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Energy Systems

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DCP/NRC1182
NSD-NRC-97-5486
Docket No.: 52-003

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Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: T. R. QUAY

SUBJECT: PIPE RUPTURE LIMITING ANALYSIS

Reference: 1. NRC Letter Dated October 7, 1997, Summary of Meeting to Review Completeness of Westinghouse Documentation Needed to Support a Final Quality Assurance (QA) Inspection.

2. Letter DCP/NRC1107 Dated October 27, 1997, Pipe Rupture Analysis.

Dear Mr. Quay:

In a meeting on October 7, 1997, the NRC staff noted that some AP600 large bore piping systems were not analyzed for some dynamic loads. See Reference 1 for a summary of the meeting. Westinghouse explained that, based on previous experience, piping design is not expected to change due to evaluation of these loads. The staff requested that an example analysis be completed for the AP600 to show that analysis of dynamic loads would not be expected to change the piping design. During a subsequent discussion with the staff, agreement was reached on a limiting case of pipe rupture to be analyzed.

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Reference 2 outlined the limiting analysis approach to demonstrate that the evaluation of the pipe rupture dynamic transients will not result in layout modifications to the piping systems. This, in turn, would allow the combined license applicant to perform the pipe rupture dynamic analysis with little or no risk of impacting piping system layout.

A specific limiting case analysis has been performed by Westinghouse. The case chosen for this analysis was that of a 16 inch main feedwater break at the steam generator nozzle, and its impact on the passive residual heat removal (PRHR) return line which attaches directly to the steam generator. This break was expected to have the most significant consequences on the ASME Class 1 auxiliary piping systems identified in Reference 2, which contain active valves and are required to mitigate the postulated break.

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A step load of 450 kips was applied to the feedwater nozzle to represent the combined jet thrust and jet impingement load associated with the postulated break. The time-history analysis was performed using the GAPPIPE computer program for a 1.4 second time period. Review of the time-history displacements indicates that this was enough time for responses to peak and show a definite attenuation with subsequent cycles of response. The largest responses were near the SG, as anticipated.

The maximum loadings in the PRHR line due to a main feedwater pipe break are approximately 10% of the corresponding SSE loadings. Because these pipe rupture loadings are combined by SRSS with the SSE loadings, the total combined faulted load [SRSS(SSE, FWBK)] increases by approximately 1% over the SSE results. The maximum faulted stress ratio without pipe rupture is 0.801 and the maximum faulted stress ratio including pipe rupture is approximately 0.81. This 1% increase is not significant for the systems of interest, and there are certainly no layout changes expected because of the inclusion of pipe rupture loadings into the total faulted load. Additionally, the 1% increase in total combined faulted loads has no significant impact on the evaluation of active valve nozzle stress limits, equipment nozzle loads, and support design. The pipe rupture loadings in the PRHR line are representative, if not bounding, for the loadings expected in the other auxiliary lines.

The overall conclusion is that the pipe rupture loadings in the applicable auxiliary piping systems are small relative to the seismic loads and do not have a significant impact on the layout considerations for these lines. Identifying the COL as responsible for the completion of the pipe rupture dynamic analysis is acceptable, since there is little likelihood that pipe routing changes will result from these evaluations.

Please contact D. A. Lindgren at (412) 374-3856 if your have any questions.

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jls

cc: J. M. Sebrosky, NRC
N. J. Liparulo, Westinghouse

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