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Dominion®

January 18, 2011

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Serial No. 10-047A
LIC/JG/R0
Docket No.: 50-305
License No.: DPR-43

DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION
SUPPLEMENT 1 TO LICENSE AMENDMENT REQUEST 246: REVISION TO REACTOR COOLANT SYSTEM PRESSURE AND TEMPERATURE LIMITS AND LOW TEMPERATURE OVERPRESSURE PROTECTION LIMITATIONS

By letter dated April 13, 2010 (Reference 1) Dominion Energy Kewaunee, Inc. (DEK) requested an amendment to facility operating license number DPR-43 for Kewaunee Power Station (KPS). The proposed amendment would revise the Operating License by modifying KPS Technical Specifications (TS), including new heatup and cooldown pressure-temperature (P/T) limit curves and a higher enabling temperature for low temperature overpressure protection (LTOP). The amendment would also extend the applicability of the P/T limit curves and LTOP enabling temperature through the expected period of a KPS extended license. This supplement to the proposed amendment provides the description of changes to convert the associated portions of Custom Technical Specifications (CTS), as originally proposed, to a format and content consistent with the Improved Technical Specification (ITS) format being approved by NRC for KPS in response to amendment request 249, submitted on August 24, 2009 (as amended).

As discussed in Reference 1, in addition to the originally proposed amendment, DEK had also submitted a license amendment request (LAR) proposing to convert the CTS to ITS. However, the amendment as originally proposed in LAR 246 was to the then-existing CTS. Based on imminent NRC approval of the ITS conversion, LAR 246 now requires modification to comport with the ITS. The affected sections are ITS 3.4.3, "Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits", ITS 3.4.5, "RCS Loops – MODE 3", ITS 3.4.6, "RCS Loops – MODE 4", ITS 3.4.10, "Pressurizer Safety Valves", ITS 3.4.12, "Low Temperature Overpressure Protection (LTOP) System", and ITS 3.5.2, "ECCS – Operating". The revised requirements would consist of new heatup and cooldown P/T limit curves and a higher LTOP enabling temperature (identical to the changes proposed in the original LAR 246), along with additional restrictions on RCS mass addition consistent with Improved Standard Technical Specifications. The revisions would correspondingly extend the applicability of the heatup and cooldown P/T limit curves through 52.1 EFPY.

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NRR

DEK plans to initiate use of the proposed P/T and LTOP limitations after startup of Fuel Cycle 31 (spring 2011). Therefore, DEK requests approval of the amendment by April 13, 2011. Once approved, the amendment shall be implemented within 120 days.

Attachment 1 to this letter contains a description of the proposed changes from the CTS to ITS format. Attachment 2 contains the marked-up ITS pages. Attachment 3 contains marked-up ITS Bases pages (for information). The analysis provided in Reference 1 remains applicable and bounding to this proposed change. The conclusions of the no significant hazards consideration and the environmental considerations contained in Reference 1 are not affected by, and remain applicable to, this supplement.

The KPS Facility Safety Review Committee has approved the proposed change and a copy of this submittal has been provided to the State of Wisconsin in accordance with 10 CFR 50.91(b).

If you have questions or require additional information, please contact Mr. Jack Gadzala at 920-388-8604.

Very truly yours,

Leslie N. Hartz
Vice President – Nuclear Support Services

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Leslie N. Hartz, who is Vice President Nuclear Support Services of Dominion Energy Kewaunee, Inc. She has affirmed before me that she is duly authorized to execute and file the foregoing document in behalf of that Company, and the statements in the document are true to the best of her knowledge and belief.

Acknowledged before me this 18th day of January, 2011.

My Commission expires: 4/30/13.

Notary Public I was commissioned a notary as Ginger L. Alligood

GINGER LYNN MELTON
Notary Public
Commonwealth of Virginia
310847
My Commission Expires Apr 30, 2013

Attachments:

1. Discussion of Change
2. Marked-up Improved Technical Specifications Pages
3. Marked-up Improved Technical Specifications Bases Pages

References:

1. Letter from J. Alan Price (Dominion Energy Kewaunee) to Document Control Desk, "Dominion Energy Kewaunee, Inc., Kewaunee Power Station, License Amendment Request 246: Revision to Reactor Coolant System Pressure and Temperature Limits and Low Temperature Overpressure Protection Limitations", dated April 13, 2010.

Commitments made by this letter: None

cc: Regional Administrator, Region III
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ATTACHMENT 1

LICENSE AMENDMENT 246
SUPPLEMENT 1
REACTOR COOLANT SYSTEM PRESSURE AND TEMPERATURE LIMITS AND LOW TEMPERATURE OVERPRESSURE PROTECTION

DISCUSSION OF CHANGE

KEWAUNEE POWER STATION
DOMINION ENERGY KEWAUNEE, INC.

LICENSE AMENDMENT 246
SUPPLEMENT 1
REVISION TO REACTOR COOLANT SYSTEM PRESSURE AND TEMPERATURE LIMITS AND LOW TEMPERATURE OVERPRESSURE PROTECTION LIMITATIONS

TABLE OF CONTENTS

1.0 DESCRIPTION

License amendment request (LAR) 246 proposes to revise the current heatup and cooldown pressure-temperature (P/T) limit curves and low temperature overpressure protection (LTOP) requirements for the Kewaunee Power Station (KPS). This supplement to LAR 246 provides the description of changes to convert the associated portions of Custom Technical Specifications (CTS), as originally submitted in LAR 246 (Reference 1), to a format and content consistent with the Improved Technical Specification (ITS) format being approved by NRC for KPS in response to the ITS conversion request (LAR 249) submitted on August 24, 2009 (as amended). This supplement also provides additional restrictions on reactor coolant system (RCS) mass addition consistent with Improved Standard Technical Specifications.

2.0 PROPOSED CHANGE

The proposed amendment would modify the KPS Technical Specifications (TS) associated with reactor coolant system (RCS) temperature and pressure. The proposed amendment would extend the applicability period of the heatup and cooldown P/T limit curves and LTOP limitations from the currently existing 31.1 effective full power years (EFPY) to the proposed value of 52.1 EFPY. The revised requirements consist of new heatup and cooldown P/T limit curves, a higher LTOP enabling temperature, and associated restrictions on reactor coolant pump starts and mass additions into the RCS. The revision would extend the applicability of the P/T limit curves and LTOP enabling temperature through the expected period of the KPS extended license.

2.1 Conversion of Custom TS to Improved TS

The changes proposed in the originally submitted LAR 246 (Reference 1) applied to KPS Custom TS (CTS).

Based on discussions with NRC staff, the NRC was in the final stages of approving License Amendment 207, which revises the KPS Custom TS (CTS) to Improved TS (ITS), consistent with the Improved Standard Technical Specifications (ISTS) described in NUREG 1431, "Standard Technical Specifications - Westinghouse Plants," Revision 3.0. The ITS and ITS Bases pages being provided herein for subsequent revision are the same pages being readied by NRC staff for approval.

This supplement to LAR 246 proposes the changes necessary to conform the original submittal to the format and content of the ITS. Since the ITS replace the CTS in their entirety, all references to CTS in the original submittal are rendered moot. As such, Section 2.0, "Proposed Change", in the original submittal (Reference 1) is superseded in its entirety by this supplement. The changes to the CTS proposed in the original submittal are replaced in their entirety by the corresponding changes to the ITS proposed in this supplement.

This supplement proposes modification to the following ITS sections.

ITS 3.4.3, "Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits"
ITS 3.4.5, "RCS Loops – MODE 3"
ITS 3.4.6, "RCS Loops – MODE 4"
ITS 3.4.10, "Pressurizer Safety Valves"
ITS 3.4.12, "Low Temperature Overpressure Protection (LTOP) System"
ITS 3.5.2, "ECCS – Operating"

The revised requirements would consist of new heatup and cooldown P/T limit curves and a higher LTOP enabling temperature (identical to the changes proposed in the original LAR 246), along with additional restrictions on RCS mass addition consistent with Improved Standard Technical Specifications. These revisions would correspondingly extend the applicability of the heatup and cooldown P/T limit curves through 52.1 EFPY, as proposed in the original submittal.

3.0 BACKGROUND

The background information provided in the originally submitted LAR 246 remains applicable to, and unaltered by, this supplement.

4.0 TECHNICAL ANALYSIS

The technical analysis provided in the originally submitted LAR 246 remains applicable to, and unaltered by, this supplement.

The individual justifications for the specific changes, needed to revise the originally proposed changes (Reference 1) consistent with the ISTS, are provided below.

In the conversion of the CTS changes that were proposed in the original LAR 246 (Reference 1) into the plant specific ITS, certain changes (wording preferences, editorial changes, reformatting, revised numbering, etc.) are made to obtain consistency with NUREG-1431, Rev. 3.0, "Standard Technical Specifications-Westinghouse Plants" (ISTS). Such changes are administrative changes and are acceptable because they do not result in technical alteration to the originally proposed CTS changes.

4.1 ITS 3.4.3, "RCS Pressure and Temperature (P/T) Limits"

The new heatup and cooldown pressure-temperature (P/T) limit curves provided in the originally submitted LAR 246 (CTS Figure TS 3.1-1 and CTS Figure TS 3.1-2) replace ITS Figure 3.4.3-1 and ITS Figure 3.4.3-2, respectively. The amendment also extends the applicability of the P/T limit curves through 52.1 effective full power years (EFPY) as originally submitted in LAR 246, which is the expected period of a KPS extended license. Accordingly, the existing note beneath ITS Figure 3.4.3-1 and ITS Figure 3.4.3-

2 limiting the curves to 31.1 EFPY is deleted. This change is administrative because it only converts the new P/T limit curves in the originally submitted LAR 246 into the format and structure of ISTS.

The Bases for ITS 3.4.3 are correspondingly revised to reflect the above changes.

4.2 ITS 3.4.5, "RCS Loops – MODE 3"

A new Note 2 is added to LCO 3.4.5 specifying that no reactor coolant pump (RCP) shall be started with any RCS cold leg temperature ≤ 356°F unless the secondary side water temperature of each steam generator (SG) is < 100°F above each of the RCS cold leg temperatures. An indicated temperature of ≤ 356°F must be used to account for instrument uncertainty when applying the LTOP Applicability temperature of ≤ 343°F. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started. This change is more restrictive because a new requirement has been added to the LCO. This change is consistent with ISTS.

The Bases for ITS 3.4.5 are correspondingly revised to reflect the above changes.

4.3 ITS 3.4.6, "RCS Loops – MODE 4"

A new Note 2 is added to LCO 3.4.6 specifying that no reactor coolant pump (RCP) shall be started with any RCS cold leg temperature ≤ 356°F (applicable throughout Mode 4) unless the secondary side water temperature of each steam generator (SG) is < 100°F above each of the RCS cold leg temperatures. An indicated temperature of ≤ 356°F must be used to account for instrument uncertainty when applying the LTOP Applicability temperature of ≤ 343°F. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started. This change is more restrictive because a new requirement has been added to the LCO. This change is consistent with ISTS.

The Bases for ITS 3.4.6 are correspondingly revised to reflect the above changes.

4.4 ITS 3.4.10, "Pressurizer Safety Valves"

The Applicability section for LCO 3.4.10 is revised to reduce the range of applicable modes, in which pressurizer safety valves are required to be operable, to align with the expansion of the Applicability section for LTOP protection in ITS 3.4.12. Because the LTOP protection required by ITS 3.4.12 is being expanded to include the portion of MODE 3 up to 356°F, the Applicability section for LCO 3.4.10 is being correspondingly reduced to only include the portion of MODE 3 with both RCS cold leg temperatures > 356°F. An indicated temperature of > 356°F must be used to account for instrument uncertainty (13°F) when applying the LTOP Applicability temperature of ≤ 343°F. Pressurizer safety valves will continue to be required in MODES 1 and 2 as before. The Actions and their associated Note are revised to reflect the lessened Applicability range. This change is administrative because it only incorporates the new LTOP Applicability temperature from the originally submitted LAR 246 into the corresponding section of the ITS. This change is consistent with ISTS.

The Bases for ITS 3.4.10 are correspondingly revised to reflect the above changes.

4.5 ITS 3.4.12, "Low Temperature Overpressure Protection (LTOP) System"

A new requirement is added to LCO 3.4.12 to specify that a maximum of one safety injection (SI) pump be capable of injecting into the RCS and that the accumulators be isolated.

This LCO provides RCS overpressure protection by limiting reactor coolant input capability and ensuring adequate pressure relief capacity. Limiting coolant input capability requires that one safety injection (SI) pump be incapable of injection into the RCS and that the accumulators are isolated. With limited coolant input capability, the ability to provide core coolant addition is restricted. However, the LCO does not require the makeup control system to be deactivated or the SI actuation circuits to be blocked. Due to the generally lower pressures in the LTOP MODES and the expected low core decay heat levels, the makeup system can provide adequate flow via the makeup control valve. If conditions require the use of more than one SI pump for makeup in the event of loss of RCS inventory, then a second pump can be made available through manual actions. This change is more restrictive because a new requirement has been added to the LCO.

As discussed in USAR Section 9.3.4.3, KPS LTOP relief capacity is analyzed for simultaneous injection of one safety injection pump and all three charging pumps. Therefore, no TS restriction is needed to limit the number of charging pumps capable of injection into the RCS.

This LCO is modified by one new Note. Note 1 states that accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing temperature, as allowed by the P/T limit curves. This Note permits the accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions (i.e., new Surveillance Requirement SR 3.4.12.2 is only required to be performed when accumulator isolation is required). The existing Note is renumbered as Note 2 and modified to reflect the revised LTOP enabling temperature of 356°F.

The Applicability section is also revised to expand this LCO up to MODE 3 when any RCS cold leg temperature is ≤ 356°F. An indicated temperature of ≤ 356°F must be used to account for instrument uncertainty when applying the LTOP Applicability temperature of ≤ 343°F.

The new expanded applicability of LCO 3.4.12 overlaps with the applicability of LCO 3.5.2, which requires that two SI trains be operable. This overlap is addressed by a new Note 2 in LCO 3.5.2, as discussed in Section 4.6 on TS 3.5.2, "ECCS – Operating", below.

New actions are added to correspond with the new LCO requirement. A new Note prohibits the application of LCO 3.0.4.b to an inoperable LTOP System. There is an increased risk associated with entering MODE 4 from MODE 5, or entering MODE 3 from MODE 4, with LTOP inoperable. Therefore, the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

With two SI pumps capable of injecting into the RCS (within the Mode of Applicability for LCO 3.4.12), RCS overpressurization is possible. Therefore, the new required actions direct immediate initiation of verification that a maximum of one SI pump is capable of injecting into the RCS. To immediately initiate action to restore restricted coolant input capability to the RCS reflects the urgency of removing the RCS from this condition.

LCO 3.4.12 specifies that an unisolated accumulator requires isolation within 1 hour. This is only required when the accumulator pressure is at or more than the maximum RCS pressure for the existing temperature allowed by the P/T limit curves.

If accumulator isolation is needed and cannot be accomplished in 1 hour, new Required Action C.1 and Required Action C.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > 356°F, an accumulator pressure of 775 psig (maximum nitrogen cover pressure permitted by TS 3.5.1, Accumulators) will not result in overpressurization of the RCS if the accumulators are fully injected. Depressurizing the accumulators below the LTOP limit from TS Figure 3.4.3-1 and Figure 3.4.3-2 also gives this protection.

The associated Completion Times for the above actions are based on operating experience that these activities can be accomplished in these time periods and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

The existing Conditions and Required Actions are renumbered to accommodate the new LCO requirements.

Two Surveillance Requirements (SRs) are added to periodically verify the new LCO requirements every 12 hours (a maximum of one SI pump capable of injecting into the RCS; and, each accumulator isolated).

To minimize the potential for a low temperature overpressure event by limiting the RCS mass input capability, a maximum of one SI pump is verified incapable of injecting into the RCS and the accumulator discharge isolation valves are verified closed and locked out.

An SI pump is rendered incapable of injecting into the RCS by racking the breaker out under administrative control and thereby removing power from the pump. An alternate method of SI pump control may be employed using at least two independent means to prevent a pump start such that a single failure or single action will not result in an injection into the RCS. This may be accomplished by placing the pump control switch in pull to lock and having at least one valve in the discharge flow path closed.

The Frequency of 12 hours is sufficient to verify the required status of the equipment, considering other indications and alarms available to the operator in the control room. This change is designated as more restrictive because a new Surveillance Requirement has been added.

The proposed changes to ITS 3.4.12 are consistent with ISTS.

The Bases for ITS 3.4.12 are correspondingly revised to reflect the above changes.

4.6 ITS 3.5.2, "ECCS – Operating"

A new Note 2 is added to LCO 3.5.2 specifying that in MODE 3, an SI pump may be made incapable of injecting to support transition into or from the Applicability of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," for up to 4 hours or until the temperature of all RCS cold legs exceeds 381°F, whichever comes first.

LCO 3.5.2, which is applicable in Modes 1, 2, and 3, requires that two trains of SI be Operable. However, during low temperature conditions in the RCS, limitations are placed on the maximum number of SI pumps that may be Operable. The temperature range of these limitations, which are governed by LCO 3.4.12, is being expanded into the lower-temperature portion of Mode 3. As a result, the new expanded applicability of LCO 3.4.12 overlaps with the applicability of LCO 3.5.2.

As indicated in the new Note 2 to LCO 3.5.2, operation in Mode 3 with an SI pump made incapable of injecting in order to facilitate entry into or exit from the Applicability of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System", is necessary with an LTOP arming temperature at or near the Mode 3 boundary temperature of 350°F. LCO 3.4.12 requires that an SI pump be rendered incapable of injecting at and below the LTOP arming temperature (356°F). Since this temperature is near the Mode 3 boundary temperature, time is needed to make a SI pump incapable of injecting prior to entering the LTOP Applicability, and provide time to restore the inoperable pump to Operable status on exiting the LTOP Applicability. Note 2 provides this allowance by permitting four hours for this transition activity, or until both RCS cold leg temperatures exceed 381°F (which is the LTOP arming temperature plus 25°F), whichever occurs first.

This change relaxes the existing requirement in LCO 3.5.2 by providing an allowance for one SI train to be inoperable for a limited period of time while enabling LTOP during a plant cooldown or while restoring an inoperable SI train during a plant heatup. This change is required to facilitate transition between LCO 3.5.2 and LCO 3.4.12. The four hour allowance is acceptable since the remaining SI train is Operable, thus the associated coolant injection capability remains available. Additionally, the four hour allowance is a small fraction of the 72 hour Completion Time allowed by LCO 3.5.2 to restore one inoperable SI train to Operable status. A 25°F temperature allowance above the LTOP limit is a reasonable RCS temperature band in which to perform the transition activities. Although appropriate, this change is less restrictive because conditions that allow removal of one SI train from service have been added to the TS. This change is consistent with ISTS.

The Bases for ITS 3.5.2 are correspondingly revised to reflect the above changes.

4.7 Conclusion

The proposed changes will ensure that the RCS and reactor vessel are protected from overpressurization under the conditions when LTOP is required.

The proposed P/T and LTOP limitations have been developed and determined in accordance with NRC approved methodology cited in 10 CFR 50, Appendices G and H, and 10 CFR 50.61; NRC approved exemptions to the rule (discussed in Reference 1); and, Appendix G of ASME Section XI, 1998 Edition (through 2000 Addendum).

The LTOP enabling temperature is being increased from 200°F to 343°F. By system design, the LTOP system is enabled whenever the residual heat removal (RHR) system is aligned with its suction side isolation valves to the reactor coolant system (RCS) open. TS are being revised to require that LTOP be operable (with a maximum of one safety injection (SI) pump capable of injecting into the RCS and the accumulators isolated) whenever any RCS cold leg temperature is ≤ 356°F (343°F plus instrument uncertainty of 13°F) and the reactor vessel head is installed. This change will thus require that RHR be aligned to provide the LTOP function when RCS temperature decreases to the LTOP enabling temperature. Factoring in instrument uncertainty (13°F), LTOP will need to be enabled when indicated RCS temperature decreases to 356°F. Associated surveillance requirements, consistent with ISTS, are also being proposed for addition.

The setpoint for the LTOP relief valve is unaffected by this proposed amendment and remains at 500 psig, which is adequate to mitigate the effects from either the existing postulated energy or mass addition events. Each of the reactor vessel beltline and extended beltline materials has RT_{PTS} values and upper shelf energies that satisfy regulatory criteria for neutron exposure projections through 52.1 EFPY. For the period of operation through 52.1 EFPY, changes in the fracture toughness properties of ferritic materials in the reactor vessel beltline region have been monitored by surveillance capsule T and used to establish the proposed P/T and LTOP limitations. The remaining surveillance capsule is adequate for monitoring fluence during the 52.1 EFPY period of operation.

The proposed heatup and cooldown P/T limit curves, along with the corresponding Technical Specification changes, are provided in Attachment 2. Attachment 3 contains marked up Technical Specification Bases pages.

WCAP-15074, Revision 1, WCAP-16609-NP, Revision 0, WCAP-16641-NP, Revision 0, WCAP-16642-NP, Revision 0, and WCAP-16643-NP, Revision 2 (all of which were provided in Reference 1) provide supporting documentation for the proposed heatup and cooldown limit curves, a revised PTS evaluation, and LTOP enabling temperature.

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Consideration

The conclusions of the no significant hazards consideration contained in Reference 1 are not affected by, and remain applicable to, this supplement.

5.2 Applicable Regulatory Requirements/Criteria

The applicable regulatory requirements/criteria contained in Reference 1 are not affected by, and remain applicable to, this supplement.

6.0 ENVIRONMENTAL CONSIDERATION

The conclusions of the environmental considerations contained in Reference 1 are not affected by, and remain applicable to, this supplement.

7.0 REFERENCES

1. Letter from J. Alan Price (Dominion Energy Kewaunee) to Document Control Desk, "Dominion Energy Kewaunee, Inc. Kewaunee Power Station, License Amendment Request 246: Revision to Reactor Coolant System Pressure and Temperature Limits and Low Temperature Overpressure Protection Limitations", dated April 13, 2010.

ATTACHMENT 2

LICENSE AMENDMENT 246
SUPPLEMENT 1
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS AND LOW TEMPERATURE OVERPRESSURE PROTECTION

MARKED UP TECHNICAL SPECIFICATIONS PAGES:

ITS 3.4.3, "Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits"
ITS 3.4.5, "RCS Loops – MODE 3"
ITS 3.4.6, "RCS Loops – MODE 4"
ITS 3.4.10, "Pressurizer Safety Valves"
ITS 3.4.12, "Low Temperature Overpressure Protection (LTOP) System"
ITS 3.5.2, "ECCS – Operating"

KEWAUNEE POWER STATION
DOMINION ENERGY KEWAUNEE, INC.

Replace with proposed CTS Figure TS 3.1-1 (Insert 1).

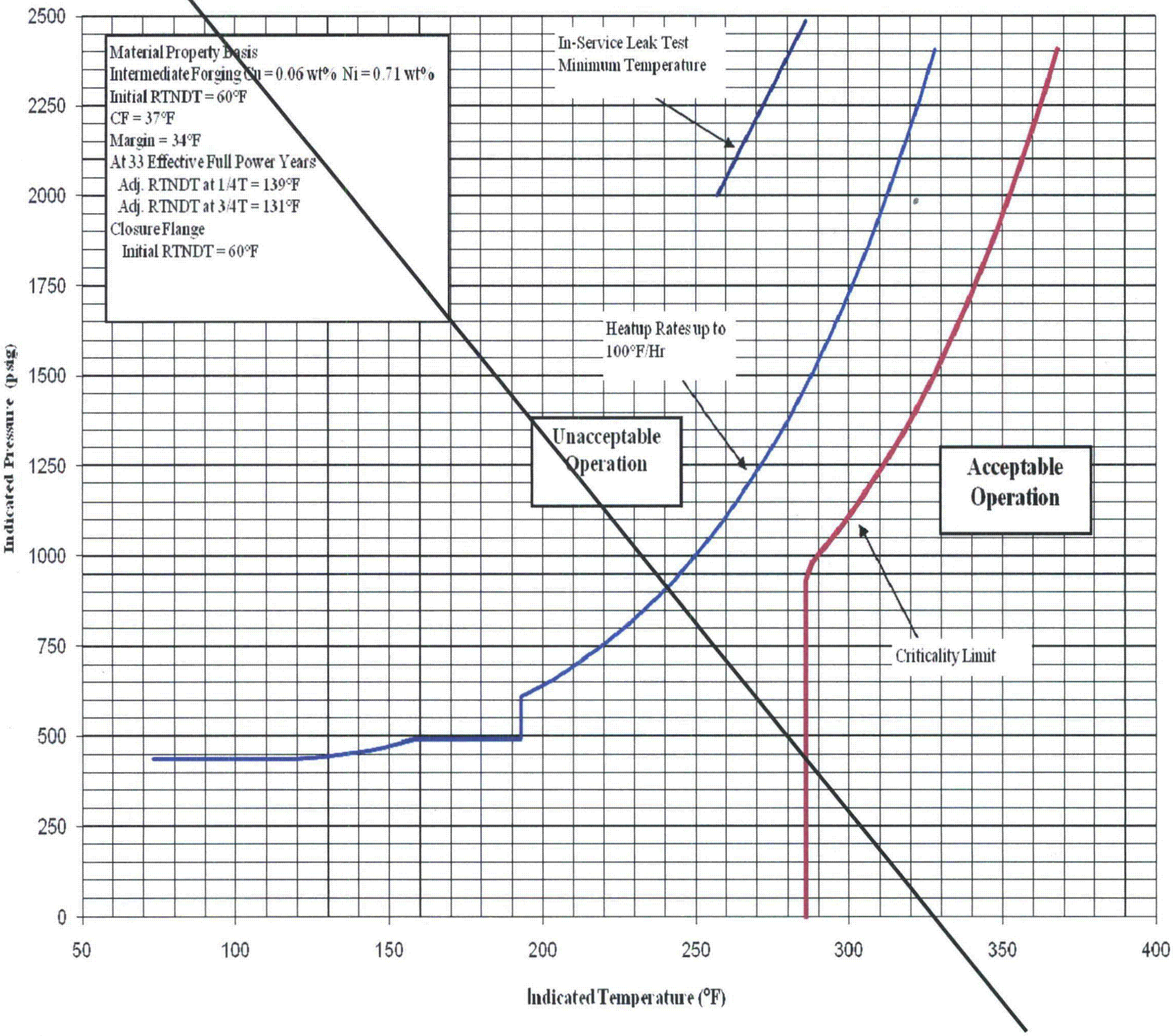

Figure 3.4.3-1 (page 1 of 1)
KPS Heatup, Criticality, and In-Service Leak Test Limitation Curves
Applicable for Periods up to 52.1 ~~33~~[(1)] Effective Full Power Years (EFPY)

~~(1) Curves limited to 31.1 EFPY due to changes in vessel fluence associated with operation at power uprate~~

Replace with proposed CTS Figure TS 3.1-2 (Insert 2).

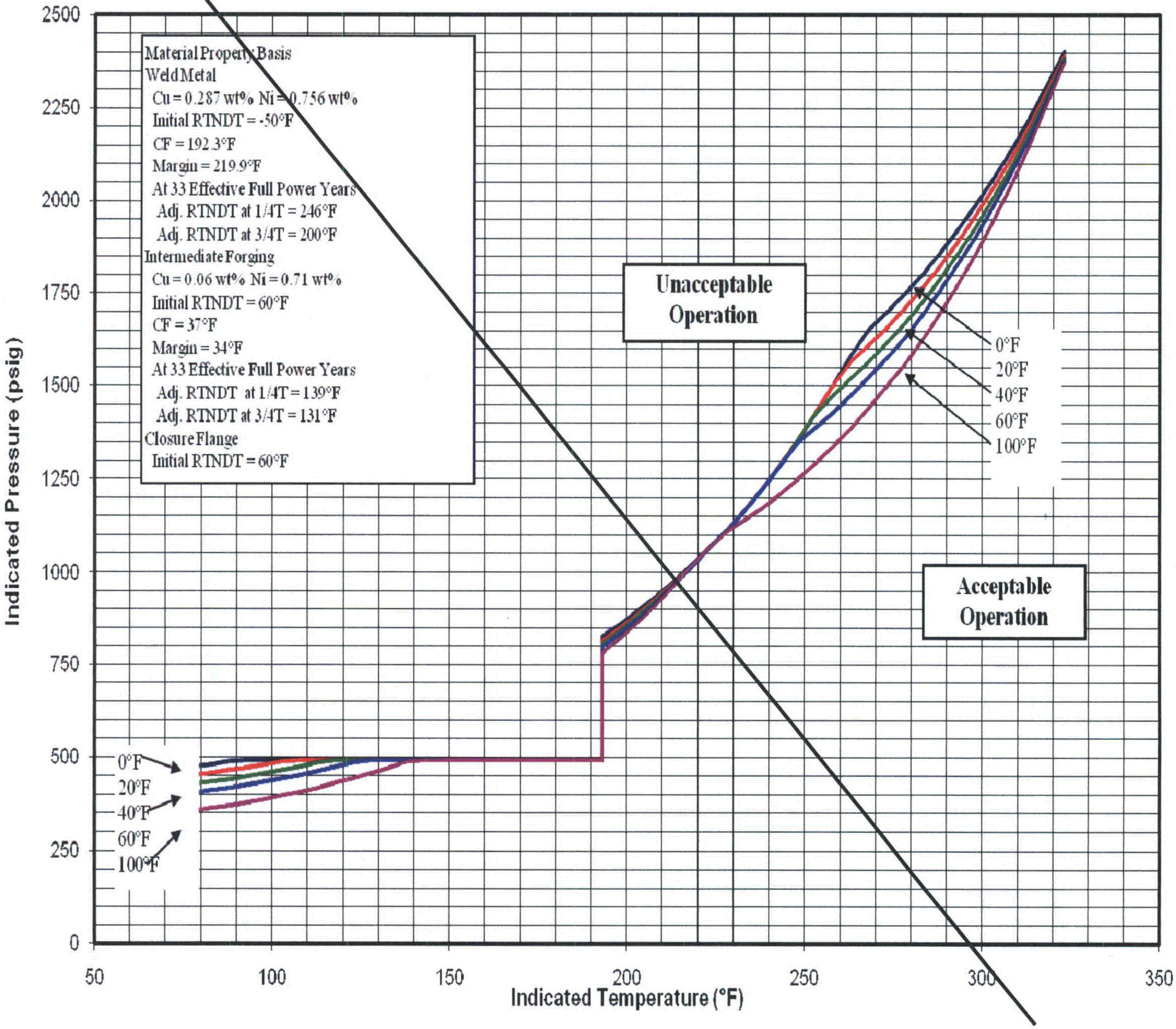

Figure 3.4.3-2 (page 1 of 1)
KPS Cooldown and LTOP Event Limitation Curves
Applicable for Periods up to 52.1 ~~33(1)~~ EFPY

~~(1) Curves limited to 31.1 EFPY due to changes in vessel fluence associated with operation at power uprate~~

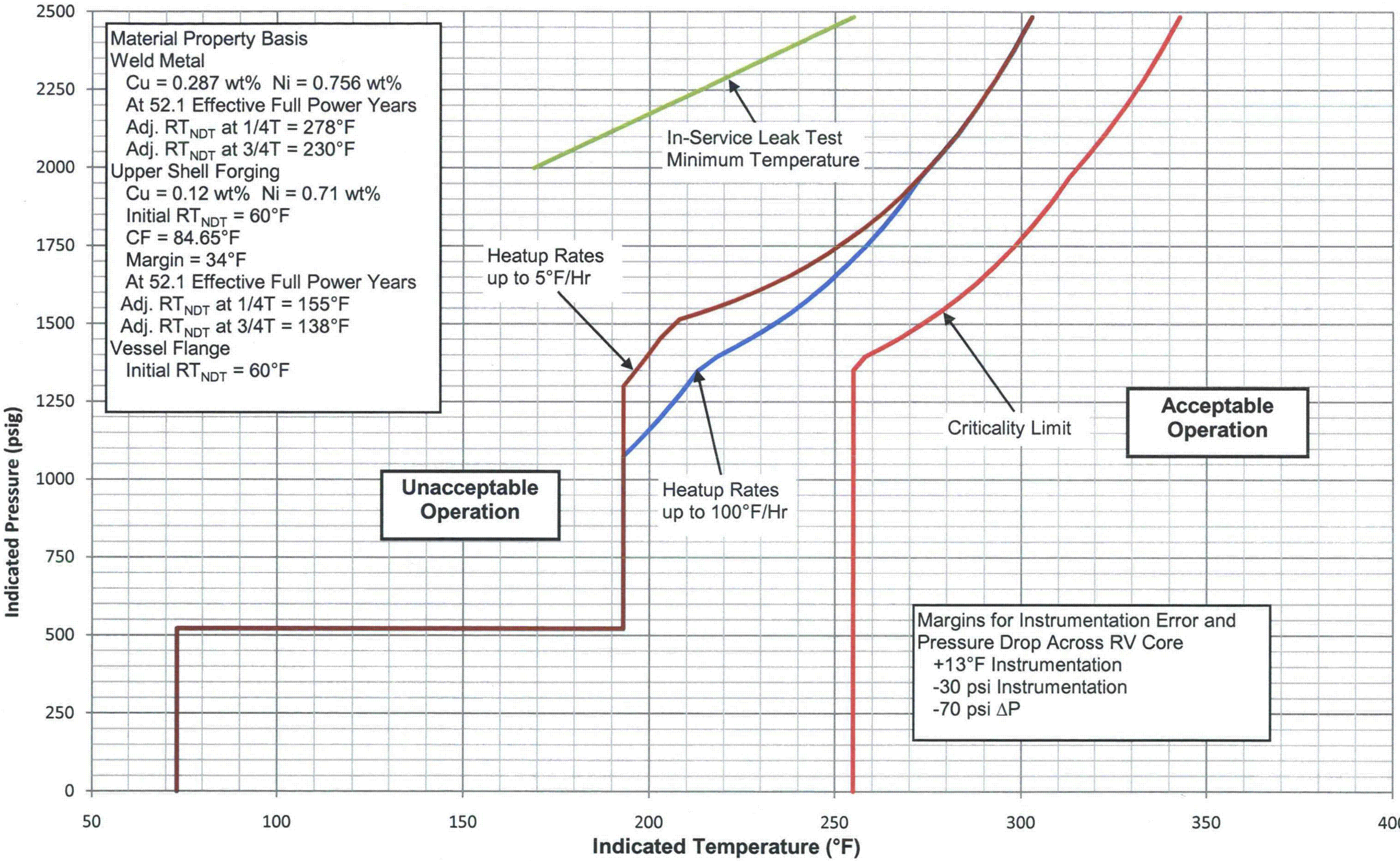

Figure 3.4.3-1 (page 1 of 1)
KPS Heatup, Criticality, and In-Service Leak Test Limitation Curves
Applicable for Periods up to 52.1 Effective Full Power Years (EFPY)

Insert 2

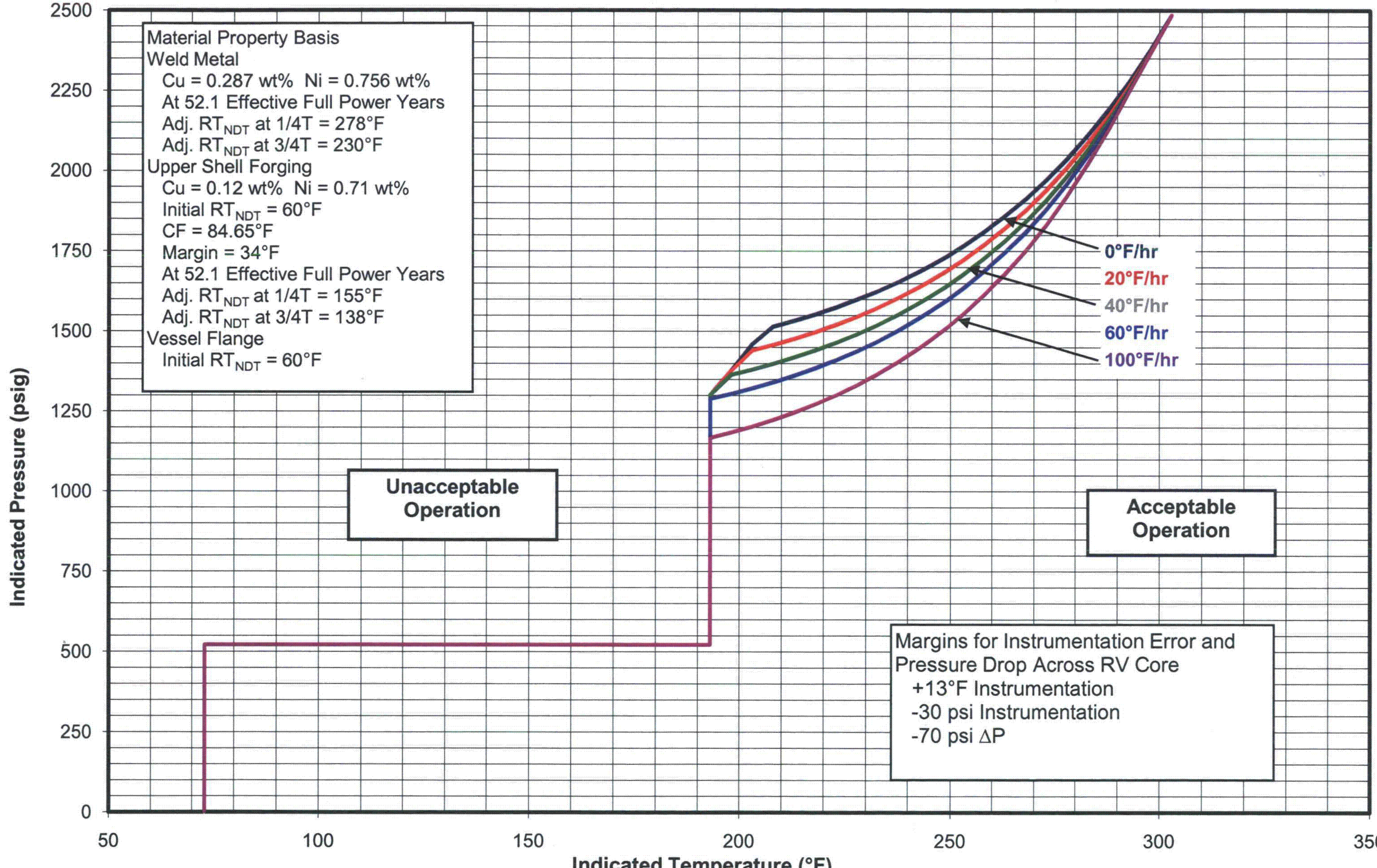

Figure 3.4.3-2 (page 1 of 1)
KPS Cooldown and LTOP Event Limitation Curves Applicable for Periods up to 52.1 EFPY

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.5 RCS Loops - MODE 3

LCO 3.4.5 Two RCS loops shall be OPERABLE, and one RCS loop shall be in operation.

--NOTES--

1. All reactor coolant pumps (RCPs) may be removed from operation for ≤ 1 hour per 8 hour period provided:

   a. No operations are permitted that would cause introduction of coolant into the RCS with boron concentration less than required to meet the SDM of LCO 3.1.1, "SHUTDOWN MARGIN"; and

   b. Core outlet temperature is maintained at least 10°F below saturation temperature.

2. No RCP shall be started with any RCS cold leg temperature ≤ 356°F unless the secondary side water temperature of each steam generator (SG) is < 100°F above each of the RCS cold leg temperatures.

APPLICABILITY: MODE 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RCS loop inoperable.	A.1 Restore RCS loop to OPERABLE status.	72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 4.	12 hours

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.6 RCS Loops - MODE 4

LCO 3.4.6 Two loops consisting of any combination of RCS loops and residual heat removal (RHR) loops shall be OPERABLE, and one loop shall be in operation.

--NOTES--

1. All reactor coolant pumps (RCPs) and RHR pumps may be removed from operation for ≤ 1 hour per 8 hour period provided:

    a. No operations are permitted that would cause introduction of coolant into the RCS with boron concentration less than required to meet the SDM of LCO 3.1.1, "SHUTDOWN MARGIN"; and

    b. Core outlet temperature is maintained at least 10°F below saturation temperature.

2. No RCP shall be started with any RCS cold leg temperature ≤ 356°F unless the secondary side water temperature of each steam generator (SG) is < 100°F above each of the RCS cold leg temperatures.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required loop inoperable.	A.1 Initiate action to restore a second loop to OPERABLE status.	Immediately
	AND	
	A.2 --------------NOTE-------------- Only required if RHR loop is OPERABLE. ------------------------------------- Be in MODE 5.	24 hours

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.10 Pressurizer Safety Valves

LCO 3.4.10 Two pressurizer safety valves shall be OPERABLE with lift settings ≥ 2410.45 psig and ≤ 2559.55 psig.

--NOTE--
The pressurizer safety valves may be inoperable during a hydro test of the RCS provided the pressurizer power operated relief valves and the safety valves on the discharge pump are set at > the test pressure +35 psi.

APPLICABILITY: MODES 1, 2, ~~3,~~ and
MODE 3 with both RCS cold leg temperatures > 356°F~~4~~.

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--NOTE--
The lift settings are not required to be within the LCO limits during MODE~~S~~ 3 (with both RCS cold leg temperatures > 356°F) ~~and 4~~ for the purpose of setting the pressurizer safety valves under ambient (hot) conditions. This exception is allowed for 36 hours following entry into MODE 3 provided a preliminary cold setting was made prior to heatup.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One pressurizer safety valve inoperable.	A.1 Restore valve to OPERABLE status.	15 minutes
B. Required Action and associated Completion Time not met. OR Two pressurizer safety valves inoperable.	B.1 Be in MODE 3. AND B.2 Be in MODE 3 with any RCS cold leg temperatures ≤ 356°F~~5~~.	6 hours 36 hours

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 Low Temperature Overpressure Protection (LTOP) System

LCO 3.4.12

An LTOP System shall be OPERABLE with a maximum of one safety injection (SI) pump capable of injecting into the RCS and the accumulators isolated and one of the following pressure relief capabilities:

a. The Residual Heat Removal (RHR) System LTOP overpressure relief valve with a lift setting ≤ 500 psig and two RHR suction flow paths OPERABLE; or

b. An RCS vent of ≥ 6.4 square inches.

---NOTES---

1. Accumulator may be unisolated when accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in Figure 3.4.3-1 and Figure 3.4.3-2.

2. A reactor coolant pump shall not be started with one or more RCS cold leg temperatures ≤ ~~200°F~~ 356°F unless the secondary water temperature of each steam generator is < 100°F above each of the RCS cold leg temperatures.

APPLICABILITY:

MODE 3 when any RCS cold leg temperature is ≤ 356°F,
MODES 4, 5,
MODE 6 when the reactor vessel head is on.

ACTIONS

-----NOTE-----
LCO 3.0.4.b is not applicable when entering MODES 3 or 4.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Two SI pumps capable of injecting into the RCS.	A.1 Initiate action to verify a maximum of one SI pump is capable of injecting into the RCS.	Immediately
B. An accumulator not isolated when the accumulator pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in Figure 3.4.3-1 and Figure 3.4.3-2.	B.1 Isolate affected accumulator.	1 hour
C. Required Action and associated Completion Time of Condition B not met.	C.1 Increase RCS cold leg temperature to > 356°F. OR C.2 Depressurize affected accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed in Figure 3.4.3-1 and Figure 3.4.3-2.	12 hours 12 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~A~~D. One RHR suction flow path inoperable.	~~A~~D.1 Verify suction valves in the other RHR suction flow path are locked open with the motive power removed.	Immediately
	AND	
	~~A~~D.2 Restore RHR suction flow path to OPERABLE status.	5 days
~~B~~E. Two RHR suction flow paths inoperable. OR Required Action and associated Completion Time of Condition A, C, or D not met. OR RHR System LTOP overpressure relief valve inoperable.	~~B~~E.1 Depressurize RCS and establish RCS vent of ≥ 6.4 square inches.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.12.1	Verify a maximum of one SI pump is capable of injecting into the RCS.	12 hours
SR 3.4.12.2	Verify each accumulator is isolated.	12 hours
SR 3.4.12.~~1~~3	Verify RHR suction valves are open for each RHR suction flow path.	12 hours
SR 3.4.12.~~2~~4	Verify required RCS vent ≥ 6.4 square inches is open.	12 hours for unlocked open vent valve(s) AND 31 days for other vent path(s)

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.2 ECCS - Operating

LCO 3.5.2 Two ECCS trains shall be OPERABLE.

---------------------------------------NOTES---------------------------------------

1. A safety injection (SI) train may be considered OPERABLE for up to 1 hour when being used to fill an SI accumulator, provided the other SI train is OPERABLE.
2. In MODE 3, an SI pump may be made incapable of injecting to support transition into or from the Applicability of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System", for up to 4 hours or until the temperature of all RCS cold legs exceeds 381°F, whichever comes first.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more trains inoperable.	A.1 Restore train(s) to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours
C. Less than 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available.	C.1 Enter LCO 3.0.3.	Immediately

Serial No. 10-047A

ATTACHMENT 3

LICENSE AMENDMENT 246
SUPPLEMENT 1
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS AND LOW TEMPERATURE OVERPRESSURE PROTECTION

MARKED-UP TECHNICAL SPECIFICATIONS BASES PAGES:

ITS 3.4.3, "Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits"
ITS 3.4.5, "RCS Loops – MODE 3"
ITS 3.4.6, "RCS Loops – MODE 4"
ITS 3.4.10, "Pressurizer Safety Valves"
ITS 3.4.12, "Low Temperature Overpressure Protection (LTOP) System"
ITS 3.5.2, "ECCS – Operating"

KEWAUNEE POWER STATION
DOMINION ENERGY KEWAUNEE, INC.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.3 RCS Pressure and Temperature (P/T) Limits

BASES

BACKGROUND

All components of the RCS are designed to withstand effects of cyclic loads due to system pressure and temperature changes. These loads are introduced by startup (heatup) and shutdown (cooldown) operations, power transients, and reactor trips. This LCO limits the pressure and temperature changes during RCS heatup and cooldown, within the design assumptions and the stress limits for cyclic operation.

This LCO contains P/T limit curves for heatup, cooldown, inservice leak and hydrostatic (ISLH) testing, criticality, and data for the maximum rate of change of reactor coolant temperature (Ref. 1).

Each P/T limit curve defines an acceptable region for normal operation. The usual use of the curves is operational guidance during heatup or cooldown maneuvering, when pressure and temperature indications are monitored and compared to the applicable curve to determine that operation is within the allowable region.

The LCO establishes operating limits that provide a margin to brittle failure of the reactor vessel and piping of the reactor coolant pressure boundary (RCPB). The vessel is the component most subject to brittle failure, and the LCO limits apply mainly to the vessel. The limits do not apply to the pressurizer, which has different design characteristics and operating functions.

10 CFR 50, Appendix G (Ref. 2), requires the establishment of P/T limits for specific material fracture toughness requirements of the RCPB materials. Reference 2 requires an adequate margin to brittle failure during normal operation, anticipated operational occurrences, and system hydrostatic tests. It mandates the use of the American Society of Mechanical Engineers (ASME) Code, Section III, Appendix G (Ref. 3) and ASME Code, Section XI, Appendix G (Ref. 4). Master curve methodology (Ref. 5) provides an exemption from portions of these requirements.

The neutron embrittlement effect on the material toughness is reflected by increasing the nil ductility reference temperature (RT_{NDT}) as exposure to neutron fluence increases.

The actual shift in the RT_{NDT} of the vessel material will be established periodically by removing and evaluating the irradiated reactor vessel material specimens, in accordance with ASTM E 185 (Ref. ~~5~~6) and Appendix H of 10 CFR 50 (Ref. ~~6~~7). The operating P/T limit curves will be adjusted, as necessary, based on the evaluation findings and the recommendations of Regulatory Guide 1.99 (Ref. ~~7~~8).

BASES

BACKGROUND (continued)

The P/T limit curves are composite curves established by superimposing limits derived from stress analyses of those portions of the reactor vessel and head that are the most restrictive. At any specific pressure, temperature, and temperature rate of change, one location within the reactor vessel will dictate the most restrictive limit. Across the span of the P/T limit curves, different locations are more restrictive, and, thus, the curves are composites of the most restrictive regions.

The heatup curve represents a different set of restrictions than the cooldown curve because the directions of the thermal gradients through the vessel wall are reversed. The thermal gradient reversal alters the location of the tensile stress between the outer and inner walls.

The criticality limit curve includes the Reference 2 requirement that it be ≥ 40°F above the heatup curve or the cooldown curve, and not less than the minimum permissible temperature for ISLH testing. However, the criticality curve is not operationally limiting; a more restrictive limit exists in LCO 3.4.2, "RCS Minimum Temperature for Criticality."

The consequence of violating the LCO limits is that the RCS has been operated under conditions that can result in brittle failure of the RCPB, possibly leading to a nonisolable leak or loss of coolant accident. In the event these limits are exceeded, an evaluation must be performed to determine the effect on the structural integrity of the RCPB components. The ASME Code, Section XI, Appendix E (Ref. ~~8~~9), provides a recommended methodology for evaluating an operating event that causes an excursion outside the limits.

APPLICABLE SAFETY ANALYSES

The P/T limits are not derived from Design Basis Accident (DBA) analyses. They are prescribed during normal operation to avoid encountering pressure, temperature, and temperature rate of change conditions that might cause undetected flaws to propagate and cause nonductile failure of the RCPB, an unanalyzed condition. Reference 1 establishes the methodology for determining the P/T limits. Although the P/T limits are not derived from any DBA, the P/T limits are acceptance limits since they preclude operation in an unanalyzed condition.

RCS P/T limits satisfy Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The two elements of this LCO are:

a. The limit curves for heatup, cooldown, criticality, and ISLH testing; and

b. Limits on the rate of change of temperature (maximum of 100°F/hr for heatup and cooldown).

BASES

LCO (continued)

The LCO limits apply to all components of the RCS, except the pressurizer. These limits define allowable operating regions and permit a large number of operating cycles while providing a wide margin to nonductile failure.

The limits for the rate of change of temperature control the thermal gradient through the vessel wall and are used as inputs for calculating the heatup, cooldown, and ISLH testing P/T limit curves. Thus, the LCO for the rate of change of temperature restricts stresses caused by thermal gradients and also ensures the validity of the P/T limit curves.

Figure 3.4.3-1 and Figure 3.4.3-2 ~~were originally developed for service periods of up to 33~~are applicable for 52.1 effective full power years (EFPY)~~. However, the curves are limited to 31.1 EFPY due to changes in the vessel fluence associated with operation at uprated power~~ of fluence, projected to coincide with the beginning of fuel cycle 46 based on continuous 18 month fuel cycles).

Figure 3.4.3-1 and Figure 3.4.3-2 define limits to assure prevention of non-ductile failure only. For normal operation, other inherent plant characteristics, e.g., pump heat addition and pressurizer heater capacity may limit the heatup and cooldown rates that can be achieved over certain pressure-temperature ranges. Allowable combinations of pressure and temperature for specific temperature change rates are below and to the right of the limit lines shown. Limit lines for cooldown rates between those presented may be obtained by interpolation.

Furthermore, the Figures include margins for instrumentation error and pressure drop (+ 13°F, ~~-58~~ 30 psi, and -70 psi ΔP).

Violating the LCO limits places the reactor vessel outside of the bounds of the stress analyses and can increase stresses in other RCPB components. The consequences depend on several factors, as follow:

a. The severity of the departure from the allowable operating P/T regime or the severity of the rate of change of temperature;

b. The length of time the limits were violated (longer violations allow the temperature gradient in the thick vessel walls to become more pronounced); and

c. The existences, sizes, and orientations of flaws in the vessel material.

BASES

APPLICABILITY

The RCS P/T limits LCO provides a definition of acceptable operation for prevention of nonductile failure in accordance with 10 CFR 50, Appendix G (Ref. 2). Although the P/T limits were developed to provide guidance for operation during heatup or cooldown (MODES 3, 4, and 5) or ISLH testing, their Applicability is at all times in keeping with the concern for nonductile failure. The limits do not apply to the pressurizer.

During MODES 1 and 2, other Technical Specifications provide limits for operation that can be more restrictive than or can supplement these P/T limits. LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits," LCO 3.4.2, "RCS Minimum Temperature for Criticality," and Safety Limit 2.1, "Safety Limits," also provide operational restrictions for pressure and temperature and maximum pressure. Furthermore, MODES 1 and 2 are above the temperature range of concern for nonductile failure, and stress analyses have been performed for normal maneuvering profiles, such as power ascension or descent.

ACTIONS

A.1 and A.2

Operation outside the P/T limits during MODE 1, 2, 3, or 4 must be corrected so that the RCPB is returned to a condition that is within the limits of the applicable Figures (i.e., Figures 3.4.3-1 and 3.4.3-2).

The 30 minute Completion Time reflects the urgency of restoring the parameters to within the analyzed range. Most violations will not be severe, and the activity can be accomplished in this time in a controlled manner.

Besides restoring operation within limits, an evaluation is required to determine if RCS operation can continue. The evaluation must verify the RCPB integrity remains acceptable and must be completed within 72 hours. Several methods may be used, including comparison with pre-analyzed transients in the stress analyses, new analyses, or inspection of the components.

ASME Code, Section XI, Appendix E (Ref. ~~8~~9), may be used to support the evaluation. However, its use is restricted to evaluation of the vessel beltline.

The 72 hour Completion Time is reasonable to accomplish the evaluation. The evaluation for a mild violation is possible within this time, but more severe violations may require special, event specific stress analyses or inspections.

BASES

ACTIONS (continued)

Condition A is modified by a Note requiring Required Action A.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 alone per Required Action A.1 is insufficient because higher than analyzed stresses may have occurred and may have affected the RCPB integrity.

B.1 and B.2

If any Required Action and associated Completion Time of Condition A is not met, the plant must be placed in a lower MODE because either the RCS remained in an unacceptable P/T region for an extended period of time or a sufficiently severe event resulted in a determination that the RCS is or may be unacceptable for continued operation. Either possibility indicates a need for more careful examination of the event, best accomplished with the RCS at reduced pressure and temperature. In reduced pressure and temperature conditions, the possibility of propagation with undetected flaws is decreased.

If the required restoration activity cannot be accomplished within 30 minutes, Required Action B.1 and Required Action B.2 must be implemented to reduce pressure and temperature.

If the required evaluation for continued operation cannot be accomplished within 72 hours or the results are indeterminate or unfavorable, action must proceed to reduce pressure and temperature as specified in Required Action B.1 and Required Action B.2. A favorable evaluation must be completed and documented before returning to operating pressure and temperature conditions.

Pressure and temperature are reduced by bringing the plant to MODE 3 within 6 hours and to MODE 5 with RCS pressure < 500 psig within 36 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

BASES

ACTIONS (continued)

C.1 and C.2

Actions must be initiated immediately to correct operation outside of the P/T limits at times other than when in MODE 1, 2, 3, or 4, so that the RCPB is returned to a condition that is within the limits of the applicable Figures (i.e., Figures 3.4.3-1 and 3.4.3-2).

The immediate Completion Time reflects the urgency of initiating action to restore the parameters to within the analyzed range. Most violations will not be severe, and the activity can be accomplished in this time in a controlled manner.

Besides restoring operation within limits, 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. ~~8~~9), 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.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 alone per Required Action C.1 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 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.

BASES

SURVEILLANCE REQUIREMENTS (continued)

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.

REFERENCES

1. WCAP-~~14278, Rev. 1, "Kewaunee Heatup and Cooldown Limit Curves for Normal Operation."~~16643-NP, "Kewaunee Power Station Heatup and Cooldown Limit Curves for Normal Operation", dated June 2009.

2. 10 CFR 50, Appendix G.

3. ASME, Boiler and Pressure Vessel Code, Section III, Appendix G.

4. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix G.

5. Exemption from the Requirements of 10 CFR 50, Appendix G, Appendix H, and Section 50.61, dated May 1, 2001.

~~5~~6. ASTM E 185-70 (removal) and ASTM E 185-82 (evaluation).

~~6~~7. 10 CFR 50, Appendix H.

~~7~~8. Regulatory Guide 1.99, Revision 2, May 1988.

~~8~~9. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix E.

BASES (continued)

LCO

The purpose of this LCO is to require that two RCS loops be OPERABLE and one RCS loop in operation. The required number of RCS loops in operation ensures that the accident analysis criteria will be met for the postulated accident.

One RCS loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. An additional RCS loop is required to be OPERABLE to ensure redundant capability for heat removal.

~~The~~ Note 1 permits all RCPs to be removed from operation for ≤ 1 hour per 8 hour period. The purpose of the Note is to perform tests that are designed to validate various accident analyses values. One of these tests is validation of the pump coastdown curve used as input to a number of accident analyses including a loss of flow accident. This test is generally performed in MODE 3 during the initial startup testing program, and as such should only be performed once. If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values of the coastdown curve must be revalidated by conducting the test again. Another test performed during the startup testing program is the validation of rod drop times during cold conditions, both with and without flow.

The no flow test may be performed in MODE 3, 4, or 5 and requires that the pumps be stopped for a short period of time. ~~The~~ Note 1 permits the stopping of the pumps in order to perform this test and validate the assumed analysis values. As with the validation of the pump coastdown curve, this test should be performed only once unless the flow characteristics of the RCS are changed. The 1 hour time period specified is adequate to perform the desired tests, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of ~~the~~ Note 1 is permitted provided the following conditions are met, along with any other conditions imposed by initial startup test procedures:

a. No operations are permitted that would dilute the RCS boron concentration with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1, "SHUTDOWN MARGIN," thereby maintaining the margin to criticality. Boron reduction with coolant at boron concentrations less than required to assure SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and

b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

BASES

LCO (continued)

Note 2 requires that the secondary side water temperature of each SG be ≤ 100°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 356°F. An indicated temperature of ≤ 356°F must be used to account for instrument uncertainty when applying the LTOP Applicability temperature of ≤ 343°F. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

An OPERABLE RCS loop consists of one OPERABLE RCP and one OPERABLE SG, which has the minimum water level specified in SR 3.4.5.2. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow.

APPLICABILITY

In MODE 3, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2;"
LCO 3.4.6, "RCS Loops - MODE 4;"
LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled;"
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled;"
LCO 3.9.3, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6); and
LCO 3.9.4, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1

If one RCS loop is inoperable, redundancy for heat removal is lost. The Required Action is restoration of the RCS loop to OPERABLE status within the Completion Time of 72 hours. This time allowance is a justified period to be without the redundant, nonoperating loop because a single loop in operation has a heat transfer capability greater than that needed to remove the decay heat produced in the reactor core and because of the low probability of a failure in the remaining loop occurring during this period.

B.1

If restoration for Required Action A.1 is not possible within 72 hours, the unit must be brought to MODE 4. In MODE 4, the unit may be placed on the Residual Heat Removal System. The additional Completion Time of 12 hours is compatible with required operations to achieve cooldown and

BASES

ACTIONS (continued)

depressurization from the existing plant conditions in an orderly manner and without challenging plant systems.

C.1, C.2, and C.3

If two RCS loops are inoperable or the required RCS loop is not in operation, except as during conditions permitted by ~~the~~ Note 1 in the LCO section, the Rod Control System must be placed in a condition incapable of rod withdrawal (e.g., all CRDMs must be de-energized by opening the RTBs or de-energizing the MG sets). All operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended, and action to restore one of the RCS loops to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and opening the RTBs or de-energizing the MG sets removes the possibility of an inadvertent rod withdrawal. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.5.1

This SR requires verification every 12 hours that one loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS loop performance.

SR 3.4.5.2

SR 3.4.5.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ 5% for the RCS loops. If the SG secondary side narrow range water level is < 5%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink for removal of the decay heat. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to a loss of SG level.

BASES

LCO (continued)

~~The~~ Note 1 permits all RCPs or RHR pumps to be removed from operation for ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests that are designed to validate various accident analyses values. One of the tests performed during the startup testing program is the validation of rod drop times during cold conditions, both with and without flow. The no flow test may be performed in MODE 3, 4, or 5 and requires that the pumps be stopped for a short period of time. The Note permits the stopping of the pumps in order to perform this test and validate the assumed analysis values. If changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values must be revalidated by conducting the test again. The 1 hour time period is adequate to perform the test, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of ~~the~~ Note 1 is permitted provided the following conditions are met along with any other conditions imposed by initial startup test procedures:

a. No operations are permitted that would dilute the RCS boron concentration with coolant with boron concentrations less than required to meet SDM of LCO 3.1.1, "SHUTDOWN MARGIN," thereby maintaining the margin to criticality. Boron reduction with coolant at boron concentrations less than required to assure SDM is maintained is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and,

b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

Note 2 requires that the secondary side water temperature of each SG be ≤ 100°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 356°F (applicable in all of MODE 4). An indicated temperature of ≤ 356°F must be used to account for instrument uncertainty when applying the LTOP Applicability temperature of ≤ 343°F. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

An OPERABLE RCS loop comprises an OPERABLE RCP and an OPERABLE SG, which has the minimum water level specified in SR 3.4.6.2.

BASES

ACTIONS (continued)

This Required Action is modified by a Note which indicates that the unit must be placed in MODE 5 only if a RHR loop is OPERABLE. With no RHR loop OPERABLE, the unit is in a condition with only limited cooldown capabilities. Therefore, the actions are to be concentrated on the restoration of a RHR loop, rather than a cooldown of extended duration.

B.1 and B.2

If two required loops are inoperable or a required loop is not in operation, except during conditions permitted by ~~the~~ Note 1 in the LCO section, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore one RCS or RHR loop to OPERABLE status and operation must be initiated. The required margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that the required RCS or RHR loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

SR 3.4.6.2

SR 3.4.6.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ 5%. If the SG secondary side narrow range water level is < 5%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.10 Pressurizer Safety Valves

BASES

BACKGROUND

The pressurizer safety valves provide, in conjunction with the Reactor Protection System, overpressure protection for the RCS. The pressurizer safety valves are totally enclosed pop type, spring loaded, self actuated valves with backpressure compensation. The safety valves are designed to prevent the system pressure from exceeding the system Safety Limit (SL), 2735 psig, which is approximately 110% of the design pressure.

Because the safety valves are totally enclosed and self actuating, they are considered independent components. The relief capacity for each valve, 345,000 lb/hr, is based on postulated overpressure transient conditions resulting from a complete loss of steam flow to the turbine. This event results in the maximum surge rate into the pressurizer, which specifies the minimum relief capacity for the safety valves. The discharge flow from the pressurizer safety valves is directed to the pressurizer relief tank. This discharge flow is indicated by an increase in temperature downstream of the pressurizer safety valves or increase in the pressurizer relief tank temperature or level.

Overpressure protection is required in MODES 1, 2, 3, 4, and 5; however, in MODE 3 when any RCS cold leg temperature is ≤ 356°F, MODES 4, 5, and MODE 6 with the reactor vessel head on, overpressure protection is provided by operating procedures and by meeting the requirements of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System."

The upper and lower pressure limits are based on the ± 3% tolerance requirement (Ref. 1) for lifting pressures above 1000 psig. The lift setting is for the ambient conditions associated with MODES 1, 2, and 3. This requires either that the valves be set hot or that a correlation between hot and cold settings be established.

The pressurizer safety valves are part of the primary success path and mitigate the effects of postulated accidents. OPERABILITY of the safety valves ensures that the RCS pressure will be limited to 110% of design pressure. The consequences of exceeding the American Society of Mechanical Engineers (ASME) pressure limit (Ref. 1) could include damage to RCS components, increased leakage, or a requirement to perform additional stress analyses prior to resumption of reactor operation.

BASES (continued)

APPLICABLE SAFETY ANALYSES

All accident and safety analyses in the USAR (Ref. 2) that require safety valve actuation assume operation of two pressurizer safety valves to limit increases in RCS pressure. The overpressure protection analysis (Ref. 3) is also based on operation of two safety valves. Accidents that could result in overpressurization if not properly terminated include:

a. Uncontrolled RCCA withdrawal from full power;

b. Loss of reactor coolant flow;

c. Loss of external electrical load;

d. Loss of normal feedwater;

e. Loss of all AC power to station auxiliaries; and

f. Locked rotor.

Detailed analyses of the above transients are contained in Reference 2. Compliance with this LCO is consistent with the design bases and accident analyses assumptions.

Pressurizer safety valves satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The two pressurizer safety valves are set to open at the RCS design pressure (2500 psia), and within the ASME specified tolerance, to avoid exceeding the maximum design pressure SL, to maintain accident analyses assumptions, and to comply with ASME requirements. The upper and lower pressure tolerance limits are based on the ± 3% tolerance requirements (Ref. 1) for lifting pressures above 1000 psig. The limit protected by this Specification is the reactor coolant pressure boundary (RCPB) SL of 110% of design pressure. Inoperability of one or more valves could result in exceeding the SL if a transient were to occur. The consequences of exceeding the ASME pressure limit could include damage to one or more RCS components, increased leakage, or additional stress analysis being required prior to resumption of reactor operation.

The LCO is modified by a Note which allows the pressurizer safety valves to be inoperable during a hydro test of the RCS. During the hydro test of the RCS, the pressurizer safety valves may be blanked provided the pressurizer power operated relief valves and the safety valve on the discharge pump are set at ≤ the test pressure +35 psi to protect the system during this test.

BASES (continued)

APPLICABILITY

In MODES 1, 2, ~~3,~~ and MODE 3 with both RCS cold leg temperatures > 356°F~~4~~, OPERABILITY of two valves is required because the combined capacity is required to keep reactor coolant pressure below 110% of its design value during certain accidents. MODE 3 ~~and MODE 4 are~~is conservatively included, although the safety valves may not be required for protection.

The LCO is not applicable in MODE 3 when any RCS cold leg temperature is ≤ 356°F and in MODES 4 and 5 because LTOP is provided. Overpressure protection is not required in MODE 6 with reactor vessel head detensioned.

The Note allows entry into MODE~~S~~ 3 ~~and 4~~ with the lift settings outside the LCO limits. This permits testing and examination of the safety valves at high pressure and temperature near their normal operating range, but only after the valves have had a preliminary cold setting. The cold setting gives assurance that the valves are OPERABLE near their design condition. Only one valve at a time will be removed from service for testing. The 36 hour exception is based on 18 hour outage time for each of the two valves. The 18 hour period is derived from operating experience that hot testing can be performed in this timeframe.

ACTIONS

A.1

With one pressurizer safety valve inoperable, restoration must take place within 15 minutes. The Completion Time of 15 minutes reflects the importance of maintaining the RCS Overpressure Protection System. An inoperable safety valve coincident with an RCS overpressure event could challenge the integrity of the pressure boundary.

B.1 and B.2

If the Required Action of A.1 cannot be met within the required Completion Time or if two pressurizer safety valves are inoperable, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 3 with any RCS cold leg ≤ 356°F~~5~~ within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. In MODE 3 with any RCS cold leg temperature ≤ 356°F~~5~~, overpressure protection is provided by the LTOP System. The change from MODE 1, 2, or 3~~, or 4~~ to MODE 3 with any RCS cold leg ≤ 356°F~~5~~ reduces the RCS energy (core power and pressure), lowers the potential for large pressurizer insurges, and thereby removes the need for overpressure protection by two pressurizer safety valves.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.12 Low Temperature Overpressure Protection (LTOP) System

BASES

BACKGROUND

The LTOP System controls RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G (Ref. 1). The reactor vessel is the limiting RCPB component for demonstrating such protection. LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," provides the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Reference 1 requirements during the LTOP MODES. The 5°F/hr heatup limit curve in Figure 3.4.3-1 and the isothermal curve (0°F curve) in Figure 3.4.3-2 defines the limits to assure prevention of non-ductile failure applicable to low temperature overpressurization events only. Application of this curve is limited to evaluation of LTOP events whenever one or more of the RCS cold leg temperatures are less than or equal to the LTOP enabling temperature of ~~200~~356°F.

The reactor vessel material is less tough at low temperatures than at normal operating temperature. As the vessel neutron exposure accumulates, the material toughness decreases and becomes less resistant to pressure stress at low temperatures (Ref. 2). RCS pressure, therefore, is maintained low at low temperatures and is increased only as temperature is increased.

The potential for vessel overpressurization is most acute when the RCS is water solid, occurring only while shutdown; a pressure fluctuation can occur more quickly than an operator can react to relieve the condition. Exceeding the RCS P/T limits by a significant amount could cause brittle cracking of the reactor vessel. LCO 3.4.3 requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the P/T limits.

This LCO provides RCS overpressure protection by having a minimum coolant input capability and having adequate pressure relief capacity. Limiting coolant input capability requires all but one safety injection (SI) pump incapable of injection into the RCS and isolating the accumulators. The pressure relief capacity is sufficient to accommodate the input of one SI pump and three charging pumps injecting into the RCS (Reference 4). The pressure relief capacity requires either one RHR System LTOP overpressure relief valve (RHR 33-1) and two RHR suction flow paths or a depressurized RCS and an RCS vent of sufficient size. One RHR System LTOP overpressure relief valve or the open RCS vent is the overpressure protection device that acts to terminate an increasing pressure event.

BASES

BACKGROUND (continued)

With minimum coolant input capability, the ability to provide core coolant addition is restricted. The LCO does not require the makeup control system deactivated or the SI actuation circuits blocked. Due to the lower pressures in the LTOP MODES and the expected core decay heat levels, the makeup system can provide adequate flow via the makeup control valve. If conditions require the use of more than one SI pump for makeup in the event of loss of inventory, then a second pump can be made available through manual actions.

The LTOP System for pressure relief consists of an RHR System LTOP overpressure relief valve (RHR 33-1) and two RHR suction flow paths OPERABLE or a depressurized RCS and an RCS vent of sufficient size. An OPERABLE RHR suction flow path is accomplished by maintaining either valves RHR 1A and RHR 2A or RHR 1B and RHR 2B open.

RHR System LTOP Overpressure Relief Valve and RHR Suction Flow Path Requirements

During LTOP MODES, the RHR System is operated for decay heat removal and low pressure letdown control. Therefore, the RHR suction isolation valves are open in the piping from the RCS hot legs to the inlets of the RHR pumps. While these valves are open, the RHR System LTOP overpressure relief valve is exposed to the RCS and is able to relieve pressure transients in the RCS.

The RHR System LTOP overpressure relief valve is a spring loaded, bellows type water relief valve with pressure tolerances and accumulation limits established by Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 3) for Class 2 relief valves.

RCS Vent Requirements

Once the RCS is depressurized, a vent exposed to containment atmosphere will maintain the RCS at or near containment ambient pressure in an RCS overpressure transient, if the relieving requirements of the transient do not exceed the capabilities of the vent. Thus, the vent path must be capable of relieving the flow resulting from the limiting LTOP mass or heat input transient, and maintaining pressure below the P/T limits. The required vent capacity may be provided by one or more vent paths.

For an RCS vent to meet the flow capacity requirement, it requires removal of a pressurizer safety valve or steam generator manway, or similarly establishing a vent that has an effective flow cross section ≥ 6.4 square inches. The vent path(s) must be above the level of reactor coolant, so as not to drain the RCS when open.

BASES

APPLICABLE SAFETY ANALYSES

Safety analyses (Reference 4) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, ~~3,~~ and 4in MODE 3 when any RCS cold leg temperature is ≥ 356°F, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 9 limits. At ~~200~~356°F and below, overpressure prevention falls to the OPERABLE RHR System LTOP overpressure relief valve or to a depressurized RCS and a sufficient sized RCS vent. Each of these means has a limited overpressure relief capability.

The actual temperature at which the pressure in the P/T limit curve falls below the RHR System LTOP overpressure relief valve setpoint increases as the reactor vessel material toughness decreases due to neutron embrittlement. Each time the P/T limit curves are revised, the LTOP System must be re-evaluated to ensure its functional requirements can still be met using the RHR relief valve method or the depressurized and vented RCS condition.

Any change to the RCS must be evaluated against the Reference 4 analyses to determine the impact of the change on the LTOP acceptance limits.

Transients that are capable of overpressurizing the RCS are categorized as either mass or energy input transients. The mass input transient assumes an inadvertent safety injection (SI) pump start with two RHR and two reactor coolant pumps operating. The energy input transient assumes an initial reactor coolant pump start with steam generator to RCS temperature difference of 100°F and two RHR pumps operating.

During the LTOP MODES, to ensure that unanalyzed mass and energy input transients do not occur, a reactor coolant pump shall not be started with one or more RCS cold leg temperatures ≤ ~~200~~356°F unless the secondary water temperature of each steam generator is < 100°F above each RCS cold leg temperature.

The Reference 4 analyses demonstrate that either the RHR System LTOP overpressure relief valve or the depressurized RCS and RCS vent can maintain RCS pressure below limits when only one SI pump and three charging pumps are actuated. Thus, the LCO allows only one SI pump OPERABLE during the LTOP MODES. Since neither the RHR System LTOP overpressure relief valve nor the RCS vent can handle the pressure transient from accumulator injection, when RCS temperature is low, the LCO also requires the accumulators' isolation when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in Figure 3.4.3-1 and Figure 3.4.3-2. Administrative controls provide for isolation of the accumulators as needed to prevent inadvertent injection when RCS pressure is ≤ 775 psig.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The isolated accumulators must have their discharge valves closed and the valve power supply breakers fixed in their open positions.

ASME Section XI, Appendix G (Ref. 8) established the temperature of LTOP Applicability at ~~200~~343°F (i.e., the greater of RT_{NDT} + 50°F or 200°F). An indicated temperature of ≤ 356°F must be used to account for instrument uncertainty when applying the LTOP Applicability temperature of ≤ 343°F.

RHR System LTOP Overpressure Relief Valve Performance

The RHR System LTOP overpressure relief valve does not have variable pressure and temperature lift setpoints. Analyses must show that the RHR System LTOP overpressure relief valve with a lift setting ≤ 500 psig will pass flow greater than that required for the limiting LTOP transient while maintaining RCS pressure less than the P/T limit curve. The RHR System LTOP overpressure relief valve set pressure specified includes consideration for the opening setpoint tolerance of ± 3% (± 15 psig) as defined in ASME Boiler and Pressure Vessel Code, Section III, Subsection NC: Class 2 Components for Safety Relief Valves (Ref. 3). The analysis of pressure transient conditions has demonstrated acceptable relieving capability at the upper tolerance limit of 515 psig.

Although the RHR System LTOP overpressure relief valve may itself meet single failure criteria, its inclusion and location within the RHR System does not allow it to meet single failure criteria when spurious RHR suction isolation valve closure is postulated. Also, as the RCS P/T limits are decreased to reflect the loss of toughness in the reactor vessel materials due to neutron embrittlement, the RHR System LTOP overpressure relief valve must be analyzed to still accommodate the LTOP transients.

The RHR System LTOP overpressure relief valve is considered an active component.

BASES

APPLICABLE SAFETY ANALYSES (continued)

RCS Vent Performance

With the RCS depressurized, analyses show a vent size of 6.4 square inches (equivalent to that of the LTOP overpressure relief valve) is capable of mitigating the allowed LTOP overpressure transient. The capacity of a vent this size is greater than the flow of the limiting transients for the LTOP configuration. The licensing basis mass input transient assumes an inadvertent SI pump start with two RHR pumps and two reactor coolant pumps (RCPs) operating. The licensing basis energy input transient assumes an initial RCP start with a steam generator to RCS temperature differential of 100°F and two RHR pumps operating.

The RCS vent size will be re-evaluated for compliance each time the P/T limit curves are revised based on the results of the vessel material surveillance.

The RCS vent is passive and is not subject to active failure.

The LTOP System satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that the LTOP System is OPERABLE. The LTOP System is OPERABLE when the minimum coolant input and pressure relief capabilities are OPERABLE. Violation of this LCO could lead to the loss of low temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient.

To limit the coolant input capability, the LCO requires that a maximum of one SI pump be capable of injecting into the RCS, and all accumulator discharge isolation valves be closed and immobilized (when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in Figure 3.4.3-1 and Figure 3.4.3-2).

The LCO is modified by two Notes.

Note 1 states that accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing temperature, as allowed by the P/T limit curves. This Note permits the accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions.

BASES

LCO (continued)

Note 2 requires that the secondary side water temperature of each SG be ≤ 100°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 356°F. An indicated temperature of ≤ 356°F must be used to account for instrument uncertainty when applying the LTOP Applicability temperature of ≤ 343°F. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

The elements of the LCO that provide low temperature overpressure mitigation through pressure relief are:

a. The OPERABLE RHR System LTOP overpressure relief valve and two RHR suction flow paths OPERABLE;

   The RHR System LTOP overpressure relief valve (RHR 33-1) is required to be OPERABLE for LTOP. In addition, the RHR shall be aligned to the RCS by maintaining both RHR suction flow paths OPERABLE. Valves RHR 1A, RHR 1B, RHR 2A, and RHR 2B must be open for the suction flow paths to be OPERABLE.

b. A depressurized RCS and an RCS vent.

An RCS vent is OPERABLE when open with an area of ≥ 6.4 square inches.

Each of these methods of overpressure prevention is capable of mitigating the limiting LTOP transient.

APPLICABILITY

This LCO is applicable in MODE 3 when any indicated RCS cold leg temperature is ≤ 356°F, in MODES 4, 5, and in MODE 6 when the reactor vessel head is on. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above ~~200~~356°F. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES.
LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and MODE 3~~, and 4~~ (with both RCS cold leg temperatures ≥ 356°F).

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or energy input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

BASES

ACTIONS

A Note prohibits the application of LCO 3.0.4.b to an inoperable LTOP System. There is an increased risk associated with entering MODE 4 from MODE 5, or entering MODE 3 from MODE 4, with LTOP inoperable and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

A.1

With two SI pumps capable of injecting into the RCS, RCS overpressurization is possible.

To immediately initiate action to restore restricted coolant input capability to the RCS reflects the urgency of removing the RCS from this condition.

B.1, C.1, and C.2

An unisolated accumulator requires isolation within 1 hour. This is only required when the accumulator pressure is at or more than the maximum RCS pressure for the existing temperature allowed by the P/T limit curves.

If isolation is needed and cannot be accomplished in 1 hour, Required Action C.1 and Required Action C.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > 356°F, an accumulator pressure of 775 psig will not overpressurize the RCS if the accumulators are fully injected. Depressurizing the accumulators below the LTOP limit from Figure 3.4.3-1 and Figure 3.4.3-2 also gives this protection.

The Completion Times are based on operating experience that these activities can be accomplished in these time periods and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

~~A~~D.1 and ~~A~~D.2

The consequences of operational events that will overpressurize the RCS are more severe at lower temperature (Reference 5). Thus, with one of the two RHR suction flow paths inoperable, action must be taken to immediately verify that the suction valves in the other RHR suction flow path are locked open with the motive power removed. Additionally, the inoperable RHR suction flow path must be restored to OPERABLE status. The Completion Time to restore the RHR suction flow path to OPERABLE status is 5 days.

BASES

ACTIONS (continued)

The Completion Time for the inoperable RHR suction flow path represents a reasonable time to investigate and repair the RHR suction flow path without exposure to a lengthy period with only one OPERABLE RHR suction flow path to protect against overpressure events and is acceptable as described in Reference 6.

BE.1

The RCS must be depressurized and a vent must be established within 8 hours when:

a. Both required RHR suction flow paths are inoperable;

b. The Required Action and associated Completion Time of Condition A, C, or D is not met; or

c. The RHR System LTOP overpressure relief valve is inoperable.

The vent must be sized ≥ 6.4 square inches to ensure that the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. This action is needed to protect the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time considers the time required to place the plant in this Condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements. The Completion Time was also approved in Amendment 108 (Ref. 6)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.12.1 and SR 3.4.12.2

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, a maximum of one SI pump is verified incapable of injecting into the RCS and the accumulator discharge isolation valves are verified closed and locked out.

The SI pump is rendered incapable of injecting into the RCS through removing the power from the pumps by racking the breakers out under administrative control. An alternate method of LTOP control may be employed using at least two independent means to prevent a pump start such that a single failure or single action will not result in an injection into the RCS. This may be accomplished through the pump control switch being placed in pull to lock and at least one valve in the discharge flow path being closed.

The Frequency of 12 hours is sufficient, considering other indications and alarms available to the operator in the control room, to verify the required status of the equipment.

SR 3.4.12.~~1~~3

Each required RHR suction valve shall be demonstrated OPERABLE by verifying the valve is open and by testing it in accordance with the Inservice Testing Program. This Surveillance is only required to be performed if the RHR suction relief valve is being used to meet this LCO.

The RHR suction valves are verified to be opened every 12 hours. The Frequency is considered adequate in view of other administrative controls such as valve status indications available to the operator in the control room that verify the RHR suction valves remain open.

The ASME Code (Ref. 7), test per Inservice Testing Program verifies OPERABILITY by proving proper relief valve mechanical motion and by measuring and, if required, adjusting the lift setpoint.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.12.24

The RCS vent of ≥ 6.4 square inches is proven OPERABLE by verifying its open condition either:

a. Once every 12 hours for a valve that is not locked (valves that are sealed or secured in the open position are considered "locked" in this context); or

b. Once every 31 days for other vent path(s) (e.g., a vent valve that is locked, sealed, or secured in position). A removed pressurizer safety valve or open manway also fits this category.

The passive vent path arrangement must only be open to be OPERABLE. This Surveillance is required to be met if the vent is being used to satisfy the pressure relief requirements of the LCO 3.4.12.b.

REFERENCES

1. 10 CFR 50, Appendix G.
2. Generic Letter 88-11.
3. ASME, Boiler and Pressure Vessel Code, Section III.
4. USAR, Section 9.3.4.3.2.
5. Generic Letter 90-06.
6. Kewaunee Power Station Technical Specification Amendment No. 108 (ADAMS Accession No. ML020770581).
7. ASME Code for Operation and Maintenance of Nuclear Power Plants.
8. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix G.
9. ASME, Boiler and Pressure Vessel Code, Section III, Article NB-7000.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.2 ECCS - Operating

BASES

BACKGROUND

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

a. Loss of coolant accident (LOCA), coolant leakage greater than the capability of the normal charging system;

b. RCCA ejection accident;

c. Steam Line Break accident; and

d. Steam generator tube rupture (SGTR).

The addition of negative reactivity is designed primarily for the steam line break accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power.

There are two phases of ECCS operation: injection and recirculation. In the injection phase, water is taken from the refueling water storage tank (RWST) and injected into the Reactor Coolant System (RCS) through the cold legs and vessel injection nozzles. When sufficient water is removed from the RWST to ensure that enough boron has been added to maintain the reactor subcritical and the containment sump has enough water to supply the required net positive suction head to the ECCS pumps, suction is switched to the containment sump for the recirculation phase. When RCS pressure drops below the Residual Heat Removal (RHR) pump shutoff head, the RHR flow is directed into the reactor vessel upper plenum to reduce the boiling in the top of the core and any resulting boron precipitation.

The ECCS consists of two separate subsystems: safety injection (SI) (high head) and residual heat removal (RHR) (low head). Each subsystem consists of two redundant, 100% capacity trains. The ECCS accumulators and the RWST are also part of the ECCS, but are not considered part of an ECCS flow path as described by this LCO.

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the RWST can be injected into the RCS following the accidents described above. The major components of each subsystem are the RHR pumps, heat exchangers, and the SI pumps. Each of the two subsystems consists of two 100% capacity trains that are interconnected and redundant such that either train is capable of supplying 100% of the flow required to mitigate the accident consequences. This interconnecting and redundant subsystem design

BASES

BACKGROUND (continued)

provides the operators with the ability to utilize components from opposite trains to achieve the required 100% flow to the core.

During the injection phase of LOCA recovery, a suction header supplies water from the RWST to the ECCS pumps. Separate piping supplies each subsystem and each train within the subsystem. The RHR pumps deliver through two nozzles that penetrate the reactor vessel and core barrel. The SI pumps deliver into two separate headers which are cross connected so that either pump is capable of providing flow to the RCS cold legs or reactor vessel injection nozzles. One header supplies the cold legs and the other header supplies the reactor vessel. The header to the reactor vessel (normally isolated) divides into two separate injection lines which connect to the lines from the RHR pumps and supply the two reactor vessel nozzles. These lines are normally isolated. The header to the cold legs divides into two injection lines connected to the cold legs of the RCS. Manual valves (SI-10A and SI-10B) in the safety injection lines to the RCS cold legs are positioned and locked to the correct throttle position to ensure proper flow and balance of flow of each loop. This balance ensures sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the RCS cold legs.

During the recirculation phase of LOCA recovery, RHR pump suction is transferred to the containment sump. The recirculation flow goes from the discharge of the RHR pump through the RHR heat exchanger and then into the reactor via either a low-head injection path or a high-head injection path via a safety injection pump. The high-head injection paths are provided in the event of a small break in which the pressure in the RCS is higher than the shutoff head of the RHR pump.

The safety injection subsystem of the ECCS also functions to supply borated water to the reactor core following increased heat removal events, such as a main steam line break (MSLB). The limiting design conditions occur when the negative moderator temperature coefficient is highly negative, such as at the end of each cycle.

During low temperature conditions in the RCS, limitations are placed on the maximum number of ECCS pumps that may be OPERABLE. Refer to the Bases for LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System", for the basis of these requirements.

The ECCS subsystems are actuated upon receipt of an SI signal. The actuation of safeguard loads is accomplished in a programmed time sequence. If offsite power is available, the safeguard loads start immediately in the programmed sequence. If offsite power is not available, the Engineered Safety Feature (ESF) buses shed normal operating loads and are connected to the emergency diesel generators (EDGs). Safeguard loads are then actuated in the programmed time sequence. The time delay associated with diesel starting, sequenced

BASES

BACKGROUND (continued)

loading, and pump starting determines the time required before pumped flow is available to the core following a LOCA.

The active ECCS components, along with the passive accumulators and the RWST covered in LCO 3.5.1, "Accumulators," and LCO 3.5.4, "Refueling Water Storage Tank (RWST)," provide the cooling water necessary to meet USAR, General Design Criteria (GDC) 44 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. 2), will be met following a LOCA:

a. Maximum fuel element cladding temperature is ≤ 2200°F;

b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react;

d. Core is maintained in a coolable geometry; and

e. Adequate long term core cooling capability is maintained.

The LCO also limits the potential for a post trip return to power following an MSLB event and helps ensure that containment temperature limits are met.

Each ECCS subsystem is taken credit for in a large break LOCA event at full power (Ref. 4). This event establishes the requirement for runout flow for the ECCS pumps, as well as the maximum response time for their actuation. The SI pumps are credited in a small break LOCA event. The SGTR and MSLB events also credit the safety injection pumps. The OPERABILITY requirements for the ECCS are based on the following LOCA analysis assumptions:

a. A large break LOCA event, with loss of offsite power and a single failure disabling one RHR pump (both EDG trains are assumed to operate due to requirements for modeling full active containment heat removal system operation); and

b. A small break LOCA event, with a loss of offsite power and a single failure disabling one ECCS train.

BASES

APPLICABLE SAFETY ANALYSES (continued)

During the blowdown stage of a LOCA, the RCS depressurizes as primary coolant is ejected through the break into the containment. The nuclear reaction is terminated either by moderator voiding during large breaks or control rod insertion for small breaks. Following depressurization, emergency cooling water from the SI pumps is injected into the cold legs, flows into the downcomer, fills the lower plenum, and refloods the core and emergency cooling water from the RHR pumps is injected into the reactor vessel upper plenum.

The effects on containment mass and energy releases are accounted for in appropriate analyses (Ref. 4). The LCO ensures that an ECCS train will deliver sufficient water to match boiloff rates soon enough to minimize the consequences of the core being uncovered following a large break LOCA. It also ensures that the SI pumps will deliver sufficient water and boron during a small break LOCA to maintain RCS inventory. For small break LOCAs, the SI pump delivers sufficient fluid to maintain RCS inventory. For a small break LOCA, the steam generators continue to serve as the heat sink, providing part of the required core cooling.

The ECCS trains satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

In MODES 1, 2, and 3, two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming a single failure affecting either train. Additionally, individual components within the ECCS trains may be called upon to mitigate the consequences of other transients and accidents.

In MODES 1, 2, and 3, an ECCS train consists of an SI subsystem and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and manually transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the two cold leg injection nozzles (SI pumps) and RCS vessel injection nozzles (RHR pumps). In the long term, this flow path may be switched to take its supply from the containment sump and to supply its flow to the RCS cold legs or vessel.

The flow path for each train must maintain its designed independence to ensure that no single active failure can disable both ECCS trains.

As indicated in ~~the~~ Note 1, an SI train may be considered OPERABLE for up to 1 hour when being used to fill an SI accumulator, provided the other SI train is OPERABLE.

BASES

LCO (continued)

As indicated in Note 2, operation in MODE 3 with an SI pump made incapable of injecting in order to facilitate entry into or exit from the Applicability of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System", is necessary with an LTOP arming temperature at or near the MODE 3 boundary temperature of 350°F. LCO 3.4.12 requires that an SI pump be rendered incapable of injecting at and below the LTOP arming temperature. Since this temperature is near the MODE 3 boundary temperature, time is needed to make a pump incapable of injecting prior to entering the LTOP Applicability, and provide time to restore the inoperable pump to OPERABLE status on exiting the LTOP Applicability. Note 2 provides four hours for this activity, or until both RCS cold leg temperatures exceed 381°F (Low Temperature Overpressure Protection (LTOP) arming temperature plus 25°F), whichever occurs first.

APPLICABILITY

In MODES 1, 2, and 3, the ECCS OPERABILITY requirements for the limiting Design Basis Accident, a large break LOCA, are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. MODE 2 and MODE 3 requirements are bounded by the MODE 1 analysis.

This LCO is only applicable in MODE 3 and above. Below MODE 3, certain SI signals are manually bypassed by operator control, and system functional requirements are relaxed as described in LCO 3.5.3, "ECCS - Shutdown."

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low.

ACTIONS

A.1

With one or more trains inoperable and at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on an NRC reliability evaluation (Ref. 5) and is a reasonable time for repair of many ECCS components.

An ECCS train is inoperable if it is not capable of delivering design flow to the RCS. Individual components are inoperable if they are not capable of performing their safety function or supporting systems are not available.

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one active component in a train does not render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train,