ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Thursday, April 30, 2009 6:14 PM
To: Getachew Tesfaye
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); DUNCAN Leslie E (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 64, Supplement 2
Attachments: RAI 64 Supplement 2 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 9 of the 11 questions of RAI No. 64 on October 22, 2008. AREVA NP submitted Supplement 1 to the response on November 19, 2008 to address 1 of the remaining 2 questions. The attached file, "RAI 64 Supplement 2 Response US EPR DC.pdf" provides a technically correct and complete response to the remaining question, as committed.

The response document references ANP-10283P, Revision 1, "U.S. EPR Pressure-Temperature Limits Metodology for RCS Hetup and Cooldown Technical Report," submitted by AREVA NP letter, NRC:09:049, dated April 30, 2009.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 64 Question 05.03.02-5.

The following table indicates the respective page in the response document, "RAI 64 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 64 — 05.03.02-5	2	2

This concludes the formal AREVA NP response to RAI 64, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Ronda Pederson
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Licensing Manager, U.S. EPR Design Certification
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An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, November 19, 2008 5:52 PM
To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); SLIVA Dana (EXT);

PORTER Thomas (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 64, Supplement 1

Getachew,

AREVA NP Inc. provided responses to 9 of the 11 questions of RAI No. 64 on October 22, 2008. The attached file, "RAI 64 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete response to 1 of the remaining 2 questions. A partial response to the second remaining questions is provided.

The following table indicates the respective page in the response document, "RAI 64 Supplement 1 Response US EPR DC.pdf," that contains AREVA NP's response to each question.

Question #	Start Page	End Page
RAI 64 — 05.03.02-3	2	2
RAI 64 — 05.03.02-5	3	3

The schedule for a technically correct and complete response to the remaining question has been revised as provided below:

Question #	Response Date
RAI 64 — 05.03.02-5	April 30, 2009

Sincerely,

Ronda Pederson
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New Plants Deployment
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From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, October 22, 2008 5:57 PM
To: 'Getachew Tesfaye'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PORTER Thomas (EXT); WELLS Russell D (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 64(994,995,996,997), FSAR Ch 5

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 64 Response US EPR DC.pdf" provides technically correct and complete responses to 9 of the 11 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 64 Questions 05.03.01-1, 05.03.01-2, 05.03.01-5, 05.03.02-1, and 05.03.02-2.

The following table indicates the respective pages in the response document that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 64 — 05.03.01-1	2	2
RAI 64 — 05.03.01-2	3	3
RAI 64 — 05.03.01-3	4	4
RAI 64 — 05.03.01-4	5	5
RAI 64 — 05.03.01-5	6	6
RAI 64 — 05.03.02-1	7	7
RAI 64 — 05.03.02-2	8	8
RAI 64 — 05.03.02-3	9	9
RAI 64 — 05.03.02-4	10	10
RAI 64 — 05.03.02-5	11	11
RAI 64 — 05.03.03-1	12	12

Question #	Response Date
RAI 64 — 05.03.02-3	November 20, 2008
RAI 64 — 05.03.02-5	November 20, 2008

Sincerely,

Ronda Pederson
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Monday, September 22, 2008 10:06 AM
To: ZZ-DL-A-USEPR-DL
Cc: Allison Black; Tarun Roy; David Terao; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 64(994,995,996,997), FSAR Ch 5

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 27, 2008, and discussed with your staff on September 15, 2008. No change was made to the draft RAI as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 442

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D31DFFBA0)

Subject: Response to U.S. EPR Design Certification Application RAI No. 64, Supplement 2
Sent Date: 4/30/2009 6:14:16 PM
Received Date: 4/30/2009 6:14:21 PM
From: Pederson Ronda M (AREVA NP INC)

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Files	**Size**	**Date & Time**
MESSAGE	6000	4/30/2009 6:14:21 PM
RAI 64 Supplement 2 Response US EPR DC.pdf	260551	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 64, Supplement 2

9/22/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 05.03.01 - Reactor Vessel Materials
SRP Section: 05.03.02 - Pressure-Temperature Limits, Upper-Shelf Energy, and Pressurized Thermal Shock
SRP Section: 05.03.03 - Reactor Vessel Integrity
Application Section: FSAR Ch. 5
CIB1 Branch

Question 05.03.02-5:

Section 5.3.2 of the FSAR states that the COL applicant will provide a plant-specific Pressure Temperature Limits Report (PTLR). To enhance the level of standardization in the certification information, it would appear appropriate to provide the PTLR at the design certification stage rather than in each COL application. Discuss your rationale for not including the PTLR in the FSAR. Also, discuss how the adequacy of Technical Specification requirements for pressure-temperature limits can be assured at the design certification stage if generic P-T limits or a PTLR is not provided at the design certification stage.

Response to Question 05.03.02-5:

In AREVA NP's response to this question in RAI 64 Supplement 1, the company committed to revising ANP-10283P ("U.S. EPR Pressure-Temperature Limits Methodology for RCS Heatup and Cooldown Technical Report") and to make the corresponding changes to the U.S. EPR FSAR. The revised report is submitted under a separate letter, NRC:09:049, dated April 30, 2009, and the FSAR changes are described below.

ANP-10283P, Revision 1 includes the methodology for determining pressure-temperature limits and follows the content guidance in NRC Generic Letter 96-03. It also contains a generic PTLR that is bounding for the U.S. EPR design. U.S. EPR FSAR Tier 2, Section 1.6 and Section 5.3.2 and U.S. EPR Technical Specifications Section 3.4.3 (Bases) and Section 5.6.4 will be revised to refer to ANP-10283P, Revision 1.

The P-T limit curves in U.S. EPR FSAR Tier 2, Figure 5.3-1 and Figure 5.3-2 will be replaced with new P-T limit curves. These curves contain additional information required by GL 96-03, and are consistent with the P-T limits in ANP-10283P, Revision 1.

While revising ANP-10283P, AREVA NP identified an inaccuracy in the U.S. EPR FSAR regarding compliance with a position on the required low temperature overpressure protection (LTOP) enable temperature in Branch Technical Position 5-2. The U.S. EPR design deviates from Position B.2 in BTP 5-2 and instead follows the requirements of ASME Code Section XI, Appendix G for the definition of LTOP enable temperature. U.S. EPR FSAR Tier 2, Section 5.2.2 and ANP-10292 ("U.S. EPR Conformance with Standard Review Plan (NUREG-0800) Technical Report") will be revised to identify the deviation from the Branch Technical Position. The justification for the deviation is provided in ANP-10283P, Revision 1.

AREVA NP's review also identified an inconsistency in U.S. EPR FSAR, Tier 2, Section 5.2.2.9 regarding the number of pressurizer safety relief valves required for LTOP. U.S. EPR FSAR Tier 2, Section 5.2.2.9 will be revised to be consistent with the LTOP analyses described in Section 5.2.2.2.2.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 1.6-1, Section 5.2.2, Section 5.3.2, Section 5.3.4, Figure 5.3-1, Figure 5.3-2, and Chapter 16 Technical Specifications (TS) Section 3.4.3 (Bases) and TS Reporting Requirement Section 5.6.4 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

Table 1.6-1—Reports Referenced
Sheet 1 of 4

Report No. (See Notes 1, 2, and 3)	Title	Date Submitted to NRC	FSAR Section Number(s)
ANF-89-060P-A ANF-89-060NP-A Supplement 1	Generic Mechanical Design Report High Thermal Performance Spacer and Intermediate Flow Mixer	3/28/91	4.2
ANP-10263P-A ANP-10263NP-A	Codes and Methods Applicability Report for the U.S. EPR	11/06/07	4, 5.1, 15, 16, and 19
ANP-10264NP-A	U.S. EPR Piping Analysis and Pipe Support Design Topical Report	~~9/29/06~~11/07/08	3.6, 3.7, 3.8, 3.9, 3.10, 3.12, App. 3A, and App. 3C
ANP-10266-A	AREVA NP Inc. Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR Topical Report	06/18/07	7.1, 17.1, 17.2, 17.3, 17.5, 18.1, 18.7, and 18.11
ANP-10268P-A ANP-10268NP-A	U.S. EPR Severe Accident Evaluation Topical Report	~~10/31/06~~ 2/26/08	6.2.5, 15.4, 19.1, and 19.2
ANP-10269P-A ANP-10269NP-A	The ACH-2 CHF Correlation for the U.S. EPR Topical Report	~~11/30/06~~ 3/10/08	4.4, 5, 7, 15, and 19
ANP-10272	Software Program Manual TELEPERM XS™ Safety Systems Topical Report	12/21/06	7.1 and 7.6
ANP-10273P ANP-10273NP	AV42 Priority Actuation and Control Module Topical Report	11/28/06	7 and 16
ANP-10275P-A ANP-10275NP-A	U.S. EPR Instrument Setpoint Methodology Topical Report	~~3/26/07~~ 2/26/08	7 and 16
ANP-10278P ANP-10278NP	U.S. EPR Realistic Large Break Loss of Coolant Accident Topical Report	3/26/07	6.2 and 15
ANP-10279	U.S. EPR Human Factors Engineering Program Topical Report	1/29/07	3.4, 7.1, 13.1, and 18
ANP-10281P ANP-10281NP	U.S. EPR Digital Protection System Topical Report	3/27/07	3.1.3, 4.6, 7, and 8.1
ANP-10282P ANP-10282NP	POWERTRAX/E Online Core Monitoring Software for the U.S. EPR Technical Report	11/27/07	4.4
ANP-10283P, Revision 1 ANP-10283NP, Revision 1	U.S. EPR Pressure-Temperature Limits Methodology for RCS Heat-Up and Cool-Down Technical Report	4/30/09 ~~12/607~~ ~~(Note 4)~~	5.3 and 16
ANP-10284	U.S. EPR Instrumentation and Controls Diversity and Defense-in-Depth Methodology Topical Report	6/20/07	7

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5.2.2.2.2 Low Temperature Overpressure Protection

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Features that provide low temperature overpressure protection (LTOP) for the RCPB are designed in accordance with BTP 5-2 (Reference 8), with the exception of Position B.2 on the LTOP enable temperature. The LTOP enable temperature is defined according to ASME Code Section XI, Appendix G, as explained in ANP-10283P, Revision 1. Each PSRV is equipped with two solenoid-operated pilot valves in series for LTOP of the RCPB, although only two PSRVs are used during low temperature operations. During reactor cool down, an alarm is generated from the wide range cold leg temperature instrumentation once conditions for permissive P17 are met, allowing the operator to validate the permissive to enable LTOP. Refer to Section 7.2.1.3.12 for a description of the P17 permissive. The operator manually validates permissives to enable LTOP. Low temperature overpressure protection is operable during startup and shutdown conditions at or below the reactor pressure vessel (RPV) brittle fracture protection function enable temperature.

The LTOP enable temperature and PSRV set points are selected so that the peak RPV pressure does not exceed the 10 CFR Part 50, Appendix G limits. PSRV setpoints are presented in Section 5.4.13. Section 5.3.2 addresses pressure-temperature limits for the RPV.

Low temperature RCPB overpressure events include mass input events and heat input events. These events are considered and are presented with the interlock or equipment lock-out that could prevent the event, where applicable:

- Mass input events.
  - Unplanned start of four medium head safety injection (MHSI) pumps simultaneously with a failure of one large miniflow line to open.
    - P17 holds open the large miniflow lines to prevent overpressurizing the RCS if this scenario occurs, however one large miniflow line is assumed to fail closed.
  - Both charging pumps running and the control valve failed open (a maximum runout flow of 112.66 lb_m/second, total for both pumps).
  - Unplanned start of two extra borating system pumps.
  - Release of accumulators into the RCS.
    - To prevent the potential for a LTOP event, the accumulator isolation valves are closed and the motor will be de-energized.
- Heat input events.

Section III, NB-7000. Section 5.2.1 identifies the code edition and addenda applicable to the design.

Section 3.2 identifies the classifications applied to the overpressure protection equipment and components.

5.2.2.7 Material Specification

Section 5.2.3 describes RCPB material requirements and fabrication controls. The selected PSRV materials are consistent with specifications identified in ASME Section II in accordance with ASME Section III, NB-2000, and can be found in Table 5.2-2—Material Specifications for RCPB Components. Code cases which may be applied in the selection of PSRV materials are listed in Section 5.2.1.2.

5.2.2.8 Process Instrumentation

Temperature sensors in each PSRV discharge line provide indications and alarms in the MCR to alert the operator to steam discharge through the PSRVs from valve operation or leakage. Discharge flow is also indicated by an increase in the PRT temperature or level. Valve stem position indication for each PSRV is displayed in the MCR, in accordance with 10 CFR 50.34(f)(2)(xi).

The operator is alerted when the LTOP function is to be enabled during plant cool down. Positive indication is provided in the MCR when the low temperature protection function is enabled.

Refer to Section 7.3 for further details on process instrumentation associated with overpressure protection.

5.2.2.9 System Reliability

During hot RCS conditions, the PSRVs are considered a passive device. The spring-operated pilot valves are designed in accordance with the requirements of ASME Section III, NB-7511.1. With successful operation of the pilot valve, a large differential pressure reliably opens the main relief disk, which relieves RCS pressure. Detailed operation of the PSRV is described in Section 5.4.13.

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The two solenoid-operated pilot valves in series provide single failure protection against spurious opening or failure to close the PSRVs during low temperature operation. The series pilot valves are powered from separate electrical divisions that are backed by uninterruptible power supplies. ~~Although only one PSRV is required for LTOP, a~~At least two PSRVs are in service to meet the single failure criteria. The U.S. EPR can cope with an inadvertent opening of a PSRV. Section 15.6.1 presents the analysis for inadvertent opening of a PSRV.

5.3.2 Pressure-Temperature Limits, Pressurized Thermal Shock, and Charpy Upper-Shelf Energy Data and Analyses

Section 5.3.1 identifies the regulations with which the RPV design complies, including GDC 1, GDC 14, GDC 31, GDC 32, 10 CFR 50.55a, 10 CFR 50.60, and 10 CFR Part 50, Appendix G. The RPV is designed and fabricated to meet these requirements and the fracture toughness requirements of 10 CFR 50.61 for protection against pressurized thermal shock events.

5.3.2.1 Pressure-Temperature Limit Curves

Radiation embrittlement causes a reduction in the ductility of the RPV beltline materials. This reduction is measured in terms of the adjusted reference nil ductility temperature RT_{NDT}. The presence of elements such as copper, nickel and phosphorus is controlled to limit reductions in ductility and fracture toughness in the steel that forms the RPV, in accordance with Section 5.3.1.1. Pressure-temperature (P-T) limits, derived using linear-elastic fracture mechanics principles, provide margins of safety to prevent nonductile fracture during normal operation, heat-up, cooldown, AOOs, system hydrostatic, preservice and inservice leakage tests. The analysis of RPV beltline material properties satisfies the requirements of GDC 31 and complies with the requirements of 10 CFR Part 50, Appendix G. The analysis follows the guidance provided in RG 1.99 and the methodology of ASME Section XI (Reference 11), Appendix G. From the analyses, curves are developed that specify pressure-temperature limits to envelop plant operation for 60 years (conservatively considering 60 EFPY).

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ANP-10283P, Revision 1, "US EPR Pressure-Temperature Limits Methodology for RCS Heat-Up and Cool-Down" (Reference 12), contains the detailed methodology for developing the P-T limit curves. The P-T limits are revised as necessary, for various reasons including refined end of life (EOL) fluence estimations obtained from the material surveillance program, in accordance with the recommendations of RG 1.190. Testing of each surveillance capsule will be performed in accordance with 10 CFR 50, Appendix H. The material data will be evaluated using the guidance of RG 1.99. The P/T limits will be recalculated or the applicable EFPY will be adjusted, as necessary, to confirm that the 1/4T and 3/4T adjusted RT_{NDT} of the RPV based P/T limits is not exceeded. The initial RT_{NDT}, final predicted RT_{NDT} or adjusted reference temperature (ART), and the copper and nickel contents for materials in the RPV beltline are provided in Table 5.3-3 and Table 5.3-4. The fluence attenuation to the 1/4T and 3/4T locations and the ART values are calculated per RG 1.99, Revision 2.

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Generic heatup and cooldown curves for the U.S. EPR RPV design are provided in Figure 5.3-1—Reactor Coolant System Heatup Pressure-Temperature Curve and Figure 5.3-2—Reactor Coolant System Cooldown Pressure-Temperature Curve, and are based on limiting vessel material properties. A COL applicant that references the

10. NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation of Failure in Nuclear Power Plants," U.S. Nuclear Regulatory Commission, June 1990.

11. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," The American Society of Mechanical Engineers, 2004.

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12. ANP-10283P, Revision 1, "U.S. EPR Pressure-Temperature Limits Methodology for RCS Heat-Up and Cool-Down," AREVA NP Inc., ~~December 2007~~April 2009.

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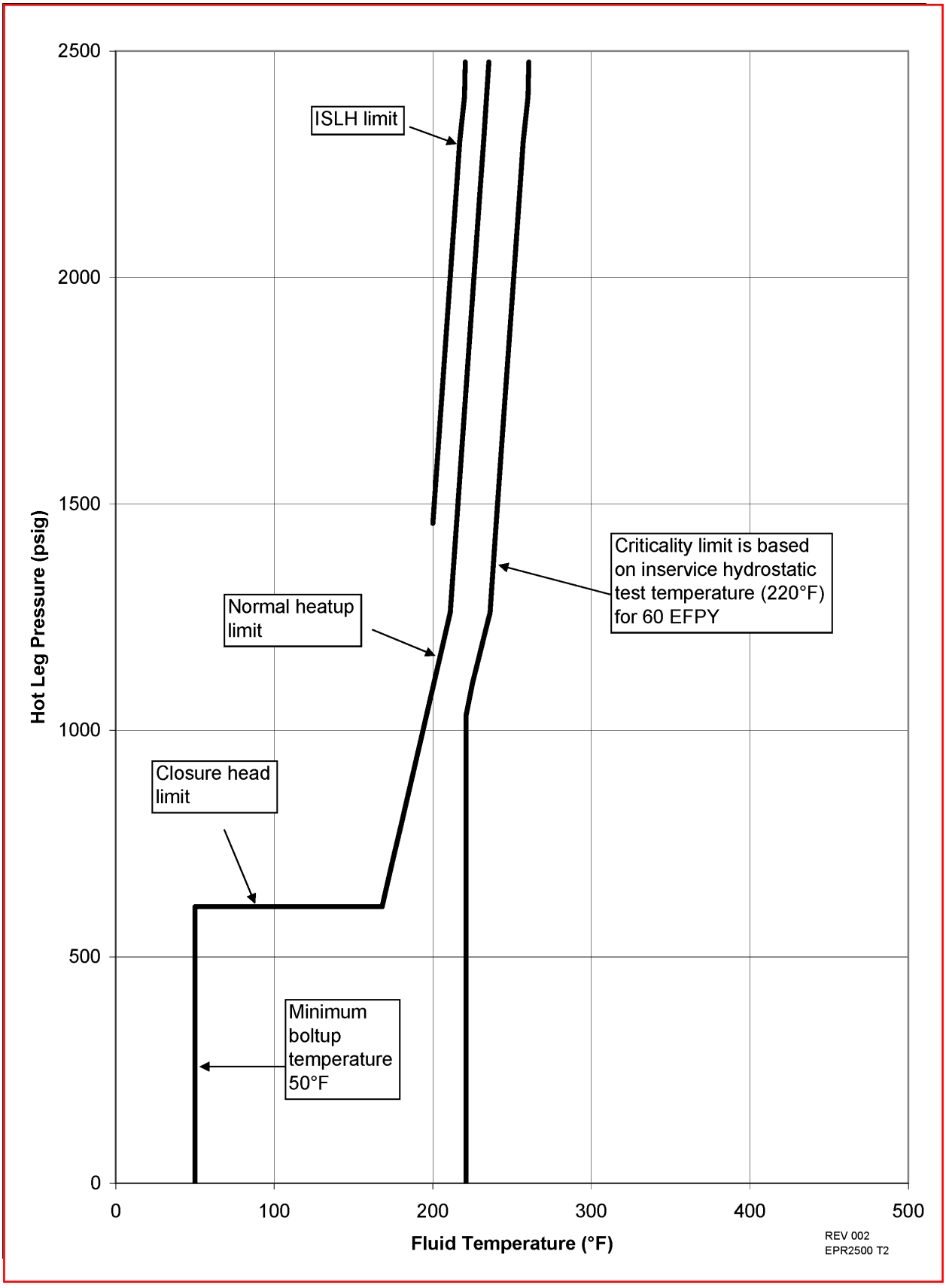
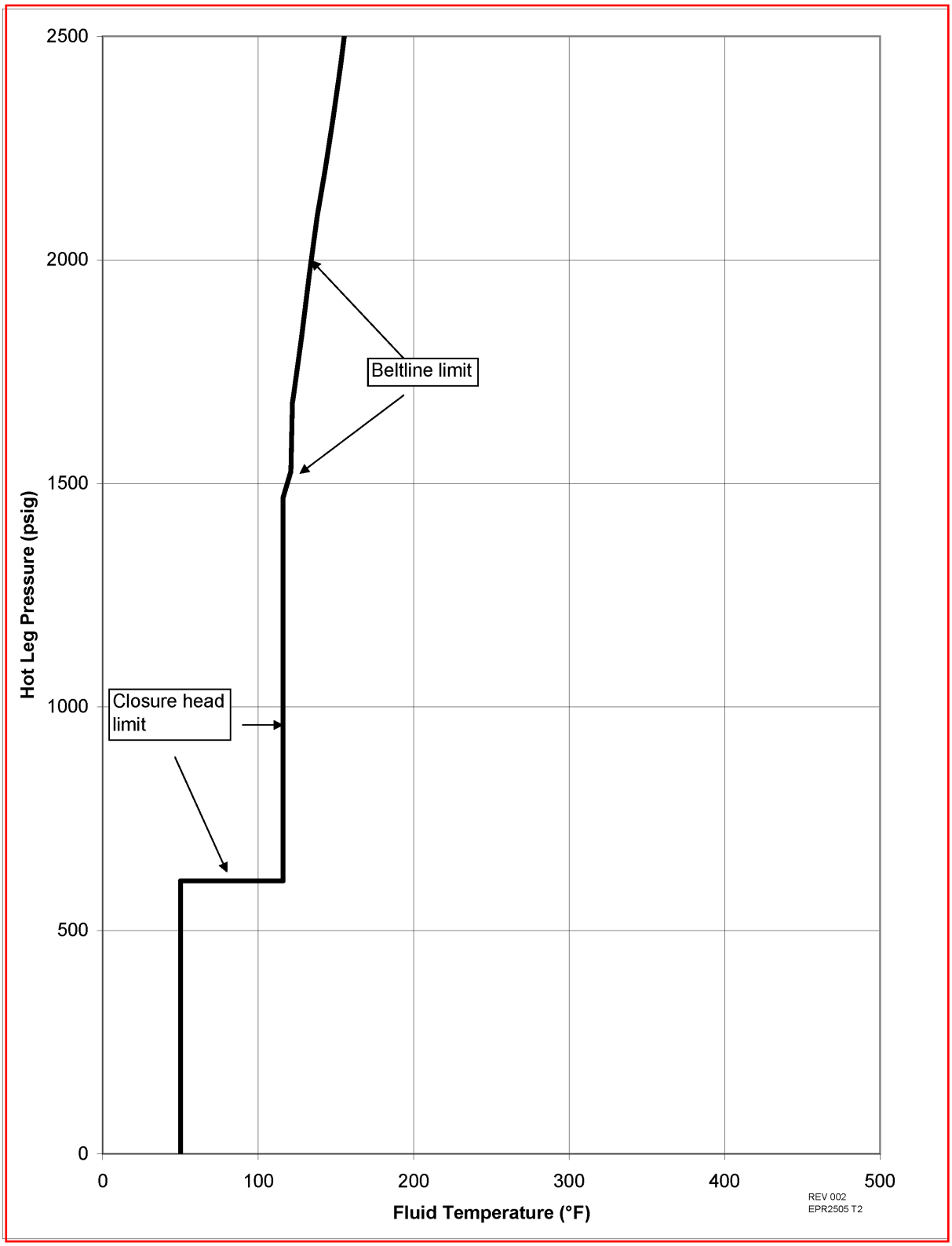
Figure 5.3-1—Reactor Coolant System Heatup Pressure-Temperature Curve



05.03.02-5

Figure 5.3-2—Reactor Coolant System Cooldown Pressure-Temperature Curve



5.6 Reporting Requirements

5.6.3 CORE OPERATING LIMITS REPORT (COLR) (continued)

c. The core operating limits shall be determined assuming operation at RATED THERMAL POWER such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.4 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heat up, cooldown, low temperature operation, criticality, and hydrostatic testing, low temperature overpressure protection settings, and pressurizer safety relief valve lift settings as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

1. LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits;"

2. LCO 3.4.11, "Low Temperature Overpressure Protection (LTOP)."

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b. 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 the following documents:

1. ANP-10283P, Rev. ~~0~~1, "U.S. EPR Pressure-Temperature Limits Methodology for RCS Heatup and Cooldown."

c. The PTLR shall be provided to the ~~applicable regulatory body~~NRC upon issuance for each reactor vessel fluence period and for any revision or supplement thereto.

5.6.5 Post Accident Monitoring Report

When a report is required by Condition B ~~or F~~ of LCO 3.3.2, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

BASES

ACTIONS (continued)

Besides restoring operation within limits and reducing RCS pressure, an evaluation is required to determine if RCS operation can continue. The evaluation must verify that the RCPB integrity remains acceptable and must be completed prior to entry into MODE 4. Several methods may be used, including comparison with pre-analyzed transients in the stress analyses, or inspection of the components.

ASME Code, Section XI, Appendix E (Ref. 7), may be used to support the evaluation. However, its use is restricted to evaluation of the vessel beltline.

Condition C is modified by a Note requiring Required Action C.~~3~~ 2 to be completed whenever the Condition is entered. The Note emphasizes the need to perform the evaluation of the effects of the excursion outside the allowable limits. Restoration and reduction of RCS pressure alone per Required Action~~s~~ C.1 ~~and C.2 are~~is insufficient because higher than analyzed stresses may have occurred and may have affected the RCPB integrity.

SURVEILLANCE REQUIREMENTS

SR 3.4.3.1

Verification that operation is within the PTLR limits is required every 30 minutes when RCS pressure and temperature conditions are undergoing planned changes. This Frequency is considered reasonable in view of the control room indication available to monitor RCS status. Also, since temperature rate of change limits are specified in hourly increments, 30 minutes permits assessment and correction for minor deviations within a reasonable time.

Surveillance for heatup, cooldown, or ISLH testing may be discontinued when the definition given in the relevant plant procedure for ending the activity is satisfied.

This SR is modified by a Note that only requires this SR to be performed during system heatup, cooldown, and ISLH testing. No SR is given for criticality operations because LCO 3.4.2 contains a more restrictive requirement.

05.03.02-5

REFERENCES

1. ANP-10283P, Rev. ~~0~~1, "U.S. EPR Pressure - Temperature Limits Methodology for RCS Heatup and Cooldown"
2. 10 CFR 50, Appendix G.
3. ASME, Boiler and Pressure Vessel Code, Section III, Appendix G.