Entergy

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Kevin H. Bronson
Site Vice President

June 25, 2007

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

SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket No: 50-293
License No. DPR-35

Licensee Event Report 2007-003-00

LETTER NUMBER: 2.07.059

Dear Sir or Madam:

The enclosed Licensee Event Report (LER) 2007-003-00, "Reactor Coolant Boundary Leakage due to Reactor Vessel Nozzle Weld Crack Propagation," is submitted in accordance with 10 CFR 50.73.

This letter contains no commitments.

Please contact Bryan Ford, (508) 830-8403, if there are questions regarding this submittal.

Sincerely,

Kevin H. Bronson

FXM/dl
Enclosure

cc: Mr. James Kim, Project Manager
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NRR

1. NRC Form 366 **U.S. NUCLEAR REGULATORY COMMISSION**

LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503.

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TITLE (4)
Reactor Coolant Pressure Boundary Leakage due to Reactor Vessel Nozzle Weld Crack Propagation

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	05000
04	26	2007	2007	003	00	06	25	2007	FACILITY NAME N/A	DOCKET NUMBER 05000

OPERATING MODE (9)	N
POWER LEVEL (10)	0%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (Check one or more) (11)

20.2201(b)	22.2203(a)(3)(i)	50.73(a)(2)(i)(C)	50.73(a)(2)(vii)
22.2202(d)	20.2203(a)(3)(ii)	X 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(3)(1)(i)(A)	50.73(a)(2)(iii)	50.73(a)(2)(ix)(A)
20.2203(a)(2)(ii)	50.36(3)(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)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Bryan Ford, Licensing Manager	(508) 830-8403

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	AD	NZL		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 15 single-spaced typewritten lines) (16)

On April 26, 2007, at approximately 1930 hours, the N2K recirculation system inlet nozzle experienced slight water seepage while repairs were being performed to install a full structural weld overlay.

The cause of the leakage is attributed to a planar-type, circumferential flaw in N2K safe-end-to-nozzle weld. The weld was installed in 1984 and included Inconel 182 butter and filler which is a material now known to be susceptible to interdentritic stress corrosion cracking (IDSCC). Subsequent to the weld repair, crack propagation continued via IDSCC due to high residual weld stresses in the weld material. Ultra-sonic testing performed in Refueling Outage 16 (RFO 16) detected planar indication in the Inconel weld material that was indicative of cracking. This prompted the installation of the weld overlay.

Corrective action taken included nozzle weld repair consisting of a full structural weld overlay.

The event posed no threat to public health and safety.

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

BACKGROUND

The N2K safe-end-to-nozzle weld is located at the inlet to the reactor vessel from the "B" recirculation loop. This section of the piping system supplies drive water for two jet pumps. There are 10 similar N2 safe-end-to-nozzle welds in the reactor coolant pressure boundary.

During RFO 16, a scheduled ultrasonic test (UT) was performed on the N2K safe-end-to-nozzle weld. A weld discontinuity was recorded.

Construction records were reviewed and repairs in the area of the flaw were noted to have been performed in 1984 during the recirculation pipe replacement project. Lack of detailed documentation prevented determining the amount of grinding that was performed (e.g., depth, length). The limited documentation that is available indicates that grinding for weld repair was required and took place at most 0.75 inches from the outside diameter (OD). However, RFO 16 UT tests revealed indications were present nearer to the inside diameter (ID) of the pipe. The discrepancy between the repair records and UT test results caused elevated concern by the Level III inspector.

A third party review was solicited and an evaluation of construction radiographs, 1997 UT data, and 2007 UT data was performed. The detailed evaluation of the N2K flaw determined that the weld discontinuity was a subsurface planar flaw per IWB-3320. A conservative estimate concluded that the flaw was a planar-type circumferential flaw within the Alloy 82/182 weld that was inside surface connected. The review characterized a flaw depth of 1.02 inches with 0.13 inches remaining (89% through-wall flaw).

Based on the weld examinations performed, a weld repair was determined to be necessary.

EVENT DESCRIPTION

On April 26, 2007, at approximately 1930 hours during initial welding activities associated with installation of the full weld overlay, water seepage occurred at the outside diameter of the existing weld in the vicinity of the flaw on the N2K recirculation system inlet nozzle. The seepage confirmed that the weld flaw was inside surface connected. The crack in the weld material was peened and seal welded to stop the seepage.

The weld was subsequently repaired via the installation of a full structural weld overlay. The weld repair methodology was approved by the NRC in relief request PRR-15, Rev. 01.

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CAUSE

The cause of leakage from the reactor coolant pressure boundary was due to welding preparation activities taken to repair the N2K safe-end-to-nozzle weld. The cause of the almost through-wall flaw found on the N2K nozzle is a small crevice condition most likely from lack of fusion at the pipe ID, which created a crack initiation site (likely crevice corrosion) in the Inconel 182 butter. The crack propagated outward through the Inconel 182 butter and into the weld. Given the crack is entirely within the Inconel weld, the mechanism for crack propagation is Interdendritic Stress Corrosion Cracking (IDSCC). IDSCC differs from Intergranular Stress Corrosion Cracking (IGSCC) in that the crack occurs entirely within the weld material whereas IGSCC occurs within the base metal heat affected zone. The IDSCC mechanism propagated the crack due to high residual weld stresses.

CORRECTIVE ACTION

Corrective action taken included an automated, full structural weld overlay. The weld overlay was installed with Inconel 52M weld metal, which is highly resistant to stress corrosion cracking. The weld overlay process also imparts a compressive residual stress due to the welding process, which prevents further crack growth. The weld overlay was installed under an NRC approved relief request.

After the N2K nozzle-to-safe-end weld flaw was identified, additional UT examinations were performed on an expanded scope of four Category D welds. All other Category D welds had already been examined using the EPRI Performance Demonstration Initiative (PDI) requirements during prior outages. Three of the welds in the expanded scope are N2 nozzle-to-safe-end welds. No unacceptable flaws were identified in the four expanded scope UT examinations performed in RFO 16.

An extent of condition evaluation was also performed. The evaluation assessed critical attributes related to the N2K nozzle weld flaw. The evaluation identified that 34 Category D welds at PNPS are in the BWRVIP-75 Program. Of those 34 welds, 17 are welds that contain Inconel. All 17 of the welds with Inconel were UT examined during the last two outages (RFO 15 and RFO 16). However, not all sections of each weld could be UT inspected because of transducer lift off resulting from irregular weld and pipe configurations. Best efforts have been made to contour the surface of the welds to meet EPRI PDI requirements and to maximize weld volume coverage without violating minimum wall requirements. Ongoing corrective actions for the event includes a review of weld repair records for SSC susceptible Inconel 182 welds to determine if the repaired weld sections were fully covered by the UT examinations.

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SAFETY CONSEQUENCES

The event posed no threat to public health and safety.

The leakage from the N2K safe-end to-nozzle weld was identified while work was being performed to repair the weld. The weld repair was necessary based on the results of scheduled ultrasonic testing in accordance with the PNPS ISI Program which identified weld discontinuity in the form of a subsurface planar flaw. Only slight water seepage was reported in the area of the welding flaw. The crack was sealed by peening and seal welding before a full structural overlay was installed.

At the time that the leakage was noted, the reactor was shutdown for refueling. All required control rods were in the fully inserted position. The reactor vessel was at atmospheric pressure. The reactor vessel water temperature was less than 212 degrees Fahrenheit. Reactor water level was flooded up for refueling and being maintained at the 116' elevation.

The flaw in the N2K safe-end–to-nozzle weld was not through-wall when it was identified during a scheduled UT examination. The flaw length noted in the N2K weld is 2.87 inches wide; with an inside surface connected crack located 0.13 inches from the outside diameter. Reactor coolant leakage did not occur until weld repairs were initiated.

Since September 1991, PNPS has been operating with Hydrogen Water Chemistry (HWC). HWC arrests stress corrosion cracking initiation sites and slows existing crack growth rates. During RFO 16 the first application of Noble Metal Chemical Addition (NMCA) was completed. NMCA used in combination with Hydrogen Water Chemistry (HWC) is also effective at arresting crack initiation and slowing crack growth rates. In addition, the N2 nozzle design loads result in relatively low primary stress levels and as such fatigue is not considered to be a significant degradation factor. Therefore, if this flaw had remained in-service slow growth crack rates would be expected during future operating cycles.

The flaw length is a small fraction of the overall pipe circumference and therefore, if the flaw had breached the outside diameter, some leakage would have occurred. This leakage would be detected by installed drywell leak detection systems. Limits on unidentified leakage in the drywell would force reactor shutdown before there is any threat of crack growth that would jeopardize the overall structural integrity of the reactor coolant boundary piping (i.e., guillotine failure).

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REPORTABILITY

This report was submitted in accordance with 10 CFR 50.73(a)(2)(ii)(A), because the N2K weld leak represents a condition of the nuclear power plant, including its principle safety barriers, that was seriously degraded.

SIMILARITY TO PREVIOUS EVENTS

A review was conducted of Pilgrim Station LERs submitted since 2000. The review focused on reactor coolant boundary leakage and welding flaws. The review identified that LER 03-06-00 reported a similar event which involved a nozzle-to-cap weld on the N10 nozzle.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for this report are as follows:

COMPONENTS	CODES
Nozzle (N2K Nozzle)	NZL
SYSTEMS	CODES
Reactor Recirculation	AD