

Dry Cask Storage System Canister Aging Management Guidance

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San Onofre Community Engagement Panel
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Our History...Born in a Blackout



- EPRI was founded by and for the electricity industry in 1972 following **The Great Northeast Blackout** in New York City in 1965
- Formally established in 1973 as the Electric Power Research Institute, EPRI manages a broad public-private collaborative research program on behalf of the electric utility industry, the industry's customers, and society at large

Global Collaboration

GLOBAL PARTICIPANTS



>320 reactors worldwide

GLOBAL BREADTH & DEPTH



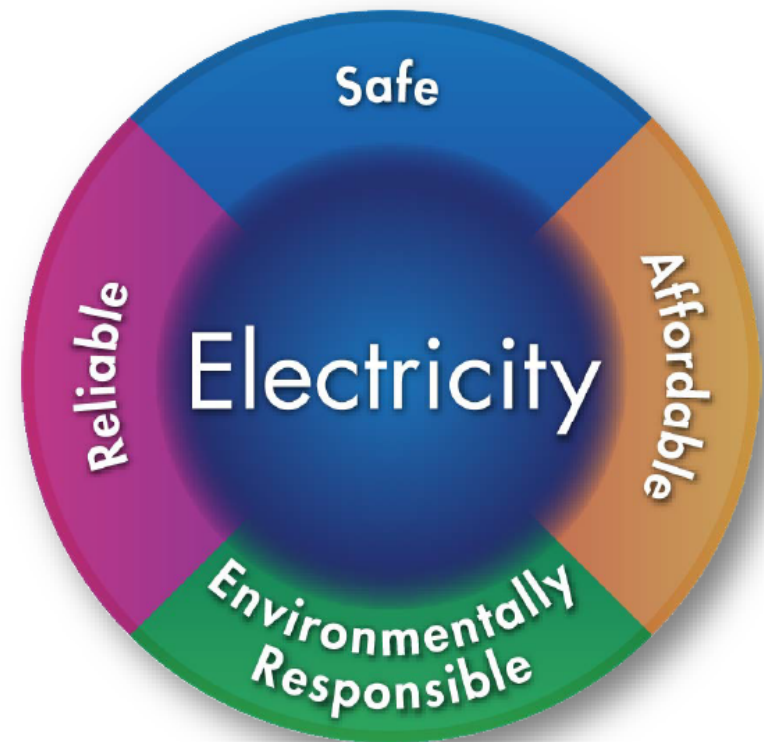
>75% of the
world's commercial
nuclear units

Participants Encompass Most Nuclear Reactor Designs

Together...Shaping the Future of Electricity

EPRI's Mission

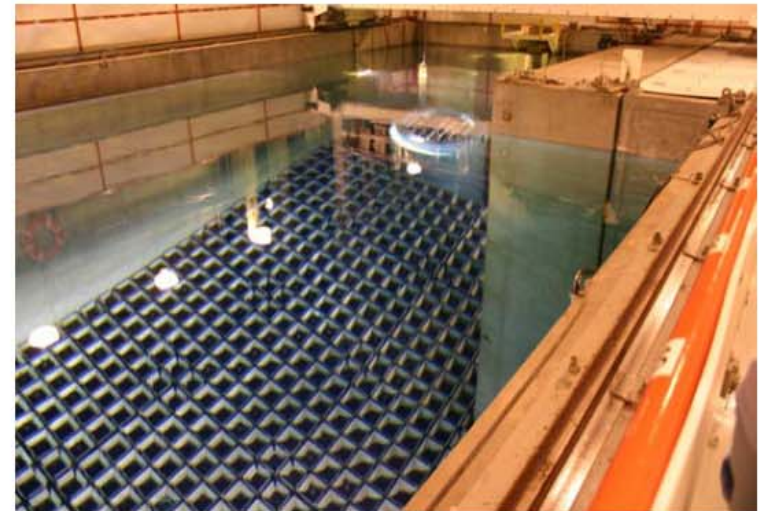
Advancing **safe, reliable, affordable** and **environmentally responsible** electricity for society through global collaboration, thought leadership and science & technology innovation



Independent, Collaborative, Nonprofit

Overview

- Dry Cask Storage System (DCSS) are licensed for temporary storage of spent fuel
 - Permanent repositories not yet available
- DCSS are being used for longer than the original 20 year license period
 - Currently >2500 casks/canisters in operation
- Inspection of DCSS canisters is a key issue for continued licensing and operations and is a part of an Aging Management Plan



What is an Aging Management Plan (AMP)?

- Identifies the actions, timing, and acceptance criteria used to address aging effects
- AMPs - used throughout the nuclear industry
 - Boiling Water Reactor Internals
 - Pressurized Water Reactor Internals
 - Reactor Pressure Vessel
 - Reactor Head
- In general, AMPs are designed to enable early identification of degradation based on inspecting most susceptible specimens
 - Engineering analysis and operating experience



EPRI Canister Inspection Guidance Overview



EPRI Aging Management Guidance

Aging Management Guidance to Address Potential Chloride-Induced Stress Corrosion Cracking of Welded Stainless Steel Canisters

Published in March 2017, Publicly Available, search for **3002008193** on www.epri.com

Primary audience includes:

- ASME Task Group developing In-service Inspection guidance for welded canisters (code case N-860)
- Personnel developing Chloride-Induced Stress Corrosion Cracking (CISCC) Aging Management Programs (AMPs) for license or certificate of conformance (CoC) renewal
- Personnel adapting CISCC AMP in renewed CoC for application at specific site
- Personnel reviewing the CISCC AMP during periodic tollgate assessment

Guidance relies on Susceptibility Assessment Criteria Ranking to identify inspection sample and guide additional actions

EPRI Dry Cask Storage System Inspection Developments

Non Destructive Evaluation Techniques Under Development

EPRI Projects

- Eddy Current Array (ECA)
 - Using advanced array designs with excellent results
- Guided Waves
 - Ability to find defects in inaccessible areas (under rails, supports, etc.)
- Acoustic Emission
 - Potential to monitor from outside



Vendor Development Needs

- Gaps correlate to vendor strengths
 - Visual Techniques (VT-1 & VT-3)
 - Ultrasonics for length and depth sizing

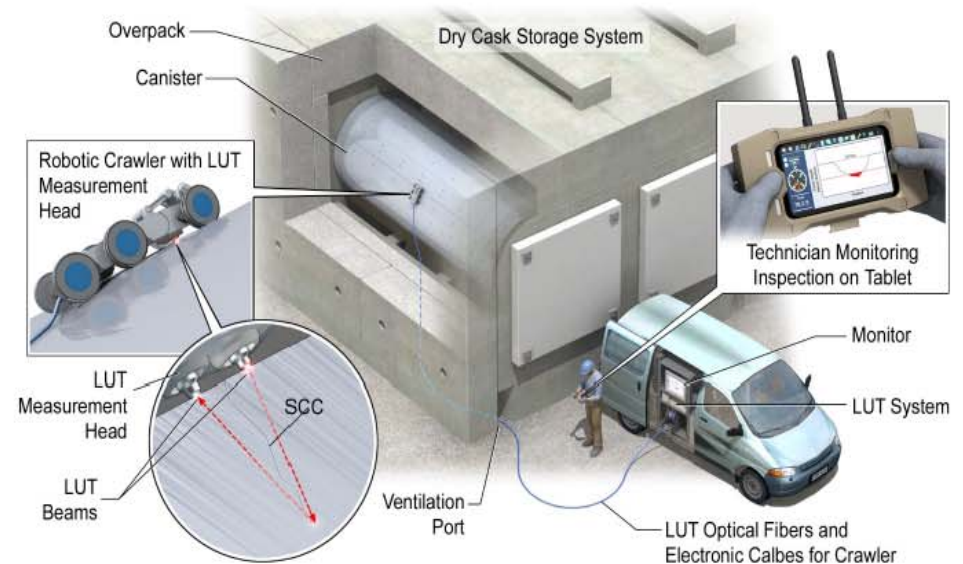


Image Courtesy of Intelligent Optical Systems – used with permission

Mockup Development

- EPRI is working with industry to build flaw mockups for industry use
- A growing number of mockups are being made available for both EPRI and industry use

Numerous companies have worked with EPRI to develop inspection techniques using these mockups



EPRI Video

SONGS Participation in EPRI Field Trials

- SONGS staff have participated in EPRI field trials to help guide the development of inspection technologies, providing
 - Input on needs for inspections
 - Restrictions of different canister systems
 - Insights on design modifications and improvements



AREVA Field Trial – Tested a robot on horizontal mockups

Palo Verde Field Trial

- 2nd-generation robotic prototype with NDE payloads
 - Onboard camera
 - Eddy current array
 - Guided waves

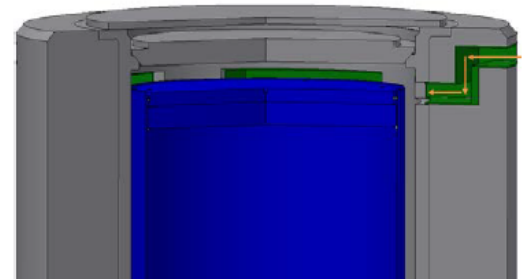
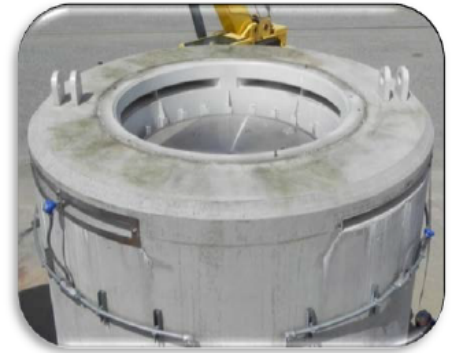


Maine Yankee Field Trial - Inspected a GTCC-loaded Canister



Summary

- EPRI has developed guidance for dry canister aging management plans
 - Aging management plans are widely used in the nuclear industry
 - Susceptibility assessments form the basis for the EPRI guidance for aging management
 - Actual requirements to be developed by the ASME code case or licensing commitments
 - Results contained in EPRI Report 3002008193
- Significant progress has been made with the development of solutions for DCSS inspection technology and more development is underway
 - Mockup fabrication
 - NDE development
 - Robotic delivery
 - Results contained in EPRI Report 3002008234
 - Future reports: 3002010617 (worldwide NDE development efforts) & 3002010621 (latest NDE developments at EPRI)





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