UNITED STATES
NUCLEAR REGULATOPY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555-0001

April 18, 1997

NRC INFORMATION NOTICE 97-19: SAFETY INJECTION SYSTEM WELD FLAW AT SEQUOYAH NUCLEAR POWER PLANT, UNIT 2

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to potential cracking of a safety injection system line detected in a Westinghouse plant. The crack occurred in the upstream weld of the check valve adjacent to the unisolable section of this line, and was determined to have been caused by intergranular stress-corrosion cracking (IGSCC). However, it is also possible that similar cracks could be caused in these lines by thermal fatigue cycling from possible reactor coolant leakage through the valve seat. The concern therefore involves potential cracking of piping in portions of safety-related systems due to either IGSCC or thermal stresses induced by intermittent leakage of hot water through isolation valves, impacting welds with considerable residual stresses due to extensive reworking. Because both abnormal conditions could lead to similar results, this information notice addresses the potential for both failure mechanisms. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On May 2, 1996, a routine American Society of Mechanical Engineers (ASME) Section XI ultrasonic test (UT) inservice inspection (ISI) at Sequoyah Unit 2 revealed a pipe crack indication in a low-pressure safety injection system (SIS) line. The UT indicated a 7-inch (17.8 cm)-long, 75-percent through-wall 7-inch circumferential crack on the inside surface of the (25.4 cm) 10-inch Schedule 140 stainless steel line. The crack was located at the top dead center of the base metal adjacent to the upstream weld of the check valve closest to the Reactor Coolant System (RCS) cold leg (see figure). This check valve isolates the RCS from the SIS. Although the crack was on the upstream side of the check valve, the circumstances that created this crack initially appeared to also reflect those described in NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," and a review of the plant records revealed that this valve had a history of leakage. In addition, the records also showed that this particular weld had been reworked four times during plant construction before it was finally accepted.

Discussion

Cracks in piping attached to the reactor coolant loop have been found in other plants. NRC Bulletin 88-08 and associated supplements describe leaking cracks found in unisolable sections of safety injection lines and residual heat removal lines at Farley, Unit 2. A similar crack was also found at Nine Mile Point, Unit 1. These cracks are thought to have resulted from thermal cycling induced by intermittent leakage through isolation valves.

The initiation and propagation of this particular crack was initially attributed to intermittent leakage of hot reactor coolant through the check valve seat into the stagnant cold fluid side of the check valve (a cause similar to that described in the earlier bulletin). The weld and adjacent base metal were replaced, and a subsequent metallurgical examination established that the cracking began at the inside diameter surface of the counterbore region of the pipe-to-valve weld and progressed radially outward through the sensitized region of the heat-affected zone (HAZ). The metallurgical evaluation concluded that the cracking in the pipe was caused by intergranular stress-corrosion cracking which, in turn, was caused by exposure of the sensitized region of the HAZ to oxygenated boric acid water in the SIS. This situation was exacerbated by additional sensitization due to the large residual stresses caused by the four cycles of repair to this weld zone.

Identification of potential crack locations of this type may be facilitated by considering the history of the weld zones and the leak-tightness of the check valves in low-pressure SISs connected to RCS piping when performing required ISI testing .

Related Generic Communications

Problems relating to cracks in safety-related lines connected to the reactor coolant loop have been discussed in the following NRC communications:

NRC Bulletin 88-08: "Thermal Stresses in Piping Connected to Reactor Coolant Systems," dated June 22, 1988.

NRC Bulletin 88-08, Supplement 1: "Thermal Stresses in Piping Connected to Reactor Coolant Systems," dated June 24, 1988.

NRC Bulletin 88-08, Supplement 2: "Thermal Stresses in Piping Connected to Reactor Coolant Systems," dated August 4, 1988.

NRC Bulletin 88-08, Supplement 3: "Thermal Stresses in Piping Connected to Reactor Coolant Systems," dated April 11, 1989.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Thomas T. Martin, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

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William Burton, NRR
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Attachments:
1. Figure - Weld Flaw Location
2. List of Recently Issued NRC Information Notices

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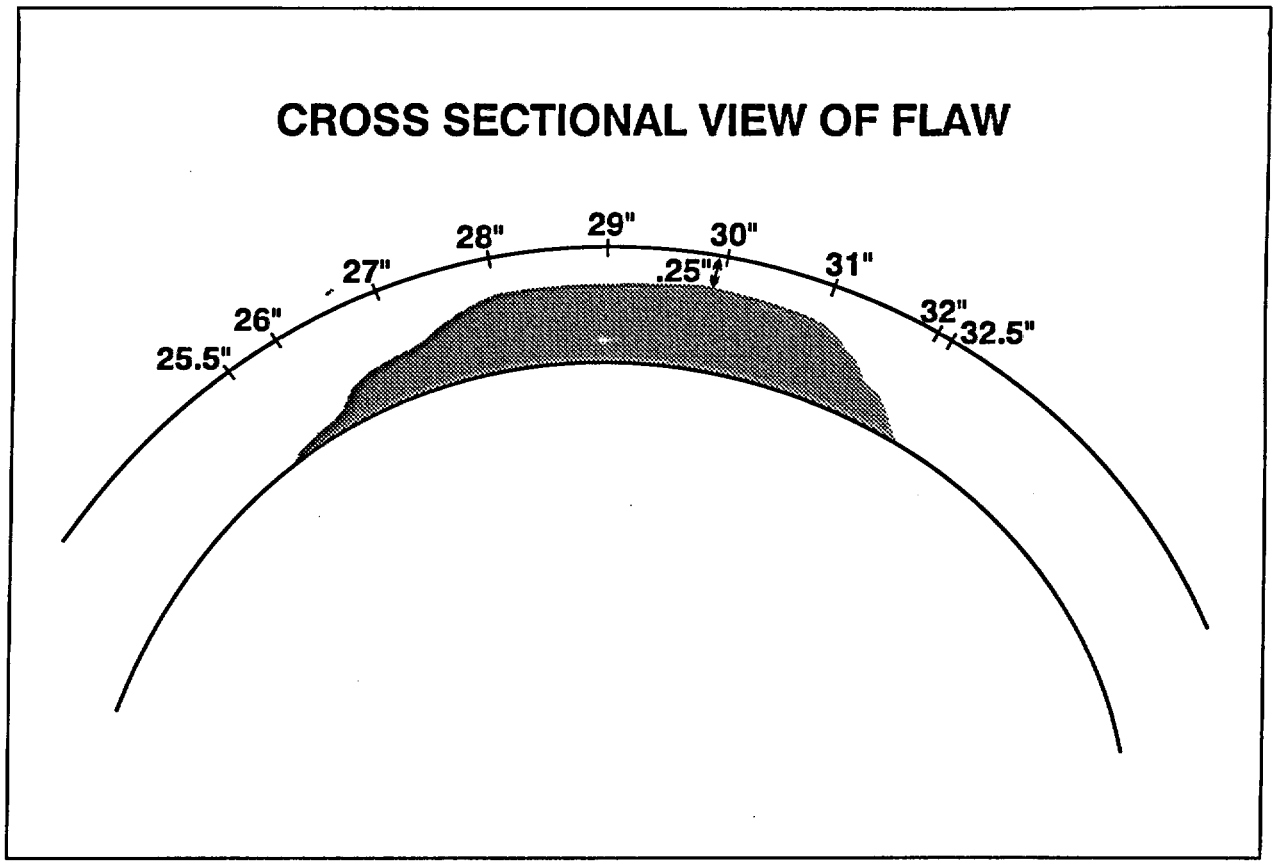
CROSS SECTIONAL VIEW OF FLAW
25.5"
26"
27"
28"
29"
30"
.25"
31"
32"
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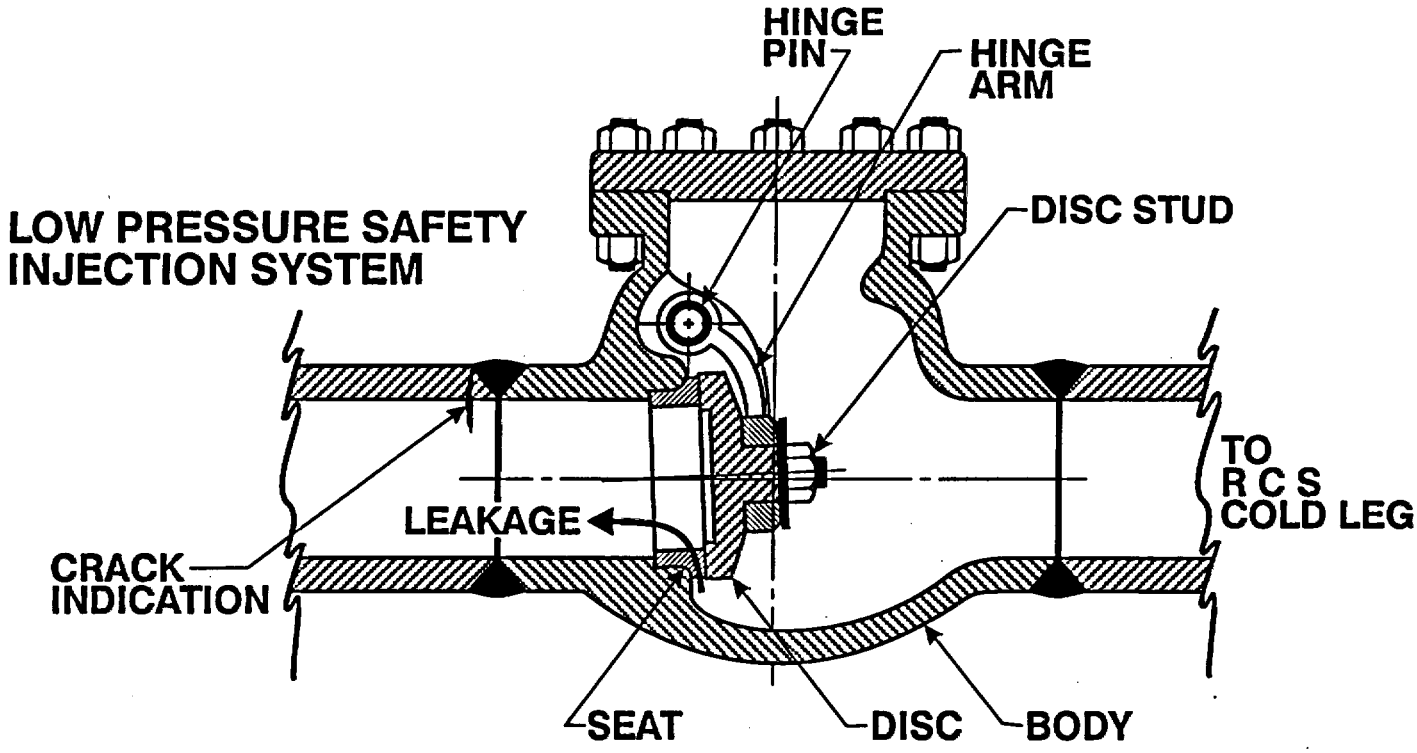
LOW PRESSURE SAFETY INJECTION SYSTEM
HINGE PIN
HINGE ARM
DISC STUD
TO R C S COLD LEG
LEAKAGE
CRACK INDICATION
SEAT
DISC
BODY

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-14, Supp. 1	Failure to Implement Requirements for Biennial Medical Examinations and Notification to the NRC of Changes in Licensed Operator Medical Conditions	04/14/97	All holders of OLs or CPs for nuclear power and non-power reactors and all licensed reactor operators and senior reactor operators
97-18	Problems Identified During Maintenance Rule Baseline Inspections	04/14/97	All holders of OLs, CPs, and decommissioning-stage licenses for nuclear power reactors
97-17	Cracking of Vertical Welds in the Core Shroud and Degraded Repair	04/04/97	All holders of OLs or CPs for boiling-water reactors
97-16	Preconditioning of Plant Structures, Systems, and Components Before ASME Code Inservice Testing or Technical Specification Surveillance Testing	04/04/97	All holders of OLs or CPs for nuclear power reactors
97-15	Reporting of Errors and Changes in Large-Break Loss-of-Coolant Accident Evaluation Models of Fuel Vendors and Compliance with 10 CFR 50.46(a)(3)	04/04/97	All holders of OLs or CPs for nuclear power reactors and all reactor fuel vendors

OL = Operating License
CP = Construction Permit

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signed by M.M. Slosson for
Thomas T. Martin, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

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IN 97-04

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The initiation and propagation of this particular crack were initially attributed to thermal cycling caused by leakage of hot reactor coolant through the check valve seat into the stagnant cold fluid side of the check valve (a cause similar to that described in the earlier bulletin). The weld and adjacent base metal were replaced, and a subsequent metallurgical examination established that the cracking began at the inside diameter surface of the counterbore region of the pipe-to-valve weld and progressed radially outward through the sensitized region of the heat- affected zone (HAZ). The metallurgical evaluation concluded that the cracking in the pipe was caused by intergranular stress-corrosion cracking which, in turn, was caused by exposure of the sensitized region of the HAZ to oxygenated boric acid water in the SIS. This situation was exacerbated by the additional sensitization caused by the four cycles of repair to this weld zone.

Identification of potential crack locations of this type may be facilitated by considering the history of the weld zones and the leak-tightness of the check valves in low-pressure SISs connected to RCS piping when performing required ISI testing .

Related Generic Communications

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