

**From:** Dan Hoang  
**To:** James Medoff  
**Date:** 07/05/2006 12:57:41 PM  
**Subject:** PNPS's TLAA Section 4.6

Jim,

For your review and comments

Thanks,

Dan

**CC:** James Davis; Peter Wen

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## **4.6 Containment Liner Plate, Metal Containment, and Penetration fatigue Analysis**

### **4.6.1 Fatigue of Primary Containment**

In the LRA, the applicant indicated that the PNPS containment was analyzed as part of the Mark I containment long term program (Reference 4.6-1) using the methods and assumptions consistent with NUREG-0661.

The Mark I Containment Long-Term Program analyzed the torus and attached piping systems for fatigue due to mechanical loadings as well as thermal and anchor motion. This analysis was based on assumptions of the number of SRV actuations, operating basis earthquakes, and accident conditions during the life of the plant.

The analysis considered all BWR plants which utilized the mark I containment design. The analysis concluded that for all plants and piping systems considered, the fatigue usage factor for an assumed 40-year plant life was less than 0.5. Extending plant life by an additional 20 years would produce a usage factor below 0.75. Since less than 1.0, the fatigue criteria are satisfied. This TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

#### **4.6.1.1 Staff Evaluation**

During an audit and review, the staff requested that the applicant to provide a statement indicating that the estimate of the total number of 60-year SRV actuations used in the design fatigue analysis remains valid and conservative, based on the actual SRV actuations counted through 2005. In it response, the applicant stated that Per the MPR 751, all domestic mark I BWRs appear to meet MPR 751 for both current operating and license renewal terms. It should be noted that PNPS's SRV operation has been very low. PNPS has tracked SRV actuations from 1992 to 2005, a total of 14 actuations have been recorded on valve A, and 13 each on valve B, C, and D. Using the 14 actuations in this thirteen year period, the project actuations for the rest of 60 years are 31 lifts. The number of lifts in the first 21 years of the plant life (1972 - 1993) were not recorded. These lifts were more frequent in the early years, so PNPS estimated these 21 years at 5 times the recorded rate. This yield 120 lifts in the first 20 years. Combining the early period, the recorded period, and the projected period, there will be an estimated 165 lifts in 60 years.

PNPS plant specific analysis (Teledyne Engineering Services [TES] document TR-5310-2) states that the SRV penetrations are qualified for 7500 cycles of maximum load. Based on this, the project CUF for 60 years is calculated as 0.022.

During an audit and review, the staff also requested the applicant to provide a Fatigue Analysis of the SRV discharge piping and Fatigue Analysis of other attached piping. In it responded, the applicant indicated that the TES document TR-5310-2 documents stress evaluations for the SRV for various load combinations, but does not include a fatigue analysis (the fatigue analysis of the SRV piping along with all the other Torus Attached Piping [TAP]). TAP is bounded by MPR-751, the GE Mark I Containment Program. MPR-751 concluded that for all plants and piping systems considered, in all cases the fatigue usage factors for an assumed 40-year plant life was less than 0.5. In worse case scenario, extending plant life for an additional 20 years would produce usage factors below 0.75. Since this is less than 1.0, the fatigue criteria are satisfied. The MPR-751 generic fatigue analysis is thus protected for the period of extended

operation in accordance with 10 CFR 54.21(c)(1)(ii).

A PNPS plant-specific analysis addresses the SRV discharge piping and its supports, as well as the main vent penetration through which the SRV discharge enter the torus. This analysis states that the SRV penetrations are qualified for 7500 cycles of maximum load while the SRV are expected to see less than 50 cycles at maximum load and less than 4500 cycle at partial load. The report concludes "Since the 7500 cycles of maximum load bound both of these by such a large margin and since no other significant loads are imposed on the line, the penetration was assumed acceptable for fatigue without further evaluation." Increasing the 40 years cycles by 1.5 for the period of extended operation would still be less than the 7500 maximum load cycle permitted. The fatigue analysis for torus penetrations thus remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(I).

The PNPS plant specific analysis (TR-5310-2) references the generic GE Mark I Containment Program for other torus attached piping. The results of the generic GE Mark I Containment Program (based on 40 years of operation) were that 92% of the TAP would have cumulative usage factors of less than 0.3 and that 100% would have usage factors less than 0.5. Conservatively multiplying the CUFs by 1.5 shows that for 60 years of operation, 92% of the TAP would have CUFs below 0.45, and 100% would have CUFs below 0.75. These calculations have thus been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). The staff reviewed the applicant's response and found it acceptable because it conforms with nuclear industry practice.

#### **4.6.2 References**

- 4.6-1 Technical Report MPR-751, Mark I Containment Program Augmented Class 2/3 Fatigue Evaluation Method and results for Typical Torus Attached and SRV Piping Systems, November 1982.

#### **4.6.4 UFSAR Supplement**

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of Fatigue of Primary Containment, Attached Piping, and Components Section A.2.2.4. On the basis of its review of the UFSAR supplement. The staff found that the summary description of the applicant's actions to address the Fatigue of Primary Containment, Attached Piping, and Components is adequate, because it reflects the information provided in the LRA

#### **4.6.5 Conclusion**

On the basis of its review, as discussed above, the staff concluded that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that for the Containment Liner Plate, Metal Containment, and Penetrations fatigue analyses TLAA, the analyses have been projected to the end of period of extended operation. The staff also concluded that the UFSAR supplement contains an appropriate summary description of Fatigue of Primary Containment, Attached Piping, and Components TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d).

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