



DEC 15 2009

10CFR50.73

LR-N09- 0287

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington DC 20555-001

LER 311/09-002  
Salem Nuclear Generating Station Unit 2  
Facility Operating License No. DPR-75  
NRC Docket No. 50-311

SUBJECT: 22 Component Cooling Heat Exchanger Inoperable for Greater Than  
Allowed Outage Time

This Licensee Event Report, "22 Component Cooling Heat Exchanger Inoperable  
for Greater Than Allowed Outage Time," is being submitted pursuant to the  
requirements of the Code of Federal Regulations 10CFR50.73 (a)(2)(i)(B), "any  
operation ... prohibited by the plant's Technical Specification."

The attached LER contains no commitments. Should you have any questions or  
comments regarding this submittal, please contact Mr. Brian Thomas at 856-339-2022.

Sincerely,

A handwritten signature in black ink, appearing to be "R. Braun", with a long horizontal flourish extending to the right.

Robert Braun  
Site Vice President - Salem

Attachments (1)

IE22  
NRR

**DEC 15 2009**

cc Mr. S. Collins, Administrator, Region I, NRC  
Mr. R. Ennis, Licensing Project Manager – Salem, NRC  
Mr. D. Schroeder, USNRC Senior Resident Inspector, Salem (X24)  
Mr. P. Mulligan, Manager IV, NJBNE  
L. Marabella, Corporate Commitment Tracking Coordinator  
H. Berrick, Salem Commitment Tracking Coordinator

## LICENSEE EVENT REPORT (LER)

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 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.

1. FACILITY NAME Salem Generating Station - Unit 2	2. DOCKET NUMBER 05000311	3. PAGE 1 of 5
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4. TITLE 22 Component Cooling Heat Exchanger Inoperable for Greater Than Allowed Outage Time

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
10	17	2009	2009	0 0 2	0	12	15	2009		DOCKET NUMBER

9. OPERATING MODE  6	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)											
	<input type="checkbox"/> 20.2201(b) <input type="checkbox"/> 20.2201(d) <input type="checkbox"/> 20.2203(a)(1) <input type="checkbox"/> 20.2203(a)(2)(i) <input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 20.2203(a)(2)(iii) <input type="checkbox"/> 20.2203(a)(2)(iv) <input type="checkbox"/> 20.2203(a)(2)(v) <input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 20.2203(a)(3)(i) <input type="checkbox"/> 20.2203(a)(3)(ii) <input type="checkbox"/> 20.2203(a)(4) <input type="checkbox"/> 50.36(c)(1)(i)(A) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input type="checkbox"/> 50.36(c)(2) <input type="checkbox"/> 50.46(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(i)(A) <input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(i)(C) <input type="checkbox"/> 50.73(a)(2)(ii)(A) <input type="checkbox"/> 50.73(a)(2)(ii)(B) <input type="checkbox"/> 50.73(a)(2)(iii) <input type="checkbox"/> 50.73(a)(2)(iv)(A) <input type="checkbox"/> 50.73(a)(2)(v)(A) <input type="checkbox"/> 50.73(a)(2)(v)(B) <input type="checkbox"/> 50.73(a)(2)(v)(C) <input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 50.73(a)(2)(vii) <input type="checkbox"/> 50.73(a)(2)(viii)(A) <input type="checkbox"/> 50.73(a)(2)(viii)(B) <input type="checkbox"/> 50.73(a)(2)(ix)(A) <input type="checkbox"/> 50.73(a)(2)(x) <input type="checkbox"/> 73.71(a)(4) <input type="checkbox"/> 73.71(a)(5) <input type="checkbox"/> OTHER Specify in Abstract below or in NRC Form 366A								
10. POWER LEVEL  0												

## 12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME Brian Thomas	TELEPHONE NUMBER (Include Area Code) (856) 339 -2022
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## 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
X	BS	V	P340	Y					

## 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 October 17, 2009 at 0538 hours, control room operators noted an abnormal increase in reactor coolant system (RCS) temperature following performance of section 5.3 of procedure S2.OP-ST.SSP-0002, "SEC MODE OPS TESTING 2A VITAL BUS." The control room supervisor (CRS) directed a walk down of the residual heat removal (RHR) and component cooling (CC) system which identified that the 22 CC Heat Exchanger (HX) service water outlet valve 22SW356 gearbox had rotated causing the valve to go partially closed. At 0603, the CRS entered the abnormal operating procedure for component cooling. Technical Specification 3.9.8.2 was entered at 0603 hours for less than 2 trains of RHR operable and water level less than 23 feet above the reactor flange. At 0658 hours, the 22SW356 valve was secured in position to prevent the valve from going closed any further. At 0753 hours, operators verified the ability of the 22 CC HX to provide adequate core cooling by adjusting the RHR HX outlet control valve. RCS temperature reduced from 125.6 °F to 124.5 °F. At 0818 hours, 3000 gpm of service water flow was established to the 21 CC HX and a RCS temperature decrease was observed. At 1004 hours, 9000 gpm of flow was established to the 21 CC HX. At 1017 hours, TS 3.9.8.2 was exited.

The causes of this event were installation of the wrong material mounting bolts and incorrect torque values. Corrective actions consist of replacement of the valve and gearbox using proper mounting bolts, procedure changes, roll-outs to appropriate personnel, and generation of preventive maintenance tasks.

This report is being made in accordance with 10CFR50.73 (a)(2)(i)(B), "any operation ... prohibited by the plant's Technical Specification."

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## NARRATIVE

**PLANT AND SYSTEM IDENTIFICATION**

Westinghouse – Pressurized Water Reactor (PWR/4)

Component Cooling Water System {CC/-}

Service Water System {BS/-}

\* Energy Industry Identification System {EIS} codes and component function identifier codes appear as {SS/CCC}

**IDENTIFICATION OF OCCURRENCE**

Event Date: October 17, 2009

Discovery Date: October 17, 2009

**CONDITIONS PRIOR TO OCCURRENCE**

Salem Unit 2 was in Operational Mode 6 during the seventeenth (2R17) refueling outage with both loops of Residual Heat Removal (RHR) being cooled by the 22 Component Cooling (CC) heat exchanger (HX). The 21 CCHX was removed from service as a result of planned maintenance activities.

**DESCRIPTION OF OCCURRENCE**

On October 17, 2009, at 0538 hours control room operators noted an abnormal increase in reactor coolant system (RCS) temperature following performance of section 5.3 of procedure S2.OP-ST.SSP-0002, "SEC MODE OPS TESTING 2A VITAL BUS." The control room supervisor (CRS) directed a walk down of the RHR and CC system for abnormalities. Salem Unit 2 was in Mode 6 with both loops of RHR being cooled by the 22 CC HX {CC/HX}. The field walk down identified that the 22 CC HX service water outlet valve 22SW356 {BS/V} gearbox had rotated causing the valve to go partially closed. At 0603, the CRS entered the abnormal operating procedure for component cooling. Technical Specification 3.9.8.2 was entered at 0603 hours for less than 2 trains of RHR operable and water level less than 23 feet above the reactor flange (the reactor head was de-tensioned). At 0615 hours, the CRS entered the abnormal procedure for RHR and directed restoration of the 21 CC HX. At 0658 hours, the 22SW356 valve was secured in position to prevent the valve from going closed any further. Service water flow through the 22 CC HX was approximately 3400 gpm. At 0747 hours, filling and venting of the 21 CC HX was complete. At 0753 hours, operators verified the ability of the 22 CC HX to provide adequate core cooling by adjusting the RHR HX outlet control valve. RCS temperature reduced from 125.6 °F to 124.5 °F. At 0818 hours, 3000 gpm of service water flow was established to the 21 CC HX and a RCS temperature decrease was observed. The abnormal operating procedures were exited at 0846 hours with the restoration of the 21 CC HX. At 1004 hours, 9000 gpm of flow was established to the 21 CC HX. At 1017 hours, TS 3.9.8.2 was exited.

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**NARRATIVE**

### DESCRIPTION OF OCCURRENCE (cont'd)

It has been determined that since valve 22SW356 gear box mounting bolts failed after operation at 9500 gpm of service water flow during the outage, a similar failure could have occurred during post-LOCA conditions. Since the 22 CC HX was not able to perform its design basis post-LOCA heat removal function during the past operating cycle, the 22 CC HX was inoperable for greater than the allowed outage time of TS 3.7.3.

This report is being made in accordance with 10CFR50.73 (a)(2)(i)(B), "any operation ... prohibited by the plant's Technical Specification."

### CAUSE OF OCCURRENCE

The gear box for the 22SW356 valve failed to the partially open position when all four (4) gear box-to-valve mounting bolts failed. Based on examination and lab analysis, the bolts failed due to lateral impact loads. The bolt failures are attributed to installing improper low strength bolts in April 2002 since the correct bolts were not specified in the work order. The lower strength bolts did not retain the preload allowing the bolts to loosen during high flow conditions when system vibration was elevated. In addition, the installation procedure that was created in 1996 did not include a torque value for the manual operator in use (MTD-4S). The procedure provided a torque value for a similar manual operator (MTD-4). This value was lower than the torque specified by the vendor for MTD-4S.

### PREVIOUS OCCURRENCES

A review of LERs for Salem Units 1 and 2 for the previous three years did not identify any previous similar events.

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**SAFETY CONSEQUENCES AND IMPLICATIONS**

The 22 CC HX manual outlet valve 22SW356 failed to a partially open position on October 17, 2009. Salem Unit 2 was shutdown on October 13, 2009 to begin the seventeenth refueling outage (2R17) and Mode 5 was entered on October 14, 2009 at 0430 hours. At 0459 hours, the 22 CC HX was placed in service with 9500 gpm service water flow to support both trains of RHR and removal of the 21 CC HX to support outage maintenance activities. On October 16, 2009 at 1703 hours, Salem Unit 2 entered Mode 6 and the reactor head was fully de-tensioned at 2355 hours. On October 17, 2009 at 0603 hours, operators reported from the field that the gear box for valve 22SW356 had shifted and that flow through the 22 CC HX was reading approximately 3200 gpm. Operators entered Technical Specification (TS) 3.9.8.2 for two loops of RHR not being operable. At 0658 hours, the 22SW356 valve was secured in position to prevent the valve from going closed any further. Service water flow through the 22 CC HX was approximately 3400 gpm. At 0753 hours, operators verified the ability of the 22 CC HX to provide adequate core cooling by adjusting the RHR HX outlet control valves. RCS temperature reduced from 125.6 °F to 124.5 °F. At 0818 hours, service water flow was established to the 21 CC HX and a RCS temperature decrease was observed. Conservatively, the control room operators did not exit TS 3.9.8.2 until the 21 CC HX was configured to support both trains of RHR with one service water header out of service. Although there was a reduction in service water flow through the 22 CC HX, the capability to remove core decay heat during shutdown conditions was maintained as demonstrated by the ability to reduce RCS temperature through the manipulation of the RHR HX outlet control valves.

It has been determined that since valve 22SW356 gear box mounting bolts failed after 72 hours of operation at 9500 gpm during the outage, a similar failure could have occurred during post-LOCA conditions. For the majority of the previous operating cycle, the 21 CC HX was available and capable of providing post-LOCA heat removal. The 21 CC HX was inoperable for three periods during the previous operating cycle – December 2008 for ~ 25 hours; January 2009 for ~11.5 hours; February 2009 for ~ 44 hours. During these periods, the maximum calculated post-LOCA flow demand was approximately 6800 gpm and since the system vibration would have been considerably lower there is reasonable assurance that the 22SW356 valve gear box mounting bolts would not have failed. During these periods, the 22 CC HX was therefore capable of performing its design basis heat removal function.

A review of this event determined that a Safety System Functional Failure (SSFF) as defined in NEI 99-02, Regulatory Assessment Performance Indicator Guidelines, did not occur since the ability to remove residual heat and mitigate the consequences of an accident were maintained as described above.

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### **CORRECTIVE ACTIONS**

1. The 22SW356 valve and gearbox were replaced using the correct mounting bolts. The bolts were torqued to the correct values.
2. A roll-out of the work order deficiencies was conducted with the appropriate maintenance and planning personnel. This roll-out included a discussion on the use of proper bolts listed on the bill of materials.
3. The maintenance procedure for the manual valve operator has been placed on hold to prevent use of the procedure until revised to include the proper torque acceptance criteria for the mounting bolts.
4. New preventive maintenance items will be created for valves 11SW121 (11 CC HX inlet valve), 11SW355 (11 CC HX outlet valve), 21SW121 (21 CC HX inlet valve), 21SW355 (21 CC HX outlet valve), 22SW121 (22 CC HX inlet valve), and 22SW356 (22 CC HX outlet valve) to include removing the mounting bolts to inspect for damage, proper bolt material, inspection of bolt holes and reinstallation in accordance with procedure SC.MD-PM.ZZ-0167.

The above actions are being tracked in PSEG's corrective action program.

### **COMMITMENTS**

No commitments are made in this LER.