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FPL Energy

Duane Arnold Energy Center

April 20, 2007

NG-07-0364

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Duane Arnold Energy Center
Docket 50-331
License No. DPR-49

Licensee Event Report #2007-003-00

Please find attached the subject Licensee Event Report (LER) submitted in accordance with 10 CFR 50.73. This letter contains no new commitments.

Gary Van Middlesworth

Gary Van Middlesworth
Site Vice President, Duane Arnold Energy Center
FPL Energy Duane Arnold, LLC

cc: Administrator, Region III, USNRC
Project Manager, DAEC, USNRC
Resident Inspector, DAEC, USNRC

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NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)	Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Duane Arnold Energy Center	05000 331	1 OF 4

4. TITLE
Linear indications found during UT examination of safe-end to nozzle welds

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER 05000
02	18	2007	2007	- 3 -	0	04	20	2007	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE
5

10. POWER LEVEL
0%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☑ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Robert J. Murrell, Regulatory Affairs Engineering Analyst	(319) 851-7900

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
○ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ◉ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

Safe-end to nozzle weld RRF-F002 was scheduled in RFO20 as an examination under BWRVIP-75 and as a successive examination under ASME Section XI. On 2/18/07, the examination revealed a linear indication at the bottom of the weld that did not meet the acceptance criteria (IWB-3500) of ASME Section XI. Based on this unacceptable linear indication a scope expansion was required for both programs (BWRVIP-75 and ASME Section XI). The scope expansion included safe-end to nozzle weld RRC-F002. On 2/21/07, this weld also was determined to not meet the acceptance standards (IWB-3500) of ASME Section XI. Both welds were subsequently overlaid under an NRC verbally approved relief request.

The root cause of the indications in both welds (RRF-F002 and RRC-F002) was determined to be Intergranular Stress Corrosion Cracking (IGSCC). This is based on the signal discrimination of the Ultrasonic Test examination, a review of the operating experience (OE) and the independent review of the event by outside organizations.

There were no actual safety consequences and no effect on public health and safety as a result of this event.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Duane Arnold Energy Center	05000331	2007	-- 003 --	00	2 of 4

TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

I. Description of Event:

During the Duane Arnold refueling outage 20 (RFO20), ultrasonic inspections of welds susceptible to IGSCC were performed in accordance with the BWRVIP-75 and ASME Section XI inspection programs. On 2-18-07, ultrasonic inspection of the N2F reactor recirculation riser safe-end to nozzle weld, RRF-F002, identified a circumferential flaw. The RRF-F002 circumferential weld indication was approximately 5.9" (150mm) long by 0.59" (15mm) deep (55.6% through-wall (TW)) and identified as ID surface connected. As part of the BWRVIP and ASME Section XI Inspection Programs, the inspection population was expanded to determine the extent of condition (CAP 47960). On 2-21-07 another circumferential indication was identified in the N2C reactor recirculation riser safe-end to nozzle weld, RRC-F002. The flaw indication in the N2C safe end weld, RRC-F002, was 6.3" (160mm) long by 0.787" (20mm) deep (74% TW) and identified as ID surface connected. Both welds were dissimilar metal welds (ASME Category B-F) made with alloy 82/182 weld material. Both flaws exceeded the acceptance criteria of 10.4% TW in ASME Section XI, Table IWB-3410-1 and Table IWB-3514-2. A component that does not meet the acceptance standards of Table IWB-3410-1 and IWB-3514 for Category B-F welds shall be corrected by repair/replacement (IWB-3132.2), or justified for acceptance using analytical evaluation (IWB-3132.3).

Both welds were subsequently overlaid under an NRC verbally approved relief request.

This event was reported to the NRC as an 8 hour event under 10 CFR 50.72(b)(3)(ii)(A), Any event or condition that results in: (A) The condition of the nuclear power plant, including its principal safety barriers being seriously degraded.

II. Assessment of Safety Consequences:

This report is being submitted pursuant to 10CFR50.73(a)(2)(ii)(A).

An evaluation of the known sized flaws was performed to determine whether the flaws met the acceptance criteria established in ASME Section XI, IWB-3600. The report concluded the following:

1. The allowable through-wall flaw depth for the two flawed nozzle-to-safe end welds is very large. They are at least 75% of pipe wall and could be as large as through-wall if the 75% through-wall limit imposed by ASME Section XI is not considered.
2. The N2C and N2F nozzle flaws met the ASME Code Section XI IWB-3640 requirements (75% of wall for the as-found lengths) at the time of the inspection.
3. Under Normal Water Chemistry (NWC) conditions, it will take an initial 10% flaw at least 19 months to reach the allowable flaw depth (75% of wall) and under hydrogen water chemistry conditions, it will take at least 195 months for the initial 10% through-wall flaw to reach the allowable flaw depth (75% of wall).
4. Under Hydrogen Water Conditions (HWC) conditions, the flaw at the N2F nozzle weld would be acceptable for at least one additional operating cycle based on the crack growth analysis results. Although the N2C flaw was slightly less than the 75% allowable flaw depth limit, the flaw would be predicted to exceed the 75% limit during the next operating cycle.
5. Based on the fact that Duane Arnold Energy Center (DAEC) is on HWC, it is very likely that both flaws have been present for a significant time, e.g. multiple cycles, and were not identified by previous inspections.

Therefore, this event has no nuclear safety significance because the flaws were within Code allowable when discovered and the affected areas have overlays installed to restore long term structural integrity

III. Cause of Event:

The cause of the circumferential flaws identified in the RRF-F002 (N2F) and RRC-F002 (N2C) reactor recirculation riser safe-end to nozzle welds is IGSCC. The cause is based on the following considerations: The industry experience that alloy 82/182 butt welds are susceptible to IGSCC, even in HWC. Weld repairs made on the N2F safe end weld (10-23-78 to 10-25-78 in N2F repair history), and weld repairs and potential oxidation of the root of the N2C (10-28-78 N2C repair notation) during the 1978/79 recirculation riser safe end replacement, may have increased susceptibility to stress corrosion cracking (SCC) and contributed to the flaw initiation. The flaw length, depth, and orientation characteristics are comparable to other flaws identified in the BWR industry that have also been attributed to IGSCC. In addition, a review of the automated Non-Destructive Examination (NDE) data by EPRI concluded that the flaw ultrasonic responses have similar characteristics to a crack that was specifically fabricated to simulate the response from SCC in this type of weld configuration.

IV. Corrective Actions:

Corrective Actions to Restore

Two Work Orders were planned to perform repairs of the safe-end to nozzle welds (WO 1139064 (RRC-F002) and WO 1139059 (RRF-F002)). The repair was to overlay the flawed welds with material (Alloy 52M) resistant to SCC. The implementation of the overlay required a relief request from the NRC to approve the use of two code cases (N-504-2 and 638-1). The overlays were successfully applied and the ultrasonic examination results were found to be acceptable.

Interim Corrective Actions

None identified.

Corrective Actions to Prevent Recurrence

CATPR 1-1 (CA045700), Mitigation techniques for the remaining safe-end to nozzle welds that have not been overlaid (RRA-F002, RRE-F002, RRG-F002 and RRH-F002) shall be completed prior to completion of RFO22. The mitigation techniques available are Mechanical Stress Improvement (MSIP) or weld overlay.

The overlays are considered acceptable as a mitigation technique for the two welds (RRC-F002 and RRF-F002). For the remaining safe-end to nozzle welds (RRA-F002, RRE-F002, RRG-F002 and RRH-F002) an evaluation of a mitigation technique shall be completed prior to next refueling outage. The mitigation techniques available are Mechanical Stress Improvement (MSIP) or weld overlay. It is known that the Pressurized Water Reactors are addressing their primary water stress corrosion cracking (PWSCC) issue by implementing “mitigative” overlay and using Code Case N-740 (note that the ASME Section XI committee has revised Code Case N-740 to address many of the NRC concerns).

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Duane Arnold Energy Center	05000331	2007	-- 003 --	00	4 of 4

TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

V. Additional Information:

Previous Similar Occurrences:

LER 1999-006, "Indications in Recirculation Riser Nozzle-to-Safe End Welds."

In 1999, stress corrosion cracking was found in two safe-end to nozzle welds (RRB-F002 and RRD-F002). Both of these welds were overlaid using an approved relief request from the NRC. The specifics are discussed in the above LER.

EIIS System and Component Codes:

AD Reactor Recirculation System

Reporting Requirements:

This report is being submitted under 10 CFR 50.73(a)(2)(ii)(A)