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10 CFR 50.73

Serial: BSEP 15-0066

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Brunswick Steam Electric Plant, Unit No. 2
Renewed Facility Operating License No. DPR-62
Docket No. 50-324
Licensee Event Report 2-2015-003, Revision 1

Reference: LER 2-2015-003 for Brunswick, Unit 2, "Oil Leak Renders Residual Heat Removal Service Water System Pump Inoperable," Revision 0, dated June 8, 2015, ADAMS Accession Number ML15173A012

In accordance with the Code of Federal Regulations, Title 10, Part 50.73, Duke Energy Progress, Inc., submits the enclosed Revision 1 to Licensee Event Report (LER) 2-2015-003. This report provides results of the completed cause evaluation.

Please refer any questions regarding this submittal to Mr. Lee Grzeck, Manager – Regulatory Affairs, at (910) 457-2487.

Sincerely,

William R. Gideon

SWR/swr

Enclosure: Licensee Event Report 2-2015-003, Revision 1

IE22
NRR

cc (with enclosure):

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NRC FORM 366 (02-2014) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB: NO. 3150-0104 | EXPIRES: 01/31/2017

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Oil Leak Renders Residual Heat Removal Service Water System Pump Inoperable

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
04	08	2015	2015	- 003	- 01	08	05	2015		05000
									FACILITY NAME	DOCKET NUMBER
										05000

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)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
093	☐ 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)*
Lee Grzeck, Manager – Regulatory Affairs	(910) 457-2487

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	BO	MO	G080	Yes					

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 April 8, 2015, at 1639 Eastern Daylight Time (EDT), licensed personnel were informed that oil leakage on the motor for Residual Heat Removal Service Water (RHRSW) system pump 2C exceeded the amount that would be acceptable in order for the pump to meet its 30-day mission time. Event investigators found that sealant had not been applied to mechanical joints in the bearing housings on the horizontal motor, resulting in oil leaking through the unsealed joints. Based on the historical rate of oil additions, engineering personnel concluded that the bearings would not have been able to operate throughout their full mission time, and licensed personnel declared the 2C RHRSW pump inoperable on that basis. The condition resulted in a failure to comply with Technical Specification (TS) 3.7.1, "Residual Heat Removal Service Water (RHRSW)," and with TS Limiting Condition for Operation (LCO) 3.0.4, and also resulted in a loss of the safety function. The direct cause of this event was lack of sealant in mechanical joints of the bearing housings. The root cause was that the process for identifying and updating maintenance procedures impacted by a safety related engineering change was less than adequate, and a contributing cause was a lack of questioning attitude. Corrective actions for this event included applying sealant to the bearing housings, revising procedures to address safety related engineering changes, and discussing the event with appropriate maintenance personnel.

NARRATIVE

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

Background

Initial Conditions

At the time of this event, Unit 2 was in Mode 1 at a power level of approximately 93 percent of rated thermal power.

Reportability Criteria

This event is reportable per 10 CFR 50.73(a)(2)(i)(B) because the plant operated in a condition which was prohibited by the Technical Specifications (TS). Specifically, a residual heat removal service water system (RHRSW) [BO] pump was inoperable for a period greater than allowed by TS 3.7.1.

Since RHRSW pump 2C is required in Modes 1, 2, and 3 and the completion time for correcting a failure to meet this condition is not unlimited, the plant did not comply with TS Limiting Condition for Operation (LCO) 3.0.4 when it entered any of these modes. Therefore, the plant entered a condition which is prohibited by the TS, and the event is reportable per 10 CFR 50.73(a)(2)(i)(B) for entry into Modes 1, 2, and 3 with one RHRSW pump not operable.

This event is also reportable per 10 CFR 50.73(a)(2)(v)(B) for loss of safety function of a system designed to remove decay heat. Specifically, three instances were identified in the past three years in which the Residual Heat Removal (RHR) system or RHRSW Loop B was removed from service for planned maintenance while RHRSW pump 2C in Loop A was inoperable due to an oil leak on its motor.

Event Description

On April 8, 2015, a non-licensed component engineer was observing performance of procedure 0PT-08.1.4B, "RHR Service Water System Operability Test – Loop B." While looking at nearby pump RHRSW 2C, which was not involved in the Loop B test, he noted the presence of oil that had leaked from its pump motor. Personnel checked maintenance records on this motor and discovered that oil had been added on several recent occasions. Based on the timing and volume of oil additions, the cumulative run time on the pump, and the volume of the bearing oil reservoir, it was concluded that the volume of oil leakage would not support operation of the pump for its full, 30-day mission time. Licensed personnel were notified, and the pump was declared inoperable at 1639 Eastern Daylight Time (EDT) on April 8, 2015.

Repair of the oil leak was performed on April 9 through 10, 2015. During repair activities, maintenance personnel observed that no sealant had been applied to mechanical joints in the bearing housings on the motor. Sealant was applied to correct the condition, and the post-maintenance test was successfully completed on April 11, 2015. The pump was then declared operable at 0450 EDT on April 11, 2015.

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Personnel investigating this event found evidence that no sealant was applied to the bearing housings on this motor during maintenance activities in 2010 and 2013. Since the motor has not been worked on since that time, it's concluded that the motor has not been capable of operating through its full, 30-day mission time since 2010. Documentary or photographic evidence did not exist for the time before 2010. Evidence from interviews suggests this condition may have existed since the motor was originally purchased and installed in 2002.

Event Cause

The direct cause of this event is the lack of sealant applied to mating surfaces in the bearing housings of the 2C RHRSW pump motor. The mechanical joints are not pressure-retaining, so oil leakage takes the form of weeping through the mechanical joints. The weeping was largely into areas of the motor that are not visible externally. The leakage eventually worked its way out of these areas and collected beneath the motor where it was observed by an engineer as previously noted. The delay between the occurrence of the leakage from the bearings and the accumulation of oil beneath the motor meant that leakage was often not evident while the motor was operating.

Maintenance records show sealant has been absent since 2010. Evidence from interviews suggests the sealant may not have been applied by the manufacturer when the motor was installed in 2002. The condition has therefore existed since 2010 and may have existed since the motor was received from the manufacturer and installed in the plant in 2002.

Contributing causes of this event were a maintenance procedure with insufficient detail and a lack of a questioning attitude on the part of maintenance personnel. Maintenance procedure 0CM-M503, "Maintenance Instructions for the RHR Service Water Booster Pump Motors," directs the user to coat the sealing surfaces of the oil shield with sealant. However, the procedure was unclear about what the oil shield is. Sealant was therefore not applied to all of the necessary mechanical joints. Given that the procedure mentioned sealant, maintenance personnel using the procedure should have questioned why it was not present on the critical mechanical joints when disassembling the motor, but did not do so.

The root cause of this event was that the process for identifying and updating maintenance procedures that are impacted by an engineering change of a safety-related component was less than adequate. When this motor was replaced in 2002, the vendor manual supplied with it was also replaced at that time. The replacement of the vendor manual created an opportunity for the associated maintenance procedure to have clarified where sealant should be applied to the bearing housings. However, the process guidance in place at that time was not specific about the kinds and extent of procedure reviews to be performed. No evidence was found that a technical review of the relevant maintenance procedure was performed. Thus, unclear guidance remained in the maintenance procedure, contributing to the sealant not being applied in 2010 and 2013.

Safety Assessment

The RHRSW system is designed to provide cooling water for the RHR system heat exchangers, which are required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. The RHRSW system is operated whenever the RHR heat exchangers are required to operate in the shutdown cooling mode or in the suppression pool cooling or spray mode of the RHR system. The RHRSW system removes heat from the suppression pool to limit the suppression pool temperature and

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primary containment pressure following a loss-of-coolant accident (LOCA). This ensures that the primary containment can perform its function of limiting the release of radioactive materials to the environment following a LOCA.

To satisfy operability requirements, a component must be capable of performing its specified safety function throughout the mission time in the current licensing basis. The BSEP design basis document for the RHRSW system says the mission time for the system is 30 days. In this event, one of four RHRSW pumps had an oil leak which would have resulted in the pump being unable to operate through its full, 30-day mission time without an oil addition. Therefore, the pump was inoperable.

This condition was reviewed for the past three years per 10 CFR 50.73(a)(1) for compliance with TS LCO 3.0.4. This specification prohibits the plant from changing modes when an LCO will not be met in the mode that is being entered, unless certain conditions are met. Therefore, the plant did not comply with TS LCO 3.0.4 when BSEP Unit 2 changed modes with RHRSW pump 2C inoperable. Hence, the event is reportable per 10 CFR 50.73(a)(2)(i)(B). The following table shows the occasions when the plant entered a different mode or applicability condition in which the mode change did not comply with TS LCO 3.0.4.

Date	Reason	Mode Change
05/03/2013	Startup from refueling outage	from 4 to 2
05/05/2013	Startup from refueling outage	from 4 to 2
05/07/2013	Startup from refueling outage	from 2 to 1
04/04/2015	Startup from refueling outage	from 4 to 2
04/05/2015	Startup from refueling outage	from 2 to 1

While operating in Mode 1, the duration of RHRSW pump 2C inoperability exceeded the required restoration time of 14 days per TS 3.7.1, Condition A, without shutting down as required per TS 3.7.1, Condition D. Therefore, the plant was operated in a condition prohibited by the TSs, and the event is reportable per 10 CFR 50.73(a)(2)(i)(B).

Instances were identified when RHRSW Loop B was inoperable while RHRSW pump 2C had its active oil leak. These occurred as follows:

Date	Reason	Duration
07/11/2012	Planned maintenance RHRSW Loop B	35.08 hours
10/24/2013	Planned maintenance RHRSW Loop B	5.72 hours
07/09/2014	Planned maintenance RHRSW Loop B	50.48 hours

During these periods, both loops of RHR or RHRSW were inoperable at the same time. In two instances when the duration exceeded 20 hours, the plant entered a condition prohibited by TS 3.7.1, Conditions C and D. In addition, per NUREG-1022, Revision 3, a loss of safety function exists when a system is inoperable per the TS; the inoperability is due to equipment failure, and no redundant equipment in the same system is operable. When RHRSW pump 2C was inoperable in Loop A, and RHR Loop B was removed from service, no redundant equipment was available in the same system. Therefore, the event is reportable per 10 CFR 50.73(a)(2)(v)(B), as a condition that could have prevented the fulfillment of its safety function.

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The engineering evaluation found that the RHRSW pump motor can operate reliably with up to 10 ounces of oil loss. Maintenance records of refilling the oil indicate that the maximum observed oil loss was 5 ounces over a period of 107.5 hours of recorded in-service time, occurring between March 20 and March 27, 2015. Extrapolating this to the maximum allowable oil loss of 10 ounces means the pump could have become inoperable in approximately 9 days of continuous operation following a refill. Based on the as-found condition of the 2C pump, which was 5 ounces below full, it's reasonable to expect the pump could have operated for at least 4.5 days before actual failure due to loss of oil in a bearing.

BSEP calculation BNP-E-7.010, "Emergency Diesel Generator Static & Dynamic Load Study," states two RHRSW pumps are required for decay heat removal for the first 24 hours after a LOCA, and only one pump is required thereafter. Therefore, even though RHRSW Loop A was inoperable because the 2C pump could not meet its 30-day mission time, it's concluded that in each case when the plant was relying solely on RHRSW Loop A, two RHRSW pumps in Loop A would have been available during the initial 24 hours, and the unaffected RHRSW pump would have been available thereafter. In conditions when the plant was crediting two loops of RHRSW, three operable pumps were available, and a fourth was available for up to 4.5 days of continuous service as described above. Thus, the plant was capable at all times of removing the decay heat from the core as required.

Based on this analysis, it's concluded that this event had no significant impact on nuclear safety.

Corrective Actions

Any changes to the corrective actions and schedules noted below will be made in accordance with the site's corrective action program.

- The oil leak was corrected by application of sealant to the oil bearing housing joints. This action is complete.
- Maintenance procedure 0CM-M503 has been revised to ensure correct placement of sealant in order to prevent oil leakage. This action is complete.
- The lessons learned from this event have been communicated to appropriate maintenance personnel, specifically, the interpretation and assumptions made by maintenance technicians without using a questioning attitude. This action is complete.
- Appropriate engineering procedures will be revised to ensure that when engineering changes are made to safety-related structures, systems, or components (SSCs), then a formal review will also be performed on procedures for maintaining these SSCs. This action will be completed by December 1, 2015.

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Previous Similar Events

A review of LERs for the past three years did not identify any previous similar occurrences. A review of the site's Corrective Action Program database also did not identify any previous similar occurrences.

Commitments

No regulatory commitments are contained in this report.