CP&L
A Progress Energy Company

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U. S. Nuclear Regulatory Commission
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BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-324/LICENSE NOS. DPR-71 AND DPR-62
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING
REQUEST FOR LICENSE AMENDMENTS - EXTENDED POWER UPRATE
(NRC TAC NOS. MB2700 AND MB2701)

Ladies and Gentlemen:

On August 9, 2001 (i.e., Serial: BSEP 01-0086), Carolina Power & Light (CP&L) Company requested a revision to the Operating Licenses (OLs) and the Technical Specifications for the Brunswick Steam Electric Plant (BSEP), Units 1 and 2. The proposed license amendments increase the maximum power level authorized by Section 2.C.(1) of OLs DPR-71 and DPR-62 from 2558 megawatts thermal (MWt) to 2923 MWt. On March 11, 2002, the NRC provided an electronic version of a request for additional information (RAI) concerning Anticipated Transient Without Scram (ATWS) analyses supporting the extended power uprate. The response to this RAI is enclosed.

Please refer any questions regarding this submittal to Mr. David C. DiCello, Manager - Regulatory Affairs, at (910) 457-2235.

Sincerely,

[signature] for J.S. Keenan

John S. Keenan

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A001

Enclosure:
Response to Request for Additional Information (RAI) 5-14a

C. J. Gannon, having been first duly sworn, did depose and say that the information contained herein is true and correct to the best of his information, knowledge and belief; and the sources of his information are officers, employees, and agents of Carolina Power & Light Company.

Kenneth M. Sicily
Notary (Seal)

My commission expires: MAY 18, 2003

cc:

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ENCLOSURE

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Response to Request for Additional Information (RAI) 5-14a

Background

On August 9, 2001 (i.e., Serial: BSEP 01-0086), Carolina Power & Light (CP&L) Company requested a revision to the Operating Licenses (OLs) and the Technical Specifications for the Brunswick Steam Electric Plant (BSEP), Units 1 and 2. The proposed license amendments increase the maximum power level authorized by Section 2.C.(1) of OLs DPR-71 and DPR-62 from 2558 megawatts thermal (MWt) to 2923 MWt. On March 11, 2002, the NRC provided an electronic version of a RAI concerning Anticipated Transient Without Scram (ATWS) analyses supporting the extended power uprate (EPU). The response to this RAI follows.

NRC Question 5-14a

The PUSAR did not identify which Unit was used for the EPU ATWS analysis. The BSEP units have different bypass capacities, which would lead to different ATWS response for some of the analyzed events. In addition, the PUSAR reports a peak ATWS vessel pressure of 1492 psig compared to a limit of 1500 psig. Please, respond to the following questions to confirm that your ATWS analysis is based on the limiting conditions and used the limiting key input parameters.

5-14a(1)

Identify which unit was analyzed for each event and state if the analyzed unit would be the most limiting unit in terms of peak vessel pressure. Also confirm that 1 SRV OOS was assumed in the all of the events, since SRV-OOS would affect the Units' ability to reduce vessel pressure and the Units are licensed to operate with one SRV-OOS.

Response to NRC Question 5-14a(1)

The following table presents the BSEP Unit and the associated main turbine bypass capacity assumed in each of the four analyzed ATWS events. The Pressure Regulator Failure – Open (PRFO) event is the limiting event for the calculation of peak reactor pressure. The Unit 2 bypass capacity is the most limiting unit for the calculation of the peak reactor pressure in the PRFO event. The bypass capacity selected for the remaining three ATWS events is not based on peak reactor pressure. For all analyzed ATWS events, the most limiting parameter from each unit was used, thereby providing a bounding analysis. Each of these four events was analyzed assuming one Safety/Relief Valve (SRV) is out of service. Additionally, Standby Liquid Control system discharge relief valve evaluations described in CP&L's response to RAIs 5-12, 5-13, and 5-15 (i.e., CP&L letter dated March 12, 2002, Serial: BSEP 01-0166) were performed based on results that bound the reevaluated PFRO case.

Analyzed ATWS Events	Bypass Capacity Input	Associated Brunswick Unit
Main Steam Isolation Valve Closure (MSIVC)	20.64%	Unit 1
Pressure Regulator Failure - Open (PRFO)	69.6%	Unit 2
Loss of Offsite Power (LOOP)	20.64%	Unit 1
Inadvertent Opening of Relief Valve (IORV)	20.64%	Unit 1

The original analysis of all four ATWS events, presented in the PUSAR, used the Unit 1 bypass capacity since it is more conservative for the LOOP event. However, the most limiting case of the PRFO event is based on the Unit 2 turbine bypass capacity, and a revised ATWS analysis of the PRFO event has been performed. The net effect of the revised ATWS analysis has been to decrease the calculated peak reactor vessel pressure, thereby increasing the margins to acceptance limits.

The calculated peak reactor pressure of 1492 psig, originally reported in PUSAR Table 9-7, has been revised to 1487 psig. The 1487 psig value is based on Unit 2 bypass capacity of 69.6% of rated EPU steam flow and an SRV setpoint uncertainty of 34 psig. The value of 1492 psig was based on the Unit 1 bypass capacity of 20.64% of rated EPU steam flow and an SRV setpoint uncertainty of 44 psig.

The effect of the larger Unit 2 bypass capacity is to increase the peak reactor pressure by approximately 2 psig. The effect of the decreased SRV setpoint uncertainty is a lower calculated peak reactor pressure of approximately 7 psig. The revised SRV setpoint uncertainties are consistent with the analytical limits presented in Table 5-1 of the PUSAR, although different than those originally presented in PUSAR Table 9-6.

ATWS is not a design basis event and nominal plant conditions may be used in the analysis. Both the original BSEP ATWS analysis, presented in the PUSAR, and the revised ATWS analysis discussed herein used the BSEP Technical Specification 3.3.4.1, "Anticipated Transient Without Scram Recirculation Pump Trip (ATWS-RPT) Instrumentation," upper limit allowable value for the high pressure ATWS RPT setpoint (i.e., 1147 psig). The use of the ATWS RPT setpoint allowable value is consistent with Extended Power Uprates previously approved by the NRC. The high pressure ATWS RPT setpoint allowable value is consistent with the existing licensing basis, but is inappropriately labeled as an analytical limit in PUSAR Tables 5-1 and 9-6. Although the allowable value used in the EPU ATWS analysis has not changed from the existing Technical Specification allowable value, it is a change from the pre-EPU ATWS analysis, which uses the high pressure ATWS RPT trip setpoint analytical limit of 1170 psig. The 1170 psig analytical limit was established in conjunction with a setpoint methodology that included uncertainties applicable to a design basis accident analysis. Some of the uncertainties included were overly conservative for an analysis based on nominal plant conditions. Nominal plant conditions are used because an ATWS is assumed to initiate from normal plant operating conditions. The margin between the actual ATWS RPT setpoint of 1138 psig and the Technical Specification allowable value of 1147 psig addresses applicable uncertainties such as instrument drift.

For the remaining ATWS criteria (i.e., peak clad temperature, peak suppression pool temperature, and peak containment pressure), the Unit 1 bypass capacity was used. However, the bypass capacity is not the governing input in the analyses for these remaining ATWS criteria.

The following tables clarify the changes to PUSAR Tables 5-1, 9-6, and 9-7 as a result of the revised ATWS analysis for the PRFO event.

Updated Table 5-1
ANALYTICAL LIMITS FOR SETPOINTS

	Analytical Limit	
Parameter	**Current**	**EPU**
APRM Calibration Basis (MWt)	2558	2923
APRM Simulated Thermal Power Scram		
TLO Fixed (%RTP)	118.5	No change
SLO Fixed (%RTP)	118.5	No change
TLO Flow Biased (%RTP)	$0.66W_D + 63.5$ (1)	$0.55W_D + 64$
SLO Flow Biased (%RTP)	$0.66W_D + 63.5$ (1)	$0.55W_D + 55.5$
APRM Neutron Flux Scram (%)	121	No change
RBM Low Power Setpoint (%RTP)	30.0	No change
RBM Intermediate Power Setpoint (%RTP)	65.0	No change
RBM High Power Setpoint (%RTP)	85.0	No change
RBM Low Trip Setpoint (Division) (2)	117	No change
RBM Intermediate Trip Setpoint (Division) (2)	111.2	No change
RBM High Trip Setpoint (Division) (2)	107.4	No change
Vessel High Pressure Scram (psig)	1096	No change
Reactor Vessel Low Water Level Scram, LL1/L3 (inches above vessel zero)	517	No change
High Pressure ATWS RPT (psig) (4)	1170	1147
Safety Relief Valve Setpoints (psig)	4 @ 1163.9	No change
	4 @ 1174.2	No change

	Analytical Limit	
Parameter	Current	EPU
	3 @ 1184.5	No change
TSV & TCV Scram Bypass (%RTP)	30	26
Main Steam Line High Flow Isolation (% rated steam flow)	140	No change
Main Steam Line Tunnel High Temperature Isolation (°F)	200	No change
Feedwater Flow/Recirculation Upshift Interlock (Mlb/hr)	2.09	No change
Low Steam Line Pressure MSIV Closure (Run Mode) (psig)	785.0	No change
RCIC Steam Line High Flow Isolation (lbm/hr)	75,210 (3)	No change
HPCI Steam Line High Flow Isolation (lbm/hr)	573,000	No change

NOTES:

(1) These values refer to the original MELLLA basis for ALs and not to the current reactor stability Long-Term Solution Option I-A (E1A) values. These values are provided to show how the new ALs are derived.

(2) Setpoint relative to a full-scale reading of 125.

(3) The AL is based on 300% of the steam flow corresponding to extended system operation at a maximum flow rate of 500 gpm. The minimum steam flow that would be expected from a complete line break is 105,000 lbs/hr (419%).

(4) The value of 1170 psig is the high pressure ATWS RPT trip setpoint analytical limit established by the 105% power uprate. The Brunswick EPU ATWS analysis used the Brunswick Technical Specification upper limit allowable value for the high pressure ATWS Recirculation Pump Trip (RPT) setpoint of 1147 psig. ATWS is not a design basis event and nominal plant conditions may be used in the analysis.

Where:

W_D is recirculation drive flow in percent of that required to achieve 100% core flow at 100% power.

Updated Table 9-6
Key Inputs for ATWS Analysis

ATWS Input Variable	Baseline Condition Value	EPU Condition Value
Reactor power (MWt)	2436	2923
Reactor dome pressure (psia)	1045	1045
SRV opening setpoint pressure (psig)	See Table 5-1	See Table 5-1
High pressure ATWS-RPT allowable value (psig)	1147	1147
Number of SRVs Out-of-service (OOS)	1	1

Updated Table 9-7
Results of ATWS Analysis

ATWS Acceptance Criteria	Baseline Condition Result	EPU Condition Result
Peak vessel bottom pressure (psig)	1372	1487
Peak clad temperature (°F) (1)	1449	1309
Peak suppression pool temperature (°F)	194.8	195.5
Peak containment pressure (psig)	12.7	12.9

NOTES:
(1) Cladding oxidation remains less than the requirements of 10 CFR 50.46.

NRC Question 5-14a(2)

For the PRFO event, (i) explain why the unit with the larger bypass capacity would be more limiting in terms of peak pressure, (ii) if turbine bypass valves OOS were assumed in the analysis, justify why this would be conservative in terms of peak pressure relative to assuming the full Unit 2 bypass capacity.

Response to NRC Question 5-14a(2)

For the PRFO event, the larger bypass capacity is slightly more limiting in terms of peak reactor pressure. The larger bypass capacity results in a more rapid decrease in reactor pressure, resulting in increased void fraction and a larger positive reactivity insertion after reactor isolation has been completed. Therefore, resulting power increases slightly compared to the power increase resulting for the use of a smaller bypass capacity. Thus, the larger bypass capacity results in a higher calculated peak reactor pressure. As discussed above, the revised ATWS analysis has offset the pressure increase by establishing SRV setpoint uncertainties consistent with the analytical limits presented in Table 5-1 of the PUSAR.

The revised ATWS analysis of the PRFO event does not assume any bypass valves out of service for the PRFO event. For the PFRO event, full Unit 2 bypass capacity of 69.6% of rated EPU steam flow was assumed.

NRC Question 5-14a(3)

The audit material included a GE note stating that the results from the ATWS analysis are based on the use of 5.03-inch throat diameter SRVs. The report recommended that CP&L confirm that the BSEP Units 1 and 2 SRVs have a throat diameter of 5.03. Since the peak vessel pressure margin was small, please confirm that the SRV throat diameters for the two BSEP units do, in fact, meet the analytically assumed size.

Response to NRC Question 5-14a(3)

The SRVs on both BSEP Unit 1 and Unit 2 have been verified, by field walkdown, to have a throat diameter of 5.03 inches, the analytically assumed size.

NRC Question 5-14a(4)

From the audit material the staff understands that GE's ATWS analysis was based on, (i) SRV analytical opening setpoints (including drift/uncertainty of 44 psig) of 1174,1184, 1194, and (ii) ATWS-RPT analytical setpoint of 1170 psig. For the reanalyzed PRFO event, identify any changes in the key input parameters made and justify the basis for the change. Explain if the input parameter changes in the current ATWS reanalysis would increase or decrease the calculated peak vessel pressure.

Response to NRC Question 5-14a(4)

The changes to the revised PRFO analysis from that present in the PUSAR are limited to: (1) a lower SRV setpoint uncertainty, and (2) an increased turbine bypass capacity. The following table addresses the effect of the change on the calculated peak reactor pressure and the justification for each change.

Change	Effect	Justification
Decreased SRV setpoint uncertainty from 44 psig to 34 psig	Decrease peak reactor pressure by 7 psig	The SRV setpoint uncertainty for the original PRFO analysis was not based on a Brunswick-specific setpoint value. Rather, it was based on a generic industry value of setpoint drift for SRVs. The 34 psig uncertainty is consistent with the maximum drift allowed by Brunswick Technical Specification 3.4.3, "Safety/Relief Valves (SRVs)."
Increased turbine bypass capacity from 20.64% to 69.6% of rated EPU steam flow	Increase peak reactor pressure by 2 psig	The larger turbine bypass capacity in the PRFO event produces the most limiting calculated peak reactor pressure.
Net effect	Decrease calculated peak reactor pressure by 5 psig, thereby increasing the margin to the acceptance limit.	

The ATWS RPT setpoint used in the revised analysis has not changed. Both the original analysis presented in the PUSAR and the revised analysis presented in the attached tables used an ATWS RPT setpoint of 1147 psig.