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- POTENTIAL NEW INITIATIVES
OVERVIEW

EST Regulatory Program Review

Phase I. ANALYSIS OF TECHNICAL INFORMATION NEEDS

Phase II. ADDITIONAL RESEARCH AND TECHNICAL ANALYSIS

Phase III. REGULATORY TECHNICAL BASIS AND GUIDANCE

Phase IV. IMPLEMENTATION

CROSS CUTTING STRATEGIES:

- Risk-Informed Enhancements
- Standards Development
- International Cooperation
- Technology Incentives
- Stakeholder Participation

NMSS RESEARCH

Road Map

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U.S. NRC
United States Nuclear Regulatory Commission

Promoting Public Trust for a Safer Future
### Analysis of Technical Information Needs

#### PRIORITY 1

**Degradation mechanisms**
- Stress corrosion cracking of SS canister body and welds
- Cladding Stress due to fuel pellets swelling and gas release

**Crosscutting areas**
- Thermal calculations
- Effects of residual moisture after normal drying
- In-service monitoring methods for dry storage systems

#### PRIORITY 2

- Propagation of existing flaws in cladding
- Wet corrosion, SCC, and metal fatigue of fuel assembly hardware
- Structural and Thermal Fatigue, and Aging Effects
  - Cladding, Neutron absorbers, Fuel Basket
- Low temperature creep and galvanic corrosion of cladding
- Microbiologically induced corrosion
- Concrete degradation
PAST EFFORTS (Continued)

Work Completed

- Stress corrosion cracking analysis
  - NDE on atmospheric SCC, (PNNL-22495, ML13276A196)
  - SCC on chloride and non-chloride atmosphere (NUREG/CR-7171, ML14051A417)

- Potential residual moisture after vacuum drying
  - Evaluation of drying adequacy, (ML13169A039)
  - Factors that could affect the quantity of residual water, (ML13192A125)
  - Potential test plan, (ML13192A127)

- Analysis on Technical Information Needs
  (ML14043A402)

- Horizontal DCSS Thermal Analysis (NUREG/CR-7191)

ONGOING ACTIVITIES

Vertical DCSS Thermal Analysis

MOTIVATION
- Flow pattern varies between the vertical and the horizontal cask
- Conduction and radiation inside the canister are the predominant heat transfer modes
- Convection and radiation are the predominant heat transfer modes at the outside wall of the dry casks system
- DOE-Demo will provide measured data to validate the 3D-CFD analysis

Illustration: Steve Stankiewicz
http://spectrum.ieee.org/energy/nuclear/canned-heat
ONGOING ACTIVITIES (Continued)

In-service Monitoring and Cladding Stress Analyses

• Literature review of in service monitoring for
  – temperature and relative humidity
  – chloride concentration and microbial activity
  – internal pressure
  – materials degradation inside and outside the system

• Cladding Stress Analyses
  – FRAPCON-SFMOD, modified to predict up to 300 years
  – Fuel swelling & decay gas production were analyzed
  – The potential for delayed hydride cracking was assessed

POTENTIAL NEW INITIATIVES

Future Work

• Potential internal corrosion and long term fatigue
• Neutron absorber potential long term degradation
• Microbiological corrosion
• Effects of thermal fluctuations
### Aging Management Tables

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>Structure, system, or component (SSC)</td>
<td>SSC subject to aging-related degradation</td>
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<td>Intended safety function</td>
<td>(e.g., criticality control, shielding, confinement, heat transfer, structural integrity, retrievability)</td>
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<tr>
<td>Material</td>
<td>(e.g., stainless steel, concrete)</td>
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<tr>
<td>Environment</td>
<td>SSC operating environment during normal conditions (e.g., air, water)</td>
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<td>Aging mechanism</td>
<td>Degradation phenomenon potentially affecting the SSC</td>
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<td>Relevant timeframe</td>
<td>Judgment on whether the aging mechanism is relevant to the first 60 years of operation, or is potentially manifested</td>
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### Ongoing Activities (Continued)

#### Renewal Spent Fuel Management Strategy

- **Enhancement of Standard Review Process (NUREG-1927)**
- **Coordinated review of aging management & regulations**
- **Development of learning, proactive, and responsive aging management by:**
  - considering operating experience in Aging Management Programs
  - incorporating results of long term confirmatory research
- **Development of a storage aging management report (2015) by:**
  - creating inspection guidance
  - engaging stakeholder throughout 2014-15 to discuss proposed changes
QUESTIONS?