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General Comment

Figure 2-1: This figure should be supplemented with a figure showing DM weld detail including backweld / weld buildup to help the reader understand the weld geometry. It is also recommended to note here the unusual nature of the weld buildup in this weld configuration, which was used to seat a thermal sleeve and is not part of the design basis weld.

Table 2-2: A row should be added noting that participants were requested to perform minor QA type activities, including independent review of analysis model and post processing.

Figure 3-15: The red and blue dashed line legend descriptions appear to be switched. It doesn't seem correct that the tolerance bounds using all the profiles would be smaller than the tolerance bounds using the "original 5".

Chapter 4: The focus of this chapter is entirely on axial stress and circumferential flaws. Circumferential flaws are the limiting flaw case for safety, but axial flaws (due to hoop stress) are typically the limiting case for flaw growth limits. Recommend adding material to Chapter 4 that does the same comparisons, but using hoop stresses for axial flaw growth.

Section 5.4.2: There is no basis provided for the statement that the two measurement data sets are not from the same population. All measurements were taken from the same welded mockup, and the DHD measurements were taken before the contour measurements were taken.

Table B-1, B-8, and B-15: The table captions should state these data are true stress vs true plastic strain data as a function of temperature. Not all FEA programs use the same convention for isotropic hardening inputs.

Table C-1 and C-2 are missing a row for x/t = 0.50

1. The NRC recommended the use of the average hardening approach in the current version of the draft NUREG (average hardening meaning the arithmetic mean of isotropic and nonlinear kinematic results). Given the discussion in Section 5.2, please comment on the advantages and disadvantages of using either the averaging approach or isotropic hardening. What initial and recurring costs are foreseen in implementing either approach in future analyses?

The costs of following the NRC recommended approach are small relative to the overall problem scope. However, I disagree with NRC specifying a required set of material inputs for all WRS modeling. Other material hardening approaches should be acceptable provided that they meet the validation criteria.

2. The NRC introduced four options for benchmark in Section 5.4.2. The NRC chose to develop the validation scheme with a benchmark based upon the modeling results, rather than the measurements. Please comment on the NRC's proposal and whether the justification is adequate.

Typical validation approaches for WRS analysis, particularly those performed in the international community, are benchmarked based on measurement. Additional justification of the NRC approach could include a statement that the mean of the average models is considered validated against the measured data, and therefore it is acceptable to validate further models against the mean of the average models.

3. Please comment on the proposed quality metrics introduced in Section 5.4.7. Are these metrics appropriate for their intended purpose? Has the NRC presented an appropriate technical justification (see Sections 5.4.8 and 5.4.10) for the proposed metrics?

The average RMS error and the ID 10% average difference (diff-avg) metrics are acceptable and are demonstrated to impact the calculated crack growth time. The average RMS error on the first derivative and the requirement to plot the first derivative and perform a semi-quantitative comparison on the plot are not sufficiently demonstrated as having the same impact on calculated crack growth. It appears that the first derivative checks are largely correlated to the average RMS error or the diff-avg metrics.

4. Please comment on the feasibility of the proposed validation scheme. What initial (e.g., software and guidance development) and recurring (i.e., costs for each analysis) costs are foreseen for implementing the validation scheme?

For an analyst skilled in the art of performing numerical analysis of welding residual stress, the proposed validation scheme will have a non-negligible cost, but it should also be feasible. Performing and documenting the validation analysis, especially if corrections are needed, for a less experienced analyst will require significant additional costs.