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10 CFR § 50.73
L-2005-184

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

Re: Turkey Point Unit 4
Docket No. 50-251
Reportable Event: 2004-004-01
Date of Event: December 25, 2004
Manual Reactor Trip Due to Lowering Condenser Vacuum

The attached Licensee Event Report 251/2004-004-01 is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(iv)(A) to provide updated information regarding the cause of the event and additional corrective actions.

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 4	05000251	1 OF 4

4. TITLE
Manual Reactor Trip Due to Lowering Condenser Vacuum

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
12	25	2004	2004	- 004 -	01	10	21	2005	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	SG	COND	F175	N					

14. SUPPLEMENTAL REPORT EXPECTED

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

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
08	15	2005

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

On December 25, 2004, at 07:36 EST with Unit 4 operating in Mode 1 at 100 percent power, Turkey Point Unit 4 experienced a declining vacuum in the main condenser. When condenser vacuum reached less than 22 inches Hg, reactor trip criteria was met and the plant was manually shut down. Decay heat was removed via the Atmospheric Steam Dumps. The Auxiliary Feedwater System automatically started as expected. All rods inserted correctly and all systems functioned as designed. The apparent cause of the lowering condenser vacuum was failure of a turbine slop drain line inside the condenser. Corrective action was taken to temporarily plug the inlet and outlet ends of the leaking slop drain until the condenser could be accessed and permanent repairs completed during the 2005 Spring Refueling Outage. The apparent cause of the failed slop drain line was determined to be a poor bi-metallic weld coupled with a weak joint design and inadequate supports. Lab analysis of the failed bi-metallic weld indicated it failed in high cycle fatigue. Failure of both of the piping U-bolt supports allowed vibration to cycle the bi-metallic weld to the point of failure. The health and safety of the public were not affected by this event. Unit 3 is susceptible to the same failure; therefore, the slop drains have been plugged. They will have similar repairs in the next refueling outage.

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Turkey Point Unit 4	05000251	2004	- 004 -	01	Page 2 of 4

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

DESCRIPTION OF THE EVENT

On 12/25/04 Unit 4 experienced a sudden loss of condenser [EIIS: SG] vacuum. Annunciator E-5/3, Condenser Lo Vacuum alarmed [EIIS: SG, PI]. Operators noted one pressure indicator (PI) at 27 inches Hg and one PI at 24.5 inches Hg and lowering rapidly. Operations staff noted Gross Generation had lowered 40 MWe and referred to station Alarm Response Procedures and Off-Normal procedures for actions to restore condenser vacuum. The Steam Jet Air Ejector Hogging jet [EIIS:SB, P] was placed in service to restore vacuum and the operators commenced reducing turbine load. However, vacuum could not be recovered and the reactor was manually tripped when vacuum decreased to about 22 inches Hg.

Actions to resolve the cause of the condenser vacuum loss were completed, and Unit 4 was restarted on 12/26/04. In accordance with 10CFR 50.72(b)(2)(iv)(B), a four-hour Emergency Notification System report was made to the NRC Operations Center on December 25, 2004, at 08:50 (Event Number 41292) for the manual reactor trip.

ANALYSIS OF THE EVENT

At the time of the event, the plant was in Mode 1 at 100% power with automatic Reactor Coolant System [EIIS: AB] (RCS) pressure control operational. A 100% loss of load resulted when the turbine was tripped by the manual reactor trip due to lowering condenser vacuum. The plant response for this trip was comparable to that for a loss of electrical load event due to a turbine trip, analyzed in UFSAR section 14.1. UFSAR minimum and maximum values were not exceeded during this transient. The Auxiliary Feedwater System [EIIS: BA] auto-initiated as required, due to the expected decrease in steam generator levels below 10% narrow range on a reactor trip from 100% power. The 4C Charging pump [EIIS: CB, P] was started during the event to maintain RCS inventory. The RCS pressure remained below the setpoint for pressurizer PORV or Code safety valve actuation. No unexplained aspects of this transient, when compared to the UFSAR, were noted.

CAUSE OF THE EVENT

The Unit 4 manual reactor trip was in response to decreasing condenser vacuum. A subsequent inspection determined that the decreasing condenser vacuum was a result of a leak in one of the turbine slop drains. The slop drain system drains oil and water leaking from the bearing and gland seals on both ends of the LP1 and LP2 (low pressure) turbines. The four 1¼-inch lines are routed through the condenser and join together at a common oil waste drain. The condenser air in-leakage was stopped by temporarily plugging the leaking slop drain at the inlet and outlet. The conditions causing the event are applicable to the remaining seven slop drain pipes for Units 3 and 4. Therefore, these drains were likewise plugged. A failure analysis of the failed weld in the slop drainpipe on the south condenser south wall was performed once the condenser internals could be accessed (during the 2005 Unit 4 Cycle 22 refueling outage). Examination of the failed bi-metallic weld revealed lack of penetration in the weld root and possible lack of fusion. Porosity was also

observed in the weld. The areas that were not properly fused acted as an ideal path for a fatigue crack. It is suspected the steam flow from the turbine induced vibration on the line caused the support U-bolts to fail because of inadequate pipe support (not enough angle supports.) Once the pipe had no restraint, vibration cycled the inadequate bi-metallic weld to the point of failure. The piping was also fit up at an angle to the socket, which may have led to undue external stresses from vibration for which the joint was not designed.

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. As a result of this review, the condition is reportable as described below.

10CFR50.73(a)(2)(iv)(A) states that the licensee shall report any event or condition that resulted in a manual or automatic actuation of any of the systems listed in 10CFR50.73(a)(2)(iv)(B). Systems to which the requirements of 10CFR50.73(a)(2)(iv)(A) apply include the Reactor Protection System (RPS) actuation resulting in a reactor scram or manual trip (10 CFR 50.73(a)(iv)(B)(1). Unit 4 was manually tripped in response to the lowering condenser vacuum. The event is also reportable in accordance with 10 CFR 50.73 (a)(2)(iv)(A), due to MSIV closure (10 CFR 50.73(a)(2)(iv)(B)(2)), and AFW system actuation (10 CFR 50.73(a)(2)(iv)(B)(6)).

ANALYSIS OF SAFETY SIGNIFICANCE

This event had no significant effect on the health and safety of the public. A manual reactor trip was initiated in response to the lowering condenser vacuum. All safety systems operated as designed; and no unexplained aspects of this transient, when compared to the UFSAR, were noted. Therefore, there were no actual safety consequences for the event. The condenser continued to function as a heat sink and condenser steam dumps remained operable throughout this event. Post-trip reviews established that plant parameters were within UFSAR analyzed minimum and maximum values for a loss of load event. No radiological release occurred. Therefore, the health and safety of the public were not affected by this event.

CORRECTIVE ACTIONS

Short Term - As an interim repair, the inlet and outlet ends of the leaking slop drain were plugged. The other slop drains on both units were plugged.

Long Term - During the 2005 Unit 4 Cycle 22 refueling outage, the failed slop drain pipe and the rest of the Unit 4 slop drains (total of four) were repaired, utilizing a repair design that had more support and is more resistant to vibration. The repairs will be inspected during the next unit 4 refueling outage to confirm the effectiveness of the repair and the drains opened as appropriate.

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

Engineering will develop a repair package for the Unit 3 slop drains similar to that done for Unit 4. Currently, the Unit 3 slop drains are plugged. They will be repaired like Unit 4 during the next Unit 3 refueling outage. Engineering will determine if plugging is required for the Unit 3 slop drains following their repair.

Additionally, the weld control manual is to be revised to add augmented inspection requirements for non-nuclear safety welds critical to unit operation.

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: SLOP DRAIN INTEGRITY FAILURE

SIMILAR EVENTS

A review of previous Licensee Event Reports identified LER 2001-003-00, Manual Reactor Trip Due to Low Condenser Vacuum. However, the root cause was different: inadequately designed sensing lines for the control room condenser vacuum instrumentation and the turbine low vacuum alarm.

However, a review of past condition reports revealed that Unit 3 experienced a similar sudden loss of condenser vacuum, with vacuum decreasing to approximately 23 inches and power decreasing to 667 megawatts. The turbine slop drain piping was found to be the source of the air inleakage causing the vacuum loss (CR 2003-2861).