L-2017-094
10 CFR § 50.73
May 16, 2017

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Re: Turkey Point Unit 3
Docket No. 50-250
Reportable Event: 2017-001-00
Date of Event: March 18, 2017
Reactor Trip, Auxiliary Feed Water and Emergency Diesel Generator 3A Actuations, Loss of Safety Injection Function, and Completion of Technical Specification Required Shutdown

The attached Licensee Event Report 05000250/2017-001-00 is submitted pursuant to 10 CFR 50.73(a)(2)(i)(A), 10 CFR 50.73(a)(2)(iv)(A), and 10 CFR 50.73(a)(2)(v)(D),

If there are any questions, please call Mr. Mitch Guth, Licensing Manager, at 305-246-6698.

Sincerely,

Thomas Summers
Regional Vice President – Southern Region
Florida Power & Light Company

Attachment

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

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

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 and Information Collections 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)

(See Page 2 for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Turkey Point Unit 3	05000250	1 of 4

4. TITLE

Loss of 3A 4kV Vital Bus Results in Reactor Trip, Safety System Actuations and Loss of Safety Injection Function

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
3	18	2017	2017	001	00	5	16	2017	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 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)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
100%	☐ 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)
Paul F. Czaya	305-246-7150

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

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

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

On March 18, 2017 at approximately 1107 hours, the Turkey Point Unit 3 reactor tripped from 100% power as a result of an electrical fault on the 3A 4kV vital bus. The Auxiliary Feed Water System actuated as expected, and the 3A Emergency Diesel Generator started but did not load, as designed, due to the lockout of the 3A 4kV bus. The 3A 4kV bus remained de-energized and the reactor was stabilized in Mode 3. Both Unit 4 High Head Safety Injection (HHSI) pumps were out of service for maintenance. The 3A HHSI pump was unable to be powered from the 3A 4kV bus resulting in a loss of the Safety Injection safety function for approximately 2.5 hours on both Units 3 and 4. The safety function is achieved by operation of two of the four pumps which are shared by both units. The loss of the 3A 4kV bus was caused by an electrical fault created by a conductive foreign material that had entered the current-limiting reactor cubicle that bridged an air gap between an uninsulated bus bar and the cubicle wall. The foreign material was a carbon fiber mesh used to reinforce a Thermo-Lag installation taking place in the 3A 4kV switchgear room. Corrective actions include: 1) The Thermo-Lag installation procedure will be revised to incorporate additional precautions for handling Thermo-Lag materials, and 2) the Engineering product risk and consequence assessment process will be revised to ensure a review is conducted of Safety Data Sheets for material being considered in the design. This event had no effect on the health and safety of the public.

NARRATIVE

DESCRIPTION OF THE EVENT

On March 18, 2017 at approximately 1107 hours, the Turkey Point Unit 3 reactor [AC, RDT] tripped from 100% power as a result of an electrical fault on the 3A 4kV vital bus [EB, BU]. The three reactor coolant pumps (RCP) [AB, P] tripped. The 3B RCP was later restarted for forced recirculation. The reactor was stabilized in Mode 3. The 3A 4kV bus remained de-energized. Unit 4 remained operating at 100% power. The loss of the 3A 4kV bus required a plant shutdown to Mode 5 (cold shutdown) in accordance with Technical Specification 3.8.3.1, Action 'a'. The completion of the shutdown is reportable in accordance with 10 CFR 50.73(a)(2)(i)(A).

The electrical fault resulted in smoke in the 3A 4kV switchgear room which prompted the declaration of an alert (Event Notification 52621) that ended at 1420 hours.

Auxiliary Feed Water (AFW) [BA] actuated as expected on low level in Steam Generator A [SB, SG] and was secured at approximately 1135 hours. The 3A Emergency Diesel Generator (EDG) [EK, DG] started but did not load, as designed, due to the lockout resulting from the 3A 4kV bus fault. The 3A EDG was stopped at approximately 1332 hours. The actuations of the Reactor Protection System [JC], AFW and the 3A EDG are reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A).

The Unit 4 4A and 4B High Head Safety Injection (HHSI) pumps [BQ, P] were out of service for maintenance. A loss of safety function affecting both Units 3 and 4 occurred upon the loss of the 3A 4kV bus because the 3A HHSI pump could not be powered. This caused three of the four HHSI pumps to be inoperable. The four HHSI pumps are shared by both Units 3 and 4. The safety function is achieved by two of the four HHSI pumps. Both Unit 4 HHSI pumps were restored to operable status at 1336 hours on 3/18/17. The loss of safety function is reportable in accordance with 10 CFR 50.73(a)(2)(v)(D).

The Unit 3 shutdown required by the TS and the equipment actuations were reported in accordance with 10 CFR 50.72 in Event Notification 52623.

CAUSE OF THE EVENT

The direct cause of the reactor trip was loss of the 3A 4kV bus. The direct cause of the fault in the 3A 4kV bus is attributed to the introduction of foreign material (FM) into the Current-Limiting Reactor (CLR) cubicle.

Root Cause: The Thermo-Lag installation procedure does not address control of FM nor provide guidance on precautions that should be taken to control airborne debris fibers generated during installation of Thermo-Lag.

Contributing Causes:

1. Workers performing Thermo-Lag installation did not recognize that airborne FM could enter closed switchgear cabinets and cause an adverse affect. Personnel and the FM exclusion program focus more on

prevention of FM intrusion when systems are opened. The Thermo-Lag installation did not require opening switchgear cubicles.

2. The design process does not prompt review of Safety Data Sheets for material being considered in a design to determine if there are any hazards being introduced during installation and use of the material.

ANALYSIS OF THE EVENT

Thermo-Lag 770-1 material was being installed over existing Thermo-Lag 330-1 to increase power cable protection fire ratings to 3 hours in the 3A 4kV switchgear room. The process placed 770 material (hard panels) around the existing material. Sealant 770 is used on the seams to strengthen the enclosure. A black loosely-woven fabric (carbon fiber mesh) is placed onto the seam and covered with the 770 sealant.

The 3A 4kV switchgear room was classified as a foreign material exclusion (FME) area and was being maintained "clean as you go" by the insulators during the work activity. To control cleanliness in the room, the carbon fiber mesh was being cut outside the room. The material occasionally needed trimming, which was done inside the switchgear room on a scaffold covered in griffolyn to prevent materials from dropping below. To maintain the FME area, a supervisor inspected the area at completion of work to verify the area was clean and free of debris.

A CLR is a protective device used to limit fault current by introducing reactance between sections of a line or between line and ground. The CLR is centered in its cubicle. The bus bars in the CLR cubicle are uninsulated. The 3A 4kV switchgear bus grounded to the inside of the CLR cubicle when the air gap was bridged by the carbon fiber mesh material to the 'C' phase bus bar. This resulted in an electrical arc flash which potentially damaged the adjacent CLR. The carbon fiber mesh material entered the CLR cubicle through gaps in the enclosure.

The internal bus fault caused the Unit 3 auxiliary transformer feeder breaker [EA, BKR] to open and a 3A 4 kV switchgear lockout. The Unit 3 reactor tripped on an undervoltage condition to vital power. The pressure from the arc flash damaged a fire door to the adjacent redundant 3B 4kV vital switchgear room.

All three RCPs tripped at the beginning of the event. In addition to the 3A RCP that is powered from the 3A 4kV bus, the 3B and 3C RCPs which are powered from the 3B 4kV bus tripped on underfrequency. The 3B RCP was started approximately 57 minutes after the event began to restore forced circulation.

ANALYSIS OF SAFETY SIGNIFICANCE

When an arc flash occurs in a switchgear train, all equipment fed from it would be de-energized as a result of protection actuations creating a plant transient. The reactor shutdown and the opposite vital electrical train was relied on to maintain Unit 3 in a safe and stable shutdown condition.

The Turkey Point units have alternate methods to provide power to the equipment necessary to maintain shutdown. For this reason, the potential to reach a condition in which one or more barriers fail, increasing the likelihood of radioactive release is very low.

All safety systems actuated as required in response to the bus failure and operators maintained adequate decay heat removal for a controlled cool down to Mode 5 (cold shutdown).

The fire door that separates the 3A and 3B 4kV vital switchgear rooms was compromised during the event by a damaged latching mechanism. However, given the low combustible load in the CLR cubicle and proper operation of the auxiliary transformer feeder breaker, there was no fire scenario that required proper functioning of the fire door.

In conclusion, based on the unique susceptibility of the CLR cubicle to FM induced arcing, the low internal combustible loading of the cubicle, proper actuation of the fault protection devices, and operator recovery actions, the safety significance of the 3A 4kV bus failure is considered to be low and there was no effect on the health and safety of the public.

The Safety Injection function for both units was lost for approximately 2.5 hours. There was low safety significance associated with the HHSI unavailability as the success criterion is one HHSI pump for small and medium loss of coolant accidents (LOCA). In addition, the control switches for the Unit 4 HHSI pumps had been placed in the pull-to-lock position and the pumps could have been started manually to mitigate a large break LOCA if needed.

CORRECTIVE ACTIONS

Corrective actions are in accordance with Condition Report 2192198 and include:

1. The CLR was removed from its cubicle, sent to a vendor for examination and testing, and then reinstalled and returned to service.
2. The Thermo-Lag installation procedure will be revised to incorporate additional precautions for handling Thermo-Lag materials.
3. A case study will be provided to targeted personnel concerning this event emphasizing that FME also applies to nearby equipment that is not opened and that can be affected by the work activity.
4. Procedures governing FM and material control will be revised to enhance personnel awareness of the potential to introduce FM into nearby equipment that is not opened and that can be affected by the work activity.
5. The Engineering product risk and consequence assessment process will be revised to ensure the Responsible Engineer includes a review of Safety Data Sheets for material being considered in the design.

ADDITIONAL INFORMATION

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

FAILED COMPONENTS IDENTIFIED: None

PREVIOUS SIMILAR EVENTS: None