PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

PSEG
Nuclear LLC

FEB 1 2 2001

LRN-01-0052
LCR H00-05, Sup. 1

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

SUPPLEMENTAL INFORMATION FOR
REQUEST FOR LICENSE AMENDMENT
INCREASED LICENSED POWER LEVEL
HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NO. NPF-57
DOCKET NO. 50-354

On December 1, 2000, PSEG Nuclear LLC submitted a request to change Facility Operating License No. NPF-57 and the Technical Specifications (TS) in Appendix A thereto for Hope Creek Generating Station. The proposed license amendment would increase the licensed core power level for operation to 3339 megawatts, 1.4% greater than the current level. As part of this request for amendment, Figures 3.4.6.1-1, 3.4.6.1-2 and 3.4.6.1-3, which contain the pressure-temperature (P-T) limit curves for the Hope Creek Reactor Pressure Vessel, were revised.

In a teleconference between members of the NRC and PSEG Nuclear on February 2, 2001, the NRC indicated that the neutron fluence used to develop the revised P-T curves did not reflect the guidance contained in Draft Regulatory Guide DG-1053, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," and therefore the NRC could not support approval of the new P-T limits out to 32 Effective Full Power Years (EFPY). Since there are no currently NRC approved methods that follow the guidance of DG-1053, PSEG Nuclear requests that the curves submitted on December 1, 2000 be approved for use until the end of Hope Creek Cycle 11 (currently scheduled to end in April 2003). This will allow continued operation of Hope Creek until methods are approved by the NRC that follow the guidance of DG-1053. Attachment 1 provides the revised marked-up pages of figures 3.4.6.1-1, 3.4.6.1-2, and 3.4.6.1-3 with a note that states that the new P-T curves are only valid until the end of Hope Creek Cycle 11. Please replace the revised P-T curves contained in the December 1, 2001 submittal with the P-T curves contained in Attachment 1 of this submittal.

A001

In addition, as discussed by teleconference between the NRC and PSEG Nuclear on January 22, 2001, PSEG Nuclear is providing a copy of calculation H-1-BB-NDC-1858, Rev 0IR0, "Reactor Vessel Fluence Calculation for 1.5% Power Uprate," as Attachment 2.

This supplemental information does not alter the information supporting the conclusion of No Significant Hazards Consideration contained in the December 1, 2000 submittal.

Should you have any questions regarding this submittal, please contact Mr. Brian Thomas at (856)339-2022.

Sincerely,

Mark B. Bezilla
Vice President – Technical Support

Affidavit
Attachments (2)

C Mr. H. J. Miller, Administrator - Region I
U. S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. R. Ennis
Licensing Project Manager - Hope Creek
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop 8B1
11555 Rockville Pike
Rockville, MD 20852

USNRC Senior Resident Inspector - Hope Creek (X24)

Mr. K. Tosch, Manager IV
Bureau of Nuclear Engineering
P.O. Box 415
Trenton, NJ 08625

BJT

BC Manager - Hope Creek Operations (H07)
Director - QA/Nuclear Training/Emergency Planning (120)
Manager - Licensing (N21)
Manager - Business Planning & Co-Owners Affairs (N18)
Manager - System Engineering - Hope Creek (H18)
Manager - Nuclear Fuels (N20)
Project manager - NRB (N38)
J. Keenan, Esq. (N21)
Records Management (N21)
Microfilm Copy
File Nos. 1.2.1 (Hope Creek)
2.3 (LCR H00-05)

REF: LRN-01-0052
LCR H00-05, Sup. 1

STATE OF NEW JERSEY)
) SS.
COUNTY OF SALEM)

Mark B. Bezilla, being duly sworn according to law deposes and says:

I am Vice President – Technical Support of PSEG Nuclear LLC, and as such, I find the matters set forth in the above referenced letter, concerning Hope Creek Generating Station are true to the best of my knowledge, information and belief.

____

Subscribed and Sworn to before me
this 12th day of February, 2001

____
Notary Public of New Jersey

My Commission expires on 6/16/2003

Attachment 1

LRN-01-0052

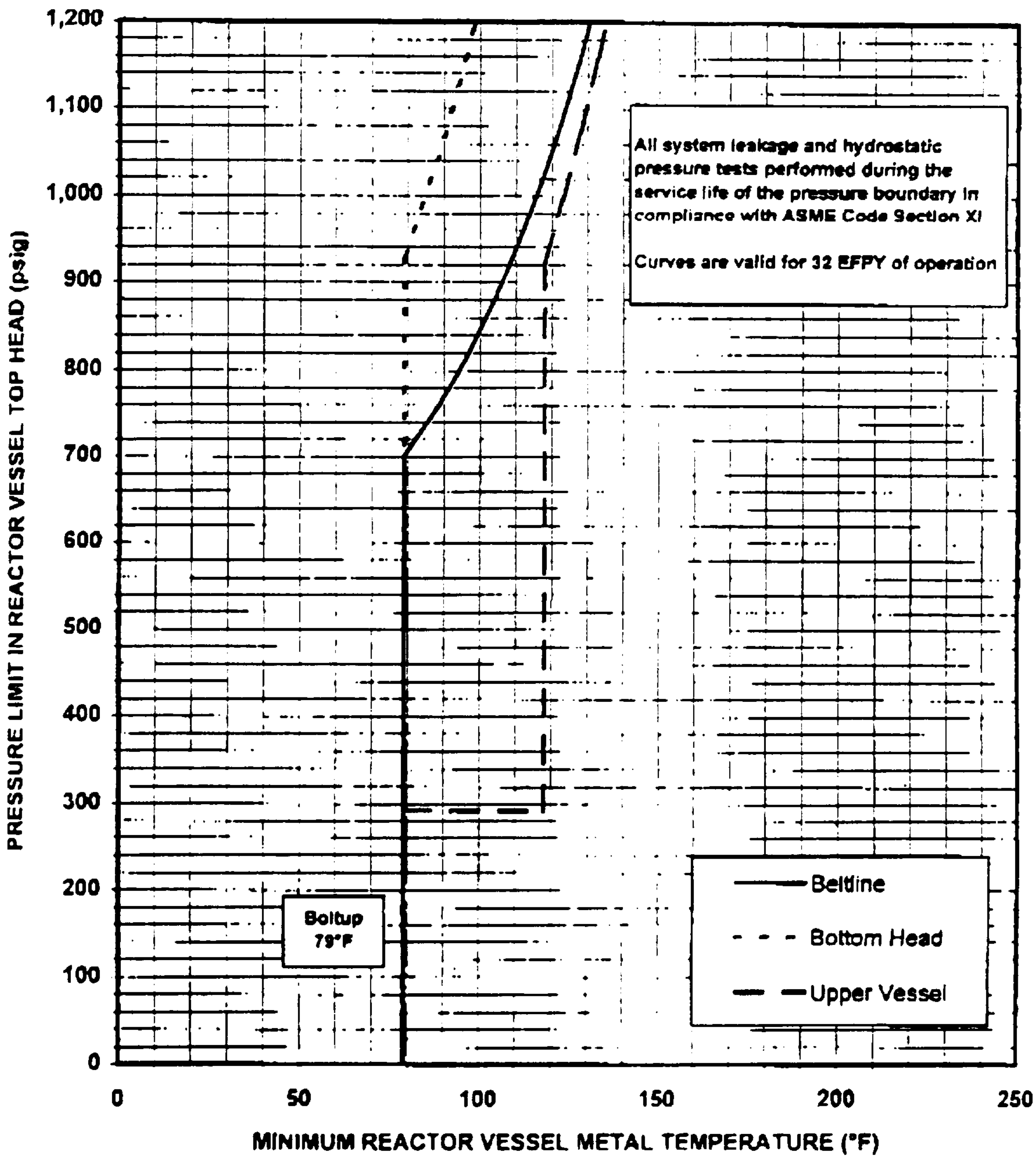
HOPE CREEK GENERATING STATION
UNIT 1

DOCKET NO. 50-354

Note: This figure is valid through Cycle 11 Operation in accordance with NRC Safety Evaluation Report supporting Amendment No. ____

Insert 1

Figure 3.4.6.1-1
Hydrostatic Pressure and Leak Tests Pressure/Temperature Limits - Curve A

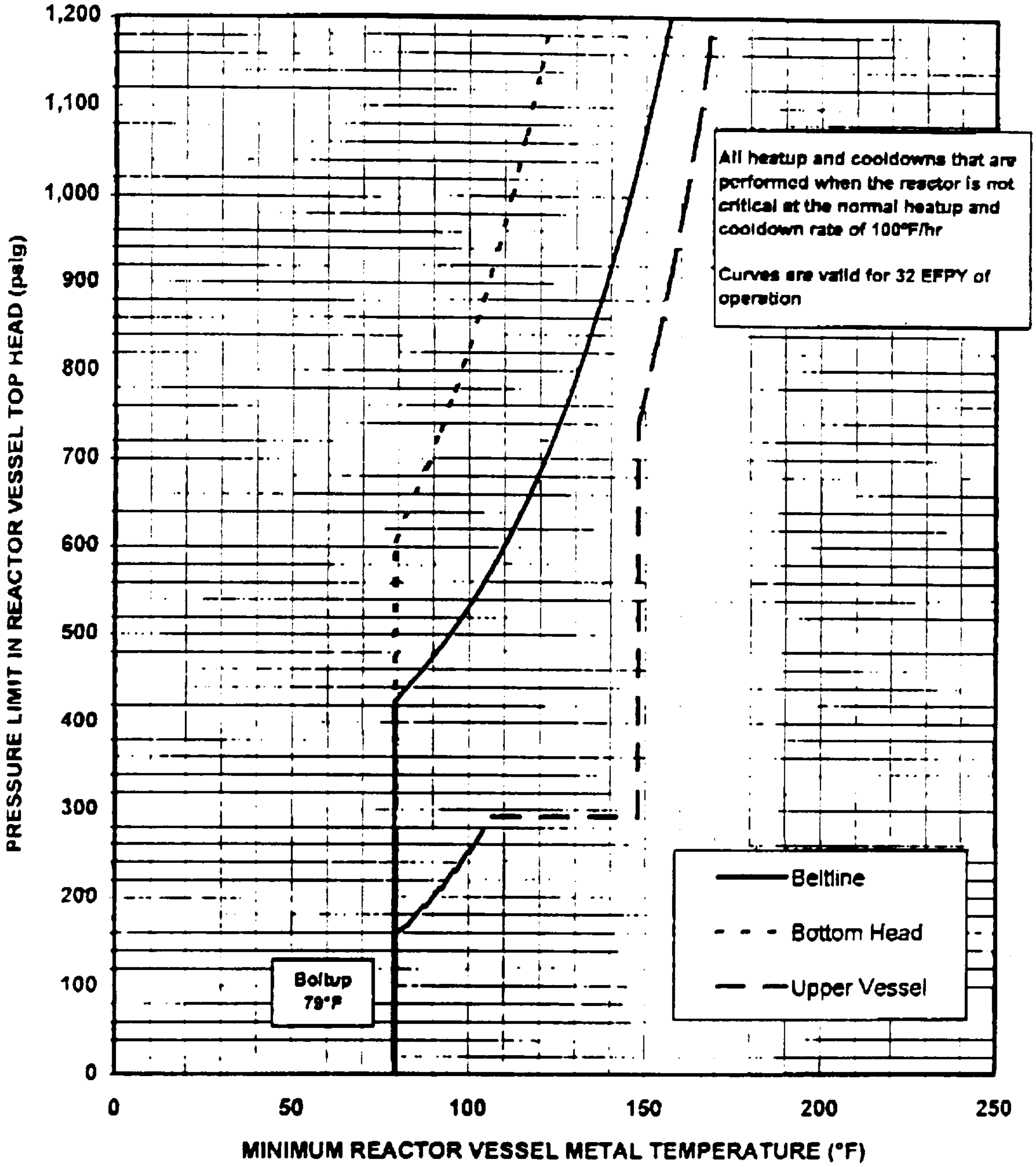


Insert Note

Insert 2

Figure 3.4.6.1-2

Non-Nuclear Heatup and Cooldown Pressure/Temperature Limits - Curve B

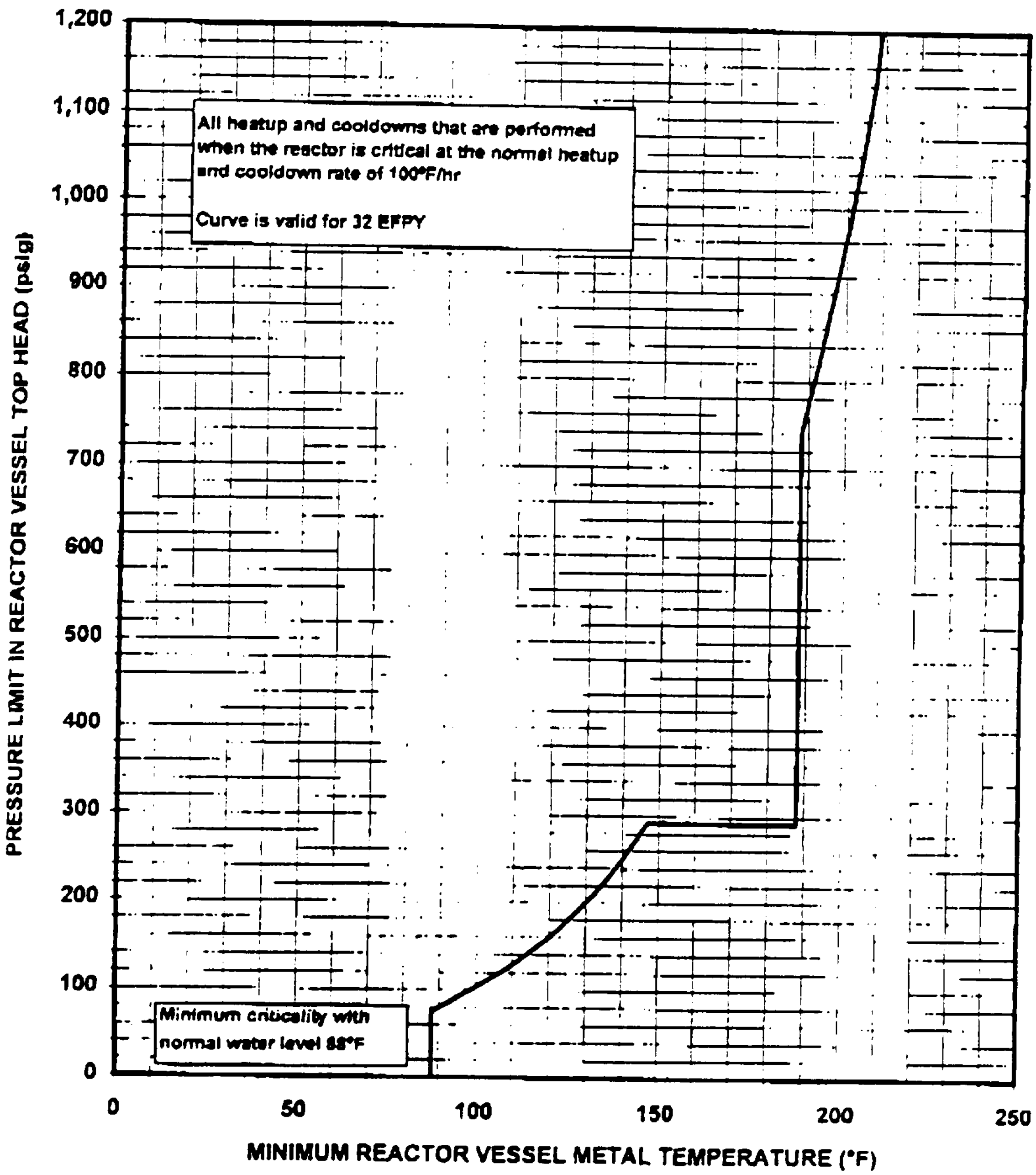


Insert Note

Insert 3

Figure 3.4.6.1-3

Core Critical Heatup and Cooldown Pressure/Temperature Limits - Curve C



INSERT NOTE

Attachment 2

LRN-01-0052

HOPE CREEK GENERATING STATION
UNIT 1

DOCKET NO. 50-354

CALC NO.: H-1-BB-NDC-1858 **REVISION: 0IR0**		**CALCULATION COVER SHEET**				**Page 1 of 9**	
CALC. TITLE:	Reactor Vessel Fluence Calculation for 1.5% Power Uprate						
# SHTS (CALC):	9	**# ATT / # SHTS:**	1/1	**# IDV/50.59 SHTS:**	1	**# TOTAL SHTS:**	11

CHECK ONE:

☐ FINAL ■ INTERIM (Proposed Plant Change) ☐ FINAL (Future Confirmation Req'd) ☐ VOID

SALEM OR HOPE CREEK: ☐ Q – LIST ☐ IMPORTANT TO SAFETY ☐ NON-SAFETY RELATED
HOPE CREEK ONLY: ■Q ☐Qs ☐Qsh ☐F ☐R

☐ STATION PROCEDURES IMPACTED, IF SO CONTACT SYSTEM MANAGER
☐ CDs INCORPORATED (IF ANY): ______________________

DESCRIPTION OF CALCULATION REVISION (IF APPL.):

Initial Issue
This calculation will be used to calculate information that will be used in a significant hazard evaluation (10CFR 50.92), which will be submitted to the NRC. Therefore a 50.59 applicability review is not required.

PURPOSE:
This calculation establishes for Hope Creek, 32 EFPY and 48 EFPY peak fluence estimates at the surface of the reactor vessel and at ¼ T location for the 1.5% power uprate condition. The 32 EFPY fluence values will be used as inputs for the RPV Fracture Toughness analysis being performed for power uprate. The Fracture Toughness analysis will develop Pressure Temperature curves and will evaluate upper shelf energy IAW 10CFR50, Appendix G. The 48EFPY fluence values will only be used for informational purposes.

CONCLUSIONS:

The fluence values have been calculated and are included in the continuation sheets. The 32 EFPY values can be used for the development of Pressure Temperature curves and to evaluate upper shelf energy IAW 10CFR50, Appendix G for power uprate. No actions are necessary to support the conclusion.

	Printed Name / Signature	**Date**
ORIGINATOR/COMPANY NAME:	RJ Schmidt [signature]	9/27/00
PEER REVIEWER/COMPANY NAME:	Emin Ortalan [signature]	9/28/00
VERIFIER/COMPANY NAME:	Emin Ortalan [signature]	9/28/00
PSEG SUPERVISOR APPROVAL:	Robert DeNight [signature]	9/28/00

	CALCULATION CONTINUATION SHEET	SHEET: 2 CONT'D ON SHEET: 3			
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:			
ORIGINATOR,DATE	REV:	9/27/00	OIRO		
REVIEWER/VERIFIER,DATE		9/28/00			

Purpose:

This calculation establishes for Hope Creek, a 32 EFPY and 48 EFPY peak fluence estimates at the surface of the reactor vessel and at ¼ T location for the 1.5% power uprate condition. The 32 EFPY values will be used as inputs for the RPV Fracture Toughness analysis being performed for power uprate. The Fracture Toughness analysis will develop Pressure Temperature curves and will evaluate upper shelf energy IAW 10CFR50, Appendix G. The 48EFPY fluence values will only be used for informational purposes.

Scope:

This calculation will be performed for 32 EFPY and 48 EFPY for the new uprated condition starting in cycle 10. The 32 EFPY is based on 40-year operation at an 80% capacity factor and is the standard EFPY value used for determining the end-of-life condition (non-license extension) in RPV Fracture Toughness analyses. The 48 EFPY calculation will be used for information in future studies for license extension.

The calculation will be performed for the reactor vessel's lower-intermediate shell, lower shell, intermediate shell, and the LPCI nozzle.

Design Inputs:

1. This calculation uses data from the latest Hope Creek Flux Wire analysis that was performed from the last RPV Surveillance Material Testing Report [1].

   - Flux wire fluence — 1.42×10^{17} n/cm^2
   - EFPY associated with flux wire — 6.01 EFPY
   - Lead factor (ratio of flux at the surveillance flux wire location to the peak inside surface location) — 1.01

	CALCULATION CONTINUATION SHEET	SHEET: 3 CONT'D ON SHEET: 4
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:
ORIGINATOR,DATE	REV:	~~9/29/00~~ 9/27/00	0 IRO
REVIEWER/VERIFIER,DATE		9/28/00

- Elevation factor for the decreased fluence at the intermediate vessel shell (no. 3) versus the lower-intermediate shell (no. 4) — 0.66

- Azimuthal factor for the decrease in fluence due to the LPCI nozzle azimuthal variation versus the peak location of the intermediate vessel shell — 0.82

2. EFPH associated with the first nine (9) cycles of operation is 95769 [2]. This converted to EFPY is 95769 EFPH / 24 hrs / 365.25 days = 10.93 EFPY.

3. This calculation will be performed for 32 EFPY and 48 EFPY for the new uprated condition starting in cycle 10. The 32 EFPY is based on 40-year operation at an 80% capacity factor and is the standard EFPY value used for determining the end-of-life condition in RPV Fracture Toughness analyses. The 48 EFPY calculation will be used for information in future studies for license extension.

4. The vessel beltline lower-intermediate shell and intermediate shell are 6.10 inches thick [1].

Assumptions:

1. This calculation will assume a 1.5% power uprate condition. This will result in an increase in flux at the vessel surface of 1.5%. The actual approved power uprate condition will be less than 1.5%, thus the calculated fluence will be a conservative input to the RPV Fracture Toughness analysis.

2. This calculation will assume a power uprate condition has occurred for the entire cycle 10 operation and beyond. Actually at the beginning of cycle 10 reactor power was not uprated and is planned to be uprated during cycle 10. This calculation will provide a higher fluence than actual. Therefore this will provide a conservative input to the RPV Fracture Toughness analysis.

	CALCULATION CONTINUATION SHEET	SHEET: 4 CONT'D ON SHEET: 5		
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:		
ORIGINATOR,DATE	REV:	KGS ~~9/29/00~~ 9/27/00	OIRO	
REVIEWER/VERIFIER,DATE		EBO 9/28/00		

Estimate of 32 EFPY Fluence(USING THE METHODOLOGY OF REFERENCE 1).

1. Peak vessel inside surface fluence for the non power uprated period (end of cycle 9)

   To determine this, use the flux wire results and extrapolate to end of cycle 9, adjusting with the lead factor.

   f_{surf}(end of cycle 9) = flux wire fluence*(EFPY @ end of cycle 9/EFPY of flux wire)/lead factor

   f_{surf}(end of cycle 9) = $1.42 \times 10^{17} * (10.93/6.01) / 1.01$

   f_{surf}(end of cycle 9) = 2.56×10^{17} n/cm^2

2. Peak vessel inside surface fluence for the uprated period (beginning of cycle 10 through 32 EFPY or beyond cycle 9)

   To determine this use the flux wire results, adjust for the power uprate (1.015), and extrapolate beyond cycle 9 to 32 EFPY.

   EFPY beyond cycle 9 = 32 – EFPY beginning of cycle 10

   = 32 – 10.93 = 21.07 EFPY

   f_{surf}(beyond cycle 9) =
   flux wire fluence*power uprate*(EFPY beyond cycle 9/flux wire EFPY)/lead factor

   f_{surf}(beyond cycle 9) = $1.42 \times 10^{17} * 1.015 * (21.07/6.01) / 1.01$

   f_{surf}(beyond cycle 9) = 5.00×10^{17} n/cm^2

	CALCULATION CONTINUATION SHEET	SHEET: 5 CONT'D ON SHEET: 6			
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:			
ORIGINATOR,DATE	REV:	MJS ~~9/29/00~~ 9/27/00	0 IRO		
REVIEWER/VERIFIER,DATE		EMS 9/~~29~~28/00			

3. Peak vessel inside surface fluence at 32 EFPY

f_{surf}(32 EFPY) = f_{surf}(end of cycle 9) + f_{surf}(beyond cycle 9)

f_{surf}(32 EFPY) = 2.56×10^{17} + 5.00×10^{17}

f_{surf}(32 EFPY) = 7.56×10^{17} n/cm^2

This fluence represents the peak fluence, which occurs in the lower-intermediate shell (no. 4) and will be conservatively applied to the lower shell (no. 5). See figure 3-2 of reference [1].

4. Peak intermediate shell (no. 3) inside surface fluence at 32 EFPY

f_{surf}(32 EFPY) = peak vessel inside surface fluence (lower-intermediate shell) * elevation factor

f_{surf}(32 EFPY) = $7.56\times10^{17} * 0.66$

= 4.99×10^{17} n/cm^2

5. Peak LPCI nozzle inside surface fluence at 32 EFPY

f_{surf}(32 EFPY) = Peak intermediate shell inside surface fluence * azimuthal factor

f_{surf}(32 EFPY) = $4.99\times10^{17} *0.82$

= 4.09×10^{17} n/cm^2

	CALCULATION CONTINUATION SHEET	SHEET: 6 CONT'D ON SHEET: 7			
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:			
ORIGINATOR,DATE	REV:	MJS 9/27/00	01R0		
REVIEWER/VERIFIER,DATE		SKS 9/28/00			

6. ¼ T fluence (f) is calculated as follows to Reg. Guide 1.99 [3]

$f = f_{surf} * (e^{-0.24x})$ where x=distance, in inches, to the ¼ depth.

The vessel beltline lower-intermediate shell and intermediate shell are 6.10 inches thick. The corresponding depth x is 1.53 inches. The above equation yields:

$f(32\ EFPY) = f_{surf} * (0.693) = 5.24 \times 10^{17}\ n/cm^2$ *for the lower-intermediate & lower shell*

$f(32\ EFPY) = f_{surf} * (0.693) = 3.46 \times 10^{17}\ n/cm^2$ *for the intermediate shell*

$f(32\ EFPY) = f_{surf} * (0.693) = 2.83 \times 10^{17}\ n/cm^2$ *for the LPCI nozzle*

	CALCULATION CONTINUATION SHEET	SHEET: 7 CONT'D ON SHEET: 8		
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:		
ORIGINATOR,DATE	REV:	~~9/25/00~~ 9/27/00	0IRD	
REVIEWER/VERIFIER,DATE		~~9/29/00~~ 9/28/00		

Estimate of 48 EFPY Fluence:

1. Peak vessel inside surface fluence for the non power uprated period (end of cycle 9)

   To determine this, use the flux wire results and extrapolate to end of cycle 9, adjusting with the lead factor.

   f_{surf}(end of cycle 9) = flux wire fluence*(EFPY @ end of cycle 9/EFPY of flux wire)/lead factor

   f_{surf}(end of cycle 9) = $1.42 \times 10^{17} * (10.93/6.01) / 1.01$

   f_{surf}(end of cycle 9) = 2.56×10^{17} n/cm^2

2. Peak vessel inside surface fluence for the uprated period (beginning of cycle 10 through 48 EFPY or beyond cycle 9)

   To determine this use the flux wire results, adjust for the power uprate (1.015), and extrapolate beyond cycle 9 to 48 EFPY.

   EFPY beyond cycle 9 = 48 – EFPY beginning of cycle 10

   = 48 – 10.93 = 37.07 EFPY

   f_{surf}(beyond cycle 9) =
   flux wire fluence*power uprate*(EFPY beyond cycle 9/flux wire EFPY)/lead factor

   f_{surf}(beyond cycle 9) = $1.42 \times 10^{17} * 1.015 * (37.07/6.01) / 1.01$

   f_{surf}(beyond cycle 9) = 8.80×10^{17} n/cm^2

	CALCULATION CONTINUATION SHEET	SHEET: 8 CONT'D ON SHEET: 9
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:

ORIGINATOR,DATE	REV:	MJS ~~9/25/00~~ 9/27/00	01 RD			
REVIEWER/VERIFIER,DATE		SBJ 9/~~29~~28/00				

3. Peak vessel inside surface fluence at 48 EFPY

f_{surf}(48 EFPY) = f_{surf}(end of cycle 9) + f_{surf}(beyond cycle 9)

f_{surf}(48 EFPY) = $2.56 \times 10^{17} + 8.80 \times 10^{17}$

f_{surf}(48 EFPY) = 11.36×10^{17} n/cm^2

This fluence represents the peak fluence, which occurs in the lower-intermediate shell (no. 4) and will be conservatively applied to the lower shell (no. 5). See figure 3-2 of reference [1].

4. Peak intermediate shell (no. 3) inside surface fluence at 48 EFPY

f_{surf}(48 EFPY) = peak vessel inside surface fluence (lower-intermediate shell) * elevation factor

f_{surf}(48 EFPY) = $11.36 \times 10^{17} * 0.66$

= 7.50×10^{17} n/cm^2

5. Peak LPCI nozzle inside surface fluence at 48 EFPY

f_{surf}(48 EFPY) = Peak intermediate shell inside surface fluence * azimuthal factor

f_{surf}(48 EFPY) = $7.50 \times 10^{17} * 0.82$

= 6.15×10^{17} n/cm^2

	CALCULATION CONTINUATION SHEET	SHEET: 9 CONT'D ON SHEET: Last		
CALC. NO.: H-1-BB-NDC-1858		REFERENCE:		
ORIGINATOR,DATE	REV:	NGS 9/27/00	OIRO	
REVIEWER/VERIFIER,DATE		BMS 9/28/00		

6. ¼ T fluence (f) is calculated as follows to Reg. Guide 1.99 [3]

$f = f_{surf} * (e^{-0.24x})$ where x=distance, in inches, to the ¼ depth.

The vessel beltline lower-intermediate shell and intermediate shell are 6.10 inches thick. The corresponding depth x is 1.53 inches. The above equation yields:

$f(48\ EFPY) = f_{surf} * (0.693) = 7.87\times10^{17}\ n/cm^2$ *for the lower-intermediate & lower shell*

$f(48\ EFPY) = f_{surf} * (0.693) = 5.20\times10^{17}\ n/cm^2$ *for the intermediate shell*

$f(48\ EFPY) = f_{surf} * (0.693) = 4.26\times10^{17}\ n/cm^2$ *for the LPCI nozzle*

Conclusions:

The above fluence values can be used for the development of Pressure Temperature curves and to evaluate upper shelf energy IAW 10CFR50, Appendix G for power uprate. No actions are necessary to support the conclusion.

Documents Affected:

None

References:

[1] "Hope Creek 1 Generating Station RPV Surveillance Materials Testing and Fracture Toughness Analysis," General Electric report GE-NE-523-A164-1294R1, December 1997. Vendor document number 323326.
[2] NFS 00-212, "HCGS End of Cycle 9 Effective Full Power Hours," September 25, 2000.
[3] "Radiation Embrittlement of Reactor Vessel materials," USNRC Regulatory Guide 1.99, Revision 2, May 1988.

CAL C NO. H-1-BB-NDC-1858

Revision 0

PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

Attachment 1
page 1 of 1

PSEG
Nuclear LLC

To: Randy Schmidt
Senior Engineer – Material/Chemistry Technology

From: Don Notigan
Engineering Supervisor - Fuels

Subject: **HCGS END OF CYCLE 9 EFFECTIVE FULL POWER HOURS**

Date: 09/25/2000
NFS 00-212

In response to your request, the following information is provided.

The total effective full power hours (EFPH) from cycle 1 to end of cycle 9 is 95769 EFPH. This value was established by Westinghouse for the Cycle 10 databank utilizing the POLCA7 nodal simulator. The POLCA7 nodal simulator is and will continue to be the Core Monitoring System exposure tracking bases for HCGS.

If you have any further questions, please contact Frank Safin on extension 1265.

Reference: NFSI-2000-128, Hope Creek Cycle 10 Data Bank and Databook, 04/27/00.

FJS

FORM-1
(Page 2 of 3)

CERTIFICATION FOR DESIGN VERIFICATION

Reference No. Calc. H-1-BB-NDC-1858, R0 IRO

SUMMARY STATEMENT

Reviewed calculation in its entirety. Check the inputs and the approached used. Assumptions are conservative for the intended use. Verified the math. Thus, calculation is acceptable.

The undersigned hereby certifies (in the right column) that the design verification for the subject document has been completed, the questions from the generic checklist have been reviewed and addressed as appropriate, and all comments have been adequately incorporated.

R.W. DeNight Design Verifier Assigned By (signature of Manager/Director)*	9/26/05 Signature of Design Verifier* / Date
Design Verifier Assigned By (signature of Manager/Director)*	Signature of Design Verifier* / Date
Design Verifier Assigned By (signature of Manager/Director)*	Signature of Design Verifier* / Date
Design Verifier Assigned By (signature of Manager/Director)*	Signature of Design Verifier* / Date

*If the Manager/Supervisor acts as the Design Verifier, the signature of the next higher level of technical management is required in the left column.

Page 1 of 1