ANS Answers Multi-Part Inquiry on ANSI/ANS-58.2-1988 (W1998), "Design Basis for Protection of Light Water Nuclear Power Plants Against the Effects of Postulated Pipe Rupture."

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Question #1:

I am interested to know why ANSI/ANS-58.2-1988 (W1998), Section 4.3.1, uses the limiting value of U (Cumulative Usage Factor (CUF)) as 0.4 when the U.S. Nuclear Regulatory Commission Standards Review Plan, Section 6.6.2, Branch Technical Position Mechanical Engineering Branch 3-1 cites the limiting value of 0.1. What is the practice in the United States and other countries?

Response #1:

A response to an inquiry about practices in the United States and other countries is not in the purview of the ANS Standards Committee to address in the inquiry process.

Question #2:

In which cases do you recommend the value 0.4 and why (contrary to the NRC Position)?

Response #2:

With respect to the use of a value of 0.4 for the CUF as noted in Section 4.3.1 of ANSI/ANS-58.2-1988 (R1998), history indicates that the regulatory agencies have specified generic values for use. In the United States the NRC has specified generic use of 0.1 for the CUF, unless sufficient information has been provided to support conservative application of a higher value. As cautioned in Footnote 4 of the standard, regulatory authorities are requiring consideration of a CUF less than 0.4. It is noted that the design organization may elect to seek regulatory approval of a greater value based on their experience and available data.

Question #3:

Is the value of 0.4 conservative for Class 1 piping of nuclear power plants?

Response #3:

The CUF used in the American Society of Mechanical Engineers codes is linked to crack initiation. If a component has a cyclic usage due to operational transients that would yield a CUF of 1.0, one must assume that crack initiation has occurred. The stress-cycle fatigue test curves for piping materials are also moved in a conservative direction for use in design. The design curve will have the larger of a factor of 2 on stress or 20 on cycles to ensure it is conservative. This means that a calculated CUF of 1.0 maintains significant margin be-fore one would expect a crack in the pipe and that crack is still just the initiating flaw that may require several years (depending on the loadings) to grow through the complete wall thickness and create a leak. At the time the standard was written, the value of 0.4 was believed to be conservative for Class 1 piping.