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

FPL

This letter forwards proprietary information in accordance with 10 CFR 2.390. The balance of this letter may be considered non-proprietary upon removal of Attachment 1.

March 6, 2012

L-2012-075
10 CFR 50.90
10 CFR 2.390

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 Mechanical and Civil Engineering Branch (EMCB) 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 – Mechanical & Civil Engineering Branch (EMCB), dated January 13, 2012.

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 January 13, 2012 [Reference 2], additional information was requested by the NRC staff in the Mechanical and Civil Engineering Branch (EMCB) to support their review of the EPU License Amendment Request (LAR). The request for additional information (RAI) identified 47 questions.

A001
NRR

Attachment 1 to this letter contains FPL's response to RAIs EMCB-34 through EMCB-40. Attachment 1 contains Areva NP Inc. proprietary information and Attachment 2 is the fully non-proprietary version of Attachment 1. Attachment 3 contains the Areva NP Inc. Proprietary Information Affidavit. The purpose of this attachment is to withhold the proprietary information contained in Attachment 1 from public disclosure. The Affidavit, signed by Areva NP Inc. as the owner of the information, sets forth the basis for which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of § 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the information which is proprietary to Areva NP Inc. be withheld from public disclosure in accordance with 10 CFR 2.390.

Attachment 4 includes supplemental information regarding EPU LAR Attachment 5, Section 2.2.2.5.2.5, Steam Generator (SG) Tube Vibration and Wear Evaluation. This supplemental information provides the results of the January 2011 in-service inspection (ISI) of the SG tubing and the results of the comprehensive root cause analysis addressing tube wear.

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.

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

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 06-March-2012

Very truly yours,

Richard L. Anderson
Site Vice President
St. Lucie Plant

Attachments (4)

cc: Mr. William Passetti, Florida Department of Health

ATTACHMENT 2

Response to
NRC Mechanical and Civil Engineering Branch
Request for Additional Information
Regarding Extended Power Uprate
License Amendment Request

NON-PROPRIETARY INFORMATION

(Cover page plus 11 pages)

Response to NRC Mechanical and Civil Engineering Branch (EMCB)
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) dated February 25, 2011, Accession Number ML110730116.

In an email dated January 13, 2012 from NRC (Tracy Orf) to FPL (Chris Wasik), Subject: St. Lucie 2 EPU draft RAIs - Mechanical & Civil Engineering Branch (EMCB), the NRC requested additional information regarding FPL's request to implement the EPU. The RAI consisted of forty-seven (47) questions from the NRC's Mechanical and Civil Engineering Branch (EMCB). The responses to RAIs EMCB-34 through 40 are documented below. The responses to RAIs EMCB-1 through EMCB-33 and EMCB-41 through EMCB-47 have been transmitted to NRC under a separate submittal.

EMCB-34

Please provide the basis for the SG two-phase stability ratio of greater than [ ]^{a,c} In addition, discuss the terms, the purpose and significance of the two-phase stability ratio.

Response:

The St. Lucie Unit 2 replacement steam generator (RSG) water level stability study is included in EPU LAR Attachment 5, Section 2.2.2.5.2.1. The purpose of the water level stability study is to verify that small internal perturbations mainly generated by inlet or outlet conditions on the secondary side are not amplified by thermal hydraulic feedbacks associated with density waves, but are spontaneously damped in a short time.

This study is carried out by simulating the dynamic thermal-hydraulic response of the RSG subjected to different types of perturbations, using the one dimensional code dedicated to SG transient simulation ([ ] code), and for several power levels from 50% NP (nominal power) up to full load including EPU conditions (1517 MWth/SG).

The objective is first to set off a free level oscillation by exciting all the frequencies. For that, a step of amplitude [ ] of the steam and feedwater flowrates is simulated from a steady state. If the steam generator has a good stability, the water level stabilizes after some oscillations and the natural period and damping coefficient of the SG water level are deduced from the results. Then additional calculations are made to create resonance in the SG in order to obtain larger water level oscillation amplitudes and to evaluate the response qualitatively. Starting from a steady state, perturbations of the steam and feedwater flowrates are considered in alternating steps ([ ]) in phase or out of phase with a period of the alternative step corresponding to the resonance period.

The result for St. Lucie Unit 2 RSG is that the pressure and water level fluctuations are always quickly damped whatever the conditions and the power level, including the EPU conditions. Consequently, the risk of instability is excluded for RSG.

The [ ] computer code has been qualified for these dynamic stability studies by numerous tests performed on the [ ] mock-up, which simulates the secondary side of a SG, and is equipped with a throttle vane at the tube bundle outlet. As the SG stability is linked to the ratio between one phase and two phase pressure drops in the circulation loop (a low ratio which corresponds to the important part of two phase flow pressure drops in the circulation loop will increase the risk of instability), the detection of the instability threshold was possible on the mock-up by increasing the pressure drop across the throttle vane located in the two phase region. Simulations with [ ] of the [ ] mock up demonstrated the ability of the [ ] code to accurately predict the stability threshold which was experimentally obtained on the mock up as a function of power, feedwater temperature and circulation ratio.

Furthermore, the [ ] simulations performed on all the [ ] tests allow the conclusion that the stability threshold was never reached when the damping ratio is greater than [ ]. The lowest damping coefficient ([ ]) obtained for EPU conditions (1517 MWth/SG) confirms the stability of the St. Lucie Unit 2 RSGs.

EMCB-35

Show how the maximum fluid elastic stability ratio of [ ]^{a,c} was derived and whether it is in the U-bend region. Provide the calculated critical gap cross-flow velocity (Ucr) and the calculated maximum effective gap velocity (Ueff) equations and values for CLTP and EPU conditions and discuss the methodology and basis used to derive these values. If a benchmark case of another plant was used, show its applicability to St. Lucie U1.

Response:

Both thermal-hydraulic and flow-induced vibration analyses have been performed specifically for the St. Lucie Unit 2 replacement steam generators (RSGs) and not from benchmarking using data from another plant. The qualified computer code [ ] developed by AREVA has been used for the calculation of three dimensional two-phase flows in the tube bundle. The results have been used to define the input data (density and velocity profiles) necessary to perform the flow-induced vibration analysis.

The vibration calculations have been performed using the [ ] code which is a qualified computer code developed by the CEA (French Alternative Energies and Atomic Energy Commission) and AREVA for vibration analyses of steam generator tubes subjected to secondary cross-flow excitation. These codes and the methodology presented below to evaluate the maximum fluid-elastic stability ratio are used by AREVA for the vibration analyses of the steam generator tubes.

The flow-induced vibration analysis is performed for a selection of tubes exposed to the greatest vibration risk. This selection is based on the following considerations:

[ ]

For each vibration mode n of the studied tubes, the effective gap velocity between U_{eff_n} is calculated and compared with the critical gap cross-flow velocity U_{cr_n} to ensure that the stability criterion is satisfied:

$$\frac{U_{eff\_n}}{U_{cr\_n}} < 1$$

$\frac{U_{eff\_n}}{U_{cr\_n}}$ is the fluid-elastic stability ratio for mode number n.

In addition, a maximum stability ratio < 0.75 is specified for St. Lucie Unit 2, which represents a 33 percent margin of safety. The critical velocity U_{cr_n} is evaluated with the Connors model which can be expressed as follows:

$$U_{cr\_n} = \beta f_n D \sqrt{\frac{m_o \delta_n}{\rho_o D^2}}$$

Where:

β	:	Connors coefficient (Instability coefficient),
f_n	:	Natural frequency of the n^{th} mode,
D	:	Outer diameter of the tube,
m0	:	Reference mass of the tube,
δn	:	Logarithmic decrement of damping $\delta n = 2\pi\xi n$ where ξn is the damping ratio of the nth mode,
ρ_0	:	Reference density of the secondary fluid.

The effective excitation velocity U_{eff_n} (obtained by mode shape weighting) is calculated through the following relation:

$$U_{eff\_n} = \sqrt{\frac{\int_0^L \frac{\rho(s)}{\rho_o} V^2(s)\, \varphi_n^2(s)\, ds}{\int_0^L \frac{m(s)}{m_o}\, \varphi_n^2(s)\, ds}}$$

Where:

φn	:	Mode shape of the nth mode
m(s)	:	Equivalent mass per unit length of the tube along the curved abscissa s which takes into account the mass of the metal, the mass of the primary fluid and the additional mass due to the secondary fluid moved by the displacement of the tube
$\rho(s)$	:	Density of the secondary fluid along the curved abscissa s
V(s)	:	Flow velocity perpendicular to the tube of the secondary fluid along the curved abscissa s

The RSG calculations were originally performed using the following umbrella End Of Life (EOL) operating conditions at 1490 MWth/SG:

- Uprated power (1490.5 MWth per SG) at full load (110 %),
- 20% tube plugging,
- Design fouling equal to 50 x 10^{-6}°F-ft²-hr/Btu,
- SG outlet temperature equal to 549°F,
- RCS flowrate equal to 71.9 x10^6 lb/hr per SG.

A maximum fluid-elastic stability ratio of [ ] was calculated for the St. Lucie Unit 2 tube bundle. The associated mode occurs in the U-bend region. The mode shape corresponding to the maximum fluid-elastic ratio of [ ] is presented in Figure 1. It has been calculated using the velocity profile presented in Figure 2.

EPU conditions (1517 MWth/SG, 551°F SG outlet, in EOL conditions; i.e. tubes fouled and 10% tube plugging) have also been analyzed. The fluid-elastic stability ratio is proportional to the square root of the dynamic pressure term ρV^2 and the maximum stability ratio at 1490 MWth/SG occurs in the U-bend region of the tubes. Therefore, the impact on the margin of stability caused by the EPU changes in operating conditions can be evaluated by determining the change in the value of ρV^2 in the U-bend region. If we only consider the power increase, the impact on the dynamic pressure term ρV^2 between power levels can be approximated by the ratio:

$$\frac{1517}{1490.5} = 1.02$$

Then the maximum fluid-elastic stability ratio of [ ] in 1490.5 MWt/SG conditions becomes:

[ ] at EPU conditions.

However, if we consider all EPU changes in operating conditions, the increase in power and decrease in allowable tube plugging (from 20% to 10%), combined with the increase in primary temperature, results in a small decrease in the mean ρV^2 value in the U-Bend region (from [ ] at 1490 MWth/SG to [ ] for EPU conditions). It can be concluded that the results of the original fluid-elastic instability analysis at 1490 MWth/SG remain bounding for EPU conditions. The margin concerning the risk of fluid-elastic instability in the bundle is large, and the maximum ratio remains below the specified maximum ratio of 0.75.

Figure 1: Mode shape of the tube leading to the maximum fluid-elastic stability ratio

[ ]

Figure 2: Cross-flow velocity profile of the secondary fluid along the tube leading to the maximum fluid-elastic stability ratio

[ ]

EMCB-36

For the EPU estimated maximum of [ ]^{a,c} and [ ]^{a,c} tube wear thickness depths, show how these values were calculated and state the basis for the acceptance criterion of 40% through wall tube ware.

Response:

As for the fluid-elastic stability analysis (see response to RAI EMCB-35), the computer code [ ] has been used for the thermal-hydraulic calculation and the computer code [ ] has been used for the vibration calculations. The maximum tube wear thickness depth has been evaluated for the St. Lucie Unit 2 replacement steam generators (RSGs) using AREVA methodology which is presented below.

[ ]

Following this methodology, for the 1490.5 MWt/SG original conditions, a maximum wear depth of [ ] of the tube wall thickness has been obtained in the U-bend section i.e. at the intersections between tube and AVBs.

The evaluation of the kinetic energy for the 1517 MWt/SG EPU conditions showed a slight decrease in the U-bend part of the tube compared to the original 1490.5 MWt/SG conditions. Considering the formulas presented above, turbulent and fluid-elastic forces acting on the tube depend on the kinetic energy. Thus, a decrease of kinetic energy will lead to less wear. Therefore, the wear analysis originally performed at 1490.5 MWt/SG has been considered bounding for EPU conditions.

The basis for the acceptance criterion of 40% through wall tube wear is based on the requirements presented in ASME Code Section XI, 1998 Edition, "Requirements for Class 1 Components"; specifically IWB-3521 "Standards for Examination Category B-Q, Steam Generator Tubes." Furthermore, the 40% through wall flaw depth acceptance criterion is contained in St. Lucie Unit 2 Technical Specification (TS) 6.8.4.l.1.c, "Steam Generator (SG) Program." This TS requires that tubes found by in-service inspection to contain flaws with a depth equal to or exceeding 40% of the nominal tube wall thickness be plugged.

EMCB-37

The EPU LR states that SGs have ample tube support to ensure that flow induced vibration amplitudes are very small and tube cyclic stresses are negligible.

a) Please discuss the analysis performed and the methodology and criteria employed to determine that the vibratory tube stresses are below the material endurance limit and show the maximum calculated alternating stress intensity compared to the endurance limit.

b) Provide the SG tube spacing distance and the EPU maximum tube vibration amplitude due to turbulence excitation. The LR shows [ ]a,c mils for maximum vortex shedding resonance amplitude. Address whether these values are in the U-bend region area and show how they were derived. If a benchmark case of another plant was used, discuss its applicability to St. Lucie U1. In addition, please show how the acceptance limit of [ ]a,c mils vibratory amplitude was derived and the basis of its derivation (i.e., whether the American Society of Mechanical Engineers (ASME) Operation and Maintenance (OM) Code Part 3, S_{alt} equation for steady state vibration was used).

Response:

a) The flow-induced vibration amplitudes due to turbulence have been calculated with the [ ] code, following the methodology used by AREVA for this type of analysis. This methodology is presented below.

[ ]

The random displacements of the tube over time follow a Gaussian distribution. The Root Mean Square (RMS) amplitude represents the standard deviation of this distribution: 68% of the displacements of the tube are in the range ± the RMS value, and more than 99% of the displacements of the tube are in the range ± three times the RMS value.

The maximum RMS vibration amplitude due to turbulence has been evaluated at [ ]. This maximum displacement occurs in the straight section of the tube. Based on previous experience, the tube stresses associated with such levels of vibration amplitudes are small enough to exclude risks of fatigue.

However, the alternating stresses in the tube can be calculated using:

- The [ ] code,
- An analytical solution as presented below.

The maximum bending stress occurring in the tube is evaluated considering a single span beam, with a displacement acting at its mid-span and corresponding to the

RMS peak amplitude of vibration ([ ]). The following boundary conditions at the ends of the beam are studied:

- Simply supported at both ends,
- Simply supported at one end and clamped at the other end.

The maximum RMS bending stress obtained is lower than [ ] for St. Lucie Unit 2 RSGs.

To evaluate fatigue, the alternating stress, equal to twice the stress calculated above, has to be compared to the material property of the tube. The fatigue curves of nickel-chromium-iron alloy show endurance limit of about 2800 psi RMS (the RMS fatigue curves were derived from the fatigue curves published in the ASME Section III). The tube stresses due to turbulence are small enough to exclude risks of fatigue.

The turbulence-induced responses calculated at the original RSG power level of 1490.5 MWt/SG are low and the small variation of the dynamic pressure term ρV^2 at EPU conditions have a very low impact on these results. It can be concluded that the risks of fatigue due to turbulence response can be excluded at EPU conditions.

b) The tube pitch for the St. Lucie Unit 2 replacement steam generators (RSG) is 1 inch. The maximum random turbulence excitation (RTE) amplitude for current and EPU conditions and the RTE acceptance criteria is provided in EPU LAR Attachment 5, Table 2.2.2.5-11. The basis for the RTE acceptance limit is discussed in EPU LAR Attachment 5, Section 2.2.2.5.2.5.2.

   As stated in the EPU LAR Attachment 5, Section 2.2.2.5.2.5.3, an explicit analysis for vortex-shedding excitation (VSE) was not performed for the St. Lucie Unit 2 RSG tube bundle since the secondary side flow turbulence, the non-uniform flow in the entrance of the first span and U-bend regions of the tube bundle, and the tightly packed tube bundle disrupt the wake shedding vortices from forming downstream of the tubes. Further, wake shedding is an organized phenomenon which has not been observed in tube bundles subjected to two-phase flow condition.

EMCB-38

Discuss whether any acoustic resonance could be generated at EPU flow or during power ascension to EPU power in the feedwater and main steam lines (due to standing waves in stagnant side branches) and describe how the acoustics driven dynamic pressure loading acting on the components inside the steam generator under EPU conditions will be estimated.

Response:

A piping vibration program for the St. Lucie Unit 2 EPU, as described in EPU LAR Attachment 5, Section 2.12.1.2.3.4, Vibration Monitoring, has been established to ensure that any steady state flow induced piping vibrations are not detrimental to the plant piping systems, including the main steam and feedwater piping systems. Piping systems that will experience an increase in process flow rates as a result of EPU have been monitored at current power conditions (i.e., baseline plant walkdowns), and will be monitored during power ascension to ensure piping system acceptability with respect to piping vibration. Branch piping and vents/drains directly connected to main piping systems experiencing flow rate increases due to EPU have also been monitored at current plant conditions, and will be monitored during power ascension, to ensure that potential acoustic resonance affecting these lines are acceptable with respect to piping vibration. The piping vibration program and related monitoring will be performed in accordance with ASME OM-S/G-2007 Part 3.

The discussion regarding acoustic resonance of steam drum components inside the replacement steam generators under EPU conditions can be found in EPU LAR Attachment 5, Section 2.2.2.5.2.8.4.

EMCB-39

Please discuss procedures in place for preparation, response and preventive actions designed to detect and remove loose parts that could potentially occur due to component degradation as a result of the EPU increased steam feed flows. Also please discuss the potential for damage that these loose parts could have to safety related SSCs.

Response:

FPL employs procedures which address examination, monitoring and maintenance activities associated with ensuring the integrity of the steam generator secondary side components.

With regards to inspection of the tube bundle, two types of inspection techniques are routinely performed: 1) primary side eddy current (ECT) examinations, and 2) secondary side foreign object search and retrieval (FOSAR). FPL procedures provide the schedule for SG primary and secondary side inspections.

St. Lucie Unit 2 employs a Loose Parts Monitoring System (LPMS) that monitors the reactor coolant system (RCS) for internal loose parts. The LPMS consists of transducers, preamplifiers, a computer and a flat panel display to automatically detect and record the occurrence of a loose part within the RCS. A description of the LPMS as well as detection capabilities and type of data collected is provided in St. Lucie Unit 2 UFSAR Section 4.4.6.1. The LPMS is permanently installed to fulfill the in-service monitoring function during plant operation.

Foreign object wear is a function of the drag force, object vibration, and tube displacement. The drag force and displacements of the foreign object are a function of fluid density and velocity (dynamic pressure). Higher fluid densities and velocities will result in an increased wear rate due to the loose part. The saturated water density for the 1517 MWt/SG EPU condition (EPU LAR Attachment 5, Section 2.2.2.5.2.1) is slightly lower compared to the 1490.5 MWt/SG condition analyzed to benchmark the current operation of the plant. The feedwater mass flow is slightly increased for the 1517 MWt/SG EPU conditions and the recirculation ratio is slightly less, resulting in a total secondary side mass flow entering the tube bundle that is slightly higher for the 1517 MWt/SG EPU conditions compared to the 1490.5 MWt/SG current conditions. As described in EPU LAR Attachment 5, Section 2.2.2.5.2.5.2, the worst case increase in the dynamic pressure for the 1517 MWt/SG EPU condition, including the effects of fouling and tube plugging, is 2 percent for an approximate 4 percent increase in the tube wear rate for the 1517 MWt/SG EPU conditions.

Flow-induced vibration (FIV) and wear analyses show that the critical FIV responses and calculated wear rates for bundle entrance tubes remain acceptable for the 1517 MWt/SG EPU conditions. There is sufficient margin in the wear rates calculated for the benchmark conditions that the repair criteria will not be exceeded for the 1517 MWt/SG EPU conditions. There is no history of a foreign object in the U-bend region of the replacement steam generators (RSG) and it is unlikely that any object will be transported up to the U-bend region in the future. Based on the assessment for FIV and wear rates for the 1517 MWt/SG EPU conditions, which conservatively used the scaling factor for the tube bundle entrance to evaluate the u-bend region, the critical FIV responses and calculated wear rates for the u-bend region remain acceptable for the 1517 MWt/SG EPU conditions.

The risk of a primary to secondary tube leak due to loose part damage is managed through regularly scheduled inspection and maintenance activities, including eddy current (ECT) inspections, tubesheet flushing, and foreign object search and retrieval (FOSAR). ECT inspections will detect tube wear due to loose parts so that the affected tubes can be plugged and/or the objects can be removed. Tubesheet flushing and FOSAR will identify parts on the top of tubesheet region so the parts can be removed and/or the affected tubes plugged if required.

EMCB-40

Please discuss planned inspections to identify degradation, due to the EPU increased feed and steam flow rates, of the steam drum and SG upper internals and of the feedwater ring with J-nozzles and supports.

Response:

Consistent with the requirements of the Steam Generator Secondary Side Integrity Plan, FPL plans to perform a baseline visual inspection of the steam separators during secondary side inspection of the steam generators prior to the implementation of the EPU. Inspections are expanded, if necessary, based on the results of the inspection. Subsequent visual inspections of the steam separators will be performed in accordance with the inspection schedule contained in the Steam Generator Secondary Side Integrity Plan.

As discussed in St. Lucie Unit 2 EPU LAR Attachment 5, Section 2.2.2.5.2.8.4 under "FAC Related Degradation", an evaluation of the design of the steam drum and upper internals of the replacement steam generators (RSGs) at EPU conditions was performed. The evaluation concludes that there is a sufficient margin between the EPU maximum flow velocity and the velocity threshold at which flow-accelerated corrosion (FAC) is of concern. The occurrence of FAC in the secondary side environment of the

RSGs for the material grades considered is unlikely for the 1517 MWt/SG EPU operating conditions. This conclusion is supported by more than 25 years of favorable operating experience (OE) associated with the first 20 French 1300 MWe units (80 steam generators).

ATTACHMENT 3

Response to NRC Mechanical and Civil Engineering Branch Request for Additional Information Regarding Extended Power Uprate License Amendment Request

NON-PROPRIETARY INFORMATION

Areva NP Inc. Application for Withholding Proprietary Information from Public Disclosure

(Cover page plus 3 pages)

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is Gayle F. Elliott. I am Manager, Product Licensing, for AREVA NP Inc. and as such I am authorized to execute this Affidavit for our parent company AREVA NP SAS (AREVA).

2. I am familiar with the criteria applied by AREVA to determine whether certain AREVA information is proprietary. I am familiar with the policies established by AREVA to ensure the proper application of these criteria.

3. I am familiar with the AREVA information contained in the NRC RAI response on the St Lucie Unit 2 EPU LAR for RAIs number EMCB-34, EMCB-35, EMCB-36, and EMCB-37 dated February 2012 and referred to herein as "Document." Information contained in this Document has been classified by AREVA as proprietary in accordance with the policies established by AREVA for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is

requested qualifies under 10 CFR 2.390(a)(4) "Trade secret and commercial or financial information."

6. The following criteria are customarily applied by AREVA to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA in product optimization or marketability.

(e) The information is vital to a competitive advantage held by AREVA, would be helpful to competitors to AREVA, and would likely cause substantial harm to the competitive position of AREVA.

The information in the Document is considered proprietary for the reasons set forth in paragraphs 6(b) above.

7. In accordance with AREVA's policies governing the protection and control of information, proprietary information contained in this Document have been made available, on a limited basis, to others outside AREVA only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

SUBSCRIBED before me this 17th
day of February 2012.

Kathleen Ann Bennett
NOTARY PUBLIC, COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES: 8/31/15
Reg. # 110864

KATHLEEN ANN BENNETT
Notary Public
Commonwealth of Virginia
110864
My Commission Expires Aug 31, 2015

ATTACHMENT 4

Extended Power Uprate License Amendment Request
Attachment 5, Section 2.2.2.5.2.5
Steam Generator Tube Vibration and Wear Evaluation
Supplemental Information

NON-PROPRIETARY INFORMATION

(Cover page plus 2 pages)

St. Lucie Unit 2
Extended Power Uprate License Amendment Request
Attachment 5, Section 2.2.2.5.2.5, Tube Vibration and Wear Evaluation
Supplemental 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) dated February 25, 2011, Accession Number ML110730116.

As discussed in Section 2.2.2.5.2.5 of Attachment 5 to the St. Lucie Unit 2 Extended Power Uprate (EPU) License Amendment Request (LAR), indications of tube wear were detected in the replacement steam generators (RSGs) during in-service inspection (ISI) of the tubing during refueling outage 18. This inspection took place in May of 2009 approximately 16 months after RSG installation. Wear was the only degradation mechanism identified during the 2009 tube inspection. The majority of the wear indications were located at the anti-vibration bars (AVBs) that support the U-bends to preclude excessive flow-induced vibrations. A higher than expected total of 5857 indications on 2046 tubes in the two RSGs has been reported. None of the tubes exceeded the Technical Specification (TS) plugging limit of 40 percent through-wall (TW) depth. A total of 14 tubes were plugged in accordance with the Steam Generator Integrity Program (SGIP) to provide added margin for Cycle 18 operation.

Following the 2009 in-service inspection, a comprehensive root cause investigation was initiated with the RSG supplier to determine the cause(s) for the unexpected wear rates.

Additional ISI data was gathered during the subsequent January 2011 refueling outage to ascertain the required RSG inspection frequency and ensure that tube integrity performance criteria are maintained. Additional indications of tube wear were detected during this inspection. Consistent with the 2009 examination, the majority of the wear indications were again located at the AVBs that support the U-bends. The number of indications increased to 8825 on a total of 2987 tubes in the two RSGs. One of the AVB wear indications met the TS plugging criteria of 40% TW and was plugged. A total of 20 additional tubes were plugged in accordance with the SGIP to provide additional margin for Cycle 19 operation. Although the number of tubes affected by wear increased, the average depth of new indications decreased and the trend shows that the wear rate in the second cycle was lower than in the first cycle. These results were consistent with the predictions of an analysis performed by the supplier as part of the investigation into the cause of the results observed during the first inspection. The observed wear indications in the St. Lucie Unit 2 RSGs have not exceeded the SGIP performance criteria.

The comprehensive root cause analysis was completed in January 2012. The root cause analysis performed an in-depth evaluation of the various aspects of the RSGs, including procurement, material, design, manufacturing, installation and operational factors that may have contributed to the unexpected tube wear.

The root cause of the unexpected tube wear is as follows:

- Non-homogeneous gap distributions along U-bends combined with side loads pushing the AVBs against the tubes are resulting in the wear indications.

The main contributors to the non-homogeneous gap distribution and side loads are:

- A deflection of U-bends and potential yielding of AVBs occurred during the RSG tubing installation process,
- The differential thermal expansion between the RSG tubes and the AVB supporting system.

Additional contributors to the root cause are:

- Dead weight of the U-bends and the AVB supporting system,
- Stiffness of the AVB supporting system,
- Inefficiency of the temporary tube bundle supporting system during the RSG tubing installation process.

The RSG wear rate model has been revised to account for the tube examination results from the 2009 and 2011 in-service inspections. Several methods were evaluated to adjust wear rate model predictions for agreement to the examination results. The methods were based on applying scaling factors to adjust wear rate model projections to agree with the observed wear population. With the appropriate scaling applied, it was determined that a bounding value of 1.24 should be applied to the nominal cycle growth rate distributions to evaluate the wear progression for an EPU operating cycle.

An additional analysis that considers multiple cycles of operation, the development and growth of new indications and cycle dependent growth rate distributions, as well as an adjustment to account for increased growth due to EPU was performed. The analysis concludes that the RSG AVB wear for the proposed St. Lucie Unit 2 EPU is predictable and manageable.

This supplemental information demonstrates that the Steam Generator Program is in full compliance with regulatory and industry guidance and will continue to ensure that the integrity of the steam generator tubes is maintained during future operating cycles at EPU conditions.