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April 2, 2001

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MEMORANDUM TO: Jack R. Strosnider, Director
Division of Engineering
Office of Nuclear Reactor Regulation

FROM: Charles Casto, Director **/RA H. CHRISTENSEN FOR:/**
Division of Reactor Safety

SUBJECT: V. C. SUMMER HOT LEG NOZZLE-TO-PIPE WELD CRACK -
POTENTIAL GENERIC ISSUES

On October 12, 2000, a leak was identified in the V. C. Summer "A" hot leg nozzle-to-pipe dissimilar metal weld (DMW). The leak resulted from an essentially through-wall 2" long axial crack with a 3/16" exit point "weep hole" at the outside surface. Additional smaller cracks were found using eddy current (ET) inspection techniques. The cracking was caused by primary water stress corrosion (PWSCC). A Special Inspection Team was chartered to review activities associated with the weld leak and crack, and to determine if potential generic issues could have contributed to: (1) the cause of the cracking and (2) failure of the required inservice inspection (ISI) program to detect the cracking. The team's findings are documented in Inspection Report 50-395/00-08.

The team identified the following two issues that should be considered for generic implications:

- The licensee's root cause analysis identified the "lack of nondestructive examination (NDE) detection of the flaw" as a contributing cause for the reactor coolant pressure boundary leak. Although the large crack that leaked was identified by current technology ultrasonic (UT) inspection, a number of smaller cracks identified by ET inspection (a non-approved inspection method for ISI) were not identified by the Code required UT inspection method. Also, the 1993 ISI UT did not detect a crack (if crack initiation had occurred at that time). However, a review of the 1993 data shows that transducer de-coupling occurred at the location of the large axial crack and resulted in that area not being fully inspected. Although de-coupling occurred in this area, the total volume inspected met Code requirements. The lack of NDE detection was partially attributed to the contribution of surface contour, surface roughness, and detector physical parameters inhibiting a successful inspection.

The adequacy of the required ISI UT inspection to detect PWSCC in PWR Inconel (Alloy 82 and 182) nozzle-to-pipe welds appears to be an issue that should be evaluated for generic implications.

- The cause of the PWSCC was primarily attributed to high residual stresses on the inside of the DMW due to extensive weld repairs during construction. At V. C. Summer, the nozzle-to-pipe welds were field welded and required a significant amount of repair. The "A" hot leg weld had significant repairs and surface grinding from the inside, which

resulted in higher tensile stresses on the inside surface. The ASME Code does not limit or provide guidance on the extent of repairs for these DMWs.

The lack of Code controls for residual stresses due to extensive repairs in Alloy 82/182 weld material used in a primary water environment appears to be an issue that should be evaluated for generic implications.

We understand that NRR is aware of these issues and discussions have been initiated with industry groups for resolution. The purpose for this memorandum is to complete the charter of the Special Inspection Team, which required collection of information for future programmatic review of the adequacy of NRC-required ISI programs.

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(*) see previous page for concurrence

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