

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Quad-Cities Nuclear Power Station, Unit 2										DOCKET NUMBER (2) 0 5 0 0 0 2 6 5					PAGE(S) 1 OF 0 4								
TITLE (4) Linear Indication on Reactor Recirculation System Welds																							
EVENT DATE (6)			LER NUMBER (8)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (9)													
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES NA				DOCKET NUMBER(S) 0 5 0 0 0										
0	4	0	1	8	5	8	5	0	0	8	0	1	0	7	1	5	8	5	0	5	0	0	0
OPERATING MODE (10)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following) (11)																					
2		20.402(b)				20.408(a)				80.73(a)(2)(iv)				73.71(b)									
POWER LEVEL (10)		20.408(a)(1)(i)				80.36(a)(1)				80.73(a)(2)(v)				73.71(e)									
0 0 0		20.408(a)(1)(ii)				80.36(a)(2)				80.73(a)(2)(vi)				OTHER (Specify in Abstract below and in Text, NRC Form 308A)									
		20.408(a)(1)(iii)				80.73(a)(2)(i)				80.73(a)(2)(viii)(A)													
		20.408(a)(1)(iv)				X 80.73(a)(2)(ii)				80.73(a)(2)(vii)(B)													
		20.408(a)(1)(v)				80.73(a)(2)(iii)				80.73(a)(2)(ix)													
LICENSEE CONTACT FOR THIS LER (12)																							
NAME Ken Medulan, Technical Staff										TELEPHONE NUMBER AREA CODE 3 0 9 6 5 4 - 2 2 4 1													
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																							
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC													
X	A	D	P	S	X	D	2	4	0	Y													
SUPPLEMENTAL REPORT EXPECTED (14)												EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR							
YES (If yes, complete EXPECTED SUBMISSION DATE)												X NO											

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On March 18, 1985, Quad-Cities Unit 2 was shutdown for refueling. On April 1, a visual inspection revealed a Recirculation (AD) weld area with water seeping from a small crack. Subsequent to this discovery, while reviewing ultrasonic test data taken during the ongoing inspections required by the Inservice Inspection Program and the NUREG 1061, two additional Recirculation welds were identified to have circumferential and axial indications in their heat affected zones. The cause of this occurrence is postulated as being Intergranular Stress Corrosion Cracking. This report provides the summation of all findings, the final evaluation, and the corrective actions taken as a result of these indications.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO 3150-0104

EXPIRES 8/31/85

FACILITY NAME (1) Quad-Cities Nuclear Power Station, Unit 2	DOCKET NUMBER (2) 0 5 0 0 0 2 6 5	LER NUMBER (8)			PAGE (3)		
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TEXT (If more space is required, use additional NRC Form 388A's) (17)

Event Description

On March 18, 1985, Quad-Cities Unit 2 was shutdown to begin the End of Cycle Seven Refueling Outage. On April 1, 1985, a small crack with water seeping was discovered on Recirculation (AD) weld number 02M-F7, while conducting a visual inspection of the prepared weld surface prior to ultrasonic examination. After this weld indication was identified, two additional welds were identified as having circumferential and axial indications in their heat affected zones. Two other welds were identified as having "long" circumferential indications. The ultrasonic inspections were performed by technicians from Lambert, McGill and Thomas, Incorporated. The four subject welds are:

<u>Weld Number</u>	<u>Pipe Size</u>	<u>Location</u>
02M-S3	12"	'M' Riser Elbow to Pipe
02E-F6A	12"	'E' Riser Pipe to Pipe
02AS-S4	28"	'A' Suction Elbow to Pipe
10S-F5	20"	Shutdown Cooling Pipe to Valve

The inspection scope was augmented per NUREG 1061 as a result of new crack indications discovered in weld 02E-F6A. Crack indications in weld 02M-S3 have grown from indications which had been discovered during the 1983 Refuel Outage on Unit 2. Crack indications in weld 02M-F7 were screened by the presence of the lack of fusion flaw discovered during the 1983 Refuel Outage. Crack indications in welds 10S-F5 and 02AS-S4 could not be proven to have grown but are slightly above the generic letter 84-11 acceptable crack length and/or size.

Crack indications of this type tend to propagate at a slow rate. Therefore, a 100 percent through-wall crack could be easily detected using existing Primary Containment leakage monitoring systems before a complete failure would occur. No leakage was detected prior to the current refuel outage.

Seventy-four stainless steel welds were ultrasonically inspected during the current Quad-Cities Unit 2 Refueling Outage, 34 in the Recirculation System. Two welds (02E-F6A and 02M-F7) which showed no reportable crack indications during the last inspection are now considered to have crack indications and were overlaid.

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TEXT: If more space is required, use additional NRC Form 388A's (17)

Event Description (continued)

Of the 13 welds with previously identified crack indications, Commonwealth Edison determined that one weld, 02AS-S3, showed significant change to merit an overlay application. The NRC raised concerns on two other welds (10S-F5 and 02AS-S4) which were previously identified as cracked and, based on subsequent discussions a decision was made to overlay these two welds raising the total to five welds overlayed this outage.

Commonwealth Edison believes that a meaningful UT inspection cannot be performed on overlayed welds. The nine previously overlayed welds were visually inspected during the hydrostatic test and three welds (02D-F6, 02F-F6, and 02BS-F7) were examined by use of the EPRI Minac system. Finally, Commonwealth Edison ultrasonically inspected the overlay material on weld number 02D-F6. No adverse indications were noted in any of the examinations.

Table 1, attached, provides specific information related to the five weld overlays. Overlay dimensions are provided for all five welds. Table 2 provides predicted flaw growth for welds 10S-F5 and 02AS-S4. Figures 1 and 2 provide the residual stress distribution for those two welds.

This report is being submitted to comply with requirements of 10 CFR 50.73(a)(2)(ii).

Cause

The cause of the crack indication is postulated to be Intergranular Stress Corrosion Cracking (IGSCC). The materials used in the original Recirculation piping and fittings are regular Grade Type 304 stainless steel which is known to be susceptible to stress corrosion cracking based on plant operating history.

The normal heat generated by the welding of Type 304 stainless steel causes a sensitized heat affected zone at the weld-to-pipe interface. This, combined with coolant impurities, are the factors necessary for IGSCC to occur.

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TEXT (If more space is required, use additional NRC Form 308A's) (17)

Corrective Action

The crack indication evaluation and repair criteria was performed by NUTECH Engineers, Incorporated. Indications were evaluated based on indication depth, length, direction, and applied stresses.

As a general rule, circumferential indications with a length greater than 120 degrees of the pipe circumference and/or a depth greater than 25 percent of the pipe wall thickness were repaired by applying a weld overlay. All axial indications and welds seeping water required either a weld overlay or flaw removal. All analyses were performed to the guidelines specified in the ASME Boiler and Pressure Vessel Code, Section XI, paragraph IWB-3640, "Acceptance Criteria for Austenitic Steel Piping". The five welds were repaired using weld overlay. The length and thickness of each overlay differed, depending upon the flaw size, analyzed stresses, and pipe geometry.

Prior to the Reactor startup, the Recirculation System was hydrostatically tested in conjunction with the Reactor Vessel Hydrostatic Test at 1.1 times the system nominal operating pressure.

TABLE 1

WELD OVERLAY REPAIR DIMENSIONS

SPRING 1985 OUTAGE

QUAD CITIES UNIT 2

<u>Weld ID</u>	<u>Design Overlay Length</u>	<u>Actual Overlay Length</u>	<u>Design Overlay Thickness</u>	<u>Actual Overlay Thickness Upstream/Downstream</u>
02E-F6A	4.50"	4.5"	0.208"	0.22"/0.201"
02M-S3	4.0"	5.0"	0.208"	0.253"/0.256"
02M-F7	3.0"	3.44"	0.208"	0.242"/0.284"
10S-F5	2.5" ⁽¹⁾	2.5"	Two Layers	NA ⁽²⁾ /0.156"
02AS-S4	7.0"	8.0"	Two Layers	0.173"/0.181"

Notes:

1. From centerline of weld going away from valve.
2. Valve side of weld.

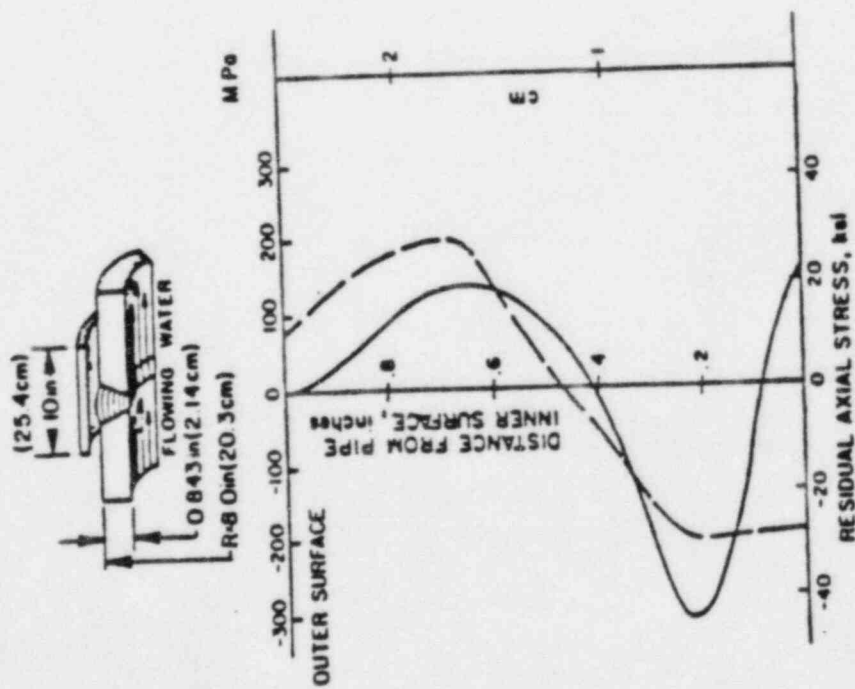
TABLE 2
PREDICTED FLAW GROWTH⁽¹⁾
FOR ONE FUEL CYCLE
QUAD CITIES UNIT 2

<u>Weld ID</u>	<u>Beginning- of-Cycle Flaw Depth Ratio</u>	<u>Predicted Flaw Depth Ratio w/o Mitigation</u>	<u>Predicted Flaw Depth Ratio w/ IHSI Mitigation</u>	<u>Predicted Flaw Depth Ratio w/ Overlay Mitigation</u>	<u>Allowable Flaw Depth Ratio (2)</u>
10S-F5	0.17	(3)	0.17	0.19	0.47
02AS-S4	0.20	0.36	0.20	0.20	0.48

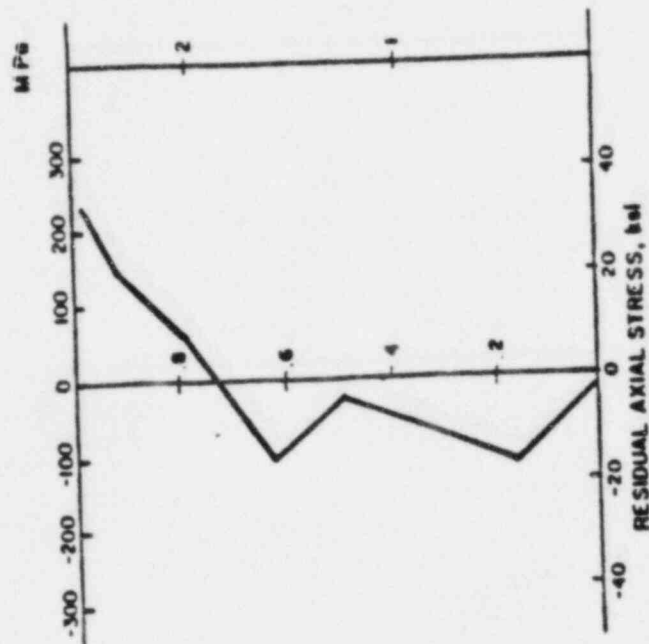
NOTES:

1. All flaws assumed to be 360° in circumferential length.
2. Allowable flaw depth ratio is 2/3 of Table IWB-3641-1 allowable depth ratios.
3. Will grow through-wall in less than one fuel cycle.

FIGURE 1

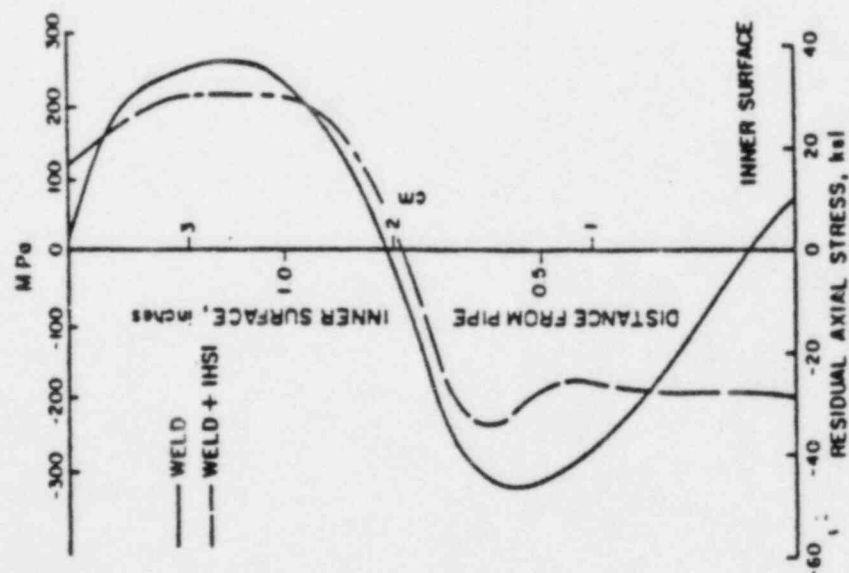
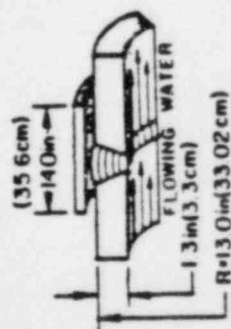


16" NPS PRE- AND POST-IHSI
THROUGH-WALL RESIDUAL STRESS
DISTRIBUTIONS (FROM EPRI
NP-2662-LD)

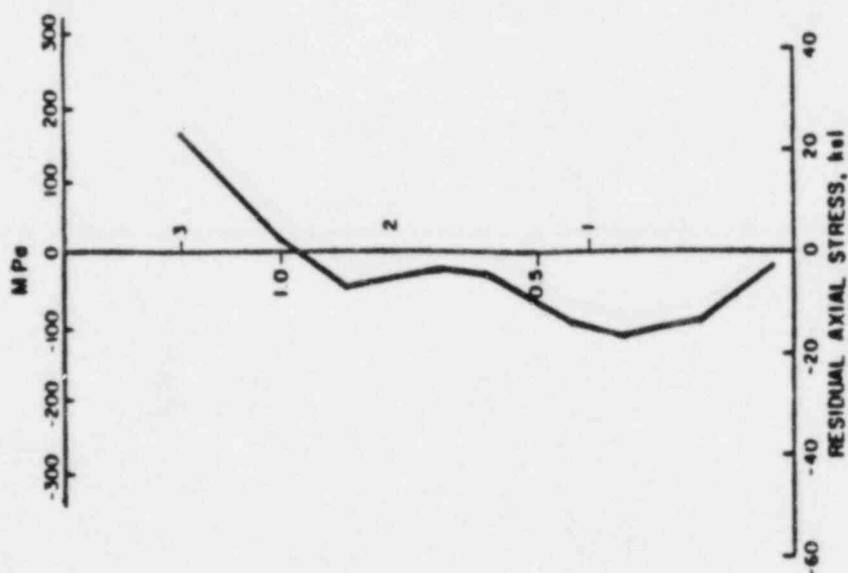


WELD 10S-F5 (20" O.D. x 0.96" WALL)
THROUGH-WALL RESIDUAL STRESS
DISTRIBUTION AFTER TWO LAYER
OVERLAY (FROM NUTECH "WELDS II" ANALYSIS)

FIGURE 2



26" NPS PRE- AND POST-IHSI
THROUGH-WALL RESIDUAL STRESS
DISTRIBUTIONS (FROM EPRI
NP-2662-LD)



WELD 02AS-S4 (28" O.D. x 1.203" WALL)
THROUGH-WALL RESIDUAL STRESS
DISTRIBUTION AFTER TWO LAYER
OVERLAY (FROM NUTECH "WELDS II"
ANALYSIS)



Commonwealth Edison

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NJK-85-194

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U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Reference: Quad-Cities Nuclear Power Station
Docket Number 50-265, DPR-30, Unit Two

Enclosed please find Licensee Event Report (LER) 85-008, Revision 1, for Quad-Cities Nuclear Power Station.

This supplemental report is submitted to you in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(ii), to inform you of the corrective actions performed on cracks found during the Quad-Cities Unit Two Primary Coolant Circuit NDE UT Inspections.

Respectfully,

COMMONWEALTH EDISON COMPANY
QUAD-CITIES NUCLEAR POWER STATION

N. J. Kalivianakis
Station Manager

NJK:BRS/bb

Enclosure

cc J. Wojnarowski
A. Madison
INPO Records Center
NRC Region III

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