Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

FPL

September 22, 2011

L-2011-383
10 CFR 50.90

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

Re: St. Lucie Plant Unit 2
Docket No. 50-389
Renewed Facility Operating License No. NPF-16

Response to NRC Containment and Ventilation Branch Request for Additional Information Regarding Extended Power Uprate License Amendment Request

References:

(1) R. L. Anderson (FPL) to U.S. Nuclear Regulatory Commission (L-2011-021), "License Amendment Request for Extended Power Uprate," February 25, 2011, Accession No. ML110730116.
(2) Email from T. Orf (NRC) to C. Wasik (FPL), "St. Lucie 2 EPU draft RAIs – Containment and Ventilation (SCVB)," August 5, 2011.

By letter L-2011-021 dated February 25, 2011 [Reference 1], Florida Power & Light Company (FPL) requested to amend Renewed Facility Operating License No. NPF-16 and revise the St. Lucie Unit 2 Technical Specifications (TS). The proposed amendment will increase the unit's licensed core thermal power level from 2700 megawatts thermal (MWt) to 3020 MWt and revise the Renewed Facility Operating License and TS to support operation at this increased core thermal power level. This represents an approximate increase of 11.85% and is therefore considered an extended power uprate (EPU).

By email from the NRC Project Manager dated August 5, 2011 [Reference 2], additional information related to containment and ventilation was requested by the NRC staff in the Containment and Ventilation Branch (SCVB) to support their review of the EPU LAR. The request for additional information (RAI) identified sixteen questions (SCVB-1 through SCVB-16). The attachment to this letter provides the FPL responses to the SCVB RAI questions.

A001
NRR

In accordance with 10 CFR 50.91(b)(1), a copy of this letter is being forwarded to the designated State of Florida official.

This submittal does not alter the significant hazards consideration or environmental assessment previously submitted by FPL letter L-2011-021 [Reference 1].

This submittal contains no new commitments and no revisions to existing commitments.

Should you have any questions regarding this submittal, please contact Mr. Christopher Wasik, St. Lucie Extended Power Uprate LAR Project Manager, at 772-429-7138.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Executed on Sept. 22, 2011.

Very truly yours,

FOR RLA

Richard L. Anderson
Site Vice President
St. Lucie Plant

Attachment

cc: Mr. William Passetti, Florida Department of Health

Response to Request for Additional Information

The following information is provided by Florida Power & Light (FPL) in response to the U.S. Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI). This information was requested to support Extended Power Uprate (EPU) License Amendment Request (LAR) for St. Lucie Nuclear Plant Unit 2 that was submitted to the NRC by FPL via letter (L-2011-021), February 25, 2011, Accession No. ML110730116.

In an email dated August 5, 2011 from NRC (Tracy Orf) to FPL (Chris Wasik), Subject: St. Lucie 2 EPU draft RAIs – Containment and Ventilation (SCVB), the NRC staff requested additional information regarding FPL's request to implement the EPU. The RAI consisted of sixteen (16) questions from the NRC Containment and Ventilation Branch (SCVB). These sixteen RAI questions and the FPL responses are documented below.

Requests for Additional Information (RAIs) for Section 2.6 " Containment Review Considerations", of the Licensing Report (LR) (Attachment 5 to Florida Power and Light letter dated February 25, 2011)

SCVB-1

Section 2.6.1.2.2.2 states "The peak pressure case that produces the highest containment temperature is used for the Equipment Qualification (EQ) case."

(a) Please explain why the peak pressure case was chosen rather than a case which gives the highest temperature regardless of the pressure.

(b) Section 2.6.1.2.2.3 states that the limiting peak pressure case is at 0-percent power. Please explain why the initial pressure was chosen to be the minimum containment pressure (first bullet in Section 2.6.1.2.2.2) to delay the reactor trip.

Response

The objective of a containment main steam line break (MSLB) analysis is to consider a range of initial power levels and single failures so the peak pressure can be identified. Fifteen (15) MSLB cases were performed for the EPU. Each case identifies its peak pressure and temperature. EPU LAR Attachment 5, Section 2.6.1.2.2.2 should be understood as, "The case that produces the highest containment temperature is used for the Equipment Qualification (EQ) case."

(a) The MSLB case which produces the highest containment temperature (100.3% power MSLB with the failure of a main steam isolation valve (MSIV) to close) was chosen for the EQ case.

(b) The maximum initial containment pressure (15.41 psia) is used for all cases except one EQ case. This EQ case assumes a minimum containment pressure, which will delay the reactor trip. Delaying the reactor trip results in more energy being added to the reactor coolant system (RCS). The RCS energy is transferred to the steam generator resulting in a more limiting containment temperature.

<u>SCVB-2</u>

Section 2.6.1.2.2.2 claims to list the differences between the EQ methodology and the peak pressure methodology, whereas only the EQ methodology is described in the three bullets. Provide a table listing the differences and conservatisms in the EPU peak pressure methodology and the EQ methodology. Provide separate tables listing the differences in the current licensing basis (CLB) and the EPU basis for the (a) peak pressure methodology and (b) EQ methodology, and justify the differences between the CLB and the EPU basis for both methodologies.

<u>Response</u>

The following table lists the differences between the peak pressure methodology and the EQ methodology. The table also provides conservative assumptions that are used for both the peak pressure methodology and EQ methodology.

EPU Peak Pressure and EQ Differences and Conservatisms

Peak Pressure and EQ Differences		
Peak Pressure	**Equipment Qualification**	**Justification**
Maximum Initial Containment Pressure	Minimum Initial Containment Pressure	A higher initial pressure will result in a more limiting containment peak pressure. A lower initial pressure will result in a more limiting containment peak temperature for EQ cases.
Superheating upon steam generator (SG) U-tube uncovery not considered	Superheating upon SG U-tube uncovery considered	This allows the calculation code to continue to heat the steam in contact with uncovered U-tubes instead of only producing steam. The effect of superheat is required by IE Information Notice No. 84-90 for EQ cases.
No re-evaporation of condensation from the heat sinks	8% re-evaporation of condensation from the heat sinks	NUREG-0588 Rev. 1, Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment, Appendix B, Section 1.b states that credit for as much as 8% evaporation can be allowed when superheat exists.

Peak Pressure and EQ Conservatisms	
Conservatisms	**Justification**
Metal expansion due to pressure and temperature increases reactor coolant system (RCS) and SG volumes by 2%	Results in more steam released from the SG as well as additional energy to be transferred from the primary and secondary systems.
Maximum RCS flow	Allows the maximum possible heat transfer from primary to secondary systems
No safety injection (SI)	SI would decrease the primary system heat.
No SG tube plugging (SGTP)	SGTP would reduce the primary to secondary heat transfer.
Initially all rods are fully out	This maximizes the time required to reduce core power.
All main feedwater flow is assumed to be delivered to the ruptured SG	Results in twice as much feedwater flow to ruptured SG.

The EPU analysis follows the same peak pressure and EQ methodologies used in the current licensing basis (CLB). The EPU analysis does limit the return to power to a value that bounds the maximum value identified in the safety analysis MSLB, because the conservative assumption to not credit SI can allow the restart power to greatly exceed the maximum value.

The following table lists some of the more significant differences between input data used in the CLB and the EPU peak pressure analyses.

Summary of CLB and EPU Peak Pressure Differences

Parameter	CLB Peak Pressure	EPU Peak Pressure	Justification
Core Power (MWt)	2754	3030	The uprate will increase the current power to 3020 MWt. Including an uncertainty of 0.3% increases the core power to 3030 MWt.
Initial Pressure (psia)	14.7	15.41	A higher initial pressure will result in more limiting containment peak pressure results.
Containment Volume (ft^3)	2.506×10^6	2.493×10^6	A smaller containment volume will result in more limiting containment peak pressure and temperature results.
Heat Sink Area (ft^2)	Nominal	Nominal minus 2%	This reduces the heat transfer area for the inactive heat sinks in containment to remove heat from the steam releases.

The following table lists some of the more significant differences between input data used in the CLB and EPU peak temperature analyses.

Summary of CLB and EPU EQ Differences

Parameter	CLB EQ	EPU EQ	Justification
Core Power (MWt)	2754	3030	The uprate will increase the current power to 3020 MWt. Including an uncertainty of 0.3% increases the core power to 3030 MWt.
Initial Pressure (psia)	14.7	14.022	A lower initial pressure will result in a more limiting containment peak temperature for EQ cases.
Containment Volume (ft^3)	2.506×10^6	2.493×10^6	A smaller containment volume will result in more limiting containment peak pressure and temperature results.
Heat Sink Area (ft^2)	Nominal	Nominal minus 2%	This reduces the heat transfer area for the inactive heat sinks in containment to remove heat from the steam releases.

SCVB-3

Section 2.6.1.2.2.2 does not state whether the three single failure scenarios at 0-percent, 25-percent, 50-percent, 75-percent, and full hot power were analyzed with or without offsite power available. Please clarify.

Response

Loss of offsite power (LOOP) results in a loss of reactor coolant system (RCS) flow, which greatly reduces the rate of energy transfer from the RCS to the secondary side. This results in lower energy release to containment, which reduces containment pressure/temperature response. For conservatism, all cases (peak pressure and EQ) assume offsite power is available.

SCVB-4

Section 2.6.2.2.2, under heading "Secondary Shield Wall", please explain why the M&E release for a suction leg guillotine break for the current licensing basis bounds the M&E release from the same break under the EPU conditions.

Response

EPU LAR Attachment 5, Section 2.6.2.2.2 presents the information with respect to the design capacity of the secondary shield wall relative to containment subcompartment pressurization. The information presented in Section 2.6.2.2.2 is clarified as follows:

a. The 1400 in^2 suction leg guillotine break represents the bounding current licensing basis (CLB) mass and energy (M&E) release into the compartment among all other postulated reactor coolant system (RCS) pipe breaks, including the bounding main steam line double-ended guillotine break.

b. Subsequent application of leak before break (LBB) criteria for large reactor coolant pipe breaks has eliminated the need to evaluate the 1400 in^2 suction leg guillotine break.

c. The M&E release at EPU conditions resulting from all other smaller postulated RCS pipe breaks including the bounding main steam line double-ended guillotine break is bounded by the M&E release utilized for the original licensing basis 1400 in^2 suction leg guillotine break.

Based on the above, EPU LAR Attachment 5 Section 2.6.2.2.2 concludes that the differential pressure across the secondary shield structure at EPU conditions is bounded by the original design since the secondary wall is designed to withstand a differential pressure expected across the secondary wall as a result of the original licensing basis suction leg guillotine break.

SCVB-5

In Section 2.6.1.2.2.3, the EPU peak EQ temperature reported is 384.29°F which is about 34°F less than the current peak EQ temperature of 418.3 °F. Please describe and justify the differences between the assumption and the inputs used in the EPU analysis and the current analysis and describe the conservatisms in the EPU analysis.

Response

The replacement steam generators (SGs) have nozzle restrictors which effectively reduce the break size. This reduces the amount of steam released (and therefore the energy) to containment before containment sprays begin to inject and cool the containment atmosphere. This results in a lower peak EQ temperature. See response to SCVB-2 for a list of analysis assumption and input differences between the CLB, EPU, and EQ cases.

SCVB-6

NUREG-0800, Standard Review Plan (SRP) 6.2.1.5, under heading "SRP Acceptance Criteria" item 2B states that Branch Technical Position (BTP) 6-2, "Minimum Containment Pressure Model for PWR ECCS Performance Evaluation," delineates the calculation approach that should be followed for a conservative prediction of the minimum containment pressure. Please specify which guidance of BTP 6-2, Rev 3 was not used in setting the containment model input parameters and provide justification for not using the conservative guidance.

Response

The following guidance in BTP 6-2 Rev. 3 was not used in setting the containment model input parameters for calculating a conservative prediction of the minimum containment pressure for the EPU large break loss of coolant accident (LBLOCA) emergency core cooling system (ECCS) performance analysis.

> BTP 6.2, Section B.2.C, Containment Steam Mixing with Water from Ice Melt – This guidance does not apply since St. Lucie Unit 2 does not have containment ice condensers.

All other guidance in BTP 6.2 Rev. 3 was used in setting the containment model input parameters.

SCVB-7

Refer to Section 2.6.6.2.2 of LR, provide a table that compares inputs and assumptions made in the EPU basis from the current licensing basis and justify those inputs and assumptions which are less conservative in the EPU basis.

Response

The EPU large break loss of coolant accident (LBLOCA) emergency core cooling system (ECCS) performance analysis was performed in accordance with the 1999 evaluation model (EM) for Combustion Engineering (CE) designed pressurized water reactors (PWRs) and the assumptions associated with the EM apply. There were no changes in the EM assumptions made from the current analysis-of-record (AOR) for the EPU analysis. There are no additional assumptions made regarding the implementation of standard practice or standard methodology for performing the 1999 EM LBLCOA ECCS performance analysis.

A summary of all input differences between the AOR and EPU LBLOCA ECCS performance analyses that are relevant to the calculations of the conservative prediction of the minimum containment pressure is given in the table below. None of the EPU inputs are less conservative that those for the AOR.

Summary of Input Differences Relative to the Calculations of the Conservative Prediction of the Minimum Containment Pressure During a LBLOCA

Input Description	AOR		EPU		Rationale
Maximum containment spray (CS) delivery flowrate data	6,900 gpm total		9,000 gpm total		New CS pump flowrates combined with additional margin implemented for EPU
Maximum safety injection (SI) pump delivery flowrate data	7,480 gpm total		10,924 gpm total		New SI pump flowrates combined with additional margin implemented for EPU
Maximum containment fan cooler (CFC) heat removal capacity per fan	0°F	0 BTU/s	0°F	0 BTU/s	A conservative increase in the capacity of the CFC implemented for EPU.
	60°F	0 BTU/s	60°F	0 BTU/s	
	120°F	3,167 BTU/s	120°F	3,230 BTU/s	
	200°F	14,722 BTU/s	200°F	15,016 BTU/s	
	280°F	27,639 BTU/s	280°F	28,192 BTU/s	
Containment passive heat sinks	Updated Final Safety Analysis Report (UFSAR) Table 6.2-7		UFSAR Table 6.2-7 with at least 5% conservatism included		A conservative uncertainty has been applied to the containment passive heat sink data for EPU.

SCVB-8

Refer to LR Section 2.6.5.2.4, under heading "Net Positive Suction Head (NPSH)"; list the conservative assumptions for the NPSH analysis which minimized the available pump NPSH during the injection and recirculation phases.

Response

The net positive suction head (NPSH) calculations utilize assumptions that tend to maximize the flow rate. These include reduced containment pressure (see the response to SCVB-10 for specific values), maximum inservice testing (IST) acceptance criteria, instrument uncertainty and emergency diesel generator (EDG) overfrequency. Maximizing the flow maximizes the fluid pressure drop and reduces the available NPSH ($NPSH_A$). The manufacturer's NPSH required ($NPSH_R$) values are increased to account for the increased pump speed due to EDG overfrequency. The methodology for adjusting the $NPSH_R$ values is based on an article in Pumps and Systems Magazine, Aug 2009 edition by Terry Henshaw, P.E, "Do Pumps Require Less NPSH on Hydrocarbons? Stepping NPSHR to Different Speeds".

The NPSH margin calculation does not consider the reduction in $NPSH_R$ that can be realized when pumping water at temperatures that exceed the water temperature during the NPSH test.

Injection mode

The refueling water tank (RWT) level used in the pump NPSH calculation is the centerline of the tank outlet nozzle which is approximately 30 inches below the elevation that represents the recirculation actuation system (RAS) setpoint minus instrument uncertainty. This minimizes the static head between the RWT water level and the pump suction.

The NPSH calculation also assumes that all of the emergency core cooling system (ECCS) and containment spray (CS) pumps are operating (no pump failures) and drawing water from the RWT. This assumption maximizes the pressure drop in the tank outlet/pump suction header piping, which reduces NPSH available.

Recirculation Mode

The volume of water injected into the containment is minimized. All sources are at their minimum allowable values. Heldup water volumes are maximized. Volume shrinkage due to the mixing of sources that are initially at different temperatures is considered in establishing the minimum sump water level. These assumptions minimize the static head between the sump water level and the pump suction.

Debris and chemical precipitate losses, in addition to friction losses, are included in the NPSH calculation.

<u>SCVB-9</u>

Provide a discussion of how the post accident debris generation is impacted by the extended power uprate (EPU). What effect should it have on response to Generic Letter (GL) 2004-02, which relates to the resolution of Generic Safety Issue (GSI)-191? Also, provide the impact of the EPU on the sump strainer head loss and on the emergency core cooling system (ECCS) pump NPSH evaluations during post-loss of coolant accident (LOCA) operation of the ECCS pumps. Confirm that the GSI-191 resolution will assume plant condition after EPU implementation.

<u>Response</u>

As explained in the following paragraphs, EPU has no effect on the issues that need to be addressed to resolve NRC concerns on the resolution of Generic Safety Issue (GSI)-191 for St Lucie Unit 2. Therefore, the review and approval of the EPU LAR should be considered to be independent of the resolution of GSI-191.

The EPU has no effect on post accident debris generation. The zone of influence used in calculating debris destruction radii is independent of reactor coolant system (RCS) operating conditions (temperature, pressure). The zone of influence is only affected by the inside diameter of the pipe break and the insulation type, which is not being changed by EPU.

The recirculation phase flows are driven by the flow rates of the emergency core cooling system (ECCS) and containment spray (CS) pumps. These flow rates are not a function of RCS operating parameters or post-loss of coolant accident (LOCA) decay heat rates. EPU is not changing the flow rates for these pumps and therefore has no effect on total sump flow.

The sump strainer head loss values are a function of sump flow rate, temperature and debris loading. The sump flow rates used in the net positive suction head (NPSH) calculations are conservatively selected to be greater than the GSI-191 sump design flow rates. The EPU NPSH calculations include consideration of the GSI-191 sump screen head losses. The head losses determined by the GSI-191 project are adjusted to reflect the EPU NPSH calculation flow rates and sump water temperatures. This results in sump head loss values that are conservatively high. The final resolution of GSI-191 for St Lucie Unit 2 will be based on the plant conditions that will exist after EPU has been implemented.

SCVB-10

Provide a summary of the NPSH analyses at the EPU conditions, including NPSH required (NPSHR), containment accident pressure (CAP) used, and the method of calculating NPSH available (NPSHA). What was the containment atmospheric pressure used in the analyses? Provide the basis for the NPSHR of the ECCS and containment spray pumps, including flow rates assumed, and a comparison with the flow rate for the LOCA peak cladding temperature (PCT) analyses. Does the NPSHR value used in the analysis correspond to the '3-percent pump head drop' basis suggested in the hydraulic institute (HI) standard? Please describe any uncertainty or sensitivity analysis performed for NPSHR margins.

Response

NRC Safety Guide (SG)-1 (i.e., Regulatory Guide (RG)-1.1) provides guidance on the determination of available net positive suction head (NPSH) for the emergency core cooling system (ECCS) pumps. SG-1 notes that it is important that proper performance of ECCS pumps be independent of calculated increases in containment pressure caused by loss of coolant accident (LOCA). SG-1 notes that changes in NPSH caused by increases in temperature of the pumped fluid can be accommodated through plant design without reliance on the calculated increase in the containment pressure. The regulatory position stated in RG-1.1 is that ECCS pumps should be designed so that adequate NPSH is provided assuming:

1. Maximum expected temperature of the pumped fluid, and
2. No increase in containment pressure from that present prior to the postulated LOCA.

The available NPSH ($NPSH_A$) for the ECCS and containment spray (CS) pumps can be found by application of the classical NPSH formula

$$NPSH_A = ((P_A - P_V) \times 144)/\rho + H_S - H_L$$

where,

P_A = total ambient or containment pressure (sum of air partial pressure and steam partial pressure), as applicable, psia

P_V = vapor pressure of the pumped fluid, psia

ρ = density of the pumped fluid, lb/ft^3

H_S = static elevation head (difference between the refueling water tank (RWT) or containment sump water elevation and the elevation of impeller eye of the pump), ft

H_L = suction piping head losses including as applicable strainer piping/plenum loss, sump screen head loss, and the suction line friction loss, ft

Calculations have demonstrated that throughout the recirculation mode duration the containment sump water temperature never exceeds 200°F. In order to be consistent with RG-1.1, the minimum allowable containment air partial pressure (P_A) under normal operation is used as the total containment pressure (P_A). Accordingly, the containment accident pressure (CAP) is not credited in the analysis.

As part of EPU, hydraulic calculations determine the maximum flow rates that would be delivered by the CS, low pressure safety injection (LPSI) and high pressure safety injection (HPSI) pumps. These calculations use a Fathom hydraulic model of the piping systems. Enhanced pump performance curves are part of the input to these calculations.

The enhanced pump curves are based on the following assumptions:

1. The shape of the pump curve is based on the manufacturer's certified test pump curve;
2. The pump curve is shifted vertically upward so that it passes through the flow/head point defined by the maximum inservice testing (IST) acceptance criteria;
3. The pump curve is shifted vertically upward a second time to account for the uncertainty associated with the test instrumentation; and
4. The curve is modified again to account for emergency diesel generator (EDG) overfrequency of 1%. Using the pump affinity laws, the flow is multiplied by a factor of 1.01 and the head is multiplied by a factor of 1.02.

Using these adjusted pump curves, HPSI and LPSI pump delivery rates are determined as a function of reactor coolant system (RCS) pressure. For the CS pump, flow rates are calculated as a function of containment pressure and RWT and containment sump level.

Based on the above information, the flow rates shown on Tables 1 and 2 below are used in the NPSH calculations.

The NPSH required ($NPSH_R$) values used in the NPSH evaluation are obtained from the manufacturer's $NPSH_R$ curves, which were based on the Hydraulic Institute (HI) 3% head drop standard. This value is then adjusted to account for the 1% EDG overfrequency. The methodology for adjusting the $NPSH_R$ values is based on an article in Pumps and Systems Magazine, Aug 2009 edition by Terry Henshaw, P.E, "Do Pumps Require Less NPSH on Hydrocarbons? Stepping NPSHR to Different Speeds".

Injection mode NPSH calculations are performed at an RWT water temperature of 124°F and a containment and RCS backpressure of 0 psig. The RWT level is minimized to provide the maximum flow rate. The results for this mode are provided in Table 1.

For the recirculation mode, NPSH calculations are performed for sump water temperatures ranging from 80°F to 192°F, which is the highest calculated sump water temperature that will occur during the recirculation mode. The results for this mode are provided in Table 2.

The HPSI, LPSI and CS system performance analyses that support the NPSH and peak cladding temperature (PCT) analyses were performed in separate evaluations. Each evaluation used appropriately conservative assumptions to maximize system performance for NPSH calculations or to maximize PCT for LOCA calculations. The assumptions in the HPSI, LPSI, and CS pump delivery evaluations are appropriate to determine the conservative, minimum available NPSH and conservative, maximum required NPSH. The delivery values used in the NPSH and ECCS performance analyses are shown in Table 3 below. Note that delivery used in the small break LOCA (SBLOCA) evaluation is not included as that evaluation conservatively minimizes safety injection system (SIS) and CS performance.

Direct comparison of pump or system delivery flow rate values in the NPSH and large break LOCA (LBLOCA) evaluations is not possible due to different analysis-specific, conservatively based assumptions. These assumptions were used to conservatively maximize system performance rather than system delivery. For example, the system delivery used in the $NPSH_A$ evaluation to determine the conservative, minimum available NPSH is less than the maximum possible system delivery. This is because some of the analysis inputs, such as RWT level, were conservatively adjusted for the overall purpose of minimizing the static pressure to the pump, which has a greater impact on the $NPSH_A$ than the associated difference in delivery due to the change in RWT level. In addition, in a comparison between the values developed for NPSH versus LBLOCA, the system performance is determined at different assumed discharge pressures.

It can be shown, however, that the system performance assumed to support the LBLOCA evaluation bounds the system performance in the NPSH evaluation. An example of this conservatism is that the system performance assumed in the LBLOCA evaluation was based on the direct sum of the maximum HPSI, LPSI, and CS pumps separately, rather than the actual condition of running the HPSI, LPSI, and CS pumps simultaneously.

Note that containment accident pressure is not an assumption in the delivery evaluation that supports the LBLOCA and SBLOCA evaluations.

Table 1
NPSH Calculation Injection Mode[1]

Pump	Flow Rate [5]	Containment / RCS Press	Atm Press	Static Press Head at Pump Inlet [4]	Velocity Head at Pump inlet	Vapor Pressure Head [1]	$NPSH_A$ Min RWT	$NPSH_R$ Min RWT [3]	NPSH Margin Min RWT	NPSH Margin Percent [2]
	gpm	psig	psig	ft	ft	ft	ft	ft	ft	%
CS Pump 2A	4080	0	0	54.7	1.3	4.4	51.6	22.2	29.4	132
CS Pump 2B	4014	0	0	54.7	1.3	4.4	51.6	21.3	30.3	142
HPSI Pump 2A	742	0	0	49.8	5.4	4.4	50.8	30.3	20.5	68
HPSI Pump 2B	720	0	0	51.2	5.1	4.4	51.9	27.0	24.9	92
LPSI Pump 2A	4232	0	0	48.8	2.1	4.4	46.5	23.3	23.2	100
LPSI Pump 2B	4446	0	0	46.2	2.3	4.4	44.1	23.3	20.8	89

(1) RWT temperature assumed to be 124°F.
(2) Margin percent =($(NPSH_A-NPSH_R)/NPSH_R$) x 100
(3) Includes adjustment for operation at EDG overfrequency speed
(4) Elevation head minus piping head loss
(5) This column reflects the flow rates used to determine $NPSH_A$. $NPSH_R$ was based on flow rates equal to or greater than these values. This minimizes the NPSH margin and is therefore conservative relative to evaluating NPSH.

Table 2
NPSH Calculation Recirculation Mode Design Case(1)

Pump	Flow Rate	Static Head at Min Sump Level (3)	Sump Strainer Head Loss	Total Head Loss (5)	$NPSH_A$ Min Sump Level (3)	$NPSH_R$ (4)	NPSH Margin Min Sump Level(3)	NPSH Margin Percent (2) (3)
	gpm	ft	ft	ft	ft	ft	ft	%
CS Pump 2A	4,350	28.2	2.79	4.91	32.42	23.9	8.52	35.7
CS Pump 2B	4,350	28.2	2.79	4.91	32.42	23.9	8.52	35.7
HPSI Pump 2A	700	30.02	2.79	6.58	32.57	25.5	7.07	27.7
HPSI Pump 2B	700	30.02	2.79	6.58	32.57	25.5	7.07	27.7

(1) At sump water temperature of 192°F
(2) Margin percent =($(NPSH_A-NPSH_R)/NPSH_R$) x 100
(3) These values are applicable to the LBLOCA. For the SBLOCA subtract 0.64 feet from these values. Margin for SBLOCA is 33 % for the CS pump and 25.2 % for the HPSI pump.
(4) Includes adjustment for operation at EDG over frequency speed
(5) Includes sump strainer head loss + pump suction line losses

Table 3
Total Flow Rates for NPSH and LBLOCA Evaluations

Evaluation	Combined HPSI/LPSI Pump Delivery (gpm)	CS Pump Delivery (gpm)
Required NPSH	11,662.5 @ 14.7 psia	8094.0 @ 14.7 psia
Available NPSH	10,114.6 @ 14.7 psia	8059.5 @ 14.7 psia
LBLOCA	10,942.4 @ 20 psia	9,000*

* Conservatively used regardless of containment or RCS pressure during the transient.

SCVB-11

Please demonstrate that NPSH margin still exists after including the uncertainties in the required NPSH without crediting containment accident pressure as discussed in the draft guidance. A 21-percent margin on the '3%-required NPSH' is acceptable to the staff, if desired, in lieu of performing a detailed plant specific uncertainty evaluation. The draft guidance document, which is publically accessible, was transmitted by NRC to PWR Owners Group by letter dated March 24, 2010 (ADAMS No. ML100740516) with attachment (ADAMS No. ML100550869).

Response

Updated Final Safety Analysis Report (UFSAR) Tables 6.2-42 and 6.3-18 present a summary of the net positive suction head (NPSH) calculation for the injection and recirculation modes for the containment spray (CS) and high pressure safety injection (HPSI) pumps respectively. As discussed in the response to RAI SCVB-10, as part of the EPU project, new higher pump flow rates are used in the NPSH calculations. An update to information presented in the UFSAR tables using the new pump flow rates and associated required NPSH ($NPSH_R$) is presented in Table 2 of the response to RAI SCVB-10. As documented in Table 2, the recirculation mode NPSH calculation demonstrates a margin greater than 21% without taking any credit for the containment accident pressure (CAP). Note that this margin is based on a conservative sump water temperature of 192°F, which is the maximum calculated sump water temperature.

RAIs for Section 2.7 "Habitability, Filtration, and Ventilation", of the Licensing Report (LR) (Attachment 5 to Florida Power and Light letter dated February 25, 2011)

SCVB-12

Section 2.7.3.2.2 states that the maximum temperature of the component cooling water will be increased from 108°F to 120°F. Please describe the reasons for increasing this temperature. Provide an evaluation of the ventilation equipment in order to be able to maintain the required temperature and humidity while operating at the increased cooling water temperature. Section 2.7.3.2.4 states: "An increase in the maximum cooling water temperature supplied to the control room cooling equipment will be addressed by the modification process to ensure the ventilation systems will maintain design conditions at the elevated component cooling water temperature under EPU operation." Please further explain this statement and provide the impact of increase in the cooling water temperature on the capability of the ventilation equipment to perform its required functions.

Response

The current control room air conditioning (CRAC) units are designed to operate with a component cooling water (CCW) supply temperature of 108°F. At EPU, the decay heat from the reactor increases, which would result in increased CCW temperatures during hot shutdown and accident conditions. Therefore, for EPU, the maximum CCW supply limit is increasing to 120°F for hot shutdown and accident conditions and the three CRAC units are being modified as follows:

a. Replacement of the refrigerant from R-22 to an accepted alternative;

b. Replacement of the existing compressors and drive motors with new compressors and drive motors;

c. Replacement of existing ASME Section III certified condensers with new ASME Section III certified condensers and all associated local piping and valves;

d. Replacement of existing evaporator cooling coils with new evaporator cooling coils; and

e. Replacement of existing analog controls and associated panels with modernized controls and associated panels.

The modified CRAC units are designed to maintain the normal indoor design temperature of 75°F ± 5°F, the maximum indoor design temperature of 80°F ± 4°F and a relative humidity of approximately 40% in the control room while operating at the increased cooling water temperature of 120°F. These control room design conditions are the same as those for the existing system. Therefore, the ventilation equipment will continue to be capable of performing its required functions.

SCVB-13

During normal plant operation under EPU conditions, what is the effect of loss of spent fuel pool cooling on the fuel handling building ventilation system?

Response

During normal plant operation, the fuel handling building ventilation system is designed to reduce plant personnel doses by preventing the accumulation of airborne radioactivity in the fuel handling building due to diffusion of fission products from the spent fuel pool. The system consists of two separate supply and exhaust systems serving two separate areas; one serving the spent fuel pool area and the other serving the spent fuel pool equipment areas (cooling and purification pumps, heat exchanger and pool filter areas) and the new fuel storage area. The fuel handling building ventilation system is typically in service during normal plant operation. The fuel handling building ventilation system is separate and independent from the reactor building ventilation system.

The normal spent fuel pool temperature is typically below 90°F, except for summer months when the temperature approaches 95°F. An alarm for low spent fuel pool pump discharge header pressure and a subsequent alarm for high spent fuel pool temperature set at 136°F will notify the operator that a loss of spent fuel pool cooling has occurred. EPU LAR Attachment 5 Section 2.5.4.1, Spent Fuel Pool Cooling and Cleanup System, contains the results of loss of spent fuel pool cooling analyses.

If the fuel pool cooling capability has been lost and cannot be reestablished the following actions are initiated:

- The cause of the failure is determined and an estimate of the time necessary to make the repairs is made.
- If the fuel pool ventilation is not in service, it is placed in service.
- Makeup is provided through an existing pipe from the refueling water tank (RWT) utilizing procedural guidance which does not require entry into the spent fuel pool area.

If the total loss of forced convection were to occur, it is anticipated that the spent fuel pool area temperature would eventually follow the spent fuel pool temperature due to the heat contribution from pool evaporation.

The spent fuel pool cooling pumps and heat exchangers area is ventilated by its separate ventilation system and access to make any necessary repairs to the spent fuel pool cooling system equipment can be accomplished without entering the spent fuel pool area.

SCVB-14

Refer to LR Section 2.7.5.2.2, states that EPU modifications will results in less than 1-percent increase in load currents from the existing total nameplate motor ratings supplied by the switchgear and load centers in the turbine switchgear room. Please explain why the increase does not impact the heat load and the turbine switchgear room ventilation system.

Response

The increase in heat release from the turbine building switchgear room electrical equipment at EPU conditions is less than 1%. The pre-EPU margin of the turbine building switchgear room ventilation system is 12.5%. With the addition of the increase in heat release from electrical equipment due to EPU, the available margin of the turbine building switchgear room ventilation system is 11.6%. Therefore, the heat load impact due to EPU can be accommodated by the current design of the turbine building switchgear room ventilation system.

SCVB-15

Section 2.7.6.2.1 under heading "Component Cooling Area Ventilation System" last sentence states *".....component cooling water ventilation system is nonsafety and nonseismic"*. Section 2.7.6.2.4 states: *"EPU will result in an increase in heat gain from the CCW and ICW piping and heat exchangers, however; the increase remains within the capability of the component cooling area ventilation system to maintain design temperatures during accident conditions."* Please justify taking credit for the use of non-safety and non-seismic system to maintain the required EPU design temperature (which is same as the current licensing basis design temperature) in the component cooling area during accident conditions.

Response

The component cooling area ventilation system is designed to assure a controlled thermal environment in the component cooling area. For personnel comfort during normal operation, two fans and associated exhaust ductwork are provided. During normal or accident conditions, the mechanical exhaust fans are not required to operate and therefore, this active ventilation system is non-safety and non-seismic. The safety related ventilation function for the component cooling area is based on natural ventilation. Cool air is drawn in through the screened missile protected intake openings, picks up heat from the piping and equipment, and due to a stack effect, the hot air rises and is exhausted through the screened missile protected openings in the roof. The missile protected intake and exhaust openings are part of the safety related seismic building. This natural ventilation is sufficient to maintain a temperature below 120°F during accident conditions.

Examination of the accident operating conditions in the analysis of record (AOR) indicates that the major heat contribution is from the operating temperatures associated with the component cooling water (CCW) heat exchangers and the CCW inlet piping and intake cooling water (ICW) outlet piping. The heat gains calculated for these components in the AOR bound the heat gains at EPU conditions. The AOR is based upon natural ventilation and does not consider operation of the non-safety mechanical exhaust fans. Therefore, the temperature in the component cooling area following EPU will continue to remain below the design limit of 120°F during accident conditions.

The paragraph in EPU LAR Attachment 5 Section 2.7.6.2.4 (page 2.7.6-7) should be revised to:

> "The heat loads in the component cooling area are from component cooling water (CCW) pump motors, piping, transmission through walls and roof, lights, people and ambient outside conditions. The heat gains from the CCW and intake cooling water (ICW) piping and heat exchangers in the analysis of record for accident conditions bound those at EPU, such that natural ventilation will continue to maintain the component cooling area temperature below 120°F. The space temperature during normal operation will increase approximately 1°F; however no credit was taken in the analysis of record for the operation of the ventilation fans which are available as needed during normal operation. There are no other additional heat loads added to the component cooling area enclosure that result from EPU. Refer to LR Section 2.5.4.3 for additional information regarding evaluation of the CCW operation at EPU. There are no revisions to the component cooling area ventilation system by EPU. Therefore, the component cooling area ventilation system's capability to provide appropriate temperature conditions for personnel and equipment is not impacted by EPU."

SCVB-16

Editorial comment: Section 2.7.2.2.2, under heading "Control Room Emergency Cleanup System", several statements in the first two paragraphs are repeated. In addition the statements "....and thus required no provisions for cooling in design", and "........no flow through the filters" is stated in the second paragraph only. Please merge these paragraphs into one paragraph clearly providing the description of analyses and evaluations for the control room emergency cleanup system.

Response

EPU LAR Attachment 5 Section 2.7.2.2.2 Control Room Emergency Cleanup System has been revised to provide a clear description of the analyses and evaluations as shown below.

Control Room Emergency Cleanup System

For the control room filters, there are several factors that are considered in making an assessment of the control room ventilation system charcoal absorber loading relative to that of the shield building ventilation system (SBVS). Following a loss of coolant accident (LOCA), the airborne fission products that eventually reach the control room charcoal filters originate from two sources: filtered effluent releases from the SBVS and unfiltered containment bypass leakage. The net source from these two pathways is less than that which is used to calculate the SBVS inventory. When these sources are combined with atmospheric dilution, the concentration of fission products that can potentially reach the control room outside air intakes and penetrate the control room envelope as unfiltered inleakage is greatly reduced resulting in significantly lower iodine inventories per gram of charcoal on the control room filter. The Updated Final Safety Analysis Report (UFSAR) Table 6.5-1 Regulatory Position 3k evaluation indicates that the iodine decay heating rate post-LOCA is small in the control room charcoal filters, and thus required no provisions for cooling in the design. With the maximum decay heat rate and the adsorbers thermally isolated, the maximum temperature rise in the charcoal is approximately 1°F. This temperature rise added to the control room temperature of 81°F results in an adsorber temperature well below the ignition temperature and the iodine de-adsorption temperature. EPU does not change this conclusion. Lastly, the application of alternative source term (AST) reduced iodine inventory and associated heat load in the charcoal filters to less than that predicted to have been accumulated in the TID-14844 design basis analysis. Although the proposed power uprate will increase the source term, the resulting iodine inventory and associated heat load in the charcoal filters will still remain below the design basis TID-14844 values. Thus, it is expected that both the maximum temperature rise and the iodine loading will be much smaller when compared to that of the SBVS filters addressing both the impact of the AST and EPU.