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

July 2, 1992

NRC INFORMATION NOTICE 92-50: CRACKING OF VALVES IN THE CONDENSATE RETURN LINES OF A BWR EMERGENCY CONDENSER SYSTEM

Addressees

All holders of operating licenses or construction permits for boiling water reactors (BWRs).

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to inform addressees of cracking found in valves in the condensate return lines of the emergency condenser system at the Nine Mile Point Nuclear Station, Unit 1. 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

Following a reactor trip at Nine Mile Point, Unit 1, on May 1, 1992, the licensee (Niagara Mohawk Power Corporation) inspected the drywell to investigate the cause of a recent increase of unidentified leakage in the reactor coolant system. The licensee found a 0.5 gpm leak coming from a manual gate valve at a 1-inch drain line connection. The leaking gate valve, designated valve 39-02, is located in the condensate return line for the loop 12 emergency condenser system.

The emergency condenser system has two independent loops (loops 11 and 12). Figure 1 shows the configuration of the condensate return line in loops 11 and 12. In the condensate return line, a manual gate valve is connected downstream of a tilting disc check valve. At each of those two valves, two 1-inch drain lines are connected to the bottom part of the valve body with one drain line at the upstream side and the other one at the downstream side of the valve. The valve bodies are made of CF8M cast stainless steel.

While investigating the leakage at the manual gate valve 39-02, the licensee removed the internal components of the adjacent check valve to perform a visual test (VT), a radiographic test (RT), and an ultrasonic test (UT). The licensee visually observed cracks on the inside surfaces at both valves in loop 12. At gate valve 39-02, the licensee found cracks near each of the two drain holes. At check valve 39-04, the licensee found cracks near a downstream drain hole and found evidence of cracking in the threads of the

upstream drain. These cracks were further examined radiographically and ultrasonically. The licensee found four cracks including a throughwall crack near the drain hole upstream of gate valve 39-02. The licensee reported the throughwall crack to be about 3.5 inches long and oriented radially outward from the hole. The other three cracks were all reported to be within 0.15 to 0.35 inch of passing through the wall (1.25 inch wall thickness). The licensee found two cracks in the drain hole area downstream of the gate valve (39-02), which is the unisolable side of the valve body. The licensee reported the deepest crack to be about 1 inch long and within 0.15 inch of passing through the wall. The licensee found four cracks near the drain hole downstream of check valve 39-04 with the deepest reported to be within 0.1 inch of passing through the wall. The licensee visually observed one small indication on the seat ring in manual gate valve 39-02. The licensee also examined valves 39-01 and 39-03 in the condensate return line for loop 11 of the emergency condenser system and found two cracks near the drain hole upstream of manual gate valve 39-01. The largest crack was reported to be about 1.25 inch long and 1 inch deep. The licensee reported the cracking of the valve body in loop 11 to be less severe than that in loop 12. The licensee observed cracking indications on the inside surface of a butt weld that joins the gate valve to the check valve but did not confirm these indications by the radiographic examination. The licensee ultrasonically examined selected piping welds inboard of the condensate return isolation valves and found no indications.

The licensee removed a boat sample containing a 0.5-inch long crack from manual gate valve 39-02 in loop 12. The licensee examined the boat sample metallographically and fractographically (using a scanning electron microscope) and found that the crack had propagated transgranularly with very little secondary cracking. These features are typical of fatigue crack propagation. The licensee noted possible fatigue striations that were not well-developed. The licensee measured the delta ferrite content of the boat sample to be about 15 percent.

Discussion

The emergency condensate system at Nine Mile Point, Unit 1, which is connected directly to the reactor coolant system, operates by natural circulation and acts as a backup for the main condenser to remove the reactor decay heat following a reactor isolation. The emergency condenser system at Nine Mile Point, Unit 1, as shown in Figure 2, has two loops (loop 11 and loop 12) with two condensers in each loop. During normal plant operation, the condensate return isolation valves (39-05 and 39-06) are closed, and the steam isolation valves (39-07, 08, 09, and 10) are open in each loop. As shown in Figure 1, two valves, a manual gate valve and a tilting disc check valve, are located in horizontal sections of the condensate return line. The horizontal sections are connected to the suction side of the recirculation piping system. The manual gate valves are maintenance valves and are open during normal operation.

The licensee postulated thermal fatigue as the root cause of the cracking in the valve bodies, upon considering the straight and transgranular cracking morphology, the location of the cracks on the bottom surface near

discontinuities, and the orientation of the cracks. However, the licensee did not find the direct causes of the apparent thermal stratification and cycling at the affected valves. The licensee speculated that the observed cracking may have been caused by the leaking of the cold water from the condensate isolation valves (39-05 and 06) and the periodic opening of the tilting disc in the check valve. The licensee provided a limited history of the time and temperature as evidence of thermal cycling in the loop 12 condensate return line valve 39-06. Although the licensee also observed cracking in loop 11, it did not observe such thermal cycling on the condensate return line during a 1-week test. The sections of the emergency condenser condensate return lines that showed evidence of cracking are classified as American Society of Mechanical Engineers (ASME) Code Class 1. The licensee extended its current outage to complete acceptable code repairs because of the extent of the cracks in the reactor coolant pressure boundary and, in particular, the cracks found at the downstream drain line hole for valve 39-02.

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.

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Office of Nuclear Reactor Regulation

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(301) 504-2706

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(301) 504-2768

Attachments:
1. Figure 1, NMP-1 Emergency Condenser System Condensate Return Line Configuration Inside Drywell
2. Figure 2, Nine Mile Point Unit One Emergency Condenser System Simplified Diagram
3. List of Recently Issued NRC Information Notices

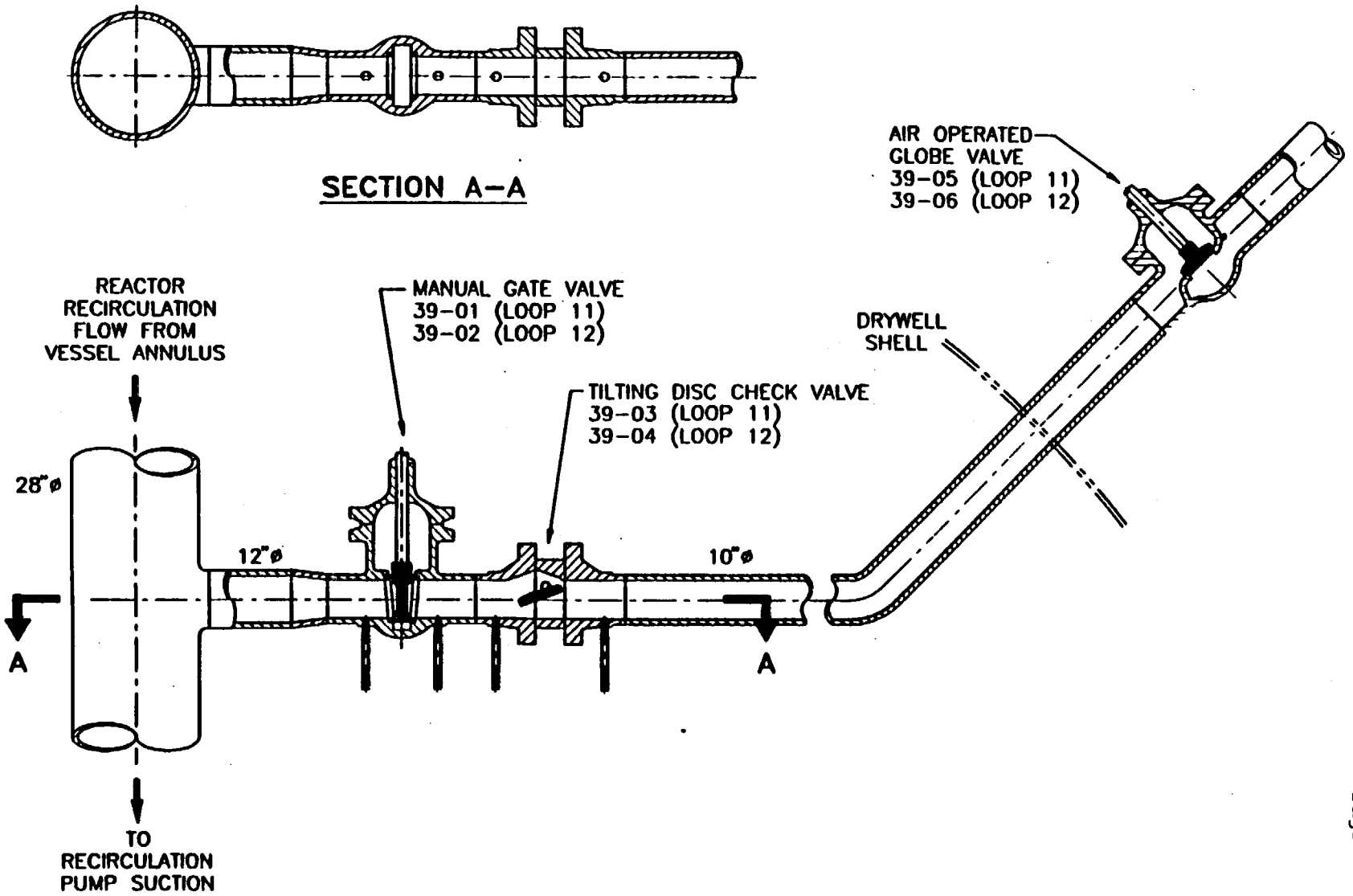

FIGURE 1
NMP-1 EMERGENCY CONDENSER SYSTEM
CONDENSATE RETURN LINE
CONFIGURATION INSIDE DRYWELL

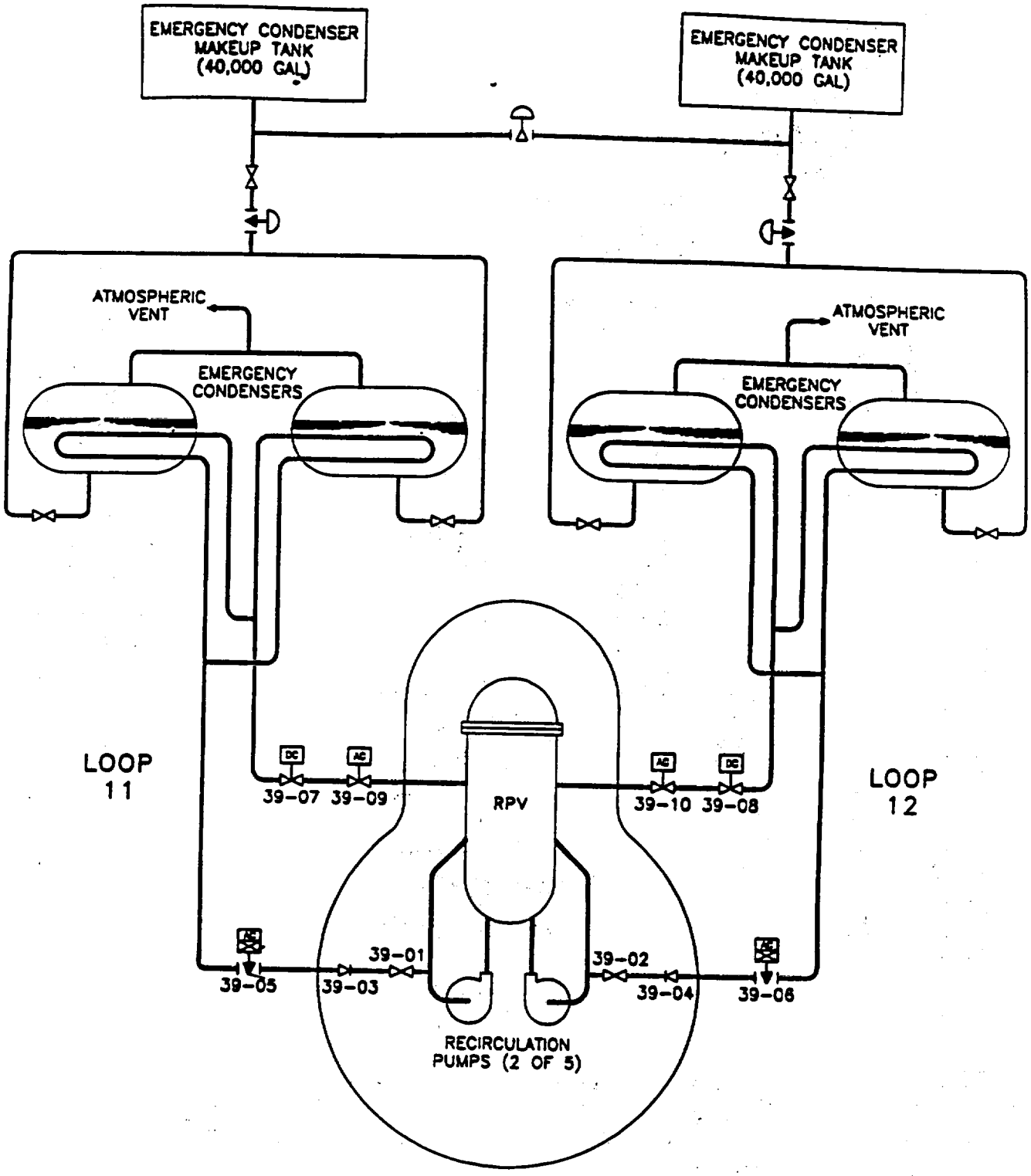

FIGURE 2 NINE MILE POINT UNIT ONE EMERGENCY CONDENSER SYSTEM SIMPLIFIED DIAGRAM

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
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92-48	Failure of Exide Batteries	07/02/92	All holders of OLs or CPs for nuclear power reactors
92-47	Intentional Bypassing of Automatic Actuation of Plant Protective Features	06/29/92	All holders of OLs or CPs for nuclear power reactors
92-46	Thermo-Lag Fire Barrier Material Special Review Team Final Report Findings, Current Fire Endurance Tests, and Ampacity Calculation Errors	06/23/92	All holders of OLs or CPs for nuclear power reactors.
92-45	Incorrect Relay Used in Emergency Diesel Generator Output Breaker Control Circuitry	06/22/92	All holders of OLs or CPs for nuclear power reactors.
92-44	Problems with Westinghouse DS-206 and DSL-206 Type Circuit Breakers	06/18/92	All holders of OLs or CPs for nuclear power reactors.
92-43	Defective Molded Phenolic Armature Carriers Found on Elmwood Contactors	06/09/92	All holders of OLs or CPs for nuclear power reactors.
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OL = Operating License
CP = Construction Permit

discontinuities, and the orientation of the cracks. However, the licensee did not find the direct causes of the apparent thermal stratification and cycling at the affected valves. The licensee speculated that the observed cracking may have been caused by the leaking of the cold water from the condensate isolation valves (39-05 and 06) and the periodic opening of the tilting disc in the check valve. The licensee provided a limited history of the time and temperature as evidence of thermal cycling in the loop 12 condensate return line valve 39-06. Although the licensee also observed cracking in loop 11, it did not observe such thermal cycling on the condensate return line during a 1-week test. The sections of the emergency condenser condensate return lines that showed evidence of cracking are classified as American Society of Mechanical Engineers (ASME) Code Class 1. The licensee extended its current outage to complete acceptable code repairs because of the extent of the cracks in the reactor coolant pressure boundary and, in particular, the cracks found at the downstream drain line hole for valve 39-02.

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Document Name: CRACKCON.IN
*SEE PREVIOUS CONCURRENCES

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*OGCB:DOEA:NRR	*EMCB:DET:NRR	*EMCB:DET:NRR	*C/EMCB:DET:NRR	*D/DET:NRR
DCKirkpatrick	WKoo	RHermann	JWiggins	JRichardson
06/12/92	05/29/92	05/29/92	05/29/92	06/18/92

discontinuities, and the orientation of the cracks toward the hoop. However, the licensee did not find the direct causes of the thermal stratification and cycling at the affected valves. The licensee speculated that the observed cracking may have been caused by the leaking of the cold water from the condensate isolation valves (39-05 and 06) and the periodic opening of the tilting disc in the check valve. The licensee provided a limited history of the time and temperature as evidence of thermal cycling in the loop 12 condensate return line valve 39-06. Although the licensee also observed cracking in loop 11, it did not observe such thermal cycling on the condensate return line during a 1-week test. The sections of the emergency condenser condensate return lines that showed evidence of cracking are classified as American Society of Mechanical Engineers (ASME) Code Class 1. The licensee extended its current outage to complete acceptable code repairs because of the extent of the cracks in the reactor coolant pressure boundary, and in particular the cracks found at the downstream drain line hole for valve 39-02.

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OGCB:DOEA:NRR	*EMCB:DET:NRR	*EMCB:DET:NRR	*C/EMCB:DET:NRR	D/DET:NRR
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WKoo	RHermann	JWiggins	JRichardson	TechEd JMain
05/29/92	05/29/92	05/29/92	06/ /92	06/10/92

of the observed cracking in the valve bodies. However, the direct causes that created the thermal stratification and cycling at the affected valves were not specifically identified. The licensee speculated that the observed cracking may have resulted from the leaking of the cold water from the condensate isolation valves (39-05, 06) coupled with the periodic opening of the tilting disc in the check valve. The licensee provided some evidence of thermal cycling in the loop 12 condensate return line valve 39-06 based on some limited temperature time history data. Although cracking was also observed in loop 11, such thermal cycling was not observed on the condensate return line during a one week test. The sections of the emergency condenser condensate return lines that showed evidence of cracking are classified as ASME Code Class 1. Because of the extent of cracking in the reactor coolant pressure boundary, in particular that found at the downstream drain line hole for valve 39-02, the licensee extended its current outage to complete acceptable code repairs.

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