UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 14, 1979

MEMORANDUM FOR: Edward S. Christenbury, Chief Hearing Counsel, OELD

FROM: Darrell G. Eisenhut, Acting Director, Division of Operating Reactors

SUBJECT: BOARD NOTIFICATION - PIPE CRACKS IN STAGNANT BORATED WATER SYSTEMS AT PWRs

We recommend that the attached Bulletin, 79-17, which discusses cracking incidents in safety-related piping of some PWR plants, be provided to the Salem, Trojan, and Zion Spent Fuel Pool Expansion Boards.

Cracks have occurred in safety related type 304 stainless steel piping systems which contain stagnant borated water. These systems include the spent fuel pool cooling piping at TMI-1. The cracking is apparently due to stress corrosion cracking caused by residual welding stresses at heat affected zones.

We consider the safety significance of cracks in the low pressure spent fuel cooling system to be nil. Small leaks and boron crystals will appear first. Substantial leaking from such cracked piping is not likely. If repairs are needed they can be made by interrupting if necessary the loop cooling flow for the period of time needed to repair. This issue is not directly related to and does not stem from the spent fuel pool modifications. These pool expansions allow storage of additional older spent fuel and do not materially impact either the heat removal load of the cooling system or the fission product inventory that might be released during postulated spent fuel pool accidents.

Cracks in other plant systems in our judgment are outside the scope of the issues before the spent fuel pool Boards.

Darrell G. Eisenhut, Acting Director
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Enclosure:
IE Bulletin 79-17

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ENCLOSURE 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D. C. 20555

IE Bulletin No. 79-17
Date: July 26, 1979

PIPE CRACKS IN STAGNANT BORATED WATER SYSTEMS AT PWR PLANTS

Description of Circumstances:

During the period of November 1974 to February 1977 a number of cracking incidents have been experienced in safety-related stainless steel piping systems and portions of systems which contain oxygenated, stagnant or essentially stagnant borated water. Metallurgical investigations revealed these cracks occurred in the weld heat affected zone of 8-inch to 10-inch type 304 material (schedule 10 and 40), initiating on the piping I.D. surface and propagating in either an intergranular or transgranular mode typical of Stress Corrosion Cracking. Analysis indicated the probable corrodents to be chloride and oxygen contamination in the affected systems. Plants affected up to this time were Arkansas Nuclear Unit 1, R. E. Ginna, H.B.Robinson Unit 2, Crystal River Unit 3, San Onofre Unit 1, and Surry Units 1 and 2. The NRC issued Circular 76-06 (copy attached) in view of the apparent generic nature of the problem.

During the refueling outage of Three Mile Island Unit 1 which began in February of this year, visual inspections disclosed five (5) through-wall cracks at welds in the spent fuel cooling system piping and one (1) at a weld in the decay heat removal system. These cracks were found as a result of local boric acid buildup and later confirmed by liquid penetrant tests. This initial identification of cracking was reported to the NRC in a Licensee Event Report (LER) dated May 16, 1979. A preliminary metallurgical analysis was performed by the licensee on a section of cracked and leaking weld joint from the spent fuel cooling system. The conclusion of this analysis was that cracking was due to Intergranular Stress Corrosion Cracking (IGSCC) originating on the pipe I.D. The cracking was localized to the heat affected zone where the type 304 stainless steel is sensitized (precipitated carbides) during welding. In addition to the main through-wall crack, incipient cracks were observed at several locations in the weld heat affected zone including the weld root fusion area where a miniscule lack of fusion had occurred. The stresses responsible for cracking are believed to be primarily residual welding stresses in as much as the calculated applied stresses were found to be less than code design limits. There is no conclusive evidence at this time to identify those aggressive chemical species which promoted this IGSCC attack. Further analytical efforts in this area and on other system welds are being pursued.