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

FPL

May 19, 2011

L-2011-180
10 CFR 50.90

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

Re: St. Lucie Plant Unit 1
Docket No. 50-335
Renewed Facility Operating License No. DPR-67

Response to NRC Steam Generator Tube Integrity and Chemical Engineering 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-2010-259), "License Amendment Request for Extended Power Uprate, November 22, 2010, Accession No. ML103560419.
(2) Email from T. Orf (NRC) to C. Wasik (FPL), "St. Lucie Unit 1 EPU – request for additional information (SG Tube Integrity and Chem. Eng.)," April 27, 2011, Accession No. ML111170269.

By letter L-2010-259 dated November 22, 2010 [Reference 1], Florida Power & Light Company (FPL) requested to amend Renewed Facility Operating License No. DPR-67 and revise the St. Lucie Unit 1 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 April 27, 2011 [Reference 2], additional information related to protective coatings, regenerative heat exchanger materials, and Flow Accelerated Corrosion (FAC) was requested by the NRC staff in the Steam Generator Tube Integrity and Chemical Engineering Branch (CSGB) to support their review of the EPU LAR. The request for additional information (RAI) identified three questions. The response to these RAIs is provided in Attachment 1 to this letter.

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-2010-259 [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 19-May-2011

Very truly yours,

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 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 1 that was submitted to the NRC by FPL via letter (L-2010-259) dated November 22, 2010, Accession Number ML103560419.

In an email dated April 27, 2011 from NRC (Tracy Orf) to FPL (Chris Wasik), (Accession Number ML111170269), Subject: St. Lucie Unit 1 EPU – request for additional information (SG Tube Integrity and Chem. Eng.), the NRC requested additional information regarding FPL's request to implement the EPU. The RAI consisted of three (3) questions from the NRC's Steam Generator Tube Integrity and Chemical Engineering Branch (CSGB). These three RAI questions and the FPL responses are documented below.

CSGB-1

Service level I protective coatings are laboratory tested to withstand the worst case Design Basis Accident (DBA) conditions of temperature, pressure, radiation, and pH, in order to demonstrate that coating failure and the subsequent build-up of coatings materials at the containment sump strainers does not occur. The Updated Final Safety Analysis Report (UFSAR), Amendment 24, Section 3.8.3.6.1, states that the worst case DBA environment service condition inside containment pertains to a Loss of Coolant Accident (LOCA) and the values given in Table 3.11-1 for temperature, pressure, humidity and radiation are applicable. The license amendment request (LAR) Table 2.1.7-1 compares DBA test conditions with the expected conditions inside containment for a DBLOCA at extended power uprate (EPU) conditions. The Staff requests clarification on the following item:

The following table has been compiled from data contained in UFSAR Table 3.11-1 and LAR Table 2.1.7-1:

Time (Hours)	DBA Test Conditions Max Temp at LOCA (°F)	LAR EPU Conditions Max Temp at LOCA (°F)	UFSAR Conditions Expected Temp at LOCA (°F)
2.8 – 23.9	219	~215	N/A
2 – 24	N/A	N/A	240

Please confirm that the Service Level I protective coating DBA test temperature bounds the postulated post-LOCA temperature for the initial 24 hours following a LOCA.

Response

As documented in NRC Generic Letter 98-04, the concern for Service Level I protective coatings is that they have the potential to degrade the performance of emergency core cooling systems following a LOCA. UFSAR Section 3.8.3.6.1 discusses the ability of Service Level I protective coatings to withstand LOCA conditions and then refers to UFSAR Section 3.11, which describes the 10 CFR 50.49 environmental qualification (EQ) program. The environmental conditions for the EQ program are more severe than that of a LOCA. Service Level 1 protective coatings are not qualified for EQ conditions, nor are they required to be qualified for EQ conditions. A change to UFSAR Section 3.8.3.6.1 has been initiated by FPL to provide clarification that Service Level I coatings are required to withstand DBA LOCA conditions.

LAR Figure 2.3.1-1 contains both the Environmental Qualification and DBA LOCA temperature profiles. As shown in Table 2.1.7-1 of the LAR, the DBA test temperature for Service Level 1 coatings bounds the postulated post-LOCA temperature for the initial 24 hours following a LOCA.

CSGB-2

The regenerative heat exchanger (HX) cools the normal letdown flow from the reactor coolant system (RCS), which is at RCS T_{cold} temperature. The LAR states that the design inlet temperature of the regenerative HX is 550 degrees F. The LAR further states that the full-load EPU T_{cold} temperature is 551 degrees F, one degree over the design inlet temperature for the regenerative HX, and that the regenerative HX materials were evaluated and determined to be acceptable for a range of temperature that bound the maximum EPU operating temperatures. Please provide additional details concerning the analysis performed to reach this conclusion.

Response

The design temperature of the regenerative heat exchanger is 650°F. This is the bounding value for the material properties of the heat exchanger. Since this design value is higher than the maximum expected transient temperature through the heat exchanger (551°F), the regenerative HX materials were determined to be acceptable at EPU conditions.

CSGB-3

The LAR stated that the flow-accelerated corrosion (FAC) program manages the aging effects of loss of material due to FAC by predicting, detecting, monitoring and mitigating FAC in high energy carbon steel piping associated with main steam, extraction steam, main feedwater, heater drains and blowdown systems. Table 2.1.8-2 of the LAR was used to compare predicted wall thickness with measured wall thickness to ensure that CHECWORKS™ SFA predictions bound the actual FAC conditions of the plant. However, 14 of the 24 selected lines have no nondestructive evaluation (NDE) data reported. The staff requests additional information to ensure that the CHECWORKS™ SFA predictions bound actual conditions in the plant.

a. Please explain why NDE data is not available for the 14 lines described above. Provide a description of your plans, and a schedule, for obtaining the NDE

data at those locations, including a discussion of how the predicted wear rate will inform future NDE examinations.

b. **Given that the majority of the high risk components provided in Table 2.1.8-2 do not have NDE data to confirm the predictive code, justify how you can validate the effectiveness of the code for all susceptible components.**

c. **Accuracy of the CHECWORKS™ SFA code is highly dependent on field NDE measurements to tune the code for plant-specific conditions. Please describe your operating experience with CHECWORKS™ SFA. How long has the program been used at St. Lucie Unit 1? How many NDE measurements have been entered into the CHECWORKS™ SFA program? What confidence do you have in the maturity of the CHECWORKS™ SFA program at St. Lucie Unit 1?**

Response

Item (a)
The lines originally provided in Tables 2.1.8-1 and 2.1.8-2 were a sampling of high risk lines without regard to inspection status. The purpose was to indicate how current wear rates would compare with post-EPU wear rates. The attached table has been generated to provide information on inspected components in the lines in Table 2.1.8-2 where "no NDE" is noted, or information on inspected components in lines having similar operating conditions. As noted in the table, the components in the main steam crossunder piping from the high pressure turbine to the moisture separator heaters are not modeled in CHECWORKS™; components in these lines are inspected per an FPL specification. Inspection scope (component) selection will continue to be in accordance with our procedures that are based on NSAC-202L. One factor considered in the selection of components for inspection is the predicted wear rate and/or time remaining to reach critical wall thickness. NDE examination data is incorporated into the CHECWORKS™ model to enhance the predictive capability of the model.

Item (b)
As stated in the response to Item (a), the lines originally provided in Tables 2.1.8-1 and 2.1.8-2 were a sampling of high risk lines without regard to inspection status. The purpose was to indicate how current wear rates would compare with post-EPU wear rates. The attached table has been generated to provide information on inspected components in the lines in Table 2.1.8-2 where "no NDE" is noted, or information on inspected components in lines having similar operating conditions. It is not uncommon for a plant predictive model of a plant with a mature FAC program to have a large number of uninspected components. St. Lucie 1 has inspected approximately 50% of the modeled components in the CHECWORKS™ database, and this very large percentage provides reasonable assurance of the effectiveness of the model.

Item (c)
Florida Power & Light Company, and specifically St. Lucie 1, has been using the CHEC family of products produced by the Electric Power Research Institute (EPRI) since the early 1990s. The evolution of products has been from CHEC to CHECMATE to CHECWORKS. The CHECWORKS™ Steam Feedwater Application software has been

in use by St. Lucie 1 for over 10 years. The current St. Lucie 1 plant predictive model utilizes CHECWORKS™ SFA version 3.0 Service Pack 2 (current release). Our operating experience with CHECWORKS™ SFA has been satisfactory. This satisfaction is consistent with that of the industry; numerous domestic nuclear plants use CHECWORKS™ as the flow-accelerated corrosion plant predictive model.

EPRI does not consider it appropriate to evaluate a plant predictive model based on the percentage of components with NDE measurements entered into the plant predictive model. The basis for this position is that there are numerous factors that could adequately justify a large range of responses to the question, e.g., material replacement, secondary water chemistry changes, etc. However, NDE data has been entered into the St. Lucie 1 CHECWORKS™ SFA model for in excess of 1,000 components.

As previously discussed, FPL has concluded that its FAC Program and St. Lucie 1 CHECWORKS™ SFA plant predictive model are mature. This conclusion is based on the duration of use and the fact that NDE data associated with each inspection outage is entered into the model to further refine the predictive capability of the model at each subsequent use.

COMPARISION OF PREDICTED AND MEASURED WALL THICKNESS FOR COMPONENTS INSPECTED IN THE LINES IN LAR TABLE 2.1.8-2 WHERE "NO NDE" IS NOTED

Line Description	Component ID	Pipe Spec.	CHECWORKS Current Wear-Rate 100% Power (mils/year)	CHECWORKS Line Correction Factor	Predicted Remaining Service Life Following SL1-25 @ EPU Wear Rate (months)	Predicted Thickness at Current Wear Rate at the end of Cycle 24 (inches)	NDE (UT or RT) Measured Thickness (inches) (Note 2)
CD: HTR 1A,B-2A,B PSL-1-34	20C26-2-E-5-9	20" - .594" Sch 40	1.06	0.978	282	0.516	No NDE
	20C26-1-E-3-5	20" - .594" Sch 40	1.06	0.978	756	0 556	0.572 @ 138892 hrs
	20C26-P-2-6	20" - .594" Sch 40	0.917	0.978	900	0.558	0.563 @ 202663 hrs
CD: HTR 2B-3B PSL-1-35,-36	20C31-3-P-2-7	20" - .594" Sch 40	0.883	0.978	536	0.529	No NDE
	20C31-P-1-4	20" - .594" Sch 40	1.285	0.978	309	0.523	0.553 @ 96883 hrs
	20C31-3-E-5-9	20" - .594" Sch 40	1.485	0.978	1314	0.647	0.678 @ 107490 hrs
ES: XUES TO FWH 4B 1-20 (Note 3)	20ES4-P-6-13	20" - .375" Sch 20	0.039	1.00 (Note 1)	55013	0.374	No NDE
ES: XUES TO FWH 4A 1-19 (Note 3)	20ES3-P-4-8	20" - .375" Sch 20	0.060	1.00 (Note 1)	35,692	0.373	0.344 @ 165757 hrs
ES: MSR TIEIN TO FWH 5B -1-18	12ES2-E-15-38	12" - .375" Std	0.259	1.00 (Note 1)	78157	0.369	No NDE
	12ES2-T-2-36	12" - .375" Std	0.457	1.00 (Note 1)	136986	0.363	0.365 @ 202663 hrs
	12ES2-X-1-39	12" - .375" Std	0.174	1.00 (Note 1)	201061	0.506	0.509 @ 107490 hrs

Line Description	Component ID	Pipe Spec.	CHECWORKS Current Wear-Rate 100% Power (mils/year)	CHECWORKS Line Correction Factor	Predicted Remaining Service Life Following SL1-25 @ EPU Wear Rate (months)	Predicted Thickness at Current Wear Rate at the end of Cycle 24 (inches)	NDE (UT or RT) Measured Thickness (inches) (Note 2)
BF: HTR 5B TO SEISMIC -1-43,-45	20BF9-1-R-1-2 (D/S)	20" - 1.500" Sch 120	2.167	2.441	692	1.336	No NDE
	20BF17-E-6-18	20" - 1.500" Sch 120	2.505	2.441	1674	1.592	1.602 @ 213815 hrs
	20BF17-P-8-19	20" - 1.500" Sch 120	1.693	2.441	1459	1.427	1.434 @ 213815 hrs
HD: DRNCLR A TO PUMP A -1-24	16HD34-3-E-5-13	16" - .375"	1.128	0.670	1298	0.286	No NDE
	16HD34-E-6-17	16" - .375"	1.128	0.670	2108	0.365	0.377 @ 165757 hrs
	16HD34-P-7-18	16" - .375"	0.762	0.670	2959	0.354	0.362 @ 165757 hrs
HD: FWH 1A TO COND. -1-33 (Note 4)	10HD53-P-3-9	10.75" - .365" Sch 40	0.443	1.238	7782	0.332	No NDE
HD: FWH 1B TO COND. -1-33 (Note 4)	14HD71-X-2-21	14"XS – 0.500"	0.511	1.238	7033	0.496	0.500 @ 190238 hrs
HD: FWH 1B TO COND. -1-33 (Note 4)	14HD71-X-2-21 (D/S)	10" – 0.500" Sch 40	0.321	1.238	10120	0.465	0.467 @ 190238 hrs
HD: FWH 2A TO FWH 1A -1-33 (Notes 5, 6)	8HD60-1-P-2-6	8.625" - .322" Sch 40	0.762	1.238	3519	0.266	No NDE
HD: FWH 2B TO FWH 1B -1-33 (Note 6)	12HD78-X-3-20	12"XS – 0.500"	1.387	1.238	2285	0.429	0.452 @ 128590 hrs
HD: FWH 2B TO FWH 1B -1-33 (Note 6)	12HD78-X-3-20 (D/S)	12"XS – 0.500"	0.445	1.238	7527	0.464	0.471 @ 128590 hrs
HD: FWH 2B TO FWH 1B -1-33 (Note 6)	12HD78-P-9-21	12"XS – 0.500"	0.371	1.238	12094	0.441	0.447 @ 128590 hrs

Line Description	Component ID	Pipe Specification	CHECWORKS Current Wear-Rate 100% Power (mils/year)	CHECWORKS Line Correction Factor	Predicted Remaining Service Life Following SL1-25 @ EPU Wear Rate (months)	Predicted Thickness at Current Wear Rate at the end of Cycle 24 (inches)	NDE (UT or RT) Measured Thickness (inches) (Note 2)
HD: FWH 4A TO DRNCLR 1A -1-23	30HD29-4-P-5-10	30" -.375"	0.289	1.159	2864	0.352	No NDE
	30HD29-E-2-5	30" -.375"	0.535	1.159	1524	0.373	0.376 @ 202663 hrs
HD: FWH 5B TO FWH 4B -1-22	10HD17-1-E-2-5	10.750" - .365" Sch 40	1.700	1.159	520	0.232	No NDE
	10HD17-P-1-4	10.750" - .365" Sch 40	1.149	1.159	1740	0.332	0.353 @ 118589 hrs
	10HD17-P-8-18	10.750" - .365" Sch 40	1.149	1.159	1996	0.358	0.370 @ 165757 hrs
MS: CLBK TO TURB CON1,3 -1-2	3A3-38MS15-2-R-3-63	38" - 1.25" Sch USR	0.082	1.00 (Note 1)	1494	1.247	No NDE
	38MS15-E-14-57	38" - 1.25" Sch USR	0.234	1.00 (Note 1)	8824	1.635	1.636 @ 213815 hrs
MS: XU-HPT to MSR 1A PSL-1-3 (Note 7)	4A-HP-MSR1A-P-9-18	36" - .750" Sch 40	9.211	1.00 (Note 1)	89	0.353	No NDE
MS: TO MSR 1A RHTR -1-9,-10	8MS19-P-6-12	8.625" - .322" Sch 40	1.405	6.997	110	0.295	0.301 inches @ 213815 hrs. (Note 8)

Line Description	Component ID	Pipe Specification	CHECWORKS Current Wear-Rate 100% Power (mils/year)	CHECWORKS Line Correction Factor	Predicted Remaining Service Life Following SL1-25 @ EPU Wear Rate (months)	Predicted Thickness at Current Wear Rate at the end of Cycle 24 (inches)	NDE (UT or RT) Measured Thickness (inches) (Note 2)
HR: MSR C RHTR TO FWH5A -1-14	6HD14-13P13-30	6.625" - .280" Sch 40	0.687	0.983	288	0.231	No NDE
	6HD14-P-9-21	6.625" - .280" Sch 40	0.574	0.983	794	0.254	0.263 @ 128590 hrs
	6HD14-P-14-33	6.625" - .280" Sch 40	0.879	0.983	434	0.248	0.264 @ 118589 hrs

Notes:

1. Inspection data was not used to calibrate these lines. Line Correction Factor is equal to 1.00.
2. Latest component inspection data measured thickness is recorded along with operating hours at time on inspection.
3. There are no measured thickness values for the components in ES line XUES TO FWH 4B 1-20. Used a component in line XUES TO FWH 4A 1-19.
4. There are no measured thickness values for the components in HD line FWH 1A TO CONDENSER-1-33. Used components in line FWH 1B TO CONDENSER-1-33.
5. Line "FWH 2A TO FWH 1A -1-22" in Table 2.1.8-2 has been corrected to read line "FWH 2A TO FWH 1A -1-33."
6. There are no measured thickness values for the components in HD line FWH 2A TO FWH 1A -1-33. Used components in line FWH 2B TO FWH 1B -1-33.
7. The components in the MS crossunder piping from the HP turbine to MSRs 1A, 1B, 1C, and 1D are not modeled in CHECWORKS™. Components in these lines are inspected per FPL Specification SPEC-M-044, "Crossunder Piping Inspection and Repairs for St. Lucie Units 1 and 2."
8. Information for line MS line 8MS19-P-6-12 has been corrected to show a measured thickness of 0.301 inches @ 213815 hrs.