Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
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Ralph A. Dodds, III
Director, Nuclear Safety Assurance

January 16, 2012

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

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

Licensee Event Report 2011-005-00, Technical Specification Required Shutdown Due To Inoperable Feedwater Check Valve

LETTER NUMBER: 2.12.002

Dear Sir or Madam:

The enclosed Licensee Event Report (LER) 2011-005-00, "Technical Specification Required Shutdown Due To Inoperable Feedwater Check Valve" is submitted in accordance with 10 CFR 50.73.

This letter contains no commitments.

Please do not hesitate to contact Mr. Joseph R. Lynch, (508) 830-8403, if there are any questions regarding this submittal.

Sincerely,

R Dodds, III

Ralph A. Dodds

RMB/rmb

Attachment 1: Licensee Event Report 2011-005-00, Technical Specification Required Shutdown Due To Inoperable Feedwater Check Valve (6 Pages)

IE22
NRR

cc:

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USNRC Senior Resident Inspector
Pilgrim Nuclear Power Station

Attachment 1
Letter Number 2.12.002

Licensee Event Report 2011-005-00

Technical Specification Required Shutdown Due To Inoperable Feedwater Check Valve

(6 Pages)

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Service Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@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.

LICENSEE EVENT REPORT (LER)

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4. TITLE

Technical Specification Required Shutdown Due To Inoperable Feedwater Check Valve

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
									N/A	05000
11	17	2011	2011	005	00	1	16	2012	FACILITY NAME: N/A	DOCKET NUMBER: 05000

9. OPERATING MODE

N

10. POWER LEVEL

50%

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
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Joseph R. Lynch, Licensing Manager	(508)-830-8403

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
X	SJ	BFP	A391	Yes					

14. SUPPLEMENTAL REPORT EXPECTED

☐ Yes (If yes, complete 15. *EXPECTED SUBMISSION DATE*) ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

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

On Thursday, November 17, 2011, at 1515 hours, with the reactor at approximately 50% core thermal power, the station entered a 24 hour cold shutdown action statement due to the inability to provide a manual isolation for a main feedwater line check valve that had been declared inoperable due to a leak. The reactor was at reduced power in order to perform a planned main condenser thermal backwash. While at reduced power an inspection of the main steam tunnel (a normally locked closed high radiation area) was performed as part of a scheduled system inspection. The inspection identified a leak on the feedwater line 'B' outboard check valve (6-CK-62B). The feedwater check valve was declared inoperable and the Limiting Condition for Operation (LCO) for Technical Specification (TS) 3.7.A.2.a.5 "All containment isolation check valves are operable or at least one containment isolation valve in each line is secured in the isolated position" was entered. Because there was no ability to manually isolate the primary containment penetration the station was required to be in cold shutdown within 24 hours per TS 3.7.A.5.

This event was initially reported to the USNRC under 10 CFR 50.72 (b)(2)(i) via Event Report #47454 and had no impact on the health and/ or safety of the public.

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NARRATIVE

EVENT DESCRIPTION:

During a planned station downpower for a main condenser thermal backwash on November 17, 2011, an inspection of the main steam tunnel found a leak through the cover plate of feedwater check valve 6-CK-62B. Because the leak was inside the containment boundary and there was no ability to manually isolate the primary containment penetration it was determined that a plant shutdown was required to repair the valve.

Prior to the planned station downpower, the following events were being monitored by plant personnel.

On 11/9/11, Operations received a steam tunnel high temperature alarm indicating 140°F while swapping the Contaminated Exhaust Fans per PNPS Procedure 2.2.40; Reactor Building Heating, Cooling, and Ventilation System. A functional failure evaluation was assigned to System Engineering and it was determined that this was not a Maintenance Rule Functional Failure (MRFF). A Condition Report (CR) was generated to perform the functional failure evaluation and was subsequently closed.

On 11/10/11, Engineering observed that steam tunnel temperatures had been steadily increasing since 10/8/11. The temperature was 129°F on 11/10/11. Subsequently a walk down of the steam tunnel was scheduled for the next downpower on 11/17/11. System Engineering continued to monitor temperature conditions in the steam tunnel.

On 11/15/11, Operations reported that the steam tunnel temperature had reached 131°F. This required operations to start a second contaminated exhaust fan to maintain steam tunnel temperatures below the alarm set point.

On 11/17/11, during the planned downpower, Operations inspected the steam tunnel and found a leak through the cover of feedwater check valve 6-CK-62B. Based on the leak location, it appeared that the bonnet pressure seal gasket had failed.

Check valve 6-CK-62B is an 18"-900 lb Anchor/Darling tilting disk check valve. The valve is assembled by first lowering the bonnet into the valve and then inserting the pressure seal gasket, the spacer ring and the retaining ring. The retainer (or cover) is installed and the nuts are tightened to draw the bonnet, gasket and spacer ring up against the retaining ring. The retainer is not sealed and is not a pressure boundary. The leak entered the space between the bonnet and the retainer and exited around the retainer periphery and through the threaded connection for the pipe plug at the center of the retainer.

A work order was initiated for inspection, disassembly and repair of check valve 6-CK-62B. During disassembly, a leak location was identified through the pressure seal gasket. The leak had cut an area approximately ¼" wide through the seal area of the gasket. Although the gasket is 1.187" high, only the bottom portion; about 3/8"; performs the sealing function. At the location of the leak on the gasket, a series of score marks were identified on the seal area of the valve body. The score marks extended through the sealing area and continued intermittently down into the valve body. The depth of the score in the seal area was measured to be about 0.004". Examination of the valve bonnet identified a small steam cut on the bonnet sealing surface that aligned with the seal leak and the body score marks. A score mark was found on the edge of the bonnet, running from the steam cut to the base of the bonnet.

The leak occurred because a portion of the score extended across the seal area between the gasket and the valve body. Although, the pressure seal gasket is made of soft steel with a thin silver coating so that it can deform and seal some imperfections in the sealing surface, it is not designed to be able to seal this type of score mark (approximately .004" deep).

Based on the alignment of the valve body score mark and the bonnet score mark, the marks were most likely caused by a small piece of foreign material (about 1/32" based on the dimensions of the body and bonnet) that was caught between body and bonnet and dragged over the body seating surface. This may not have been noticed when it occurred because of the close fit between the body and bonnet and the weight of the bonnet. Standard Foreign Material Exclusion (FME) practices were followed as part of valve disassembly, inspection, repair, and reassembly.

The Root Cause Team interviewed personnel involved in the valve maintenance during Refueling Outage (RFO) 18 (April/ May 2011) and examined the score marks to determine if the scoring occurred during disassembly or during reassembly of the valve. Task 01 of the RFO Work Order included instructions for disassembly, inspection, hinge pin bushings replacement, soft seat replacement, valve seat re-conditioning, disc alignment/re-alignment and reassembly of the valve in accordance with PNPS Procedure 3.M.4-49; Feedwater Check Valve Maintenance.

The other feedwater check valve work orders in RFO 18 were reviewed to determine how the pressure seal inspections were handled. The work orders for the inboard Feedwater check valves, 6-CK-58A & B, found the seal area to be satisfactory. There was no indication of any issues. Work orders for check valve 6-CK-62A included a Turnover sheet that noted that there were scores on the bonnet seating area. In this case, the sealing area was found satisfactory after evaluation by PNPS personnel.

The score marks on check valve 6-CK-62B were evaluated to determine if the scoring occurred during disassembly or assembly. Based on an evaluation of the marks, the score probably occurred while the bonnet was being inserted during reassembly. One of the marks is shallow at the top and digs deeper before popping out a divot at the bottom. This kind of mark could only be explained by downward motion.

Based on review of the available documentation, the interviews with the personnel involved and evaluation of the score marks, the RCE Team concluded that the scoring occurred during reassembly of the valve.

This event was reported to the USNRC via Event Report #47454 on 11/17/12 pursuant to 10 CFR 50.72 (b)(2)(i) - Technical Specification Required Shutdown.

ROOT CAUSE OF EVENT:

The root cause of the check valve leakage was the failure of the work crew to adequately perform a final inspection of the pressure sealing surface during the last RFO. The craft were aware of the importance of the pressure sealing surface but did not perform a final inspection or did not perform it in sufficient detail to identify the score on the valve body. In addition, Entergy did not have adequate programmatic controls for check valve inspection in place.

CONTRIBUTING CAUSES OF EVENT:

A contributing cause of the check valve leakage is the as-found inside diameter (ID) of the valve body sealing area.

Drawing M117A1-4SH2 indicates that the ID should be 20.000" +0.002". In 1991, Anchor/Darling informed PNPS that the standard size pressure seal gasket could be used on bores up to 20.017". During the forced outage, the ID was measured at 20.010" to 20.021". The leak location was near the 20.021" diameter. The increased diameter makes it more difficult for the pressure seal gasket to seat against the valve body. The body bore ID of 6-CK-62B has grown significantly (0.004") since it was last recorded in 1991.

Additionally, PNPS Procedure 3.M.4-49 relied on craftsmanship to ensure that the pressure sealing area was inspected after the bonnet was lowered into the valve.

EXTENT OF CONDITION:

The extent of the problem (leaking pressure seal) could extend to the 3 remaining feedwater (FW) check valves (6-CK-58A, 58B & 62A). All are disassembled and reassembled in every RFO following the same procedures. The work packages for the 3 remaining FW check valves were reviewed and no issues were identified and the valves were visually inspected during the forced outage for leakage and no leakage was noted. Because these valves have experienced similar operating conditions to 6-CK-62B it is very likely that if any of these valves had a propensity to leak due to scoring of the pressure seal area, some level of leakage would have already occurred. Therefore, the condition does not currently apply to these valves and there is low concern that leaks may develop during this cycle. In the unlikely event that another FW check valve exhibits leakage it will be more easily identified. If an inboard FW check valve develops leakage it will result in increased drywell unidentified leakage which is monitored daily by Operations and System Engineering

The corrective actions developed for the Root Cause relating to disassembly and assembly procedures will be applied to all 4 feed-water check valves.

CORRECTIVE ACTIONS:

The following corrective actions have been completed:

1] Disassembled and repaired check valve 6-CK-62B.

2] Walked down the steam tunnel to identify extent of damage and completed repairs to damaged equipment.

The following corrective actions are planned and are captured in the PNPS Corrective Action Program:

1] Revise PNPS Procedure 3.M.4-49 "Feedwater Check Valve Maintenance" to require Maintenance Management to inspect the body and bonnet seating surfaces. Add a step to visually examine the bonnet for cleanliness prior to lowering it into the valve body. Add a step to perform a final inspection of the sealing surfaces after installation of the bonnet but prior to installation of the pressure seal with Maintenance Management Concurrence.

2] Revise PNPS Procedure 3.M.4-49 "Feedwater Check Valve Maintenance" to include dimensional checks of the body seal area and bonnet.

ASSESSMENT OF SAFETY CONSEQUENCES:

The check valve leak and subsequent reduction in nuclear safety margin is mitigated by the demonstrated operability of upstream primary containment check valve 6-CK-58B and the limited extent of the leak.

From the onset of leakage from check valve 6-CK-62B, Pilgrim operated at a reduced margin in regard to nuclear safety. The primary containment function of check valve 6-CK-62B was compromised by the identified leak, resulting in a potential path for radioactive leakage outside primary containment.

There were no significant radiological or industrial safety concerns although additional dose was received in order to repair the valve and the risk of an industrial safety issue is increased anytime there is work required in the plant. The nuclear safety concerns were resolved by the check valve repair.

Condition of check valve 6-CK-58B

Feedwater check valve 6-CK-62B is in series with check valve 6-CK-58B to function as primary containment isolation valves for containment penetration X-9B. Had containment isolation been required, the inboard check valve, 6-CK-58B would have isolated; preventing containment and reactor vessel pressure and flow from exiting containment through the 'B' feedwater line. During RFO18, check valve 6-CK-58B was disassembled, inspected and the valve soft seat replaced in accordance with approved station procedures. Post work local leak rate testing was successfully performed in accordance with approved station procedures. As-left leakage at 45.4 psig was 120 standard cubic centimeters per minute (SCCM) or 0.12 standard cubic liters per minute (SLM).

The maximum allowable test leakage (L_a) as stated in Pilgrim Station Technical Specification section 3.7 bases is 1.0% of containment volume per day. The term L_a is defined in PNPS station procedures as 210.5 SLM by calculation. Based on the as-left leakage through check valve 6-CK-58B, leakage would have been a small fraction of L_a.

Based on the as-left condition of check valve 6-CK-58B, the worst case leakage from check valve 6-CK-62B would not have exceeded the assumed post-accident leak rate. Had the worst case accident – a Design Basis Accident (DBA) Loss of Coolant Accident, coincident with a Loss of Offsite Power – occurred with the observed leakage from check valve 6-CK-62B, release rates would have remained within design limits. While the margin of nuclear safety was reduced, there were no actual or potential consequences that would deviate from design limits or accident analyses.

Other affected equipment

Other safety related equipment in the steam tunnel could have been impacted by the water and steam leaking from check valve 6-CK-62B. This was investigated and evaluated utilizing the PNPS Corrective Action Program. Some minor repairs were performed and insulation on the High Pressure Coolant Injection (HPCI) and Feedwater lines needed to be replaced, but no safety significant problems caused by the leak were identified.

The check valve leak posed no threat to the public health and safety.

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PREVIOUS OCCURRENCES:

The PNPS Merlin database was searched for pressure seal leakage at PNPS. Several were identified.

Problem Report 95.0595 reported a leak in the pressure seal of Reactor Feed Pump Suction Valve 6-HO-441C. The leak occurred because of an assembly error attributed to time pressure on contractor maintenance.

Problem Report 01.2188 reported that signs of steam leakage were found during disassembly of Reactor Core Cooling Isolation (RCIC) Outboard Isolation Valve MO-1301-17.

Condition Report CR-PNP-2007-3368 reported that there was a 30 dpm leak from the pressure seal of Reactor Water Cleanup (RWCU) Blowdown Valve MO-1201-77.

REFERENCES:

Condition Report CR-PNP-2011-5228 associated with Root Cause Evaluation Report; Feedwater Check Valve 6-CK-62B Pressure Seal Leak contains reference to various station procedures.