



**Progress Energy**

**James Scarola**  
Vice President  
Brunswick Nuclear Plant  
Progress Energy Carolinas, Inc.

**DEC 22 2006**

SERIAL: BSEP 06-0135

10 CFR 50.73

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

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2  
Docket Nos. 50-325 and 50-324/License Nos. DPR-71 and DPR-62  
Licensee Event Report 1-2006-006

Ladies and Gentlemen:

In accordance with the Code of Federal Regulations, Title 10, Part 50.73, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc., submits the enclosed Licensee Event Report. This report fulfills the requirement for a written report within sixty (60) days of a reportable occurrence.

Please refer any questions regarding this submittal to Mr. Randy C. Ivey, Manager - Support Services, at (910) 457-2447.

Sincerely,

B. C. Waldrep  
Plant General Manager  
Brunswick Steam Electric Plant

LJG/ljg

Enclosure:

Licensee Event Report

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TE22

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**LICENSEE EVENT REPORT (LER)**

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

Estimated burden per response to comply with this mandatory information collection request: 50 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](mailto: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.

<b>1. FACILITY NAME</b> Brunswick Steam Electric Plant (BSEP), Unit 1	<b>2. DOCKET NUMBER</b> 05000325	<b>3. PAGE</b> 1 OF 5
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**4. TITLE**  
Technical Specifications for Reactor Recirculation Pump Speed Match Criteria is Non-Conservative.

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	27	2006	2006	006	00	12	22	2006	BSEP, Unit 2	05000324
									FACILITY NAME	DOCKET NUMBER
										05000

<b>9. OPERATING MODE</b> 1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §:</b> (Check one or more)									
<b>10. POWER LEVEL</b> 100	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)						
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)						
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER						
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A						

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME Lee J. Grzeck, Senior Engineer – Licensing	TELEPHONE NUMBER (Include Area Code) (910) 457-2487
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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

14. SUPPLEMENTAL REPORT EXPECTED				15. EXPECTED SUBMISSION DATE		MO	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO						

**ABSTRACT** (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On October 27, 2006, plant personnel determined that Technical Specification (TS) Surveillance Requirement (SR) 3.4.1.1, which verifies that the recirculation pump speeds are within 20% of each other when operating at less than 75% of rated core flow or within 10% of each other when operating at greater than or equal to 75% of rated core flow, does not provide adequate assurance that the recirculation loops are operating within the initial conditions of the existing design bases loss of coolant accident (LOCA) analysis. SR 3.4.1.1 was a new surveillance, added during Brunswick Steam Electric Plants (BSEP) conversion to the Improved Technical Specifications in 1998. SR 3.4.1.1 required the recirculation loops to be operated with matched pump speeds, instead of matched pump flows, due to availability of control room indication.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(ii)(B), as an event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

The root cause of this event was determined to be ineffective implementation of the SR due to not fully understanding the relationship between recirculation pump speed mismatch and core flow mismatch. Corrective actions included issuing a new surveillance procedure to ensure plant operation within the design basis limits, and revising the Limited Condition of Operation (LCO) requirements of TS 3.4.1 and SR 3.4.1.1.

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Brunswick Steam Electric Plant (BSEP), Unit 1	05000325	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 5
		2006	-- 006	-- 00	

**NARRATIVE** (If more space is required, use additional copies of NRC Form 366A) (17)

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

INTRODUCTION

On October 27, 2006, plant personnel determined that Technical Specification (TS) Surveillance Requirement (SR) 3.4.1.1, which verifies that the Recirculation pump [AD] speeds are within 20% of each other when operating at less than 75% of rated core flow or within 10% of each other when operating at greater than or equal to 75% of rated core flow, does not provide adequate assurance that the recirculation loops are operating within the initial conditions of the existing design bases loss of coolant accident (LOCA) analysis. To be bounded by the existing LOCA analysis, SR 3.4.1.1 must verify that for core flows less than 75% of rated, the loop flows shall be within 10% of rated core flow and for core flows greater than or equal to 75% of rated, the loop flows shall be within 5% of rated core flow. The current TS requirement was implemented during Brunswick Steam Electric Plants (BSEP) conversion to the Improved Technical Specifications in 1998. The TS SR for recirculation pump speed mismatch is non-conservative when compared to the flow mismatch analyzed in the design bases document. A review of the operating history of both Unit 1 and Unit 2 over the past three years found that Unit 1 had no instances of recirculation flow mismatches in excess of the 5% flow limit when operating greater than or equal to 75% of rated. Unit 2 had a number of instances exceeding the 5% flow limit when operating greater than or equal to 75% of rated core flow during the three year period, and thus had the potential to be outside the bounds of the design analysis with respect to core flow on those occasions if a LOCA had occurred.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(ii)(B), as an event or condition that resulted in the nuclear power plant being in an unanalyzed condition that significantly degraded plant safety.

EVENT DESCRIPTION

*Initial Conditions*

At the time of the event, both Units 1 and 2 were in Mode 1, operating at approximately 100 percent of rated thermal power.

*Discussion*

The Reactor Recirculation system is designed to provide a forced coolant flow through the core to remove heat from the fuel. The operation of the Reactor Recirculation system is an initial condition assumed in the design basis LOCA. During a LOCA caused by a recirculation loop pipe break, the intact loop is assumed to provide coolant flow during the first few seconds of the accident. The initial core flow decrease is rapid because the recirculation pump in the broken loop ceases to pump reactor coolant to the vessel almost immediately. The pump in the intact loop coasts down relatively slowly. The pump coastdown governs the core flow response for the next several seconds until the jet pump suction is uncovered. The LOCA analysis assumes that both loops are operating at the same flow prior to the accident. However, the LOCA analysis

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EVENT DESCRIPTION (continued)

was reviewed for the case with a flow mismatch between the two loops, with the pipe break assumed to be in the loop with the higher flow. While the flow coastdown and core response are potentially more severe in this assumed case (i.e., since the intact loop starts at a lower flow rate and the core response is the same as if both loops were operating at a lower flow rate), a small mismatch has been determined to be acceptable based on engineering judgment. The recirculation system is also assumed to have sufficient flow coastdown characteristics to maintain fuel thermal margins during abnormal operational transients. The intent of Limiting Condition of Operation (LCO) 3.4.1 and SR 3.4.1.1 is to ensure that the Reactor Recirculation system is operated within the bounds of the existing LOCA analysis.

TS 3.4.1, "Recirculation Loops Operating," currently requires the recirculation loops be operated with matched pump speeds, versus recirculation loop flow of the LOCA analysis. During conversion of the BSEP TSs to the Improved Technical Specifications, as contained in NUREG-1433, Revision 1, "Standard Technical Specifications General Electric Plants, BWR/4," a more restrictive change was made to require that operating recirculation loops be matched with respect to recirculation pump speeds. This deviated from the wording for Revision 1 of NUREG-1433, in that the NUREG required the loops be matched with respect to flows rather than pump speed. The Improved Technical Specifications were approved for BSEP Units 1 and 2 in Amendments 203 and 233, respectively, on June 5, 1998. Previous to conversion, the BSEP TSs. required that two recirculation loops be in operation with no specific requirement for matching of flows or pump speeds. The change in nomenclature was made for operator convenience. Recirculation pump speed indication is readily available to the control room operators; whereas recirculation loop jet pump flow indication is not. As such, pump speed was chosen as the means to verify recirculation loop flow matching.

For BSEP, GE Nuclear Energy provided by letter an analysis that determined the LOCA analysis assumption is met, for core flows less than 75% of rated, when the recirculation loop flows are operating within 10% of each other based on rated core flow and, for flows greater than or equal to 75% of rated, when the recirculation loop flows are within 5% of each other based on rated core flow. The same GE Nuclear Energy document indicates that a 5% mismatch in terms of core flow conservatively equated to a 10% mismatch in terms of either loop flow or pump speed. Based on this guidance, the existing LCO 3.4.1 and SR 3.4.1.1 requirements were established.

In October 2006, Operations personnel noted that for a small indicated difference in recirculation pump speeds the deviation in loop flow was larger than expected. Based on this observation, Engineering initiated an evaluation of the bases for the criteria established in SR 3.4.1.1. On October 27, 2006, based on the Engineering evaluation, it was determined that pump speed requirements, established in SR 3.4.1.1, are not sufficiently conservative. The above factors resulted in the potential that, although meeting the requirements of SR 3.4.1.1, the operating recirculation loops could, in fact, be outside the bounds of the LOCA analysis with respect to core flow. To remedy this condition, a procedure was developed to confirm recirculation loop flows are within 10% of rated core flow when operating at less than 75% of rated, and for core flows greater than or equal to 75% of rated, the loop flows shall be within 5% of rated core flow.

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EVENT DESCRIPTION (continued)

Secondly, the LCO requirements of TS 3.4.1 and SR 3.4.1.1 are being revised to directly monitor recirculation loop jet pump flows; consistent with the LOCA analysis assumption as well as the current version of the Standard Technical Specifications (i.e., NUREG 1433).

EVENT CAUSE

The root cause of this event is ineffective implementation of the SR due to not fully understanding the relationship between recirculation pump speed mismatch and core flow mismatch. The GE Nuclear Energy guidance regarding mismatch contained sufficient information to have implemented an adequate LCO and SR.

SAFETY ASSESSMENT

The safety significance of this condition is considered minimal.

Recirculation loop mismatch criteria were established to ensure fuel thermal limit margins are maintained. Operation of the recirculation system for periods of time, since June 1998, has not in any way challenged the integrity of the recirculation system. Additionally, BSEP Units 1 and 2 do not have the low pressure coolant injection system loop select logic. As such, the impact of potential recirculation pump flow mismatch is minimal.

CORRECTIVE ACTIONS

- BSEP procedure OPT-13.5, "Reactor Recirculation Pump Differential Speed and Loop Flow Check," was issued on October 27, 2006, which provided loop flow surveillance requirements.
- A TS Amendment change package has been submitted on December 21, 2006, revising the LCO requirements of TS 3.4.1 and SR 3.4.1.1 to directly monitor recirculation loop jet pump flows.

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#### PREVIOUS SIMILAR EVENTS

A review of LERs, corrective action program condition reports, and events which have occurred within the past three years has not identified any previous similar occurrences.

#### COMMITMENTS

No regulatory commitments are contained in this report.