

Synopsis of Memorandum From Jack Grobe, RIII, to Scott Newberry, RES, May 2002

Primary Concern

- Possible failure or significant degradation of BWR low pressure emergency core cooling systems (ECCS) pumps due to unanticipated, large quantities of entrained gas in the containment wetwell suction piping causing gas binding, vapor locking, or cavitation

Prior AEOD Evaluations

- An AEOD evaluation addressed the recirculation phase only and did not address the large air bubbles generated during initial blow-down because the gas was assumed to rise quickly out of the pool water. (Reference AEOD memorandum dated March 31, 1982, (AEOD/E218), "Engineering Evaluation - Potential for Air Binding or Degraded Performance of BWR RHR System Pumps During the Recirculation Phase of a LOCA.")
- The AEOD evaluation, for potential air binding or performance degradation of RHR pumps, used only the volume of water in the RHR suction piping to determine the amount of dissolved gas. However, the amount of gas that is potentially available to affect pump performance with this generic issue is based on the total volume of water in the suction piping and the suppression pool. The potential for pump air binding or performance degradation may need to consider this total volume of available water in determining the volume of entrained gas.

Details

- Due to the violent nature of LOCA blow-down, the issue revolves around the gas that may become entrained in the suction flow to the ECCS pumps as a result of turbulence or mixing effects. The question is whether sufficient gas will get entrained in the suction flow to the ECCS to cause failure or degraded performance of the pumps.
- Typically, the bounding design basis accidents is a loss of off site power combined with a loss of coolant accident (LOOP/ LOCA). While this may be bounding from an ECCS performance perspective, it may not be bounding from a gas entrainment perspective. Because the pumps will start sooner during a LOCA without a LOOP, bubbles generated during the initial blow-down may not have risen to the surface and more may become entrained in the ECCS suction piping. Since a LOCA without a LOOP may not be considered, this aspect needs to be evaluated further.
- The "swell/exclusion zone" in the torus after a LOCA has been considered to be limited to less than one diameter of the down-comer pipe. But there may not be a basis for this assumption and it may not be conservative. The intrusion of non-condensable gas into the torus may thus be greater and the effect may be worse due to the larger suction strainers installed in response to NRC Bulletin 96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling Water Reactors."
- Adequate bases to limit the exclusion zone to less than one diameter of the down-comer pipe should be established, especially with respect to the recently installed larger suction strainers.

Applicability

- Mark I or Mark II containments during large or medium break LOCAs