Advanced Passive 1000 (AP1000)
Generic Technical Specification Traveler (GTST)

Title: Changes Related to LCO 3.4.14, Low Temperature Overpressure Protection (LTOP) System

I. Technical Specifications Task Force (TSTF) Travelers, Approved Since Revision 2 of STS NUREG-1431, and Used to Develop this GTST

TSTF Number and Title:

TSTF-359-A, Rev 9, Increase Flexibility in MODE Restraints
TSTF-479-A, Rev 0, Changes to Reflect Revision of 10 CFR 50.55a
TSTF-481-T, Rev 0, Correct Bases for LTOP COT

STS NUREGs Affected:

TSTF-359-A, Rev 9: NUREGs 1430, 1431, 1432, 1433, and 1434
TSTF-479-A, Rev 0: NUREGs 1430, 1431, 1432, 1433, and 1434
TSTF-481-T, Rev 0: NUREG 1431

NRC Approval Date:

TSTF-359-A, Rev 9: 12-May-03
TSTF-479-A, Rev 0: 06-Dec-05
TSTF-481-T, Rev 0: 10-Dec-04

TSTF Classification:

TSTF-359-A, Rev 9: Technical Change
TSTF-479-A, Rev 0: Technical Change
TSTF-481-T, Rev 0: Bases Only Change

II. Reference Combined License (RCOL) Standard Departures (Std. Dep.), RCOL COL Items, and RCOL Plant-Specific Technical Specifications (PTS) Changes Used to Develop this GTST

RCOL Std. Dep. Number and Title:

There are no Vogtle departures applicable to Specification 3.4.14.

RCOL COL Item Number and Title:

There are no Vogtle COL items applicable to Specification 3.4.14.

RCOL PTS Change Number and Title:

VEGP LAR DOC A060: TS 3.4.14 Title is revised
VEGP LAR DOC A061: TS 3.4.14 is revised
VEGP LAR DOC A062: TS 3.4.14 Condition A is revised
VEGP LAR DOC M09: TS 3.4.14 Condition C is revised

III. Comments on Relations Among TSTFs, RCOL Std. Dep., RCOL COL Items, and RCOL PTS Changes

This section discusses changes: (1) that were applicable to previous designs, but are not to the current design; (2) that are already incorporated in the GTS; and (3) that are superseded by another change.

TSTF-479-A has been applied to AP1000 GTS 3.4.14, Rev 19 by Westinghouse. TSTF-479-A will not be discussed further as a part of this GTST.

TSTF-481-T clarifies the Westinghouse Owners Group (WOG) surveillance (STS SR 3.4.12.8) regarding a COT on the PORVs to verify that the PORV is capable of performing its LTOP function. The AP1000 design does not utilize pressurizer PORVs to provide LTOP protection and a similar SR for the AP1000 does not exist. Therefore, TSTF-481-T does not apply to the AP1000 GTS. TSTF-481-T will not be discussed further as a part of this GTST.

VEGP LAR DOC M06 was initially applied to this GTS. The VEGP TSU LAR was modified in response to NRC staff RAIs in Reference 8 and the Southern Nuclear Operating Company RAI Response in Reference 9. VEGP LAR DOC M06 was withdrawn.

IV. Additional Changes Proposed as Part of this GTST (modifications proposed by NRC staff and/or clear editorial changes or deviations identified by preparer of GTST)

TSTF-359-A adds an Action Table Note prohibiting the use of LCO 3.0.4.b based on risk by stating “LCO 3.0.4.b is not applicable when entering MODE 4.” The Note is further modified for clarity to indicate plant status by stating “LCO 3.0.4.b is not applicable when entering MODE 4 from MODE 5 and in MODE 4 when decreasing temperature of any RCS cold leg to 275°F or below.” The bases discussion is also updated to support the revised Action Table Note.

In addition, clarification is added in several places in the bases and grammatical errors are corrected in the bases.

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.4.14 Low Temperature Overpressure Protection (LTOP) System

Changes to the Generic Technical Specifications and Bases:

LCO title and description is revised. This is an editorial change for clarity. (DOC A060)

Applicability Note is moved to become an LCO Note. This is an editorial change for clarity. (DOC A061)

An Actions Note is added to state that “LCO 3.0.4.b is not applicable when entering MODE 4.” (TSTF-359-A) The Note is further modified for clarity to indicate plant status by stating “LCO 3.0.4.b is not applicable when entering MODE 4 from MODE 5 and in MODE 4 when decreasing temperature of any RCS cold leg to 275°F or below.” The bases discussion is also updated to support the revised Action Table Note.

Mathematical symbol in Condition A is replaced by text equivalent. This is an editorial change for clarity. (DOC A062)

The Statement of Condition C is replaced. The proposed change revises Condition C such that it applies to either the RNS suction relief valve or RCS depressurized with a vent path using LTOP methods. (DOC M09)

A Note is added to SR 3.4.14.1, SR 3.4.14.2, and SR 3.4.14.4. This is an editorial change for clarity. (DOC A061)

Note text is revised in SR 3.4.14.3. This is an editorial change for clarity. (DOC A061)

VI. Traveler Information

Description of TSTF changes:

AP1000 GTS LCO 3.0.4 is revised by TSTF-359-A to allow entry into a MODE or other specified condition in the Applicability while relying on the associated ACTIONS, provided that there is a risk assessment performed which justifies the use of LCO 3.0.4, the ACTIONS to be entered permit continued operation in the MODE or other specified condition in the Applicability for an unlimited period of time, or an NRC approved allowance is provided in the Specification to be entered. The current AP1000 GTS LCO 3.0.4 allows entry into a MODE or a specified condition in the Applicability, while relying on the associated ACTIONS, only if the ACTIONS permit continued operation in the MODE or other specified condition in the Applicability for a unlimited period of time, or if an NRC approved allowance is provided in the Specification to be entered. SR 3.0.4 is revised to reflect the concepts of the change to LCO 3.0.4. The applicability of LCO 3.0.4 and SR 3.0.4 is expanded to include transition into all MODES or other specified conditions in the Applicability, except when required to comply with ACTIONS or that are part of a shutdown of the unit. As a result, many LCO exceptions to LCO 3.0.4 can be eliminated or revised. For TS 3.4.14, a note prohibiting the use of LCO 3.0.4.b was added based on risk.

Rationale for TSTF changes:

The safety analysis in TSTF-359-A includes a discussion of the application of LCO 3.0.4.b. Applying LCO 3.0.4.b requires a quantitative, qualitative, or blended risk assessment to be performed to assess the risk impact of the MODE change, based on the specific plant configuration at that time, and the risk impacts must be managed in accordance with the assessment results. Since this is allowable, and since in general the risk impact in that particular MODE bounds the risk of transitioning into and through the applicable MODES or other specified conditions in the Applicability of the LCO, the use of the LCO 3.0.4.b allowance is generally acceptable, as long as the risk is assessed and managed as stated above. However, there is a small subset of systems and components, including those in the LTOP system addressed by STS 3.4.14, that have been determined to be more important to risk and use of the LCO 3.0.4.b allowance is prohibited.

Description of changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

VEGP LAR DOC A060 revises TS 3.4.14, “Low Temperature Overpressure Protection (LTOP) System,” by deleting “System” from the title and corresponding references such that the title is “Low Temperature Overpressure Protection (LTOP).”

VEGP LAR DOC A061 moves LCO Applicability Note to after the LCO statement. SR 3.4.14.1 is revised by adding a Note stating “Only required to be met when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.” SR 3.4.14.2 and SR 3.4.14.4 are revised by adding a Note stating “Only required to be met when complying with LCO 3.4.14.a.” SR 3.4.14.3 is revised by changing “to be performed” to “to be met.”

VEGP LAR DOC A062 revises Condition A by replacing the symbol “≥” with “greater than or equal.”

VEGP LAR DOC M09 revises Condition C from “The RNS suction relief valve inoperable,” to “Required LTOP method inoperable for reasons other than Condition A or B.”

A more detailed description of each DOC can be found in Reference 2, VEGP TSU LAR Enclosure 1, and the NRC staff safety evaluation can be found in Reference 3, VEGP LAR SER. The VEGP TSU LAR was modified in response to NRC staff RAIs in Reference 8 and the Southern Nuclear Operating Company RAI Response in Reference 9.

Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

VEGP LAR DOC A060 is implemented because the reference to a Low Temperature Overpressure Protection (LTOP) System is misleading. There is no “system” for overpressure protection; instead, there are methods of overpressure protection, or conditions that must be met to prevent overpressurization, as specified in LCO 3.4.14.

Editorial changes per VEGP LAR DOC 61 and DOC A062 are consistent with the guidance provided in the TS Writer's Guide (Reference 7).

VEGP LAR DOC M09 is implemented because no Condition currently addresses the Actions required to be taken in the event the required method of LTOP consisting of RCS depressurized and an RCS vent of ≥ 4.15 square inches is not Operable in compliance with current LCO 3.4.14.b. The proposed change revises Condition C such that it applies to either the RNS suction relief valve or RCS depressurized with a vent path using LTOP methods. In either case, the existing Required Actions and Completion Times specified in Required Action C.1 and Required Action C.2 are reasonable and result in restoration of LTOP.

Description of additional changes proposed by NRC staff/preparer of GTST:

TSTF-359-A adds an Action Table Note prohibiting the use of LCO 3.0.4.b based on risk by stating “LCO 3.0.4.b is not applicable when entering MODE 4.” The Note and supporting bases discussion are further modified to indicate plant status by stating “LCO 3.0.4.b is not applicable when entering MODE 4 from MODE 5 and in MODE 4 when decreasing temperature of any RCS cold leg to 275°F or below.”

Clarifications are also added to the bases and several grammatical errors are corrected in the bases.

Rationale for additional changes proposed by NRC staff/preparer of GTST:

The modification to the Action Table Note added by TSTF-359-A provides additional clarity regarding plant status.

Clarifying remarks are necessary to make the bases discussion complete.

VII. GTST Safety Evaluation

Technical Analysis:

TSTF-359-A allows entry into a higher mode of operation, or other specified condition in the TS applicability, while relying on the TS conditions, and associated required actions and completion times, provided a risk assessment is performed to confirm the acceptability of that action. Technical specifications have taken advantage of risk technology as experience and capability have increased. The proposal revises STS LCO 3.0.4 and SR 3.0.4, and their application to the TS. New paragraphs (a), (b), and (c) are proposed for LCO 3.0.4.

The proposed LCO 3.0.4(a) retains the current allowance, permitting the mode change when the TS required actions allow indefinite operation.

The addition of LCO 3.0.4(b), which allows entry into a MODE or other specified condition in the Applicability while relying on ACTIONS based on a risk assessment, is reasonable based on many factors. The licensee, and particularly the licensee management, is always responsible for maintaining overall plant configuration and safety. Developments in the Maintenance Rule and other Industry/NRC initiatives (including the configuration risk management programs) enhance the tools available to licensees to assess the risk associated with various plant configurations. This change is a logical step of requiring licensees to assess the application of LCO 3.0.4 allowances in light of the newly available tools and information.

The risk assessment may consider a variety of factors, but will focus on managing plant risk. Consideration would be given to the probability of completing restoration such that the requirements of the LCO would be met prior to the ACTIONS requiring that the Applicability be exited. The assessment may also establish appropriate compensatory measures to enhance safe and effective operations until restoration of compliance with the LCO. The proposed change would provide the flexibility of not restricting which MODES can be entered while relying on the ACTIONS, as do the current LCO 3.0.4 exceptions, but would add the requirement to assess the risks prior to making the MODE change when using LCO 3.0.4(b).

In the case of TS 3.4.14, the risk analysis indicates that entering MODE 4 from MODE 5 with LTOP inoperable has an unacceptable risk. Therefore, a Note is added disallowing the use of LCO 3.0.4.b in this circumstance. The Note is further modified to provide clarity regarding plant status.

When an LCO is not met, the licensee must restore compliance with the LCO consistent with the requirements of the TS. This restoration may include corrective maintenance. 10CFR50.65 requires that licensees assess the effect equipment maintenance will have on the plant's capability to perform safety functions before beginning any maintenance activity on structures, systems, or components within the scope of the maintenance rule. Plant procedures must be in place to implement 10 CFR 50.65(a)(4) to address the situation where entering a mode or other specified condition in the applicability is contemplated with plant equipment inoperable. Such plant procedures typically follow the guidance in NUMARC 93-01, Section 11, as revised in February 2000 and endorsed by NRC RG 1.182.

The LCO 3.0.4(b) allowance does not apply to values and parameters of the TSs that have their own respective LCOs (e.g., Reactor Coolant System Specific Activity), but instead those values and parameters are addressed by LCO 3.0.4(c). The LCO 3.0.4(c) allowances apply to parameters and values which have been previously approved by the NRC in a plant’s specific TS. The licensee will provide in their TS Bases a discussion and list of each NRC-approved,

LCO 3.0.4(c)-specific value and parameter allowance. The risk assessments performed to justify the use of LCO 3.0.4(b) usually only consider systems and components. For this reason, LCO 3.0.4(c) is typically applied to Specifications which describe values and parameters (e.g., [Containment Air Temperature, Containment Pressure, Moderator Temperature Coefficient]), and may be applied to other Specifications based on NRC plant-specific approval. The TS values and parameters, for which mode transition allowances apply, will have a note that states LCO 3.0.4(c) is applicable.

Accident analyses presented in the UFSAR do not address the effects of the plant being in ACTIONS. The accident analyses assume that the necessary equipment is available and then, in most cases, assumes the single most limiting active failure occurs. It is this assumption that leads to limiting the length of Completion Times in order to minimize the length of time that the plant is not within the initial conditions of the accident analysis. This change does not affect the Completion Times. Therefore, this proposal would not affect the accident analyses and is therefore acceptable.

VEGP LAR DOC A060 revises TS 3.4.14, “Low Temperature Overpressure Protection (LTOP) System,” by deleting “System” from the title and corresponding references such that the title is “Low Temperature Overpressure Protection (LTOP).” Reference to a LTOP System is misleading. There is no “system” for overpressure protection; instead, there are methods of overpressure protection, or conditions that must be met to prevent overpressurization, as provided in the TS 3.4.14 LCO.

VEGP LAR DOC M09 revises Condition C from “The RNS suction relief valve inoperable,” to “Required LTOP method inoperable for reasons other than Condition A or B.” TS 3.4.14 LCO requires accumulators to be isolated and either the Normal Residual Heat Removal System (RNS) suction relief valve with lift setting within the limit specified in the Pressure Temperature Limits Report (PTLR), or the RCS depressurized with an RCS vent of ≥ 4.15 square inches. TS 3.4.14 provides Actions in the event an accumulator is not isolated when required (Condition A) and for an inoperable RNS suction relief valve (Condition C). However, no Condition currently addresses the Actions required to be taken in the event the required method of LTOP consisting of RCS depressurized and an RCS vent of ≥ 4.15 square inches is not operable in compliance with current LCO 3.4.14.b.

With respect to current TS 3.4.14, the LCO is applicable in Mode 4 when any cold leg temperature is ≤ 275°F; in Mode 5; and in Mode 6 when the reactor vessel head is on. If the required method of LTOP consists of the depressurized RCS with an RCS vent of ≥ 4.15 square inches, and the vent is found to be covered such that sufficient pressure protection does not exist, the current TS 3.4.14 Actions would result in entry into the requirements of LCO 3.0.3. LCO 3.0.3 requires, in part, that when an LCO is not met and an associated Action is not provided, that the unit shall be placed in a Mode or other specified condition in which the LCO is not applicable. Action shall be initiated within 1 hour to place the unit, as applicable, in: a) Mode 3 within 7 hours; and b) Mode 4 within 13 hours; and c) Mode 5 within 37 hours. Therefore, if in Mode 4 with cold leg temperature ≤ 275°F with an insufficient RCS vent, LCO 3.0.3 would require that action be initiated within 1 hour to place the unit in Mode 5 within 37 hours. LCO 3.0.3 would then require no further actions; the unit would still be in the Mode of applicability without sufficient LTOP. Entry into LCO 3.0.3 would result in no actions if the unit is in Mode 5 or Mode 6 when the reactor vessel head is on with an insufficient RCS vent.

DOC M09 revises Condition C such that it applies to either the RNS suction relief valve or RCS depressurized with a vent path using LTOP methods. In either case, the existing Required Actions and Completion Times specified in Required Action C.1 and Required Action C.2 are reasonable and result in restoration of LTOP.

The remaining changes are editorial, clarifying, grammatical, or otherwise considered administrative. These changes do not affect the technical content, but improve the readability, implementation, and understanding of the requirements, and are therefore acceptable.

References to Previous NRC Safety Evaluation Reports (SERs):

TSTF-359-A: Federal Register /Vol. 68, No. 65 / Friday, April 4, 2003 /Notices

VEGP LAR SER (Reference 3)

VIII. Review Information

Evaluator Comments:

None

Randy Belles
Oak Ridge National Laboratory
865-574-0388
bellesrj@ornl.gov

Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on Friday, May 16, 2014.

NRC Final Approval Date:

NRC Contact:

Hien Le
United States Nuclear Regulatory Commission (US NRC)
301-415-1511
Hien.Le@nrc.gov

IX. Evaluator Comments for Consideration in Finalizing Technical Specifications and Bases

The database does not yet recognize non-breaking hyphens or spaces. For Rev. 0 of this GTST, it was necessary to manually insert (1) non-breaking hyphens as necessary to interlock designations such as P-10 to avoid breaking across the end of a line; and (2) non-breaking spaces as necessary to (a) keep symbols such as “≥” with the subsequent value; and (b) avoid stranding a number value on a subsequent line, such as MODE 5.

X. References Used in GTST

1. AP1000 DCD, Revision 19, Section 16, “Technical Specifications,” June 2011 (ML11171A500).

2. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Technical Specifications Upgrade License Amendment Request, February 24, 2011 (ML12065A057).

3. NRC Safety Evaluation (SE) for Amendment No. 13 to Combined License (COL) No. NPF-91 for Vogtle Electric Generating Plant (VEGP) Unit 3, and Amendment No. 13 to COL No. NPF-92 for VEGP Unit 4, September 9, 2013, ADAMS Package Accession No. ML13238A337, which contains:

ML13238A355	Cover Letter - Issuance of License Amendment No. 13 for Vogtle Units 3 and 4 (LAR 12-002).
ML13238A359	Enclosure 1 - Amendment No. 13 to COL No. NPF-91
ML13239A256	Enclosure 2 - Amendment No. 13 to COL No. NPF-92
ML13239A284	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13)
ML13239A287	Enclosure 4 - Safety Evaluation (SE), and Attachment 1 - Acronyms
ML13239A288	SE Attachment 2 - Table A - Administrative Changes
ML13239A319	SE Attachment 3 - Table M - More Restrictive Changes
ML13239A333	SE Attachment 4 - Table R - Relocated Specifications
ML13239A331	SE Attachment 5 - Table D - Detail Removed Changes
ML13239A316	SE Attachment 6 - Table L - Less Restrictive Changes

   The following documents were subsequently issued to correct an administrative error in Enclosure 3:

ML13277A616	Letter - Correction To The Attachment (Replacement Pages) - Vogtle Electric Generating Plant Units 3 and 4-Issuance of Amendment Re: Technical Specifications Upgrade (LAR 12-002) (TAC No. RP9402)
ML13277A637	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13) (corrected)

4. 10 CFR 50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”

5. NUMARC 93-01, Section 11, Revision 4, “Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” December 2010 (ML110050227).

6. NRC Regulatory Guide 1.182, "Assessing and Managing Risk before Maintenance Activities at Nuclear Power Plants," May 2000 (ML003699426).

7. TSTF-GG-05-01, "Writer's Guide for Plant-Specific Improved Technical Specifications," June 2005.

8. RAI Letter No. 01 Related to License Amendment Request (LAR) 12-002 for the Vogtle Electric Generating Plant Units 3 and 4 Combined Licenses, September 7, 2012 (ML12251A355).

9. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Response to Request for Additional Information Letter No. 01 Related to License Amendment Request LAR-12-002, ND-12-2015, October 04, 2012 (ML12286A363 and ML12286A360)

XI. MARKUP of the Applicable GTS Section for Preparation of the STS NUREG

The entire section of the Specifications and the Bases associated with this GTST is presented next.

Changes to the Specifications and Bases are denoted as follows: Deleted portions are marked in strikethrough red font, and inserted portions in bold blue font.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14 Low Temperature Overpressure Protection (LTOP) ~~System~~

LCO 3.4.14 At least one of the following **o**~~O~~verpressure **p**~~P~~rotection **methods** ~~Systems~~ shall be OPERABLE, with the accumulators isolated:

a. The Normal Residual Heat Removal System (RNS) suction relief valve with lift setting within the limit specified in the PTLR, or

b. The RCS depressurized and an RCS vent of ≥ 4.15 square inches.

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

1. No reactor coolant pump (RCP) shall be started when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%.

2. No RCP shall be started with any RCS cold leg temperature ≤ 350°F unless the secondary side water temperature of each steam generator (SG) is ≤ 50°F above each of the RCS cold leg temperatures and the RCP is started at ≤ 25% of RCP speed.

3. Accumulator isolation is only required when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 when any cold leg temperature is ≤ 275°F,
MODE 5,
MODE 6 when the reactor vessel head is on.

~~----------NOTE----------~~
~~Accumulator isolation is only required when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.~~

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ACTIONS

----------**NOTE**----------

LCO 3.0.4.b is not applicable when entering MODE 4 from MODE 5 and in MODE 4 when decreasing temperature of any RCS cold leg to 275°F or below.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. 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 the PTLR.	A.1 Isolate affected accumulator.	1 hour
B. Required Action and associated Completion Time of Condition A not met.	B.1 Increase RCS cold leg temperature to a level acceptable for the existing accumulator pressure allowed in the PTLR. OR B.2 Depressurize affected accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours 12 hours
C. **Required LTOP method inoperable for reasons other than Conditions A or B.** ~~The RNS suction relief valve inoperable.~~	C.1 Restore the RNS suction relief valve to OPERABLE status. OR C.2 Depressurize RCS and establish RCS vent of ≥ 4.15 square inches.	12 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.14.1	----------**NOTE**---------- **Only required to be met when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.** ----------	
	Verify each accumulator is isolated.	12 hours
SR 3.4.14.2	----------**NOTE**---------- **Only required to be met when complying with LCO 3.4.14.a.** ----------	
	Verify both RNS suction isolation valves in one RNS suction flow path are open.	12 hours
SR 3.4.14.3	----------NOTE---------- Only required to be **met** ~~performed~~ when complying with LCO 3.4.14.b. ----------	
	Verify RCS vent ≥ 4.15 square inches is open.	12 hours for unlocked-open vent AND 31 days for locked-open vent
SR 3.4.14.4	----------**NOTE**---------- **Only required to be met when complying with LCO 3.4.14.a.** ----------	

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.14.4 (continued)	Verify the lift setting of the RNS suction relief valve.	In accordance with the Inservice Testing Program

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.14 Low Temperature Overpressure Protection (LTOP) ~~System~~

BASES

BACKGROUND

~~The~~ LTOP ~~System~~ limits RCS pressure at low temperatures so that 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. The PTLR provides the limits which set the maximum allowable setpoints for the Normal Residual Heat Removal System (RNS) suction relief valve. LCO 3.4.3 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 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, “RCS Pressure and Temperature (P/T) Limits,” requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the PTLR limits.

This LCO provides RCS overpressure protection by having a maximum coolant input capability and having adequate pressure relief capacity. Limiting coolant input capability requires isolating the accumulators. The pressure relief capacity requires the RNS suction relief valve or a depressurized RCS and an RCS vent of sufficient size. The RNS suction relief valve or the open RCS vent is the overpressure protection device that acts to terminate an increasing pressure event.

BASES

BACKGROUND (continued)

RNS Suction Relief Valve Requirements

During the LTOP MODES, the RNS system is operated for decay heat removal. Therefore, the RNS suction isolation valves are open in the piping from the RCS hot legs to the inlet of the RNS system. While these valves are open, the RNS suction relief valve is exposed to the RCS and able to relieve pressure transients in the RCS.

The RNS suction relief valve is a spring loaded, water relief valve with a pressure tolerance and an accumulation limit established by Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 3) for Class 2 relief valves.
The RNS suction isolation valves must be open to make the RNS suction relief valves OPERABLE for RCS overpressure mitigation.

RCS Vent Requirements

Once the RCS is depressurized, a vent exposed to the containment atmosphere will maintain the RCS at 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 may require removing one or more pressurizer safety valves or manually opening one or more Automatic Depressurization System (ADS) valves. 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 (Ref. 4) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with the RCS temperature above 275°F, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. When the RNS is aligned and open to the RCS, overpressure protection is provided by the RNS suction relief valve, or a depressurized RCS and a sufficiently sized open RCS vent.

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

The PTLR contains the acceptance limits that define the LTOP requirements. 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 heat input transients. The events listed below were used in the analysis to size the RNS suction relief valve. Therefore, any events with a mass or heat input greater than the listed events cannot be accommodated and must be prevented.

Mass Input

a. Makeup water flow rate to the RCS assuming both CVS makeup pumps are in operation and letdown is isolated.

Heat Input

a. Restart of one reactor coolant pump (RCP) with water in the steam generator secondary side 50°F hotter than the primary side water, and the RCS water solid.

APPLICABLE SAFETY ANALYSES (continued)

RNS Suction Relief Valve Performance

Since the RNS suction relief valve does not have a variable P/T lift setpoint, the analysis must show that with **the** chosen setpoint, the relief valve will pass flow greater than that required for the limiting LTOP transient while maintaining RCS pressure less than the minimum of either the P/T limit curve, 110 percent of the design pressure of the normal residual heat removal system, or the acceptable RNS relief valve inlet pressure. The current analysis shows that up to a temperature of 70°F, the mass input transient is limiting, and above this temperature the heat input transient is limiting.

To prevent the possibility of a heat input transient, and thereby limit the required flow rate of the RNS suction relief valve, administrative requirements in the LCO note have been imposed for starting an RCP.

RCS Vent Performance

With the RCS depressurized, a vent size of 4.15 square inches is capable of mitigating a limiting overpressure transient. The area of the vent is equivalent to the area of the inlet pipe to the RNS suction relief valve so the capacity of the vent is greater than the flow possible with either the mass or heat input transient, while maintaining the RCS pressure less than the minimum of either the maximum pressure on the P/T limit curve or 110 percent of the design pressure of the normal residual heat removal system.

The required vent area may be obtained by opening one ADS Stage 2, 3, or 4 flow path.

The RCS vent size will be reevaluated 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).

BASES

LCO

This LCO requires that ~~the~~ LTOP ~~System~~ is OPERABLE. ~~The~~ LTOP ~~System~~ is OPERABLE when the maximum coolant input and minimum 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 all accumulator discharge isolation valves closed and immobilized, when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS temperature allowed in the PTLR.
The elements of the LCO that provide low temperature overpressure mitigation through pressure relief are:

a. One OPERABLE RNS suction relief valve; or

   An RNS suction relief valve is OPERABLE for LTOP when both RNS suction isolation valves in one flow path are open, its setpoint is set within the PTLR (Reference 6) limit, and testing has proven its ability to open at this setpoint.

b. A depressurized RCS and an RCS vent.

   An RCS vent is OPERABLE when open with an area of ≥ 4.15 square inches.

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

Note 1 prohibits startup of an RCP when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 2 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 350°F, and the RCP must be started at ≤ 25% of RCP speed. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started. This limitation also helps to ensure that the RNS system pressure remains below both the piping design pressure and the acceptable RNS relief valve inlet pressure.

BASES

LCO (continued)

Note 3 provides 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 closed position verification Surveillance to be performed only under these pressure and temperature conditions.

APPLICABILITY

This LCO is applicable in MODE 4 when any cold leg temperature is below 275°F, MODE 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 275°F. In MODE 6, **when** the reactor vessel head is off, ~~and~~ overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.6, “Pressurizer Safety Valves,” requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 with the RNS isolated or RCS temperature ≥ 275°F.

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

~~The Applicability is modified by a Note stating 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

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 and in MODE 4 when decreasing temperature of any RCS cold leg to 275°F or below 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 these circumstances.

A.1, B.1, and B.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 B.1 and Required Action B.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > 275°F, the accumulator pressure cannot **result in** exceed**ing** the LTOP limits if the accumulators are fully injected. Depressurizing the accumulators below the LTOP limit **in** ~~from~~ the PTLR 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.

C.1 and C.2

If the RNS suction relief valve is inoperable and the RCS is not depressurized, there is a potential to overpressurize the RCS and exceed the limits allowed in LCO 3.4.3. The suction relief valve is considered inoperable if the RNS isolation valves have isolated the RNS from the RCS in such a way that the suction relief valve cannot perform its intended safety function, or if the valve itself will not operate to perform its intended safety function. **If the RCS is depressurized but the RCS vent path does not provide a flow area sufficient to mitigate any of the design low temperature overpressure events and the RNS suction relief valve is inoperable, there is a potential to**

BASES

ACTIONS (continued)

overpressurize the RCS and exceed the limits allowed in LCO 3.4.3. The RCS vent path is considered inoperable if the area of the vent is not equivalent to the area of the inlet pipe to the RNS suction relief valve.

Under these conditions, Required Actions C.1 **and** ~~or~~ C.2 provide two options, either of which must be accomplished in 12 hours. If the RNS suction relief valve cannot be restored to OPERABLE status, the RCS must be depressurized and vented with a**n** RCS vent which provides a flow area sufficient to mitigate any of the design low temperature overpressure events.

The 12 hour Completion Time represents a reasonable time to repair the relief valve, open the RNS isolation valves or otherwise restore the **LTOP** ~~system~~ to OPERABLE status, or depressurize and vent the RCS, without imposing a lengthy period when **no** ~~the~~ LTOP **methods are available** ~~system is not able~~ to mitigate a low temperature overpressure event.

SURVEILLANCE REQUIREMENTS

SR 3.4.14.1

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, the accumulator discharge isolation valves are verified closed and locked out. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the main control room to verify the required status of the equipment.

SR 3.4.14.1 is modified by a Note stating 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 requires the accumulator discharge isolation valve Surveillance to be met only under these pressure and temperature conditions.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.14.2

The RNS suction relief valve shall be demonstrated OPERABLE by verifying two RNS suction isolation valves in one flow path are open. This Surveillance is only performed if the RNS suction relief valve is being used to satisfy this LCO.

The RNS suction isolation 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 RNS suction isolation valves remain open. **This Surveillance is required to be met if the RNS suction relief valve is being used to satisfy the pressure relief requirements of LCO 3.4.14.a.**

SR 3.4.14.3

The RCS vent of ≥ 4.15 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 or a removed pressurizer safety valve or open manway also fits this category).

The passive vent arrangement must only be open to be OPERABLE. This Surveillance is required to be **met** ~~performed~~ if the vent is being used to satisfy the pressure relief requirements of ~~the~~ LCO 3.4.14**.**b.

SR 3.4.14.4

The RNS suction relief valve shall be demonstrated OPERABLE by verifying that two RNS suction isolation valves in one flow path are open and by testing it in accordance with the Inservice Testing Program. (Refer to SR 3.4.14.2 for the RNS suction isolation valve Surveillance.) This Surveillance is only required to be **met** ~~performed~~ if the RNS suction relief valve is being used to meet this LCO. The ASME OM Code (Ref.

BASES

SURVEILLANCE REQUIREMENTS (continued)

5) test per Inservice Testing Program verifies OPERABILITY by proving proper relief valve mechanical motion and by measuring and, if required, adjusting the lift setpoint. **This Surveillance is required to be met if the RNS suction relief valve is being used to satisfy the pressure relief requirements of LCO 3.4.14.a.**

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix G, “Fracture Toughness Requirements.”
2. Generic Letter 88 11, “NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operation.”
3. ASME Boiler and Pressure Vessel Code, Section III.
4. Section 5.2.2, “Overpressure Protection.”
5. ASME OM Code, “Code for Operation and Maintenance of Nuclear Power Plants.”
6. APP-RXS-Z0R-001, Revision 2, “AP1000 Generic Pressure Temperature Limits Report,” F. C. Gift, September 2008.

XII. Applicable STS Subsection After Incorporation of this GTST's Modifications

The entire subsection of the Specifications and the Bases associated with this GTST, following incorporation of the modifications, is presented next.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14 Low Temperature Overpressure Protection (LTOP)

LCO 3.4.14 At least one of the following overpressure protection methods shall be OPERABLE, with the accumulators isolated:

a. The Normal Residual Heat Removal System (RNS) suction relief valve with lift setting within the limit specified in the PTLR, or

b. The RCS depressurized and an RCS vent of ≥ 4.15 square inches.

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

1. No reactor coolant pump (RCP) shall be started when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%.

2. No RCP shall be started with any RCS cold leg temperature ≤ 350°F unless the secondary side water temperature of each steam generator (SG) is ≤ 50°F above each of the RCS cold leg temperatures and the RCP is started at ≤ 25% of RCP speed.

3. Accumulator isolation is only required when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY: MODE 4 when any cold leg temperature is ≤ 275°F,
MODE 5,
MODE 6 when the reactor vessel head is on.

LTOP
3.4.14

ACTIONS

----------NOTE----------
LCO 3.0.4.b is not applicable when entering MODE 4 from MODE 5 and in MODE 4 when decreasing temperature of any RCS cold leg to 275°F or below.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. 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 the PTLR.	A.1 Isolate affected accumulator.	1 hour
B. Required Action and associated Completion Time of Condition A not met.	B.1 Increase RCS cold leg temperature to a level acceptable for the existing accumulator pressure allowed in the PTLR. OR B.2 Depressurize affected accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours 12 hours
C. Required LTOP method inoperable for reasons other than Conditions A or B.	C.1 Restore the RNS suction relief valve to OPERABLE status. OR C.2 Depressurize RCS and establish RCS vent of ≥ 4.15 square inches.	12 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.14.1	----------NOTE---------- Only required to be met when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR. ---------- Verify each accumulator is isolated.	12 hours
SR 3.4.14.2	----------NOTE---------- Only required to be met when complying with LCO 3.4.14.a. ---------- Verify both RNS suction isolation valves in one RNS suction flow path are open.	12 hours
SR 3.4.14.3	----------NOTE---------- Only required to be met when complying with LCO 3.4.14.b. ---------- Verify RCS vent ≥ 4.15 square inches is open.	12 hours for unlocked-open vent AND 31 days for locked-open vent
SR 3.4.14.4	----------NOTE---------- Only required to be met when complying with LCO 3.4.14.a. ----------	

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.14.4 (continued)	Verify the lift setting of the RNS suction relief valve.	In accordance with the Inservice Testing Program

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.14 Low Temperature Overpressure Protection (LTOP)

BASES

BACKGROUND

LTOP limits RCS pressure at low temperatures so that 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. The PTLR provides the limits which set the maximum allowable setpoints for the Normal Residual Heat Removal System (RNS) suction relief valve. LCO 3.4.3 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 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, “RCS Pressure and Temperature (P/T) Limits,” requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the PTLR limits.

This LCO provides RCS overpressure protection by having a maximum coolant input capability and having adequate pressure relief capacity. Limiting coolant input capability requires isolating the accumulators. The pressure relief capacity requires the RNS suction relief valve or a depressurized RCS and an RCS vent of sufficient size. The RNS suction relief valve or the open RCS vent is the overpressure protection device that acts to terminate an increasing pressure event.

BASES

BACKGROUND (continued)

RNS Suction Relief Valve Requirements

During the LTOP MODES, the RNS system is operated for decay heat removal. Therefore, the RNS suction isolation valves are open in the piping from the RCS hot legs to the inlet of the RNS system. While these valves are open, the RNS suction relief valve is exposed to the RCS and able to relieve pressure transients in the RCS.

The RNS suction relief valve is a spring loaded, water relief valve with a pressure tolerance and an accumulation limit established by Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 3) for Class 2 relief valves.
The RNS suction isolation valves must be open to make the RNS suction relief valves OPERABLE for RCS overpressure mitigation.

RCS Vent Requirements

Once the RCS is depressurized, a vent exposed to the containment atmosphere will maintain the RCS at 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 may require removing one or more pressurizer safety valves or manually opening one or more Automatic Depressurization System (ADS) valves. 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 (Ref. 4) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with the RCS temperature above 275°F, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. When the RNS is aligned and open to the RCS, overpressure protection is provided by the RNS suction relief valve, or a depressurized RCS and a sufficiently sized open RCS vent.

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

The PTLR contains the acceptance limits that define the LTOP requirements. 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 heat input transients. The events listed below were used in the analysis to size the RNS suction relief valve. Therefore, any events with a mass or heat input greater than the listed events cannot be accommodated and must be prevented.

Mass Input

a. Makeup water flow rate to the RCS assuming both CVS makeup pumps are in operation and letdown is isolated.

Heat Input

a. Restart of one reactor coolant pump (RCP) with water in the steam generator secondary side 50°F hotter than the primary side water, and the RCS water solid.

APPLICABLE SAFETY ANALYSES (continued)

RNS Suction Relief Valve Performance

Since the RNS suction relief valve does not have a variable P/T lift setpoint, the analysis must show that with the chosen setpoint, the relief valve will pass flow greater than that required for the limiting LTOP transient while maintaining RCS pressure less than the minimum of either the P/T limit curve, 110 percent of the design pressure of the normal residual heat removal system, or the acceptable RNS relief valve inlet pressure. The current analysis shows that up to a temperature of 70°F, the mass input transient is limiting, and above this temperature the heat input transient is limiting.

To prevent the possibility of a heat input transient, and thereby limit the required flow rate of the RNS suction relief valve, administrative requirements in the LCO note have been imposed for starting an RCP.

RCS Vent Performance

With the RCS depressurized, a vent size of 4.15 square inches is capable of mitigating a limiting overpressure transient. The area of the vent is equivalent to the area of the inlet pipe to the RNS suction relief valve so the capacity of the vent is greater than the flow possible with either the mass or heat input transient, while maintaining the RCS pressure less than the minimum of either the maximum pressure on the P/T limit curve or 110 percent of the design pressure of the normal residual heat removal system.

The required vent area may be obtained by opening one ADS Stage 2, 3, or 4 flow path.

The RCS vent size will be reevaluated 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.

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

BASES

LCO

This LCO requires that LTOP is OPERABLE. LTOP is OPERABLE when the maximum coolant input and minimum 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 all accumulator discharge isolation valves closed and immobilized, when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS temperature allowed in the PTLR.
The elements of the LCO that provide low temperature overpressure mitigation through pressure relief are:

a. One OPERABLE RNS suction relief valve; or

   An RNS suction relief valve is OPERABLE for LTOP when both RNS suction isolation valves in one flow path are open, its setpoint is set within the PTLR (Reference 6) limit, and testing has proven its ability to open at this setpoint.

b. A depressurized RCS and an RCS vent.

   An RCS vent is OPERABLE when open with an area of ≥ 4.15 square inches.

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

Note 1 prohibits startup of an RCP when the RCS temperature is ≥ 350°F unless pressurizer level is < 92%. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 2 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ 350°F, and the RCP must be started at ≤ 25% of RCP speed. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started. This limitation also helps to ensure that the RNS system pressure remains below both the piping design pressure and the acceptable RNS relief valve inlet pressure.

BASES

LCO (continued)

Note 3 provides 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 closed position verification Surveillance to be performed only under these pressure and temperature conditions.

APPLICABILITY

This LCO is applicable in MODE 4 when any cold leg temperature is below 275°F, MODE 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 275°F. In MODE 6, when the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.6, “Pressurizer Safety Valves,” requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 with the RNS isolated or RCS temperature ≥ 275°F.

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

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 and in MODE 4 when decreasing temperature of any RCS cold leg to 275°F or below 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 these circumstances.

ACTIONS (continued)

A.1, B.1, and B.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 B.1 and Required Action B.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > 275°F, the accumulator pressure cannot result in exceeding the LTOP limits if the accumulators are fully injected. Depressurizing the accumulators below the LTOP limit in the PTLR 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.

C.1 and C.2

If the RNS suction relief valve is inoperable and the RCS is not depressurized, there is a potential to overpressurize the RCS and exceed the limits allowed in LCO 3.4.3. The suction relief valve is considered inoperable if the RNS isolation valves have isolated the RNS from the RCS in such a way that the suction relief valve cannot perform its intended safety function, or if the valve itself will not operate to perform its intended safety function. If the RCS is depressurized but the RCS vent path does not provide a flow area sufficient to mitigate any of the design low temperature overpressure events and the RNS suction relief valve is inoperable, there is a potential to overpressurize the RCS and exceed the limits allowed in LCO 3.4.3. The RCS vent path is considered inoperable if the area of the vent is not equivalent to the area of the inlet pipe to the RNS suction relief valve.

Under these conditions, Required Actions C.1 and C.2 provide two options, either of which must be accomplished in 12 hours. If the RNS suction relief valve cannot be restored to OPERABLE status, the RCS must be depressurized and vented with an RCS vent which provides a flow area sufficient to mitigate any of the design low temperature overpressure events.

BASES

ACTIONS (continued)

The 12 hour Completion Time represents a reasonable time to repair the relief valve, open the RNS isolation valves or otherwise restore the LTOP to OPERABLE status, or depressurize and vent the RCS, without imposing a lengthy period when no LTOP methods are available to mitigate a low temperature overpressure event.

SURVEILLANCE REQUIREMENTS

SR 3.4.14.1

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, the accumulator discharge isolation valves are verified closed and locked out. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the main control room to verify the required status of the equipment.

SR 3.4.14.1 is modified by a Note stating 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 requires the accumulator discharge isolation valve Surveillance to be met only under these pressure and temperature conditions.

SR 3.4.14.2

The RNS suction relief valve shall be demonstrated OPERABLE by verifying two RNS suction isolation valves in one flow path are open. This Surveillance is only performed if the RNS suction relief valve is being used to satisfy this LCO.

The RNS suction isolation 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 RNS suction isolation valves remain open. This Surveillance is required to be met if the RNS suction relief valve is being used to satisfy the pressure relief requirements of LCO 3.4.14.a.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.14.3

The RCS vent of ≥ 4.15 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 or a removed pressurizer safety valve or open manway also fits this category).

The passive vent 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 LCO 3.4.14.b.

SR 3.4.14.4

The RNS suction relief valve shall be demonstrated OPERABLE by verifying that two RNS suction isolation valves in one flow path are open and by testing it in accordance with the Inservice Testing Program. (Refer to SR 3.4.14.2 for the RNS suction isolation valve Surveillance.) This Surveillance is only required to be met if the RNS suction relief valve is being used to meet this LCO. The ASME OM Code (Ref. 5) test per Inservice Testing Program verifies OPERABILITY by proving proper relief valve mechanical motion and by measuring and, if required, adjusting the lift setpoint. This Surveillance is required to be met if the RNS suction relief valve is being used to satisfy the pressure relief requirements of LCO 3.4.14.a.

BASES

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix G, “Fracture Toughness Requirements.”

2. Generic Letter 88 11, “NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operation.”

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

4. Section 5.2.2, “Overpressure Protection.”

5. ASME OM Code, “Code for Operation and Maintenance of Nuclear Power Plants.”

6. APP-RXS-Z0R-001, Revision 2, “AP1000 Generic Pressure Temperature Limits Report,” F. C. Gift, September 2008.