Meeting Between the U.S. Nuclear Regulatory Commission Staff and the Nuclear Energy Institute to Discuss Time-Limited Aging Analyses for Reactor License Renewal

February 3, 2011

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Agenda

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- Introduction and Opening Remarks
- Environmentally-Assisted Fatigue
- Break
- Reactor Pressure Vessel Integrity Time-Limited Aging Analyses (TLAAs)
- Identification of TLAAs, Exemptions, and Applicable Requirements
- Metal Fatigue TLAAs
- Plant-Specific TLAAs
- Public Participation

Reactor Pressure Vessel Integrity TLAAs (1 of 2)

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- Consistency
  - If an applicant proposes changes to previously submitted information and analyses (e.g., changes in chemical compositions or initial values) it needs to provide information and references to support the new values
- Documentation
  - Provide sufficient level of detail and information
  - If an applicant's analyses rely on or reference documents not previously submitted to the NRC, the applicant needs to be prepared to make these documents available or provide them with the LRA for the NRC staff's review

Reactor Pressure Vessel Integrity TLAAs (2 of 2)

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- Beltline Materials
  - Applicants should carefully consider whether additional beltline materials (based on the definition of beltline in the regulations), in particular nozzles, need to be addressed for the period of extended operation
  - If so, it is important that the applicant include the appropriate analyses and submit data (e.g., chemical composition and initial properties) to support its conclusions

TLAA Requirements in 10 CFR Part 54

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- 10 CFR 54.3 – specifies the six criteria to identify a TLAA
- 10 CFR 54.21(c)(1) – states that the applicant shall identify TLAAs and demonstrate that either:
  - (i) the analyses remain valid for the period of extended operation,
  - (ii) the analyses have been projected to the end of the period of extended operation, or
  - (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation
- 10 CFR 54.29 – states that the aging management programs (AMPs) and TLAAs are consistent with the current licensing basis (CLB), or that the CLB is updated

Issues Leading to Requests for Additional Information (RAIs)

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- Identification of TLAAs per the definition in 10 CFR 54.3
- Identification of TLAA exemptions per 10 CFR 54.21(c)(2)
- License renewal application (LRA), CLB, and design basis inconsistencies
- Transient projections
- Disposition bases: 10 CFR 54.21(c)(1)(i) vs. (ii)
- Use of Fatigue Monitoring Programs
- Environmentally-assisted fatigue calculations

TLAA Identification Issues

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- A generic analysis, as listed in Section 4.1 of NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), is not part of the CLB; however, the NRC staff's review indicates that it may be applicable to the applicant's CLB
- Analysis does not conform to TLAA Criterion 3 in 10 CFR 54.3 (time-limited assumptions)
- Analysis does not conform to TLAA Criterion 4 in 10 CFR 54.3 (relevant to a safety determination)

TLAA Exemption Identification Issues

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- 10 CFR 54.21(c)(2) – requires that the application include a list of all exemptions granted under 10 CFR 50.12 that are based on a TLAA
- Other exemptions pursuant to 10 CFR 50.60(b): 10 CFR Part 50, Appendix G (upper shelf energy or pressure-temperature (P-T) limits assessments) and Appendix H (reactor vessel surveillance program)
- Example – In the 1990's, the NRC staff granted many 10 CFR 50.12 exemptions requested under 10 CFR 50.60(b) relative to 10 CFR Part 50, Appendix G, P-T limit generation requests, including American Society of Mechanical Engineers (ASME) Code Case N-514 low temperature overpressure protection (LTOP) setpoint requests for pressurized water reactors. The LTOP pressure lift setpoint is based on a function of the pressure value in the P-T curve for the system's enable temperature set-point value.

Examples of Inconsistency Issues

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- Information in one part of the LRA is contradicted by information in another part of the LRA
- A cited NRC safety evaluation pertains to a technical and regulatory matter different from the one claimed by the applicant
- TLAA information or bases are inconsistent with technical specification (TS) requirements, applicable regulatory requirements, or design basis information in the final safety analysis report (FSAR)

Transient Projection Bases

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- Linear averaging based on transients occurring from initial plant start-up may be non-conservative if the data shows a non-linear trend in the number of occurrences
- Gaps in the data for transients required to be monitored by TS requirements or under design criteria in an applicant's cycle counting program
- Basis for estimating transient occurrences during periods associated with gaps in the data should be justified

Disposition Issues

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- 10 CFR 54.21(c)(1)(i) – use for the same cumulative usage factor (CUF) value
- 10 CFR 54.21(c)(1)(ii) – use for a changed CUF value
- Special information is needed for demonstration of 10 CFR 54.21(c)(1)(ii) disposition bases for implicit fatigue analyses for ASME Code Class 2 and 3 components and ANSI/USAS B31.1 components

Use of Fatigue Monitoring Programs (1 of 2)

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- The scope of NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," AMP X.M1, "Fatigue Monitoring," is limited to cycle-counting activities against design-type CUF fatigue TLAAs
- Use of this AMP for 10 CFR 54.21(c)(1)(iii) disposition of non-CUF-related TLAAs (e.g., leak-before-break, ASME Code Case N-481, and ASME Code Section XI flaw growth fracture mechanics assessments) may not be within the scope of the applicant's CLB
  - Relevant cycle counting TS
  - Applicable NRC-endorsed ASME Code Section XI of record
  - FSAR
  - Applicable procedures (transient counting and ASME Code Section XI procedures)
  - Technical requirements manual or TS bases document

Use of Fatigue Monitoring Programs (2 of 2)

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- Needed updates to the CLB or design basis should be docketed consistent with 10 CFR 54.29
- Applicants should include appropriate enhancements to their fatigue monitoring programs, specifically to the "scope of program," "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" program elements, consistent with the design and safety bases defined in these non-CUF analyses
- Corrective actions may involve re-performing the analysis and submitting the analysis to the NRC staff for review and approval if the non-CUF analysis was required to receive NRC staff approval (e.g., leak-before-break analyses or analyses in support of ASME Code Case N-481 alternative examinations bases for pump casings)

Fatigue Monitoring Programs – Cycle Counting

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- Transients within the scope of TS requirements:
  - Administrative TS calls-out transients specified in the FSAR
  - Design TS lists transients and their limits
  - These transients must be tracked unless an appropriate license amendment is made to the TS (design-type TS) or an appropriate 10 CFR 50.59 change and 10 CFR 50.71(e) update is made to the transient basis in the FSAR (administrative-type TS) to give the basis for not tracking a given transient or TS-invoked transient
- Transients needing to be monitored outside the scope of applicable TS cycle-counting requirements
  - Either the TS or FSAR would need to be updated to ensure tracking of these transients

Environmentally-Assisted Fatigue Analyses

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- Demonstrate that the locations selected for environmentally-assisted fatigue analyses consist of the most-limiting locations for the plant (beyond the generic components identified in the NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," guidance)
- Justify dissolved oxygen level assumptions used in the Fen adjustment factor derivations
- Justify strain rate assumptions used in the Fen adjustment factor derivations