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

FPL

Designated Original

December 20, 2004

L-2004-244
10 CFR 50.90

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

RE: St. Lucie Unit 1
Docket No. 50-335
Proposed License Amendment
Extension of the Reactor Coolant System
Pressure/Temperature Curve Limits and LTOP to 35 EFPY

Pursuant to 10 CFR 50.90, Florida Power & Light Company (FPL) requests to amend Facility Operating License DPR-67 for St. Lucie Unit 1. The proposed amendment revises Technical Specification (TS) Figures 3.1-1b, 3.4-2a, 3.4-2b, and 3.4-3. The current St. Lucie Unit 1 Technical Specification pressure/temperature (P/T) limit curves, also called the heatup and cooldown curves, are applicable for 23.6 EFPY of cumulative operation. Accordingly, the Technical Specifications require revision prior to Unit 1 reaching 23.6 EFPY, which is projected to occur during the middle of cycle 20. Cycle 20 is currently scheduled to start in December 2005.

This proposed license amendment would extend the effectiveness of the current P/T limit curves from 23.6 to 35 effective full power years (EFPY). The low temperature overpressure protection (LTOP) requirements, which are based on the P/T limits, would also be extended to 35 EFPY.

Attachment 1 is a description of the proposed changes and the supporting justification. Attachment 2 is the Determination of No Significant Hazards and Environmental Considerations. Attachment 3 is marked-up copies of the proposed Technical Specification changes. Attachment 4 is information copies of the proposed changes to the TS Bases. Attachment 5 is copies of the retyped TS pages.

The St. Lucie Facility Review Group and the Florida Power & Light Company Nuclear Review Board have reviewed the proposed amendment. In accordance with 10 CFR 50.91 (b)(1), a copy of the proposed amendment is being forwarded to the State Designee for the State of Florida.

A001

Approval of this proposed license amendment is requested by April 2006 to support continued operation of St. Lucie Unit 1 for the remainder of Cycle 20. Please issue the amendment to be effective on the date of issuance and to be implemented within 60 days of receipt by FPL. Please contact George Madden at 772-467-7155 if there are any questions about this submittal.

Very truly yours,

William Jefferson, Jr.
Vice President
St. Lucie Plant

WJ/GRM

Attachments

cc: Mr. William A. Passetti, Florida Department of Health

STATE OF FLORIDA)
) ss.
COUNTY OF ST. LUCIE)

William Jefferson, Jr. being first duly sworn, deposes and says:

That he is Vice President, St. Lucie Plant, for the Nuclear Division of Florida Power & Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information, and belief, and that he is authorized to execute the document on behalf of said Licensee.

William Jefferson, Jr.

STATE OF FLORIDA

COUNTY OF ST LUCIE

Sworn to and subscribed before me

this 20th day of December, 2004
by William Jefferson, Jr., who is personally known to me.

Carla J. Heinold
Name of Notary Public - State of Florida

NOTARY PUBLIC STATE OF FLORIDA
OFFICIAL NOTARY SEAL
CARLA J HEINOLD
COMMISSION NUMBER
DD021761
MY COMMISSION EXPIRES
APR. 30,2005

Carla J. Heinold.
(Print, type or stamp Commissioned Name of Notary Public)

PURPOSE/SCOPE

The current St. Lucie Unit 1 Technical Specification pressure/temperature (P/T) limit curves, also called the heatup and cooldown curves, are applicable for 23.6 EFPY of cumulative operation. Accordingly, the Technical Specifications require revision prior to Unit 1 reaching 23.6 EFPY, which is projected to occur during the middle of cycle 20, that is scheduled to start in December 2005.

This proposed license amendment evaluation would extend the effectiveness of the current P/T limit curves from 23.6 to 35 effective full power years (EFPY). The low temperature overpressure protection (LTOP) requirements, which are based on the P/T limits, would also be extended to 35 EFPY.

BACKGROUND

Pressure/temperature limits are developed to satisfy 10 CFR Part 50, Appendix A, Design Criteria 14 and 31. These design criteria require that the reactor coolant pressure boundary be designed, fabricated, erected, and tested in order to have an extremely low probability of abnormal leakage, and of rapid or gross failure. The criteria also require that the reactor coolant pressure boundary be designed with sufficient margin to assure that when stressed, the boundary behaves in a non-brittle manner and the probability of rapidly propagating fracture is minimized.

The requirements of 10 CFR 50, Appendix G, Fracture Toughness Requirements, describe the requirements for developing P/T limits and the basis for the limitations. The margins of safety against fracture provided by the P/T limits using the requirements of 10 CFR 50, Appendix G are equivalent to those recommended in ASME Section XI, Appendix G. The method to predict the reactor vessel material irradiation damage is provided in Regulatory Guide 1.99, Rev. 2, Radiation Embrittlement of Reactor Vessel Materials.

The period of applicability is based on projections of irradiation embrittlement for the reactor vessel beltline limiting materials. The current P/T limit curves and LTOP analysis were submitted by FPL letter L-89-408 dated December 5, 1989, and approved by Amendment 104 dated June 11, 1990. The curves were extended in 1995 by FPL request in FPL Letter L-95-139 dated May 17, 1995 and approved by Amendment 141 dated October 27, 1995. In addition, the current P/T limit curves and LTOP analysis were re-analyzed in 1999 to include the replacement steam generators (RSG) and new pressurizer heaters as inputs. The existing P/T limit curves and LTOP analysis bounds these new inputs. New fluence and embrittlement projections show that the limiting material values of adjusted reference temperature (ART) that the current P/T limit curves are based upon will not be reached until 35 EFPY. Actual accumulated fluence and benchmarked fluence projections are significantly less than previously projected. Using the new fluence projections, the period of applicability for the existing P/T limit curves and LTOP requirements can be extended from 23.6 EFPY to 35 EFPY with the same analyzed margin of safety.

The 1995 extension was based on new material property data (initial reference temperature (RT_{NDT}) and best estimate chemistry) that was discovered with the initial response to NRC Generic Letter 92-01. Surveillance data was also available for the limiting plate. Since the original P/T limit curve analysis, two additional surveillance capsules were removed and the fluence projections were benchmarked in Westinghouse Report WCAP-12751[1] dated November 1990 and Westinghouse Report WCAP-15446,[2] Revision 1 dated January 2002. WCAP-15446 was submitted by FPL letter L-2002-082 dated May 2, 2002. Actual accumulated fluence and benchmarked fluence projections prepared in support of license renewal[3] are significantly less than previously projected. These fluence projections are the same as those utilized for preparation of the pressurized thermal shock (PTS) calculations and new surveillance capsule schedule submitted to the NRC as part of the St. Lucie Units 1 and 2 license renewal application by FPL Letter L-2001-258 dated November 29, 2001. New best estimate material chemistry was also updated from the final response to NRC Generic Letter 92-01 submitted by FPL Letter L-97-223 dated August 28, 1997 after the 1995 extension of the limit curves. New fluence and embrittlement projections show that the limiting material values of ART that the P/T limit curves are based upon, will not be achieved until 35 EFPY. Using the new fluence prediction data and materials properties, the existing P/T curves in the Technical Specifications can be extended with the same analyzed margin of safety.

Overpressure protection is provided to keep the reactor coolant system (RCS) pressure below the P/T limits after the initiation of assumed energy-addition and mass-addition transients, while operating at low temperatures, in accordance with Standard Review Plan Section 5.2.2, Revision 2. Since this evaluation demonstrates that the existing P/T limit curves and limiting ART values remain unchanged, the LTOP requirements, which are based on the P/T limit curves and ART values will remain unchanged.

DESCRIPTION OF PROPOSED CHANGE

The current St. Lucie Unit 1 Technical Specification reactor coolant system (RCS) P/T limits are applicable up to 23.6 EFPY of operation. The existing LTOP analysis that is based upon these P/T limits is also applicable up to 23.6 EFPY.

The proposed extension of the applicability of the P/T limits to 35 EFPY is based upon fluence projections, limiting material embrittlement predictions, and the Limiting Conditions for Operation (LCO). These P/T limits will continue to ensure that all RCS components will be able to withstand the effects of transient loads due to system temperature and pressure changes without their functions or performance being

1 Westinghouse Report WCAP-12751, Analysis of Capsule 104° From the Florida Power and Light Company St. Lucie Unit 1 Reactor Vessel Material Surveillance Program, November 1990.
2 Westinghouse Report No. WCAP-15446, Revision 1, Analysis of Capsule 284° From the Florida Power and Light Company St. Lucie Unit 1 Reactor Vessel Material Surveillance Program, January 2002.
3 FPL Engineering Calculation, PSL-BFJF-01-002, Rev.1, St. Lucie Unit 1 and 2 Vessel Fluence Projections for Life Extension Project, June 2002.

impaired. These loads are introduced by normal load transients, reactor trips, and startup and shutdown operations.

The LTOP system, provided by the power operated relief valves (PORV), ensures RCS over pressurization below certain temperatures would be prevented, thus, maintaining reactor coolant pressure boundary integrity. The existing LTOP analysis for 23.6 EFPY has also been extended to 35 EFPY, based upon extending the P/T limits. The LTOP analysis yields Limiting Conditions for Operation (LCO) that constitutes LTOP system alignments for the period of applicability.

The proposed changes are as follows:

a. LCO 3.4.9.1 currently provides the pressure and temperature limits in terms of Figures 3.4-2a, 3.4-2b, and 3.4-3 for the RCS (except the pressurizer) during heatup, cooldown, criticality, and in service leak and hydrostatic testing for 23.6 EFPY. Figure 3.1-1b is also used for heatup and cooldown rates when the flow path from the refueling water tank (RWT) to the RCS is established via a single high pressure safety injection (HPSI) pump per LCO 3.1.2.1 and 3.1.2.3 and RCS pressure boundary is established. The footnote applicable to LCOs 3.1.2.1 and 3.1.2.3 makes reference to Figure 3.1-1b to limit the potential mass transient during LTOP conditions. The proposed amendment would use these existing figures, as-is, and only revise the title by changing "23.6 EFPY" to "35 EFPY." A note was added to Figures 3.4-2a and 3.4-2b to identify the limiting material ART values. This note has no operational impact.

BASIS AND JUSTIFICATION OF PROPOSED CHANGE

The original analysis for the current P/T limits and LTOP requirements were provided with the proposed license amendment in FPL Letter L-89-408 dated December 5, 1989, and approved for 15 EFPY by Amendment 104 to the facility operating license. The 15 EFPY curves were extended to 23.6 EFPY based on new material data, which included an initial RT_{NDT} value to replace the generic value for the limiting welds, and calculated chemistry factor and reduced margin for the limiting plate based on surveillance capsule results. The extension to 23.6 EFPY was approved by Amendment 141 to the facility operating license. Following the replacement of the steam generators and increased capacity pressurizer heaters, the P/T limits and LTOP requirements were re-analyzed to document the inputs and effects of these new components. The conclusion was that the existing approved P/T limits and LTOP requirements in the TS remain valid and bounding.

Since the original P/T limit curve analysis was approved:

1) Two additional surveillance capsules were removed and the fluence projections were benchmarked. The results are documented in WCAP-12751 and WCAP-15446, Revision 1. Actual accumulated fluence and benchmarked fluence projections are significantly less than previously projected.

2) New best estimate material chemistry was also updated from the final response to NRC Generic Letter 92-01 submitted by FPL letter L-97-223 dated August 28, 1997 after the 23.6 EFPY extension of the limit curves.

New fluence and embrittlement projections show that the limiting material values of ART that the P/T limit curves are based upon will not be achieved until 35 EFPY. Using the new fluence prediction data and materials properties, the existing 23.6 EFPY limit curves can be extended with the same analyzed margin of safety because the same adjusted reference temperature assumed for the current 23.6 EFPY curves will not be reached until 35 EFPY. The basis and justification to change the expiration of these P/T limits and LTOP requirements from 23.6 EFPY to 35 EFPY is provided below.

EXTENDING THE PERIOD OF APPLICABILITY OF THE P/T LIMIT CURVES

P/T Limit Curve and LTOP Calculation Method:

The current P/T limit curves and LTOP analysis were developed using the requirements of 10 CFR 50, Appendix G. The basic calculation method used K_{Ia} and was referenced in the 1986 edition of ASME Boiler and Pressure Vessel Code, Section III, Appendix G. The current Section XI, Appendix G method in the 1998 Edition through 2000 Addenda[4] (codified in 10 CFR 50.55a) has incorporated significant advances in fracture mechanics and the analysis of reactor vessel integrity. The current Section XI, Appendix G allows the use of K_{Ic} instead of the lower bound fracture toughness curve K_{Ia} utilized in the 1986 ASME Code. The current method also permits the LTOP maximum pressure in the vessel to be 110% of the pressure determined to satisfy the P/T limits when K_{Ia} is used (per Appendix G of Section XI, Article G-2215). The existing P/T limit curves and LTOP analysis do not utilize the advantages of K_{Ic} or the 10% LTOP margin allowance.

The plant-specific material input to the Appendix G lower bound fracture toughness curve/methodology identified above is performed by determining the adjusted reference temperature (ART) of the limiting reactor vessel beltline material at the end of the period of applicability. These ART predictions utilize initial material test properties, material chemistry and surveillance capsules results, fluence and margin, and are the only plant specific material inputs that are considered in the P/T analysis. The ART values are calculated using the prediction methods of Regulatory Guide 1.99, Revision 2.[5]

4 ASME Boiler and Pressure Vessel Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components – 1998 Edition through the 2000 Addenda. (This code year has been accepted for use by the NRC as published in pp755-774 in the 2004 edition of 10CFR50 Effective January 1, 2004, From the U.S. Government Printing Office via GPO Access).
5 NRC Regulatory Guide 1.99, Radiation Embrittlement of Reactor Vessel Materials, Revision 2, dated May 1988.

The method to calculate the new period of P/T curve and LTOP applicability is as follows:

1) Review current and previous analyses to identify the limiting ART values for 1/4T and 3/4T used in the current P/T limit curves and LTOP analysis.
2) Update the accumulated fluence and projections for the reactor vessel beltline materials.
3) Evaluate all surveillance results for the St. Lucie Unit 1 beltline materials and consider appropriate chemistry factor and margin term to be applied.
4) Select the most limiting material at the 1/4T and 3/4T locations.
5) Determine the fluence associated with the limiting ART values at 1/4T and 3/4T used in the current analysis with updated best estimate material properties.
6) Find the EFPY that corresponds to the limiting surface fluence.
7) Project the ART at 1/4T and 3/4T for all beltline materials to show that the P/T limit curves bound all data for the new period of applicability.

Identify the Limiting ART Value Used for the P/T Limit Curves:

The current 23.6 EFPY P/T limit curves and LTOP analysis is based on a limiting material ART of 191°F at 1/4T and 137°F at 3/4T as provided in FPL letters L-89-408 and L-95-139 for the lower shell axial welds (heat No. 305424). These ART values are from the original 15 EFPY P/T limit curve analysis that was extended to 23.6 EFPY and are shown in Table 1. All calculations to determine the new period of applicability are based on the limiting lower shell axial welds with a verification that this material is limiting by performing ART calculations for all beltline materials once the new limiting fluence is determined.

Fluence Projections:

The latest fluence projections incorporate calculated fluence through the end of cycle 15 and projections based on the most recent core loading patterns into the future. The model used for this calculation is benchmarked against actual surveillance capsule dosimetry data in WCAP-15446, Revision 1, analyzed through the EOC 15 (17.23 EFPY fluence). Fluence projections beyond end-of-cycle (EOC) 15 utilize the maximum flux calculated for cycle 15 and incorporate a 10% factor to account for minor variations in fuel management. The limiting beltline materials are the lower shell axial welds, which are at azimuthal angles of 15°, 45°, and 15° (15°, 135°, and 255° vessel angles) from the peak fluence. Therefore, projections are made for the vessel maximum at 0° and at the critical axial weld azimuthal angle of 15°. These projections form the basis for the fluence used to determine the new period of applicability for the P/T limit curves. The fluence projections incorporate the guidance in Regulatory Guide (RG) 1.190[6] and are shown in the table below:

6 NRC Regulatory Guide 1.190 (Previous drafts were DG-1053 and DG-1025), Calculational and Dosimetry Methods for Determining Pressure Vessel Fluence, dated March 2001.

St. Lucie Unit 1 Reactor Vessel Beltline Fluence Projections

Vessel/Location	17.23 EFPY fluence n/cm^2	flux n/cm^2-sec	fluence/ EFPY n/cm^2	35 EFPY fluence n/cm^2
PSL-1 Critical Welds (15°)	8.96E+18	1.749E+10	5.52E+17	1.88E+19
PSL-1 Maximum	1.39E+19	2.596E+10	8.19E+17	2.85E+19

Evaluation of St. Lucie Unit 1 Surveillance Capsule Results:

Although RG 1.99, Revision 2, does not require surveillance data to be used to determine ART, guidance provided in an NRC/Industry conference in 1998[7] and the change to 10 CFR 50.61 indicate that surveillance data should be considered if it could affect the embrittlement calculation. The St. Lucie Unit 1 surveillance capsule program contains data for the lower shell plate C-8-2 (heat No. C-5935-2) and the girth weld heat No. 90136. The limiting weld heat No. 305424 is contained in the Beaver Valley Unit 1 surveillance program. The latest capsule report, WCAP-15446, Revision 1, from the St. Lucie Unit 1 and Beaver Valley Unit 1 programs were reviewed for credibility and possible incorporation into the determination of ART projections. Both capsule analyses contained updated fluence for all previous capsules in the program. The previously reported shift in RT_{NDT}, that were hand drawn, was also updated using a hyperbolic tangent curve fitting program. The fluence recalculation and curve fitting program resulted in slight differences in the ART values compared to the values contained in the NRC RVID2 database.

Table 2 shows the capsule results and credibility determination for the materials applicable to the St. Lucie Unit 1 reactor vessel using the sum of the squares method identified in RG 1.99, Revision 2. The surveillance data in Table 2 for the limiting lower shell axial welds, heat No. 305424, was identified as non credible since not all data was within the 1σ scatter band. However, the tabular chemistry factor (CF) value with the 2σ margin term is conservative for predictions of ART.

The surveillance data for the lower shell plate C-8-2 and the girth weld heat No. 90136 are credible. The calculated chemistry factor for plate C-8-2 will be used directly. Since the other two lower shell plates, C-8-1 and C-8-3 are from the same Lukens heat Nos. C-5935-1 and C-5935-3, as the C-8-2 plate, a ratio adjusted chemistry factor will be used. The surveillance weld heat No. 90136 chemistry is also different than the vessel best estimate, so the ratio procedure is applied to this weld. The ratio adjusted CF values are shown in Table 3. The calculated CF from the surveillance data and the 1σ margin term is used for embrittlement calculations.

7 NRC/Industry Workshop on Reactor Pressure Vessel Integrity, February 12-13, 1998 and NRC Memorandum, Meeting Summary for November 12, 1997 Meeting With Owners Group Representatives and NEI Regarding Review of Responses to Generic Letter 92-01, Revision 1, Supplement 1, Responses, From Keith Wichman to Edmund Sullivan, November 19, 1997.

The complete credibility analyses for the St. Lucie Unit 1 surveillance data WCAP-15446, Revsion 1 and the applicable Beaver Valley Unit 1 surveillance data WCAP-15571[8] Revision 0, for weld heat No. 305424 are contained in Appendix D of the most recent surveillance capsule report from each program. The credible surveillance capsule data is incorporated to determine the chemistry factor for embrittlement calculations.

Selection of the Most Limiting Material at the 1/4T and 3/4T Locations:

The most limiting material at the 1/4T and 3/4T for the current P/T limits curves and LTOP analysis is the lower axial shell welds of heat No. 305424. This material will be used to determine the limiting fluence. Once the surface fluence is determined, the ART values for all the beltline materials will be calculated.

Determine the Fluence Associated With the Limiting ART Values at 1/4T And 3/4T Used in the Current Analysis With Updated Best Estimate Material Properties.

This material will be used to determine the limiting fluence at these locations based on the current limiting ART values of 191°F and 137°F.

Material properties for weld heat No. 305424 (seams 3-203A/B/C)		
Material Property	Value	Reference Source
Best Estimate Cu	= 0.27 %	FPL letter L-97-223
Best Estimate Ni	= 0.63 %	FPL letter L-97-223
Initial RT_{NDT}	= - 60°F (actual value)	FPL Letter L-95-139
Chemistry Factor (CF)	= 188.8°F	FPL letter L-97-223 & RG 1.99
Margin	= 56°F	RG 1.99
ART 1/4T limiting value	= 191°F	FPL Letter L-95-139
ART 3/4T limiting value	= 137°F	FPL Letters L-89-408 & L-95-139
$ART_{(1/4T)}$ = Initial RT_{NDT} + ΔRT_{NDT} + Margin		RG 1.99
$\Delta RT_{NDT} = (CF) f^{(0.28 - 0.10 \log f)}$		RG 1.99
191°F = -60°F + (188.8°F) $f^{(0.28 - 0.10 \log f)}$ + 56°F		
(191°F + 60°F-56°F)/188.8°F = $f^{(0.28 - 0.10 \log f)}$		
	1.033 = $f^{(0.28 - 0.10 \log f)}$	
Using Figure 1 from RG 1.99 Rev. 2: f is approximately 1.1×10^{19}		
Iteration determines $f_{(1/4T)} = 1.12(\times 10^{19})$ at the 1/4 T weld location.		

8 Westinghouse Report WCAP-15571, Rev. 0, Analysis of Capsule Y From First Energy Company Beaver Valley Unit 1 Reactor Vessel Material Radiation Surveillance Program, November 2000.

The surface fluence is proportional to the vessel thickness based on the RG 1.99 formula.	
Thickness of the PSL-1 beltline: 8 5/8"	FPL Letter L-95-139
$X_{(1/4T)}$ = 8 5/8" / 4 = 2.156"	
$X_{(3/4T)}$ = 8 5/8" x 3/4 = 6.469"	
$f_{(1/4T)} = f_{SURF}\ (e^{-0.24x})$	RG 1.99
$f_{(1/4T)} = 1.12 \times 10^{19} = f_{SURF}\ (0.596)$	
$f_{SURF} = f_{(1/4T)} / (0.596) = 1.12 \times 10^{19} / (0.596) = 1.88 \times 10^{19}$ n/cm^2	
$f_{SURF} = 1.88 \times 10^{19}$ n/cm^2 at the axial weld HtNo. 305424 location 3-203A/B/C.	

Find the EFPY that corresponds to the limiting surface fluence at the weld:

f_{SURF} = 1.88 E19 n/cm^2(@ 191°F limiting RT_{NDT} for weld seams 3-203A/B/C) as shown above.
From the fluence table above, the accumulated fluence at the critical weld is 8.96×10^{18} n/cm^2 at 17.23 EFPY and the fluence rate is 5.52×10^{17} n/cm^2 per EFPY.
EFPY = 17.23 EFPY + $[(1.88 \times 10^{19} - 8.96 \times 10^{18}) / 5.52 \times 10^{17}]$
EFPY= 17.23 EFPY + 17.81 EFPY = 35.04 EFPY
The new period of applicability for the limiting weld material is 35 EFPY.

Project the ART at 1/4T and 3/4T for all beltline materials to show that the P/T curves bound all data for the new period of applicability.

To determine the ART for all the beltline materials at 35 EFPY, the applicable fluence needs to be used from the fluence table above.

The 35 EFPY fluence at the critical welds is 1.88×10^{19} n/cm^2 as determined above, and is applicable for all axial welds.

The maximum vessel fluence at 35 EFPY is 2.85 10^{19}n/cm^2 and is applicable for all plates and the girth weld.

(Max fluence $_{(35\ EFPY)}$=2.85 10^{19}n/cm^2 = 1.39×10^{19} n/cm^2 + (35-17.23) x 8.19×10^{17} n/cm^2)

These fluence values are used to calculate the ART values for all beltline materials in Table 4. A review of the 1/4T and 3/4T ART values in Table 4 shows that the lower shell axial welds (heat No. 305424) are bounding for all beltline materials.

The projected fluence at 35 EFPY results in the same limiting ART values used in the 23.6 EFPY P/T limit curve analysis (extended based on the 15 EFPY analysis). Therefore, the current Technical Specification P/T limit curves and LTOP analysis is applicable for a period not to exceed 35 EFPY with the same margin of safety as the current 23.6 EFPY analysis. This equivalence covers the P/T limits for heatup, cooldown, hydrostatic test, and core critical operation.

Extension of the applicability of the current P/T limit curves and LTOP analysis from 23.6 EFPY to 35 EFPY is possible because the accumulated fluence through EOC 15 was less than previously projected and a reduction of the limiting material chemistry factor from RG 1.99 based on the final best estimate weld chemistry provided in the responses to NRC Generic Letter 92-01 and its supplements in FPL Letter L-97-223.

LOWEST SERVICE TEMPERATURE, MINIMUM BOLTUP TEMPERATURE, AND MINIMUM PRESSURE LIMITS

The P/T analysis for 23.6 EFPY also provided the limits for lowest service temperature, minimum boltup temperature, and minimum pressure limits on the P/T limit curves for reference. These limits are not based on accumulated fluence at the reactor vessel beltline material, and remain unchanged.

The lowest service temperature is based on the most limiting RT_{NDT} for the balance of RCS components plus 100°F per ASME Section III NB-2332. The most limiting RT_{NDT} for the balance of the RCS is the reactor coolant system piping (+90°F). Accumulated plant operation does not affect material properties of these components; therefore, the lowest service temperature remains unchanged at 190°F.

The minimum boltup temperature is the minimum allowable temperature, at pressures below 20% of the pre-operational system hydrostatic test pressure, that stresses can be applied to the flange region. It is defined as the initial RT_{NDT} for the higher stressed region of the reactor vessel, plus any irradiation effects (ASME Section III, Appendix G 2222, now in Section XI). The maximum initial RT_{NDT} associated with the stressed region of the reactor vessel flange (which conservatively includes the upper shell plate adjacent to the flange ring) is +30°F. For conservatism a minimum boltup temperature of 80°F is utilized.

The flange region fluence is greater than three orders of magnitude lower than the peak vessel fluence at the vessel beltline materials (i.e., at fuel core midplane). A typical fluence reduction factor from the vessel maximum, at core midplane to the top of the fuel assembly (~79") is 0.1.[9] Since the flange is approximately 130 inches above the top of the core, and the fluence level in the stressed flange region is reduced by well over three orders of magnitude (<1E+17 n/cm^2), there is no measurable irradiation effect on the flange region material properties as indicated in RG 1.99, Revision 2. Therefore, the 80°F minimum boltup temperature is unchanged and provides sufficient margin over the measured flange region RT_{NDT} of +30°F to account for any uncertainties or changes in flange material fracture toughness.

The minimum pressure limit is the break point between the minimum boltup temperature and the lowest service temperature, and is defined by the ASME Boiler and Pressure Vessel Code as 20% of the pre-operational hydrostatic pressure after accounting for pressure corrections and pump flow corrections. This value was not affected by accumulated plant operation.

9 CE Report TR-F-MCM-004 FPL, PSL 1 Evaluation Irradiated of Capsule W97, dated December 1983.

CORRECTION FACTORS

Since the P/T limit curves and LTOP setpoints are based on coordinates of pressurizer pressure and indicated RCS fluid temperature, correction factors are included in the analysis to account for actual conditions at the limiting beltline materials. The P/T limits and LTOP analysis for 23.6 EFPY provided for these correction factors, which address the concerns of NRC Information Notice 93-58, Nonconservatism in Low-Temperature Overpressure Protection for Pressurized Water Reactors.

Pressure correction factors were based upon: 1) the static head due to the elevation difference of the vessel wall adjacent to the active core and the pressurizer pressure instrument nozzle, and; 2) the pressure differential based on the number of reactor coolant pumps (RCP) in operation. Actual pressure at the core region would be higher than at the RCS hot leg and the pressurizer by the amount of head loss due to RCP flow and the static head. Below 200°F, flow induced pressure drop is based on two RCPs in operation; above 200°F, pressure drop is based on three RCPs in operation. This addresses the concerns identified in Information Notice 93-58.

The lead/lag temperature differential between the vessel base metal and the RCS bulk fluid has been accounted for in the calculations based on the rate of heat up or cooldown.

Instrument uncertainties have not been included in the P/T limit curves. The uncertainties (errors) were determined to be insignificant relative to the conservatism of the margin terms included in the ASME Section III, Appendix G, K_{Ia} lower bound fracture toughness curve. There is uncertainty added to the LTOP analysis and setpoints both in the form of instrument uncertainty and accumulation pressure associated from the lag in time from actuation signal to relief valve opening. Application of uncertainty to the P/T limit curves along with uncertainty in the LTOP analysis would be overly restrictive since the LTOP system prevents the RCS pressure from approaching the P/T limits up to the enable temperature. There is also inherent margin in the LTOP analysis, since the setpoints protect 100% of the pressure determined to satisfy the P/T limits instead of the 110% allowed by Code Case N-641. In addition, since the setpoints are fixed, they protect the lowest point on the P/T limit curves within the range of applicability, thereby keeping the allowable pressure below a horizontal limit while the actual P/T limit curve is increasing with increasing temperature. NRC concurrence was documented in the original 15 EFPY analysis with this approach. A more recent precedent for not using instrument uncertainties when using K_{Ia} lower bound fracture toughness curve is the approval of the Turkey Point Units 3 and 4 P/T limit curves in 2000.[10]

10 Turkey Point Units 3 and 4 - Issuance of Amendments 208 and 202 Regarding Pressure-Temperature Limits and Cold Overpressure Mitigation System Requirements, K.N. Jabbour (NRC) to T.F. Plunkett, dated October 30, 2000.

Correction factors are not affected by neutron fluence, and therefore, remain unchanged by the extension of applicability to 35 EFPY.

LTOP ANALYSIS

The objective of the current LTOP analysis was to preclude violation of the P/T limits during startup and shutdown conditions. The LTOP analysis remains unchanged by the applicability extension to 35 EFPY because the P/T limit curves are not being changed. Therefore, it is not necessary to re-analyze or modify the LTOP system.

A relaxation of the LTOP requirements from ASME Code Case N-514 was incorporated in the 1993 Addenda of ASME, Section XI, Appendix G. This code change permitted the LTOP system to limit the maximum pressure in the vessel to 110% of the pressure determined to satisfy the P/T limits per Appendix G of Section XI when using K_{Ia}. When the 1998 Edition through 2000 Addenda of Section XI, Appendix G, was changed to allow the use of K_{Ic} for determination of P/T limits and LTOP requirements, Code Case N-641 was approved to allow the provision to have the LTOP system limit the maximum pressure in the vessel to 110% of the P/T limits that were determined using K_{Ia}. The NRC has approved the use of Code Case N-641 in NRC Regulatory Issue Summary 2004-04 dated April 5, 2004. The current LTOP analysis and setpoints are inherently conservative since they do not utilize the 10% margin relaxation allowed by the ASME Code.

Table 1: Existing P/T Limit Curve Limiting Material Adjusted Reference Temperature Inputs.

Original 15 EFPY PT/LTOP Curve Material Input Data From L-89-408 (Controlling RT_{NDT} Values Enlarged)

LOCATION	ID #	Cu%	Ni%	CALC. CF	TABLE CF	INIT. RT_{NDT}	MARGIN	PEAK FLUENCE, (n/cm^2)	1/4T FLUENCE, (n/cm^2)	3/4T FLUENCE , (n/cm^2)	15 EFPY ART @ 1/4T	15 EFPY ART @ 3/4T
Lower shell plate	C-8-1	0.15	0.56	NA	107.8	20 °F	34 °F	2.05E+19	1.22E+19	4.34E+18	168 °F	**137 °F**
Lower shell plate	C-8-2	0.15	0.57	NA	108.4	20 °F	34 °F	2.05E+19	1.22E+19	4.34E+18	168 °F	**137 °F**
Lower axial welds	305424	0.30	0.64	NA	200.2	-56 °F	65.5 °F	1.202E+19	7.16E+18	2.54E+18	**191 °F**	135 °F

23.6 EFPY PT/LTOP CURVE Material Input Data From L-95-139 (Controlling RT_{NDT} Values Enlarged)

LOCATION	ID #	Cu %	Ni%	CALC. CF	TABLE CF	INIT. RT_{NDT}	MARGIN	23.6 EFPY FLUENCE, (n/cm^2)	1/4T FLUENCE, (n/cm^2)	3/4T FLUENCE, (n/cm^2)	23.6 EFPY ART @ 1/4T	23.6 EFPY ART @ 3/4T
Lower shell plate	C-8-1	0.15	0.56	79.42	NA	20 °F	17 °F	2.82E+19	1.68E+19	5.97E+18	128 °F	105 °F
Lower shell plate	C-8-2	0.15	0.57	79.82	NA	20 °F	17 °F	2.82E+19	1.68E+19	5.97E+18	128 °F	105 °F
Lower axial welds	305424	0.28	0.63	NA	191.7	-60 °F	56 °F	1.783E+19	1.063E+19	3.78E+18	**191 °F**	**136 °F**

Summary of changes from 15 EFPY to 23.6 EFPY P/T Limit Curves:

1. New interim best estimate chemistry for the controlling weld resulting in lower chemistry factor.
2. Actual initial RT_{NDT} from the Beaver Valley Unit 1 surveillance program resulting in a lower margin.
3. Lower shell plates use calculated chemistry factor and reduce margin term making them not limiting.

Table 2: Surveillance Results and Credibility Determination for St. Lucie Unit 1 Reactor Vessel Materials

Plant	Capsule / Material	Measure ΔT30 shift (°F)	Fluence (n/cm^2)	Fluence Factor (ff)	ff^2	M Shift x ff	Best fit CF (°F)	Calc shift (°F)	Scatter (°F)	Measured-Calc Shift	Credible
St. Lucie 1	97°,C-8-2,Trans	63.83	5.91E+18	0.853	0.727	54.43	78.86	67.25	17	-3.42	Yes
St. Lucie 1	97°,C-8-2,Long	68.7	5.91E+18	0.853	0.727	58.58	78.86	67.25	17	1.45	Yes
St. Lucie 1	104°,C-8-2,Long	79.87	9.18E+18	0.976	0.953	77.95	78.86	76.97	17	2.90	Yes
St. Lucie 1	284°,C-8-2,Trans	84.99	1.45E+19	1.103	1.217	93.74	78.86	86.98	17	-1.99	Yes
St. Lucie 1	284°,C-8-2,Long	87.93	1.45E+19	1.103	1.217	96.99	78.86	86.98	17	0.95	Yes
St. Lucie 1	97°,90136 weld	72.34	5.91E+18	0.853	0.727	61.69	69.91	59.61	28	12.73	Yes
St. Lucie 1	104°,90136 weld	67.4	9.18E+18	0.976	0.953	65.78	69.91	68.23	28	-0.83	Yes
St. Lucie 1	284°,90136 weld	68	1.45E+19	1.103	1.217	75.00	69.91	77.11	28	-9.11	Yes
Beaver Valley 1 (BV-1)											
BV-1	"V", 305424 weld	159.72	3.23E+18	0.689	0.475	110.12	178.57	123.11	28	36.61	No
BV-1	"U", 305424 weld	166.32	6.46E+18	0.878	0.770	145.95	178.57	156.71	28	9.61	Yes
BV-1	"W", 305424 weld	187.73	9.86E+18	0.996	0.992	186.99	178.57	177.87	28	9.86	Yes
BV-1	"Y", 305424 weld	179.69	2.15E+19	1.208	1.459	217.05	178.57	215.70	28	-36.01	No

Table 3: Calculated and Ratio Adjusted Chemistry Factors Based on Surveillance Results

LOCATION	Cu%	Ni%	CALC. CF	TABLE CF	Ratio adjusted CF
Lower shell plate (C-8-1)	0.15	0.56	-	*107.80*	78.46
Lower shell plate (C-8-2)	0.15	0.57	78.86	*108.35*	-
Lower shell plate (C-8-3)	0.12	0.58	-	*82.6*	60.12
Surv Weld 90136 (tag J)	0.23	0.07	69.91	106.6	-
Vessel Best Est. 90136	0.27	0.07	-	118.95	78.00

Notes: The surveillance weld for 90136 is identified as "tag J" in CE report CE-NPSD-1039 Revision 2[11] which is different then the vessel best estimate in the CE report and the NRC RVID2 database.

11 CE Report CE-NPSD-1039, Revision 2, Best Estimate Copper and Nickel Values in CE Fabricated Reactor Vessel Welds, Prepared for the Combustion Engineering Owners Group, June 1997.

Table 4: Proposed 35 EFPY P/T Limit Curve Limiting Material Adjusted Reference Temperatures (Controlling RT_{NDT} Values Enlarged)

LOCATION	ID #	Cu%	Ni%	CALC. CF	TABLE CF	INIT RT_{NDT}	MARGIN	35 EFPY PEAK FLUENCE (n/cm^2)	1/4T FLUENCE (n/cm^2)	3/4T FLUENCE (n/cm^2)	35 EFPY ART @ 1/4T	35 EFPY ART @ 3/4T
Lower shell plate (C-8-1)	C-5935-1	0.15	0.56	78.46	NA	20 °F	17 °F	2.85E+19	1.70E+19	6.03E+18	127 °F	104 °F
Lower shell plate (C-8-2)	C-5935-2	0.15	0.57	78.86	NA	20 °F	17 °F	2.85E+19	1.70E+19	6.03E+18	127 °F	105 °F
Lower shell plate (C-8-3)	C-5935-3	0.12	0.58	60.12	NA	0 °F	17 °F	2.85E+19	1.696E+19	6.03E+18	86 °F	69 °F
Int. shell plate (C-7-1)	A-4567-1	0.11	0.64	NA	74.6	0 °F	34 °F	2.85E+19	1.696E+19	6.03E+18	119 °F	98 °F
Int. shell plate (C-7-2)	B-9427-1	0.11	0.64	NA	74.6	-10 °F	34 °F	2.85E+19	1.696E+19	6.03E+18	109 °F	88 °F
Int. shell plate (C-7-3)	A-4567-2	0.11	0.58	NA	73.8	10 °F	34 °F	2.85E+19	1.696E+19	6.03E+18	129 °F	107 °F
Int to Lower girth welds	90136	0.27	0.07	78.00	NA	-60 °F	28 °F	2.85E+19	1.70E+19	6.03E+18	57 °F	35 °F
Lower axial welds (3-203A,B,C)	305424	0.27	0.63	NA	188.8	-60 °F	56 °F	1.88E+19	1.12E+19	3.97E+18	**190.7 °F**	**136.5 °F**
Int. shell axial welds (2-203A,B,C)	A-8746 & 34B009	0.19	0.09	NA	90.7	-56 °F	65.5 °F	1.88E+19	1.12E+19	3.97E+18	103 °F	77 °F

Summary of changes from 23.6 EFPY to proposed 35 EFPY P/T Limit Curves:

1. New best estimate chemistry for the controlling weld resulting in lower chemistry factor reported in L-97-223 [1]
2. Updated fluence projections.
3. New calculated chemistry factor for the lower shell plates based on three surveillance capsules and revised capsule fluence.

ATTACHMENT 2

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Introduction

The current P/T limit curves also called the heatup and cooldown curves, are applicable for 23.6 EFPY of cumulative operation. Accordingly, the Technical Specifications require revision prior to Unit 1 reaching 23.6 EFPY, which is projected to occur during the middle of cycle 20.

This proposed license amendment will extend the applicability of the current St. Lucie Unit 1 Technical Specification pressure/temperature (P/T) limit curves from 23.6 to 35 effective full power years (EFPY). The low temperature overpressure protection (LTOP) requirements, which are based on the P/T limits, would also be extended to 35 EFPY.

Determination of No Significant Hazards Consideration

The standards used to arrive at a determination that a request for amendment involves a no significant hazards consideration are included in the Commission's regulation, 10 CFR 50.92, which states that no significant hazards considerations are involved if the operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. Each standard is discussed as follows:

(1) Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.

The pressure/temperature (P/T) limit curves in the Technical Specifications are conservatively generated in accordance with the fracture toughness requirements of 10 CFR 50, Appendix G, as supplemented by the ASME Code Section XI, Appendix G recommendations. The adjusted reference temperature (ART) values are based on the Regulatory Guide 1.99, Revision 2, shift prediction and attenuation formula and have been validated by a credible reactor vessel surveillance program. There are no changes to the limit curve, only a change in the period of applicability based on more recent fluence predictions and new best estimate chemistry information. Based on the current fluence projections, analysis has demonstrated that the current P/T limit curves will remain conservative for up to 35 EFPY.

In conjunction with extending the effectiveness of the existing P/T limit curves, the low temperature overpressure protection (LTOP) analysis for 23.6 EFPY is also

extended to 35 EFPY. The LTOP analysis confirms that the current setpoints for the power operated relief valves (PORVs) will provide the appropriate overpressure protection at low reactor coolant system (RCS) temperatures. Because the P/T limit curves have not changed, the existing LTOP values have not changed, which include the PORV setpoints.

The P/T limit curves and LTOP analysis have not changed; therefore, the proposed amendment does not represent a change in the configuration or operation of the plant. The results of the existing LTOP analysis have not changed, and the limiting pressures for given temperatures will not be exceeded for the postulated transients. Therefore, assurance is provided that reactor vessel integrity will be maintained. Thus, the proposed amendment does not involve an increase in the probability or consequences of accidents previously evaluated.

(2) Operation of the facility in accordance with the proposed amendment would not create the possibility of a new or different kind of accident from any previously evaluated.

The requirements for P/T limit curves and LTOP have been in place since the beginning of plant operation. The only changes in these curves are the extension of the period of applicability (EFPY), which is based on new fluence data and the operating time (EFPY) required to reach the same limiting adjusted reference temperature projection used for the current 23.6 EFPY P/T limit curves. Since there is no change in the configuration or operation of the facility as a result of the proposed amendment, the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

(3) Operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.

Analysis has demonstrated that the fracture toughness requirements of 10 CFR 50, Appendix G, are satisfied and that conservative operating restrictions are maintained for the purpose of low temperature overpressure protection. The P/T limit curves will provide assurance that the RCS pressure boundary will behave in ductile manner and that the probability of a rapidly propagating fracture is acceptably low. Therefore, operation in accordance with the proposed amendment would not involve a significant reduction in a margin of safety.

Based on the above, we have determined that the proposed amendment does not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the possibility of a new or different kind of accident from any previously evaluated, or (3) involve a significant reduction in a margin of safety; and therefore does not involve a significant hazards consideration.

Environmental Impact Consideration Determination

The proposed license amendment changes requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The proposed amendment involves no significant increase in the amounts and no significant change in the types of any effluents that may be released off-site, and no significant increase in individual or cumulative occupational radiation exposure. FPL has concluded that the proposed amendment involves no significant hazard consideration, and therefore, meets the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), an environmental impact statement or environmental assessment need not be prepared in connection with issuance of the amendment.

ATTACHMENT 3

ST. LUCIE UNIT 1 MARKED-UP TECHNICAL SPECIFICATION PAGES

TS Pages

3/4 1-9a

3/4 4-23a

3/4 4-23b

3/4 4-23c

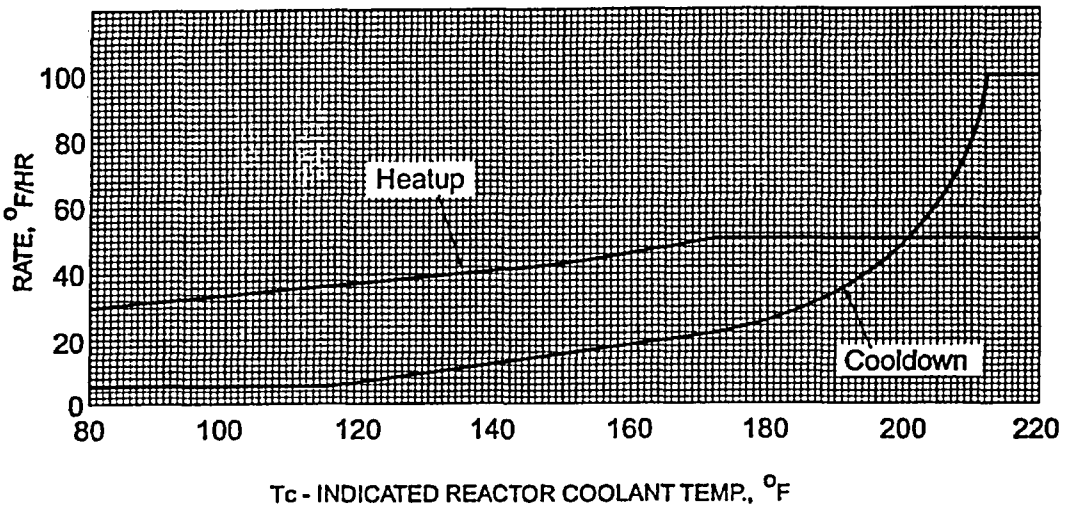


FIGURE 3.1-1b

MAXIMUM ALLOWABLE HEATUP AND COOLDOWN RATES, SINGLE HPSI PUMP IN OPERATION

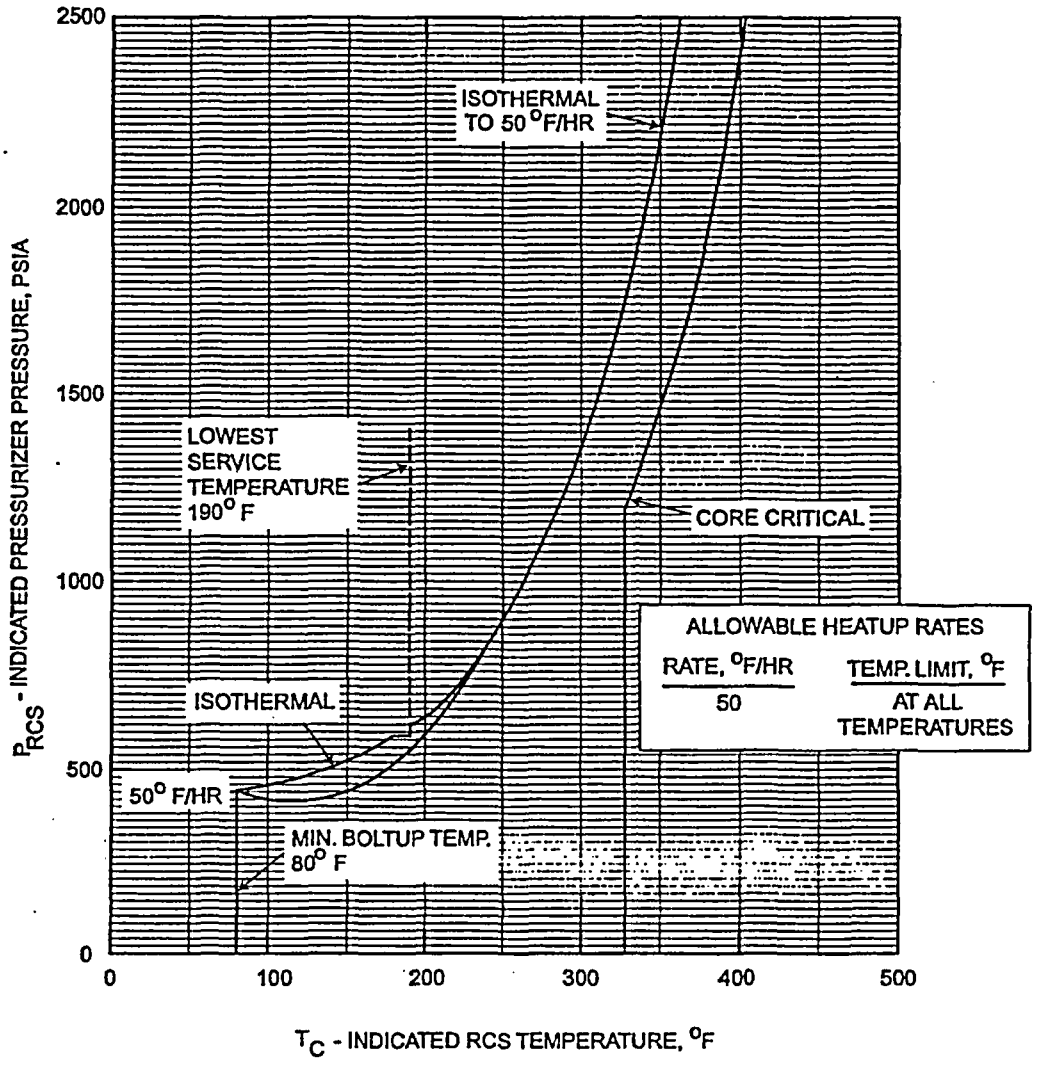
~~(23.6 EFPY)~~ Delete

(Applicable to '35 EFPY) Replace

Insert 35 EFPY

FIGURE 3.4-2a

ST. LUCIE UNIT 1 P/T LIMITS, ~~23.0 EFPY~~
HEATUP AND CORE CRITICAL

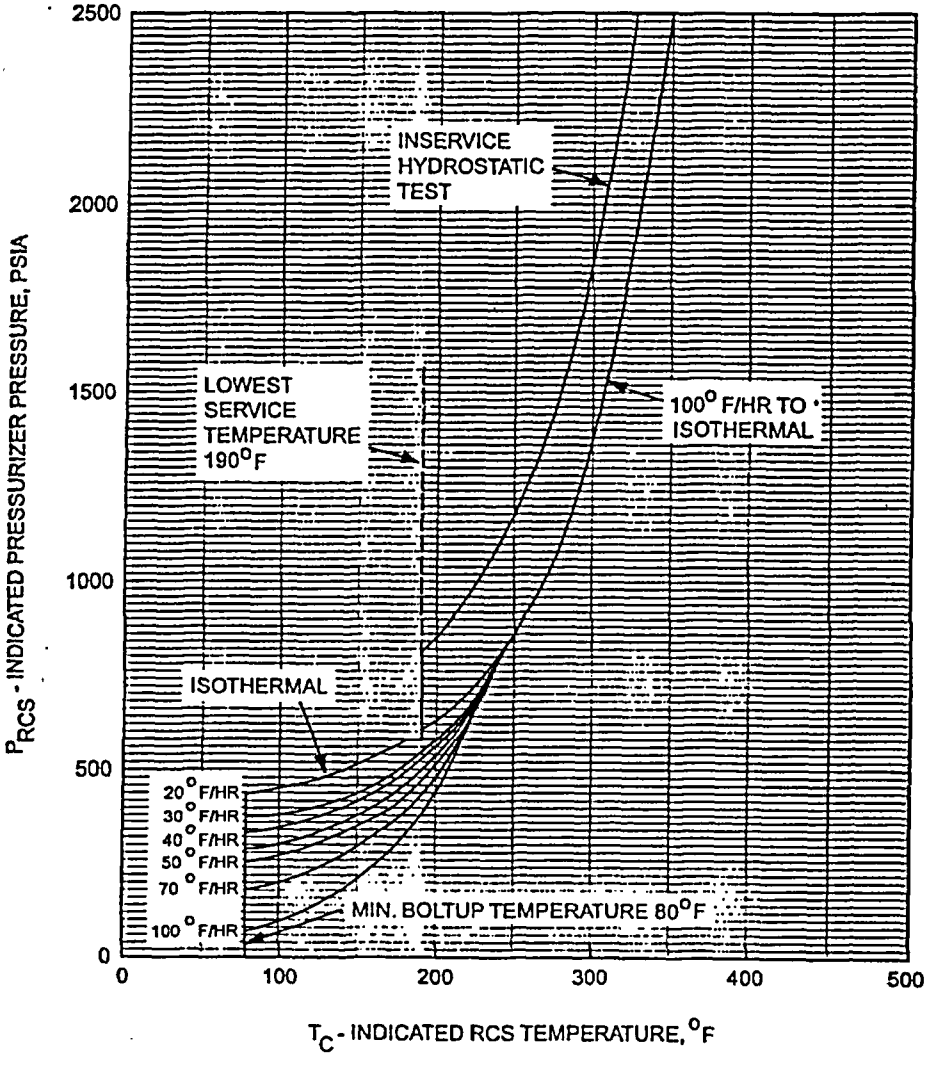


Add

Limiting Material: Lower Shell Axial Welds (Ht.# 305424)
Limiting ART Values at 35 EFPY: 1/4T, 191°F
3/4T, 137°F

FIGURE 3.4-2b

ST. LUCIE UNIT 1 P/T LIMITS, ~~23.6 EFPY~~ 35 EFPY
COOLDOWN AND INSERVICE TEST



Add

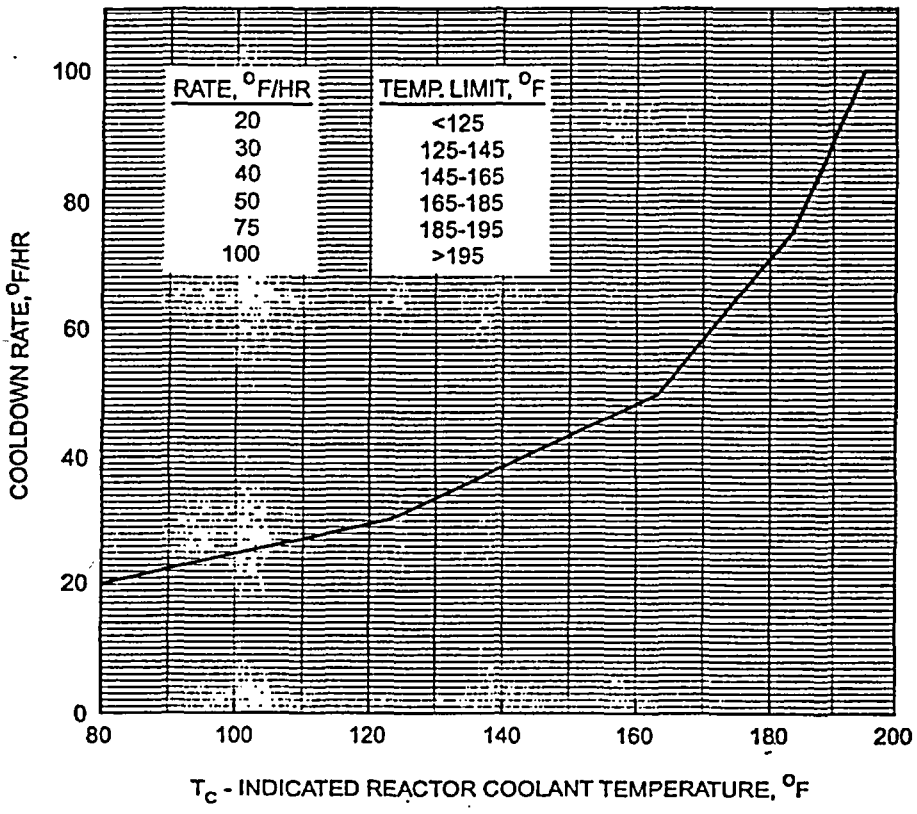
Limiting Material: Lower Shell Axial Welds (Ht.# 305424)
Limiting ART Values at 35 EFPY: 1/4T, 191°F
3/4T, 137°F

Delete Insert

FIGURE 3.4-3

ST. LUCIE UNIT 1 ~~23.6 EFPY~~ 35 EFPY

MAXIMUM ALLOWABLE COOLDOWN RATES



NOTE: A MAXIMUM COOLDOWN RATE OF 100°F/HR IS ALLOWED AT ANY TEMPERATURE ABOVE 195°F

ATTACHMENT 4

ST. LUCIE UNIT 1 RETYPED TECHNICAL SPECIFICATION PAGES

The attached retyped pages reflect the currently issued version of the Technical Specifications. Pending Technical Specification changes or Technical Specification changes issued subsequent to this submittal are not reflected in the enclosed retyped pages. The enclosed retyped pages should be checked for continuity with Technical Specifications prior to issuance

TS Pages

3/4 1-9a

3/4 4-23a

3/4 4-23b

3/4 4-23c

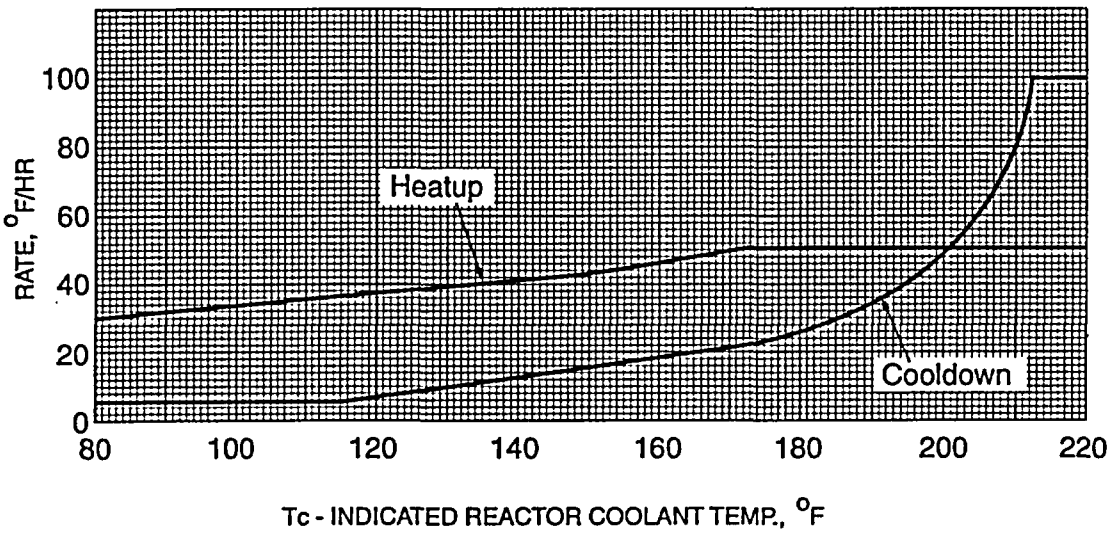
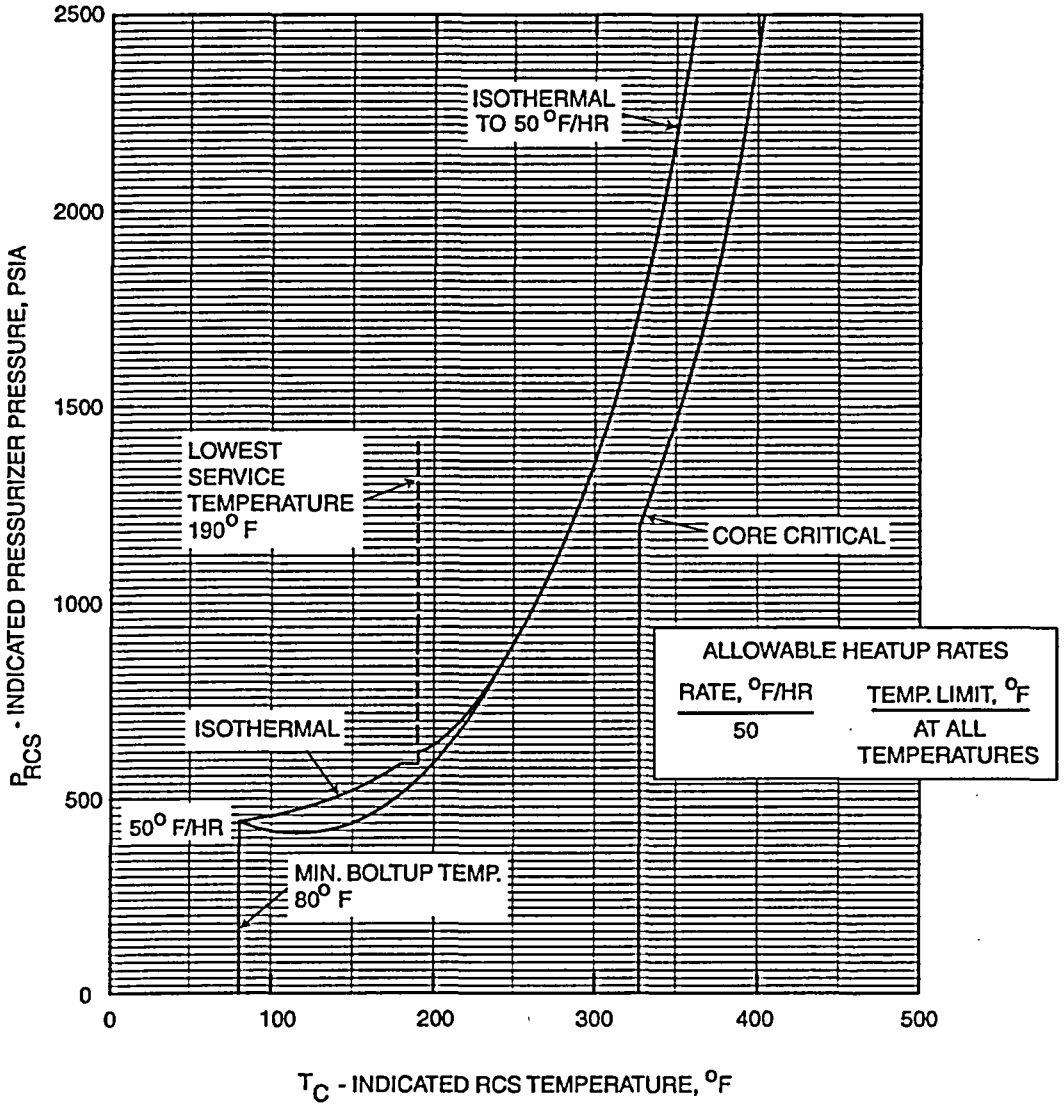


FIGURE 3.1-1b

MAXIMUM ALLOWABLE HEATUP AND COOLDOWN RATES, SINGLE HPSI PUMP IN OPERATION (Applicable to 35 EFPY)

FIGURE 3.4-2a

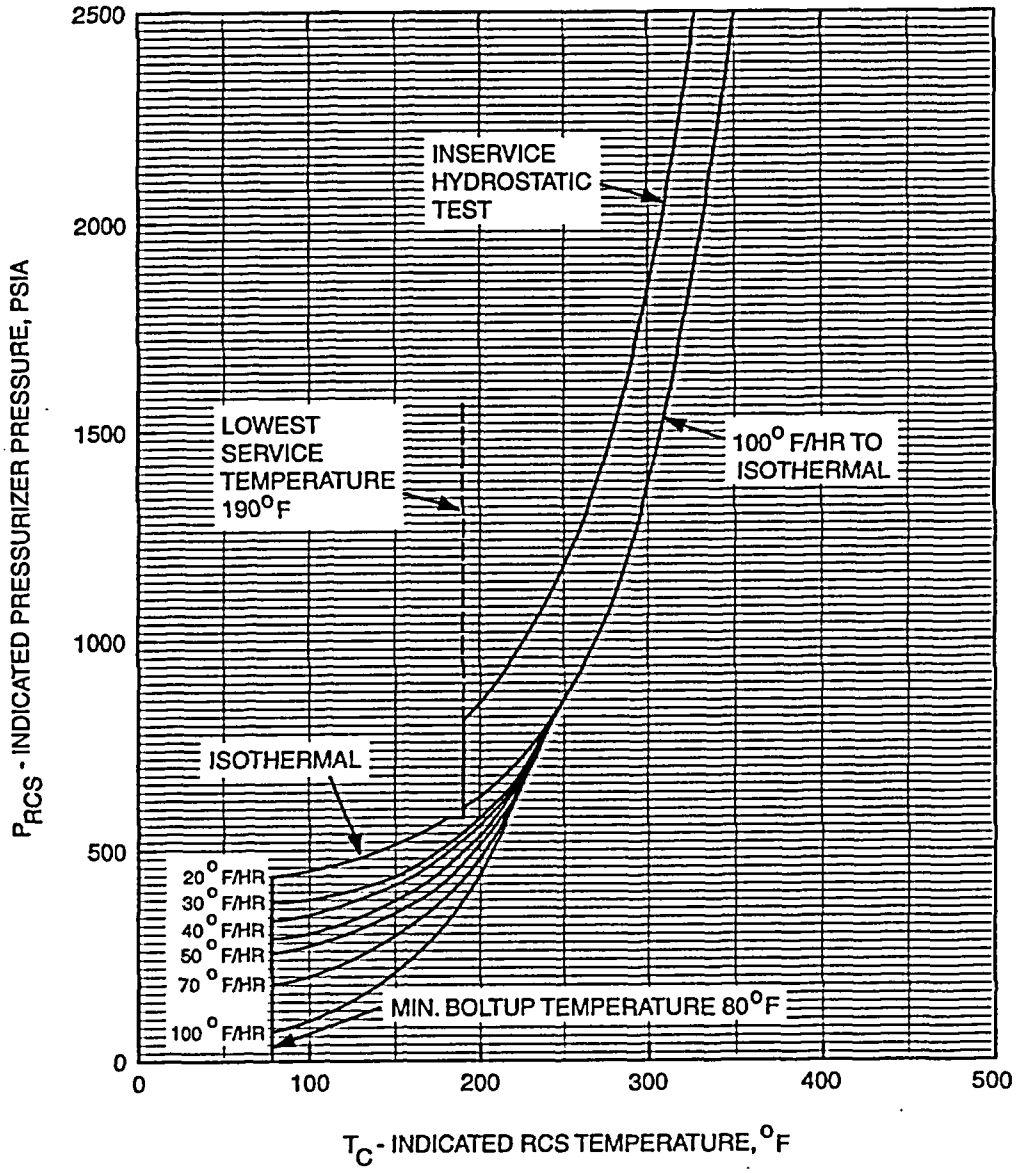
**ST. LUCIE UNIT 1 P/T LIMITS, 35 EFPY
HEATUP AND CORE CRITICAL**



Limiting Material: Lower Shell Axial Welds (Ht. #305424)
Limiting ART Values at 35 EFPY: 1/4T, 191°F
3/4T, 137°F

FIGURE 3.4-2b

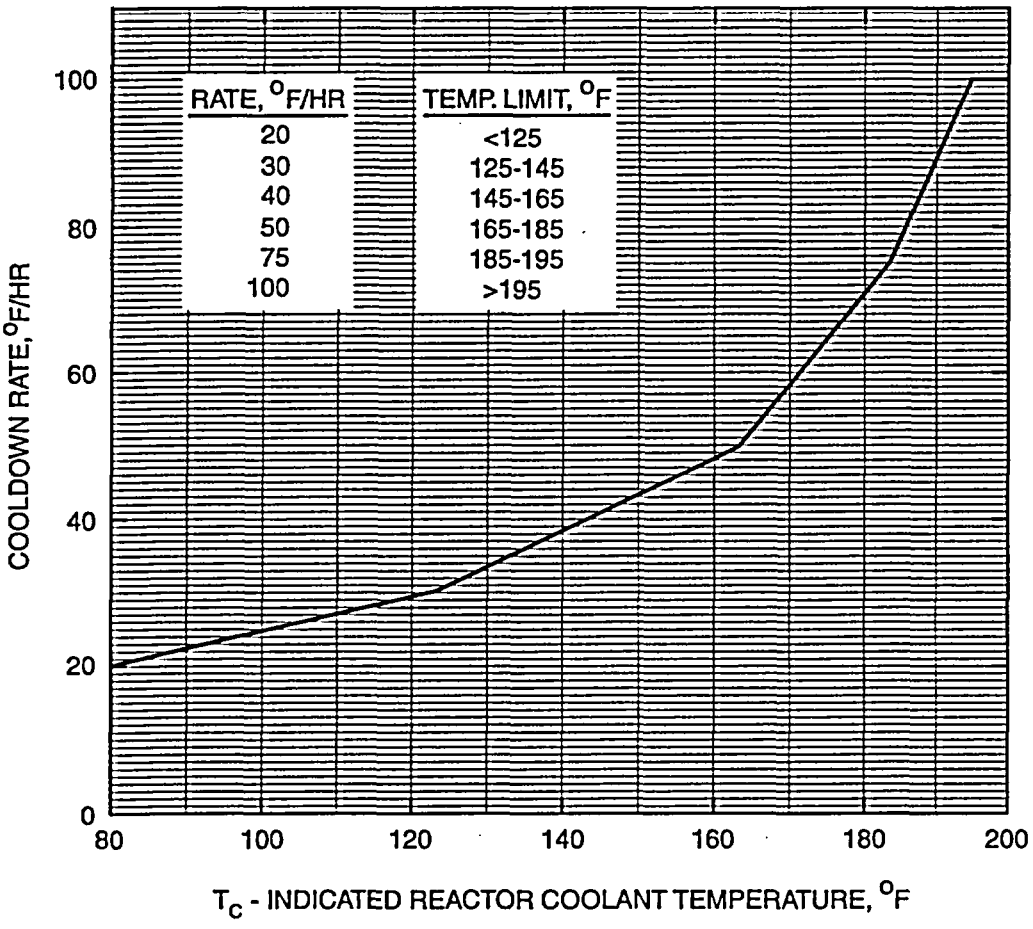
ST. LUCIE UNIT 1 P/T LIMITS, 35 EFPY COOLDOWN AND INSERVICE TEST



Limiting Material: Lower Shell Axial Welds (Ht. #305424)
Limiting ART Values at 35 EFPY: 1/4T, 191°F
3/4T, 137°F

FIGURE 3.4-3

ST. LUCIE UNIT 1, 35 EFPY
MAXIMUM ALLOWABLE COOLDOWN RATES



NOTE: A MAXIMUM COOLDOWN RATE OF 100°F/HR IS ALLOWED AT ANY TEMPERATURE ABOVE 195°F