29

From: Steven Long NRR
To: Allen Hiser; Andrea Lee; Bill Bateman; Chia-Fu Sheng; Farouk Eltawila; INTERNET: NRR wjshack@anl.gov; Jack Strosnider; Keith Wichman
Date: Thu, Oct 18, 2001 8:09 AM
Subject: Re: DAVIS-BESSE QUESTIONS

Allen,

I reviewed the questions and think they are adequate for purposes of the risk assessment review. The risk assessment results are highly dependent on 3 factors:

1. the size of the circumferential flaw that can exist at the point in time that identifiable boron deposits first appear on the head at the opening of the annular crevise.

2. the probability that an identifiable boron deposit will not be identified when an inspection is done

3. the probability that the growth rates of the flaws are low enough that a a flaw cannot grow from the unobservable size to the critical size during one inspection interval.

I think all 3 of these factors are covered appropriately by the questions that you have developed.

Steve

>>> Allen Hiser 10/17/01 05:44PM >>>
Attached are RAIs for Davis-Besse related to their two submittals.

Please review and provide any and all comments to me by 9 AM Thursday.

We want to e-mail these questions to the licensee tomorrow and then have a (short) telecon to address any clarifications or questions.

Allen

CC: Brian Sheron; Douglas Pickett; F. Mark Reinhart; Jin Chung; Richard Barrett

F 25

NRC STAFF REQUESTS FOR ADDITIONAL INFORMATION ON
DAVIS-BESSE CRDM NOZZLE SUBMITTALS

SAI Report, "Finite Element Gap Analysis of CRDM Penetrations (Davis-Besse)"

SAI-1 Page 5 states that "the final weld connection between the hemispherical head and the CRDM tubes is via a series of degree-of-freedom couples between the nodes along the inner surface of the hole in the hemispherical head and the outer surface nodes of the CRDM tubes." Does the phrase, "a series of degree-of-freedom couples between the nodes" mean the process of equating the three displacements of a hole node to the three displacements of a corresponding tube node at the J-weld location? Is one layer of solid element in the tube thickness direction good enough considering that at the J-weld location certain restraint is imposed on one face of this single layer of solid elements?

SAI-2 Page 6 states that pressure was applied to the hemispherical head side end of the CRDM tube and to the flange closure face out to a radius of [redacted] inches. Indicate on Figure 5 the location that was referred to as the "hemispherical head side end of the CRDM tube." If pressure was applied to the flange closure face out to a radius of [redacted] inches, this would be beyond the compression surface shown in Figure 2. What does this mean physically? Ex 4

SAI-3 Page 6 notes that "applied cap load was actually applied in the negative direction in ANSYS, thus providing a traction load." Was the "traction" load a shear load in your definition? Clarify the "negative" direction of the traction load.

SAI-4 The FEM results indicate that four CRDM tubes (Tube 1, 2, 3, and 4) provide no gap during normal operation. What is your plan to monitor these four CRDM tubes, on which a circumferential flaw could be developed below the location of interference without giving any visual indication of leakage on the RPV head?

Framatome Report 51-5012567-01, "RV Head Nozzle and Weld Safety Assessment"

The staff notes that the risk assessment presented in Section 9 of this report is a B&W generic version of an analysis submitted by Oconee in their Bulletin response. At a public meeting with Oconee on September 7, 2001, the staff identified many issues with the analysis to the Oconee and Framatome staff participating in the meeting, and indicated that the analysis did not provide a sufficient risk basis. A review of the report does not indicate that any of the staff issues raised at the meeting have been addressed, and it is not clear that the report provides any new information not previously available to the staff. As indicated in Question FRA-12, the licensee should provide the staff with the identified references to the report in order for the staff to complete its review.

FRA-1 What is the crack growth rate (in./year), mean value and distribution, used in the deterministic and PFM analyses for OD circumferential cracks in Alloy 600 in the annular environment? If the values are typical of PWSCC, why is this appropriate without consideration of any acceleration factor for this potentially aggressive

environment?

FRA-2 With the probability of missing a leak is 0.06 at the first inspection. 0.065 at the second inspection and 0.11 at subsequent inspections, how is this concept incorporated in the analysis?

(a) Does the human error probability relate to nozzles that are found to be free of relevant deposits by the visual examination but may actually have flaws, or the number of nozzles that have relevant deposits?

(b) Address whether the human error probability assumptions consider (1) the crack doesn't leak enough to the top of the head to give a visible indication; (2) it leaked initially, and formed some deposit that was missed in an early inspection (before the inspections were sensitive to small amounts of boric acid) and the crack doesn't leak anymore (due to leak plugging).

(c) The human error probability discussion assumes that there is no probability that a through-wall (or very deep) crack of some length already exists at the time of the inspection. This is essentially an inspection that is perfect in finding big cracks and only has a 0.06 chance of missing a small leak. Provide justification for assuming a "perfect"inspection for large circumferential cracks.

FRA-3 Page 26 of the report assumes that the annular environment required for OD PWSCC "will coincide roughly with the presence of visible boron crystal deposits." What is the basis for this statement, given the fact that it will take time to fill the annular region with leakage deposits prior to the presence of visible deposits on the head and the hypothesis of "leak plugging" on page 26 of the report? What is the time required from initial break through of a through-wall crack in the weld (or interface with the nozzle) prior to visible leakage on the RPV head? How is "leak plugging" considered in the analysis presented in the report?

FRA-4 Page 27 states that "the RV head inspection process is simple and straightforward, such that a written procedure is not necessary for a successful inspection." This statement appears to conflict with Criterion V of Appendix B to 10 CFR Part 50, which states that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings. Was the Davis-Besse visual examination of 2000 performed using a written procedure?

FRA-5 What are the stress magnitudes used in the probabilistic analysis, and what are the "worst case stresses" described on page 29?

FRA-6 How do the assumptions of crack size and crack growth rate appropriately consider the effects of multiple crack initiation (and growth) sites, and how do the assumptions bound the multiple site case?

FRA-7 What link is there (if any) between the leakage rate or deposit size and the length of through-wall circumferential cracks, to support the statements on page 35 regarding detectable leakage of steam through a large through-wall circumferential crack?

FRA-8 Page 53 describes leak rates for a crack configuration similar to that observed for nozzle 56 of ONS-3, with rates ranging from 0.4 gpm to 1.2 gpm, depending on the assumed annulus clearances. How do these calculated leak rates compare to that found for

nozzle 56 of ONS-3? What are the reasons for any differences between the calculated leak rates and the field experience? Could the differences manifest themselves in similar disparities from reality for other analyses in the report?

FRA-9 Page 34 of the report states that "any circumferential flaw above the weld on the outside surface of the nozzle should not be considered a safety concern." It should be noted that flaw acceptance criteria provided in a letter from K. Wichman to A. Marion would require removal and repair of all circumferential flaws located above the J-groove weld.

FRA-10 The analysis of annulus dimensions for CRDM nozzles provided on page 50 indicates that gaps will occur for B&W-design CRDM nozzles. Recent finite element analyses from Oconee and Davis-Besse do not indicate the presence of gaps for all nozzles. How can these finite element analyses be reconciled with the statements on page 50?

FRA-11 Since the report addresses CRDM nozzles as if gaps will exist at the operating conditions, and finite element analyses do not support that conclusion in all cases, what would be the recommendations in the report for nozzles without a demonstrable annulur gap at the operating conditions?

FRA-12 To complete our review of this report, provide References 8, 18, 25, 29, 30, 31, 34, and 38 (pages 38-40).