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From: Makoto Higuchi <makoto_higuchi@ihi.co.jp>
To: <nrcrep@nrc.gov>
Date: Thu, Sep 21, 2006 2:49 AM
Subject: Response from "Comment on NRC Documents"

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Makoto Higuchi (makoto_higuchi@ihi.co.jp) on Thursday, September 21, 2006 at 02:48:09

Document_Title: NUREG/CR-6909 (ML061650347)
Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials

Comments: 4.2.7 Sulfur Content in Steel
Equation (20) gives S*=0.015 at DO>1.0 ppm regardless of sulfur content. This value seems too much severe for lower sulfur steels to compare Japanese model (Figure 2 in PVP2006-93194) but the environmental condition of DO>1.0 ppm is unusual in plant operation and thus this influence on the evaluation of environmental fatigue of actual plants may be very small.
Equation (20) also gives S*=0 at S=0 and DO ¡Ü1.0 ppm, this is not supported by experimental data. Japanese model (PVP2006-93194) indicates Fen=12.3 at the conditions of S=0%, 289¡ãC, DO=0.7 ppm and 0.001%/s. The NRC model is too much unconservative for low sulfur steels.

4.2.12 Statistical Model & 4.2.13 Environmental Fatigue Correction Factor
Equation (18) does not equal to Equation (15) without environmental effects. It seems not reasonable. Why the constant A of these equations are not same? The same situation can be seen in the Equations (19) and (16). Caused by this reason, Fen does not equal to 1.0 for Equations (25) and (26) when the environmental effect is zero.
In this NUREG, the difference of Fen value between carbon and low-alloy steels becomes very little, there is no necessity to apply different equations for these steels. It seems enough to use the same equation (averaged of equations (18) and (19)). Japanese model gives only one equation for these steels.

5.2.5 Dissolved Oxygen
Japanese fatigue data indicate that fatigue life of stainless steels in water was not influenced by the dissolved oxygen concentration itself but influenced strongly by the water chemistry of PWR and BWR. Additionally, several Japanese data indicate that any fatigue life reduction of fully sensitized type 304 SS cannot be observed at the conditions of 289¡ãC BWR water, DO=0.2 and 0.01 ppm and 0.001%/s strain rate. The mechanism of fracture is considered to be fully fatigue because the fracture surface of sensitized 304 SS seems perfectly transgranular and SCC does not influence this failure. The effects of sensitization on fatigue of stainless steel need not be considered for fatigue evaluation in BWR water. Current NRC model gives too severe Fen for stainless steel in BWR water. Based on these results, the different equations should be applied for PWR and BWR, respectively, as similar as Japanese model.

5.2.12 Statistical Model & 5.2.13 Environmental Fatigue Correction Factor
Equation (32) does not equal to Equation (30) without environmental effects. It seems not reasonable. Why the constant A of these equations are not same? Caused by this reason, Fen does not equal to 1.0 for Equations (32) when the environmental effect is zero. This is the same comment as 4.2.12.
Current NRC model gives too severe Fen for stainless steel in BWR water. The different equations should be applied for PWR and BWR, respectively, as similar as Japanese model.

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