

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555-0001

February 28, 2001

NRC INFORMATION NOTICE 2000-17, SUPPLEMENT 2: CRACK IN WELD AREA OF  
REACTOR COOLANT SYSTEM  
HOT LEG PIPING AT V. C.  
SUMMER

Addressees

All holders of operating licenses for nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) supplement to provide updated information about the crack found in a weld in the A loop hot leg pipe in the reactor coolant system (RCS) at the V. C. Summer Nuclear Station. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, no specific action or written response is required.

Description of Circumstances

On October 7, 2000, during a containment inspection after entering a refueling outage, the licensee identified a large quantity of boron on the floor and protruding from the air boot around the "A" loop RCS hot leg pipe. Ultrasonic testing (UT) and eddy current testing (ET) identified an axial crack-like indication approximately 2.7 inches long located approximately 7 degrees counterclockwise from top dead center of the first weld between the reactor vessel nozzle and the "A" loop hot leg piping approximately 3 feet from the reactor vessel. Based on the UT data, the axial crack-like indication began at the inner diameter and shows evidence of complete through-wall extension. Visual examination from the outer diameter identified a small "weep hole" in the center of the weld at approximately the same circumferential location as the UT and ET indications.

The NRC developed a Web page to keep the public informed of this event:

<http://www.nrc.gov/NRC/REACTOR/SUMMER/index.htm>

The NRC issued IN 2000-17 and Supplement 1 on October 18, 2000, and November 11, 2000, respectively, to inform addressees of this information.

ML010570353

## Discussion

Based on non-destructive examination (UT, ET, and visual) results, the "A" loop hot leg weld was cut out and destructively tested. The 2.7-inch long indication was determined to be an axial crack approximately 2.5 inches long and almost through wall which was caused by primary water stress corrosion cracking (PWSCC). High tensile stresses were present in the weld as a result of extensive weld repairs during original construction and these stresses were considered a contributing cause for the PWSCC. The extensive weld repairs complicated previous in-service inspections of the weld because weld roughness made it difficult to perform UT on portions of the weld. In addition to the axial crack, the licensee identified several other ET indications in the "A" loop hot leg weld. The destructive examination of the "A" loop hot leg weld confirmed that a number of the ET indications were PWSCC cracks. The licensee also identified other ET indications in four of the other five reactor coolant system nozzle to pipe welds. Westinghouse performed an evaluation to justify continued operation of V. C. Summer without repair of these ET indications.

The NRC conducted a special inspection from October 18, 2001 to February 8, 2001, which evaluated the licensee's root cause determination and corrective actions in response to the "A" loop hot leg weld crack. The special inspection team concluded that the licensee's root cause determination was thorough and supported PWSCC as the mechanism which led to the leak. The team identified no licensee performance issues. The team concluded that all welding and non-destructive examination (UT, ET, visual, and liquid-penetrant) met American Society of Mechanical Engineers (ASME) Code requirements. The "A" loop hot leg weld was removed and replaced in its entirety. The removal and acceptable replacement of the "A" loop hot leg weld eliminates near-term staff concerns regarding this weld. The team noted that the licensee intended to make several enhancements to their leak detection capability including: 1) performing noble gas sampling, 2) performing a reactor coolant system water inventory balance once per day, 3) addition of a main control board annunciator for a 0.75 gallon per minute leak, and 4) revising the procedures for boric acid inspections to list specific components and locations to be inspected and to provide specific guidance on evaluation methodologies. The special inspection report number is 50-395/2000-08, and it will be available at ADAMS when it is issued.

The NRC staff reviewed the Westinghouse evaluation to justify continued operation of V. C. Summer without repair of existing ET indications in the "B" loop and "C" loop hot leg welds. The Westinghouse evaluation concluded that V. C. Summer could be operated for at least two fuel cycles without repair of existing ET indications. The staff performed an independent evaluation using a bounding primary water stress corrosion cracking (PWSCC) growth rate, the initial ET indication length and depth, and the flow stress for the weld material, and concluded that V. C. Summer could be operated with ET indications in the "B" loop and "C" loop hot leg welds for one fuel cycle. The staff used a crack growth rate 50 percent higher than that used by the licensee because of limited crack growth rate data for Alloy 182 weld material. The staff's evaluation was issued on February 20, 2001 and is available at ADAMS Accession Number ML010510338.

As a result of its evaluation of the event at V. C. Summer, the NRC identified several generic issues to be addressed. These issues include: 1) potential weaknesses in the ability of ASME Code-required non-destructive examination techniques to detect and size small inner-diameter stress corrosion cracks, 2) potential weaknesses in the ASME Code in that it allows multiple weld repairs which affect residual weld stress and PWSCC, 3) potential weaknesses in RCS leak detection systems, and 4) questions regarding the continued applicability of "leak before break" analyses. The NRC has held two public meetings with industry representatives on January 25, 2001 and February 16, 2001, to discuss resolution of these issues. The NRC will assess the need for further generic action as new information becomes available.

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

**/RA/**

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Attachment:  
List of Recently Issued NRC Information Notices

As a result of its evaluation of the event at V. C. Summer, the NRC identified several generic issues to be addressed. These issues include: 1) potential weaknesses in the ability of ASME Code-required non-destructive examination techniques to detect and size small inner-diameter stress corrosion cracks, 2) potential weaknesses in the ASME Code in that it allows multiple weld repairs which affect residual weld stress and PWSCC, 3) potential weaknesses in RCS leak detection systems, and 4) questions regarding the continued applicability of "leak before break" analyses. The NRC has held two public meetings with industry representatives on January 25, 2001 and February 16, 2001, to discuss resolution of these issues. The NRC will assess the need for further generic action as new information becomes available.

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Note 1: The V.C. Summer Communications Team reviewed and approved the information notice on 02/XX/2000. The Team composition was dictated in a memorandum from J. Zwolinski to B. Sheron on November 14, 2000 (Protocol for NRC Response to Cracked Weld at V. C. Summer - ADAMS Accession Number ML003768599)

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\*See previous concurrence

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OFFICE	REXB	C	MULTIPLE	N	Tech Ed		C:REXB	
NAME	EBenner	Communications Team <sup>Note1</sup>			out of office		LMarsh	
DATE	02/27/00	02/27/00			02/27/00		02/28/00	

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LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
2000-22	Medical Misadministrations Caused by Human Errors Involving Gamma Stereotactic Radiosurgery (GAMMA KNIFE)	12/18/00	All medical use licensees authorized to conduct gamma stereotactic radiosurgery treatments
2000-21	Detached Check Valve Disc not Detected by Use of Acoustic and Magnetic Nonintrusive Test Techniques	12/15/00	All holders of OLs for nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor
2000-20	Potential Loss of Redundant Safety Related Equipment Due to Lack of a High-Energy Line Break Barrier	12/11/2000	All holders of operating licenses or construction permits for nuclear power reactors
2000-19	Implementation of Human Use Research Protocols Involving U.S. Nuclear Regulatory Commission Regulated Materials	12/05/2000	All medical use licensees
2000-18	Substandard Material Supplied by Chicago Bullet Proof Systems	11/29/2000	All 10 CFR Part 50 licensees and applicants. All category 1 fuel facilities. All 10 CFR Part 72 licensees and applicants
2000-17 S1	Crack In Weld Area of Reactor Coolant System Hot Leg Piping At V.C. Summer	11/16/2000	All holders of OLs for nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel
2000-17	Crack In Weld Area of Reactor Coolant System Hot Leg Piping At V.C. Summer	10/18/2000	All holders of OLs for nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel