Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
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Ralph A. Dodds, III
Director, Nuclear Safety Assurance

January 30, 2012

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

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

Licensee Event Report 2011-006-00, HPCI Turbine Governor Control Valve Failure

LETTER NUMBER: 2.12.006

Dear Sir or Madam:

The enclosed Licensee Event Report (LER) 2011-006-00, "HPCI Turbine Governor Control Valve Failure" is submitted in accordance with 10 CFR 50.73.

This letter contains no commitments.

Please do not hesitate to contact Mr. Joseph R. Lynch, (508) 830-8403, if there are any questions regarding this submittal.

Sincerely,

R Dodds III

Ralph A. Dodds, III

FM/fm

Attachment 1: Licensee Event Report 2011-006-00, HPCI Turbine Governor Control Valve Failure

IE22
NRR

cc:

Mr. William M. Dean
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USNRC Senior Resident Inspector
Pilgrim Nuclear Power Station

Attachment 1
Letter Number 2.12.006

Licensee Event Report 2011-006-00

HPCI Turbine Governor Control Valve Failure

(5 Pages)

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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 Service 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)

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4. TITLE

HPCI Turbine Governor Control Valve Failure

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	30	2011	2011	006	00	1	30	2012	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

N

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

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Joseph R. Lynch, Licensing Manager	(508)-830-8403

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
D	BJ	TRB	T129	Yes					

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 November 30, 2011, at 1747 hours, with the reactor at 100% core thermal power and steady state conditions, Pilgrim Nuclear Power Station (PNPS) declared the High Pressure Coolant Injection (HPCI) system inoperable due to the HPCI turbine governor control valve (HO-2301-24) failing to open during planned post-maintenance testing. The governor control valve is a hydraulically operated valve and its normal position is closed. The valve has a safety function to open on a demand signal during certain event mitigation scenarios requiring the HPCI system operation.

The governor control valve failed to open during the post-maintenance testing from the Alternate Shutdown Panel (ASP) and subsequently from the Main Control Room. The HPCI system was declared inoperable and the Limiting Condition for Operation (LCO) for Technical Specification (TS) 3.5.C.2 was entered.

This event had no impact on the health and/ or safety of the public.

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NARRATIVE

EVENT DESCRIPTION:

On November 30, 2011, at 1747 hours, with the reactor at 100% core thermal power and steady state conditions, Pilgrim Nuclear Power Station (PNPS) declared the High Pressure Coolant Injection (HPCI) system inoperable due to the HPCI turbine governor control valve (HO-2301-24) failing to open during planned post-maintenance testing.

The electric governor (EG) type control system used on HO-2301-24 is an electro-mechanical system that converts electronic control signals to mechanical movement through a hydraulic positioner. The system consists of the following primary components:

- Power supply
- Ramp generator and signal converter (RGSC) module
- Electric governor-magnetic pickup (EG-M) control box
- Electric governor-remote (EG-R) hydraulic actuator
- Remote servo, pilot valve, oil relay (power cylinder), and walking beam linkage.

The EG-R hydraulic actuator has a pilot valve plunger with an armature magnet that moves up or down based on the voltage input from the EG-M. Movement of the pilot valve plunger causes oil to be ported to the remote servo. The EG-R has its own oil pump that delivers an operating oil pressure of 325 to 375 PSIG. Filtered oil is supplied to the oil pump which is driven by the turbine shaft through gears. The EG-R provides a hydraulic signal that causes vertical movement of the remote servo.

The remote servo is a power piston with multiple oil ports that transmit the hydraulic signals from the EG-R into movement of the turbine's oil relay (power cylinder). Oil pressure from the EG-R is driven into the remote servo ports to move the power piston up to close the governor valve or down to open the governor valve. A mechanical linkage provides the interface between the remote servo and the oil relay (power cylinder).

With HPCI in a standby condition the governor control valve is fully closed, the oil relay (power cylinder) is in the up position, the pilot valve is in the neutral position, and the remote servo is in the up position.

During an auxiliary (aux) oil pump start oil pressure is supplied through the EG-R to the remote servo to move it to the down position. Moving the remote servo to the down position causes the governor valve to open.

When the aux oil pump is stopped, oil pressure will bleed off and allow the components to return to their normal (standby) positions.

As background, on 11/17/2011 prior to the HPCI governor control valve failure event, a planned LCO was entered to install a new the HPCI GEMAC flow controller assembly for the Alternate Shutdown Panel (ASP) via an approved plant modification. During the post work test HPCI run the indicated HPCI pump flow was less than actual flow and the test was aborted. A condition report was identified and the original flow controller assembly was re-installed. The HPCI system was tested from the Control Room and was verified to be operable on 11/17/2011. The HPCI governor control valve operated as expected.

Governor Valve Failure Event

Investigation of the failed HPCI system flow controller test from the ASP determined that indicated flow was lower than actual because of an unaccounted for resistor in the flow controller connector. On 11/30/2011 the resistor was removed and the new flow controller assembly was re-installed per the approved modification. A planned LCO was entered in order to perform the post work test from the ASP panel. During the post work test the HPCI governor control valve failed to open. To prove operability of the HPCI System from the Main Control Room, Operations attempted to start the HPCI system from the Control Room. The governor control valve failed to open. The HPCI system was declared inoperable at 1747 hours on 11/30/2011.

A detailed troubleshooting plan was developed to systematically evaluate the turbine governor control valve operating system. These efforts revealed that the remote servo mechanism had stuck in the up position due to mechanical binding. The remote servo was replaced and the linkage was reconnected.

Subsequent to replacement of the remote servo mechanism, the HPCI system was tested to verify operability from both the Control Room and the ASP. HPCI was declared operable and the LCO was exited at 1700 hours on 12/3/2011.

CAUSE OF THE EVENT:

The cause of the HPCI governor control valve failure was mechanically binding of the remote servo mechanism at the top the piston stroke due to excessive particulate which reduced the piston to body clearances. The lack of periodic inspection is the reason the particulate was not discovered prior to failure of the remote servo mechanism. The reason the periodic inspection was not performed is that preventative maintenance procedures were not updated to incorporate EPRI Terry Turbine Maintenance Guidance. This is the apparent cause of the event.

A contributing cause of the event was identified to be ineffective management follow-up or monitoring of activities related to incorporating vendor recommended preventative maintenance information.

EXTENT OF CONDITION:

The RCIC system turbine governor control valve has the same model EG-R and remote servo as HPCI turbine governor control system. The RCIC remote servo mechanism could also be subject to mechanical binding. Currently the remote servo oil tubing and the EG-R in RCIC system are not inspected as part of a normal preventative maintenance inspection. The EPRI Terry Turbine Maintenance Guide recommends removing the EG-R cover and inspecting the coil area for moisture and particulate (Vendor Manual V2164). EPRI also recommends removing the line from the EG-R to the remote servo and inspecting the drained oil for evidence of moisture and particulate. The RCIC system preventative maintenance procedures will be revised to address remote servo mechanism inspection as identified in the Corrective Actions section below.

CORRECTIVE ACTIONS:

Corrective actions completed included replacement of the HPCI governor control remote servo mechanism. The HPCI system lube oil filters were also replaced.

Corrective actions planned include:

- Evaluate HPCI system lube oil contamination levels for excessive particulate.
- Schedule and perform a RCIC system extent of condition review.
- Revise Procedure 3.M.4-79 "HPCI Turbine Preventive Maintenance Inspection" to require disassembly and inspection of the EG-R and piping to the remote servo per the EPRI Terry Turbine Vendor Manual instruction.
- Review EPRI Vendor document for additional recommended actions and incorporate into HPCI and RCIC system preventative maintenance program documents as appropriate.
- Revise Procedure 3.M.4-78 "RCIC Turbine Major Preventive Maintenance Inspection" to require disassembly and inspection of the EG-R and piping to the remote servo per the EPRI Terry Turbine Vendor Manual instruction.

These corrective actions are being tracked in the Site Corrective Action Program.

ASSESSMENT OF SAFETY CONSEQUENCES:

The event occurred during normal power operation while at 100% core thermal power and steady state conditions.

The Core Standby Cooling Systems (CSCS) consist of the HPCI system, Automatic Depressurization System (ADS), Core Spray system, and the Residual Heat Removal (RHR) system in the Low Pressure Core Coolant Injection (LPCI) mode. Although not part of the CSCS, the Reactor Core Isolation Cooling (RCIC) system is capable of providing water to the reactor vessel for high pressure core cooling, similar to the HPCI system.

The HPCI system provides high pressure makeup water to the reactor vessel after isolation of the vessel. The HPCI system was declared inoperable due to mechanical binding in the remote servo mechanism. During this time frame the ADS, Core Spray, RHR, and RCIC systems were operable and the 14 day Technical Specification 3.5.C.2 limiting condition for operation requirements for operating the plant with an inoperable HPCI system was satisfied. These systems provided capability to supply makeup water to the vessel and ensured adequate core cooling while the HPCI system was not operable. The HPCI system was restored to operable status after three (3) days and there was no long term safety significance associated with the event.

The HPCI turbine governor valve was repaired within the HPCI system LCO time limits and posed no threat to public health and safety.

REPORTABILITY

This event was reported to the USNRC via Event Report #47492 on 11/30/11 pursuant to 10 CFR 50.72(b)(3)(v)(D) - Any event or condition that could have prevented fulfillment of the safety function of structures or systems that are needed to: Mitigate the consequences of an accident.

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PREVIOUS OCCURRENCES:

A review was conducted of previously issued Pilgrim Station LERs. The focus of the review was LERs that involved loss of system function due to failure of a hydraulically controlled turbine governor valve to open.

The review identified recent events where the HPCI system safety function was lost due to failed components:

LER-2008-004- "High Pressure Coolant Injection System Inoperable Due to Undervoltage Relay Failure in Valve Power Supply Circuit,"

LER 2005-01 – "HPCI System Inoperable Due to Fuse Failure in Motor Operated Valve Control Circuit," and

LER-2004-02 – "High Pressure Injection System Fuse Failure While System Inoperable for Planned Maintenance and Testing."

Corrective actions associated with these LER events would not have prevented the HPCI governor control valve event.

No LERs were located which involved loss of the hydraulically controlled turbine governor valve to the steam turbine due to mechanical binding of the remote servo mechanism.

A recent Pilgrim Station Apparent Cause Evaluation applicable to the RCIC system trip and throttle valve was noted to have a similar concern as it relates to omission of vendor manual information in preventive maintenance procedures. Corrective actions were initiated to update the maintenance procedures.

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES

The EIIS codes for Components and Systems referenced in this report are as follows:

COMPONENTS	CODES
Turbine	TRB
SYSTEMS	
High Pressure Coolant Injection (HPCI)	BJ

REFERENCES:

Condition Report CR-PNP-2011-5474 and the associated Apparent Cause Evaluation Report; HPCI Governor Control Valve Failed to Open.