NEXTera ENERGY POINT BEACH

April 18, 2013

NRC 2013-0036
10 CFR 50.90

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

Point Beach Nuclear Plant, Units 1 and 2
Dockets 50-266 and 50-301
Renewed License Nos. DPR-24 and DPR-27

Supplement 2 to License Amendment Request 252
Technical Specification 5.6.5, Reactor Coolant System (RCS)
Pressure and Temperature Limits Report (PTLR)

References:
(1) NextEra Energy Point Beach, LLC letter to NRC, dated January 15, 2013, License Amendment Request 252 Technical Specification 5.6.5, Reactor Coolant System (RCS) Pressure and Temperature Limits Report (PTLR) (ML13016A028)
(2) NRC E-Mail to NextEra Energy Point Beach, dated March 27, 2013, Information Needed for Review (TAC Nos. MF0532, MF0533, MF0534, and MF0535) (ML13098B070)

In Reference (1), NextEra Energy Point Beach, LLC (NextEra) submitted a license amendment request to amend renewed Facility Operating License Nos. DPR-24 and DPR-27 for Point Beach Nuclear Plant (PBNP), Units 1 and 2, respectively. The proposed amendments would revise the PBNP Technical Specifications (TS) to allow the use of two new methodologies: Framatome ANP Topical Report BAW-2308, Revisions 1-A and 2-A, "Initial RT_{NDT} of Linde 80 Weld Materials," and Westinghouse Owners Group (WOG) WCAP-14040-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves." The revision would add BAW-2308, Revisions 1-A and 2-A and WCAP-14040-A, Revision 4, as approved methodologies to TS 5.6.5, "Reactor Coolant System (RCS) Pressure and Temperature Limits Report (PTLR)," for determining RCS pressure-temperature (PT) limits.

In Reference (2), the NRC informed NextEra that supplemental information would be required in order for the LAR to meet acceptance review criteria. This letter provides the requested information.

Enclosure 1 provides the requested supplemental information. Enclosure 2 provides a mark-up of TRM 2.2, Pressure Temperature Limits Report. The mark-up of TRM 2.2 in Reference (1) had incorrect temperatures listed for the RT_{PTS} values on page 2.2-3. Enclosure 2 in this letter replaces in its entirety the mark-up of TRM 2.2, Pressure Temperature Limits Report, provided in Reference (1).

The information contained in this letter does not alter the no significant hazards consideration contained in Reference (1) and continues to satisfy the criteria of 10 CFR 51.22 for categorical exclusion from the requirements of an environmental assessment.

Approval of the proposed amendment is requested by January 1, 2014. NextEra will implement the amendment within 180 days of Commission Approval.

This letter contains no new Regulatory Commitments and no revisions to existing Regulatory Commitments.

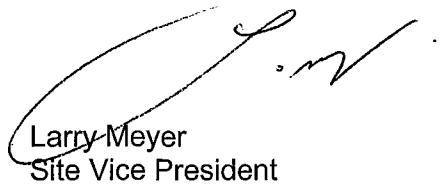
The supplemental information to the LAR has been reviewed by the Plant Operations Review Committee.

In accordance with 10 CFR 50.91, a copy of this letter is being provided to the designated Wisconsin Official.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on April 18, 2013.

Very truly yours,

NextEra Energy Point Beach, LLC



Larry Meyer
Site Vice President

Enclosures

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

SUPPLEMENT 2 TO LICENSE AMENDMENT REQUEST 252
TECHNICAL SPECIFICATION 5.6.5, REACTOR COOLANT SYSTEM (RCS)
PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

SUPPLEMENTAL INFORMATION

1.0 INTRODUCTION

License Amendment Request (LAR) 252 (Reference 1) proposes to amend the Point Beach Nuclear Plant (PBNP) Technical Specifications (TS) to allow the use of two new methodologies; Framatome ANP Topical Report BAW-2308, Revisions 1-A (Reference 2) and 2-A (Reference 3), "Initial RT_{NDT} of Linde 80 Weld Materials," and Westinghouse Owners Group (WOG) WCAP-14040-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves" (Reference 4). The revision would add BAW-2308, Revisions 1-A and 2-A and WCAP-14040-A, Revision 4, as approved methodologies to TS 5.6.5, "Reactor Coolant System (RCS) Pressure and Temperature Limits Report (PTLR)," for determining RCS pressure-temperature (PT) limits.

The NRC staff had indicated via an email dated March 27, 2013, (Reference 5) that additional information was required to evaluate use of the new methodologies at PBNP. On April 4, 2013, a teleconference between the NRC and PBNP staffs was held to discuss the NextEra Energy Point Beach, LLC (NextEra) submittal. The NRC reviewer informed NextEra that the calculations used to generate the adjusted reference temperature (ART) and reference temperature – pressurized thermal shock (RT-PTS) would be required for the review of the LAR. Additionally, the information submitted should document that the LAR meets the limitations discussed in the NRC safety evaluation report (SER) approving the BAW-2308 reports.

2.0 BACKGROUND

10 CFR 50.61(a)(5) and 10 CFR 50, Appendix G(II)(D)(i), require that the pre-service or unirradiated condition reference nil-ductility temperature (RT_{NDT}) be evaluated according to the procedures in the American Society for Mechanical Engineers (ASME) Code, Section III, Paragraph NB-2331, which requires Charpy V-notch impact tests and drop weight tests.

Topical Report BAW-2308, Revisions 1-A and 2-A, provide an NRC-approved alternate method for determining the initial, unirradiated material reference temperatures of the Linde 80 weld materials present in the beltline region of the PBNP reactor pressure vessel (RPV). BAW-2308, Revisions 1-A and 2-A, were approved by the NRC for referencing in plant-specific license amendments in NRC Safety Evaluations (SEs) dated August 4, 2005 (Reference 6) and March 24, 2008 (Reference 7), respectively. BAW-2308, Revision 2-A, is a supplement to Revision 1-A, and incorporated additional test data and a re-evaluation of the reference temperature, T_o, determination, as requested by the NRC in the SE for Revision 1-A.

The SE for Revision 2-A of BAW-2308, states that the Conditions and Limitations, Items (1) through (4), contained in the SE for Revision 1-A of BAW-2308, must be addressed in all future plant-specific applications referencing Topical Report BAW-2308, Revisions 1-A and 2-A.

Conditions and Limitations Item (1) contained in the SE for Revision 1-A of BAW-2308 states:

> *The IRT_{T0} and σ_I values given in Table 3 of this SE may be used by a licensee to define the initial heat-specific or generic properties of its facility's Linde 80 welds. For those Linde 80 weld wire heats for which heat-specific values are given, those values must be used when applying TR BAW-2308, Revision 1 if the heat-specific IRT_{T0} value is more conservative than the generic "all heats" IRT_{T0} value.*

Conditions and Limitations Item (2) contained in the SE for Revision 1-A of BAW-2308 states:

When the values from Table 3 of this SE are used by a licensee, the methodology of RG 1.99, Revision 2 may be used for the purpose of assessing the shift in initial properties due to irradiation, even though the RG 1.99, Revision 2 methodology is based upon Charpy V-notch 30 ft-lb energy level shift data. However, based on the information in TR BAW-2308, Revision 1 (see Figure 3 of this SE), a minimum chemistry factor of 167 °F must be applied when using initial properties given in Table 3 of this SE. A higher chemistry factor may be required if weld wire heat-specific chemical composition or Charpy V-notch surveillance data indicate, via the methodology of RG 1.99, Revision 2, that a higher chemistry factor should apply.

Conditions and Limitations Item (3) contained in the SE for Revision 1-A of BAW-2308 states:

When the values from Table 3 of this SE are used by a licensee, a value of $\sigma_\Delta = 28$ °F must be used to determine the overall margin term, when the margin term per TR BAW-2308, Revision 1 is defined as:

$$Margin = 2\sqrt{(\sigma_I^2 + \sigma_\Delta^2)}$$

Conditions and Limitations Item (4) contained in the SE for Revision 1-A of BAW-2308 states:

Any licensee who wants to utilize the methodology of TR BAW-2308, Revision 1 as outlined in items (1) through (3) above, must request an exemption, per 10 CFR 50.12, from the requirements of Appendix G to 10 CFR Part 50 and 10 CFR 50.61 to do so. As part of a licensee's exemption request, the NRC staff expects that the licensee will also submit information which demonstrates what values the licensee proposes to use for ΔRT_{NDT} and the margin term for each Linde 80 weld in its RPV through the end of its facility's current operating license.

3.0 REQUESTED INFORMATION

Attachments 1 and 2 of this Enclosure contain the calculations used to generate the adjusted reference temperature (ART) and reference temperature – pressurized thermal shock (RT-PTS), respectively.

The four Conditions and Limitations required by the NRC SE have been met in the calculations as described below:

- Conditions and Limitations (1), (2) and (3) contained in the SE for Revision 1-A of BAW-2308 were utilized in the two attached calculations.
    - Attachment 2, Table 1 shows compliance with the IRT_{T0} value portion of Conditions and Limitations (1) and also shows compliance with Conditions and Limitations (2).
    - Attachment 2, Table 7 shows compliance with the σ_I *values* portion of Conditions and Limitations (1) and also shows compliance with Conditions and Limitations (3).
- Conditions and Limitations (4) is met in the original submittal to the NRC (Reference 1), which included the exemption request.

4.0 REFERENCES

(1) NextEra Energy Point Beach, LLC letter to NRC, dated January 15, 2012, License Amendment Request 252 Technical Specification 5.6.5, Reactor Coolant System (RCS) Pressure and Temperature Limits Report (PTLR) (ML13016A028)

(2) Framatome ANP Topical Report BAW-2308, Revision 1-A, "Initial RT_{NDT} of Linde 80 Weld Materials," approved August 2005

(3) Framatome ANP Topical Report BAW-2308, Revision 2-A, "Initial RT_{NDT} of Linde 80 Weld Materials," approved March 2008

(4) Westinghouse Owners Group (WOG) WCAP-14040-NP-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves", dated May 2004

(5) NRC E-Mail to NextEra Energy Point Beach, dated March 27, 2013, Information Needed for Review (TAC Nos. MF0532, MF0533, MF0534, and MF0535) (ML13098B070)

(6) NRC letter to Framatome ANP, dated August 4, 2005, Final Safety Evaluation for Topical Report BAW-2308, Revision 1, "Initial RT_{NDT} of Linde 80 Weld Materials" (TAC No. MB6636) (ML052070408)

(7) NRC letter to Westinghouse Electric Company, dated March 24, 2008, Final Safety Evaluation for Pressurized Water Reactor Owners Group (PWROG) Topical Report (TR) BAW-2308, Revision 2, "Initial RT_{NDT} of Linde 80 Weld Materials" (TAC No. MD4241) (ML080770349)

ENCLOSURE 1
ATTACHMENT 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

SUPPLEMENT 2 TO LICENSE AMENDMENT REQUEST 252
TECHNICAL SPECIFICATION 5.6.5, REACTOR COOLANT SYSTEM (RCS)
PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

ART VALUES FOR
POINT BEACH UNIT 1 AND UNIT 2

51 pages follow

AREVA

CALCULATION SUMMARY SHEET (CSS)

Document Identifier 32-9019240-000

Title ART Values for Point Beach Unit 1 and Unit 2

PREPARED BY:

NAME S. B. Davidsaver

SIGNATURE S. B. Davidsaver

TITLE Engineer II DATE 6/20/06

COST CENTER 41324 REF. PAGE(S) 51

REVIEWED BY:

METHOD: ☒ DETAILED CHECK ☐ INDEPENDENT CALCULATION

NAME J. B. Hall

SIGNATURE JB Hall

TITLE Princ. Engineer DATE 6-20-06

TM STATEMENT: REVIEWER INDEPENDENCE BRG

NAME B. R. Gramban

PURPOSE AND SUMMARY OF RESULTS:

The purpose of this analysis is to determine the reactor vessel adjusted reference temperatures (ART) at the ¼ thickness (¼T) and ¾ thickness (¾T) wall locations for Point Beach Units 1 and 2 using the projected fluences for eight "cases" for each Unit. The ART values are calculated for the Point Beach Units 1 and 2 and the limited beltline materials for each Unit and each "case" are shown in the table below.

Uprate?	Hf Rods?	EFPY	Case	Unit	Limiting Beltline Material	Heat Number	¼T ART Value (°F)	¾T ART Value (°F)
Yes	Yes	53	1	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	218.8	183.3
Yes	Yes	43	2	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	209.7	173.6
No	Yes	53	3	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	217.2	181.6
No	Yes	43	4	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	208.7	172.4
Yes	Removal 10/08	53	5	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	220.0	184.6
Yes	Removal 10/08	43	6	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	210.5	174.6
No	Removal 10/08	53	7	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	218.3	182.8
No	Removal 10/08	43	8	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	209.3	173.2
Yes	Yes	53	1	2	Intermediate to Lower Shell Weld	SA-1484	255.8	218.4
Yes	Yes	43	2	2	Intermediate to Lower Shell Weld	SA-1484	247.7	209.5
No	Yes	53	3	2	Intermediate to Lower Shell Weld	SA-1484	254.5	216.9
No	Yes	43	4	2	Intermediate to Lower Shell Weld	SA-1484	246.8	208.5
Yes	Removal 04/08	53	5	2	Intermediate to Lower Shell Weld	SA-1484	265.5	229.2
Yes	Removal 04/08	43	6	2	Intermediate to Lower Shell Weld	SA-1484	254.9	217.3
No	Removal 04/08	53	7	2	Intermediate to Lower Shell Weld	SA-1484	263.4	227.0
No	Removal 04/08	43	8	2	Intermediate to Lower Shell Weld	SA-1484	253.3	215.7

THE FOLLOWING COMPUTER CODES HAVE BEEN USED IN THIS DOCUMENT:

CODE/VERSION/REV	CODE/VERSION/REV

THE DOCUMENT CONTAINS ASSUMPTIONS THAT MUST BE VERIFIED PRIOR TO USE ON SAFETY-RELATED WORK

☐ YES

☒ NO

RECORD OF REVISIONS

Revision	Description	Date
000	Original Release	June 2006

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1.0 Introduction

The purpose of this analysis is to determine the reactor vessel adjusted reference temperatures (ART) at the ¼-thickness (¼T) and ¾-thickness (¾T) wall locations for Point Beach Unit 1 and Unit 2 using the projected 60 year fluences. The ART values are calculated for Point Beach Unit 1 and Unit 2 reactor vessel beltline materials applicable to both 43 and 53 effective full power years (EFPY). The ART values for eight "cases" will be calculated, for each Unit. The cases are summarized below in Table 1.

Table 1. Case Descriptions

LTR-REA-04-64 Case Number	Case	Unit	Power (MWth)	EFPY	Hafnium Rods?
1	1	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 10/2008 1678.0 10/2008 to 53 EFPY	53	Yes
5	1	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 4/2008 1678.0 4/2008 to 53 EFPY	53	Yes
1	2	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 10/2008 1678.0 10/2008 to 43 EFPY	43	Yes
5	2	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 4/2008 1678.0 4/2008 to 43 EFPY	43	Yes
2	3	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 53 EFPY	53	Yes
6	3	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 53 EFPY	53	Yes
2	4	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 43 EFPY	43	Yes
6	4	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 43 EFPY	43	Yes
3	5	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 10/2008 1678.0 10/2008 to 53 EFPY	53	Removal October 2008
7	5	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 4/2008 1678.0 4/2008 to 53 EFPY	53	Removal April 2008
3	6	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 10/2008 1678.0 10/2008 to 43 EFPY	43	Removal October 2008
7	6	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 4/2008 1678.0 4/2008 to 43 EFPY	43	Removal April 2008
4	7	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 53 EFPY	53	Removal October 2008
8	7	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 53 EFPY	53	Removal April 2008
4	8	1	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 43 EFPY	43	Removal October 2008
8	8	2	1518.5 startup to 2/3/2003 1540.0 2/3/2003 to 43 EFPY	43	Removal April 2008

2.0 Summary of Results

The ¼T and ¾T ART values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials applicable to the EFPY are listed in Tables 3 – 10. These values were calculated in accordance with Regulatory Guide 1.99, Revision 2.[1] Based on the analysis, the limiting beltline material for the Point Beach Unit 1 and Unit 2 reactor vessel is shown below in Table 2, for each case.

Table 2. Summary of Results for Point Beach Unit 1 and Unit 2 Adjusted Reference Temperatures

Uprate?	Hf Rods?	EFPY	Case	Unit	Limiting Beltline Material	Heat Number	¼T ART Value (°F)	¾T ART Value (°F)
Yes	Yes	53	1	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	218.8	183.3
Yes	Yes	43	2	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	209.7	173.6
No	Yes	53	3	1	Intermediate Shell Longitudinal Weld	SA-812/SA-775	217.2	181.6
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No	Removal 04/08	43	8	2	Intermediate to Lower Shell Weld	SA-1484	253.3	215.7

3.0 Assumptions

No major assumptions are contained in this calculation.

4.0 Reactor Vessel Fluence

4.1 Reactor Vessel Inner Surface Fluences

The inner surface neutron fluence is the calculated value defined at clad/low alloy steel interface of the Point Beach Unit 1 and Unit 2 reactor vessels. The projected 43 and 53 EFPY inner surface fluences for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are listed in Table 11 – Table 18.[2]

4.2 Attenuation Through Reactor Vessel Wall

In accordance with Regulatory Guide 1.99, Revision 2, the neutron fluence at the ¼T and ¾T wall locations in the vessel is determined as follows:

$$f = f_{surf}\left(e^{-0.24x}\right) \quad (1)$$

where f_{surf} (10^{19} n/cm^2, E > 1.0 MeV) is the calculated value of the neutron fluence at the clad/low alloy steel interface, and "x" (in inches) is the depth into the vessel wall measured from the clad/low alloy steel interface. The Point Beach Unit 1 and Unit 2 reactor vessel thickness is reported to be 6.50 inches.[3] Therefore, the depth into the vessel wall measured from the vessel inner (wetted) surface, "x", is for ¼T = [6.5*0.25] = 1.625 inches and "x" for ¾T = [6.5*0.75] = 4.875 inches. The ¼T ART value for the intermediate shell longitudinal weld for Unit 1 will be calculated for SA-812 (ID 27%) and the ¾T ART value for the intermediate shell longitudinal weld for Unit 1 will be calculated for SA-775 (OD 73%). Using these vessel wall depths and the neutron fluence at the inner wetted surface of the vessel, the ¼T and ¾T fluence values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are calculated in accordance with Equation 1, and these values are listed in Tables 11 – 18.

Table 3. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 53 EFPY (Case 1)

Material Description				Chemical Composition				53 EFPY Fluence, n/cm^2			ΔRT_{NDT}, °F at 53 EFPY		Margin		ART, °F at 53 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Initial RT_{NDT}	Chemistry Factor	Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	2.84E+18	1.92E+18	8.81E+17	43.1	30.2	34.0	30.2	127.1	110.4
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	4.86E+19	3.29E+19	1.51E+19	104.0	88.3	56.4	56.4	161.4	145.7
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	3.70E+19	2.51E+19	1.15E+19	44.6	37.2	56.4	56.4	102.0	94.6
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	2.84E+18	1.92E+18	8.81E+17	93.5	65.5	65.7	65.7	111.6	83.6
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	3.10E+19	2.10E+19	N/A	200.7	N/A	65.7	N/A	[218.8]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	3.10E+19	N/A	9.62E+18	N/A	165.2	N/A	65.7	N/A	[183.3]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	3.71E+19	2.51E+19	1.15E+19	209.1	174.1	61.7	61.7	223.4	188.4
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	2.60E+19	1.76E+19	8.07E+18	192.9	157.0	65.7	65.7	211.1	175.3
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	4.12E+18	2.79E+18	1.28E+18	49.6	35.6	34.0	34.0	123.6	109.6
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	4.66E+19	3.16E+19	1.45E+19	75.6	63.9	34.0	34.0	149.6	137.9
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	4.15E+19	2.81E+19	1.29E+19	54.6	45.8	17.0	17.0	111.6	102.8
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	4.12E+18	2.79E+18	1.29E+18	111.2	79.8	65.5	65.5	120.7	89.3
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	3.75E+19	2.54E+19	1.16E+19	225.0	187.6	60.8	60.8	[255.8]	[218.4]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 4. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 43 EFPY (Case 2)

Material Description				Chemical Composition		Initial RT_{NDT}	Chemistry Factor	43 EFPY Fluence, n/cm²			ΔRT_{NDT}, °F at 43 EFPY		Margin		ART, °F at 43 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%			Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	2.38E+18	1.61E+18	7.39E+17	40.0	27.6	34.0	27.6	124.0	105.2
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	3.95E+19	2.67E+19	1.23E+19	100.2	83.8	56.4	56.4	157.6	141.2
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	3.11E+19	2.11E+19	9.65E+18	43.1	35.4	56.4	56.4	100.5	92.8
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	2.38E+18	1.61E+18	7.40E+17	86.7	60.0	65.7	65.7	104.8	78.1
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	2.52E+19	1.71E+19	N/A	191.6	N/A	65.7	N/A	[209.7]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	2.52E+19	N/A	7.82E+18	N/A	155.5	N/A	65.7	N/A	[173.6]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	3.10E+19	2.10E+19	9.62E+18	201.5	165.8	61.7	61.7	215.8	180.1
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	2.15E+19	1.46E+19	6.67E+18	184.4	148.1	65.7	65.7	202.5	166.4
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	3.42E+18	2.32E+18	1.06E+18	46.0	32.6	34.0	32.6	120.0	105.2
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	3.81E+19	2.58E+19	1.18E+19	72.7	60.7	34.0	34.0	146.7	134.7
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	3.45E+19	2.34E+19	1.07E+19	52.6	43.6	17.0	17.0	109.6	100.6
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	3.42E+18	2.32E+18	1.06E+18	103.2	73.1	65.5	65.5	112.7	82.6
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	3.14E+19	2.13E+19	9.75E+18	216.9	178.7	60.8	60.8	[247.7]	[209.5]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 5. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 53 EFPY (Case 3)

Material Description				Chemical Composition				53 EFPY Fluence, n/cm^2			ΔRT_{NDT}, °F at 53 EFPY		Margin		ART, °F at 53 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Initial RT_{NDT}	Chemistry Factor	Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	2.75E+18	1.86E+18	8.54E+17	42.5	29.7	34.0	29.7	126.5	109.4
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	4.69E+19	3.18E+19	1.46E+19	103.4	87.6	56.4	56.4	160.8	145.0
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	3.59E+19	2.43E+19	1.11E+19	44.4	36.9	56.4	56.4	101.8	94.3
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	2.75E+18	1.86E+18	8.54E+17	92.2	64.5	65.7	65.7	110.3	82.6
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	2.99E+19	2.02E+19	N/A	199.1	N/A	65.7	N/A	[217.2]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	2.99E+19	N/A	9.28E+18	N/A	163.5	N/A	65.7	N/A	[181.6]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	3.59E+19	2.43E+19	1.11E+19	207.7	172.6	61.7	61.7	222.0	186.9
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	2.51E+19	1.70E+19	7.79E+18	191.4	155.3	65.7	65.7	209.5	173.6
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	3.99E+18	2.70E+18	1.24E+18	48.9	35.0	34.0	34.0	122.9	109.0
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	4.49E+19	3.04E+19	1.39E+19	75.1	63.3	34.0	34.0	149.1	137.3
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	4.02E+19	2.72E+19	1.25E+19	54.2	45.5	17.0	17.0	111.2	102.5
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	3.99E+18	2.70E+18	1.24E+18	109.6	78.6	65.5	65.5	119.1	88.1
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	3.64E+19	2.46E+19	1.13E+19	223.7	186.1	60.8	60.8	[254.5]	[216.9]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 6. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 43 EFPY (Case 4)

Material Description				Chemical Composition				43 EFPY Fluence, n/cm^2			ΔRT_{NDT}, °F at 43 EFPY		Margin		ART, °F at 43 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Initial RT_{NDT}	Chemistry Factor	Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	2.33E+18	1.58E+18	7.23E+17	39.6	27.3	34.0	27.3	123.6	104.6
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	3.85E+19	2.61E+19	1.20E+19	99.7	83.3	56.4	56.4	157.1	140.7
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	3.05E+19	2.07E+19	9.47E+18	42.9	35.3	56.4	56.4	100.3	92.7
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	2.33E+18	1.58E+18	7.23E+17	85.8	59.3	65.7	65.7	103.9	77.4
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	2.46E+19	1.67E+19	N/A	190.6	N/A	65.7	N/A	[208.7]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	2.46E+19	N/A	7.64E+18	N/A	154.3	N/A	65.7	N/A	[172.4]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	3.03E+19	2.05E+19	9.47E+18	200.4	164.8	61.7	61.7	214.7	179.1
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	2.10E+19	1.42E+19	6.52E+18	183.4	147.0	65.7	65.7	201.4	165.3
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	3.34E+18	2.26E+18	1.04E+18	45.5	32.2	34.0	32.2	119.5	104.4
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	3.71E+19	2.51E+19	1.15E+19	72.3	60.3	34.0	34.0	146.3	134.3
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	3.37E+19	2.28E+19	1.05E+19	52.3	43.4	17.0	17.0	109.3	100.4
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	3.34E+18	2.26E+18	1.04E+18	102.1	72.3	65.5	65.5	111.6	81.8
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	3.08E+19	2.09E+19	9.56E+18	216.0	177.7	60.8	60.8	[246.8]	[208.5]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 7. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 5)

Material Description				Chemical Composition				53 EFPY Fluence, n/cm^2			ART_{NDT}, °F at 53 EFPY		Margin		ART, °F at 53 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Initial RT_{NDT}	Chemistry Factor	Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	3.58E+18	2.42E+18	1.11E+18	47.4	33.7	34.0	33.7	131.4	117.4
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	4.90E+19	3.32E+19	1.52E+19	104.1	88.5	56.4	56.4	161.5	145.9
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	4.55E+19	3.09E+19	1.41E+19	46.4	39.2	56.4	56.4	103.8	96.6
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	3.58E+18	2.42E+18	1.11E+18	102.9	73.2	65.7	65.7	121.0	91.3
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	3.19E+19	2.16E+19	N/A	201.9	N/A	65.7	N/A	[220.0]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	3.19E+19	N/A	9.90E+18	N/A	166.5	N/A	65.7	N/A	[184.6]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	4.43E+19	3.00E+19	1.38E+19	216.4	182.3	61.7	61.7	230.7	196.6
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	3.05E+19	2.07E+19	9.47E+18	199.9	164.5	65.7	65.7	218.1	182.7
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	5.04E+18	3.41E+18	1.56E+18	53.5	38.9	34.0	34.0	127.5	112.9
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	5.05E+19	3.42E+19	1.57E+19	76.6	65.2	34.0	34.0	150.6	139.2
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	4.90E+19	3.32E+19	1.52E+19	56.2	47.8	17.0	17.0	113.2	104.8
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	5.04E+18	3.41E+18	1.56E+18	120.0	87.3	65.5	65.5	129.5	96.8
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	4.65E+19	3.15E+19	1.44E+19	234.4	198.4	60.8	60.8	[265.2]	[229.2]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 8. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 6)

Material Description				Chemical Composition				43 EFPY Fluence, n/cm^2			ΔRT_{NDT}, °F at 43 EFPY		Margin		ART, °F at 43 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Initial RT_{NDT}	Chemistry Factor	Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	2.80E+18	1.90E+18	8.69E+17	42.9	30.0	34.0	30.0	126.9	110.0
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	3.97E+19	2.69E+19	1.23E+19	100.2	83.9	56.4	56.4	157.6	141.3
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	3.59E+19	2.43E+19	1.11E+19	44.4	36.9	56.4	56.4	101.8	94.3
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	2.80E+18	1.890E+18	8.69E+17	93.0	65.0	65.7	65.7	111.1	83.1
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	2.57E+19	1.74E+19	N/A	192.4	N/A	65.7	N/A	[210.5]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	2.57E+19	N/A	7.98E+18	N/A	156.5	N/A	65.7	N/A	[174.6]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	3.51E+19	2.38E+19	1.09E+19	206.7	171.6	61.7	61.7	221.0	185.9
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	2.42E+19	1.64E+19	7.51E+18	189.7	153.6	65.7	65.7	207.8	171.9
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	3.95E+18	2.67E+18	1.23E+18	48.7	34.9	34.0	34.0	122.7	108.9
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	4.04E+19	2.74E+19	1.25E+19	73.5	61.7	34.0	34.0	147.5	135.7
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	3.88E+19	2.63E+19	1.20E+19	53.9	45.0	17.0	17.0	110.9	102.0
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	3.95E+18	2.67E+18	1.23E+18	109.3	78.3	65.5	65.5	118.8	87.8
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	3.67E+19	2.49E+19	1.14E+19	224.1	186.5	60.8	60.8	[254.9]	[217.3]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 9. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 7)

Material Description				Chemical Composition				53 EFPY Fluence, n/cm^2			ΔRT_{NDT}, °F at 53 EFPY		Margin		ART, °F at 53 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Initial RT_{NDT}	Chemistry Factor	Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	3.43E+18	2.32E+18	1.07E+18	46.7	33.1	34.0	33.1	130.7	116.2
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	4.72E+19	3.20E+19	1.47E+19	103.6	87.7	56.4	56.4	161.0	145.1
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	4.36E+19	2.95E+19	1.35E+19	46.1	38.8	56.4	56.4	103.5	96.2
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	3.43E+18	2.32E+18	1.07E+18	101.2	71.8	65.7	65.7	119.3	89.9
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	3.07E+19	2.08E+19	N/A	200.2	N/A	65.7	N/A	[218.3]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	3.07E+19	N/A	9.53E+18	N/A.	164.7	N/A	65.7	N/A	[182.8]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	4.25E+19	2.88E+19	1.32E+19	214.7	180.5	61.7	61.7	229.0	194.8
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	2.93E+19	1.98E+19	9.10E+18	198.2	162.5	65.7	65.7	216.3	180.9
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	4.83E+18	3.27E+18	1.50E+18	52.7	38.2	34.0	34.0	126.7	112.2
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	4.85E+19	3.28E+19	1.51E+19	76.1	64.6	34.0	34.0	150.1	138.6
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	4.71E+19	3.19E+19	1.46E+19	55.9	47.3	17.0	17.0	112.9	104.3
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	4.83E+18	3.27E+18	1.50E+18	118.2	85.8	65.5	65.5	127.7	95.3
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	4.46E+19	3.02E+19	1.38E+19	232.6	196.2	60.8	60.8	[263.4]	[227.0]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 10. Adjusted Reference Temperature Evaluation for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline without Uprate, with hafnium removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 8)

Material Description				Chemical Composition				43 EFPY Fluence, n/cm²			ΔRT_{NDT}, °F at 43 EFPY		Margin		ART, °F at 43 EFPY	
Reactor Vessel Beltline Region Location	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Initial RT_{NDT}	Chemistry Factor	Clad/Low Alloy Steel Interface	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location	T/4 Location	3/4T Location
Point Beach Unit 1 Evaluation																
Nozzle Belt Forging (NB)	122P237	122P237	SA-508 Cl. 2	0.11	0.82	50	77.0	2.72E+18	1.84E+18	8.44E+17	42.4	29.6	34.0	29.6	126.4	109.2
Intermediate Shell Plate (IS)	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	1	79.3*	3.87E+19	2.62E+19	1.20E+19	99.8	83.3	56.4	56.4	157.2	140.7
Lower Shell Plate (LS)	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	1	35.8*	3.49E+19	2.36E+19	1.08E+19	44.1	36.6	56.4	56.4	101.5	94.0
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	-47.6	167.0	2.72E+18	1.84E+18	8.44E+17	91.9	64.1	65.7	65.7	110.0	82.2
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	-47.6	167.0	2.50E+19	1.69E+19	N/A	191.2	N/A	65.7	N/A	[209.3]	N/A
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	-47.6	167.0	2.50E+19	N/A	7.76E+18	N/A	155.1	N/A	65.7	N/A	[173.2]
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	-47.4	167.6	3.41E+19	2.31E+19	1.06E+19	205.5	170.3	61.7	61.7	219.8	184.6
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	-47.6	167.0	2.34E+19	1.58E+19	7.26E+18	188.2	152.0	65.7	65.7	206.3	170.3
Point Beach Unit 2 Evaluation																
Nozzle Belt Forging (NB)	123V352	123V352	SA-508 Cl. 2	0.11	0.73	40	76.0	3.83E+18	2.59E+18	1.19E+18	48.1	34.4	34.0	34.0	122.1	108.4
Intermediate Shell Forging (IS)	123V500	123V500	SA-508 Cl. 2	0.09	0.70	40	58.0	3.92E+19	2.65E+19	1.22E+19	73.1	61.2	34.0	34.0	147.1	135.2
Lower Shell Forging (LS)	123W195	123W195	SA-508 Cl. 2	0.05	0.72	40	42.8*	3.77E+19	2.55E+19	1.17E+19	53.5	44.7	17.0	17.0	110.5	101.7
NB to IS Circ. Weld (100%)	21935	21935	Linde 80 Flux	0.18	0.70	-56	170.5	3.83E+18	2.59E+18	1.19E+18	107.9	77.1	65.5	65.5	117.4	86.6
Intermediate to LS Circ. Weld (100%)	SA-1484	72442	Linde 80 Flux	0.26	0.60	-30	180.0	3.55E+19	2.40E+19	1.10E+19	222.5	184.9	60.8	60.8	[253.3]	[215.7]

[ ] - Controlling values of the adjusted reference temperatures.
* - Determined from surveillance data.

Table 11. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials with Uprate, with hafnium rods, through 53 EFPY (Case 1)

Beltline Materials	Unit	Material Ident.	53 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	2.84E+18	1.92E+18	8.81E+17
Intermediate Shell (IS)	1	A9811-1	4.86E+19	3.29E+19	1.51E+19
Lower Shell (LS)	1	C1423-1	3.70E+19	2.51E+19	1.15E+19
NB to IS Circ. Weld (100%)	1	SA-1426	2.84E+18	1.92E+18	8.81E+17
IS Long. Weld (ID 27%)	1	SA-812	3.10E+19	2.10E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	3.10E+19	N/A	9.62E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	3.71E+19	2.51E+19	1.15E+19
LS Long. Weld (100%)	1	SA-847	2.60E+19	1.76E+19	8.07E+18
Nozzle Belt Forging (NB)	2	123V352	4.12E+18	2.79E+18	1.28E+18
Intermediate Shell Forging (IS)	2	123V500	4.66E+19	3.16E+19	1.44E+19
Lower Shell Forging (LS)	2	123W195	4.15E+19	2.81E+19	1.29E+19
NB to IS Circ. Weld (100%)	2	21935	4.12E+18	2.79E+18	1.28E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.75E+19	2.54E+19	1.16E+19

Table 12. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials with Uprate, with hafnium rods, through 43 EFPY (Case 2)

Beltline Materials	Unit	Material Ident.	43 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	2.38E+18	1.61E+18	7.39E+17
Intermediate Shell (IS)	1	A9811-1	3.95E+19	2.67E+19	1.23E+19
Lower Shell (LS)	1	C1423-1	3.11E+19	2.11E+19	9.65E+18
NB to IS Circ. Weld (100%)	1	SA-1426	2.38E+18	1.61E+18	7.39E+17
IS Long. Weld (ID 27%)	1	SA-812	2.52E+19	1.71E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	2.52E+19	N/A	7.82E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	3.10E+19	2.10E+19	9.62E+18
LS Long. Weld (100%)	1	SA-847	2.15E+19	1.46E+19	6.67E+18
Nozzle Belt Forging (NB)	2	123V352	3.42E+18	2.32E+18	1.06E+18
Intermediate Shell Forging (IS)	2	123V500	3.81E+19	2.58E+19	1.18E+19
Lower Shell Forging (LS)	2	123W195	3.45E+19	2.34E+19	1.07E+19
NB to IS Circ. Weld (100%)	2	21935	3.42E+18	2.32E+18	1.06E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.14E+19	2.13E+19	9.75E+18

Table 13. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials without Uprate, with hafnium rods, through 53 EFPY (Case 3)

Beltline Materials	Unit	Material Ident.	53 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	2.75E+18	1.86E+18	8.54E+17
Intermediate Shell (IS)	1	A9811-1	4.69E+19	3.18E+19	1.46E+19
Lower Shell (LS)	1	C1423-1	3.59E+19	2.43E+19	1.11E+19
NB to IS Circ. Weld (100%)	1	SA-1426	2.75E+18	1.86E+18	8.54E+17
IS Long. Weld (ID 27%)	1	SA-812	2.99E+19	2.02E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	2.99E+19	N/A	9.28E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	3.59E+19	2.43E+19	1.11E+19
LS Long. Weld (100%)	1	SA-847	2.51E+19	1.70E+19	7.79E+18
Nozzle Belt Forging (NB)	2	123V352	3.99E+18	2.70E+18	1.24E+18
Intermediate Shell Forging (IS)	2	123V500	4.49E+19	3.04E+19	1.39E+19
Lower Shell Forging (LS)	2	123W195	4.02E+19	2.72E+19	1.25E+19
NB to IS Circ. Weld (100%)	2	21935	3.99E+18	2.70E+18	1.24E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.64E+19	2.46E+19	1.13E+19

Table 14. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials without Uprate, with hafnium rods, through 43 EFPY (Case 4)

Beltline Materials	Unit	Material Ident.	43 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	2.33E+18	1.58E+18	7.23E+17
Intermediate Shell (IS)	1	A9811-1	3.85E+19	2.61E+19	1.20E+19
Lower Shell (LS)	1	C1423-1	3.05E+19	2.07E+19	9.47E+18
NB to IS Circ. Weld (100%)	1	SA-1426	2.33E+18	1.58E+18	7.23E+17
IS Long. Weld (ID 27%)	1	SA-812	2.46E+19	1.67E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	2.46E+19	N/A	7.64E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	3.03E+19	2.05E+19	9.40E+18
LS Long. Weld (100%)	1	SA-847	2.10E+19	1.42E+19	6.52E+18
Nozzle Belt Forging (NB)	2	123V352	3.34E+18	2.26E+18	1.04E+18
Intermediate Shell Forging (IS)	2	123V500	3.71E+19	2.51E+19	1.15E+19
Lower Shell Forging (LS)	2	123W195	3.37E+19	2.28E+19	1.05E+19
NB to IS Circ. Weld (100%)	2	21935	3.34E+18	2.26E+18	1.04E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.08E+19	2.09E+19	9.56E+18

Table 15. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 5)

Beltline Materials	Unit	Material Ident.	53 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	3.58E+18	2.42E+18	1.11E+18
Intermediate Shell (IS)	1	A9811-1	4.90E+19	3.32E+19	1.52E+19
Lower Shell (LS)	1	C1423-1	4.55E+19	3.08E+19	1.41E+19
NB to IS Circ. Weld (100%)	1	SA-1426	3.58E+18	2.42E+18	1.11E+18
IS Long. Weld (ID 27%)	1	SA-812	3.19E+19	2.16E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	3.19E+19	N/A	9.90E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	4.43E+19	3.00E+19	1.38E+19
LS Long. Weld (100%)	1	SA-847	3.05E+19	2.07E+19	9.47E+18
Nozzle Belt Forging (NB)	2	123V352	5.04E+18	3.41E+18	1.56E+18
Intermediate Shell Forging (IS)	2	123V500	5.05E+19	3.42E+19	1.57E+19
Lower Shell Forging (LS)	2	123W195	4.90E+19	3.32E+19	1.52E+19
NB to IS Circ. Weld (100%)	2	21935	5.04E+18	3.41E+18	1.56E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	4.65E+19	3.15E+19	1.44E+19

Table 16. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 6)

Beltline Materials	Unit	Material Ident.	43 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	2.80E+18	1.90E+18	8.69E+17
Intermediate Shell (IS)	1	A9811-1	3.97E+19	2.69E+19	1.23E+19
Lower Shell (LS)	1	C1423-1	3.59E+19	2.43E+19	1.11E+19
NB to IS Circ. Weld (100%)	1	SA-1426	2.80E+18	1.90E+18	8.69E+17
IS Long. Weld (ID 27%)	1	SA-812	2.57E+19	1.74E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	2.57E+19	N/A	7.98E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	3.51E+19	2.38E+19	1.09E+19
LS Long. Weld (100%)	1	SA-847	2.42E+19	1.64E+19	7.51E+18
Nozzle Belt Forging (NB)	2	123V352	3.95E+18	2.67E+18	1.23E+18
Intermediate Shell Forging (IS)	2	123V500	4.04E+19	2.74E+19	1.25E+19
Lower Shell Forging (LS)	2	123W195	3.88E+19	2.63E+19	1.20E+19
NB to IS Circ. Weld (100%)	2	21935	3.95E+18	2.67E+18	1.23E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.67E+19	2.49E+19	1.14E+19

Table 17. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 7)

Beltline Materials	Unit	Material Ident.	53 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	3.43E+18	2.32E+18	1.07E+18
Intermediate Shell (IS)	1	A9811-1	4.72E+19	3.20E+19	1.47E+19
Lower Shell (LS)	1	C1423-1	4.36E+19	2.95E+19	1.35E+19
NB to IS Circ. Weld (100%)	1	SA-1426	3.43E+18	2.32E+18	1.07E+18
IS Long. Weld (ID 27%)	1	SA-812	3.07E+19	2.08E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	3.07E+19	N/A	9.53E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	4.25E+19	2.88E+19	1.32E+19
LS Long. Weld (100%)	1	SA-847	2.93E+19	1.98E+19	9.09E+18
Nozzle Belt Forging (NB)	2	123V352	4.83E+18	3.27E+18	1.50E+18
Intermediate Shell Forging (IS)	2	123V500	4.85E+19	3.28E+19	1.51E+19
Lower Shell Forging (LS)	2	123W195	4.71E+19	3.19E+19	1.46E+19
NB to IS Circ. Weld (100%)	2	21935	4.83E+18	3.27E+18	1.50E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	4.46E+19	3.02E+19	1.38E+19

Table 18. Fluence (E>1.0 MeV) Values for the Point Beach Unit 1 and Unit 2 Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 8)

Beltline Materials	Unit	Material Ident.	43 EFPY Fluence, n/cm^2		
			Inner Wetted Surface	¼T Location (x=1.625)	¾T Location (x=4.875)
Nozzle Belt Forging (NB)	1	122P237	2.72E+18	1.84E+18	8.44E+17
Intermediate Shell (IS)	1	A9811-1	3.87E+19	2.62E+19	1.20E+19
Lower Shell (LS)	1	C1423-1	3.49E+19	2.36E+19	1.08E+19
NB to IS Circ. Weld (100%)	1	SA-1426	2.72E+18	1.84E+18	8.44E+17
IS Long. Weld (ID 27%)	1	SA-812	2.50E+19	1.69E+19	N/A
IS Long. Weld (OD 73%)	1	SA-775	2.50E+19	N/A	7.76E+18
Intermediate to LS Circ. Weld (100%)	1	SA-1101	3.41E+19	2.31E+19	1.06E+19
LS Long. Weld (100%)	1	SA-847	2.34E+19	1.58E+19	7.26E+18
Nozzle Belt Forging (NB)	2	123V352	3.83E+18	2.59E+18	1.19E+18
Intermediate Shell Forging (IS)	2	123V500	3.92E+19	2.65E+19	1.22E+19
Lower Shell Forging (LS)	2	123W195	3.77E+19	2.55E+19	1.17E+19
NB to IS Circ. Weld (100%)	2	21935	3.83E+18	2.59E+18	1.19E+18
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.55E+19	2.40E+19	1.10E+19

5.0 Adjusted Reference Temperature Where No Surveillance Data Is Available

The following information is required for determination of the ART in accordance with Regulatory Guide 1.99, Revision 2.

5.1 Initial RT_{NDT}

The initial RT_{NDT} is the reference temperature for the reactor vessel beltline material in the unirradiated condition, evaluated in accordance with Paragraph NB-2331 of Section III of the ASME Boiler and Pressure Vessel Code[4] or Code Case N-629.[5] Table 19 lists the initial RT_{NDT} values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials.[5,6]

Table 19. Initial RT_{NDT} Values for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Materials	Unit	Material Ident.	Initial RT_{NDT} (°F)	Reference
Nozzle Belt Forging (NB)	1	122P237	50	6
Intermediate Shell (IS)	1	A9811-1	1	6
Lower Shell (LS)	1	C1423-1	1	6
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	5
IS Long. Weld (ID 27%)	1	SA-812	-47.6	5
IS Long. Weld (OD 73%)	1	SA-775	-47.6	5
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	5
LS Long. Weld (100%)	1	SA-847	-47.6	5
Nozzle Belt Forging (NB)	2	123V352	40	6
Intermediate Shell Forging (IS)	2	123V500	40	6
Lower Shell Forging (LS)	2	123W195	40	6
NB to IS Circ. Weld (100%)	2	21935	-56	6
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	5

5.2 ΔRT_{NDT}

ΔRT_{NDT} is the mean value of the adjustment in reference temperature caused by irradiation and is calculated as follows:

$$\Delta RT_{NDT} = (CF) * (ff) \quad (2)$$

where CF = Chemistry Factor
ff = fluence factor

5.2.1 Chemistry Factor

The chemistry factor (CF) is determined from the copper and nickel content for each reactor vessel beltline region material. Using the copper and nickel contents for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials,[6] the CF is determined from Table 1 (for weld metals) and Table 2 (for base metals) in Regulatory Guide 1.99, Revision 2. Linear interpolation is permitted. When determining the CF, the "weight percent copper" and "weight percent nickel" are best estimate values for the material, which will normally be the mean of the measured values for the material. If RT_{NDT} values from BAW-2308 are used, the CF cannot be less than 167.0.

Using Tables 1 and 2 in Regulatory Guide 1.99, Revision 2, the CF values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are listed in Table 20.

Table 20. Regulatory Guide 1.99, Revision 2 Chemistry Factors for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Materials	Unit	Material Ident.	Cu wt%[6]	Ni wt%[6]	Chemistry Factor
Nozzle Belt Forging (NB)	1	122P237	0.11	0.82	77.0
Intermediate Shell (IS)	1	A9811-1	0.20	0.06	79.3*
Lower Shell (LS)	1	C1423-1	0.12	0.07	35.8*
NB to IS Circ. Weld (100%)	1	SA-1426	0.19	0.57	167.0
IS Long. Weld (ID 27%)	1	SA-812	0.17	0.52	167.0
IS Long. Weld (OD 73%)	1	SA-775	0.17	0.64	167.0
Intermediate to LS Circ. Weld (100%)	1	SA-1101	0.23	0.59	167.6
LS Long. Weld (100%)	1	SA-847	0.23	0.52	167.0
Nozzle Belt Forging (NB)	2	123V352	0.11	0.73	76.0
Intermediate Shell Forging (IS)	2	123V500	0.09	0.70	58.0
Lower Shell Forging (LS)	2	123W195	0.05	0.72	42.8*
NB to IS Circ. Weld (100%)	2	21935	0.18	0.70	170.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	0.26	0.60	180.0

* - determined from surveillance data, see Section 6.0

5.2.2 Fluence Factor

In accordance with Regulatory Guide 1.99, Revision 2, the fluence factor (ff) is determined as follows:

$$ff = f^{(0.28 - 0.10 \log f)} \quad (3)$$

Tablse 21 – 28 lists the fluence factors for the ¼T and ¾T locations of the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials.

Table 21. Fluence Factors for the ¼T and ¾T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 53 EFPY (Case 1)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor	Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	1.92E+18	0.560	8.81E+17	0.392
Intermediate Shell (IS)	1	A9811-1	3.29E+19	1.312	1.51E+19	1.114
Lower Shell (LS)	1	C1423-1	2.51E+19	1.247	1.15E+19	1.039
NB to IS Circ. Weld (100%)	1	SA-1426	1.92E+18	0.560	8.81E+17	0.392
IS Long. Weld (ID 27%)	1	SA-812	2.10E+19	1.202	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	9.62E+18	0.989
Intermediate to LS Circ. Weld (100%)	1	SA-1101	2.51E+19	1.247	1.15E+19	1.039
LS Long. Weld (100%)	1	SA-847	1.76E+19	1.155	8.07E+18	0.940
Nozzle Belt Forging (NB)	2	123V352	2.79E+18	0.652	1.28E+18	0.468
Intermediate Shell Forging (IS)	2	123V500	3.16E+19	1.303	1.45E+19	1.102
Lower Shell Forging (LS)	2	123W195	2.81E+19	1.275	1.29E+19	1.070
NB to IS Circ. Weld (100%)	2	21935	2.79E+18	0.652	1.28E+18	0.468
Intermediate to LS Circ. Weld (100%)	2	SA-1484	2.54E+19	1.250	1.16E+19	1.042

Table 22. Fluence Factors for the ¼T and ¾T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 43 EFPY (Case 2)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor	Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	1.61E+18	0.519	7.39E+17	0.359
Intermediate Shell (IS)	1	A9811-1	2.67E+19	1.263	1.23E+19	1.057
Lower Shell (LS)	1	C1423-1	2.11E+19	1.203	9.65E+18	0.990
NB to IS Circ. Weld (100%)	1	SA-1426	1.61E+18	0.519	7.39E+17	0.359
IS Long. Weld (ID 27%)	1	SA-812	1.71E+19	1.147	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	7.82E+18	0.931
Intermediate to LS Circ. Weld (100%)	1	SA-1101	2.10E+19	1.202	9.62E+18	0.989
LS Long. Weld (100%)	1	SA-847	1.46E+19	1.104	6.67E+18	0.887
Nozzle Belt Forging (NB)	2	123V352	2.32E+18	0.605	1.06E+18	0.429
Intermediate Shell Forging (IS)	2	123V500	2.58E+19	1.254	1.18E+19	1.047
Lower Shell Forging (LS)	2	123W195	2.34E+19	1.229	1.07E+19	1.019
NB to IS Circ. Weld (100%)	2	21935	2.32E+18	0.605	1.06E+18	0.429
Intermediate to LS Circ. Weld (100%)	2	SA-1484	2.13E+19	1.205	9.75E+18	0.993

Table 23. Fluence Factors for the ¼T and ¾T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 53 EFPY (Case 3)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor	Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	1.86E+18	0.552	8.54E+17	0.386
Intermediate Shell (IS)	1	A9811-1	3.18E+19	1.304	1.46E+19	1.104
Lower Shell (LS)	1	C1423-1	2.43E+19	1.239	1.11E+19	1.030
NB to IS Circ. Weld (100%)	1	SA-1426	1.86E+18	0.552	8.54E+17	0.386
IS Long. Weld (ID 27%)	1	SA-812	2.02E+19	1.192	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	9.28E+18	0.979
Intermediate to LS Circ. Weld (100%)	1	SA-1101	2.43E+19	1.239	1.11E+19	1.030
LS Long. Weld (100%)	1	SA-847	1.70E+19	1.146	7.79E+18	0.930
Nozzle Belt Forging (NB)	2	123V352	2.70E+18	0.643	1.24E+18	0.461
Intermediate Shell Forging (IS)	2	123V500	3.04E+19	1.294	1.394E+19	1.092
Lower Shell Forging (LS)	2	123W195	2.72E+19	1.267	1.25E+19	1.062
NB to IS Circ. Weld (100%)	2	21935	2.70E+18	0.643	1.24E+18	0.461
Intermediate to LS Circ. Weld (100%)	2	SA-1484	2.46E+19	1.243	1.13E+19	1.034

Table 24. Fluence Factors for the ¼T and ¾T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 43 EFPY (Case 4)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor	Fluence, n/cm^2 ($x10^{19}$)	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	1.58E+18	0.514	7.23E+17	0.355
Intermediate Shell (IS)	1	A9811-1	2.61E+19	1.257	1.20E+19	1.050
Lower Shell (LS)	1	C1423-1	2.07E+19	1.197	9.47E+18	0.985
NB to IS Circ. Weld (100%)	1	SA-1426	1.58E+18	0.514	7.23E+17	0.355
IS Long. Weld (ID 27%)	1	SA-812	1.67E+19	1.141	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	7.64E+18	0.924
Intermediate to LS Circ. Weld (100%)	1	SA-1101	2.05E+19	1.196	9.40E+18	0.983
LS Long. Weld (100%)	1	SA-847	1.42E+19	1.098	6.52E+18	0.880
Nozzle Belt Forging (NB)	2	123V352	2.26E+18	0.599	1.04E+18	0.424
Intermediate Shell Forging (IS)	2	123V500	2.51E+19	1.247	1.15E+19	1.039
Lower Shell Forging (LS)	2	123W195	2.28E+19	1.223	1.05E+19	1.013
NB to IS Circ. Weld (100%)	2	21935	2.26E+18	0.599	1.04E+18	0.424
Intermediate to LS Circ. Weld (100%)	2	SA-1484	2.09E+19	1.200	9.56E+18	0.987

Table 25. Fluence Factors for the ¼ T and ¾ T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 5)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 (x10^{19})	Fluence Factor	Fluence, n/cm^2 (x10^{19})	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	2.42E+18	0.616	1.11E+18	0.438
Intermediate Shell (IS)	1	A9811-1	3.32E+19	1.314	1.52E+19	1.116
Lower Shell (LS)	1	C1423-1	3.08E+19	1.297	1.41E+19	1.096
NB to IS Circ. Weld (100%)	1	SA-1426	2.42E+18	0.616	1.11E+18	0.438
IS Long. Weld (ID 27%)	1	SA-812	2.16E+19	1.209	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	9.90E+18	0.997
Intermediate to LS Circ. Weld (100%)	1	SA-1101	3.00E+19	1.291	1.38E+19	1.088
LS Long. Weld (100%)	1	SA-847	2.07E+19	1.197	9.47E+18	0.985
Nozzle Belt Forging (NB)	2	123V352	3.41E+18	0.704	1.56E+18	0.512
Intermediate Shell Forging (IS)	2	123V500	3.42E+19	1.321	1.57E+19	1.124
Lower Shell Forging (LS)	2	123W195	3.32E+19	1.314	1.52E+19	1.116
NB to IS Circ. Weld (100%)	2	21935	3.41E+18	0.704	1.56E+18	0.512
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.15E+19	1.302	1.44E+19	1.102

Table 26. Fluence Factors for the ¼T and ¾T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 6)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 (x10^{19})	Fluence Factor	Fluence, n/cm^2 (x10^{19})	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	1.90E+18	0.557	8.69E+17	0.389
Intermediate Shell (IS)	1	A9811-1	2.69E+19	1.264	1.23E+19	1.058
Lower Shell (LS)	1	C1423-1	2.43E+19	1.239	1.11E+19	1.030
NB to IS Circ. Weld (100%)	1	SA-1426	1.90E+18	0.557	8.69E+17	0.389
IS Long. Weld (ID 27%)	1	SA-812	1.74E+19	1.152	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	7.98E+18	0.937
Intermediate to LS Circ. Weld (100%)	1	SA-1101	2.38E+19	1.233	1.09E+19	1.024
LS Long. Weld (100%)	1	SA-847	1.64E+19	1.136	7.51E+18	0.920
Nozzle Belt Forging (NB)	2	123V352	2.67E+18	0.641	1.23E+18	0.459
Intermediate Shell Forging (IS)	2	123V500	2.74E+19	1.268	1.25E+19	1.063
Lower Shell Forging (LS)	2	123W195	2.63E+19	1.259	1.20E+19	1.052
NB to IS Circ. Weld (100%)	2	21935	2.67E+18	0.641	1.23E+18	0.459
Intermediate to LS Circ. Weld (100%)	2	SA-1484	2.49E+19	1.245	1.14E+19	1.036

Table 27. Fluence Factors for the ¼T and ¾T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 7)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 (x10^{19})	Fluence Factor	Fluence, n/cm^2 (x10^{19})	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	2.32E+18	0.606	1.07E+18	0.430
Intermediate Shell (IS)	1	A9811-1	3.90E+19	1.306	1.47E+19	1.106
Lower Shell (LS)	1	C1423-1	2.95E+19	1.287	1.35E+19	1.084
NB to IS Circ. Weld (100%)	1	SA-1426	2.32E+18	0.606	1.07E+18	0.430
IS Long. Weld (ID 27%)	1	SA-812	2.08E+19	1.199	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	9.53E+18	0.986
Intermediate to LS Circ. Weld (100%)	1	SA-1101	2.88E+19	1.281	1.32E+19	1.077
LS Long. Weld (100%)	1	SA-847	1.98E+19	1.187	9.09E+18	0.973
Nozzle Belt Forging (NB)	2	123V352	3.27E+18	0.693	1.50E+18	0.503
Intermediate Shell Forging (IS)	2	123V500	3.28E+19	1.312	1.51E+19	1.113
Lower Shell Forging (LS)	2	123W195	3.19E+19	1.305	1.46E+19	1.105
NB to IS Circ. Weld (100%)	2	21935	3.27E+18	0.693	1.50E+18	0.503
Intermediate to LS Circ. Weld (100%)	2	SA-1484	3.02E+19	1.292	1.38E+19	1.090

Table 28. Fluence Factors for the ¼T and ¾T Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 8)

Beltline Material	Unit	Material Ident.	¼T Location		¾T Location	
			Fluence, n/cm^2 (x10^{19})	Fluence Factor	Fluence, n/cm^2 (x10^{19})	Fluence Factor
Nozzle Belt Forging (NB)	1	122P237	1.84E+18	0.550	8.44E+17	0.384
Intermediate Shell (IS)	1	A9811-1	2.62E+19	1.258	1.20E+19	1.051
Lower Shell (LS)	1	C1423-1	2.36E+19	1.232	1.08E+19	1.022
NB to IS Circ. Weld (100%)	1	SA-1426	1.84E+18	0.550	8.44E+17	0.384
IS Long. Weld (ID 27%)	1	SA-812	1.69E+19	1.145	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	N/A	N/A	7.76E+18	0.929
Intermediate to LS Circ. Weld (100%)	1	SA-1101	2.31E+19	1.226	1.06E+19	1.016
LS Long. Weld (100%)	1	SA-847	1.58E+19	1.127	7.26E+18	0.910
Nozzle Belt Forging (NB)	2	123V352	2.59E+18	0.633	1.19E+18	0.452
Intermediate Shell Forging (IS)	2	123V500	2.65E+19	1.261	1.22E+19	1.055
Lower Shell Forging (LS)	2	123W195	2.55E+19	1.251	1.17E+19	1.044
NB to IS Circ. Weld (100%)	2	21935	2.59E+18	0.633	1.19E+18	0.452
Intermediate to LS Circ. Weld (100%)	2	SA-1484	2.40E+19	1.236	1.10E+19	1.027

5.2.3 ΔRT_{NDT} Calculation

The ΔRT_{NDT} values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials at the ¼T and ¾T wall locations are calculated by multiplying the chemistry factors and fluence factors. The ΔRT_{NDT} values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are presented in Tables 29 – 36.

Table 29. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials with Uprate, with hafnium rods, through 53 EFPY (Case 1)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.560	43.1	77.0	0.392	30.2
Intermediate Shell (IS)	1	A9811-1	79.3*	1.312	104.0	79.3*	1.114	88.3
Lower Shell (LS)	1	C1423-1	35.8*	1.247	44.6	35.8*	1.039	37.2
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.560	93.5	167.0	0.392	65.5
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.202	200.7	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.989	165.2
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.247	209.1	167.6	1.039	174.1
LS Long. Weld (100%)	1	SA-847	167.0	1.155	192.9	167.0	0.940	157.0
Nozzle Belt Forging (NB)	2	123V352	76.0	0.652	49.6	76.0	0.468	35.6
Intermediate Shell Forging (IS)	2	123V500	58.0	1.303	75.6	58.0	1.102	63.9
Lower Shell Forging (LS)	2	123W195	42.8*	1.275	54.6	42.8*	1.070	45.8
NB to IS Circ. Weld (100%)	2	21935	170.5	0.652	111.2	170.5	0.468	79.8
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.250	225.0	180.0	1.042	187.6

* - determined from surveillance data

Table 30. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials with Uprate, with hafnium rods, through 43 EFPY (Case 2)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.519	40.0	77.0	0.359	27.6
Intermediate Shell (IS)	1	A9811-1	79.3*	1.263	100.2	79.3*	1.057	83.8
Lower Shell (LS)	1	C1423-1	35.8*	1.203	43.1	35.8*	0.990	35.4
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.519	86.7	167.0	0.359	60.0
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.147	191.6	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.931	155.5
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.202	201.5	167.6	0.989	165.8
LS Long. Weld (100%)	1	SA-847	167.0	1.104	184.4	167.0	0.887	148.1
Nozzle Belt Forging (NB)	2	123V352	76.0	0.605	46.0	76.0	0.429	32.6
Intermediate Shell Forging (IS)	2	123V500	58.0	1.254	72.7	58.0	1.047	60.7
Lower Shell Forging (LS)	2	123W195	42.8*	1.229	52.6	42.8*	1.019	43.6
NB to IS Circ. Weld (100%)	2	21935	170.5	0.605	103.2	170.5	0.429	73.1
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.205	216.9	180.0	0.993	178.7

* - determined from surveillance data

Table 31. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials without Uprate, with hafnium rods, through 53 EFPY (Case 3)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.552	42.5	77.0	0.386	29.7
Intermediate Shell (IS)	1	A9811-1	79.3*	1.304	103.4	79.3*	1.104	87.6
Lower Shell (LS)	1	C1423-1	35.8*	1.239	44.4	35.8*	1.030	36.9
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.552	92.2	167.0	0.386	64.5
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.192	199.1	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.979	163.5
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.239	207.7	167.6	1.030	172.6
LS Long. Weld (100%)	1	SA-847	167.0	1.146	191.4	167.0	0.930	155.3
Nozzle Belt Forging (NB)	2	123V352	76.0	0.643	48.9	76.0	0.461	35.0
Intermediate Shell Forging (IS)	2	123V500	58.0	1.294	75.1	58.0	1.092	63.3
Lower Shell Forging (LS)	2	123W195	42.8*	1.267	54.2	42.8*	1.062	45.5
NB to IS Circ. Weld (100%)	2	21935	170.5	0.643	109.6	170.5	0.461	78.6
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.243	223.7	180.0	1.034	186.1

* - determined from surveillance data

Table 32. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials without Uprate, with hafnium rods, through 43 EFPY (Case 4)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.514	39.6	77.0	0.355	27.3
Intermediate Shell (IS)	1	A9811-1	79.3*	1.257	99.7	79.3*	1.050	83.3
Lower Shell (LS)	1	C1423-1	35.8*	1.197	42.9	35.8*	0.985	35.3
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.514	85.8	167.0	0.355	59.3
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.141	190.6	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.924	154.3
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.196	200.4	167.6	0.983	164.8
LS Long. Weld (100%)	1	SA-847	167.0	1.098	183.4	167.0	0.880	147.0
Nozzle Belt Forging (NB)	2	123V352	76.0	0.599	45.5	76.0	0.424	32.2
Intermediate Shell Forging (IS)	2	123V500	58.0	1.247	72.3	58.0	1.039	60.3
Lower Shell Forging (LS)	2	123W195	42.8*	1.223	52.3	42.8*	1.013	43.4
NB to IS Circ. Weld (100%)	2	21935	170.5	0.599	102.1	170.5	0.424	72.3
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.200	216.0	180.0	0.987	177.7

* - determined from surveillance data

Table 33. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 5)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.616	47.4	77.0	0.438	33.7
Intermediate Shell (IS)	1	A9811-1	79.3*	1.313	104.1	79.3*	1.116	88.5
Lower Shell (LS)	1	C1423-1	35.8*	1.297	46.4	35.8*	1.096	39.2
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.616	102.9	167.0	0.438	73.2
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.209	201.9	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.997	166.5
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.291	216.4	167.6	1.088	182.3
LS Long. Weld (100%)	1	SA-847	167.0	1.197	199.9	167.0	0.985	164.5
Nozzle Belt Forging (NB)	2	123V352	76.0	0.704	53.5	76.0	0.512	38.9
Intermediate Shell Forging (IS)	2	123V500	58.0	1.321	76.6	58.0	1.124	65.2
Lower Shell Forging (LS)	2	123W195	42.8*	1.314	56.2	42.8*	1.116	47.8
NB to IS Circ. Weld (100%)	2	21935	170.5	0.704	120.0	170.5	0.512	87.3
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.302	234.4	180.0	1.102	198.4

* - determined from surveillance data

Table 34. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 6)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.557	42.9	77.0	0.389	30.0
Intermediate Shell (IS)	1	A9811-1	79.3*	1.264	100.2	79.3*	1.058	83.9
Lower Shell (LS)	1	C1423-1	35.8*	1.239	44.4	35.8*	1.030	36.9
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.557	93.0	167.0	0.389	65.0
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.152	192.4	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.937	156.5
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.233	206.7	167.6	1.024	171.6
LS Long. Weld (100%)	1	SA-847	167.0	1.136	189.7	167.0	0.920	153.6
Nozzle Belt Forging (NB)	2	123V352	76.0	0.641	48.7	76.0	0.459	34.9
Intermediate Shell Forging (IS)	2	123V500	58.0	1.268	73.5	58.0	1.063	61.7
Lower Shell Forging (LS)	2	123W195	42.8*	1.259	53.9	42.8*	1.052	45.0
NB to IS Circ. Weld (100%)	2	21935	170.5	0.641	109.3	170.5	0.459	78.3
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.245	224.1	180.0	1.036	186.5

* - determined from surveillance data

Table 35. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 7)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.606	46.7	77.0	0.430	33.1
Intermediate Shell (IS)	1	A9811-1	79.3*	1.306	103.6	79.3*	1.106	87.7
Lower Shell (LS)	1	C1423-1	35.8*	1.287	46.1	35.8*	1.084	38.8
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.606	101.2	167.0	0.430	71.8
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.199	200.2	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.986	164.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.281	214.7	167.6	1.077	180.5
LS Long. Weld (100%)	1	SA-847	167.0	1.187	198.2	167.0	0.973	162.5
Nozzle Belt Forging (NB)	2	123V352	76.0	0.693	52.7	76.0	0.503	38.2
Intermediate Shell Forging (IS)	2	123V500	58.0	1.312	76.1	58.0	1.113	64.6
Lower Shell Forging (LS)	2	123W195	42.8*	1.305	55.9	42.8*	1.105	47.3
NB to IS Circ. Weld (100%)	2	21935	170.5	0.693	118.2	170.5	0.503	85.8
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.292	232.6	180.0	1.090	196.2

* - determined from surveillance data

Table 36. ΔRT_{NDT} Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 8)

Beltline Materials	Unit	Material Ident.	¼T Location			¾T Location		
			CF	ff	ΔRT_{NDT}	CF	ff	ΔRT_{NDT}
Nozzle Belt Forging (NB)	1	122P237	77.0	0.550	42.4	77.0	0.384	29.6
Intermediate Shell (IS)	1	A9811-1	79.3*	1.258	99.8	79.3*	1.051	83.3
Lower Shell (LS)	1	C1423-1	35.8*	1.232	44.1	35.8*	1.022	36.6
NB to IS Circ. Weld (100%)	1	SA-1426	167.0	0.550	91.9	167.0	0.384	64.1
IS Long. Weld (ID 27%)	1	SA-812	167.0	1.145	191.2	167.0	N/A	N/A
IS Long. Weld (OD 73%)	1	SA-775	167.0	N/A	N/A	167.0	0.929	155.1
Intermediate to LS Circ. Weld (100%)	1	SA-1101	167.6	1.226	205.5	167.6	1.016	170.3
LS Long. Weld (100%)	1	SA-847	167.0	1.127	188.2	167.0	0.910	152.0
Nozzle Belt Forging (NB)	2	123V352	76.0	0.633	48.1	76.0	0.452	34.4
Intermediate Shell Forging (IS)	2	123V500	58.0	1.261	73.1	58.0	1.055	61.2
Lower Shell Forging (LS)	2	123W195	42.8*	1.251	53.5	42.8*	1.044	44.7
NB to IS Circ. Weld (100%)	2	21935	170.5	0.633	107.9	170.5	0.452	77.1
Intermediate to LS Circ. Weld (100%)	2	SA-1484	180.0	1.236	222.5	180.0	1.027	184.9

* - determined from surveillance data

5.3 Margin

The "margin" is the quantity that is added to obtain conservative, upper-bound values of the ART. The margin is determined by the following expression:

$$Margin = 2\sqrt{\sigma_I^2 + \sigma_\Delta^2} \quad (4)$$

where σ_I = standard deviation for the initial RT_{NDT}
σ_Δ = standard deviation for ΔRT_{NDT}

If a measured value of the initial RT_{NDT} for the material in question is available, σ_I is to be estimated from the precision of the test method. If generic mean values are used, σ_I is the standard deviation obtained from the set of data used to establish the mean.

The standard deviation for ΔRT_{NDT}, σ_Δ, is 28°F for welds and 17°F for base metals, except that σ_Δ need not exceed 0.50 times ΔRT_{NDT}. For cases in which the results from a credible plant-specific surveillance program are used, the value of σ_Δ to be used is 14°F for welds and 8.5°F for base metal; the value of need not exceed one-half of ΔRT_{NDT}.

Tables 37 – 44 list the margin values calculated for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials for Cases 1 – 8.

Table 37. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 53 EFPY (Case 1)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDT} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	21.55	15.10*	34.0	30.2
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	50.00	44.15	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	22.30	18.60	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	46.75	32.75	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	100.35	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	82.60	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	104.55	87.05	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	96.45	78.50	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	24.80	17.80	34.0	34.0
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	37.80	31.95	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	27.30	22.90	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	55.60	39.90	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	112.50	93.80	60.8	60.8

* - Used to calculate margin term

Table 38. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 43 EFPY (Case 2)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDT} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	20.00	13.80*	34.0	27.6
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	50.10	41.90	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	21.55	17.70	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	43.35	30.00	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	95.80	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	77.75	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	100.75	82.90	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	92.20	74.05	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	23.00	16.30*	34.0	32.6
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	36.35	30.35	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	26.30	21.80	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	51.60	36.55	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	108.45	89.35	60.8	60.8

* - Used to calculate margin term

Table 39. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 53 EFPY (Case 3)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDT} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	21.25	14.85*	34.0	29.7
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	51.70	43.80	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	22.20	18.45	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	46.10	32.25	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	99.55	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	81.75	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	103.85	86.3	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	95.70	77.65	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	24.45	17.50	34.0	34.0
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	37.55	31.65	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	27.10	22.75	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	54.80	39.30	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	111.85	93.05	60.8	60.8

* - Used to calculate margin term

Table 40. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 43 EFPY (Case 4)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDI} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	19.80	13.65*	34.0	27.3
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	49.85	41.65	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	21.45	17.65	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	42.90	29.65	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	95.30	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	77.15	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	100.20	82.40	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	91.70	73.50	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	22.75	16.10*	34.0	32.2
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	36.15	30.15	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	26.15	21.70	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	51.05	36.15	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	108.00	88.85	60.8	60.8

* - Used to calculate margin term

Table 41. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 5)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDI} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	23.70	16.85*	34.0	33.7
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	52.05	44.25	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	23.20	19.60	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	51.45	36.60	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	100.95	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	83.25	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	108.20	91.15	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	99.95	82.25	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	26.75	19.45	34.0	34.0
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	38.30	32.60	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	28.10	23.90	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	60.00	43.65	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	117.20	99.20	60.8	60.8

* - Used to calculate margin term

Table 42. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 6)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDI} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	21.45	15.00*	34.0	30.0
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	50.10	41.95	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	22.20	18.45	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	46.50	32.50	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	96.20	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	78.25	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	103.35	85.8	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	94.85	76.80	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	24.35	17.45	34.0	34.0
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	36.75	30.85	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	26.95	22.50	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	54.65	39.15	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	112.05	93.25	60.8	60.8

* - Used to calculate margin term

Table 43. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 7)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDI} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	23.35	16.55*	34.0	33.1
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	51.80	43.85	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	23.05	19.40	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	50.60	35.90	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	100.10	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	82.35	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	107.35	90.25	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	99.10	81.25	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	26.35	19.10	34.0	34.0
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	38.05	32.30	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	27.95	23.65	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	59.10	42.90	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	116.3	98.10	60.8	60.8

* - Used to calculate margin term

Table 44. Margin Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 8)

Beltline Materials	Unit	Material Ident.	σ_I	σ_Δ	ΔRT_{NDT} / 2		Margin	
					¼T	¾T	¼T	¾T
Nozzle Belt Forging (NB)	1	122P237	0	17.0*	21.20	14.80*	34.0	29.6
Intermediate Shell (IS)	1	A9811-1	26.9	8.5*	49.90	41.65	56.4	56.4
Lower Shell (LS)	1	C1423-1	26.9	8.5*	22.05	18.30	56.4	56.4
NB to IS Circ. Weld (100%)	1	SA-1426	17.2	28.0*	45.95	32.05	65.7	65.7
IS Long. Weld (ID 27%)	1	SA-812	17.2	28.0*	95.60	N/A	65.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	17.2	28.0*	N/A	77.55	N/A	65.7
Intermediate to LS Circ. Weld (100%)	1	SA-1101	12.9	28.0*	102.75	85.15	61.7	61.7
LS Long. Weld (100%)	1	SA-847	17.2	28.0*	94.10	76.00	65.7	65.7
Nozzle Belt Forging (NB)	2	123V352	0	17.0*	24.05	17.20	34.0	34.0
Intermediate Shell Forging (IS)	2	123V500	0	17.0*	36.55	30.60	34.0	34.0
Lower Shell Forging (LS)	2	123W195	0	8.5*	26.75	22.35	17.0	17.0
NB to IS Circ. Weld (100%)	2	21935	17.0	28.0*	53.95	38.55	65.5	65.5
Intermediate to LS Circ. Weld (100%)	2	SA-1484	11.9	28.0*	111.25	92.45	60.8	60.8

* - Used to calculate margin term

5.4 Calculation of Adjusted Reference Temperature (ART)

The ART is given by the following expression:

$$ART = Initial\ RT_{NDT} + \Delta RT_{NDT} + Margin \quad (5)$$

Tables 45 – 52 list the ART values at the ¼T and ¾T wall locations calculated for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials for Cases 1 – 8.

Table 45. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 53 EFPY (Case 1)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{NDT}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	43.1	30.2	34.0	30.2	127.1	110.4
Intermediate Shell (IS)	1	A9811-1	1	104.0	88.3	56.4	56.4	161.4	145.7
Lower Shell (LS)	1	C1423-1	1	44.6	37.2	56.4	56.4	102.0	94.6
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	93.5	65.5	65.7	65.7	111.6	83.6
IS Long. Weld (ID 27%)	1	SA-812	-47.6	200.7	N/A	65.7	N/A	218.8	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	165.2	N/A	65.7	N/A	183.3
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	209.1	174.1	61.7	61.7	223.4	188.4
LS Long. Weld (100%)	1	SA-847	-47.6	192.9	157.0	65.7	65.7	211.1	175.3
Nozzle Belt Forging (NB)	2	123V352	40	49.6	35.6	34.0	34.0	123.6	109.6
Intermediate Shell Forging (IS)	2	123V500	40	75.6	63.9	34.0	34.0	149.6	137.9
Lower Shell Forging (LS)	2	123W195	40	54.6	45.8	17.0	17.0	111.6	102.8
NB to IS Circ. Weld (100%)	2	21935	-56	111.2	79.8	65.5	65.5	120.7	89.3
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	225.0	187.6	60.8	60.8	255.8	218.4

Table 46. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rods, through 43 EFPY (Case 2)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{NDT}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	40.0	27.6	34.0	27.6	124.0	105.2
Intermediate Shell (IS)	1	A9811-1	1	100.2	83.8	56.4	56.4	157.6	141.2
Lower Shell (LS)	1	C1423-1	1	43.1	35.4	56.4	56.4	100.5	92.8
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	86.7	60.0	65.7	65.7	104.8	78.1
IS Long. Weld (ID 27%)	1	SA-812	-47.6	191.6	N/A	65.7	N/A	209.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	155.5	N/A	65.7	N/A	173.6
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	201.5	165.8	61.7	61.7	215.8	180.1
LS Long. Weld (100%)	1	SA-847	-47.6	184.4	148.1	65.7	65.7	202.5	166.4
Nozzle Belt Forging (NB)	2	123V352	40	46.0	32.6	34.0	32.6	120.0	105.2
Intermediate Shell Forging (IS)	2	123V500	40	72.7	60.7	34.0	34.0	146.7	134.7
Lower Shell Forging (LS)	2	123W195	40	52.6	43.6	17.0	17.0	109.6	100.6
NB to IS Circ. Weld (100%)	2	21935	-56	103.2	73.1	65.5	65.5	112.7	82.6
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	216.9	178.7	60.8	60.8	247.7	209.5

Table 47. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 53 EFPY (Case 3)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{NDT}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	42.5	29.7	34.0	29.7	126.5	109.4
Intermediate Shell (IS)	1	A9811-1	1	103.4	87.6	56.4	56.4	160.8	145.0
Lower Shell (LS)	1	C1423-1	1	44.4	36.9	56.4	56.4	101.8	94.3
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	92.2	64.5	65.7	65.7	110.3	82.6
IS Long. Weld (ID 27%)	1	SA-812	-47.6	199.1	N/A	65.7	N/A	217.2	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	163.5	N/A	65.7	N/A	181.6
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	207.7	172.6	61.7	61.7	222.0	186.9
LS Long. Weld (100%)	1	SA-847	-47.6	191.4	155.3	65.7	65.7	209.5	173.6
Nozzle Belt Forging (NB)	2	123V352	40	48.9	35.0	34.0	34.0	122.9	109.0
Intermediate Shell Forging (IS)	2	123V500	40	75.1	63.3	34.0	34.0	149.1	137.3
Lower Shell Forging (LS)	2	123W195	40	54.2	45.5	17.0	17.0	111.2	102.5
NB to IS Circ. Weld (100%)	2	21935	-56	109.6	78.6	65.5	65.5	119.1	88.1
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	223.7	186.1	60.8	60.8	254.5	216.9

Table 48. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rods, through 43 EFPY (Case 4)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{ND1}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	39.6	27.3	34.0	27.3	123.6	104.6
Intermediate Shell (IS)	1	A9811-1	1	99.7	83.3	56.4	56.4	157.1	140.7
Lower Shell (LS)	1	C1423-1	1	42.9	35.3	56.4	56.4	100.3	92.7
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	85.8	59.3	65.7	65.7	103.9	77.4
IS Long. Weld (ID 27%)	1	SA-812	-47.6	190.6	N/A	65.7	N/A	208.7	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	154.3	N/A	65.7	N/A	172.4
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	200.4	164.8	61.7	61.7	214.7	179.1
LS Long. Weld (100%)	1	SA-847	-47.6	183.4	147.0	65.7	65.7	201.4	165.3
Nozzle Belt Forging (NB)	2	123V352	40	45.5	32.2	34.0	32.2	119.5	104.4
Intermediate Shell Forging (IS)	2	123V500	40	72.3	60.3	34.0	34.0	146.3	134.3
Lower Shell Forging (LS)	2	123W195	40	52.3	43.4	17.0	17.0	109.3	100.4
NB to IS Circ. Weld (100%)	2	21935	-56	102.1	72.3	65.5	65.5	111.6	81.8
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	216.0	177.7	60.8	60.8	246.8	208.5

Table 49. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 5)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{NDT}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	47.4	33.7	34.0	33.7	131.4	117.4
Intermediate Shell (IS)	1	A9811-1	1	104.1	88.5	56.4	56.4	161.5	145.9
Lower Shell (LS)	1	C1423-1	1	46.4	39.2	56.4	56.4	103.8	96.6
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	102.9	73.2	65.7	65.7	121.0	91.3
IS Long. Weld (ID 27%)	1	SA-812	-47.6	201.9	N/A	65.7	N/A	220.0	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	166.5	N/A	65.7	N/A	184.6
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	216.4	182.3	61.7	61.7	230.7	196.6
LS Long. Weld (100%)	1	SA-847	-47.6	199.9	164.5	65.7	65.7	218.1	182.7
Nozzle Belt Forging (NB)	2	123V352	40	53.5	38.9	34.0	34.0	127.5	112.9
Intermediate Shell Forging (IS)	2	123V500	40	76.6	65.2	34.0	34.0	150.6	139.2
Lower Shell Forging (LS)	2	123W195	40	56.2	47.8	17.0	17.0	113.2	104.8
NB to IS Circ. Weld (100%)	2	21935	-56	120.0	87.3	65.5	65.5	129.5	96.8
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	234.4	198.4	60.8	60.8	265.2	229.2

Table 50. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials with Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 6)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{NDT}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	42.9	30.0	34.0	30.0	126.9	110.0
Intermediate Shell (IS)	1	A9811-1	1	100.2	83.9	56.4	56.4	157.6	141.3
Lower Shell (LS)	1	C1423-1	1	44.4	36.9	56.4	56.4	101.8	94.3
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	93.0	65.0	65.7	65.7	111.1	83.1
IS Long. Weld (ID 27%)	1	SA-812	-47.6	192.4	N/A	65.7	N/A	210.5	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	156.5	N/A	65.7	N/A	174.6
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	206.7	171.6	61.7	61.7	221.0	185.9
LS Long. Weld (100%)	1	SA-847	-47.6	189.7	153.6	65.7	65.7	207.8	171.9
Nozzle Belt Forging (NB)	2	123V352	40	48.7	34.9	34.0	34.0	122.7	108.9
Intermediate Shell Forging (IS)	2	123V500	40	73.5	61.7	34.0	34.0	147.5	135.7
Lower Shell Forging (LS)	2	123W195	40	53.9	45.0	17.0	17.0	110.9	102.0
NB to IS Circ. Weld (100%)	2	21935	-56	109.3	78.3	65.5	65.5	118.8	87.8
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	224.1	186.5	60.8	60.8	254.9	217.3

Table 51. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 53 EFPY (Case 7)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{NDT}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	46.7	33.1	34.0	33.1	130.7	116.2
Intermediate Shell (IS)	1	A9811-1	1	103.6	87.7	56.4	56.4	161.0	145.1
Lower Shell (LS)	1	C1423-1	1	46.1	38.8	56.4	56.4	103.5	96.2
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	101.2	71.8	65.7	65.7	119.3	89.9
IS Long. Weld (ID 27%)	1	SA-812	-47.6	200.2	N/A	65.7	N/A	218.3	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	164.7	N/A	65.7	N/A	182.8
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	214.7	180.5	61.7	61.7	229.0	194.8
LS Long. Weld (100%)	1	SA-847	-47.6	198.2	162.5	65.7	65.7	216.3	180.9
Nozzle Belt Forging (NB)	2	123V352	40	52.7	38.2	34.0	34.0	126.7	112.2
Intermediate Shell Forging (IS)	2	123V500	40	76.1	64.6	34.0	34.0	150.1	138.6
Lower Shell Forging (LS)	2	123W195	40	55.9	47.3	17.0	17.0	112.9	104.3
NB to IS Circ. Weld (100%)	2	21935	-56	118.2	85.8	65.5	65.5	127.7	95.3
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	232.6	196.2	60.8	60.8	263.4	227.0

Table 52. ART Values for the ¼T and ¾T Wall Locations of the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials without Uprate, with hafnium rod removal October 2008 (Unit 1) and April 2008 (Unit 2), through 43 EFPY (Case 8)

Beltline Materials	Unit	Material Ident.	Initial Reference Temperature, °F	ΔRT_{NDT}, °F		Margin, °F		Adjusted Reference Temperature, °F	
				¼T Location	¾T Location	¼T Location	¾T Location	¼T Location	¾T Location
Nozzle Belt Forging (NB)	1	122P237	50	42.4	29.6	34.0	29.6	126.4	109.2
Intermediate Shell (IS)	1	A9811-1	1	99.8	83.3	56.4	56.4	157.2	140.7
Lower Shell (LS)	1	C1423-1	1	44.1	36.6	56.4	56.4	101.5	94.0
NB to IS Circ. Weld (100%)	1	SA-1426	-47.6	91.9	64.1	65.7	65.7	110.0	82.2
IS Long. Weld (ID 27%)	1	SA-812	-47.6	191.2	N/A	65.7	N/A	209.3	N/A
IS Long. Weld (OD 73%)	1	SA-775	-47.6	N/A	155.1	N/A	65.7	N/A	173.2
Intermediate to LS Circ. Weld (100%)	1	SA-1101	-47.4	205.5	170.3	61.7	61.7	219.8	184.6
LS Long. Weld (100%)	1	SA-847	-47.6	188.2	152.0	65.7	65.7	206.3	170.3
Nozzle Belt Forging (NB)	2	123V352	40	48.1	34.4	34.0	34.0	122.1	108.4
Intermediate Shell Forging (IS)	2	123V500	40	73.1	61.2	34.0	34.0	147.1	135.2
Lower Shell Forging (LS)	2	123W195	40	53.5	44.7	17.0	17.0	110.5	101.7
NB to IS Circ. Weld (100%)	2	21935	-56	107.9	77.1	65.5	65.5	117.4	86.6
Intermediate to LS Circ. Weld (100%)	2	SA-1484	-30	222.5	184.9	60.8	60.8	253.3	215.7

6.0 Adjusted Reference Temperature Calculation Where Surveillance Data is Available

The adjusted reference temperature may be calculated when two or more credible surveillance data sets are available. Using the ΔRT_{NDT} and its corresponding fluence, the chemistry factor may be calculated by multiplying each adjusted ΔRT_{NDT} by the corresponding fluence factor, summing the products, and dividing by the sum of the squares of the fluence factors.

The Master Integrated Reactor Vessel Surveillance Program (MIRVP) described in BAW-1543, Revision 4[3], provides surveillance data for the Point Beach Unit 1 weld metals SA-1101 and SA-847.

The base metal evaluations completed in Reference 5 for all base metals pertinent to Point Beach Unit 1 (A9811-1 and C1423-1) and Unit 2 (123W195) are valid.

6.1 Surveillance Data Credibility Assessment

When assessing credibility for surveillance data from several sources, the capsule data may have to be adjusted to account for the irradiation environment and chemical composition differences.

$$\textit{Temperature Adjusted } \Delta RT_{NDT,\,normalized} = \Delta RT_{NDT,\,measured} + 1.0 * (T_{capsule} - T_{capsule\ mean})$$

Additionally, if the surveillance data are from multiple sources, it is necessary to adjust the capsule data for chemical composition (copper and nickel content) differences. For the credibility determination, the surveillance data are *"normalized"* to the mean copper and nickel contents of the surveillance materials using the following equation:

$$\textit{Ratio Adjusted } \Delta RT_{NDT,\,normalized} = \left(\frac{CF_{Table,\,Surv.\,Avg.\,Chem.}}{CF_{Table,\,Surv.\,Chem.}} \right) * \Delta RT_{NDT,\,measured}$$

A best-fit line (least squares regression) is then determined from the adjusted ΔRT_{NDT} capsule surveillance data as a function of the capsule fluence factor.

The data are considered credible if the difference between the adjusted ΔRT_{NDT} (i.e., chemistry adjusted) and the predicted ΔRT_{NDT} (from the best-fit line) for all the data is within ±28°F for weld metals and ±17°F for base metals.

6.2 Credible Surveillance Data

In accordance with Regulatory Guide 1.99, Revision 2 and 10 CFR 50.61, credible surveillance data are used to determine material-specific chemistry factor values for use in reactor vessel integrity assessments. The chemistry factor is determined from a best-fit line through the surveillance data adjusted to account for differences in chemical composition (i.e., copper and nickel contents) and irradiation environment (i.e., irradiation temperature) between the capsules and the vessel. The surveillance data are adjusted in the same manner as for the credibility determination except that the 30 ft-lb transition temperature values are *"normalized"* to the best estimate copper and nickel contents and the irradiation temperature of the vessel being assessed.

6.3 Non Credible Surveillance Data

If the surveillance data are determined to be non-credible, the chemistry factor value is calculated from the generic Tables in 10 CFR 50.61 and Regulatory Guide 1.99, Revision 2 unless the chemistry factor determined from the surveillance data is significantly greater than that from the generic Tables, indicating that the Table chemistry factor is non-conservative. To determine if the generic Table chemistry factor is non-conservative, the following steps are performed:

1. Determine the chemistry factor from the generic Tables based on the surveillance specimen chemical composition; use this chemistry factor to determine the predicted ΔRT_{NDT} for each capsule:

$$(Predicted\ \Delta RT_{NDT} = CF_{Table,\ Surv.\ Avg.\ Chem.} * ff_{capsule})$$

2. Determine difference between the predicted ΔRT_{NDT} and the measured ΔRT_{NDT}.

If the difference between the predicted ΔRT_{NDT} and the measured ΔRT_{NDT} values exceeds 2 standard deviations (i.e., 56°F for weld metals and 34°F for base metals), the Table chemistry factor is considered non-conservative. When the Table chemistry factor is determined to be non-conservative, the chemistry factor determined from the "non-credible" surveillance data is used in the assessment of reactor vessel integrity using the "full" value of σ_Δ in calculating the Margin term.

6.4 Assessment of the Weld Wire Heat Surveillance Data

Tables 53 – 58 provide the credibility assessment of the weld wire heats 71249, 61782, and 72442.

NOTE: The original Charpy V-notch impact data are based on hand-fit Charpy curves using engineering judgment; these data were using a hyperbolic tangent curve fitting program to achieve consistency in the interpretation of the available surveillance test data.

Table 53. Credibility Assessment for Weld Wire Heat Number 71249

Capsule Designation	Cu wt%	Ni wt%	Chem. Factor	Irrad. Temp. (°F)	Fluence ($x10^{19}$n/cm^2)	Fluence Factor	Meas. ΔRT_{NDT} (°F)	Temp. Adj. ΔRT_{NDT} (°F)	Ratio Adj. ΔRT_{NDT} (°F)	Pred. ΔRT_{NDT} (°F) from best fit line	(Adjusted – Predicted) ΔRT_{NDT} (°F)
Turkey Point Unit 3: Capsule T SA-1101: Plant Specific RVSP Material	0.33	0.57	201.3	546	0.739	0.915	166	165	163.3	158.0	5.3
Turkey Point Unit 3: Capsule V SA-1101: Plant Specific RVSP Material	0.33	0.57	201.3	546	1.530	1.118	179	178	176.2	193.1	-16.9
Turkey Point Unit 4: Capsule T SA-1094: Plant Specific RVSP Material	0.29	0.60	191.0	546	0.708	0.903	211	210	219.0	156.0	63.0
Turkey Point Unit 3: Capsule X SA-1101: Plant Specific RVSP Material	0.33	0.57	201.3	546	2.900	1.283	191	190	188.0	221.6	-33.6
B&WOG: Capsule A5 SA-1101: TP-3 Plant Specific RVSP Matl.	0.33	0.57	201.3	551	2.572	1.253	215	219	216.7	216.4	0.3
Surv. Avg.	0.322	0.576	199.2	547							

where ***Predicted ΔRT_{NDT} = ($Slope_{best\ fit}$) * (Fluence Factor)*** and

$Slope_{best\ fit}$ = best fit line relating Adjusted ΔRT_{NDT} to the Fluence Factor
(i.e., 172.7)

These data points are not credible since the scatter is greater than ±28°F for two surveillance points.

Table 54. Table Chemistry Factor Non-Conservatism Assessment for Weld Wire Heat Number 71249

Capsule Designation	Table Chem. Factor (Surv. Avg.)	Capsule Fluence Factor	Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F)	(Adjusted – Predicted) ΔRT_{NDT} (°F)
Turkey Point Unit 3: Capsule T SA-1101: Plant Specific RVSP Material	199.2	0.915	163.3	182.3	-19.0
Turkey Point Unit 3: Capsule V SA-1101: Plant Specific RVSP Material	199.2	1.118	176.2	222.7	-46.5
Turkey Point Unit 4: Capsule T SA-1094: Plant Specific RVSP Material	199.2	0.903	219.0	179.9	39.1
Turkey Point Unit 3: Capsule X SA-1101: Plant Specific RVSP Material	199.2	1.283	188.0	255.6	-67.6
B&WOG: Capsule A5 SA-1101: TP-3 Plant Specific RVSP Matl.	199.2	1.253	216.7	249.6	-32.9

The above assessment results indicate that the generic Table chemistry factor for the surveillance data grossly over-predicts the adjusted measured data. Therefore, the Table chemistry factor calculated using the weld wire heat best-estimate copper and nickel contents is considered conservative.

Table 55. Credibility Assessment for Weld Wire Heat Number 61782

Capsule Designation	Cu wt%	Ni wt%	Chem. Factor	Irrad. Temp. (°F)	Fluence ($x10^{19}$n/c m^2)	Fluence Factor	Meas. ΔRT_{NDT} (°F)	Temp. Adjusted ΔRT_{NDT} (°F)	Ratio Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F) from Best Fit Line	(Adjusted - Predicted) ΔRT_{NDT} (°F)
R. E. Ginna: Capsule V SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	0.5028	0.808	146	142	148.2	123.5	24.7
R. E. Ginna: Capsule R SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	1.105	1.028	167	163	170.2	157.1	13.1
R. E. Ginna: Capsule T SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	1.864	1.171	169	165	172.3	179.0	-6.7
R. E. Ginna: Capsule S SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	3.746	1.342	223	219	228.6	205.1	23.5
B&WOG: Capsule DB1-LG1 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	0.27	0.59	182.6	556	1.030	1.008	138	145	133.8	154.0	-20.2
B&WOG: Capsule DB1-LG2 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	0.27	0.59	182.6	556	1.635	1.136	146	153	141.2	173.6	-32.4
Surv. Avg.	0.250	0.543	168.5	548.7							

where ***Predicted ΔRT_{NDT} = ($Slope_{best\ fit}$) * (Fluence Factor)*** and

$Slope_{best\ fit}$ = best fit line relating Adjusted ΔRT_{NDT} to the Fluence Factor
(i.e., 152.8)

These data points are not credible since the scatter is greater than ±28°F for two surveillance points.

Table 56. Table Chemistry Factor Non-Conservatism Assessment for Weld Wire Heat Number 61782

Capsule Designation	Table Chem. Factor (Surv. Avg.)	Capsule Fluence Factor	Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F)	(Adjusted – Predicted) ΔRT_{NDT} (°F)
R. E. Ginna: Capsule V SA-1036: Plant Specific RVSP Material	168.5	0.808	149	136.2	12.8
R. E. Ginna: Capsule R SA-1036: Plant Specific RVSP Material	168.5	1.028	170	173.2	-3.2
R. E. Ginna: Capsule T SA-1036: Plant Specific RVSP Material	168.5	1.171	173	197.3	-24.3
R. E. Ginna: Capsule S SA-1036: Plant Specific RVSP Material	168.5	1.342	229	226.1	2.9
B&WOG: Capsule DB1-LG1 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	168.5	1.008	134	169.8	-35.8
B&WOG: Capsule DB1-LG2 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	168.5	1.136	141	191.4	-50.4

Since the scatter for all data points is less than 2 standard deviations (56°F), the Table chemistry factor is conservative.

Table 57. Credibility Assessment for Weld Wire Heat Number 72442[7]

Capsule Designation	Cu wt%	Ni wt%	Chem. Factor	Irrad. Temp (°F)	Fluence ($x10^{19}$ n/cm^2)	Fluence Factor	Meas. RT_{NDT} (°F)	Predicted RT_{NDT} from best fit line (°F)	(Measured – Predicted) ΔRT_{NDT} (°°F)
B&WOG: Capsule CR3-LG1 WF-67: MD1 Nozzle Belt Dropout Matl.	0.22	0.60	167.0	556	0.609	0.861	167	126.9	40.1
B&WOG: Capsule CR3-LG2 WF-67: MD1 Nozzle Belt Dropout Matl	0.22	0.60	167.0	556	1.950	1.182	138	174.2	-36.2
EPRI: PWR-5 WF-67	0.22	0.60	167.0	556	1.140	1.037	161	152.9	8.1
Surv. Avg.	0.22	0.60	167.0	556					

where ***Predicted ΔRT_{NDT} = ($Slope_{best\ fit}$) * (Fluence Factor)*** and

$Slope_{best\ fit}$ = best fit line relating Adjusted ΔRT_{NDT} to the Fluence Factor
(i.e., 147.4)

These data points are not credible since the scatter is greater than ±28°F for two surveillance points.

Table 58. Table Chemistry Factor Non-Conservatism Assessment for Weld Wire Heat Number 72442

Capsule Designation	Table Chem. Factor (Surv. Avg.)	Capsule Fluence Factor	Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F)	(Adjusted – Predicted) ΔRT_{NDT} (°F)
B&WOG: Capsule CR3-LG1 WF-67: MD1 Nozzle Belt Dropout Matl.	167.0	0.861	167	143.8	23.2
B&WOG: Capsule CR3-LG2 WF-67: MD1 Nozzle Belt Dropout Matl	167.0	1.182	138	197.4	-59.4
EPRI . PWR-5 WF-67	167.0	1:037	161	173.2	-12.2

The above assessment results indicate that the generic Table chemistry factor for the surveillance data over-predicts the adjusted measured data. Therefore, the Table chemistry factor calculated using the weld wire heat best-estimate copper and nickel contents is considered conservative.

7.0 References

1. U. S. Nuclear Regulatory Commission, "*Radiation Embrittlement of Reactor Vessel Materials*," Regulatory Guide 1.99, Revision 2, May 1988.

2. AREVA Document 38-9008745-000, H. P. Gunawardane, "*NMC Letter Dated June 29, 2004 with Westinghouse Attachment (LTR-REA-04-64),*" December 2005.

3. AREVA Document 43-1543-04, M. J. DeVan, "*Master Integrated Reactor Vessel Surveillance Program,*" (BAW-1543-04), February 1993.

4. American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, *Nuclear Power Plant Components,* Subsection NB, Class 1 Components.

5. AREVA Document 43-2308-02, K. K. Yoon, "*Initial RT_{NDT} of Linde 80 Weld Materials,*" (BAW-2308, Revision 1-A), August 2005.

6. AREVA Document 43-2325-01, M. J. Devan, "*Response to Request for Additional Information (RAI) Regarding Reactor Vessel Pressure Integrity, B&W Owner's Group – Reactor Vessel Working Group,*" (BAW-2325-01), January 1999.

7. AREVA Document 77-2313-005, "B&WOG Reactor Vessel Working Group, Reactor Vessel Materials and Surveillance Data Information," (BAW-2313, Revision 5), December 2005.

ENCLOSURE 1
ATTACHMENT 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

SUPPLEMENT 2 TO LICENSE AMENDMENT REQUEST 252
TECHNICAL SPECIFICATION 5.6.5, REACTOR COOLANT SYSTEM (RCS)
PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

RTPTS VALUES FOR
POINT BEACH UNIT 1 AND UNIT 2

22 pages follow

AREVA

CALCULATION SUMMARY SHEET (CSS)

Document Identifier 32-9019238-000

Title RTPTS Values for Point Beach Unit 1 and Unit 2

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COST CENTER 41324 REF. PAGE(S) 22

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PURPOSE AND SUMMARY OF RESULTS:

The RTPTS values applicable to 53 EFPY for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are presented in this document. These values were calculated in accordance with the requirements specified in the Code of Federal Regulations, Title 10, Part 50.61. The RTPTS values were calculated using projected fluence values for 60 years. The controlling beltline material for the Point Beach Unit 1 reactor vessel is the intermediate shell longitudinal weld heat number 1P0815 with a predicted RTPTS value of 236.0F. Screening criterion for this material is 270F. The controlling beltline material for the Point Beach Unit 2 reactor vessel is the intermediate to lower shell circumferential shell weld heat number 72442 with a predicted RTPTS value of 280.6F. Screening criterion for this material is 300F.

THE FOLLOWING COMPUTER CODES HAVE BEEN USED IN THIS DOCUMENT:

CODE/VERSION/REV	CODE/VERSION/REV

THE DOCUMENT CONTAINS ASSUMPTIONS THAT MUST BE VERIFIED PRIOR TO USE ON SAFETY-RELATED WORK

☐ YES

☒ NO

RECORD OF REVISIONS

Revision	Description	Date
000	Original Release	May 2006

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1.0 Introduction

The purpose of this analysis is to determine the reactor vessel pressurized thermal shock reference temperatures (RT_{PTS}) applicable to 53 effective full power years (53 EFPY) for the Point Beach Unit 1 and Unit 2 Nuclear Power Plant using projected fluence values for 60 years.

2.0 Summary of Results

The RT_{PTS} values applicable to 53 EFPY for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are listed in Table 1. These values were calculated in accordance with the requirements specified in Code of Federal Regulations, Title 10, Part 50.61 (10 CFR 50.61).[1] The RT_{PTS} values were calculated using projected fluence values for 60 years. The controlling beltline material for the Point Beach Unit 1 reactor vessel is the intermediate shell longitudinal weld heat number 1P0815 with a predicted RT_{PTS} value of 236.0°F. Screening criterion for this material is 270°F. The controlling beltline material for the Point Beach Unit 2 reactor vessel is the intermediate to lower shell circumferential shell weld heat number 72442 with a predicted RT_{PTS} value of 280.6°F. Screening criterion for this material is 300°F.

3.0 Assumptions

No major assumptions are contained in this calculation.

4.0 Reactor Vessel Fluence

The projected (53 EFPY) fluences for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are listed in Table 2.[2] These values are at the clad-base metal interface on the inside surface of the vessel at the location where the material in question receives the highest fluence. The fluence values are for an uprate to 1678 MWth and hafnium rod removal in October 2008 for Point Beach Unit 1 and an uprate to 1678 MWth and hafnium rod removal in April 2008 Point Beach Unit 2.

Table 1. Point Beach Unit 1 and Unit 2 Pressurized Thermal Shock Reference Temperature Applicable to 53 EFPY

Material Description				Chemical Composition									
Reactor Vessel Beltline Region Matl.	Matl. Ident.	Heat Number	Type	Cu wt%	Ni wt%	Chem. Factor	Initial RT_{NDT}, °F	53 EFPY Fluence at Clad-Base Metal Interface, n/cm^2	Fluence Factor	ΔRT_{PTS}, °F	Margin, °F	RT_{PTS}, °F	Screening Criteria
RT_{PTS} Calculation for Unit 1													
Nozzle Belt Forging	122P237	122P237	SA-508 Cl. 2	0.11	0.82	77.0	50	3.58E+18	0.716	55.1	34.0	139.1	270
Intermediate Shell Plate	A9811-1	A9811-1	SA-508 Cl. 2	0.20	0.06	79.3*	1	4.90E+19	1.398	110.9	56.4	168.3	270
Lower Shell Plate	C1423-1	C1423-1	SA-508 Cl. 2	0.12	0.07	35.8*	1	4.55E+19	1.383	49.5	56.4	106.9	270
NB to IS Circ. Weld (100%)	SA-1426	8T1762	Linde 80 Flux	0.19	0.57	167.0	-47.6	3.58E+18	0.716	119.6	65.7	137.7	300
IS Long. Weld (ID 27%)	SA-812	1P0815	Linde 80 Flux	0.17	0.52	167.0	-47.6	3.19E+19	1.305	217.9	65.7	[236.0]	270
IS Long. Weld (OD 73%)	SA-775	1P0661	Linde 80 Flux	0.17	0.64	167.0	-47.6	N/A	N/A	N/A	N/A	N/A	270
Intermediate to LS Circ. Weld (100%)	SA-1101	71249	Linde 80 Flux	0.23	0.59	167.6	-47.4	4.43E+19	1.378	231.0	61.7	245.3	300
LS Long. Weld (100%)	SA-847	61782	Linde 80 Flux	0.23	0.52	167.0	-47.6	3.05E+19	1.295	216.3	65.7	234.4	270
RT_{PTS} Calculation for Unit 2													
Nozzle Belt Forging	123V352	123V352	SA-508 Cl. 2	0.11	0.73	76.0	40	5.04E+18	0.809	61.5	34.0	135.5	270
Intermediate Shell Forging	123V500	123V500	SA-508 Cl. 2	0.09	0.70	58.0	40	5.05E+19	1.404	81.4	34.0	155.4	270
Lower Shell Forging	122W195	122W195	SA-508 Cl. 2	0.05	0.72	42.8*	40	4.90E+19	1.398	59.8	17.0	116.8	270
NB to IS Circ. Weld (100%)	21935	21935	Linde 1092 Flux	0.18	0.70	170.5	-56	5.04E+18	0.809	137.9	65.5	147.4	300
Intermediate to LS Circ. Weld (100%)	SA-1484	72242	Linde 80 Flux	0.26	0.60	180.0	-30	4.65E+19	1.388	249.8	60.8	[280.6]	300

* - Determined from Surveillance Data

[ ] – Limiting reactor vessel beltline region material in accordance with 10 CFR 50.61

Table 2. Fluence (E>1.0 MeV) Values at 53 EFPY for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Materials	Material Ident.	Unit	53 EFPY Fluence, n/cm^2 at the Clad/Base Metal Interface on the Inside Surface
Nozzle Belt Forging (NB)	122P237	1	3.58E+18
Intermediate Shell Plate (IS)	A9811-1	1	4.90E+19
Lower Shell Plate (LS)	C1423-1	1	4.55E+19
NB to IS Circ. Weld (100%)	SA-1426	1	3.58E+18
IS Long. Weld (ID 27%)	SA-812	1	3.19E+19
IS Long. Weld (OD 73%)	SA-775	1	N/A
Intermediate to LS Circ. Weld (100%)	SA-1101	1	4.43E+19
LS Long. Weld (100%)	SA-847	1	3.05E+19
Nozzle Belt Forging (NB)	123V352	2	5.04E+18
Intermediate Shell Forging (IS)	123V500	2	5.05E+19
Lower Shell Forging (LS)	122W195	2	4.90E+19
NB to IS Circ. Weld (100%)	21935	2	5.04E+18
Intermediate to LS Circ. Weld (100%)	SA-1484	2	4.65E+19

5.0 Pressurized Thermal Shock Reference Temperature Calculation Where No Surveillance Data Is Available

The following information is required for determination of the pressurized thermal shock reference temperature in accordance with 10 CFR 50.61.

5.1 Initial RT_{NDT}

The initial RT_{NDT} is the reference temperature for the reactor vessel beltline material in the unirradiated condition, evaluated in accordance with Paragraph NB-2331 of Section III of the ASME Boiler and Pressure Vessel Code.[3]

An alternative initial reference temperature for the Linde 80 beltline welds in the Babcock & Wilcox fabricated reactor vessels is specified in BAW-2308, Revision 1-A, "Initial RT_{NDT} of Linde 80 Weld Materials".[4] This report was reviewed and approved for use by the Nuclear Regulatory Commission.[5] The alternative initial RT_{NDT} values in BAW-2308, Revision 1-A were determined based on brittle-to-ductile transition range fracture toughness test data of these welds obtained in accordance the ASTM Standard E1921 and using ASME Boiler and Pressure Vessel Code Case N-629. Due to the generally low Charpy V-notch upper shelf energy behavior of Linde 80 welds, the testing specified in ASME Code, Section III, Paragraph NB-2331 has been shown to be overly conservative when used to predict the transition from the ductile to brittle failure in Linde 80 welds.

Table 3 lists the initial RT_{NDT} values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials.[4,6]

Table 3. Initial RT_{NDT} for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Materials	Material Ident.	Unit	Initial RT_{NDT}, °F	Reference
Nozzle Belt Forging (NB)	122P237	1	50	6
Intermediate Shell Plate (IS)	A9811-1	1	1	6
Lower Shell Plate (LS)	C1423-1	1	1	6
NB to IS Circ. Weld (100%)	SA-1426	1	-47.6	4
IS Long. Weld (ID 27%)	SA-812	1	-47.6	4
IS Long. Weld (OD 73%)	SA-775	1	-47.6	4
Intermediate to LS Circ. Weld (100%)	SA-1101	1	-47.4	4
LS Long. Weld (100%)	SA-847	1	-47.6	4
Nozzle Belt Forging (NB)	123V352	2	40	6
Intermediate Shell Forging (IS)	123V500	2	40	6
Lower Shell Forging (LS)	122W195	2	40	6
NB to IS Circ. Weld (100%)	21935	2	-56	6
Intermediate to LS Circ. Weld (100%)	SA-1484	2	-30	4

5.2 ΔRT_{NDT}

ΔRT_{NDT} is the mean value of the adjustment in reference temperature caused by irradiation and is calculated as follows:

$$\Delta RT_{NDT} = (CF) * (ff) \quad (1)$$

where CF = Chemistry Factor
ff = fluence factor

5.2.1 Chemistry Factor

The chemistry factor (CF) is determined from the copper and nickel content for each reactor vessel beltline region material. Using the copper and nickel contents for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials,[6] the CF is determined from Table 1 (for weld metals) and Table 2 (for base metals) in 10 CFR 50.61. Linear interpolation is permitted. When determining the CF, the "weight percent copper" and "weight percent nickel" are best estimate values for the material, which will normally be the mean of the measured values for the material. Table 4 lists the chemistry factors for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials.

Table 4. 10 CFR 50.61 Chemistry Factors for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Materials	Material Ident.	Unit	Cu wt%	Ni wt%	Chemistry Factor
Nozzle Belt Forging (NB)	122P237	1	0.11	0.82	77.0
Intermediate Shell Plate (IS)	A9811-1	1	0.20	0.06	79.3*
Lower Shell Plate (LS)	C1423-1	1	0.12	0.07	35.8*
NB to IS Circ. Weld (100%)	SA-1426	1	0.19	0.57	167.0
IS Long. Weld (ID 27%)	SA-812	1	0.17	0.52	167.0
IS Long. Weld (OD 73%)	SA-775	1	0.17	0.64	167.0
Intermediate to LS Circ. Weld (100%)	SA-1101	1	0.23	0.59	167.6
LS Long. Weld (100%)	SA-847	1	0.23	0.52	167.0
Nozzle Belt Forging (NB)	123V352	2	0.11	0.73	76.0
Intermediate Shell Forging (IS)	123V500	2	0.09	0.70	58.0
Lower Shell Forging (LS)	122W195	2	0.05	0.72	42.8*
NB to IS Circ. Weld (100%)	21935	2	0.18	0.70	170.5
Intermediate to LS Circ. Weld (100%)	SA-1484	2	0.26	0.60	180.0

* - determined from surveillance data[6]

5.2.2 Fluence Factor

In accordance with 10 CFR 50.61, the fluence factor (ff) is determined as follows:

$$ff = f^{(0.28 - 0.10 \log f)} \qquad (2)$$

Table 5 lists the fluence factors for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials at 53 EFPY.

Table 5. Fluence Factors Through 53 EFPY for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Materials	Material Ident.	Unit	Fluence, n/cm^2 ($\times 10^{19}$)	Fluence Factor
Nozzle Belt Forging (NB)	122P237	1	3.58E+18	0.716
Intermediate Shell Plate (IS)	A9811-1	1	4.90E+19	1.398
Lower Shell Plate (LS)	C1423-1	1	4.55E+19	1.383
NB to IS Circ. Weld (100%)	SA-1426	1	3.58E+18	0.716
IS Long. Weld (ID 27%)	SA-812	1	3.19E+19	1.305
IS Long. Weld (OD 73%)	SA-775	1	N/A	N/A
Intermediate to LS Circ. Weld (100%)	SA-1101	1	4.43E+19	1.378
LS Long. Weld (100%)	SA-847	1	3.05E+19	1.295
Nozzle Belt Forging (NB)	123V352	2	5.04E+18	0.809
Intermediate Shell Forging (IS)	123V500	2	5.05E+19	1.404
Lower Shell Forging (LS)	122W195	2	4.90E+19	1.398
NB to IS Circ. Weld (100%)	21935	2	5.04E+18	0.809
Intermediate to LS Circ. Weld (100%)	SA-1484	2	4.65E+19	1.388

5.2.3 ΔRT_{NDT} Calculation

The ΔRT_{NDT} values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are calculated by multiplying the chemistry factors and fluence factors. The 53 EFPY ΔRT_{NDT} values for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials are presented in Table 6.

Table 6. ΔRT_{NDT} Values for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Materials	Material Ident.	Unit	Chemistry Factor	Fluence Factor	ΔRT_{NDT}, °F
Nozzle Belt Forging (NB)	122P237	1	77.0	0.716	55.1
Intermediate Shell Plate (IS)	A9811-1	1	79.3	1.398	110.9
Lower Shell Plate (LS)	C1423-1	1	35.8	1.383	49.5
NB to IS Circ. Weld (100%)	SA-1426	1	167.0	0.716	119.6
IS Long. Weld (ID 27%)	SA-812	1	167.0	1.305	217.9
IS Long. Weld (OD 73%)	SA-775	1	167.0	N/A	N/A
Intermediate to LS Circ. Weld (100%)	SA-1101	1	167.6	1.378	231.0
LS Long. Weld (100%)	SA-847	1	167.0	1.295	216.3
Nozzle Belt Forging (NB)	123V352	2	76.0	0.809	61.5
Intermediate Shell Forging (IS)	123V500	2	58.0	1.404	81.4
Lower Shell Forging (LS)	122W195	2	42.8	1.398	59.8
NB to IS Circ. Weld (100%)	21935	2	170.5	0.809	137.9
Intermediate to LS Circ. Weld (100%)	SA-1484	2	180.0	1.388	249.8

5.3 Margin

The "margin" is the quantity that is added to obtain conservative, upper-bound values of the adjusted reference temperature. The margin is determined by the following expression:

$$\text{Margin} = 2\sqrt{\sigma_I^2 + \sigma_\Delta^2} \qquad (3)$$

where σ_I = standard deviation for the initial RT_{NDT}
σ_Δ = standard deviation for ΔRT_{NDT}

If a measured value of initial RT_{NDT} for the material in question is available, σ_I is to be estimated from the precision of the test method. If generic mean values are used, σ_I is the standard deviation obtained from the set of data used to establish the mean.

The standard deviation for ΔRT_{NDT}, σ_Δ, is 28°F for welds and 17°F for base metals, except that σ_Δ need not exceed 0.50 times the mean value of ΔRT_{NDT}. For cases in which the results from a credible plant-specific surveillance program are used, the value of σ_Δ to be used is 14°F for welds and 8.5°F for base metal; the value of need not exceed one-half of RT_{NDT}.

Table 7 lists the margin values calculated for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials through 55 EFPY.

Table 7. Margin Values for the Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials

Beltline Material	Material Ident.	Unit	σ_I	σ_Δ	$\Delta RT_{NDT} / 2$	Margin
Nozzle Belt Forging (NB)	122P237	1	0	17.0*	27.55	34.0
Intermediate Shell Plate (IS)	A9811-1	1	26.9	8.5*	55.45	56.4
Lower Shell Plate (LS)	C1423-1	1	26.9	8.5*	24.75	56.4
NB to IS Circ. Weld (100%)	SA-1426	1	17.2	28*	59.80	65.7
IS Long. Weld (ID 27%)	SA-812	1	17.2	28*	108.95	65.7
IS Long. Weld (OD 73%)	SA-775	1	N/A	N/A	N/A	N/A
Intermediate to LS Circ. Weld (100%)	SA-1101	1	12.9	28*	115.50	61.7
LS Long. Weld (100%)	SA-847	1	17.2	28*	108.15	65.7
Nozzle Belt Forging (NB)	123V352	2	0	17.0*	30.75	34.0
Intermediate Shell Forging (IS)	123V500	2	0	17.0*	40.70	34.0
Lower Shell Forging (LS)	122W195	2	0	8.5*	29.90	17.0
NB to IS Circ. Weld (100%)	21935	2	17.0	28*	68.95	65.5
Intermediate to LS Circ. Weld (100%)	SA-1484	2	11.9	28*	124.90	60.8

* - Used to calculate margin term.

5.4 Calculation of Pressurized Thermal Shock Reference Temperature (RT_{PTS})

The RT_{PTS} is given by the following expression:

$$RT_{PTS} = Initial\ RT_{NDT} + \Delta RT_{NDT} + Margin \quad (4)$$

Table 8 lists the RT_{PTS} calculated for the Point Beach Unit 1 and Unit 2 reactor vessel beltline materials through 55 EFPY.

Table 8. Pressurized Thermal Shock Reference Temperature for Point Beach Unit 1 and Unit 2 Reactor Vessel Beltline Materials Through 53 EFPY

Beltline Materials	Material Ident.	Unit	Initial RT_{NDI},°F	ΔRT_{NDI}, °F	Margin, °F	RT_{PTS}, °F
Nozzle Belt Forging (NB)	122P237	1	50	55.1	34.0	139.1
Intermediate Shell Plate (IS)	A9811-1	1	1	110.9	56.4	168.3
Lower Shell Plate (LS)	C1423-1	1	1	49.5	56.4	106.9
NB to IS Circ. Weld (100%)	SA-1426	1	-47.6	119.6	65.7	137.7
IS Long. Weld (ID 27%)	SA-812	1	-47.6	217.9	65.7	236.0
IS Long. Weld (OD 73%)	SA-775	1	-47.6	N/A	N/A	N/A
Intermediate to LS Circ. Weld (100%)	SA-1101	1	-47.4	231.0	61.7	245.3
LS Long. Weld (100%)	SA-847	1	-47.6	216.3	65.7	234.4
Nozzle Belt Forging (NB)	123V352	2	40	61.5	34.0	135.5
Intermediate Shell Forging (IS)	123V500	2	40	81.4	34.0	155.4
Lower Shell Forging (LS)	122W195	2	40	59.8	17.0	116.8
NB to IS Circ. Weld (100%)	21935	2	-56	137.9	65.5	147.4
Intermediate to LS Circ. Weld (100%)	SA-1484	2	-30	249.8	60.8	280.6

6.0 Pressurized Thermal Shock Reference Temperature Calculation Where Surveillance Data is Available

To verify that the RT_{PTS} for each vessel beltline material is a bounding value for the reactor vessel, plant specific information shall be considered. This information includes, but is not limited to, the reactor vessel operating temperature and surveillance program results.

The results from the plant-specific surveillance program must be integrated into the RT_{PTS} estimate if the plant-specific surveillance data has been deemed credible as judged by the following criteria:

1. The materials in the surveillance capsules must be those which are the controlling materials with regard to radiation embrittlement.

2. Scatter in the plots of Charpy energy versus temperature for the irradiated and unirradiated conditions must be small enough to permit the determination of the 30 ft-lb temperature unambiguously.

3. Where there are two or more sets of surveillance data from one reactor, the scatter of ΔRT_{NDI} values must be less than 28°F for welds and 17°F for base metal. Even if the range in the capsule fluences is large (two or more orders of magnitude); the scatter may not exceed twice those values.

4. The irradiation temperature of the Charpy specimens in the capsule must equal the vessel wall temperature at the cladding/base metal interface within ±25°F.

5. The surveillance data for the correlation monitor material in the capsule, if present, must fall within the scatter band of the data base for the material.

The surveillance data deemed credible according to the criteria specified above must be used to determine a material-specific value of CF for use in the following equation:

$$\Delta RT_{NDT} = CF * ff \quad (5)$$

A material-specific value of CF is determined from the following equation:

$$CF = \frac{\sum_{i=1}^{n} [A_i * ff_i]}{\sum_{i=1}^{n} ff_i^2} \quad (6)$$

where: n = number of surveillance data points

A_i = measured value of ΔRT_{NDT}

ff_i = fluence factor for each surveillance data point.

For cases in which the results from a credible plant-specific surveillance program are used, the value of σ_Δ to be used is 14°F for welds and 8.5°F for base metals; however the value of σ_Δ may not exceed one-half ΔRT_{NDT}.

The base metal evaluations done in reference 6 for base metals pertinent to this document are still valid. There have been 6 RVSP Capsule reports reporting Charpy shift data for Linde 80 welds since reference 6 was issued in 1999. The applicable Linde 80 welds for Point Beach Unit 1 and Unit 2 are evaluated in Section 6.4.

6.1 Surveillance Data Credibility Assessment

$$\textit{Temperature Adjusted } \Delta RT_{NDT,\,normalized} = \Delta RT_{NDT,\,measured} + 1.0 * (T_{capsule} - T_{capsule\ mean}) \quad (7)$$

For the reactor vessels, numerous surveillance data are available for evaluation of irradiation embrittlement.

When assessing credibility for surveillance data from several sources, the capsule data may have to be adjusted to account for the irradiation environment and chemical composition differences.

Additionally, if the surveillance data are from multiple sources, it is necessary to adjust the capsule data for chemical composition (copper and nickel content) differences. For the credibility determination, the

surveillance data are normalized to the mean copper and nickel contents of the surveillance materials using the following equation:

$$\textit{Ratio Adjusted } \Delta RT_{NDT,\,normalized} = \left(\frac{CF_{Table,\,Surv.\,Avg.\,Chem.}}{CF_{Table,\,Surv.\,Chem.}} \right) * \Delta RT_{NDT,\,measured} \qquad (8)$$

A best-fit line (least squares regression) is then determined from the adjusted ΔRT_{NDT} capsule surveillance data as a function of the capsule fluence factor.

The data are considered credible if the difference between the adjusted ΔRT_{NDT} (i.e., chemistry adjusted) and the predicted ΔRT_{NDT} (from the best-fit line) for all the data is within ±28°F for weld metals and ±17°F for base metals.

6.2 Credible Surveillance Data

In accordance with Regulatory Guide 1.99, Revision 2 and 10 CFR 50.61, credible surveillance data are used to determine material-specific chemistry factor values for use in reactor vessel integrity assessments. The chemistry factor is determined from a best-fit line through the surveillance data adjusted to account for differences in chemical composition (i.e., copper and nickel contents) and irradiation environment (i.e., irradiation temperature) between the capsules and the vessel. The surveillance data are adjusted in the same manner as for the credibility determination except that the 30 ft-lb transition temperature values are normalized to the best estimate copper and nickel contents and the irradiation temperature of the vessel being assessed.

6.3 Non-Credible Surveillance Data

If the surveillance data are determined to be non-credible, the chemistry factor value is calculated from the generic Tables in 10 CFR 50.61 and Regulatory Guide 1.99, Revision 2 unless the chemistry factor determined from the surveillance data is significantly greater than that from the generic Tables, indicating that the Table chemistry factor is non-conservative. To determine if the generic Table chemistry factor is non-conservative, the following steps are performed:

1. Determine the chemistry factor from the generic Tables based on the surveillance specimen chemical composition; use this chemistry factor to determine the predicted ΔRT_{NDT} for each capsule:

$$(\textit{Predicted } \Delta RT_{NDT} = CF_{Table,\,Surv.\,Avg.\,Chem.} * ff_{capsule})$$

2. Determine difference between the predicted ΔRT_{NDT} and the measured ΔRT_{NDT}.

If the difference between the predicted ΔRT_{NDT} and the measured ΔRT_{NDT} values exceeds 2 standard deviations (i.e., 56°F for weld metals and 34°F for base metals), the Table chemistry factor is considered non-conservative. When the Table chemistry factor is determined to be non-conservative, the chemistry factor determined from the "non-credible" surveillance data is used in the assessment of reactor vessel integrity using the "full" value of σ_Δ in calculating the Margin term.

6.4 Assessment of Weld Wire Heat Surveillance Data

The following tables provide the credibility assessment of the weld wire heats 71249, 61782, and 72442.

NOTE: The original Charpy V-notch impact data are based on hand-fit Charpy curves using engineering judgment; these data were using a hyperbolic tangent curve fitting program to achieve consistency in the interpretation of the available surveillance test data.

Table 9. Credibility Assessment for Weld Wire Heat Number 71249[6,7,8]

Capsule Designation	Cu wt%	Ni wt%	Chem. Factor	Irrad. Temp. (°F)	Fluence ($x10^{19}$n/cm^2)	Fluence Factor	Meas. ΔRT_{NDT} (°F)	Temp. Adj. ΔRT_{NDT} (°F)	Ratio Adj. ΔRT_{NDT} (°F)	Pred. ΔRT_{NDT} (°F) from best fit line	(Adjusted – Predicted) ΔRT_{NDT} (°F)
Turkey Point Unit 3: Capsule T SA-1101: Plant Specific RVSP Material	0.33	0.57	201.3	546	0.739	0.915	166	165	163.3	158.1	5.2
Turkey Point Unit 3: Capsule V SA-1101: Plant Specific RVSP Material	0.33	0.57	201.3	546	1.530	1.118	179	178	176.2	193.1	-16.9
Turkey Point Unit 4: Capsule T SA-1094: Plant Specific RVSP Material	0.29	0.60	191.0	546	0.708	0.903	211	210	219.0	156.0	63.0
Turkey Point Unit 3: Capsule X SA-1101: Plant Specific RVSP Material	0.33	0.57	201.3	546	2.900	1.283	191	190	188.0	221.6	-33.6
B&WOG: Capsule A5 SA-1101: TP-3 Plant Specific RVSP Matl.	0.33	0.57	201.3	551	2.572	1.253	215	219	216.7	216.5	0.2
Surv. Avg.	0.322	0.576	199.2	547							

where ***Predicted ΔRT_{NDT} = ($Slope_{best\ fit}$) * (Fluence Factor)*** and

$Slope_{best\ fit}$ = best fit line relating Adjusted ΔRT_{NDT} to the Fluence Factor
(i.e., 172.8)

These data points are not credible since the scatter is greater than ±28°F for two surveillance points.

Table 10. Table Chemistry Factor Non-Conservatism Assessment for Weld Wire Heat Number 71249

Capsule Designation	Table Chem. Factor (Surv. Avg.)	Capsule Fluence Factor	Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F)	(Adjusted – Predicted) ΔRT_{NDT} (°F)
Turkey Point Unit 3: Capsule T SA-1101: Plant Specific RVSP Material	199.2	0.915	163.3	182.5	-19.2
Turkey Point Unit 3: Capsule V SA-1101: Plant Specific RVSP Material	199.2	1.118	176.2	222.7	-46.5
Turkey Point Unit 4: Capsule T SA-1094: Plant Specific RVSP Material	199.2	0.903	219.0	179.9	39.1
Turkey Point Unit 3: Capsule X SA-1101: Plant Specific RVSP Material	199.2	1.283	188.0	255.6	-67.6
B&WOG: Capsule A5 SA-1101: TP-3 Plant Specific RVSP Matl.	199.2	1.253	216.7	249.6	-32.9

The above assessment results indicate that the generic Table chemistry factor for the surveillance data grossly over-predicts the adjusted measured data. Therefore, the Table chemistry factor calculated using the weld wire heat best-estimate copper and nickel contents is considered conservative.

Table 11. Credibility Assessment for Weld Wire Heat Number 61782 [6,9]

Capsule Designation	Cu wt%	Ni wt%	Chem. Factor	Irrad. Temp. (°F)	Fluence ($x10^{19}$n/c m^2)	Fluence Factor	Meas. ΔRT_{NDT} (°F)	Temp. Adjusted ΔRT_{NDT} (°F)	Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F) from Best Fit Line	(Adjusted - Predicted) ΔRT_{NDT} (°F)
R. E. Ginna: Capsule V SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	0.5028	0.808	146	142	149	124	25
R. E. Ginna: Capsule R SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	1.105	1.028	167	163	170	157	13
R. E. Ginna: Capsule T SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	1.864	1.171	169	165	173	179	-7
R. E. Ginna: Capsule S SA-1036: Plant Specific RVSP Material	0.24	0.52	161.4	545	3.746	1.342	223	219	229	205	23
B&WOG: Capsule DB1-LG1 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	0.27	0.59	182.6	556	1.030	1.008	138	145	134	154	-20
B&WOG: Capsule DB1-LG2 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	0.27	0.59	182.6	556	1.635	1.136	146	153	141	174	-32
Surv. Avg.	0.250	0.543	168.5	548.7							

where ***Predicted ΔRT_{NDT} = ($Slope_{best\ fit}$) * (Fluence Factor)*** and

$Slope_{best\ fit}$ = best fit line relating Adjusted ΔRT_{NDT} to the Fluence Factor
(i.e., 153.1)

These data points are not credible since the scatter is greater than ±28°F for two surveillance points.

Table 12. Table Chemistry Factor Non-Conservatism Assessment for Weld Wire Heat Number 61782

Capsule Designation	Table Chem. Factor (Surv. Avg.)	Capsule Fluence Factor	Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F)	(Adjusted – Predicted) ΔRT_{NDT} (°F)
R. E. Ginna: Capsule V SA-1036: Plant Specific RVSP Material	168.5	0.808	149	136.1	12.9
R. E. Ginna: Capsule R SA-1036: Plant Specific RVSP Material	168.5	1.028	170	173.2	-3.2
R. E. Ginna: Capsule T SA-1036: Plant Specific RVSP Material	168.5	1.171	173	197.3	-24.3
R. E. Ginna: Capsule S SA-1036: Plant Specific RVSP Material	168.5	1.342	229	226.1	2.9
B&WOG: Capsule DB1-LG1 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	168.5	1.008	134	169.8	-35.8
B&WOG: Capsule DB1-LG2 SA-1135: ONS-2 Nozzle Belt Dropout Matl.	168.5	1.136	141	191.4	-50.4

Since the scatter for all data points is less than 2 standard deviations (56°F), the Table chemistry factor is conservative.

Table 13. Credibility Assessment for Weld Wire Heat Number 72442[10]

Capsule Designation	Cu wt%	Ni wt%	Chem. Factor	Irrad. Temp (°F)	Fluence ($x10^{19}$ n/cm^2)	Fluence Factor	Meas. RT_{NDT} (°F)	Predicted RT_{NDT} from best fit line (°F)	(Measured – Predicted) ΔRT_{NDT} (°°F)
B&WOG: Capsule CR3-LG1 WF-67L: MD1 Nozzle Belt Dropout Matl.	0.22	0.60	167.0	556	0.609	0.861	167	126.9	40.1
B&WOG: Capsule CR3-LG1 WF-67L: MD1 Nozzle Belt Dropout Matl	0.22	0.60	167.0	556	1.950	1.182	138	174.2	-36.2
B&WOG: PWR-5 WF-67	0.22	0.60	167.0	556	1.140	1.037	161	152.9	8.1
Surv. Avg.	0.22	0.60	167.0	556					

where ***Predicted ΔRT_{NDT} = (Slope$_{best\ fit}$) * (Fluence Factor)*** and

Slope$_{best\ fit}$ = best fit line relating Adjusted ΔRT_{NDT} to the Fluence Factor
(i.e., 147.4)

These data points are not credible since the scatter is greater than ±28°F for two surveillance points.

Table 14. Table Chemistry Factor Non-Conservatism Assessment for Weld Wire Heat Number 72442

Capsule Designation	Table Chem. Factor (Surv. Avg.)	Capsule Fluence Factor	Adjusted ΔRT_{NDT} (°F)	Predicted ΔRT_{NDT} (°F)	(Adjusted – Predicted) ΔRT_{NDT} (°F)
B&WOG: Capsule CR3-LG1 WF-67L: MD1 Nozzle Belt Dropout Matl.	167.0	0.861	167	143.8	23.2
B&WOG: Capsule CR3-LG1 WF-67L: MD1 Nozzle Belt Dropout Matl	167.0	1.182	138	197.4	-59.4
B&WOG: PWR-5 WF-67	167.0	1.037	161	173.2	-12.2

The above assessment results indicate that the generic Table chemistry factor for the surveillance data grossly over-predicts the adjusted measured data. Therefore, the Table chemistry factor calculated using the weld wire heat best-estimate copper and nickel contents is considered conservative.

7.0 References

1. Code of Federal Regulations, Title 10, "Domestic Licensing of Production and Utilization Facilities," Part 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock," Effective Date: August 28, 1996.

2. AREVA Document 38-9008745-000, "NMC Letter Dated June 29, 2004 with Westinghouse Attachment," December 2005.

3. American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, *Nuclear Power Plant Components,* Subsection NB, Class 1 Components.

4. AREVA Document 43-2308-02, "Initial RT_{NDT} of Linde 80 Weld Materials," (BAW-2308 Rev. 1-A), August 2005.

5. Nuclear Regulatory Commission, "Safety Evaluation for Topical Report BAW-2308, Revision 1, 'Initial RTNDT of Linde 80 Weld Materials' (TAC No. MB6636)," August 2005.

6. AREVA Document 77-2355-01, "B&WOG Reactor Vessel Working Response to Request for Additional Information (RAI) Regarding Reactor Pressure Vessel Integrity," (BAW-2355 Rev. 1), January 1999.

7. WCAP-15916, "Analysis of Capsule X from the Florida Power and Light Company Turkey Point Unit 3 Reactor Vessel Radiation Surveillance Program," September 2002, NRC public document number ML022940497.

8. AREVA Document 77-2350-00, "Test Results of W1 Capsule, B&WOG Owner's Group, Master Integrated Reactor Vessel Surveillance Program," (BAW-2350), April 1999.

9. AREVA Document 43-2486-000, "Analysis of the B&W Owner's Group Capsule DB1-LG2," (BAW-2486), December 2005.

10. AREVA Document 77-2313-005, "B&WOG Reactor Vessel Working Group, Reactor Vessel Materials and Surveillance Data Information," (BAW-2313, Revision 5), December 2005.

ENCLOSURE 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

SUPPLEMENT 2 TO LICENSE AMENDMENT REQUEST 252
TECHNICAL SPECIFICATION 5.6.5, REACTOR COOLANT SYSTEM (RCS)
PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

MARK-UP OF TRM 2.2
PRESSURE TEMPERATURE LIMITS REPORT

16 pages follow

Note: Applicability limits for pressure temperature limits are discussed in Section 2.0, "Operating Limits."

1.0 RCS PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

This RCS Pressure and Temperature Limits Report (PTLR) for Point Beach Nuclear Plant Units 1 and 2 has been prepared in accordance with the requirements of Technical Specification 5.6.5.

The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC; specifically those described in NRC Safety Evaluations dated October 6, 2000, July 23, 2001, ~~and~~ October 18, 2007, and XXXXXXX..

The PTLR shall be provided to the NRC upon issuance for each reactor vessel fluence period and for any revision or supplement thereto (Ref 5.19). Based upon fluence values in Westinghouse ~~report LTR-REA-08-144~~ WCAP-16983-P (Ref 5.15), this PTLR is effective for ~~35.9~~ 50 EFPY (approximately ~~June 2014~~ 2029). ~~(Ref 5.8)~~

The Technical Specifications addressed in this report are listed below:

1.1 3.4.3 Pressure/Temperature (P-T) Limits

1.2 3.4.12 Low Temperature Overpressure Protection (LTOP) System

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. Changes to these limits must be developed using the NRC approved methodologies specified in Technical Specification 5.6.5. These limits have been determined such that applicable limits of the safety analysis are met. Items that appear in capitalized type are defined in Technical Specification 1.1, "Definitions."

2.1 RCS Pressure and Temperature Limits (LCO 3.4.3)

2.1.1 The RCS temperature rate-of-change limits are:

a. A maximum heatup rate of 100°F in any one hour.

b. A maximum cooldown rate of 100°F in any one hour.

c. An average temperature change of ≤10°F per hour during inservice leak and hydrostatic testing operations.

2.1.2 The RCS P-T limits for heatup and cooldown are specified by Figures 1 and 2, respectively. (Ref 5.2)

2.1.3 The minimum temperature for pressurization or bolt up, using the methodology, is 60°F, which when corrected for possible instrument uncertainties is a minimum indicated RCS temperature of 78°F (as read on the RCS cold leg meter) or 70°F using the hand-held, digital pyrometer.

2.2 Low Temperature Overpressure Protection System Enable Temperature (LCO 3.4.6, 3.4.7, 3.4.10 and 3.4.12)

The enable temperature for the Low Temperature Overpressure Protection System is 285°F (includes instrument uncertainty for RCS T_c wide range). (Ref 5.4)

2.3 Low Temperature Overpressure Protection System Setpoints (LCO 3.4.12)

Pressurizer Power-Operated Relief Valve Lift Setting Limits

The limiting trip setpoint (Ref 5.26) for the pressurizer power-operated relief valves (PORVs) is ≤420 psig (includes instrument uncertainty).

The following operating restrictions ensure continued operability of the LTOP system:

2.3.1 RCP Operating Restriction - No more than one RCP in operation for RCS temperature <180°F. (Ref 5.20 to 5.24)

2.3.2 Charging Pumps - Limit the number of operating charging pumps to two when LTOP is in service. (Ref 5.20 to 5.24)

2.4 Criticality and Hydrostatic Leak Test Limits

2.4.1 Criticality and hydrostatic leak test limits are shown on the RCS Pressure Temperature Limits for heatup, Figure 1. (Ref 5.2)

3.0 REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM

The reactor vessel material irradiation surveillance specimens shall be removed and examined to determine changes in material properties. The removal schedules for Units 1 and 2 are provided in Tables 1 and 2, respectively.

For the period of the renewed facility operating license, all capsules in the reactor vessel that are removed and tested shall meet the test procedures and reporting requirements of ASTM E 185-82. Any changes to the capsule withdrawal schedule, including spare capsules, shall be approved by the NRC prior to implementation. (Ref 5.16 and 5.17)

The pressure vessel surveillance program is in compliance with Appendix H to 10 CFR 50, entitled, "Reactor Vessel Radiation Surveillance Program." The material test requirements and the acceptance standard utilize the nil-ductility temperature, RT_{NDT}, which is determined in accordance with ASTM E208. The empirical relationship between RT_{NDT} and the fracture toughness of the reactor vessel steel is developed in accordance with Appendix G, "Protection Against Non-Ductile Failure," to Section XI of the ASME Boiler and Pressure Vessel Code. The surveillance capsule removal schedule meets the requirements of ASTM E185-82.

Surveillance specimens for the limiting materials for the PBNP reactor vessels are not included in the plant specific surveillance program. Therefore, the results of the examinations of these specimens do not meet the credibility criteria of Regulatory Guide 1.99, Revision 2, for PBNP Units 1 and 2.

During the period of extended operation, reactor vessel surveillance capsules will be removed and tested in accordance with the schedule contained in the most recently NRC-approved Pressurized Water Reactor Owners Group (PWROG) Master Integrated Reactor Vessel Surveillance Program (MIRVSP) Document. (Ref. 5.5)(Ref 5.25)

4.0 SUPPLEMENTAL DATA INFORMATION

The limiting RT_{PTS} values for the PBNP limiting beltline materials at ~~35.9~~ 50 EFPY are:

- Unit 1 - Intermediate to Lower Shell Circ Weld = ~~281.0~~ 236.0 °F; Lower Shell Axial Weld = ~~250.3~~ 234.4 °F (Ref. ~~5.8, Attachment A~~ 5.8 Table 1
- Unit 2 - Intermediate to Lower Shell Circ Weld = ~~295.1~~ 280.6 °F; Intermediate Shell Forging = ~~150.2~~ 155.4 °F (Ref. ~~5.8, Attachment A~~ 5.8 Table 1)

5.0 REFERENCES

5.1 WCAP-14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," Revision ~~2, January 1996~~ 4, May 2004

5.2 ~~WCAP-15976~~, WCAP-16669, "Point Beach Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," Revision 1, ~~March 2008~~ January 2009

5.3 WEPCO Calculation Addendum No. 98-0156-00-A, Revision 0, "Evaluation of New Surveillance Data on Chemistry Factor for Weld Wire Heat 61782, Point Beach Unit 1," 9/22/1999

5.4 Westinghouse Letter ~~WEP-08-25, "Transmittal of LTOPS Setpoint Evaluation," dated March 14, 2008~~ Low Temperature Overpressure Protection System (LTOPS) Setpoint Analysis, January 2007

5.5 PWR Owner Group Topical Report BAW-1543(NP), Revision 4, Supplement 6-A, "Supplement to the Master Integrated Reactor Vessel Surveillance Program" (TAC No. MC9608), June 2007

5.6 BAW-2325, "Response to Request for Additional Information (RAI) Regarding Reactor Pressure Vessel Integrity," May 1998

5.7 CEOG Report "Best Estimate Copper and Nickel Values in CE Fabricated Reactor Vessel Welds," CE NPSD-1039, Revision 2, Final Report, June 1997

5.8 ~~Westinghouse Letter LTR-PCAM-08-57, "Point Beach Units 1 and 2 EPU P-T Limit Curve Applicability Determination and Related Calculations," dated December 2008~~ Areva Calculation 32-9019238-000, RTPTS Values for Point Beach Unit 1 and Unit 2, Revision 0, May 2006

5.9 ASME B&PVC Code Case N-641, "Alternative Pressure-Temperature Relationship and Low Temperature Overpressure Protection System Requirements, Section XI, Division 1"

5.10 NRC Letter, "Point Beach Nuclear Plant, Units 1 and 2 – Exemption from the Requirements of 10CFR50.60 (TAC NOS. MA9680 and MA9681)," dated October 6, 2000

5. 11 NRC Letter, "Point Beach Nuclear Plant, Units 1 and 2 – Acceptance of Methodology for Referencing Pressure Temperature Limits Report (TAC Nos. MA8459 and MA8460)," dated July 23, 2001

5. 12 NRC Letter, "Point Beach Nuclear Plant, Units 1 and 2 – Issuance of Amendments RE: The Conversion to Improved Technical Specifications (TAC Nos. MA7186 and MA7187)," dated August 8, 2001

5.13 ~~Deleted~~ Areva Calculation 32-9019240-000, ART Values for Point Beach Unit 1 and Unit 2, Revision 0, May 2006

5.14 NRC SE "Amendment Nos. 229/234 to Facility Operating Licenses DPR-24 and DPR-27, (approving use of FERRET Code as approved methodology for determining RCS pressure and temperature limits)," dated October 18, 2007

~~5.15 Westinghouse Letter LTR-REA-08-144, "Summary of Neutron Fluence Evaluations for the Point Beach Units 1 and 2 Extended Power Uprate," dated January 2009~~
WCAP-16983-P, Point Beach Units 1 and 2 Extended Power Uprate (EPU) Engineering Report

5.16 Renewed Facility Operating License DPR-24, Point Beach Nuclear Plant Unit 1

5.17 Renewed Facility Operating License DPR-27, Point Beach Nuclear Plant Unit 2

5.18 Deleted

5.19 Root Cause Evaluation 01092944, "Apparent Non-compliance with TS 5.6.5.c," Corrective Action to Prevent Recurrence (CATPR) 2 Root Cause (RC)2.

5.20 CL 4C, Low Temperature Overpressurization Protection Unit 1

5.21 CL 4C, Low Temperature Overpressurization Protection Unit 2

5.22 OP 3C, Hot Standby to Cold Shutdown

5.23 OP 4B, Reactor Coolant Pump Operation

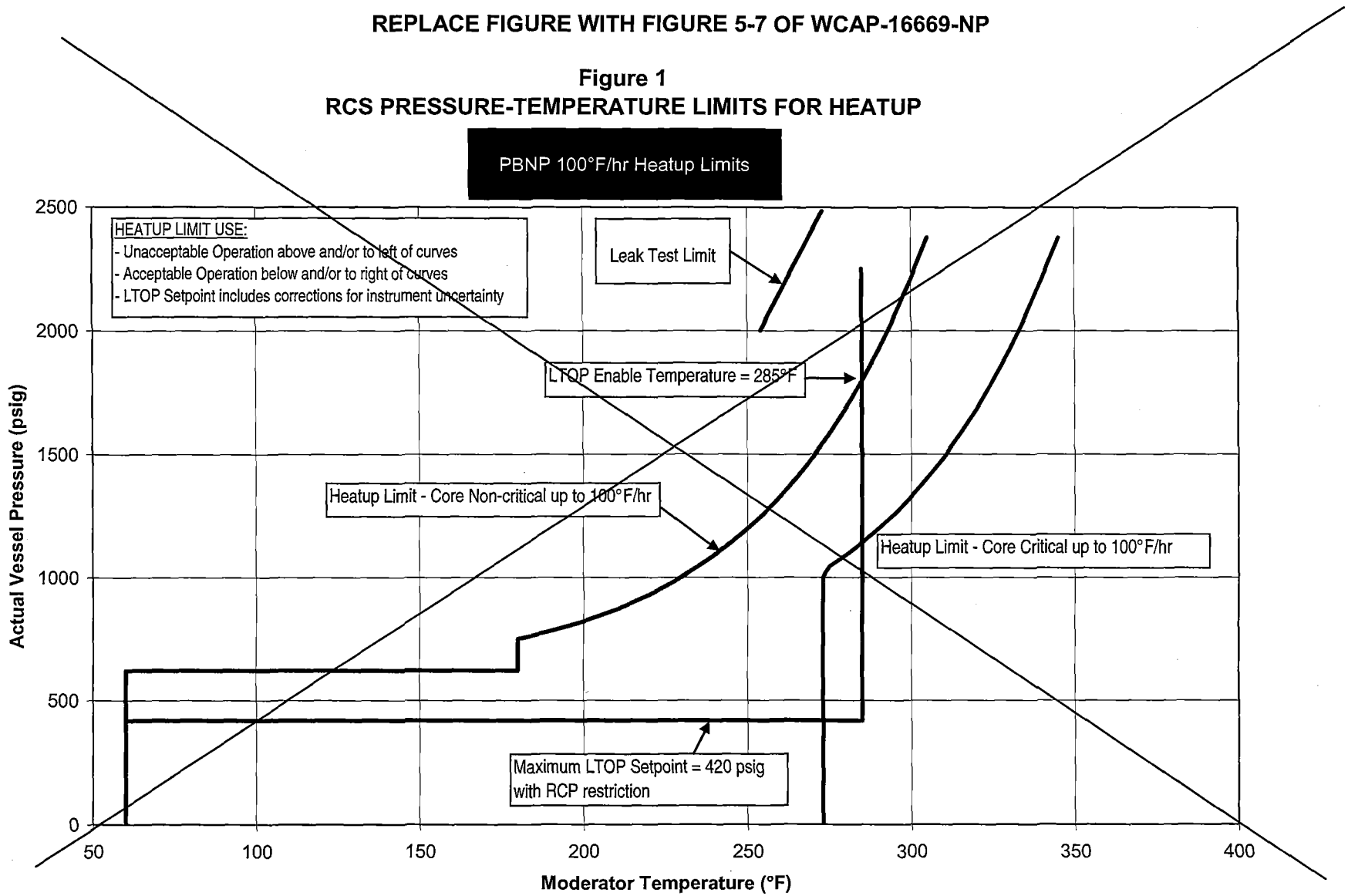
5.24 OP 1A, Cold Shutdown to Hot Standby

5.25 NextEra Point Beach Letter, "Reactor Vessel Surveillance Program Request to Change Reactor Vessel Surveillance Specimen Withdrawal Schedule," dated January 19, 2010

5.26 Point Beach Nuclear Plan Design Guide DG-I01, Instrument Setpoint Methodology

REPLACE FIGURE WITH FIGURE 5-7 OF WCAP-16669-NP

Figure 1
RCS PRESSURE-TEMPERATURE LIMITS FOR HEATUP



MATERIAL PROPERTY BASIS

LIMITING MATERIAL: Intermediate Shell Longitudinal Welds SA-812 (ID) and SA-775 (OD)
LIMITING ART VALUES AT 53 EFPY (Hafnium Removal): 1/4T, 220.0°F
3/4T, 184.6°F

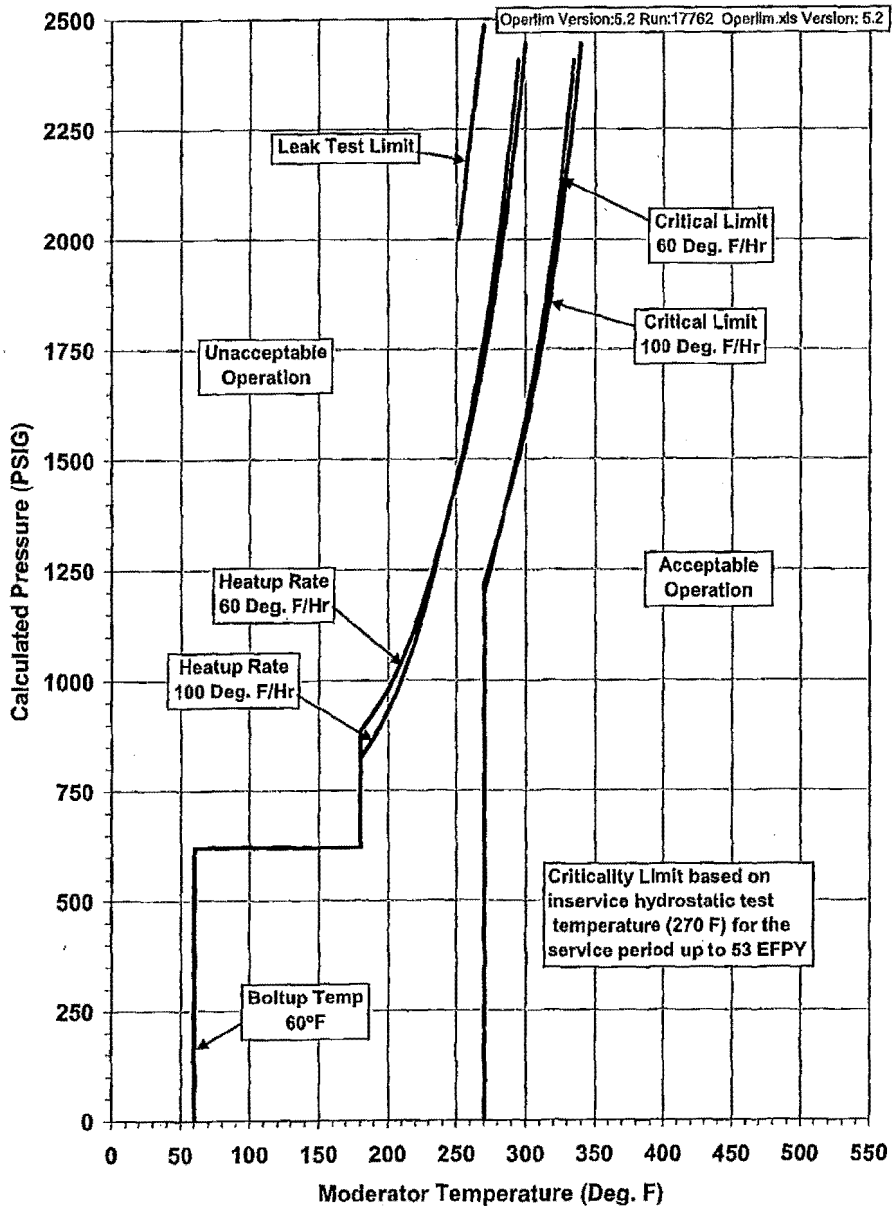
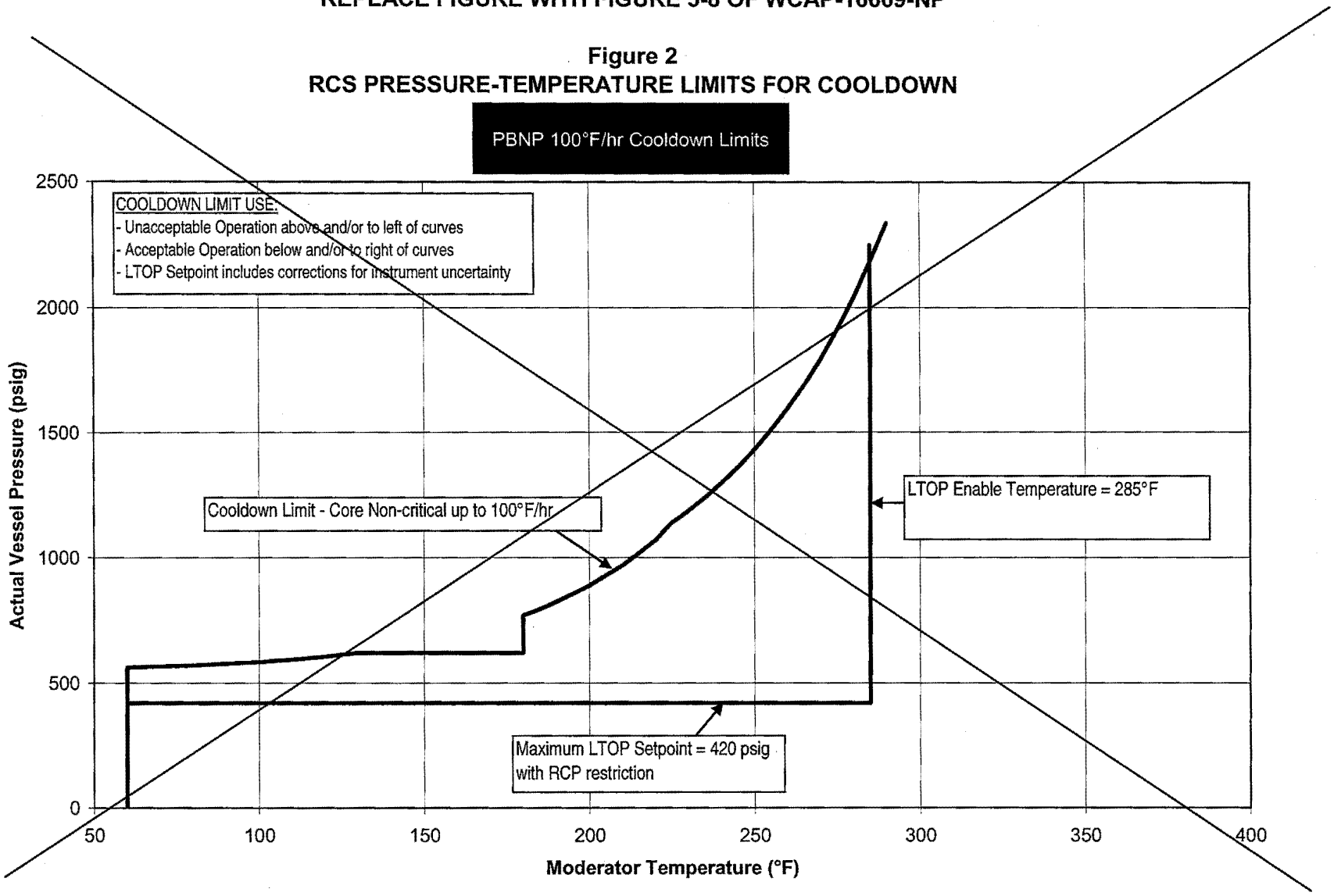


Figure 5-7 Point Beach Units 1 and 2 Reactor Coolant System Heatup Limitations (Heatup Rates of 60 and 100°F/hr) Applicable for 53 EFPY (with Hafnium Removal and without Margins for Instrumentation Errors) Using 1998 App. G Methodology (w/K_{Ic})

REPLACE FIGURE WITH FIGURE 5-8 OF WCAP-16669-NP

Figure 2
RCS PRESSURE-TEMPERATURE LIMITS FOR COOLDOWN



MATERIAL PROPERTY BASIS

LIMITING MATERIAL: Intermediate Shell Longitudinal Welds SA-812 (ID) and SA-775 (OD)
LIMITING ART VALUES AT 53 EFPY (Hafnium Removal): 1/4T, 220.0°F
3/4T, 184.6°F

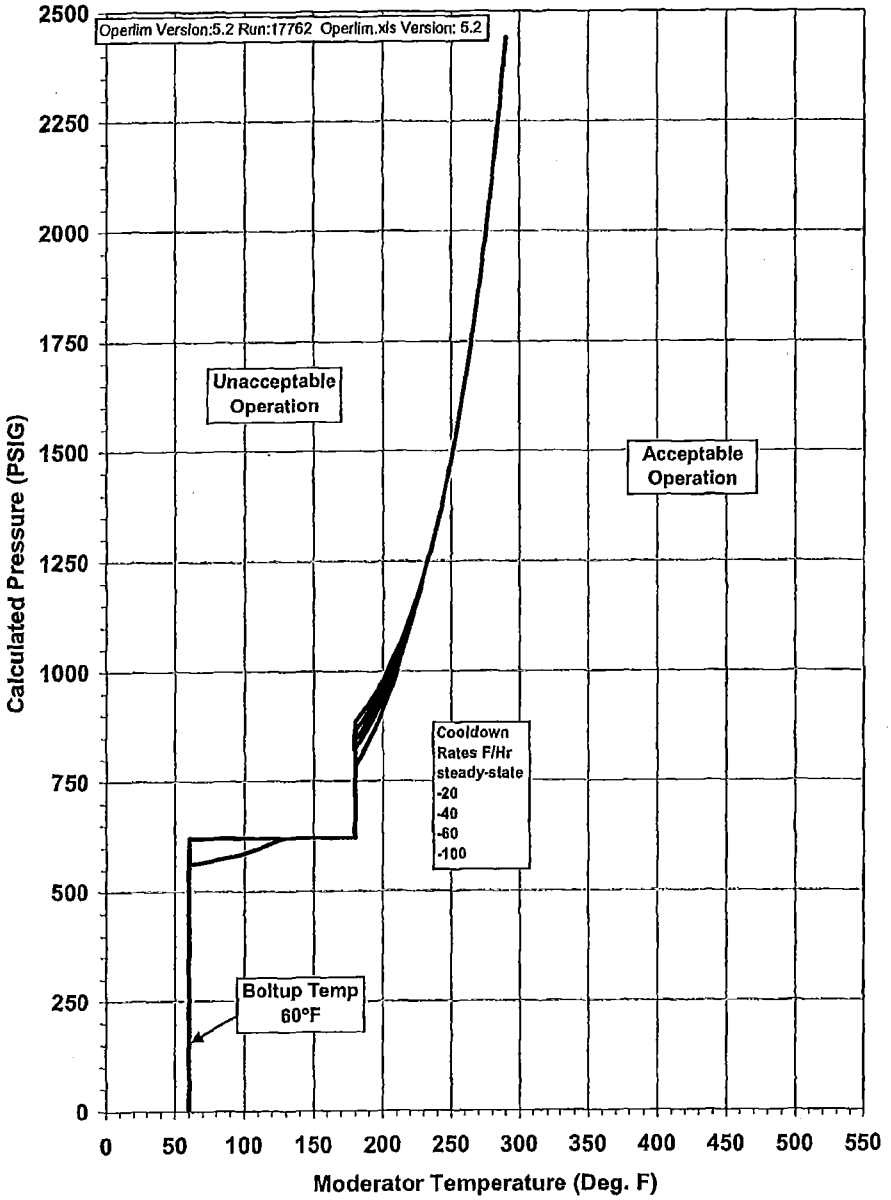


Figure 5-8 Point Beach Units 1 and 2 Reactor Coolant System Cooldown Limitations (Cooldown Rates up to 100°F/hr) Applicable for 53 EFPY (with Hafnium Removal and without Margins for Instrumentation Errors) Using 1998 App. G Methodology (w/K_{Ic})

TABLE 1 (**)
POINT BEACH NUCLEAR PLANT UNIT 1
REACTOR VESSEL SURVEILLANCE CAPSULE REMOVAL SCHEDULE

Capsule Identification Letter	Approximate Removal Date*
V	September 1972 (actual)
S	December 1975 (actual)
R	October 1977 (actual)
T	March 1984 (actual)
P	April 1994 (actual)
N	Standby

* The actual removal dates will be adjusted to coincide with the closest scheduled plant refueling outage or major reactor plant shutdown.

** During the period of extended operation, reactor vessel surveillance capsules will be removed and tested in accordance with the schedule contained in the most recently NRC-approved Pressurized Water Reactor Owners Group (PWROG) Master Integrated Reactor Vessel Surveillance Program (MIRVSP) Document. (Ref. 5.5)(Ref 5.25)

TABLE 2 (**)
POINT BEACH NUCLEAR PLANT UNIT 2
REACTOR VESSEL SURVEILLANCE CAPSULE REMOVAL SCHEDULE

Capsule Identification Letter	Approximate Removal Date*
V	November 1974 (actual)
T	March 1977 (actual)
R	April 1979 (actual)
S	October 1990 (actual)
P	June 1997 (actual)
N	Standby
A	April 2022

* The actual removal dates will be adjusted to coincide with the closest scheduled plant refueling outage or major reactor plant shutdown.

** During the period of extended operation, reactor vessel surveillance capsules will be removed and tested in accordance with the schedule contained in the most recently NRC-approved Pressurized Water Reactor Owners Group (PWROG) Master Integrated Reactor Vessel Surveillance Program (MIRVSP) Document. (Ref. 5.5)(Ref 5.25).

TABLE 3
POINT BEACH UNIT 1 RPV BELTLINE ~~35.9~~ **50** EFPY VALUES[E]

Based on Westinghouse Report ~~WCAP-15976~~,WCAP-16669, Revision 1, "Point Beach Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," (Ref 5.2). ~~Note that the estimated fluence at a specific point in time is not linearly interpolated between zero and the estimated fluence at 36.9 EFPY, due to changes in core design at certain points in the operating history of the unit. Although the analysis in WCAP-15976 is based on 36.9 EFPY, the applicability of the analysis is now 35.9 EFPY per LTR-PCAM-08-57, "Point Beach Units 1 and 2 EPU P-T Limit Curve Applicability Determination and Related Calculations" (Ref 5.8).~~

Vessel Manufacturer:	Babcock & Wilcox
Plate and Weld Thickness (without cladding):	6.5", without clad [D]

Component Description	Heat or Heat/Lot	~~35.9 EFPY~~ [E] Inside Surface Fluence (E19 n/cm^2)	~~35.9 EFPY~~ [E] 1/4T Fluence (E19 n/cm^2) [B]	~~35.9 EFPY~~ [E] 1/4T Fluence Factor [C]	~~35.9 EFPY~~ [E] 3/4T Fluence (E19 n/cm^2) [B]	~~35.9 EFPY~~ [E] 3/4T Fluence Factor [C]
Nozzle Belt Forging	122P237	~~0.25~~ 0.36	~~0.17~~ 0.24	~~0.53~~ 0.62	~~0.08~~ 0.11	~~0.37~~ 0.44
Intermediate Shell Plate	A9811-1	~~3.38~~ 4.90	~~2.29~~ 3.32	~~1.22~~ 1.31	~~1.05~~ 1.52	~~1.01~~ 1.12
Lower Shell Plate	C1423-1	~~3.04~~ 4.55	~~2.06~~ 3.08	~~1.20~~ 1.30	~~0.94~~ 1.41	~~0.98~~ 1.10
Nozzle Belt to Intermed. Shell Circ Weld (100%)	8T1762 (SA-1426)	~~0.25~~ 0.36	~~0.17~~ 0.24	~~0.53~~ 0.62	~~0.08~~ 0.11	~~0.37~~ 0.44
Intermediate Shell Long Seam (ID 27%)	1P0815 (SA-812)	~~2.19~~ 3.19	~~1.48~~ 2.16	~~1.11~~ 1.21	N/A	N/A
Intermediate Shell Long Seam (OD 73%) [A]	1P0661 (SA-775)	~~2.19~~ 3.19	N/A	N/A	~~0.68~~ 0.99	~~0.89~~ 1.00
Intermed. to Lower Shell Circ. Weld (100%)	71249 (SA-1101)	~~3.05~~ 4.43	~~2.07~~ 3.00	~~1.20~~ 1.29	~~0.95~~ 1.38	~~0.99~~ 1.09
Lower Shell Long Seam (100%) [A]	61782 (SA-847)	~~2.08~~ 3.05	~~1.41~~ 2.07	~~1.10~~ 1.20	~~0.65~~ 0.95	~~0.88~~ 0.99

Footnotes:

[A] Limiting material

[B] From an inside surface fluence value (not including cladding), fluence is attenuated to a desired thickness using equation (3) of Regulatory Guide 1.99, Revision 2: $f = f_{surf} \times e^{-0.24x}$, where f_{surf} is expressed in units of E19 n/cm^2, E>1 MeV, and x is the desired depth in inches into the vessel wall. ~~For example, for the nozzle belt forging, heat no. 122P237, at 35.9 EFPY, at a depth of 1/4 of the 6.5" vessel wall (1.625"), $f = 0.25 \times e^{-0.24(1.625)} = 0.17$ E19 n/cm^2.~~

[C] The dimensionless fluence factor is calculated using the fluence factor formula from equation (2) of Regulatory Guide 1.99, Revision 2: $ff = f^{(0.28 - 0.10 \log f)}$, where f is the fluence in units of E19 n/cm^2. ~~For example, the 35.9 EFPY 1/4T fluence factor for nozzle belt forging, heat no. 122P237, $ff = 0.17^{(0.28 - 0.10 \log 0.17)} = 0.53$.~~

[D] Instruction Manual, 132-Inch I.D. Reactor Pressure Vessel, Babcock & Wilcox, September 1969

[E] EFPY value listed here is based on various reactor fuel management strategies and reactor power levels. ~~See WCAP-15976 Revision 1 (Ref 5.2) for discussion of EFPY values. The 36.9 EFPY values listed in WCAP-15976, Revision 1, are now applicable to 35.9 EFPY.~~

TABLE 4
POINT BEACH UNIT 2 RPV BELTLINE ~~35.9~~ **50** EFPY VALUES[E]

Based on Westinghouse Report ~~WCAP-15976~~,WCAP-16669, Revision 1, "Point Beach Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," (Ref 5.2). ~~Note that the estimated fluence at a specific point in time is not linearly interpolated between zero and the estimated fluence at 36.9 EFPY, due to changes in core design at certain points in the operating history of the unit. Although the analysis in WCAP-15976 is based on 36.9 EFPY, the applicability of the analysis is now 35.9 EFPY per LTR-PCAM-08-57, "Point Beach Units 1 and 2 EPU P-T Limit Curve Applicability Determination and Related Calculations" (Ref 5.8).~~

Vessel Manufacturer:	Babcock & Wilcox and Combustion Engineering
Plate and Weld Thickness (without cladding):	6.5", without clad [D]

Component Description	Heat or Heat/Lot	~~35.9 EFPY~~ [E] Inside Surface Fluence (E19 n/cm^2)	~~35.9 EFPY~~ [E] 1/4T Fluence (E19 n/cm^2) [B]	~~35.9 EFPY~~ [E] 1/4T Fluence Factor [C]	~~35.9 EFPY~~ [E] 3/4T Fluence (E19 n/cm^2) [B]	~~35.9 EFPY~~ [E] 3/4T Fluence Factor [C]
Nozzle Belt Forging	123V352	~~0.34~~ 0.50	~~0.23~~ 0.34	~~0.60~~ 0.70	~~0.11~~ 0.16	~~0.44~~ 0.51
Intermediate Shell Forging [A]	123V500	~~3.38~~ 5.05	~~2.29~~ 3.42	~~1.22~~ 1.32	~~1.05~~ 1.57	~~1.01~~ 1.12
Lower Shell Forging	122W195	~~3.30~~ 4.90	~~2.23~~ 3.32	~~1.22~~ 1.31	~~1.02~~ 1.52	~~1.01~~ 1.12
Nozzle Belt to Intermed. Shell Circ Weld (100%)	21935	~~0.34~~ 0.50	~~0.23~~ 0.34	~~0.60~~ 0.70	~~0.11~~ 0.16	~~0.44~~ 0.51
Intermed. to Lower Shell Circ Weld (100%) [A]	72442 (SA-1484)	~~3.13~~ 4.65	~~2.12~~ 3.15	~~1.20~~ 1.30	~~0.97~~ 1.44	~~0.99~~ 1.10

Footnotes:

[A] Limiting Material

[B] From an inside surface fluence value (not including cladding), fluence is attenuated to a desired thickness using equation (3) of Regulatory Guide 1.99, Revision 2: $f = f_{surf} \times e^{-0.24x}$, where f_{surf} is expressed in units of E19 n/cm^2, E>1 MeV, and x is the desired depth in inches into the vessel wall. ~~For example, for the nozzle belt forging, heat no. 123V352, at 35.9 EFPY, at a depth of 1/4 of the 6.5" vessel wall (1.625"), $f = 0.34 \times e^{-0.24(1.625)} = 0.23$ E19 n/cm^2.~~

[C] The dimensionless fluence factor is calculated using the fluence factor formula from equation (2) of Regulatory Guide 1.99, Revision 2: $ff = f^{(0.28 - 0.10 \log f)}$, where f is the fluence in units of E19 n/cm^2. ~~For example, the 35.9 EFPY 1/4T fluence factor for nozzle belt forging, heat no. 123V352, $ff = 0.23^{(0.28 - 0.10 \log 0.23)} = 0.60$.~~

[D] Instruction Manual, Reactor Vessel, Point Beach Nuclear Plant No. 2, Combustion Engineering, CE Book #4869, October 1970 .

[E] EFPY value listed here is based on various reactor fuel management strategies and reactor power levels. ~~See WCAP-15976 Revision 1 (Ref 5.2) for discussion of EFPY values. The 36.9 EFPY values listed in WCAP-15976, Revision 1, are now applicable to 35.9 EFPY.~~

TABLE 5
POINT BEACH UNIT 1 RPV 1/4T BELTLINE MATERIAL ADJUSTED REFERENCE TEMPERATURES AT ~~35.9~~ **50** EFPY.(H)

Unless otherwise noted, all ART input data obtained from ~~BAW-2325, "Response to Request for Additional Information (RAI) Regarding Reactor Pressure Vessel Integrity," May 1998 (Ref. 5.6) and WCAP-15976,~~WCAP-16669, Revision 1, "Point Beach Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," (Ref 5.2). ~~Although the analysis in WCAP-15976 is based on 36.9 EFPY, the applicability of the analysis is now 35.9 EFPY per LTR-PCAM-08-57, "Point Beach Units 1 and 2 EPU P-T Limit Curve Applicability Determination and Related Calculations" (Ref 5.8).~~

Vessel Manufacturer:	Babcock & Wilcox
Plate and Weld Thickness (without cladding):	6.5", without clad(F)

Component Description	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF	CF Method	~~1/4T 35.9 EFPY~~(H) Fluence Factor(A)	ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	ART (°F)(E)
Nozzle Belt Forging	122P237	+50	0.11	0.82	77	Table	~~0.53~~ 0.62	~~40.8~~ 47.4	0	17	34	~~125~~ 131.4
Intermediate Shell Plate	A9811-1	+1	0.20	0.06	~~88~~	~~Table~~	~~1.22~~ 1.31	~~107.4~~	~~26.9~~	~~17~~	~~63.64~~	~~172~~
"	"	"			79.3	Surv. Data(B)	"	~~96.7~~ 104.1	"	8.5	56.4	~~154~~ 161.5
Lower Shell Plate	C1423-1	+1	0.12	0.07	55.3	Table	~~1.20~~ 1.30	~~66.4~~	~~26.9~~	~~17~~	~~63.64~~	~~131~~
"	"	"			35.8	Surv. Data(B)	"	~~43.0~~ 46.4	"	8.5	56.4	~~100~~ 103.8
Nozzle Belt to Intermed. Shell Circ Weld (100%)	8T1762 (SA-1426)	~~-5~~ -47.6	0.19	0.57	~~152.4~~ 167.0	Table	~~0.53~~ 0.62	~~80.8~~ 102.9	~~19.7~~ 17.2	28	~~68.47~~ 65.7	~~144~~ 121.0
Intermediate Shell Long Seam (ID 27%)	1P0815 (SA-812)	~~-5~~ -47.6	0.17	0.52	~~138.2~~ 167.0	Table	~~1.11~~ 1.21	~~153.4~~ 201.9	~~19.7~~ 17.2	28	~~68.47~~ 65.7	~~217~~ 220.0
Intermediate Shell Long Seam (OD 73%)	1P0661 (SA-775)	~~-5~~ -47.6	0.17	0.64	~~157.6~~ 167.0	Table	N/A	N/A	~~19.7~~ 17.2	28	N/A	N/A
Intermed. to Lower Shell Circ. Weld (100%)	71249 (SA-1101)	~~+10~~ -47.4	0.23	0.59	167.6	Table(C)	~~1.20~~ 1.29	~~201.1~~ 216.4	~~0~~ 12.9	28	~~56~~ 61.7	~~267~~ 230.7
Lower Shell Long Seam (100%)	61782 (SA-847)	~~-5~~ -47.6	0.23	0.52	~~157.4~~ 167.0	Table	~~1.10~~ 1.20	~~173.1~~ 199.9	~~19.7~~ 17.2	28	~~68.47~~ 65.7	~~237~~ 218.1
"	"	"			~~163.3~~	~~Surv. Data(D)~~	"	~~179.6~~	"	~~14~~	~~48.34~~	~~223~~

Footnotes:

(A) See Table 3

(B) Credible Surveillance Data; see BAW-2325 for evaluation.

(C) Non-credible surveillance data; see BAW-2325 for evaluation. Table CF conservative because difference between ratio-adjusted measure ΔRT_{NDT} and predicted ΔRT_{NDT} based on Table CF is less than 2σ (56°F).

(D) Credible Surveillance Data; see WE Calculation Addendum 98-0156-00-A, "Evaluation of New Surveillance Data on Chemistry Factor for Weld Wire Heat 61782, Point Beach Unit 1," (Ref.5.3) utilizing latest time-weighted temperature data for Point Beach Unit 1, which supersedes BAW-2325.

(E) Adjusted reference temperature (ART) calculated per Regulatory Guide 1.99, Rev. 2. ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin, where ΔRT_{NDT} = Chemistry Factor × Fluence Factor, and Margin = $2(\sigma_I^2 + \sigma_\Delta^2)^{0.5}$, with σ_I defined as the standard deviation of the Initial RT_{NDT} and σ_Δ defined as the standard deviation of ΔRT_{NDT}. ~~Calculated ART values are rounded to the nearest °F in accordance with the rounding-off method of ASTM Practice E29.~~

(F) Instruction Manual, 132-Inch I.D. Reactor Pressure Vessel, Babcock & Wilcox, September 1969.

(G) Deleted.

(H) EFPY value listed here is based on various reactor fuel management strategies and reactor power levels. ~~See WCAP-15976 Revision 1 (Ref 5.2) for discussion of EFPY values. The 36.9 EFPY values listed in WCAP-15976, Revision 1, are now applicable to 35.9 EFPY.~~

TABLE 6
POINT BEACH UNIT 2 RPV 1/4T BELTLINE MATERIAL ADJUSTED REFERENCE TEMPERATURES AT ~~35.9~~ **50** EFPY [I]

Unless otherwise noted, all ART input data obtained from ~~BAW-2325, "Response to Request for Additional Information (RAI) Regarding Reactor Pressure Vessel Integrity," May 1998 (Ref. 5.6) and WCAP-15976,~~ WCAP-16669, Revision 1, "Point Beach Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," (Ref 5.2). ~~Although the analysis in WCAP-15976 is based on 36.9 EFPY, the applicability of the analysis is now 35.9 EFPY per LTR-PCAM-08-57, "Point Beach Units 1 and 2 EPU P-T Limit Curve Applicability Determination and Related Calculations" (Ref 5.8).~~

Vessel Manufacturer:	Babcock & Wilcox and Combustion Engineering
Plate and Weld Thickness (without cladding):	6.5", without clad [F]

Component Description	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF	CF Method	~~1/4T 35.9~~ 50 ~~[I] EFPY~~ Fluence Factor [A]	ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	ART (°F) [E]
Nozzle Belt Forging	123V352	+40	0.11	0.73	76	Table	~~0.60~~ 0.70	~~45.6~~ 53.5	0	17	34	~~120~~ 127.5
Intermediate Shell Forging	123V500	+40	0.09	0.70	58	Table [B]	~~1.22~~ 1.32	~~70.8~~ 76.6	0	17	34	~~145~~ 150.6
Lower Shell Forging	122W195	+40	0.05	0.72	~~31~~	~~Table~~	~~1.22~~ 1.31	~~37.8~~	~~0~~	~~17~~	~~34~~	~~112~~
"	"	"			42.8	Surv. Data [C]	"	~~52.5~~ 56.2	0	8.5	17	~~110~~ 113.2
Nozzle Belt to Intermed. Shell Circ Weld (100%)	21935	-56	0.18	0.70	170	Table [H]	~~0.60~~ 0.70	~~102~~ 120.0	17	28	65.5	~~112~~ 129.5
Intermed. to Lower Shell Circ. Weld (100%)	72442 (SA-1484)	~~-5~~ -30	0.26	0.60	180	Table [D]	~~1.20~~ 1.30	~~216.0~~ 234.4	~~19.7~~ 11.9	28	~~68.47~~ 60.8	~~280~~ 265.2

Footnotes:

[A] See Table 4

[B] Non-credible surveillance data; see BAW-2325 for evaluation. Table CF conservative because difference between measured ΔRT_{NDT} and predicted ΔRT_{NDT} based on Table CF is less than 2σ (34°F)

[C] Credible surveillance data; see BAW-2325 for evaluation.

[D] Non-credible surveillance data; Table CF value based on best-estimate chemistry is higher than best fit calculated using surveillance data, and therefore, conservative.

[E] Adjusted reference temperature (ART) calculated per Regulatory Guide 1.99, Rev. 2. ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin, where ΔRT_{NDT} = Chemistry Factor × Fluence Factor, and Margin = $2(\sigma_I^2 + \sigma_\Delta^2)^{0.5}$, with σ_I defined as the standard deviation of the Initial RT_{NDT}, and σ_Δ defined as the standard deviation of ΔRT_{NDT}. ~~For example, for nozzle belt forging, heat no. 123V352, ART = 40 + (76 × 0.60) + 34 = 120°F. Calculated ART values are rounded to the nearest °F in accordance with the rounding off method of ASTM Practice E29.~~

[F] Instruction Manual, Reactor Vessel, Point Beach Nuclear Plant Unit 2, Combustion Engineering, CE Book #4869, October 1970.

[G] Deleted.

[H] Table CF value based on best-estimate chemistry data from CEOG Report "Best Estimate Copper and Nickel Values in CE Fabricated Reactor Vessel Welds," CE NPSD-1039, Revision 2, Final Report, June 1997 (Ref.5.7).

[I] EFPY value listed here is based on various reactor fuel management strategies and reactor power levels. ~~See WCAP-15976 Revision 1 (Ref 5.2) for discussion of EFPY values. The 36.9 EFPY values listed in WCAP-15976, Revision 1, are now applicable to 35.9 EFPY.~~

TABLE 7
POINT BEACH UNIT 1 RPV 3/4T BELTLINE MATERIAL ADJUSTED REFERENCE TEMPERATURES AT ~~35.9~~ **50** EFPY (H)

Unless otherwise noted, all ART input data obtained from BAW-2325, "Response to Request for Additional Information (RAI) Regarding Reactor Pressure Vessel Integrity," May 1998 (Ref. 5.6) and ~~WCAP-15976~~,WCAP-16669, Revision 1, "Point Beach Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," (Ref 5.2). ~~Although the analysis in WCAP-15976 is based on 36.9 EFPY, the applicability of the analysis is now 35.9 EFPY per LTR-PCAM-08-57, "Point Beach Units 1 and 2 EPU P-T Limit Curve Applicability Determination and Related Calculations" (Ref 5.8).~~

Vessel Manufacturer:	Babcock & Wilcox
Plate and Weld Thickness (without cladding):	6.5", without clad(F)

Component Description	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF	CF Method	~~3/4T 35.9 EFPY(H)~~ Fluence Factor(A)	ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	ART (°F)(E)
Nozzle Belt Forging	122P237	+50	0.11	0.82	77	Table	~~0.37~~ 0.44	~~28.5~~ 33.7	0	17	~~34~~ 33.7	~~113~~ 117.4
Intermediate Shell Plate	A9811-1	+1	0.20	0.06	~~88~~	~~Table~~	~~1.01~~ 1.12	~~88.9~~	~~26.9~~	~~17~~	~~63.64~~	~~154~~
"	"	"			79.3	Surv. Data(B)	"	~~80.1~~ 88.5	"	8.5	56.4	~~138~~ 145.9
Lower Shell Plate	C1423-1	+1	0.12	0.07	55.3	Table	~~0.98~~ 1.10	~~54.2~~	~~26.9~~	~~17~~	~~63.64~~	~~119~~
"	"	"			35.8	Surv. Data(B)	"	~~35.1~~ 39.2	"	8.5	56.4	~~93~~ 96.6
Nozzle Belt to Intermed. Shell Circ Weld (100%)	8T1762 (SA-1426)	~~-5~~ -47.6	0.19	0.57	~~152.4~~ 167.0	Table	~~0.37~~ 0.44	~~56.4~~ 73.2	~~19.7~~ 17.2	28	~~68.47~~ 65.7	~~120~~ 91.3
Intermediate Shell Long Seam (ID 27%)	1P0815 (SA-812)	~~-5~~ -47.6	0.17	0.52	~~138.2~~ 167.0	Table	N/A	N/A	~~19.7~~ 17.2	28	~~68.47~~ N/A	N/A
Intermediate Shell Long Seam (OD 73%)	1P0661 (SA-775)	~~-5~~ -47.6	0.17	0.64	~~157.6~~ 167.0	Table	~~0.89~~ 1.00	~~140.3~~ 166.5	~~19.7~~ 17.2	28	~~68.47~~ 65.7	~~204~~ 184.6
Intermed. To Lower Shell Circ. Weld (100%)	71249 (SA-1101)	~~+10~~ -47.4	0.23	0.59	167.6	Table(C)	~~0.99~~ 1.09	~~165.9~~ 182.3	~~0~~ 12.9	28	~~56~~ 61.7	~~232~~ 196.6
Lower Shell Long Seam (100%)	61782 (SA-847)	~~-5~~ -47.6	0.23	0.52	~~157.4~~ 167.0	Table	~~0.88~~ 0.99	~~138.5~~ 164.5	~~19.7~~ 17.2	28	~~68.47~~ 65.7	~~202~~ 182.7
"	"	"			~~163.3~~	~~Surv. Data(D)~~	"	~~143.7~~	"	~~14~~	~~48.34~~	~~187~~

Footnotes:

(A) See Table 3.

(B) Credible Surveillance Data; see BAW-2325 for evaluation.

(C) Non-credible surveillance data; see BAW-2325 for evaluation. Table CF conservative because difference between ratio-adjusted measured ΔRT_{NDT} are predicted ΔRT_{NDT} based on Table CF is less than 2σ (56°F).

(D) Credible Surveillance Data; see WE Calculation Addendum 98-0156-00-A, "Evaluation of New Surveillance Data on Chemistry Factor for Weld Wire Heat 61782, Point Beach Unit 1," utilizing latest time-weighted temperature data for Point Beach Unit 1, which supersedes BAW-2325.

(E) Adjusted reference temperature (ART) calculated per Regulatory Guide 1.99, Rev. 2. ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin, where ΔRT_{NDT} = Chemistry Factor × Fluence Factor, and Margin = $2(\sigma_I^2 + \sigma_\Delta^2)^{0.5}$, with σ_I defined as the standard deviation of the Initial RT_{NDT}, and σ_Δ defined as the standard deviation of ΔRT_{NDT}. ~~For example, for nozzle belt forging, heat no. 122P237, ART = 50 + (77 × 0.37) + 34 = 113°F. Calculated ART values are rounded to the nearest °F in accordance with the rounding off method of ASTM Practice E29.~~

(F) Instruction Manual, 132-Inch I.D. Reactor Pressure Vessel, Babcock & Wilcox, September 1969.

(G) Deleted.

(H) EFPY value listed here is based on various reactor fuel management strategies and reactor power levels. ~~See WCAP-15976 Revision 1 (Ref 5.2) for discussion of EFPY values. The 36.9 EFPY values listed in WCAP-15976, Revision 1, are now applicable to 35.9 EFPY.~~

TABLE 8
POINT BEACH UNIT 2 RPV 3/4T BELTLINE MATERIAL ADJUSTED REFERENCE TEMPERATURES AT ~~35.9~~ **50** EFPY (I)

Unless otherwise noted, all ART input data obtained from ~~BAW-2325, "Response to Request for Additional Information (RAI) Regarding Reactor Pressure Vessel Integrity," May 1998 (Ref. 5.6) and WCAP-15976,~~WCAP-16669, Revision 1, "Point Beach Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," (Ref 5.2). ~~Although the analysis in WCAP-15976 is based on 36.9 EFPY, the applicability of the analysis is now 35.9 EFPY per LTR-PCAM-08-57, "Point Beach Units 1 and 2 EPU P-T Limit Curve Applicability Determination and Related Calculations" (Ref 5.8).~~

Vessel Manufacturer:	Babcock & Wilcox and Combustion Engineering
Plate and Weld Thickness (without cladding):	6.5", without clad (F)

Component Description	Heat or Heat/Lot	Initial RT_{NDT} (°F)	%Cu	%Ni	CF	CF Method	~~3/4T 35.9 EFPY (I)~~ Fluence Factor (A)	ΔRT_{NDT} (°F)	σ_I	σ_Δ	Margin (°F)	ART (°F) (E)
Nozzle Belt Forging	123V352	+40	0.11	0.73	76	Table	~~0.44~~ 0.51	~~33.4~~ 38.9	0	17	34	~~107~~ 112.9
Intermediate Shell Forging	123V500	+40	0.09	0.70	58	Table (B)	~~1.01~~ 1.12	~~58.6~~ 65.2	0	17	34	~~133~~ 139.2
Lower Shell Forging	122W195	+40	0.05	0.72	~~31~~	~~Table~~	~~1.01~~ 1.12	~~31.3~~	~~0~~	~~17~~	~~34~~	~~105~~
"	"	"			42.8	Surv. Data (C)	"	~~43.4~~ 47.8	0	8.5	17	~~100~~ 104.8
Nozzle Belt to Intermed. Shell Circ Weld (100%)	21935	-56	0.18	0.70	170	Table (H)	~~0.44~~ 0.51	~~74.8~~ 87.3	17	28	65.5	~~84~~ 96.8
Intermed. to Lower Shell Circ. Weld (100%)	72442 (SA-1484)	~~-5~~ -30	0.26	0.60	180	Table (D)	~~0.99~~ 1.10	~~178.2~~ 198.4	~~19.7~~ 11.9	28	~~68.47~~ 60.8	~~242~~ 229.2

Footnotes:

(A) See Table 4.
(B) Non-credible surveillance data; see BAW-2325 for evaluation. Table CF conservative because difference between measured ΔRT_{NDT} and predicted ΔRT_{NDT} based on Table CF is less than 2σ (56°F).
(C) Credible surveillance data; see BAW-2325 for evaluation.
(D) Non-credible surveillance data; Table CF value based on best-estimate chemistry is higher than best fit calculated using surveillance data, and therefore, conservative.
(E) Adjusted reference temperature (ART) calculated per Regulatory Guide 1.99, Rev. 2. ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin, where ΔRT_{NDT} = Chemistry Factor × Fluence Factor, and Margin = $2(\sigma_I^2 + \sigma_\Delta^2)^{0.5}$, with σ_I defined as the standard deviation of the Initial RT_{NDT}, and σ_Δ defined as the standard deviation of ΔRT_{NDT}. ~~Calculated ART values are rounded to the nearest °F in accordance with the rounding off method of ASTM Practice E29.~~
(F) Instruction Manual, Reactor Vessel, Point Beach Nuclear Plant No. 2, Combustion Engineering, CE Book #4869, October 1970.
(G) Deleted.
(H) Table CF value based on best-estimate chemistry data from CEOG Report "Best Estimate Copper and Nickel Values in CE Fabricated Reactor Vessel Welds," CE NPSD-1039, Revision 2, Final Report, June 1997
(I) EFPY value listed here is based on various reactor fuel management strategies and reactor power levels. ~~See WCAP-15976 Revision 1 (Ref 5.2) for discussion of EFPY values. The 36.9 EFPY values listed in WCAP-15976, Revision 1, are now applicable to 35.9 EFPY.~~