) to enhance corrosion resistance

Engineered and Programmatic Controls



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■ Programmatic Controls:

- Fabrication methods such as reduction of stresses by over-roll
- Weld materials
- Welding methods such as minimization of Heat Affected Zone
- Consideration of surface improvement such as peening for reduction in stresses

- **Mitigating Controls – Aging Management:**
 - Monitoring of Radiation Detectors (existing requirement)
 - General area periodic inspections (existing requirement)
 - Maintain security surveillance and access controls (existing requirement)
 - Develop an AMP using NRC guidance to maintain the integrity of the confinement boundary
 - Monitor environmental parameters (temperature / humidity)
 - Develop surveillance tools by converting existing methodologies into monitoring plans for UMAX and NUHOMS
 - Develop chloride content inspection tools by converting existing equipment (used in pilot inspection programs)

- **Mitigating Controls – Aging Management (continued):**
 - Stage a NUHOMS existing empty canister within the salt laden atmosphere for periodic surveillance of salt accumulation
 - Install empty DSC in a CEC for periodic inspection, developing delivery tools, and evaluating inspection and repair methods
 - Install pre-stressed coupons for accelerated environmental impact within the UMAX CECs
 - Stage a transfer cask for long-term storage of any compromised canister
 - Evaluate inspection results from DSC in salt laden atmosphere, spare empty canister, pre-stressed coupons, and operating experience for input to the AMP

■ Mitigating Controls – Remediation:

- Periodically inspect using visual examination tools
- Identify any indication of salt accumulation, pit or crack that may identify the initiation of a crack
- Develop remediation measures for NUHOMS and UMAX canisters years before the risk of confinement breach becomes credible
- Develop repair methods for nuclear components to DSCs
- Convert existing delivery tools and methods for use in inspection and repair of DSCs

Concluding Remarks



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- Defense in Depth strategies for engineered, programmatic and mitigating controls
- A program to protect the long term performance integrity of the SONGS storage system is being developed
- The program will be implemented on the HI-STORM UMAX canisters for the entire life cycle of the storage systems. For NUHOMS systems, the AMP will begin concurrently with the "UMAX" system