FPL

FEB 2 1 2006

10 CFR § 50.73
L-2006-030

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

Re: Turkey Point Unit 3 and 4
Docket No. 50-250/251
Reportable Event: 2005-006-00
Date of Event/Discovery: December 21, 2005
Incorrect Installation of Inboard Journal Bearing in Auxiliary Feedwater Pump B

The attached Licensee Event Report 250/251-2005-006-00 is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(i)(B).

If there are any questions, please call Mr. Walter Parker at (305) 246-6632.

Very truly yours,

Terry Jones

Terry O. Jones
Vice President
Turkey Point Nuclear Plant

Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

IE22

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

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.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Turkey Point Unit 3	05000250	1 OF 7

4. TITLE

Incorrect Installation of the Inboard Journal Bearing in Auxiliary Feedwater Pump B

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
									Turkey Point Unit 4	05000251
12	21	2005	2005	- 006 -	00	2	21	2006	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

100

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

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☒ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☐ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Ron Everett - Licensing Engineer	305-246-6190

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
B	BA	p	I075	Y					

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
6	30	2006

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

On November 7, 2005, at about 12:30 EST with Unit 3 operating in Mode 1 at 100 percent power and Unit 4 shut down, a routine surveillance test of the "B" Auxiliary Feedwater (AFW) Pump was performed. Technical Specification 3.7.1.2 had been entered. The test was stopped due to elevated vibrations and temperature at the pump inboard journal bearing. On November 8, 2005, the "B" AFW pump was disassembled for inspection. It was found that the inboard journal bearing was installed 90 degrees from its required orientation. The maintenance history revealed that the bearing was incorrectly installed at the vendor's facility during the last pump overhaul in late August 2003. Action was taken to align the "C" AFW pump to AFW Train 2, thereby restoring the operability of two trains. An interim "past operability" assessment on December 21, 2005 reported that the pump may not have been able to fulfill its safety function mission run time. It is estimated that the "B" AFW pump would not have performed its mission run time, and was therefore inoperable from December 14, 2004 to November 11, 2005 in violation of Technical Specification 3.7.1.2. Corrective actions include replacement of the pump bearing and additional vendor oversight to prevent recurrence. There was no adverse impact on the health and safety of the public due to this event.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Turkey Point Unit 3	05000250	2005	- 006 -	00	Page 2 of 7

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

DESCRIPTION OF THE EVENT

On November 7, 2005, at about 12:30 EST with Unit 3 operating in Mode 1 at 100 percent power and Unit 4 shut down, a routine surveillance test of the "B" Auxiliary Feedwater (AFW) Pump (BA, P) was performed. Technical Specification 3.7.1.2, action 1, with a 72 hour allowed outage time, had been entered at 09:33 on November 7, 2005. The surveillance test was stopped due to elevated vibrations and temperature on the bearing housing at the pump inboard journal bearing. The vibration reading was 0.8 in/sec, exceeding the required action range for the surveillance test. Action was taken to align the "C" AFW pump to AFW Train 2, thereby restoring two trains to operability. Train 2 AFW was declared operable at 21:00 November 7, 2005 and Technical Specification 3.7.1.2, action 1 was exited. Restoration of Train 2 AFW was completed within the Technical Specification allowed outage time.

On November 8, 2005, the "B" AFW pump was disassembled for inspection. It was found that the inboard journal bearing was installed 90 degrees from its required position, blocking the oil supply to the bearing. The outboard journal bearing was inspected and no damage or specific wear was observed. The "B" pump inboard bearing was replaced with a new spare bearing and the oil system inspected and main oil reservoir cleaned out.

An extent of condition review was performed for the two other AFW pumps. A review of work order history for the "C" AFW Pump led to the conclusion that its inboard bearing was installed correctly. The inboard journal bearing of the "A" AFW Pump was inspected and verified to be correctly installed.

The installed pump is an Ingersoll-Rand 4-stage model CNTAM Pump, Size 2-1/2 CNTAM-4 which is driven by a Dresser-Rand 1-stage Terry Turbine model ZS-4N. The AFW Pump is capable of delivered flow of 466.8 gpm at 1121 psig (event involving two units). By design, the inboard bearing is a babbited journal bearing and the outboard bearing is a Kingsberry type thrust bearing with a journal bearing.

An interim "past operability" assessment reported on December 21, 2005 that the "B" AFW pump would not have been able to fulfill its safety function mission run time. It is estimated that the "B" AFW pump was inoperable from December 14, 2004 to November 11, 2005. As a result, during this time, one train of AFW would have been inoperable for more than 72 hours (in violation of Technical Specification 3.7.1.2). The associated Technical Specification action required by 3.7.1.2, action 1 is to either restore the inoperable train to an OPERABLE status within 72 hours or place the affected unit(s) in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours. The "B" AFW pump was also deemed to have been inoperable for at least a period of more than 30 days during this time period. This was also in violation of Technical Specification 3.7.1.2, which requires two independent AFW trains with three pumps operable in modes 1, 2, and 3 and restoration of an inoperable pump within 30 days. The associated Technical Specification, action 3 required by 3.7.1.2 is to verify OPERABILITY of two independent auxiliary feedwater trains, or follow ACTION statements 1 or 2 as applicable. Upon verification of the OPERABILITY of two independent auxiliary feedwater trains, restore the inoperable auxiliary feedwater pump to an OPERABLE status within 30 days, or place the operating unit(s) in at least

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Turkey Point Unit 3	05000250	2005	- 006	- 00	Page 3 of 7

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

HOT STANDBY within the next 6 hours (if applicable to both units simultaneously the time allowed to go to HOT STANDBY is 12 hours) and in HOT SHUTDOWN within the following 6 hours. These Technical Specification required actions were not performed.

ANALYSIS OF THE EVENT

The Turkey Point AFW System is a shared system between Units 3 and 4. It uses secondary steam to drive three AFW pump turbines (BA, TRB) which supply feedwater to the steam generators (AB, SG) during transients when the normal feedwater source is not available. Each AFW pump is 100% capacity. The system consists of two independent trains each capable of providing required flows to both units.

The Updated Final Safety Analysis Report (UFSAR) Chapter 14 accident analysis credits AFW for mitigation of several events. The UFSAR analyses include a total loss of main feedwater from 102% of rated thermal power, coincident with loss of AC power (UFSAR 14.1.12). The most limiting event is a dual unit loss of AC power with loss of main feedwater. The worst single failure in the auxiliary feedwater system (a loss of a single train, including two AFW pumps) is also assumed in this analysis. The consequences of the loss of AC power and main feedwater event assuming loss of one train of AFW bound the consequences that might result from the loss of the "B" AFW pump due to the incorrect installation of the journal bearing. (Additional information on the significance of the event will be provided in a supplement to this Licensee Event Report.)

Operability of the AFW system is determined by the ability of the AFW system to meet its required Technical Specification surveillance requirements. The surveillance requirements in Section 4.7.1.2.1.a.1 and 4.7.1.2.1.a.2 of the Technical Specifications state that the required independent auxiliary feedwater train shall be demonstrated operable by:

1. verifying by control panel indication and visual observation of equipment that each steam turbine-driven pump operates for 15 minutes or greater and develops a flow of greater than or equal to 373 gpm to the entrance of the steam generators; and
2. verifying by control panel indication and visual observation of equipment that the auxiliary feedwater discharge valves and the steam supply and turbine pressure valves operate as required to deliver the required flow during the pump performance test above.

Up until the surveillance test conducted November 7, 2005, the AFW pumps had met their respective Technical Specification surveillance requirements.

Technical Specification 3.7.1.2, action 1 requires either restoring the inoperable train to an OPERABLE status within 72 hours or placing the affected unit(s) in at least HOT STANDBY with the next 6 hours and in HOT SHUTDOWN within the following 6 hours. Action 3 requires that an inoperable AFW pump be returned to operable status within 30 days or the unit(s) placed in at least hot standby within 6 hours and in hot shutdown within the following six hours. Based upon the interim "past operability" assessment for required mission run time, neither of these requirements were satisfied.

CAUSE OF THE EVENT

At the time the pump was being overhauled, FPL site personnel were sent to facilitate and provide support of the repair of the pump. Sulzer Pumps is a qualified Appendix B pump supplier and is considered to be the subject matter expert. Consequently, FPL QA surveillance was focused on compliance with the work plan vs. workmanship oversight. After the pump was received and reinstalled, baseline testing revealed vibration was 0.3 in/sec, which was considered higher than expected. Based on the elevated vibration reading, more frequent vibration testing and oil sample analyses were performed. The analysis pointed to a pump alignment and/or pump baseplate voiding in the grout under the baseplate as potential causes. Condition based monitoring, including semi-annual vibration analysis, quarterly oil samples, and semi-annual thermography surveys being performed while the pump was in service (September 9, 2003 to November 7, 2005) did not detect the incorrect bearing installation. Oil sample results reviewed for the specified time period did not show a level of particles consistent with bearing wear, specifically tin. Both ferrographic analysis and filter patch testing did not reveal any conditions consistent with bearing degradation. Testing performed on a spare AFW pump with an incorrectly installed inboard bearing (to mimic the "B" AFW pump condition), resulted in little to no oil being supplied to the inboard bearing. Analysis of the vibration data and field evaluations did show several symptoms of misalignment and base degradation. Vibrations were trending up; however, other testing did not validate that a degraded internal condition existed. The base sounding identified concrete voids and evidence of soft foot under the pump inboard base. An error in alignment requirements was also found. The voids have been eliminated and the alignment criteria corrected. These symptoms focused corrective action attention on external causes for the elevated vibration levels, and masked consideration of any internal causes, since there was no indication of bearing damage from the routine oil samples.

On November 8, 2005, the "B" AFW pump bearing housing covers were removed. Inspection of the inboard journal bearing found that the bearing was installed incorrectly, with evidence of bearing wear, and degraded lubrication within the inboard bearing. A review of maintenance history concluded that no maintenance activities were performed on the inboard bearing housing since the pump was received from the vendor. The root cause of the high vibration levels identified during the surveillance test on November 7, 2005, was the incorrect assembly of the pump at the factory. This incorrect assembly resulted in inadequate lubrication to the bearing and caused flaking of the sleeve bearing babbit. A review of Sulzer's work instructions indicates that the installation of the bearing relied upon the skill of the worker rather than being procedurally driven. There was no specific step to verify bearing orientation. A Supplier Finding Report was sent in January 2006 to Sulzer Nuclear Service Center by FPL Group informing Sulzer of this event and the lack of adequate instruction or controls in their procedure to ensure proper bearing installation and orientation. The pump being assembled incorrectly by the vendor is the root cause of this event. A contributing cause of this event was insufficient vendor oversight.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Turkey Point Unit 3	05000250	2005	- 006	- 00	Page 5 of 7

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

REPORTABILITY

A review of the reporting requirements of 10 CFR 50.72 and 10 CFR 50.73 and NRC guidance provided in NUREG-1022, Revision 2, Event Reporting Guidelines 10 CFR 50.72 and 10 CFR 50.73, was performed for the subject condition. Additionally, FPL had a consultant perform an evaluation of the as-found status of the "B" AFW pump. The consultant's report has concluded that, although the pump would have continued to operate for a period of time (two to six hours), it is unlikely that the pump would have operated for the required safety function mission duration associated with a postulated loss of AC power event coincident with loss of main feedwater. From December 14, 2004 to November 11, 2005, either one or both units were in modes 1, 2, or 3 for periods exceeding 30 days. During this time, one train of AFW would have been inoperable for more than 72 hours. Technical Specification 3.7.1.2, action 3 requires that an inoperable AFW pump be returned to operable status with 30 days. Technical Specification 3.7.1.2, action 1 requires either restoring the inoperable train to an OPERABLE status within 72 hours or placing the affected unit(s) in at least HOT STANDBY with the next 6 hours and in HOT SHUTDOWN within the following 6 hours. Therefore, Technical Specification 3.7.1.2, actions 1 and 3 were not met, and the condition is reportable in accordance with 10CFR50.73 (a)(2)(i)(B).

A review of the root cause indicates that the requirements of 10CFR21 are applicable in additional to 10CFR50.73. In accordance with 10CFR21, the evaluation and reporting of defects under 10CFR50.73 satisfies the evaluation, notification, and reporting obligation to report the identified defects under 10CFR21.

Based on NUREG-1022, Rev. 2, the event date that was assigned to determine the start of the 60-day reporting requirement of 10CFR50.73 (a)(1) was December 21, 2005 (the discovery date). This is the earliest date following the pump surveillance test, whereupon, sufficient past-operability evaluation had been completed to first indicate that the "B" AFW pump would likely not have been capable of meeting its safety function mission time, sometime in the past two years for a time period greater than 30 days.

ANALYSIS OF SAFETY SIGNIFICANCE

This event had no effect on the health and safety of the public. The UFSAR analyses in Chapter 14 credit AFW system operation for the Loss of Normal Feedwater, Loss of Offsite Power, Steam Generator Tube Rupture, Main Steam Line Break and Small Break Loss of Coolant Accident events. The UFSAR analyses assume total loss of main feedwater from 102% of rated thermal power, coincident with loss of AC power (UFSAR 14.1.12). The most limiting event is a dual unit loss of AC power with loss of main feedwater. The worst single failure in the auxiliary feedwater system (a loss of a single train, including two AFW pumps) is also assumed in this analysis. The consequences of the loss of AC power and main feedwater event assuming loss of one train of AFW bound the consequences that might result from the loss of the "B" AFW pump due to the incorrect installation of the journal bearing.

In the event of a complete failure of the Auxiliary Feedwater System, there are also two non-safety grade standby steam generator feedwater pumps (one pump is diesel driven and the other motor driven) available

to supply water from the demineralized water storage tank (TK). These pumps are required to be operable in accordance with Technical Specifications 3.7.1.6.

The final safety significance determination of this event will be included in the scheduled supplement to this report.

CORRECTIVE ACTIONS

Immediate Corrective Actions:

1. Performed an as-found condition evaluation of the "B" AFW pump and determined what repairs or inspections were necessary.
2. Performed an extent of condition review on the remaining AFW pumps.
3. Disassembled, inspected and repaired the "B" AFW pump, including replacement of the inboard journal bearing. Pump vibration and bearing temperature levels returned to levels that are consistent with historical performance, prior to the incorrect bearing installation. Actions were taken to eliminate grout voids and correct the alignment criteria. The pump was successfully returned to service.
4. Disassembled the "A" AFW pump inboard bearing and validated that the bearing was correctly installed. Confirmed that the "C" AFW pump inboard bearing was correctly installed, based upon reviews of the pump work order history.

Long Term Corrective Actions:

1. Review the Sulzer vendor procedure(s) used to overhaul the AFW pump to determine whether the proper level of inspections are present to assure that all critical measurements/fits are correct and properly documented. An appropriate verification method for ensuring that the pump bearings are properly oriented prior to installing the top bearing covers is being developed.
2. Evaluation of Generic Implications of this event for vendor administrative controls will continue for other critical equipment/components. An improvement in vendor oversight and quality of materials is a long term activity to improve the vendor control process. This is focused on providing appropriate technical purchase/repair guidance in the procurement and contracting process to ensure that delivered products will perform their intended functions, without experiencing unexpected defects from materials or workmanship.
3. The root cause analysis is in the final approval stage. Any changes will be reported in a supplement to the Licensee Event Report (LER) along with any additional corrective actions and final safety significance determination.

ADDITIONAL INFORMATION

This Licensee Event Report has been prepared based on the information available at this time. A supplement will be submitted, providing the final results of the root cause evaluation and safety significance

determination. EIIS Codes are shown in the format [EIIS SYSTEM: IEEE system identifier, component function identifier, second component function identifier (if appropriate)].

FAILED COMPONENTS IDENTIFIED: The "B" AFW Pump

SIMILAR EVENTS:

A review of the LERs issued over the last three years, specifically on the Auxiliary Feedwater System, revealed no similar occurrences. However, one LER 2004-007-01, dealing with a Manual Reactor Trip Due to Generator Exciter Turbine Cooling Water Leaks, had a similar root cause: poor workmanship on the part of a vendor.