Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360

April 1, 2015

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

SUBJECT: Licensee Event Report 2015-001-00, Loss of 345KV Power Resulting in Automatic Reactor Scram During Winter Storm Juno

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket No.: 50-293
License No.: DPR-35

LETTER NUMBER: 2.15.024

Dear Sir or Madam:

The enclosed Licensee Event Report (LER) 2015-001-00, Loss of 345KV Power Resulting in Automatic Reactor Scram During Winter Storm Juno, is submitted in accordance with 10 CFR 50.73.

As specified by NUREG-1022, the delay in submittal of the LER was discussed with the NRC Region I office on March 30, 2015.

This letter contains no commitments.

Please do not hesitate to contact Mr. Everett P. Perkins, Jr. (508) 830-8323, if there are any questions regarding this submittal.

Sincerely,

David E. Noyes
Director, Regulatory and Performance Improvement

Attachment 1: Licensee Event Report 2015-001-00, Loss of 345KV Power Resulting in Automatic Reactor Scram During Winter Storm Juno (6 pages)

IE22
NRR

cc:

Mr. Daniel H. Dorman
Regional Administrator, Region 1
U.S. Nuclear Regulatory Commission
2100 Renaissance Blvd., Suite 100
King of Prussia, PA 19406-2713

USNRC Senior Resident Inspector
Pilgrim Nuclear Power Station

Ms. Nadiyah S. Morgan, Project Manager
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-8-F2
11555 Rockville Pike
Rockville, MD. 20852

Attachment 1

Letter Number 2.15.024

Licensee Event Report 2015-001-00

Loss of 345KV Power Resulting in Automatic Reactor Scram During Winter Storm Juno

(6 Pages)

NRC FORM 366 (01-2014) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Pilgrim Nuclear Power Station	05000293	1 OF 6

4. TITLE

Loss of 345KV Power Resulting in Automatic Reactor Scram During Winter Storm Juno

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
									N/A	N/A
01	27	2015	2015	001	00	03	30	2015	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
N	☐ 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)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
52	☐ 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

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Mr. Everett P. Perkins, Jr. - Regulatory Assurance Manager	508-830-8323

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	FK	BU	--	Y	B	SB	RV	T020	Y
E	LD	CMP	A544	Y					

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)*

On Tuesday January 27, 2015, at 0402 hours, while in the process of lowering reactor power, with the reactor in the RUN mode at 52 percent core thermal power, Pilgrim Nuclear Power Station (PNPS) experienced a loss of 345KV power resulting in a load reject and an automatic reactor scram. The loss of 345KV power was due to faults from flashovers in the PNPS switchyard. All control rods fully inserted. The Emergency Diesel Generators had been previously started and were powering safety-related buses A5 and A6. The plant stabilized in Hot Shutdown. At the time of the event a significant winter storm (Juno) was buffeting Southern New England.

The root cause of the event is that the design of the PNPS switchyard does not prevent flashover when impacted by certain weather conditions experienced during severe winter storms. A modification of the switchyard is planned to address the susceptibility of the PNPS switchyard to flashovers during severe winter storms.

This event posed no threat to public health and safety.

BACKGROUND

Pilgrim Station Nuclear Power Station (PNPS) is connected to the transmission lines through a 345KV ring bus located within the station's switchyard. The 345KV ring bus connects the output of the main transformer (GSU), the startup transformer (SUT), Line 355, and Line 342. There are four gas circuit breakers connecting PNPS's 345KV ring bus sections: ACB-102, ACB-103, ACB-104 and ACB-105.

The Line 355 bus connects PNPS to NSTAR (Eversource) Carver Station and is connected to ACB-102 and ACB-105. The Line 342 bus connects PNPS to the Canal Power Plant's Switchyard in Sandwich, MA and to Auburn Street Station Switchyard in Whitman, MA. The Canal Switchyard is owned and operated by NSTAR and Auburn Street Station Switchyard is owned and operated by National Grid. ACB-103 and ACB-104 connect the Line 342 bus to the SUT and GSU bus. The 345KV system is the PNPS preferred off-site power source via the SUT.

The 345KV ring bus design locates the power transmission lines such that a failure of any one line will not result in the loss of the other line. Specifically, with both transmission lines in service, a failure of either 345KV line will not result in a main generator trip, a SUT trip, or a failure of the other 345KV line. Either of the two 345KV lines is capable of carrying full station output and supplying station loads via the SUT.

The 345KV protective relay system is designed and coordinated to isolate system faults and minimize the impact to the overall transmission system. The protective systems are comprised of a primary and secondary protection scheme and are divided into four zones of protection.

- The main transformer bus (isolated by ACB-104 and ACB-105)
- The SUT bus (isolated by ACB-102 and ACB-103)
- Line 355 bus (isolated by ACB-102 and ACB-105 and Carver Station)
- Line 342 bus (isolated by ACB-103 and ACB-104 and Auburn Street Station and Canal Station)

When ACB-104 and ACB-105 open, the main transformer is isolated from the 345KV transmission system thus resulting in a generator load reject event.

In addition to the preferred 345KV off-site power lines, PNPS has a secondary off-site power source, a 23KV line from NSTAR's Manomet Substation that provides power to a shutdown transformer (SDT).

During normal station start-ups and shutdowns, the station's 4160V demands are supplied by the SUT. Once the station main generator is synchronized to the 345KV transmission system, the station unit auxiliary transformer (UAT) supplies all station 4160V demands, with the SUT maintained in standby, ready to provide 4160V power if necessary.

In anticipation of a major snow storm impacting the site on January 26, 2015, Operations entered Procedure 2.1.37 (Coastal Storm Preparations). Procedure 2.1.42 (Operation During Severe Weather) and EN-FAP-EP-010 (Severe Weather Response). During the storm on January 26-28, 2015, meteorological instruments at PNPS recorded sustained wind speeds between 37 and 61 mph with the wind direction predominantly from the ocean toward the switchyard.

EVENT DESCRIPTION:

On 1/25/15 with PNPS operating at 100 percent power, the National Weather Service (NWS) issued a blizzard warning for winter storm Juno. Wind speed of 40 mph sustained with 50 mph gusts and snow fall of more than two inches/hour were predicted. PNPS entered procedures 2.1.42, Operation During Severe Weather and 2.1.37, Coastal Storm Preparations and Actions, and started making preparations for storm arrival. Preparations were completed on 1/26/15. At 0132 hours on 1/27/15, the 345 KV Line 355 bus faulted (for the first of five times) whereupon Operations personnel commenced a reactor shutdown at 0134. The Emergency Diesel Generators (EDGs) were started and loaded with the safety related buses. Reactor Protection System (RPS) bus "A" was placed on the backup power supply. At 0235 hours, the Line 355 bus faulted for the final time at which time the Line 355 breakers at both Carver and PNPS were left tripped open. This configuration left PNPS with one transmission line connected to the grid.

At 0402 hours with the reactor at 52 percent power, Line 342 faulted resulting in a trip of ACBs 103 and 104. This isolated PNPS from the grid causing a generator load reject and automatic reactor scram. All control rods were verified fully inserted. The non-safety related back-up diesel driven air compressor, K-117 failed to start on instrument air system low pressure. K-117 failure to start was due to a battery low voltage condition. Primary Containment Isolation System (PCIS) Group II - Sampling Systems, Group VI - Reactor Water Cleanup (RWCU) System and Reactor Building Isolation System (RBIS) isolations occurred as expected. Reactor water level was maintained by the Reactor Core Isolation Cooling (RCIC) system and reactor pressure was maintained by the High Pressure Coolant Injection (HPCI) System. Once normal reactor level and pressure were restored, operators commenced a depressurization to the cold condition. At 0641 a Non-Emergency Notification to the NRC of the RPS and safety system actuations was made. (EN 50769)

During the reactor vessel depressurization, the High Pressure Coolant Injection (HPCI) System was removed from service prior to reaching the low pressure automatic isolation setpoint (Approx. 80 psig). Shortly after system shutdown, the HPCI Gland Seal Condenser Blower Overload Alarm was received. The HPCI System was declared inoperable. At 1656 hours, a Non-Emergency Notification to the NRC of the HPCI System inoperability was made. (EN 50771) Subsequent analysis determined that the cause of the overload condition was due to the inability to remove water from the condenser with the HPCI pump discharge piping isolated, since the air operated valves that would normally open to remove water were unavailable due to the loss of instrument air when K-117 failed to start. The analysis also determined that HPCI would have been available to perform pressure control or restore reactor water level if required. Upon opening of a valve in the HPCI discharge piping flow path, the HPCI Gland Seal Condenser Hotwell Pump would restore the condenser level to normal.

The depressurization continued using Main Steam Safety Relief Valves (SRVs) for pressure decrease and Core Spray Loop "B" to maintain reactor vessel water inventory. When SRV RV-203-3C was manually opened, the SRV did not appear to open or failed to open fully. Part 21 Event Report 50900 documents this condition. Post-event removal and disassembly of the valve revealed damaged parts in the main stage assembly. Further investigation by the valve manufacturer is required to determine the cause.

Core Spray Loop "A" discharge header low pressure alarm was received due to the unavailability of the non-safety related keep-fill system due to the loss of power to the non-safety related buses. Operators recognized the potential for voiding within the piping. To preclude the potential for damage of the piping due to water hammer pressure pulses, the Core Spray Loop "A" was not used during this event.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Pilgrim Nuclear Power Station	05000293	2015	001	00	4 OF 6

At 1626 hours, Residual Heat Removal (RHR) Loop "B" was placed in service in the shutdown cooling mode. At 1658 hours, the reactor moderator temperature was less than 212 degrees F.

Prior to restoration of offsite power to the switchyard, the switchyard bus insulators and bushings were cleaned of snow and salt contamination to prevent further flashovers.

On January 29, 2015 at 1643 hours, the loss of 345KV power condition was cleared when offsite power was restored to the switchyard and the startup transformer.

CAUSE OF THE EVENT

The design of the PNPS switchyard does not prevent flashover when impacted by certain weather conditions experienced during severe winter storms.

CONTRIBUTING CAUSES:

Previous corrective actions to preclude recurrence taken in response to LER 2008-006-00, Automatic Scram Resulting From Switchyard Breaker Fault During Winter Storm, LER 2008-007-00, Momentary Loss of all 345kv Off-Site Power to the Startup Transformer from Switchyard Breaker Fault, and LER 2013-001-00, Loss of Offsite Power and Reactor Scram, did not prevent recurrence. Previous cause analyses of loss of 345KV transmission lines failed to fully analyze all available weather related data to understand precisely what weather related attributes (and characteristics) were necessary to guide operators in making decisions to maneuver the plant to shutdown prior to or during snow storms with the potential for creating flashovers. As a result, Procedure 2.1.42 failed to guide operators to the correct actions necessary to preclude the automatic scram during winter storm Juno.

Previous cause analyses did not effectively use repeat events to evaluate design aspects to effectively communicate the risk of the current design.

CORRECTIVE ACTIONS

The switchyard insulators and bushings were cleaned prior to return of the switchyard to service.

The following corrective actions are planned to correct / preclude recurrence:

- Implement a switchyard design change to minimize switchyard flashovers during snow storms
- Revise procedure PNPS 2.1.42 to provide additional guidance including the requirement to place the reactor in cold shutdown prior to the anticipated arrival of certain severe winter storms

Additional corrective actions are captured in the corrective action program in Condition Report CR-PNP-2015-00558.

SAFETY CONSEQUENCES

The Loss of Coolant Accident (LOCA) design basis accident (DBA) analyzed in the Updated Final Safety Analysis Report (UFSAR) assumes coincident loss of both 345 KV and 23 KV (preferred and secondary) sources (LOOP). The design imposes a 10 second delay in re-energizing the 4160V Emergency Buses required to mitigate the DBA to allow the EDG to start and reach voltage. This delay also allows the operating motors to coast down to a stop to prevent being repowered out of phase. In cases where coincident loss of an EDG presents a bounding condition, the affected safety bus is not assumed to be picked up by the shutdown transformer (SDT). The bounding condition in which all off-site power and onsite AC (EDGs) sources would be lost is a Station Blackout (SBO) transient event (10 CFR 50.63). PNPS is designed to recover from the SBO event by having a separate SBO diesel generator capable of providing power to the required safety buses to shutdown the plant and maintain it in a safe condition. Thus, the loss of 345KV power experienced by PNPS is within the analyzed conditions.

During the event, the EDGs, RHR, Core Spray Loop "B", HPCI, and RCIC were available. These systems provided capability to supply makeup water to the vessel and ensured adequate core cooling was maintained.

During and following the storm, operators were able to maintain safe shutdown conditions (reactivity control, reactor water inventory, decay heat removal, etc.). While loss of power to non-safety related spent fuel pool cooling was a key consideration, time-to-boil never became an overriding concern with respect to reenergizing buses and there was no recently irradiated spent fuel in the pool. The most recent recently irradiated fuel was almost 21 months old, and the time to boil was approximately seven days upon loss of fuel pool cooling. The spent fuel pool temperature remained less than 105 degrees F.

The Emergency Diesel Generators were started and loaded with the safety related buses prior to the loss of 345KV power. The amount of fuel onsite initially was sufficient to operate the EDGs for 7 days (under LOCA conditions) and the SBO DG was always available.

Throughout these events there was no adverse impact on the public health or safety.

REPORTABILITY

This report is submitted in accordance with:

- 10CFR50.73(a)(2)(iv)(A) – System Actuation,
- 10CFR50.73(a)(2)(v)(B) and 10CFR50.73(a)(2)(v)(D) – Event or Condition that Could Have Prevented Fulfillment of a Safety Function.

The Reactor Protection System, Containment Isolation System, High Pressure Coolant Injection System, and Low Pressure Core Spray System are included in 10CFR50.73(a)(2)(iv)(B). The Reactor Protection System and Containment Isolation System automatically actuated. The High Pressure Coolant Injection System and Low Pressure Core Spray System were manually actuated.

Since High Pressure Coolant Injection System is a single train system to fulfill a safety function, the inoperability was reported in accordance 10CFR50.73(a)(2)(v)(B) and 10CFR50.73(a)(2)(v)(D).

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REV NO.	
Pilgrim Nuclear Power Station	05000293	2015	001	00	6 OF 6

PREVIOUS EVENTS

The most recent loss of 345KV power events at PNPS reported as LERs are as follows:

LER 2008-006-00, Automatic Scram Resulting from Switchyard Breaker Fault During Winter Storm, dated February 12, 2009.

LER 2008-007-00, Momentary Loss of all 345KV Off-Site Power to the Startup Transformer from Switchyard Breaker Fault, dated February 12, 2009.

LER 2013-001-00, Loss of Offsite Power and Reactor Scram due to Winter Storm Nemo, dated April 4, 2013.

ENERGY INDUSTRY IDEBTIFICATION SYSTEM (EIIS) CODES

COMPONENTS	CODES
Switchyard Bus	BU
Relief Valve	RV
Compressor	CMP

SYSTEMS

Switchyard System	FK
Main Steam System	SB
High Pressure Coolant Injection System	BJ\
Low Pressure Core Spray System	BM
Instrument Air System	LD
ESF Actuations (RPS,PCIS, RBIS)	JE

REFERENCES

Condition Report CR-PNP-2015-0558, Loss of Offsite Power and Reactor Scram

Condition Report CR-PNP-2015-0559 – K117 air compressor failed to start following unit scram.

Condition Report CR-PNP-2015-0561 - SRV-3C appears to have not opened fully during manual operation.

Condition Report CR-PNP-2015-0563, HPCI Overload alarm received during HPCI operation - Observed water emitting from P-223, Gland Seal Condenser Blower