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 REQUESTS FOR ADDITIONAL INFORMATION REGARDING REQUEST FOR LICENSE AMENDMENTS - EXTENDED POWER UPRATE (NRC TAC NOS. MB2700 AND MB2701)

Ladies and Gentlemen:

On August 9, 2001 (Serial: BSEP 01-0086), Carolina Power & Light (CP&L) Company requested a revision to the Operating Licenses (OLs) and the Technical Specifications (TSs) 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. Subsequently, on September 17, 2001, the NRC provided an electronic version of a Request For Additional Information (RAI); which was followed by a conference call regarding the requested information. During the conference call, an additional question was raised. The responses to these RAIs are enclosed.

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

Sincerely,

John S. Keenan

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Enclosure:
Response to Requests For Additional Information (RAIs) 1 and 2

John S. Keenan, 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.

Dean S. Mar
Notary (Seal)

My commission expires: 8/29/04

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ENCLOSURE

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Response to Requests For Additional Information (RAIs) 1 and 2

Background

On August 9, 2001 (Serial: BSEP 01-0086), Carolina Power & Light (CP&L) Company requested a revision to the Operating Licenses (OLs) and the Technical Specifications (TSs) 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. Subsequently, on September 17, 2001, the NRC provided an electronic version of a Request For Additional Information (RAI); which was followed by a conference call regarding the requested information. During the conference call, an additional question was raised. The responses to these RAIs follow.

NRC Question 1-1

> In Table 4-1, it is indicated that at Current RTP, using EPU methods, the peak drywell pressure is calculated as 44.2 psig against a UFSAR value of 40.9 psig. Is this change in pressure due to the EPU methods for calculating break flow rate and enthalpy using LAMB with Moody's Slip critical flow model against the UFSAR using Homogeneous Equilibrium Model? What are the reasons for changing the methodology for calculating the break flow?

Response to Question 1-1

The 3.3 psi difference in peak drywell pressure at current rated thermal power (RTP) is mainly due to the extended power uprate (EPU) method, which uses the break flow rates and enthalpies calculated by LAMB with Moody's Slip critical flow model. The Updated Final Safety Analysis Report (UFSAR) method used the break flow rates and enthalpies calculated with the Homogeneous Equilibrium Model based on the vessel blowdown model built into the containment analysis code M3CPT. In order to analyze the containment response at a wide range of reactor operating conditions, such as low core flow, low power and feedwater temperature reduction, it was necessary to use a more detailed vessel blowdown model than the M3CPT vessel model. Consequently, for the EPU evaluation performed at various reactor operating conditions, the LAMB code, which is based on a detailed modeling of flow behavior inside the vessel, was used to calculate the break flow rates and enthalpies. In using the LAMB code, the Moody's Slip model (Emergency Core Cooling System (ECCS) – Loss-of-Coolant-Accident (LOCA) Appendix K option for the critical flow model) was used for the BSEP EPU evaluation.

NRC Question 1-2

In Table 4-1, it is also indicated that at Current RTP, using EPU methods, the peak bulk pool temperature is calculated as 197.9°F against a UFSAR value of 189.4°F. Is the change in value mainly due to change in service water temperature from 90° to 92°F and decay heat nominal values with 2-sigma uncertainty added? Are there are other factors not indicated above?

Response to Question 1-2

The change in peak bulk pool temperature at current RTP is mainly due to change in service water temperature from 90° to 92°F and decay heat nominal values with 2-sigma uncertainty added. Other factors include more conservative decay heat calculations (i.e., longer exposure time and inclusion of miscellaneous actinides and activation terms for the EPU), and the difference in the method of removing heat from the suppression pool. The UFSAR assumed the operation of containment sprays (i.e., both drywell and wetwell spray), whereas the EPU assumed direct pool cooling (i.e., direct flow return from the Residual Heat Removal (RHR) system heat exchanger to the pool). Assuming direct pool cooling, peak pool temperature increases approximately 1°F, relative to the containment spray cooling method.

NRC Question 1-3

In Table 4-1, it is indicated that at the Current RTP, the peak wetwell pressure is calculated as 30.5 psig (22.0 psig secondary peak value based on the current methods for comparison with the UFSAR value of 14 psig). Please indicate the reasons for the above change in value.

Response to Question 1-3

The primary reason for the change in secondary peak wetwell pressure is that the UFSAR assumed the operation of containment sprays, whereas direct pool cooling was assumed for the EPU evaluation. With containment sprays in operation, the drywell and wetwell airspace temperatures are considerably lower, compared to direct pool cooling, since water from the RHR heat exchanger enters the airspace in spray form. Consequently, the wetwell pressure obtained with spray cooling for the UFSAR is considerably lower than the value obtained with direct pool cooling for the EPU.

NRC Question 1-4

In Section 4.1.1.1 (c) Local Pool Temperature with SRV Discharge, it is indicated that an evaluation was performed to determine whether steam flow from quenchers would be entrained into the ECCS suction strainer and for this, the behavior of the steam plume from the quenchers relative to ECCS was analyzed at the EPU conditions. The result shows that steam ingestion is not predicted for Brunswick EPU. Please provide additional information how the above was determined.

Response to Question 1-4

An evaluation of the likelihood of steam ingestion in the ECCS suction strainers during Safety Relief Valve (SRV) actuation was performed for BSEP at EPU conditions.

The premise was that steam ingestion would be predicted if the quencher steam plume intersects any part of the ECCS suction strainer or the entrainment envelope of the suction strainer. First, the size of the steam plume generated from a SRV quencher was calculated to determine the boundary of the steam plume, with the conservative assumption that the suppression pool is saturated (i.e., no steam condensation) in the region around the SRV quenchers. Then, the envelope of flow drawn into the suction strainers was determined, based on the geometric size and orientation of the strainer, and the volumetric flow into the strainer. The entrainment envelope represents the flow boundary within which rising steam bubbles can be drawn into the strainer. The results of these calculations show that the steam plume from the SRV quencher located closest to the suction strainers will not intersect either the suction strainers or the envelope of flow (i.e., entrainment envelope) drawn into the strainer; no steam ingestion is predicted.

NRC Question 1-5

> In Section 4.1.2.3 Annulus Subcompartment Pressurization, it is indicated that EPU results in a slight increase in local subcompartment pressures. However the design remains adequate because the increase is small and significant margin exists in the design of the primary shield wall. Please provide increased values and design margins of the subcompartment pressures.

Response to Question 1-5

As described in Table 1-3 of NEDC-33039P, "Safety Analysis Report for Brunswick Steam Electric Plant Units 1 and 2 Extended Power Uprate," dated August 2001 (i.e., the Power Uprate Safety Analysis Report (PUSAR)), the analysis of the High Energy Line Breaks (HELBs) in the annulus used version G1/9 of the COPDA computer code, which has been approved by the NRC. The application of the COPDA code for the analysis of BSEP's EPU complied with the limitations, restrictions, assumptions, and conditions of the NRC approval as described in Bechtel BN-TOP-4.

The statements in the PUSAR regarding small increases in local subcompartment pressures are based on comparisons of the results from the COPDA-based analysis using operational inputs from both EPU and Current Licensed Thermal Power (CLTP) conditions. In that way, a consistent methodology was used in the comparison.

The analysis determined that peak pressures increased from 138.3 psia to 138.8 psia, which is less than a 0.4% increase. For the various HELBs analyzed, the largest increase in pressure was from 105.3 psia to 107.8 psia, or 2.4%.

As stated in BSEP UFSAR, Section 6.2.1.2, at CLTP conditions, the biological shield wall remains adequate because the original analyzed loads included large conservatisms, which bound the uprated conditions by approximately 50%. Consequently, with an approximate 50% margin at CLTP conditions, significant margin remains in the biological shield wall design with the small increases in pressures of 2.4% for EPU conditions.

NRC Question 1-6

In Section 4.7 Post-LOCA Combustible Gas Control, it is indicated that post-LOCA production of hydrogen and oxygen by radiolysis increases proportionally with the power level and the required start time for the CAD system decreases from 6.2 days to 5.3 days for the EPU. Did the analysis consider any change in fuel design for hydrogen production for EPU?

What is the required on-site capacity of the nitrogen storage system after a LOCA and what is available.

Response to Question 1-6

The analysis for EPU considered a range of fuel designs for hydrogen production. As stated in PUSAR Section 2.1, new fuel designs are not needed for the EPU to ensure safety and the EPU evaluations considered GE 13 and GE 14 fuel types. However, the EPU analysis of the post-LOCA production of hydrogen actually considered a broader range of fuel types and selected a bounding value of zirconium in the active fuel region, which provides a lower bounding hydrogen production value (i.e. lower initial hydrogen provides lower initial dilution of the controlling parameter, oxygen concentration).

The BSEP TSs require a minimum of 4,350 gallons of liquid nitrogen (i.e., approximately 400,000 scf) to be maintained on-site. As stated in PUSAR Section 4.7, the on-site storage volume is adequate to maintain the containment atmosphere at or below the 5% oxygen flammability limit for 29 days post-LOCA. In addition to other conservatisms, the analysis uses the conservative assumptions of zero containment leakage and an initial containment oxygen concentration equal to the allowable TS maximum of 4%.

The Containment Atmosphere Dilution (CAD) tank has a capacity of 5000 gallons. Of this, 4350 gallons are provided for maintaining the oxygen concentration in the primary containment as described above. The additional 15 percent, or 650 gallons, is provided for heat losses, ullage, and process margin.

In addition to the CAD tank, liquid nitrogen is stored in the Inerting LN_2 Storage Vessel. This vessel is not required for operation of the post-accident (i.e., CAD subsystem) portion of the system. It functions only during normal operation and does not serve to mitigate the consequences of an accident. It is, therefore, not required to be safety-related or Seismic Category I. It does, however, have the capability to provide makeup to the CAD tank, if desired. The Inerting LN_2 Storage Vessel has a capacity of 21,000 gallons and is sized based on the following:

Requirement	Capacity
Inerting	10,000 gallons
Make-up	1,000 gallons
Augmented Off-Gas	50 scfm, on an infrequent basis

NRC Question 1-7

Why is the effect of EPU on the hardened vent system not discussed?

Response to Question 1-7

CP&L responded to Generic Letter 89-16, "Installation of a Hardened Wetwell Vent," on October 27, 1989 (Serial: NLS-89-291). In this response, CP&L committed to voluntarily installing hardened vents and to working with the Boiling Water Reactor Owners' Group (BWROG) to develop generic design criteria for the hardened vents, but did not provide any specific details associated with the design criteria. Consistent with the design criteria developed by the BWROG, the BSEP hardened wetwell vent design was based on 1% of RTP (i.e., RTP was 2436 MWt at the time of CP&L's response to Generic Letter 89-16). The as designed capacity was 29 MWt at a containment pressure of 70 psig. With an uprate to 2923 MWt, the BSEP hardened wetwell vents will still be capable of relieving 29 MWt at a containment pressure of 70 psig; or 1% of the new rated thermal power. This remains within the generic design criteria developed by the BWROG and, as such, the hardened wetwell vents can be considered a system affected to only a small extent by operation at EPU RTP levels.

NRC Question 2-1

Provide additional information regarding the potential impact of EPU on those HVAC systems discussed in SRPs 6.4, 6.5.1, 9.4.1, 9.4.2, and 9.4.5. This should include a discussion of the impact, if any, during both normal and post-accident operations resulting from increase heat loads due to EPU and the bases for CP&L's determination of system acceptability post-EPU.

Response to Question 2-1

Impact of Extended Power Uprate on Heating Ventilating and Air Conditioning (HVAC) Systems		
System	**Affected by EPU**	**Basis**
Control Building HVAC (includes: Control Room Emergency Ventilation (CREV), Cable Spreading Room HVAC, and Battery	No	The Control Building HVAC system supports the control room, including the back-panel area. The heat loads in this area are electrical equipment in the control room back-panel area and control room staff. There are no

Impact of Extended Power Uprate on Heating Ventilating and Air Conditioning (HVAC) Systems		
System	**Affected by EPU**	**Basis**
Room HVAC)		changes to heat loads inside the control room and only minor changes in adjacent areas. The iodine loading on the CREV charcoal beds is calculated to be 1.24 E-7 mg/gram of charcoal. This is a small fraction of the 2.5 mg/gram design limit identified in Regulatory Guide (RG) 1.52, Revision 1, 1976. As such, CREV charcoal effectiveness is not impacted by EPU. Therefore, the Control Room portion of Control Building HVAC system, including CREV, is not affected by EPU.
	Minimal	The Cable Spreading Room HVAC system is a separate once through system. A portion of the condensate piping runs through the control building cable spreading room area, which represents an increased heat load under EPU conditions. This increase was conservatively evaluated to be less than 2°F, well within the capability of the current HVAC system.
	No	The Battery Room HVAC system is a separate once through system. DC loads in the battery rooms were reviewed and evaluated to increase by less than 1% for normal and post-accident power loading under EPU conditions. Therefore, the affects of EPU are insignificant for the Battery Room HVAC system.
Standby Gas Treatment	No	As discussed in Section 4.5 of the PUSAR, the Standby Gas Treatment (SGT) system is not affected by EPU. The design capacity of SGT system is not changed by EPU. As a result of EPU and the application of alternative source terms derived from RG 1.183, the post-LOCA total iodine loading decreases from 2.1 to 0.003 mg/gm of charcoal, which is well below the original design capacity and below that allowed by RG 1.52. The SGT system retains its capability of meeting its design basis

Impact of Extended Power Uprate on Heating Ventilating and Air Conditioning (HVAC) Systems		
System	**Affected by EPU**	**Basis**
		requirement for mitigation of offsite doses following a postulated design basis accident. In addition, post-accident decay heating of the SGT system, and any resultant heat load on HVAC systems, is evaluated to decrease for EPU conditions as a result of application of alternative source terms.
Reactor Building HVAC	Minimal	The areas of the reactor building affected by EPU are the drywell and the Main Steam Isolation Valve (MSIV) pit as discussed in Section 6.6 of the PUSAR. The temperature increases in these areas were conservatively calculated to be approximately 1.1°F for the MSIV pit and 1.8°F for the drywell. Based on a review of design basis calculations and environmental qualification design temperatures, these increases are within the excess design capability available. The design and operation of reactor building HVAC is not adversely affected by the EPU.
Turbine Building HVAC	Minimal	The areas of the turbine building affected by the EPU are primarily the feedwater heater area, areas around condensate piping/pumps and the main steam tunnel area. As discussed in Section 6.6 of the PUSAR, heat loads in the feedwater heater areas may increase by up to 14%. Local temperatures near pump motors that will be impacted by EPU were evaluated. Based on a review of design basis calculations and environmental qualification design temperatures, these increases are within the excess design capability available. The design and operation of turbine building HVAC is not adversely affected by the EPU.
Diesel Generator Building HVAC	No	Under EPU conditions, the Diesel Generator remains below rated capacity and there is essentially no electrical loading or process temperature change in this area. Therefore, there is no increase in design basis heat load

Impact of Extended Power Uprate on Heating Ventilating and Air Conditioning (HVAC) Systems		
System	**Affected by EPU**	**Basis**
		for this area.
ECCS Pump Room HVAC	Minimal	ECCS motors continue to operate at or below rated horsepower for EPU. The ECCS systems' process temperature is not changed, with the exception of the slight increase in suppression pool temperature. The piping heat load temperatures used in the ECCS Pump Room HVAC design bound the increased EPU suppression pool temperature. Therefore, the ECCS Pump Room HVAC system is not adversely affected by the EPU.
Spent Fuel Pool Area HVAC	No	Spent Fuel Pool Area Ventilation System is part of the Reactor Building HVAC (i.e., discussed above). The upper limit on the spent fuel pool temperature is maintained at the same level as before EPU as indicated in PUSAR Section 6.3. Therefore, heat load impacts are negligible.