

X.S1 CONCRETE CONTAINMENT TENDON PRESTRESS

Program Description

In order to ensure the adequacy of prestressing forces in prestressed concrete containments during the extended period of operation, an applicant can develop an aging management program (AMP) under 10 CFR 54.21(c)(1)(iii).

The AMP consists of an assessment of the results of inspections performed in accordance with the requirements of Subsection IWL of the ASME Section XI Code, as supplemented by the requirements of 10 CFR 50.55a(b)(2)(ix) or (viii) in the later amendment of the regulation. The assessment related to the adequacy of the prestressing force will consist of the establishment of (1) acceptance criteria and (2) trend lines. The acceptance criteria will normally consist of predicted lower limit (PLL) and the minimum required prestressing force, also called minimum required value (MRV). NRC Regulatory Guide 1.35.1 provides guidance for calculating PLL and MRV. The trend line represents the trend of prestressing forces based on the actual measured forces. NRC Information Notice IN 99-10 provides guidance for constructing the trend line. The goal is to keep the trend line above the PLL because, as a result of any inspection performed in accordance with ASME Section XI, Subsection IWL, if the trend line crosses the PLL, the existing prestress in the containment could go below the MRV soon after the inspection and would not meet the requirements of 10 CFR 50.55a(b)(2)(ix)(B) or 10 CFR 50.55a(b)(2)(viii)(B).

As evaluated below, this is an acceptable option to manage containment tendon prestress force, except for the program element/attribute regarding operating experience. Thus, it is recommended that the staff should further evaluate an applicant's operating experience related to the containment prestress force.

The AMP related to the adequacy of prestressing force for containments with grouted tendons will be reviewed on a case-by-case basis.

Evaluation and Technical Basis

1. **Scope of Program:** The program addresses the assessment of containment prestressing force when an applicant chooses to perform the containment prestress force TLAA using 10 CFR 54.21(c)(1)(iii).
2. **Preventive Actions:** Maintaining the prestress above the MRV, as described under program description above, will ensure that the structural and functional adequacy of the containment are maintained.
3. **Parameters Monitored:** The parameters to be monitored are the containment prestressing forces in accordance with requirements specified in Subsection IWL of Section XI of the ASME Code, as incorporated by reference in 10 CFR 50.55a.
4. **Detection of Aging Effects:** The loss of containment prestressing forces is detected by the program.
5. **Monitoring and Trending:** The estimated and measured prestressing forces are plotted against time and the PLL, MRV, and trending lines developed for the period of extended operation.

6. **Acceptance Criteria:** The prestressing force trend lines indicate that existing prestressing forces in the containment would not be below the MRVs prior to the next scheduled inspection, as required by 10 CFR 50.55a(b)(2)(ix)(B) or 10 CFR 50.55a(b)(2)(viii)(B).
7. **Corrective Actions:** If acceptance criteria are not met, then either systematic retensioning of tendons or a reanalysis of the containment is warranted to ensure the design adequacy of the containment. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions.
8. **Conformation Process:** As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.
9. **Administrative Controls:** As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address administrative controls.
10. **Operating Experience:** The program incorporates the relevant operating experience that has occurred at the applicant's plant as well as at other plants. The applicable portions of the experience with prestressing systems described in NRC Information Notice 99-10 could be useful for the purpose. However, tendon operating experience could be different at plants with prestressed concrete containments. The difference could be due to the prestressing system design (e.g., button-headed, wedge, or swaged anchorages), environment, and type of reactor (i.e., PWR and BWR). Thus, the applicant's plant-specific operating experience should be further evaluated for license renewal.

References

- ASME Section XI, *Rules for In-Service Inspection of Nuclear Power Plant Components, Subsection IWL, Requirements for Class CC Concrete Components of Light-Water Cooled Plants*, 1992 Edition with 1992 Addenda; 1995 Edition with 1996 Addenda, The ASME Boiler and Pressure Vessel Code, The American Society of Mechanical Engineers, New York, NY.
- NRC Information Notice 99-10, *Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments*, U. S. Nuclear Regulatory Commission, April 1999.
- NRC Regulatory Guide 1.35.1, *Determining Prestressing Forces for Inspection of Prestressed Concrete Containments*, U. S. Nuclear Regulatory Commission, July 1990.