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NPP License Renewal and Aging Management: Extrapolating American Experience

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Aging Management: 10 CFR Part 54

- License renewal applicants are required to perform aging management reviews (AMRs) of their passive, in-scope components and to identify all aging effects that are applicable to the component materials and environmental conditions.
- Once the aging effects are identified in AMRs, the rule requires applicants to identify how they will manage the aging effects during the extended periods of operation:
 - use of aging management programs (AMPs)
 - use of time-limited aging analyses (TLAAs)



Current NRC Process for Reviewing LRAs

- Current NRC process for reviewing license renewal applications (LRAs) involves both NRC audits of the LRAs at the licensed facilities and technical staff reviews of the LRAs at NRC headquarters (Washington, DC)
- Staff currently uses NUREG-1801, “Generic Aging Lessons Learned” (GALL) Report as the basis for its reviews:
 - NUREG-1801, Revision 0 (2000)
 - NUREG-1801, Revision 1, scheduled for 09/05



GALL Report

- GALL report was issued to assist utilities in the development of their LRAs and NRC staff in its review of the U.S. LRAs.
- GALL report includes a set of AMRs that were determined to be generically applicable to the majority of U.S. nuclear plants:
 - Component / Component commodity group
 - Materials of Fabrication & Environmental Conditions
 - Applicable Aging Effects
 - Method for Aging Management: either by AMP or TLAA
 - Discussions/Bases for the AMRs
- The AMRs in GALL are presented as line items in a tabular format.



GALL Report (continued)

- LRA AMRs that are consistent with those in GALL are acceptable for the applications.
- GALL Report also provides a set of recommended aging management programs (AMPs). LRA AMPs that are based on and consistent with the recommended AMPs in GALL are considered to be acceptable programs for aging management.
- Applicants invoking the AMRs and AMPs in the GALL Report for aging management must identify and justify any exceptions to the criteria established for the corresponding AMRs and AMPs in GALL. LRAs may include plant-specific AMRs and AMPs as well.



Example of AMR Line Items in GALL

Draft NUREG-1801, Rev. 1

V-D2-4

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Item	Link	Structure and/or Component	Material	Environment	Aging Effect/Mechanism	Aging Management Program (AMP)	Further Evaluation
V-D2-13 (E-29)	V.D2.5-a	Piping and components internal surfaces	Steel	Air—indoor, uncontrolled (Internal)	Loss of material—general corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
V-D2-14 (E-27)	V.D2.1-e	Piping and components internal surfaces	Steel	Condensation (Internal)	Loss of material—general, pitting, and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific
V-D2-15 (EP-2)	EP-2	Piping, piping components, and piping elements	Aluminum	Air with borated water leakage	Loss of material—boric acid corrosion	Chapter XI.M10, "Boric Acid Corrosion"	No
V-D2-16 (EP-26)	EP-26	Piping, piping components, and piping elements	Aluminum	Treated water	Loss of material—general, pitting, and crevice corrosion	Chapter XI.M2, "Water Chemistry" The AMP is to be augmented by verifying the effectiveness of water chemistry control. See Chapter XI.M32, "One-Time Inspection," for an acceptable verification program.	Yes, detection of aging effects is to be evaluated
V-D2-17 (E-11)	V.D2.1-d	Piping, piping components, and piping elements	Cast austenitic stainless steel	Treated water >250°C (>482°F)	Loss of fracture toughness/thermal aging embrittlement	Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)"	No
V-D2-18 (EP-36)	EP-36	Piping, piping components, and piping elements	Copper alloy	Closed cycle cooling water	Loss of material—pitting, crevice, and galvanic corrosion	Chapter XI.M21, "Closed Cycle Cooling Water System"	No
V-D2-19 (EP-27)	EP-27	Piping, piping components, and piping elements	Copper alloy >15% Zn	Closed cycle cooling water	Loss of material—selective leaching	Chapter XI.M33, "Selective Leaching of Materials"	No

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Basis for Updating the GALL Report

- GALL Report is a living document and will require periodic updating.
- First revision of the GALL Report (GALL, Revision 1) is scheduled to be issued in September 2005 and will include:
 - Improved definitions for materials and environments
 - aging lessons learned since GALL, Revision 0
 - updated AMRs and AMPs to account for new NRC requirements or positions since the issuance of GALL, Revision 0
 - consolidation of some AMR line items in GALL, Revision 0



Examples of Improvements in AMR Line Items

- Improvement in classifications of material groupings:
 - Materials having the same aging mechanisms are classified together
 - Low alloy steels and carbon steels grouped together
 - Precipitation-hardened steel and cast austenitic stainless steel (CASS) are grouped in the stainless steel category
- Refinement of the classifications for environmental conditions:
 - Standardization of terminology for environmental conditions
 - Establishment of temperature thresholds for the applicability of particular aging effects – for example, 35 °C (95 °F) for thermal stresses in elastomers, 60 °C (140 °F) for initiation of stress corrosion cracking in stainless steel, 250 °C (482 °F) for thermal embrittlement of CASS materials



Examples of Updates to the AMPs in GALL

- New AMP XI.M11-A, on aging management of cracking in Nickel Alloy upper reactor vessel head penetration nozzles:
 - incorporates new augmented inspection requirements per the First Revised NRC Order EA-03-009
- AMP XI.M18, “Bolting Integrity”: updated to provide additional guidance on what is needed for aging management, particularly in the areas of stress relaxation and cracking.



Improved Process

- NRC considers the changes to its license renewal process and the update of the GALL Report will provide for a more efficient and improved basis for reviewing U.S. LRAs:
 - improved technical bases for AMRs and AMPs
 - reduced exceptions to criteria in GALL for AMRs and AMPS
 - more consistent LRA submittals
 - anticipated reductions in industry resources for developing LRA submittals and in NRC resources for LRA reviews



Logistics

- Approximately 20,000 staff hours per review
- 22 month review schedule (without hearing)
- Continuously monitor effort to identify process improvements
- Improved process



Program Status

- Renewed licenses issued for 32 units at 18 plants
- Reviewing applications for 16 units at 9 plants
- Expect to continue to receive approximately 6 applications per year