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Subject: Reconsideration of the Davis Bessie Analysis

After looking at my assumptions about what CGRs B&W used for the Davis Bessie analysis, I see that I must be wrong in assuming that they are using the value for the Scott A that was used in the 1993 report. Scaling by the full factor of 8 that I did in my earlier analysis, gives results that fail a sanity check on the the growth of a the throughwall crack which at an inch/yr should take about 2 4 years or 29 months

Rereading the B&W reports from 1993, I see that the current times are much shorter than those reported in 1993. Since I doubt they redid the stress calculations or if they did, that the results would have changed that much, they presumably have scaled the results using a different CGR law.

If I use the version of the Scott model that Scott and Amzallag suggested in PVP-324 with $A=6 \cdot 2e-12$ (i.e, a model that is a factor of 3 higher than the 1993 B&W report used), then to get the results corresponding to my estimate of the 95th percentile value of A, the Davis Bessie results should be scaled by a factor of perhaps 2.7 instead of a value of 8 I originally used.

Thus instead of the 11.5 years for the crack to grow from a initiation to failure in the Davis Bessie report, the time is $11.5/2.7=4.3$ years Failure of the throughwall crack is now $4+4/2.7=2.9$ years=35 months, roughly consistent with the sanity check value I get 44 months for the 95th percentile curve using Riccardella's K, which is also reasonably consistent with this result

The rest of the argument follows as I originally did it. Assuming that we only want to consider the portion of the CGR distribution above the 50th percentile, this says that the the time to reach a conditional POF of 0.1 is 2.9 years=35 months. For failure in 18 and 24 months, A must increase by a factor of 35/18 and 35/24, 1.9 and 1.5. This decreases the proportion of the population that will fail. Based on my estimate of the population distribution this now includes the 99th and 98th percentiles, implying the conditional POF for 18 months is 0.02 and for 24 months 0.04. This is close to where I was in my weekend memo, where failures in 18 months are at the tail of the conditional POF curve. If we assume conservatively that the probability of having a 165 crack at the last inspection is 1, then the POF is $0.02 \cdot \text{POND}$ and $0.04 \cdot \text{POND}$ for 18 and 24 months respectively where POND is the probability that the visual inspection will NOT detect the crack. With a POND of 0.05, you find that 18 months gives a POF of 0.001. At 24 months the POF is 0.002. Even if the POND is 0.5, the POF at 24 months is still below 0.01. Additionally if we assume the probability of having the throughwall 165 crack is <1 , then the POFs also decrease proportionately.

Thus the result from scaling the Davis Bessie analysis assuming that they have used the Scott A from Scott's PVP paper, is very similar to what I concluded from using Riccardella's K in my weekend analysis. If you give any significant credit to the visual inspection, then an extension to 24 months is OK. If you give no credit to the visual exam, then the extension is not OK, since after 20 years of operation the probability of having a 165 degree crack at the last exam is not significantly less than having a 180 or higher

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crack, and they should be shutting down ASAP.