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

July 22, 2011

L-2011-273
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

Information Regarding Anticipated Transients Without Scram (ATWS) Provided in Support of the 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," dated February 25, 2011 (Accession No. ML110730116).

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).

During the course of their review and as discussed in the July 12, 2011 public meeting, NRC staff in the Reactor Systems Branch informally requested information related to Anticipated Transients Without Scram (ATWS) to support their review of the EPU LAR. The requested information is documented in Attachment 1 to this letter.

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.

A001
NRR

Should you have any questions regarding this submittal, please contact Mr. Christopher Wasik, St. Lucie Extended Power Uprate LAR Project Manager, at 772-467-7138.

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

Executed on July 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 Information

The following information is provided by Florida Power & Light in response to the U. S. Nuclear Regulatory Commission's (NRC) informal request regarding anticipated transients without scram (ATWS). This information was requested to support the extended power uprate (EPU) license amendment request (LAR) for St. Lucie Unit 2 that was submitted to the NRC by FPL via letter (L-2011-021) dated February 25, 2011, Accession Number ML110730116.

SRXB Request Regarding ATWS (Paraphrased by FPL)

LAR Attachment 5, Section 2.8.5.7 states that ATWS DSS, DTT and AFAS and setpoints are not impacted by EPU. Provide justification for this determination, including the basis for ensuring that peak RCS pressure remains below 3200 psig.

Response

As addressed in the LAR, 10 CFR 50.62 specifies the design requirements with which St. Lucie Unit 2 complies. These requirements were imposed to reduce the probability of a severe ATWS event, which is defined by the NRC as the occurrence of an anticipated transient in conjunction with a failure of the reactor protection system (RPS) to trip the plant resulting in a reactor coolant system (RCS) overpressurization exceeding 3200 psig. No additional analyses are required by 10 CFR 50.62.

The limiting ATWS events are the loss of load (LOL) and the loss of main feedwater (LOFW). For the St. Lucie Unit 2 (PSL2) class of plants, Reference 1 demonstrated that a diverse scram system (DSS) with a 2450 psia trip setpoint and a 2-second response time would maintain the peak RCS pressure to <3200 psig for the limiting anticipated operational occurrences (AOOs). The pressure turn-around is dominated by the reactor trip initiated by DSS with minimal contribution from the moderator temperature coefficient. The DSS setpoint of 2450 psia is set such that it is above the RPS high pressurizer pressure trip (HPPT) setpoint and below the pressurizer safety valves (PSV) as-left setpoint.

PSL2 also complies with the requirements for a diverse turbine trip (DTT) and a diverse auxiliary feedwater actuation system (DAFAS). However, as stated in Reference 1, the addition of a DTT and a DAFAS provides an insignificant reduction of ATWS risk if a DSS is installed, and the installation of the DSS alone meets the reliability goals of the ATWS rule.

Although no explicit ATWS analyses have been performed for St. Lucie Unit 2 at EPU conditions, the EPU loss of condenser vacuum (LOCV) and feed line break (FLB) scenarios presented in the LAR provide adequate justification that LOL and LOFW scenarios with ATWS considerations would continue to meet the criteria as presented in References 1 and 2. It is important to note that the FLB analysis is a postulated accident, not an anticipated transient/AOO, and is only utilized as a conservative representation of the LOFW transient. Both the current and EPU LOCV and FLB analyses applied more conservative inputs and

assumptions with respect to the RCS overpressurization scenarios than were required in the ATWS analyses, as described in Table 1. The EPU analyses clearly demonstrate that the SL2 DSS will be effective in limiting peak RCS pressures to <3200 psig for these limiting ATWS scenarios, as described below.

Loss of Load

1. The ATWS LOL analysis (References 1 and 3) assumes instantaneous termination of all feedwater flow and steam flow to the condenser, and delays reactor trip until the DSS setpoint of 2450 psia is reached. The peak RCS pressure was ~2600 psia.
2. The EPU LOCV analysis (LAR Attachment 5, Section 2.8.5.2.1) assumes the same instantaneous termination of feedwater and steam flows, and the reactor trips on the RPS HPPT at a setpoint of 2415 psia. The peak RCS pressure was 2669 psia.

Loss of Feedwater

1. The ATWS LOFW (References 1 and 2) assumes instantaneous termination of all feedwater flow, and delays reactor trip until the DSS setpoint of 2450 psia is reached.
2. EPU FLB (LAR Attachment 5, Section 2.8.5.2.4) assumes the same instantaneous termination of feedwater; but in addition, the 0.21 ft^2 break depletes the steam generator inventory more quickly than the simple LOFW (LAR Attachment 5, Figure 2.8.5.2.4-4), forcing a degradation in heat transfer and a rapid RCS heatup. The steam generator low level trip is ignored and the reactor trips on RPS HPPT (2460 psia setpoint).

The RPS HPPT and the PSVs as-left setpoints have not changed for the EPU. With the DSS setpoint also unchanged at 2450 psia, it can be judged from the results of the current LOCV and FLB analyses that the peak pressure of ATWS LOL and LOFW at EPU conditions would remain <3200 psig.

This is further substantiated from the EPU LOCV and FLB results by a conservative adjustment to account for delaying the reactor trip from the RPS HPPT trip to the DSS trip. With the application of the conservative adjustment, the peak RCS pressure for ATWS LOL and LOFW at EPU conditions is seen to remain much less than 3200 psig, as described below:

> **EPU LOCV Adjustment** - If the EPU LOCV trip is delayed from the RPS HPPT to the DSS trip (i.e., delayed until 2450 psia with an additional 0.85 second response time as per Table 1), then the peak RCS pressure would increase by 107 psi, from 2669 to 2776 psia.[1]

[1] Reference 3, Section 2.8.5.2.1, Table 2.8.5.2.1-2 provides the HPPT setpoint of 2415 psia at 16.30 seconds, while the PSVs open at a pressure setpoint of 2575 at 18.195 seconds. Using these data, the rate of pressurization is about 84 psi/sec. If the trip is delayed to 2450 psia with 0.85 seconds additional response, then the peak pressure would increase by 107 psia [= 84*0.85 + (2450-2415)].

EPU FLB Adjustment - If the EPU FLB trip is changed from the RPS HPPT to the DSS trip, (i.e., tripped at 2450 with an additional 0.6 second response time as per Table 1), then the peak RCS pressure would increase 43 psi, from 2704 to 2747 psia.[2]

Conclusion

Based on the extrapolation of the EPU LOCV and FLB results to account for a reactor delay associated with waiting for a DSS trip while ignoring the RPS HPPT trip, it is concluded that the DSS trip set at 2450 psia will maintain the peak RCS pressure during the limiting ATWS events to <3200 psig for the EPU.

References

1. CE-NPSD-354 Task-494, Rev. 0, "Functional Design Specification for the Diverse Scram System for Compliance with the ATWS Rule 10CFR50.62."
2. CENPD-263-P, Rev. 0, "ATWS Early Verification Response to NRC Letter of February 15, 1979, for Combustion Engineering NSSS's."
3. CENPD-158, through Rev. 1, "ATWS Analyses, Analysis of Anticipated Transients without Reactor Scram in Combustion Engineering NSSS's."

[2] Reference 3, Section 2.8.5.2.4, Table 2.8.5.2.4-2 provides the HPPT setpoint of 2460 psia at 31.04 seconds, while the PSVs open at a pressure setpoint of 2575 at 32.66 seconds. Using these data, the rate of pressurization is about 71 psi/sec. If the trip remains at 2460 psia (conservative with respect to 2450 psia) with 0.6 seconds additional response, then the peak pressure would increase 43 psia [=71*0.6].

Table 1 – Input parameters for LOCV, FLB and ATWS

Parameter	EPU LOCV value	EPU FLB value	ATWS value	Units	Comments
NSSS Power	3044.2	3044.2	2710 (LOFW) 2560 (LOL)	MWt	Per References 1 & 2, the LOFW ATWS analyses assumed 2710 MW NSSS power for the 2560 MW Class of plants, whereas the LOL ATWS analyses of References 1 & 4 assumed 2560 MW for the 2560 MW Class.
RCS Volume	Nominal	Nominal	Nominal		
Full Power Cold Leg Temperature	532	532	546	°F	Lower temperature is conservative for overpressure, because it lowers SG pressure which delays MSSV opening. ATWS used a nominal value. EPU used a minimum value including uncertainties. Therefore, the EPU value is more adverse than ATWS required.
Reactor Vessel Flow	Minimum	Minimum	Nominal		The difference between the minimum and nominal RCS flow rates has a negligible impact on the peak RCS pressure for the ATWS events.
Pressurizer Pressure	2180	2180	2250	psia	Lower initial PZR pressure setpoint for the EPU delays the HPPT trip, therefore resulting in a higher RCS pressure.
Pressurizer Water Volume	932	927	782 (LOFW) 769 (LOL)	ft^3	Higher initial PZR level for the EPU causes a faster rate of pressurization once heatup begins, therefore resulting in a higher RCS pressure.
Total PORV Relief Capacity	Not credited	Not credited	302,670 (LOFW) 303,800 (LOL)	lbm/hr	Unavailable PORVs makes the overpressurization for the EPU more adverse than ATWS required.
Pressurizer Safety Valve Setpoint	2575	2575	2500	psia	Delayed opening of the PSVs makes the overpressurization for the EPU more adverse than ATWS required.
Total Pressurizer Safety Valve Rated Capacity	636,546	636,546	592,130 (LOFW) 990,000 (LOL)	lbm/hr	
Pressurizer Pressure Control System	Not credited	Not credited	Operating		Unavailable spray flow makes the overpressurization for the EPU more adverse than ATWS required.
Pressurizer Level Control System	Not credited	Not credited	Operating		Unavailable letdown flow makes the overpressurization for the EPU slightly more adverse than ATWS.

Parameter	EPU LOCV value	EPU FLB value	ATWS value	Units	Comments
Steam Generator Pressure	707	707	850	psia	Lower SG pressure is conservative for overpressure, because it delays MSSV opening. ATWS used a nominal value. EPU used a minimum value with uncertainties. Therefore, the EPU value is more adverse than ATWS required.
SG Water Level	Minimum	Minimum	Nominal		Minimum SG water level (inventory) is conservative as it absorbs less energy from the primary system during the event and results in a faster rate of RCS pressurization.
High Pressurizer Pressure Trip Setpoint	2415 (RPS)	2460 (RPS)	2450 (DSS)	psia	
High Pressurizer Pressure Trip Response Time	1.15	1.4	2	sec	DSS response time is slightly greater than the RPS HPPT. **For EPU LOCV:** Table 2.8.5.2.1-2 (Reactor trip time-HPPT Setpoint reached) **For EPU FLB:** Table 2.8.5.2.4-2 [Reactor trip time-HPPT Setpoint reached + conservative delay (0.99-0.74)]
AFAS Setpoints	N/A	N/A	N/A		AFW does not impact peak RCS pressure since no AFW flow enters the SGs prior to the time of peak RCS pressure.
Peak RCS Pressure	2669	2704	~2600	psia	ATWS LOL pressure is comparable to the LOCV and FLB pressure at pre-EPU power.