Entergy

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

Pilgrim Nuclear Power Station

January 31, 2014

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 2013-002-01, SRV-3B Safety Relief Valve Declared Inoperable Due to Leakage and Setpoint Drift

LETTER NUMBER: 2.14.009

Dear Sir or Madam:

The attached Supplement Licensee Event Report (LER) 2013-002-01, "SRV-3B Safety Relief Valve Declared Inoperable Due to Leakage and Setpoint Drift" is submitted in accordance with 10 CFR 50.73.

The LER revision is being submitted because the root cause analysis was not established at the time the LER was submitted and the LER stated that a supplemental report with additional casual analysis would be submitted upon completion of the analysis.

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,

David Noyes
Director of Regulatory and Performance Improvement

Attachment: Licensee Event Report 2013-002-01, SRV-3B Safety Relief Valve Declared Inoperable Due to Leakage and Setpoint Drift (5 pages)

IE22
NRR

cc:

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USNRC Senior Resident Inspector
Pilgrim Nuclear Power Station

Attachment
Letter Number 2.14.009

Licensee Event Report 2013-002-01

SRV-3B Safety Relief Valve Declared Inoperable Due to Leakage and Setpoint Drift

(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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Pilgrim Nuclear Power Station	05000293	1 OF 5

4. TITLE

SRV-3B Safety Relief Valve Declared Inoperable Due to Leakage and Setpoint Drift

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
01	20	2013	2013	002	01	1	31	2014	N/A	
									FACILITY NAME: N/A	DOCKET NUMBER

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, Manager, Nuclear Assurance	(508)-830-8403

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE		CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	SB	RV	T020	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 Sunday January 20, 2013, at 2050 hours with the reactor at 100% core thermal power (RMSS in RUN), PNPS declared SRV-3B inoperable and entered Technical Specification (TS) 3.6.D.2 requiring an orderly reactor shutdown such that reactor coolant pressure is less than 104 psig within 24 hours. On Monday January 21, 2013, at 1300 hours (16 hrs and 10 minutes) reactor coolant pressure was lowered to less than 104 psig. SRV-3B had been declared inoperable consistent with PNPS procedures that state an SRV is inoperable if the first stage pilot thermocouple temperature is 35° F below its baseline temperature. This LER Supplement provides the determination of cause for the leakage. The cause of the SRV leakage was that the natural frequency of the pilot assembly was close to a resonant frequency of the valve assembly when installed on the PNPS main steam line, that had failed to be considered in the design of the SRV. A contributing cause was wear and looseness of parts in the main stage of RV-203-3B.

The reactor was depressurized and a new pilot valve assembly was installed on SRV-3B. On January 22, 2013, at 1015 hours reactor restart was commenced. On January 24, 2013 at 0312 hours 100% core thermal power was achieved.

This LER also reports the as-found setpoint of one SRV pilot valve tested was less than the minimum pressure required by TS 3.6.D.1.

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

NARRATIVE

BACKGROUND:

As background, the pressure relief system includes four (4) SRVs and two (2) spring safety valves (SSVs). During Refueling Outage (RFO-18), in April/May, 2011, the four SRVs were replaced with Target Rock Model 0867F 3-stage SRVs. The SRVs discharge through their individual discharge piping, terminating below the minimum suppression pool (torus) water level. The four SRVs are installed on the main steam piping in containment between the reactor pressure vessel and the flow restrictors.

The 3-stage SRV contains a pilot (also called the first stage), a second stage, a main stage, and an air operator.

To monitor these valves for leakage, Pilgrim installed thermocouples at the pilot (first stage), at the second stage, on the tailpipe near the valve (4.5' to 6' away), on the tailpipe far from the valve (~20' away) and at the pilot bellows. Procedure 2.2.23, "Automatic Depressurization System", provides guidance for interpreting the thermocouple data and determining valve operability based in part on testing performed by Target Rock.

Subsequent to installation in RFO-18 and prior to this event, Pilgrim experienced minor second stage pilot valve leakage from SRV RV-203-3C on May 18, 2011 and November 25, 2011. Also, on December 26, 2011, SRV RV- 203-3D first stage pilot valve experienced leakage while operating at full power. The SRV was declared inoperable and the plant was shutdown on December 26, 2011 in accordance with TS 3.6.D.2 and RV-203-3C was replaced entirely, and the RV-203-3D pilot assembly was replaced (LER 2011-007-00).

EVENT DESCRIPTION:

On Sunday January 20, 2013, at 2050 hours with the reactor at 100% core thermal power (RMSS in RUN), PNPS declared SRV-3B inoperable and entered Technical Specification (TS) 3.6.D.2 requiring the initiation of an orderly reactor shutdown such that reactor coolant pressure is less than 104 psig within 24 hours. On Monday January 21, 2013, at 1300 hours (16 hrs and 10 minutes) reactor coolant pressure was less than 104 psig. SRV-3B had been declared inoperable consistent with PNPS procedures that state an SRV is inoperable if the pilot stage thermocouple temperature is 35° F below its baseline temperature.

While at full power, indication of a steam leak across the first stage pilot of RV-203-3B was identified. The leakage was evaluated and in accordance with criteria specified in procedure 2.2.23, specifically, if the pilot stage thermocouple temperature is 35 degrees F below its baseline temperature (with a smaller decrease at the second stage thermocouple) and cannot be explained by a corresponding downpower, the SRV is inoperable. The safety relief valve was subsequently declared inoperable and the Limiting Condition for Operation (LCO) for Technical Specification (TS) 3.6.D.2 was entered. Per TS 3.6.D.2 the plant was shutdown and reactor coolant pressure was below 104 psig within 24 hours.

CAUSE:

The SRVs were purchased new, installed, and tested for the first time in April/May 2011 during RFO-18.

Following an extensive investigation, it was determined that the cause of the SRV leakage was that the natural frequency of the pilot assembly was close to a resonant frequency of the valve assembly when installed on the PNPS main steam line. This was not considered in the Entergy specification or the Target Rock design of the valve.

A contributing cause was wear and looseness of parts in the main stage of RV-203-3B.

EXTENT OF CONDITION:

This condition potentially applies to all four three stage SRVs that were installed in RFO 18. During Cycle 19 operation, Pilgrim has observed leakage from RV-203-3B, 3C, and 3D.

- On May 18, 2011 and November 25, 2011, SRV RV 203-3C second stage pilot valve minor leakage was observed. This condition did not cause inoperability of the valve. SRV RV-203-3C was replaced during the December 26, 2011 shutdown.

- On December 26, 2011, SRV, RV-203-3D first stage pilot valve experienced leakage that exceeded the operability criteria while operating at full power. The plant was shut down as required by TS 3.6.D.2, RV 203-3C and 3D were repaired and the plant returned to full power operation. The cause of the pilot leakage was later determined to be a combination of the natural frequency issue and weakening of the pilot bellows spring. This bellows spring had a through wall failure during testing at an offsite test facility in March 2013. This failure was the subject of a Target Rock 10 CFR, Part 21 (Reference 1).

- On January 20, 2013, Pilgrim experienced the event described in this Licensee Event Report, first stage pilot valve leakage of SRV, RV-203-3B. The plant was shutdown as required by TS 3.6.D.2. The pilot valve was replaced with a refurbished pilot and the plant was returned to full power operation.

- On February 3, 2013, RV-203-3B first stage pilot valve leakage was identified while at full power. Reactor power was lowered to 80% and at 1000 psig pressure, the pilot was reseated. An Operability Determination with a compensatory measure was implemented to maintain the reactor power at 80% and reactor pressure at 1000 psig. An Operations Decision Making Issue (ODMI) was implemented to monitor and take corrective actions. During the forced outage on February 8, 2013, caused by a loss of offsite power due to a major winter storm, RV-203-3B first stage pilot valve was replaced with a new pilot valve and the plant was returned to power operation. The cause of the pilot leakage was determined to be a combination of the natural frequency issue and weakening of the pilot bellows spring. This bellows spring had a through wall failure during testing at an offsite test facility in March 2013. This failure was the subject of a Target Rock 10 CFR, Part 21 (Reference 1).

  The removed RV-203-3B pilot valve was sent to Wyle Laboratory for testing.

  As-found test results for the SRV, RV 203-3B pilot valve were:

Pilot S/N	SRV Position	As-Found	Deviation
23	RV-203-3B	1112 psig	(-)3.8%

  Technical Specification 3.6.D.1 requires the as-found setpoint to be within 1155±34.6 psig (1120.4 psig to 1189.6 psig). The as-found setpoint was less than the minimum pressure specification required by TS 3.6.D.1. This test result was entered into the corrective action program as a separate event, and is included in this LER since the condition was discovered within 60 days from the initial discovery of pilot leakage. Accordingly, this as-found value being out of Technical Specification setpoint is reported in this LER pursuant to 10 CFR 50.73(a)(2)(i)(B).

- The third pilot on RV-203-3B began leaking on February 26, 2013. Leakage was controlled by reducing power and pressure per the ODMI. This pilot was replaced during the Spring 2013 RFO. The cause of the pilot leakage was that the pilot assembly had a natural frequency that was close to a resonant frequency of the valve assembly when installed on the PNPS main steam line.

CORRECTIVE ACTIONS:

The following corrective actions were taken to address this event related to leaking RV-203-3B:

- The SRV-3B pilot was replaced with a refurbished and tested pilot.
- PNPS Procedure was revised to reduce reactor power and pressure to stop leakage per an ODMI as described in "Extent of Condition."

The following corrective actions are being taken to address the results of review of Extent Conditions:

- To minimize the possibility of further pilot leaks, all currently installed pilots (and replacements if necessary until the long term corrective action can be taken) have been set at the high end of their allowed set pressure band.
- The recommendations of the Target Rock 10 CFR, Part 21 are being followed.
- The only PNPS pilot with a bellows spring from the same material and heat treatment certifications as the failed bellows was removed from the plant. Detailed metallurgical analysis did not identify any intergranular cracks such as those identified in the failed bellows.
- PNPS has ordered new pilot assemblies with enhancements designed by Target Rock to raise the natural frequency of the pilot and make it more resistant to steam system vibration (References 2 and 3). These pilots include the bellows replacement recommended by the 10 CFR, Part 21. PNPS plans to install these pilots during the spring of 2015 RFO.

SAFETY CONSEQUENCES:

The leaking SRV pilot valves and the plant shutdown to repair the SRV in accordance with Technical Specification 3.6.D.2 posed no threat to the public health and safety.

All leakage from the valve was collected in plant systems, the suppression pool (torus), and processed in accordance with normal station practices.

Pilgrim has installed temperature monitoring to provide sufficient indication of SRV leakage to ensure that timely actions can be taken to ensure that the plant is maintained in a safe condition. Procedure 2.2.23 provides the instructions and guidance for interpreting and responding to SRV temperature indications. Based on these instructions, the plant was shutdown. The SRV would have been able to respond if needed to meet its core cooling or reactor pressure vessel over protection functions. As a result, the plant safety was maintained. The risk of operating with a leaking SRV is characterized by an increased chance of having an inadvertently opened SRV with increased chance of that valve failing to reclose. Assuming the plant operated for 24 hours with this condition, this results in a change in core damage frequency of less than 1.0E-7. The impact of setpoint drift (0.8% below the 3% tolerance) is considered to be bounded by delta change in core damage frequency of less than

1.0E-7.

PREVIOUS EVENTS:

Prior to Cycle 19, there were no leakage or setpoint drifts occurrences with three stage safety relief valves since the new design was installed in April/May, 2011, during Refueling Outage 18 for all four safety relief valves.

During Cycle 19, Pilgrim observed minor leakage from the second stage pilot valve of RV-203-3C. Also, first stage pilot valve leakage was observed from RV-203-3D which was confirmed, plant was shutdown as required by TS 3.6.D.2, and first stage pilot valve was replaced. This event is described in LER 2011-007-00. During the outage for RV-203-3D, the entire RV 203-3C was replaced with a new valve assembly.

The industry has experienced numerous instances where SRV leakage has occurred at other plants with other Target Rock Model three stage safety relief valves.

OE33766 - Three Stage Safety Relief Valve Pilot Leakage just below Normal Operating Pressure – Plant Hatch. The plant Hatch installed the same model 3-stage SRVs in Unit 2 in April 2011. Hatch experienced numerous pilot leaks during 2011. On some occasions, leakage was reduced by power and/or pressure reductions. Hatch Unit 2 had some success through power and/or pressure reductions and operating for several months after re-seating the first stage pilot valve through power and/or pressure reductions.

OE26394 & OE26892 - Planned Shutdown due to a three stage Safety Relief Valve Leak - Peach Bottom Unit 3

OE32805 – Safety Relief Valve Temperature Phenomenon – Fitzpatrick

OE34730 – Target Rock 3 Stage Main Steam SRV Bore to Seat Misalignment – Limerick 2

OE19219 – Plant Shutdown Due to Increasing Tailpipe Temperature – Duane Arnold

ENERGY INDUSTRY IDENTIFICATION SYSTEM (EIIS) CODES:

COMPONENTS	CODES
Valve, Relief	RV
SYSTEMS	
Main Steam	SB

REFERENCES:

1. Target Rock Letter NID#13307, "10 CFR Part 21 Report, Notification of a Defect, Bellows Failure," June 17, 2013.

2. Target Rock Technical Evaluation of Replacement Items TERI 075, "Technical Evaluation of Pilot Assembly 304095-1 Replacing Pilot Assembly 303977-1 for 0867F-001," Target Rock, Revision A, January 14, 2013.

3. Target Rock Letter SRP13003, "Enhancements to Primary Pilot Design," Target Rock, January 21, 2013.

4. Condition Report CR-PNP-2013-0378, Safety Relief Valve RV-203-3B, Pilot Leakage.