

NRC Staff Technical Concerns to Fatigue Analysis RAI Responses

Related to RAI 4.6-1 Response

Background

Section 4.6 of the SRP-LR states that if a plant's code of record requires a fatigue parameter evaluation (fatigue analysis or fatigue waiver), then this analysis may be a time-limited aging analyses (TLAA) and must be evaluated in accordance with 10 CFR 54.21(c)(1) to ensure that the effects of aging on the intended functions are adequately managed for the period of extended operation.

The current licensing basis may include fatigue waiver evaluations that preclude the need for performing CUF analyses of structural components. The ASME Code Section III rules for performing fatigue waiver evaluations for structural components are analogous to those in the Code for performing fatigue waiver evaluations of mechanical components. ASME Code NE-3222.4(d) "Analysis for Cyclic Operations, Vessels Not Requiring Analysis for Cyclic Operation," provides for a waiver from fatigue analysis when certain cyclic loading criteria are met.

RBS USAR Section 3.8.2.4.1 states: "Fatigue analysis requirements for the steel containment cylinder and dome are evaluated in accordance with the requirements of ASME Boiler and Pressure Vessel Code Section III, Division I, Subsection NE."

In its response to RAI 4.6-1, dated February 6, 2018, the applicant stated, in part, the following:

"[USAR] Table 3.8-1 indicates that fatigue is considered for operating conditions I(b), II, III(b) and IV. The free standing SCV cylinder and dome analysis reviews the operating conditions identified in USAR Table 3.8-1 and concludes that fatigue during operating conditions I(b), II, III(b) and IV does not occur because the containment vessel is free to expand, thereby preventing cyclic loading. Therefore, the freestanding containment vessel and dome were not analyzed for fatigue and there are no cycle limits or cumulative usage factors."

Issue

It is not clear if the evaluation performed for the freestanding containment vessel and dome components constitutes a fatigue waiver that relies on time dependent cycles, and whether they were evaluated and dispositioned in accordance with 10 CFR 54.21(c)(1). The staff notes that the current licensing basis may include fatigue waiver evaluations that preclude the need for performing CUF analyses of structural components which may be a TLAA and must be evaluated. The staff also notes that the statement "containment vessel is free to expand, thereby preventing cyclic loading" does not appear consistent with regard to fatigue or fatigue waiver considerations of the ASME code, Subsection NE, and cannot be concluded from USAR Table 3.8-1.

Request

Clarify if the evaluation performed for the freestanding containment vessel and dome constitutes a fatigue waiver analysis in accordance with the ASME code that relies on time dependent cycles, and state the disposition in accordance with 10 CFR 54.21(c)(1) with the technical basis.

Related to RAI 4.6-2 Response

Background

Section 4.6 of the SRP-LR states that if a plant's code of record requires a fatigue parameter evaluation (fatigue analysis or fatigue waiver), then this analysis may be a time-limited aging analyses (TLAA) and must be evaluated in accordance with 10 CFR 54.21(c)(1) to ensure that the effects of aging on the intended functions are adequately managed for the period of extended operation.

The current licensing basis may include fatigue waiver evaluations that preclude the need for performing CUF analyses of structural components. The ASME Code Section III rules for performing fatigue waiver evaluations for structural components are analogous to those in the Code for performing fatigue waiver evaluations of mechanical components. ASME Code NE-3222.4(d) "Analysis for Cyclic Operations, Vessels Not Requiring Analysis for Cyclic Operation," provides for a waiver from fatigue analysis when certain cyclic loading criteria are met.

In its response to RAI 4.6-2, dated February 6, 2018, the applicant stated, in part, the following:

- For the personnel airlock, drywell airlock, drywell combination door/hatch assembly components: *"The evaluation concluded that analysis for cyclic operation was not necessary. No cumulative usage factors were calculated. The evaluation assumed 120 plant startup cycles. LRA Table 4.3-1 has a limiting value of 168 for plant startups, but because the allowable number of cycles for this ASME Section NE 3222.4(d) criterion was 2,800 cycles, the increase in cycles shown in LRA Table 4.3-1 does not impact the conclusion that a fatigue analysis is unnecessary."*
- For the equipment hatch component: *"The equipment hatch calculation determined a fatigue analysis was not necessary after considering loads from OBE, SSE, LOCA, SRV lifts and heatups because the loads were very low. Cumulative usage factors were not calculated,"* and
- For the drywell head component: *"The drywell head calculation determined the alternating stresses from earthquakes and SRV loads were so low that the allowable number of cycles were infinite (CUF- O)."*

Issue

It is not clear if the evaluation performed under ASME Section NE 3222.4(d) criterion for the personnel airlock, drywell airlock, drywell combination door/hatch assembly components and the equipment hatch constitutes a fatigue waiver that relies on time dependent cycles, and whether they were evaluated and dispositioned in accordance with 10 CFR 54.21(c)(1). The staff notes that the current licensing basis may include fatigue waiver evaluations that preclude the need for performing CUF analyses of structural components which may be a TLAA and must be evaluated.

Additionally, it is not clear what is the disposition in accordance with 10 CFR 54.21(c)(1) for the drywell head calculation.

Request

1. Clarify if the evaluation performed under ASME Section NE 3222.4(d) criterion for the personnel airlock, drywell airlock, drywell combination door/hatch assembly components and the equipment hatch constitutes a fatigue waiver that relies on time dependent cycles, and state the disposition, in accordance with 10 CFR 54.21(c)(1), for each component evaluation.
2. Clarify the disposition, in accordance with 10 CFR 54.21(c)(1), for the drywell head fatigue analysis.