FPL

10 CFR § 50.73
L-2005-16
January 27, 2005

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

Re: Turkey Point Unit 3
Docket No. 50-250
Reportable Event: 2004-004-00
Date of Events: November 29 and 30, 2004
Plant Shutdowns Due to Drop of Shutdown Bank Rod E-11 During Low Power Physics Testing

The attached Licensee Event Report 50-250/2004-004-00 is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(i)(A) and 10 CFR 50.73(a)(2)(iv)(A) to provide notification of the subject events.

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)

(See reverse for required number of digits/characters for each block)

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Turkey Point Unit 3	05000250	1 OF 7

4. TITLE

Plant Shutdowns Due to Drop of Shutdown Bank Rod E-11 During Low Power Physics Testing

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 05000
11	29	2004	2004	- 004 -	00	1	27	2005	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE: 2

10. POWER LEVEL: 0

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

NAME	TELEPHONE NUMBER (Include Area Code)
Paul F. Czaya – Licensing Engineer	305-246-7150

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

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)*	☒ NO				

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

At Turkey Point Unit 3, on November 29, 2004 at approximately 0009 hours, the reactor was manually tripped as a result of Shutdown Bank B rod E-11 dropping into the core during low power physics testing. After troubleshooting and recommencing low power physics testing, Shutdown Bank B rod E-11 again dropped into the core on November 30, 2004. The reactor was manually tripped at 0920 hours for this occurrence. In each event the dropped rod condition placed the unit in Technical Specification 3.0.3 requiring a shutdown. For each event the unit was subcritical in Mode 2 as a result of the dropped rod prior to the reactor trip. The apparent cause is attributed to an intermittent contact in a pin in the CRDM coil stack connector associated with rod E-11. A displaced pin in the connector caused the intermittent contact. The displaced pin was due to an inadequate vendor procedure that did not specify pin inspection prior to mating the connector halves, and cable routing that did not consider connector alignment, which complicated the mating process. The E-11 coil stack connector pushed pin was reseated, a bent pin aligned and the connector was properly mated. Vendor and plant procedures, used to mate the cable to the CRDM coil stack connectors (as well as the rod position indicator coil stack connectors), will be revised to help ensure proper connector mating. The dropped rod events did not compromise the health or safety of plant personnel or the general public and there was no increase in risk.

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DESCRIPTION OF THE EVENT

At Turkey Point Unit 3, on November 29, 2004 at approximately 0009 hours, the reactor [EIIS: AC, RCT] was manually tripped as a result of Shutdown Bank B rod [EIIS: AA, ROD] E-11 dropping into the core during low power physics testing. The dropped rod condition placed the unit in Technical Specification 3.0.3 requiring a shutdown.

After troubleshooting and recommencing low power physics testing, Shutdown Bank B rod E-11 again dropped into the core on November 30, 2004. The reactor was manually tripped at 0920 hours for this occurrence. The dropped rod condition again placed the unit in Technical Specification 3.0.3 requiring a shutdown.

These events are reportable in accordance with 10 CFR 50.73(a)(2)(i)(A) and 10 CFR 50.73(a)(2)(iv)(A). While these are two separate events, they are reported together since they are nearly identical. The dropped rod events involved the same rod (E-11), occurred within a short period of time (approximately 33 hours), were caused by the same condition and had the same consequences.

BACKGROUND

The rod cluster control assemblies (RCCAs or rods) are used to add negative reactivity to the reactor core. During reactor startup, RCCAs are withdrawn from the reactor core. To shut down the reactor, RCCAs are inserted into the core. There are forty-five RCCAs. In addition to the RCCAs, adjusting boric acid concentration in the reactor coolant system [EIIS: AB] also controls reactivity. The rods are divided into two categories according to their function. Some rods compensate for changes in reactivity due to variations in operating conditions of the reactor such as power or temperature. These rods comprise the control group of rods. The remaining rods, which provide shutdown reactivity, are termed shutdown rods. The total shutdown worth of all the rods is also specified to provide adequate shutdown with the most reactive rod stuck out of the core.

RCCA movement is effected through the use of a control rod drive mechanism (CRDM) [EIIS: AA, DRIV]. Each RCCA has an associated CRDM located on the reactor head. The CRDM is used to position the rod within the core. The CRDM uses magnetic forces to lift and hold the rod. To move the RCCA up or down, one step at a time, the Rod Control System [EIIS: JD] sequentially energizes and de-energizes three coils [EIIS: AA, CL] in the CRDM. The three coils are the stationary gripper, moveable gripper, and lift coil. To hold the RCCA in place, the system maintains a low-level current through the stationary gripper coil. Signals to the coils are provided from the rod control cabinet [EIIS: JD, CAB] by a cable [EIIS: JD, CBL] to the reactor head assembly. The cable is segmented at the reactor bulkhead [EIIS: AC, BHD] to allow for head removal.

The Rod Control System is a solid state electronic control system consisting of four power cabinets, one logic cabinet, and the DC hold cabinet. The logic cabinet generates current regulating signals that are used by the power cabinets, based upon the speed, direction, and selected bank control input signals. The power cabinets generate and deliver power to the CRDM coils based upon the signals received from the logic cabinet. Power to the system is delivered via the reactor trip breakers [EIIS: JC, BKR] from two motor-generator sets [EIIS: ED, MO-GEN].

The forty-five CRDMs are divided among the four power cabinets. Each cabinet supports three groups of approximately four CRDMs. Only one group may be moved at a particular time while the other groups are held stationary. For a control rod to fall, the stationary gripper mechanism and moveable gripper mechanism must simultaneously release their grip.

Low power physics testing is performed to verify reactor core design and establish reactivity control and monitoring parameters for a new operating cycle.

During low power physics testing on Sunday, November 28, 2004 at 2334 hours rod E-11 in Shutdown Bank B (SBB) dropped fully with the shutdown bank at 221 steps (230 steps is the maximum withdrawal position). After troubleshooting and post maintenance testing, rod E-11 was returned to service at approximately 0523 hours on November 30, 2004. At 0850 hours on November 30, 2004, SBB rod E-11 dropped to 135 steps from 230 steps during physics testing with the remainder of SBB stopping at 227 steps.

In each event, the operations crew exited the low power physics test procedure (0-OSP-040.16) thereby exiting Technical Specification (TS) Special Test Exception (STE) 3.10.3. STE 3.10.3 allows the limitations of TSs 3.1.1.3, 3.1.1.4, 3.1.3.1, 3.1.3.5 and 3.1.3.6 to be suspended during performance of physics tests. By exiting low power physics testing and associated STE 3.10.3, the suspended TSs were again applicable in Mode 2 (Unit 3 was in Mode 2 during each rod drop event).

Technical Specification 3.1.3.5 requires all shutdown rods to be fully withdrawn in Modes 1 and 2. Since all of the SBB rods were not fully withdrawn (230 steps) and since the Action statement only addresses the condition of one rod not fully withdrawn, there is no TS provision relative to the condition of SBB at the time of the drop of E-11. Off-normal procedures prohibit rod withdrawal when a rod drops so compliance with LCO 3.1.3.5 could not be achieved. As a result in each event, the operations crew declared that the unit had entered TS 3.0.3, manually tripped the reactor and reported the event in accordance with 10 CFR 50.72(b)(2)(i) – initiation of plant shutdown required by TSs. Plant response to the reactor trip was as expected for each event with all withdrawn rods fully inserting.

Following the first dropped rod occurrence, an Event Response Team was formed to direct the investigation and a troubleshooting plan was developed. Based on finding no specific problem and successful rod movement as part of testing, no repairs were made.

SBB rods E-11 and E-5 were instrumented with a recorder [EIIS: IO, IR] to monitor the stationary and movable gripper coil current levels. Rod E-11 was returned to service and procedure 0-OSP-040.16, Initial Criticality after Refueling and Nuclear Design Verification, was recommenced. Rod E-5 was instrumented for comparison to rod E-11. When SBB rods were withdrawn to 230 steps both E-5 and E-11 showed nearly identical and ideal moving and stationary coil currents. When SBB was inserted from 230 steps it was noted that rod E-11 dropped into the core to about 135 steps. Examination of the recorder traces

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revealed that rod E-5 had the expected movable and stationary gripper coil current traces; however, rod E-11 had no movable gripper coil current traces. The movable gripper coil circuit for rod E-11 remained open after the second drop thereby facilitating troubleshooting. It did not remain open after the first drop.

Subsequent troubleshooting found a pushed pin in the CRDM coil stack connector [EIIS: AA, CON]. When maintenance personnel disconnected the CRDM coil stack connector cable at the reactor head, they discovered that pin E of the CRDM coil stack connector had been pushed back into the connector shell to at least half of its proper height. Additionally, pin D was offset from the expected vertical alignment. A mark on the cable side of the connector insert indicated that the pushed pin was properly aligned with its mating socket when the connector was made up.

CAUSE OF THE EVENT

The apparent cause is attributed to an intermittent contact in a pin in the CRDM coil stack connector associated with rod E-11. A displaced pin in the connector caused the intermittent contact. The displaced pin was due to an inadequate vendor procedure that did not specify pin inspection prior to mating the connector halves, and cable routing that did not consider connector alignment, which complicated the mating process.

ANALYSIS OF THE EVENT

The CRDM coil stack for rod E-11 is one of 45 new units installed during Unit 3's recent refueling outage as part of the replacement reactor vessel closure head (RVCH) assembly. The CRDM coil stack connector has two larger pins and four smaller pins. The larger pins are for the lift coil and the smaller pins are for the stationary and moveable coils.

An inspection of the old and new pinned connectors used on the CRDM coil stack did not reveal any specific differences other than the new connector insert has a softer blue silicon rubber. By inspection, the receptacle pins are similarly machined. There were no obvious differences other than the insert color and firmness. Because of the resilient silicon rubber connector insert the rigidity of the pins is less on the new connector. With little force a pin can be made to move tangentially to a small degree.

The tolerances on the connector body and the forces needed to mate the connector under ideal conditions preclude the misalignment of pins. Without pushing on the pins, or performing a close visual inspection it is possible to miss noting a pin is not properly seated. The force needed to mate the connectors is not excessive, although there needs to be sensitivity to the alignment of the connector halves.

Coil stack testing performed by the vendor prior to shipment contained no documented inspection step that visually or dimensionally verified the connectors had all pins fully extended and vertically straight after performance of the tests.

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The refueling crew performed the mating of the connectors to the cables on the head assembly while it was on the headstand. The refueling team supervisor visually observed each CRDM coil stack connector and did not see anything obvious with respect to misaligned pins. The supervisor indicated that the difficulty with the connectors was not mating but rather final turning of the connector shell to align the yellow alignment dots. Given the short height of the shell ring and limited access, the last few degrees of rotation of the connector were the critical activity. The refueling team reported that the connector halves went together easily. There was no plan or thought to separate and visually inspect pins after the original mating of the connector.

The difficulty in mating the connector halves together in the field was not foreseen when installing the cables on the new integrated head assembly. Given the short length of cable from the messenger wire support to the connector, there was insufficient cable length to freely align and engage the connector slot and key. The crew did not discuss the alignment difficulty or the consequences of incorrect connector mating.

Plant procedure 3-GMI-028.4 has a precaution to carefully inspect the pins of the connectors on the CRDM coil stack and cavity edge connectors. It directs firmly pushing in on the pins with an index finger to verify pins are not loose. It also directs inspection of each pin for foreign material, corrosion or other defects. This procedure was revised prior to the start of the outage but was not used for this installation since plant maintenance personnel were not scheduled to perform this activity. Similar inspection requirements were not included in the vendor procedure for making the connections. The vendor procedure directed the completion of the connection of the CRDM coil stack with its respective cable. The procedure has a step to visually inspect the connector for damage. There were no specific actions to inspect pins and to verify that they were seated and aligned properly. Since post modification testing for the RVCH modifications was performed to this procedure rather than the plant procedure, detailed inspection steps to verify the integrity and alignment of connector pins and receptacles were not included.

Following troubleshooting, the connector was repaired and tested following the second rod drop event. Testing confirmed that the pushed connector pin for rod E-11's movable coil circuit was the cause of the second rod drop event. The pushed pin failure also explained the first rod drop rod event and the intermittent nature of the problem. Vibration associated with continuous rod stepping resulted in loss of pin connection continuity.

Subsequent to connector repair, rod E-11 performed as expected during low power physics testing.

The design of the new integrated reactor head assembly does not require the coil stacks to be disconnected at the reactor head during a normal refueling outage. Only if CRDM or coil stack inspection, maintenance of modification is performed might it be necessary to undo a coil stack connector.

Reportability

A review of the reporting requirements and NRC guidance provided in "Event Reporting Guidelines," 10 CFR 50.72 and 10 CFR 50.73 (NUREG-1022, Rev. 2) was performed for the subject events. As a result of this review, the events are reportable as described below.

The dropped rod events are reportable as a 60-day written report under 10 CFR 50.73(a)(2)(i)(A) as completion of plant shutdowns required by Technical Specifications, and 10 CFR 50.73(a)(2)(iv) as reactor protection system actuations.

Following each dropped rod event, a report was made to the NRC Operations Center in accordance with 10 CFR 50.72(b)(2)(i) – initiation of plant shutdown required by TSs. The report numbers are 41229 and 41232. The reports were subsequently updated to clarify that the reactor was subcritical at the time of the manual reactor trips and that the events were also reportable under 10 CFR 50.72(b)(3)(iv)(A) – reactor protection system actuation.

ANALYSIS OF SAFETY SIGNIFICANCE

Based on the analysis described below, it is concluded that the health and safety of the public were not affected by this event.

RCCA drop is an Updated Final Safety Analysis Report (UFSAR) analyzed accident. The dropped rod event is assumed to be initiated by a single electrical or mechanical failure which causes any number and combination of rods from the same group of a given bank to drop to the bottom of the core. The resulting negative reactivity insertion causes reactor power to decrease. An increase in the hot channel factor may occur due to the skewed power distribution representative of a dropped rod configuration. The RCCA rod drop design basis considers the worst credible asymmetric dropped rod configurations in the core intended to maximize the peaking factors and potential for cladding damage. The analysis for the Unit 3 core design verifies that the plant will return to a stabilized condition at less than or equal to its initial power level.

In the events described in this report, the initial condition was either a complete or partial drop into the reactor core of rod E-11 in Shutdown Bank B combined with a smaller partial insertion of the remainder of the bank. Reactor power was very low prior to the rod drop and the reactor became subcritical in response to the dropped rod. Therefore, the events were bounded by the results of the UFSAR analysis, which assumes multiple control rods dropped to the bottom of the core from the same group at an initial reactor power level of 100%.

Because the assumptions and results of the analysis in the UFSAR bound the conditions of the actual events by a substantial margin, the drop of rod E-11 events did not challenge fuel design limits nor compromise the health and safety of plant personnel or the general public. There was no increase in risk.

CORRECTIVE ACTIONS

1. The E-11 coil stack connector pushed pin was reseated and the bent pin was realigned. The connector was then properly mated.

2. The vendor procedure used to mate the cable to the CRDM coil stack connector (as well as the RPI coil stack connector) will be revised to require the inspection of individual pins/receptacles prior to mating and provide guidance to ensure the appropriate sensitivity to connector alignment and pin integrity.

3. Plant procedure 3/4-GMI-028.4 will be revised to provide specific steps to inspect individual pins/receptacles at the coil stack connectors.

4. Consideration of connector alignment will be given to the layout of coil stack connector cabling on the replacement reactor vessel head for Unit 4, which will be replaced during a refueling outage scheduled for April 2005.

5. The RVCH replacement team will incorporate lessons learned from the Turkey Point experience into the plan for FPL's St. Lucie plant replacement cables and connectors for rod control and indication, as well as the adequacy of procedures for making up the same cables.

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: NONE

SIMILAR EVENTS

Turkey Point Unit 4: LER 50-251/2001-001-00 - Manual Reactor Trip due to Two Dropped Rods

The above event, while similar, occurred at 100% power rather than at very low power and the cause of the dropped rods was different. Other rod drop events have occurred in Turkey Point's past, however, the conditions relating to those events are not significant in relation to the events reported herein.