FPL

MAY 0 5 2006

10 CFR § 50.73
L-2006-117

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

Re: Turkey Point Unit 3
Docket No. 50-250
Reportable Event: 2006-003-00
Failure of RHR MOV 3-744B, Cold Leg Isolation Valve

The attached Licensee Event Report 250-2006-003-00 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,

M. Reance For

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 5

4. TITLE
Failure of RHR MOV 3-744B, Cold Leg Isolation 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
3	6	2006	2006	- 003 -	00	5	5	2006	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE
4

10. POWER LEVEL
0%

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	BO	MO	L200	Y					

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On March 6, 2006, at approximately 0840, with Unit 3 in Mode 4 during a refueling outage, Motor Operated Valve MOV-3-744B failed to open in response to a manual demand signal. Subsequent investigation determined that its power supply breaker 30613 had tripped. With power restored, MOV-3-744B indicated mid-stroke via dual position indicating lights. Reports from Operations personnel indicted that the valve moved far enough on the initial demand for the position indicating light to change from closed to mid-position. On March 7, 2006, the valve was manually opened via the hand wheel and the motor was removed from the operator. Upon inspection, the rotor fins had damaged the windings in two places and caused an electrical fault that tripped the breaker. The motor was sent to an independent vendor who reported that the failure was due to corrosion of the magnesium rotor fins and shorting bar. The failed motor was replaced on March 10, 2006. It was determined that the valve would most likely have failed on demand, while operating at power. The valve was considered inoperable at some time during the operating cycle. This condition was in violation of Technical Specification 3.5.2.e, which requires two OPERABLE flow paths capable of taking suction from the containment sump. The event caused no adverse impact on public health or safety.

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

DESCRIPTION OF THE EVENT

On March 6, 2006, at approximately 0840, with Unit 3 in Mode 4 preparing for a refueling outage, Motor Operated Valve MOV-3-744B failed to open in response to a manual demand signal. Subsequent investigation determined that its power supply breaker 30613 had tripped. With power restored, MOV-3-744B indicated mid-stroke via dual position indicating lights. Operations personnel reported that the valve moved far enough on the initial demand for the position indicating light to change from closed to mid-position. On March 7, 2006, the valve was manually opened via the hand wheel and the valve motor [V, MO] was removed from the operator. Upon inspection, the rotor fins had damaged the windings in two places and caused an electrical fault that tripped the breaker. The motor was sent to an independent vendor for further diagnostics; the vendor reported that the failure was due to corrosion of the magnesium rotor fins and shorting bar. The failed motor was replaced on March 10, 2006.

Technical Specification 3.5.2.e requires two OPERABLE flow paths capable of taking suction from the containment sump. The condition of MOV-3-744B was considered in violation of this technical specification, since evaluation of its condition revealed that it could have failed on demand at some indeterminate time during the operating cycle, prior to the refueling. This would have prevented the valve from performing its safety function of providing two OPERABLE flow paths from the containment sump. The event caused no adverse impact on public health or safety.

ANALYSIS OF THE EVENT

MOV 3-744B is a normally closed, motor operated valve that is required to provide the following safety-related functions:

1. Automatically open on receipt of a Safety Injection signal to establish a low-head injection flowpath to the three RCS [AB] cold legs.

2. Close in response to a remote-manual signal during the Loss of Coolant Accident [LOCA] recirculation phase to provide a containment barrier.

3. Passively maintain the pressure boundary integrity of the RCS and RHR [BO] systems.

Additionally, it provides the following Quality-related functions:

1. Remaining closed during normal operation to provide a pressure barrier (redundant to various check valves) against RCS leakage into the RHR system, and

2. Open to provide a reactor coolant return flowpath from RHR to the RCS during shutdown cooling operations, following a postulated fire that requires control room evacuation. It is on the Appendix R Essential Equipment List (Drawing 5610-M-723, Rev. 19).

The past operability evaluation determined that the valve may not have opened upon demand at an indeterminate time while the reactor was at full power. Therefore, it was assumed that Technical Specification 3.5.2.e that requires two OPERABLE flow paths capable of taking suction from the containment sump, was violated, since the valve may not have opened upon demand, thereby making one flowpath inoperable for an indeterminate length of time. Consequently, this event was considered reportable under 10CFR50.73(a)(2)(i)(B).

CAUSE OF THE EVENT

The motor was sent to an independent vendor to determine the reason for the motor failure. A rotor shorting ring and several associated fan blades were found to be discolored and distorted, with pieces broken off of the shorting ring and fan blades. It was determined that this condition occurred due to oxidation/corrosion of the magnesium rotor's fans and shorting ring; this condition is typically accompanied by the appearance of a grayish-black powdery residue on the destroyed pieces (as was evident on this rotor). It is believed that such corrosion of the magnesium alloy in this type of application is a result of exposure to high temperatures and high humidity (see IEEE Transactions on Energy Conversion, Volume 3, Number 1, March 1988, "An Investigation of Magnesium Rotors in Motor Operated Valve Actuators"). Visual inspection of the windings revealed evidence of rotor contact with the end-turns of the motor windings.

The rotor fins began to spread outward as the oxidation/degradation occurred; one fin eventually came into contact with the end-turns and created a turn-to-turn short in the area of the damage. There were two areas where the paint and varnish had been removed by rotor contact, leaving magnet wire exposed. There were also localized areas on both ends of the winding that were blackened due to insulation breakdown caused by the winding failure. There was no indication of rotor-to-stator contact.

The motor's condition indicated that the rotor, and ultimately the entire motor, failed due to the oxidation/corrosion of its magnesium fan blades and shorting ring. As the oxidation/corrosion progressed, portions of the shorting ring and fan degraded and distorted. The rotor fan blades eventually came into contact with the winding end-turns and nicked the conductors. The initial failure was most likely a turn-to-turn short in one of the areas where the rotor fan blades came into contact with the stator windings. A turn-to-turn short would result in excessive currents and localized heating that would begin to break down the coil insulation until a phase-to-phase or phase-to-ground short developed in the slot.

Although these conditions were found during the Unit 3 Cycle 22 Refueling Outage (RFO), there is no conclusive data that either support or refute the possibility that these conditions existed prior to shutdown (during normal power operations). As such, the valve's safety related functions to automatically open upon receipt of a Safety Injection signal or to close in response to a remote-manual signal during the LOCA recirculation phase may not have been met.

The Turkey Point evaluation of NRC Information Notice IN 86-02, "Failure of Valve Operator Motor during Environmental Qualification Testing," concluded that the failures of the magnesium rotors were due to the extreme temperatures used in the qualification testing for these motors and that these temperatures were much more severe than those postulated for Turkey Point. Therefore, no additional actions were taken in response to the Information Notice.

The root cause analysis also identified that the Operating Experience (OE) review failed to recognize and address a potential long-term degradation mechanism via required inspections or preventive maintenance. It is important to note that all large Limitorque AC motors (Frame size 180 and larger) including new, replacement motors use a magnesium alloy rotor material that is potentially susceptible to this long-term degradation.

Data supplied by Limitorque to the NRC in NRC IN 86-02 indicated that motors with frame sizes 180 and larger generally use the type of magnesium rotor that was installed in MOV-3-744B. A list of all safety related MOVs that have these motors was identified for Turkey Point. The use of these motors is limited to the RCS RHR injection flow path valves for both Unit 3 and Unit 4 (MOV-*-744A/B, where * connotes both units).

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. The past operability evaluation determined that the valve may not have opened upon demand at some indeterminate time in the past, while the reactor was at full power. Therefore, it is concluded that the condition of MOV-3-744B was in violation of Technical Specifications 3.5.2.e that requires two OPERABLE flow paths capable of taking suction from the containment sump for some period greater than the allowed outage time. This event is reportable under 10CFR50.73(a)(2)(i)(B).

ANALYSIS OF SAFETY SIGNIFICANCE

An assessment of the risk significance of the failure of MOV-3-744B to perform its Safety Related functions was made by the FPL Probabilistic Risk Assessment Group. The increase in core damage frequency (CDF), due to MOV-3-744B being Out of Service, was calculated to be 1.3E-07 per year. Assuming the Out of Service duration was 9 months, based on the T/2 methodology, the increase in core damage probability was (1.3E-07 per year) x (9 months)/(12 months/year) = 9.8E-08. This was well below the safety significant threshold of 1E-06; the failure of MOV-3-744B was not risk significant. This event had no effect on the health and safety of the public.

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

With respect to the Unit 4 safety-related valves potentially subject to the same subject conditions as MOV-3-744B, performing the inspections of these valves during the next refueling outage was justified based on the low safety significance of the failure of the MOVs (as described above), coupled with the low probability of this type of failure (only five similar failures at U.S nuclear units in Operating Experience), would not result in a significant increase in risk to nuclear safety.

CORRECTIVE ACTIONS

Immediate Corrective Actions:

1. Replaced the failed MOV-3-744B motor.
2. Performed an investigation focused on the maintenance and testing history of similar valves/actuators to identify any potential similarities or failures. Performed an extent of condition review to identify other potentially affected MOVs. The only safety related MOVs were the MOV-*-744 series valves (4 total).
3. Performed a boroscopic of the MOV-3-744A motor, with no indication of similar degradation.
4. The vendor examined the failed motor and reported the motor failure was due to corrosion of the magnesium rotor fins and shorting bar.

Long Term Corrective Action to prevent recurrence:

1. Revise the existing PMs for MOV 3(4)-744A/B to perform boroscopic motor inspections. Initially, these inspections will be performed on a 36-month frequency to coincide with the existing EQ inspection. This frequency was conservatively selected based on the fact that the subject failure occurred after the motor had been in service for 21 to 29 years. If acceptable results are obtained for two consecutive inspections, the inspection frequency may be extended to 72 months.
2. Inspect MOVs 4-744A and 4-744B at the next Unit 4 refueling outage.

ADDITIONAL INFORMATION

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

FAILED COMPONENTS IDENTIFIED: MOV 3-744B Motor

SIMILAR EVENTS:

A review of the LERs issued over the last three years, revealed no similar occurrences.