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Update on BWRVIP SLR-Related Activities

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BWRVIP Perspective on SLR

- Existing aging management guidance is robust and, unless impacted by time-dependent factors, remains adequate as-is to manage the effects of aging
- Field performance data are continually evaluated and aging management guidance updated as appropriate
- BWRVIP aging management program elements are interval-based
 - Independent of total plant operating time (or licensed operating period)
 - Periodic inspection requirements based on historical precedents, field performance, and generic flaw tolerance evaluations

BWRVIP SLR Approach

- Aging management guidance implementation should be linked to engineering-based parameters
 - Contained in the underlying analytical work forming the technical basis for AMP implementation
 - Limitations not based on any specific operating period
 - Applicability confirmed on a plant-specific basis (results need not be “bounding” for the entire fleet)
- Two new technical basis documents created to address operation beyond 60 years, “extended operations”:
 - BWRVIP-315, Reactor Internals
 - BWRVIP-316, RPV (essentially a new version of BWRVIP-74-A)
- Related technical basis documents
 - BWRVIP-329: Alternative to BWRVIP-05. Application of the evaluation procedure, acceptance criteria and results, provide a technical basis for continuing relief from the examination of circumferential welds in BWR RPVs (discussed in an earlier presentation)
 - BWRVIP-321: Update to the BWRVIP ISP for SLR (discussed in a later presentation)



BWRVIP-315, Reactor Internals Aging Management

- Comprehensive aging management review for BWR reactor internals with consideration of extended operations
 - Review of all relevant degradation mechanisms
 - Aging management evaluations comprehensively reviewed for time dependencies / limitations
- Addresses aging management concerns identified in the Standard Review Plan for SLR
- Provides a set of enhancements to BWRVIP guidance determined to be needed to address extended operations



Reactor Internals Technical Basis Report Conclusions

- No changes to periodic inspection requirements within BWRVIP I&E guidelines are necessary to address extended operations
- Limited number of revisions and enhancements to I&E guidance identified to ensure the impact of increased neutron fluence is appropriately considered by BWRVIP program owners
- Revisions are proposed for the following I&E Guidelines:
 - BWRVIP-41, Jet Pump
 - BWRVIP-42, LPCI Coupling
 - BWRVIP-47, Lower Plenum / Control Rod Guide Tubes
 - BWRVIP-76, Core Shroud
 - BWRVIP-26 / BWRVIP-183, Top Guide
- In most cases, Appendix B of BWRVIP-315 contains the detailed set of guidance changes proposed
 - Guidance revisions to be made as guidelines are revised for other purposes, with all changes to be made well before any plant reaches 60 years of operation



Recent EPRI / NRC Interactions

- September 2018 meeting held between the BWRVIP and NRC to discuss the evaluation approach used in BWRVIP-315 and the resulting conclusions
- As of late 2018, one primary technical issue remained outstanding
 - jet pump holddown beam relaxation
- That JP beam stress relaxation evaluation is now complete
 - Not considered to be significant for any plant
 - However, consistent with the BWRVIP approach for aging management, plants will be required to confirm that beam fluence remains less than the values specified within BWRVIP-315

BWRVIP-315 Summary

- Technical work is complete
- Document publishing previously held pending completion of an evaluation of jet pump holddown beam stress relaxation (*per NRC recommendation*)
- Letter transmitting the evaluation and associated revisions to BWRVIP-315 has been (or will soon be) transmitted to BWRVIP committees for review and approval
- Upon EC approval, prepare Proprietary and Non-Proprietary versions for transmittal to NRC
- Submittal to NRC for review and approval anticipated 2nd half of 2019
 - The BWRVIP intends to request a pre-submittal meeting to review the final conclusions in BWRVIP-315 in detail



BWRVIP-316, RPV Aging Management

- Represents a new version of BWRVIP-74
- Intended to address operation beyond 60 years
- Key topics addressed
 - Adequacy of existing programs to address SCC of RPV components
 - Upper Shelf Energy (USE)
 - Material Surveillance (details addressed in a separate presentation)

RPV Aging Management – Inservice Inspection

- RPV aging management largely based on ASME Section XI requirements
 - These requirements have been found adequate to address RPV aging management based on evaluations documented in BWRVIP-06, Rev. 1-A & BWRVIP-74-A
- Section XI requirements augmented in select cases
 - BWRVIP-38 – Shroud Support Welds
 - BWRVIP-48 – RPV ID Attachment Welds
- Conclusions remain appropriate for extended operations
 - No evidence of significant adverse trends in IGSCC occurrence
 - Methods used to manage cracking are interval-based (independent of plant service time) and remain adequate to manage aging during extended operating periods

RPV Aging Management – Upper Shelf Energy (USE)

■ RPV Shells and Welds

- BWRVIP-74-A, Appendix B contains criteria for demonstrating adequate material toughness
- Developed in the context of 60-year operation
- Review of this analysis indicates sufficient conservatism exists in the “60-year” evaluation in BWRVIP-74-A to address SLR (72 EFPY assumed)
- A new “time-independent” version of the applicability verification forms will be included in BWRVIP-316

■ Nozzle USE

- GEH databases of SA-508 Cl. 1 and SA-508 Cl. 2 USE reviewed
- Charpy values based on high shear data (i.e., data that are representative of upper shelf properties) indicate that USE less than regulatory requirements is unlikely
- Limiting factor for some plants may be lack of high shear data for plant-specific material heats
- Some additional work needed to understand the impact of a limited number of relatively low initial USE data identified in the SA-508 Cl. 1 material database

BWRVIP-316 Summary

- Some technical work remaining
 - Work is lower priority than completion of BWRVIP-329 (highest priority) and BWRVIP-315
 - Completion of BWRVIP-316 will become a higher priority once BWRVIP-329 and BWRVIP-315 are completed
- Submittal to NRC for review and approval anticipated late 2019 or early 2020
 - The BWRVIP intends to request a pre-submittal meeting to review the final conclusions in BWRVIP-316 in detail



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