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

Title: Changes Related to LCO 3.5.4, Passive Residual Heat Removal Heat Exchanger (PRHR HX) - Operating

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-412-A, Rev. 4, Provide Actions for One Steam Supply to Turbine Driven AFW/EFW Pump Inoperable
TSTF-439-A, Rev. 2, Eliminate Second Completion Times Limiting Time From Discovery of Failure To Meet an LCO
TSTF-479-A, Rev. 0, Changes to Reflect Revision of 10 CFR 50.55a

STS NUREGs Affected:

TSTF-359-A, Rev. 9: NUREG-1430, 1431, 1432, 1433, 1434
TSTF-412-A, Rev. 4: NUREG-1430, 1431, 1432
TSTF-439-A, Rev. 2: NUREG-1430, 1431, 1432, 1433, 1434
TSTF-479-A, Rev. 0: NUREG-1430, 1431, 1432, 1433, 1434

NRC Approval Date:

TSTF-359-A, Rev. 9: 12-May-03
TSTF-412-A, Rev. 4: 17-Jul-07
TSTF-439-A, Rev. 2: 01-Dec-05
TSTF-479-A, Rev. 0: 06-Dec-05

TSTF Classification:

TSTF-359-A, Rev. 9: Technical Change
TSTF-412-A, Rev. 4: Technical Change
TSTF-439-A, Rev. 2: Technical Change
TSTF-479-A, Rev. 0: Technical 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:

None

RCOL COL Item Number and Title:

None

RCOL PTS Change Number and Title:

VEGP LAR DOC A027:	SR editorial change for clarification
VEGP LAR DOC A038:	Deletion of the word "that" from SR
VEGP LAR DOC A073:	Editorial revision to add system name "PRHR HX" to valve description
VEGP LAR DOC A074:	Editorial revision to reword TS 3.5.4 Required Action Notes and Completion Times
VEGP LAR DOC M10:	PRHR HX Note removed and addition of new SR
VEGP LAR DOC L01:	Added SR for valve actuation
VEGP LAR DOC L17:	Revisions to Actions and SRs associated with noncondensible gases

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to previous designs, but are not to the current design; (2) that are already incorporated in the GTS; and (3) that are superseded by another change.

The Westinghouse Owners Group (WOG) STS (NUREG-1431) 3.7.5, Auxiliary Feedwater (AFW) System is equivalent to the AP1000 Specification 3.5.4, Passive Residual Heat Removal Heat Exchanger (PRHR HX). Both system remove decay heat from the Reactor Coolant System.

TSTF-359-A, Rev. 9 adds the note "LCO 3.0.4.b is not applicable [when entering MODE 1]" to the "Actions" table of WOG STS Specification 3.7.5, Auxiliary Feedwater (AFW) System. The note is added because during this phase of the startup, the plant is more dependent on AFW than when operating at steady-state conditions due to the increased potential for loss of feedwater or turbine trip. A degraded AFW system puts the plant into a more susceptible condition with regard to decay heat removal. Based on the difference between the Westinghouse 4-loop PWR AFW system and the AP1000 PRHR HX, this change is not applicable and therefore is not incorporated into the AP1000 Specification 3.5.4.

For WOG STS 3.7.5, TSTF-412-A, Rev. 4 clarifies the OPERABILITY of the turbine driven AFW pump with one steam supply inoperable. Since PRHR HX is a passive component, it does not require the actuation of active components such as pumps for its OPERABILITY. Based on the difference in the Westinghouse 4-loop PWR AFW design and AP1000 PRHR HX design these changes are not applicable. These changes are not applicable and therefore are not incorporated into the AP1000 Specification 3.5.4.

TSTF-439-A, Rev. 2 removes the second Completion Times from Required Actions A.1 and B.1 of the WOG STS Specification 3.7.5. The second Completion Time for Required Actions A.1 and B.1 precludes entry into and out of the ACTIONS for an indefinite period of time without meeting the LCO. The Required Actions for GTS 3.5.4 do not include Required Actions that require a second Completion Time to preclude entry into and out of the ACTIONS for an indefinite period of time without meeting the LCO. These changes are not applicable and therefore are not incorporated into the AP1000 Specification 3.5.4.

Applicable changes in TSTF-479-A have already been incorporated into the AP1000 GTS (DCD Revision 19). TSTF-479-A changes the reference to "ASME Boiler and Pressure Vessel Code" to "ASME OM Code" in the Inservice Testing Program. The AP1000 GTS (DCD Revision 19) includes theses changes in Specification 5.5.3, Inservice Testing Program.

TSTF-479-A also removes references to "Section XI" of the ASME Code from NUREG-1431 bases for SR 3.7.5.2, which is for testing of the AFW pumps. The AP1000 SR 3.5.4.5 does refer to the Inservice Testing Program for the Frequency of the SR, but the Bases for SR 3.5.4.5 does not specifically refer to the ASME Code. The AP1000 SR 3.5.4.5 is for testing PRHR and IRWST isolation valves are OPERABLE. Based on the differences of the bases discussion between NUREG-1431 SR 3.7.5.2 and AP1000 SR 3.5.4.5, these TSTF-479-A changes are not applicable and therefore are not incorporated into AP1000 Specification 3.5.4.

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)

Applicability statement is revised to correct the punctuation after "MODES 1, 2, and 3." from a period to a comma.

SR 3.5.4.6 is revised to correct the IRWST gutter isolation valves stroke position from "open" to "closed".

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.5.4 Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Operating

Changes to the Generic Technical Specifications and Bases:

Applicability statement is revised to correct punctuation.

LCO 3.5.4 Note is deleted and the associated "LCO" section of the Bases is revised to reflect deletion of the Note. (DOC M10)

Condition A entry statement and Required Action A.1 of TS 3.5.4, the system name "PRHR HX" is added to identify the valves. (DOC A073)

Condition C entry statement of TS 3.5.4 is changed from "Presence of non-condensible gases in the high point vent." to "PRHR HX inlet line noncondensible gas volume not within limit." Required Action C.1 of TS 3.5.4 is changed from "Vent noncondensible gases." to "Restore PRHR HX inlet line noncondensible gas volume to within limit." (DOC L17)

Required Action F.1 and F.2 Notes and Completion Times and associated "Actions" section of the Bases of TS 3.5.4 are revised. (DOC A074)

SR 3.5.4.1 and SR 3.5.4.2 and associated Bases are revised by adding the system name "PRHR HX" to identify the valves. (DOC A073)

New SR 3.5.4.4 with an associated Note is added. New SR 3.5.4.4 states "Verify one Loop 1 RCP is in operation." at a frequency of 12 hours. In addition, this new SR includes a Note, which states, "Only required to be met when one or more reactor coolant pumps (RCPs) are in operation." All subsequent SRs are renumbered. (DOC M10)

Current SR 3.5.4.4 is changed by removing the word "that", (DOC A038). Current SR 3.5.4.4 and associated Bases are revised by adding the system name "PRHR HX" to identify the valves. (DOC A073)

Current SR 3.5.4.5 and associated Bases are changed by adding "HX" after "PRHR, (DOC A073). The SR is changed from "Verify both PRHR air operated outlet isolation valves and both IRWST gutter isolation valves are OPERABLE by stroking open the valves." to "Verify both PRHR HX air operated outlet isolation valves and both IRWST gutter isolation valves stroke open." (DOC A027)

New SR 3.5.4.8 is added. New SR 3.5.4.8 verifies actuation of PRHR HX isolation valves and IRWST isolation valves on an actual or simulated actuation signal at a frequency of 24 months. (DOC L01)

VI. Traveler Information

Description of TSTF changes:

None

Rationale for TSTF changes:

None

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

VEGP LAR DOC A027 revises current SR 3.5.4.5 by removing the phrase "are OPERABLE by". The SR is changed from "Verify both PRHR air operated outlet isolation valves and both IRWST gutter isolation valves are OPERABLE by stroking open the valves." to "Verify both PRHR HX air operated outlet isolation valves and both IRWST gutter isolation valves stroke open."

VEGP LAR DOC A038 deletes the word "that" from current SR 3.5.4.4.

VEGP LAR DOC A073 adds the system name "PRHR HX" to the valve description for TS 3.5.4 Condition A entry statement, Required Action A.1, SR 3.5.4.1, SR 3.5.4.2, Current SR 3.5.4.4, and Current SR 3.5.4.5.

VEGP LAR DOC A074 revises TS 3.5.4 Required Action F.1 Note from "Prior to initiating actions to change to a lower MODE, verify that redundant means of providing Steam Generator (SG) feedwater are OPERABLE. If redundant means are not OPERABLE, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are restored to OPERABLE status." to "If redundant means of providing steam generator (SG) feedwater are not available, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are available." The Completion Time is revised from "6 hours" to "6 hours from discovery of redundant means of providing SG feedwater". Required Action F.2 Note is revised from "Prior to stopping the SG feedwater, verify that redundant means of cooling the RCS to cold shutdown conditions are OPERABLE. If redundant means are not OPERABLE, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are restored to OPERABLE status." to "If redundant means of cooling the RCS to MODE 5 are not available, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are available." The Completion Time is revised from "36 hours" to "36 hours from discovery of redundant means of cooling the RCS to MODE 5".

VEGP LAR DOC M10 deletes LCO 3.5.4 Note "When any reactor coolant pumps (RCPs) are operating, at least one RCP must be operating in the loop with the PRHR HX, Loop 1." A new SR 3.5.4.4 is added to "Verify one Loop 1 RCP is in operation." with a Frequency of 12 hours. In addition, this new SR includes a Note, which states, "Only required to be met when one or more reactor coolant pumps (RCPs) are in operation."

VEGP LAR DOC L01 adds new SR 3.5.4.8 to "Verify both PRHR HX air operated outlet isolation valves actuate to the open position and both IRWST gutter isolation valves actuate to the isolation position on an actual or simulated actuation signal." with a Frequency of 24 months.

VEGP LAR DOC L17 revises the TS 3.5.4 Condition C entry statement to change "Presence of non-condensible gases in the high point vent." to "PRHR HX inlet line noncondensible gas volume not within limit." Required Action C.1 is revised to reflect the change to the revised Condition C entry statement.

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

VEGP LAR DOC A027 change to current SR 3.5.4.5 provides clarification and is consistent with the writer's guide, TSTF-GG-05-01.

VEGP LAR DOC A038 deletes the word "that" from current SR 3.5.4.4, which is consistent with guidance provided in the writer's guide, TSTF-GG-05-01.

VEGP LAR DOC A073 changes to TS 3.5.4 Condition A entry statement, Required Action A.1, SR 3.5.4.1, SR 3.5.4.2, Current SR 3.5.4.4, and Current SR 3.5.4.5 provide clarity in citing the full name of the valve by inserting "PRHR HX".

VEGP LAR DOC A074 changes to TS 3.5.4 Required Action F.1 and F.2 Notes and Completion Times provide a presentation consistent with the writer's guide, TSTF-GG-05-01.

VEGP LAR DOC M10 replaces the LCO 3.5.4 Note with new SR 3.5.4.4, which includes a note limiting when it is required to be met when one or more RCPs are in operation. The new SR ensures OPERABILITY of the PRHR HX when one or more RCPs are in operation.

The VEGP LAR DOC L01 addition of new SR 3.5.4.8 to TS 3.5.4 results from the deletion of SR 3.3.2.7 for an Actuation Device Test. The equivalent requirement is included in the new SR for TS 3.5.4 with the same 24 month Frequency as the deleted SR 3.3.2.7.

VEGP LAR DOC L17 changes align Condition C entry statement and Required Action C.1 with the intent of the LCO as described in the Bases.

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

The Applicability statement is revised by changing the period after "MODES 1, 2, and 3." to a comma.

SR 3.5.4.6 and associated bases are revised to correct the gutter isolation valve test position from "stroke open" to "stroke closed".

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

The change to the Applicability statement is a correction to the punctuation.

The change to SR 3.5.4.6 is a correction to the stated test position of gutter isolation valve. The gutter isolation valves are normally open. The gutter isolation valves actuation and failed positions are closed. The correct test for the gutter isolation valves is to verify the valves stroke closed.

VII. GTST Safety Evaluation

Technical Analysis:

VEGP LAR DOC M10: Current TS 3.5.4 requires that the Passive Residual Heat Removal Heat Exchanger (PRHR HX) shall be Operable. The LCO has a Note which states, “When any reactor coolant pumps (RCPs) are operating, at least one RCP must be operating in the loop with the PRHR HX, Loop 1.” The TS Bases state that the Note “requires a reactor coolant pump (RCP) to be operating in the loop with the PRHR HX, Loop 1, if any RCPs are operating. If RCPs are only operating in Loop 2 and no RCPs are operating in Loop 1, there is a possibility there may be reverse flow in the PRHR HX." This Note provides a limiting condition on the operability of the PRHR HX if any RCPs are operating, since not having at least one RCP operating in Loop 1 could render the PRHR HX inoperable. New SR 3.5.4.4, “Verify one Loop 1 RCP is in operation” is added with a surveillance frequency of once every 12 hours to verify that the appropriate RCP is in operation when the PRHR HX is required to be operable. The new SR is modified by a Note only requiring the SR to be met when at least one RCP is in operation.

VEGP LAR DOC L01: Current TS 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," SR 3.3.2.7 (“Perform ACTUATION DEVICE TEST”) and SR 3.3.2.8 (“Perform ACTUATION DEVICE TEST for squib valves”) are deleted from current TS 3.3.2 and Table 3.3.2-1, Function 26.a, ESF Actuation Subsystem. The equivalent requirement (using phrasing generally consistent with NUREG-1431) is included in individual Specifications for the actuated devices with the same 24 month Frequency as the deleted SRs. The new SR added to TS 3.5.4 is due to deletion of SR 3.3.2.7. The equivalent requirement is included in the new SR for TS 3.5.4 and the same 24 month Frequency as the deleted SR 3.3.2.7. The bases for deleted SR 3.3.2.7, which discusses performance of an actuation device test demonstrates that the actuated device responds to a simulated actuation signal. As such, Surveillances associated with the testing of the actuated equipment should be addressed in the actuated equipment Specifications, where failures of the surveillance would lead to entering the Actions for the inoperable actuated equipment. The change is less restrictive, but results in closer alignment with NUREG-1431 STS presentation of actuated device testing.

VEGP LAR DOC L17: As stated in the associated Bases for the current TS 3.5.4 Actions, the presence of some noncondensible gases does not mean that the PRHR HX is immediately inoperable, but that gases are collecting and should be vented. In addition, the associated LCO Bases for TS 3.5.4 state that a relatively small gas volume was incorporated into the design for alerting operators to provide sufficient time to initiate venting operations before the gas volume would be expected to increase to a sufficient volume that might potentially challenge the OPERABILITY of natural circulation flow. The current language of TS 3.5.4, Condition C is not consistent with the intent of the LCO, as described in the Bases. Therefore, the Condition is revised for consistency with the LCO as described in the associated Bases.

Current TS 3.5.4, Required Action C.1 is revised to replace a specific method of restoration with a more general action to restore the parameter, in this case noncondensible gas volume, to within its limit. This change is made for consistency with the revised entry conditions for the Required Action. Only the specific method is deleted from the action. The associated Bases, both current and revised, describe an appropriate method for restoration. The revised Action continues to provide assurance that operation with a noncondensible gas volume that can affect the associated flow path is allowed for only a limited period of time. These changes are designated as less restrictive because the specific method of restoration is deleted and replaced with a more general requirement to restore within the limit.

Additional change to SR 3.5.4.6: Current SR 3.5.4.6 is to verify both PRHR HX air operated outlet isolation valves and both IRWST gutter isolation valves stroke open. This is correct for the PRHR HX air operated outlet isolation valves since the normal position is closed and the actuation position is open. The correct verification for the gutter isolation valves is stroke closed since the valves are normally open and the actuation position is closed.

Other Changes: 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):

None

VIII. Review Information

Evaluator Comments:

STS (NUREG-1431) 3.7.5 is equivalent to AP1000 GTS 3.5.4.

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Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on Friday, May 23, 2014.

NRC Final Approval Date:

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

None

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. 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).

4. TSTF-GG-05-01, "Writer's Guide for Plant-Specific Improved Technical Specifications," June 2005 (ML070660229).

5. 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)

6. 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).

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.

3.5 PASSIVE CORE COOLING SYSTEM (PXS)

3.5.4 Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Operating

LCO 3.5.4 The PRHR HX shall be OPERABLE.

~~----------NOTE----------~~
~~When any reactor coolant pumps (RCPs) are operating, at least one RCP must be operating in the loop with the PRHR HX, Loop 1.~~
~~----------~~

APPLICABILITY: MODES 1, 2, and 3~~.~~**,**
MODE 4 with the Reactor Coolant System (RCS) not being cooled by the Normal Residual Heat Removal System (RNS).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One air operated **PRHR HX** outlet isolation valve inoperable.	A.1 Restore air operated **PRHR HX** outlet isolation valve to OPERABLE status.	72 hours
B. One air operated In-Containment Refueling Water Storage Tank (IRWST) gutter isolation valve inoperable.	B.1 Restore air operated IRWST gutter isolation valve to OPERABLE status.	72 hours
C. ~~Presence of non-condensible gases in the high point vent~~**PRHR HX inlet line noncondensible gas volume not within limit**.	C.1 ~~Vent noncondensible gases~~**Restore PRHR HX inlet line noncondensible gas volume to within limit**.	24 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. AND D.2 Be in MODE 4 with the RCS cooling provided by the RNS.	6 hours 24 hours
E. LCO not met for reasons other than Condition A, B, or C.	E.1 Restore PRHR HX to OPERABLE status.	8 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time of Condition E not met.	F.1 ----------NOTE---------- ~~Prior to initiating actions to change to a lower MODE, verify that redundant means of providing Steam Generator (SG) feedwater are OPERABLE. If redundant means are not OPERABLE, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are restored to OPERABLE status~~**If redundant means of providing steam generator (SG) feedwater are not available, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are available**. ---------- Be in MODE 3. AND	6 hours **from discovery of redundant means of providing SG feedwater**

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. (continued)	F.2 ----------NOTE---------- ~~Prior to stopping the SG feedwater, verify that redundant means of cooling the RCS to cold shutdown conditions are OPERABLE. If redundant means are not OPERABLE, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are restored to OPERABLE status~~**If redundant means of cooling the RCS to MODE 5 are not available, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are available**. ---------- Be in MODE 5.	36 hours **from discovery of redundant means of cooling the RCS to MODE 5**

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify the **PRHR HX** outlet manual isolation valve is fully open.	12 hours
SR 3.5.4.2	Verify the **PRHR HX** inlet motor operated isolation valve is open.	12 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.4.3	Verify the volume of noncondensible gases in the PRHR HX inlet line has not caused the high-point water level to drop below the sensor.	24 hours
SR 3.5.4.4	**----------NOTE----------** **Only required to be met when one or more Reactor Coolant Pumps (RCPs) are in operation.** **----------** **Verify one Loop 1 RCP is in operation.**	**12 hours**
SR 3.5.4.~~4~~**5**	Verify ~~that~~ power is removed from the **PRHR HX** inlet motor operated isolation valve.	31 days
SR 3.5.4.~~5~~**6**	Verify both PRHR **HX** air operated outlet isolation valves **stroke open** and both IRWST gutter isolation valves **stroke closed**~~are OPERABLE by stroking open the valves~~.	In accordance with the Inservice Testing Program
SR 3.5.4.7	Verify by visual inspection that the IRWST gutters are not restricted by debris.	24 months
SR 3.5.4.8	**Verify both PRHR HX air operated outlet isolation valves actuate to the open position and both IRWST gutter isolation valves actuate to the isolation position on an actual or simulated actuation signal.**	**24 months**
SR 3.5.4.~~6~~**9**	Verify PRHR HX heat transfer performance in accordance with the System Level OPERABILITY Testing Program.	10 years

B 3.5 PASSIVE CORE COOLING SYSTEM (PXS)

B 3.5.4 Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Operating

BASES

BACKGROUND

The normal heat removal mechanism is the steam generators, which are supplied by the startup feedwater system. However, this path utilizes non-safety related components and systems, so its failure must be considered. In the event the steam generators are not available to remove decay heat for any reason, including loss of startup feedwater, the heat removal path is the PRHR HX (Ref. 1).

The principle component of the PRHR HX is a 100% capacity heat exchanger mounted in the In-containment Refueling Water Storage Tank (IRWST). The heat exchanger is connected to the Reactor Coolant System (RCS) by a inlet line from one RCS hot leg, and an outlet line to the associated steam generator cold leg channel head. The inlet line to the passive heat exchanger contains a normally open, motor operated isolation valve. The outlet line is isolated by two parallel, normally closed air operated valves, which fail open on loss of air pressure or control signal. There is a vertical collection point at the top of the common inlet piping high point which serves as a gas collector. It is provided with level detectors that indicate when noncondensible gases have collected in this area. There are provisions to manually vent these gases to the IRWST.

In order to preserve the IRWST water for long term PRHR HX operation, a gutter is provided to collect and return water to the IRWST that has condensed on the inside surface of the containment shell. During normal plant operation any water collected by the gutter is directed to the normal containment sump. During PRHR HX operation, redundant series air operated valves are actuated to block the draining of condensate to the normal sump and to force the condensate into the IRWST. These valves fail closed on loss of air pressure or control signal.

The PRHR HX size and heat removal capability is selected to provide adequate core cooling for the limiting non-LOCA heatup Design Basis Accidents (DBAs) (Ref. 2). The Probability Risk Assessment (PRA) (Ref. 3) shows that PRHR HX is not required assuming that passive feed and bleed is available. Passive feed and bleed uses the Automatic Depressurization System (ADS) for bleed and the CMTs/accumulators/ IRWST for feed.

BASES

APPLICABLE SAFETY ANALYSES

In the event of a non-LOCA DBA during normal operation, the PRHR HX is automatically actuated to provide decay heat removal path in the event the normal path through the steam generators is not available (Ref. 2).

The non-LOCA events which establish the PRHR HX parameters are those involving a decrease in heat removal by the secondary system, such as loss of main feedwater or other failure in the feedwater system. Since the PRHR HX is passive, it will mitigate the consequences of these events with a complete loss of all AC power sources. The PRHR HX actuates when the CMTs are actuated during LOCA events.

The PRHR HX satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that the PRHR HX be OPERABLE so that it can respond appropriately to the DBAs which may require its operation. Since this is a passive component, it does not require the actuation of active components such as pumps for its OPERABILITY and will be OPERABLE if the inlet valves are in their normally open position, and the normally closed, fail open outlet valves open on receipt of an actuation signal.

In addition to the appropriate valve configuration, OPERABILITY may be impaired by noncondensible gases collecting in the system. OPERABILITY is not expected to be challenged due to small gas accumulations in the high point, and rapid gas accumulations are not expected during plant operation. However, a relatively small gas volume was incorporated into the design for alerting operators to provide sufficient time to initiate venting operations before the gas volume would be expected to increase to a sufficient volume that might potentially challenge the OPERABILITY of natural circulation flow. Therefore, noncondensible gas accumulation in the inlet line high point that causes the water level to drop below the sensor will require operator action to investigate the cause of the gas accumulation and to vent the associated high point(s).

~~The note requires a~~**A** reactor coolant pump (RCP) **is required** to be operating in the loop with the PRHR HX, Loop 1, if any RCPs are operating. If RCPs are only operating in Loop 2 and no RCPs are operating in Loop 1, there is a possibility there may be reverse flow in the PRHR HX.

BASES

APPLICABILITY

The PRHR HX must be OPERABLE in MODES 1, 2, 3, and 4 with the RCS not cooled by the Normal Residual Heat Removal System (RNS) if a plant cooldown is required and the normal cooldown path is not available. Under these conditions, the PRHR HX may be actuated to provide core cooling and to mitigate the consequences of a DBA.

The PRHR HX requirements in MODE 4 with RCS cooling provided by the RNS and in MODE 5 with the RCS pressure boundary intact are specified in LCO 3.5.5, “Passive Residual Heat Removal Heat Exchanger (PRHR HX) - Shutdown, RCS Intact.”

The PRHR HX is not capable of natural circulation cooling of the RCS in MODE 5 with the RCS pressure boundary open or in MODE 6.

ACTIONS

A.1

The outlet line from the PRHR HX is controlled by a pair of normally closed, fail open, air operated valves, arranged in parallel. Thus they are redundant and, if either valve is OPERABLE, the system can function at 100% capacity, assuming other OPERABILITY conditions are met.

If one valve is inoperable, a Completion Time of 72 hours has been allowed to restore the inoperable valve(s) to OPERABLE status. This Completion Time is consistent with the Completion Times specified for other parallel redundant safety related systems.

B.1

With one air operated IRWST gutter isolation valve inoperable, the remaining isolation valve can function to drain the gutter to the IRWST. Action must be taken to restore the inoperable gutter isolation valve to OPERABLE status within 72 hours. The 72 hour Completion Time is acceptable based on the capability of the remaining valve to perform 100% of the required safety function assumed in the safety analyses.

C.1

Excessive amounts of noncondensible gases in the PRHR HX inlet line may interfere with the natural circulation flow of reactor coolant through the PRHR HX. The presence of some noncondensible gases does not mean that the PRHR HX is immediately inoperable, but that gases are

ACTIONS (continued)

collecting and should be vented. The venting of these gases requires containment entry to manually operate the appropriate vent valves. A Completion Time of 24 hours is acceptable considering that passive feed and bleed cooling is available to remove heat from the RCS.

The level sensor location has been selected to permit additional gas accumulation before natural circulation flow is significantly affected so that sufficient time may be provided to permit containment entry for venting the gas. Anticipated noncondensible gas accumulation in this piping segment is expected to be relatively slow.

The venting of these gases requires containment entry to manually operate the appropriate vent valves. A Completion Time of 24 hours is acceptable considering that passive feed and bleed cooling is available to remove heat from the RCS.

D.1 and D.2

If any of the above Required Actions have not been accomplished in the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4, with the RCS cooled by the RNS, within 24 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.

E.1

With the LCO not met for reasons other than Condition A, B, or C, the PRHR HX must be restored within 8 hours. The 8 hour Completion Time is based on the availability of passive feed and bleed cooling to provide RCS heat removal. The effectiveness of feed and bleed cooling has been demonstrated in analysis and evaluations performed to justify PRA success criteria (Ref. 3). The analysis contained in this reference shows that for a range of events including loss of main feedwater, SGTR, and small LOCA (as small as 1/2") that feed and bleed cooling provides adequate core cooling.

These analyses and evaluations provide a high confidence that with the unavailability of the PRHR HX the core can be cooled following design bases accidents.

BASES

ACTIONS (continued)

F.1 and F.2

If the PRHR HX is not restored in accordance with Action E.1 within 8 hours, the plant must be placed in a MODE in which the LCO does not apply. This is accomplished by placing the plant in MODE 3 within 6 hours and in MODE 5 within 36 hours.

Action F.1 is modified by a Note which requires that prior to initiating cooldown of the plant to MODE 3, redundant means of providing SG feedwater be verified as ~~OPERABLE~~**available**. Possible means include main feedwater and startup feedwater pumps. With the PRHR HX **inoperable** and redundant means of feeding the SGs ~~INOPERABLE~~**not available**, the unit is in a seriously degraded condition with no means for conducting a controlled cooldown. In such a condition, the unit should not be perturbed by any action, including a power change, that might result in a trip. If redundant means of feeding the SGs are not available, the plant should be maintained in the current MODE until redundant means are restored. LCO 3.0.3 and all other Required Actions shall be suspended until the redundant means are restored, because they could force the unit into a less safe condition.

The Completion Time for Required Action F.1 is intended to allow the operator time to evaluate availability of redundant means. In this Required Action, the Completion Time only begins on discovery that redundant means of feeding the SGs is available.

Action F.2 is modified by a Note which requires that prior to stopping SG feedwater, redundant means of cooling the RCS to cold shutdown conditions must be verified as ~~OPERABLE~~**available**. One redundant means of cooling the RCS to cold shutdown includes the normal residual heat removal system (RNS) and its necessary support system (both component cooling system pumps and heat exchangers, and both service water system pumps and fans). Without availability of these redundant cooling means, the unit is in a seriously degraded condition with no means for continuing the controlled cooldown. Until the redundant cooling means are restored, heat removal using SG feedwater should be maintained. LCO 3.0.3 and all other Required Actions shall be suspended until the systems and equipment required for further cooldown are restored, because they could force the unit into a less safe condition.

BASES

ACTIONS (continued)

The Completion Time for Required Action F.2 is intended to allow the operator time to evaluate availability of redundant means. In this Required Action, the Completion Time only begins on discovery that redundant means of cooling the RCS to cold shutdown conditions is available.

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

Verification, using remote indication, that the common **PRHR HX** outlet manual isolation valve is fully open ensures that the flow path from the heat exchangers to the RCS is available. Misalignment of this valve could render the heat exchanger inoperable. A 12 hour Frequency is reasonable considering that the valve is manually positioned and has control room position indication and alarm.

SR 3.5.4.2

Verification that the motor operated **PRHR HX** inlet valve is fully open, as indicated in the main control room, ensures timely discovery if the valve is not fully open. The 12 hour Frequency is consistent with the ease of verification, confirmatory open signals, and redundant series valve controls that prevent spurious closure.

SR 3.5.4.3

Verification that excessive amounts of noncondensible gases have not caused the water level to drop below the sensor in the inlet line is required every 24 hours. The inlet line of the PRHR HX has a vertical section of pipe which serves as a high point collection point for noncondensible gases. The thermal dispersion sensor location on the vertical pipe section has have been selected to permit additional gas accumulation before natural circulation flow is significantly affected so that sufficient time may be provided to permit containment entry for venting the gas.

Control room indication of the water level in this high point collection point is available to verify that noncondensible gases have not collected to the extent that the water level is depressed below the allowable level. The 24 hour Frequency is based on the expected low rate of gas accumulation and the availability of control room indication.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.4.4

Verification is required to confirm that one Loop 1 RCP is in operation, if any RCPs are operating. If RCPs are only operating in Loop 2 and no RCPs are operating in Loop 1, there is a possibility there may be reverse flow in the PRHR HX. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the main control room to monitor RCS loop performance.

The SR is modified by a Note which only requires that the Surveillance be met if one or more RCPs are in operation. If no RCPs are in operation, there is no need to verify one Loop 1 RCP is in operation.

SR 3.5.4.~~4~~**5**

Verification is required to confirm that power is removed from the motor operated **PRHR HX** inlet isolation valve every 31 days. Removal of power from this valve reduces the likelihood that the valve will be inadvertently closed as a result of a fire. The 31 day Frequency is acceptable considering the frequent surveillance of valve position and that the valve has a confirmatory open signal.

SR 3.5.4.~~5~~**6**

Verification that both air operated **PRHR HX** outlet valves **stroke open** and both IRWST gutter isolation valves **stroke closed** ~~are OPERABLE~~ ensures that the PRHR HX will actuate on command, with return flow from the gutter to the IRWST~~, since all other components of the system are normally in the OPERABLE configuration~~. Since these valves are redundant, if one valve is inoperable, the system can function at 100% capacity. Verification requires the actual operation of each **PRHR HX outlet** valve **to open and each IRWST gutter isolation valve to close**~~through a full cycle to demonstrate OPERABILITY~~. The Surveillance Frequency is provided in the Inservice Testing Program.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.4.7

This surveillance requires visual inspection of the IRWST gutters to verify that the return flow to the IRWST will not be restricted by debris. A Frequency of 24 months is adequate, since there are no known sources of debris with which the gutters could become restricted.

SR 3.5.4.8

This SR verifies that both PRHR HX air operated outlet isolation valves and both IRWST gutter isolation valves actuate to the correct position on an actual or simulated actuation signal. The ACTUATION LOGIC TEST overlaps this Surveillance to provide complete testing of the assumed safety function. The Frequency of 24 months is based on the need to perform this surveillance during periods in which the plant is shutdown for refueling to prevent any upsets of plant operation.

SR 3.5.4.~~6~~**9**

This SR requires performance of a system performance test of the PRHR HX to verify system heat transfer capabilities. The system performance test demonstrates that the PRHR HX heat transfer assumed in accident analyses is maintained. Although the likelihood that system performance would degrade with time is low, it is considered prudent to periodically verify system performance. The System Level Operability Testing Program provides specific test requirements and acceptance criteria.

REFERENCES

1. Section 6.3, “Passive Core Cooling System.”
2. Chapter 15, “Safety Analysis.”
3. AP1000 PRA.

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.

3.5 PASSIVE CORE COOLING SYSTEM (PXS)

3.5.4 Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Operating

LCO 3.5.4 The PRHR HX shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 with the Reactor Coolant System (RCS) not being cooled by the Normal Residual Heat Removal System (RNS).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One air operated PRHR HX outlet isolation valve inoperable.	A.1 Restore air operated PRHR HX outlet isolation valve to OPERABLE status.	72 hours
B. One air operated In-Containment Refueling Water Storage Tank (IRWST) gutter isolation valve inoperable.	B.1 Restore air operated IRWST gutter isolation valve to OPERABLE status.	72 hours
C. PRHR HX inlet line noncondensible gas volume not within limit.	C.1 Restore PRHR HX inlet line noncondensible gas volume to within limit.	24 hours
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3. AND D.2 Be in MODE 4 with the RCS cooling provided by the RNS.	6 hours 24 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. LCO not met for reasons other than Condition A, B, or C.	E.1 Restore PRHR HX to OPERABLE status.	8 hours
F. Required Action and associated Completion Time of Condition E not met.	F.1 ----------NOTE---------- If redundant means of providing steam generator (SG) feedwater are not available, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are available. ---------- Be in MODE 3.	6 hours from discovery of redundant means of providing SG feedwater
	AND	
	F.2 ----------NOTE---------- If redundant means of cooling the RCS to MODE 5 are not available, suspend LCO 3.0.3 and all other LCO Required Actions requiring MODE changes until redundant means are available. ---------- Be in MODE 5.	36 hours from discovery of redundant means of cooling the RCS to MODE 5

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify the PRHR HX outlet manual isolation valve is fully open.	12 hours
SR 3.5.4.2	Verify the PRHR HX inlet motor operated isolation valve is open.	12 hours
SR 3.5.4.3	Verify the volume of noncondensible gases in the PRHR HX inlet line has not caused the high-point water level to drop below the sensor.	24 hours
SR 3.5.4.4	----------NOTE---------- Only required to be met when one or more Reactor Coolant Pumps (RCPs) are in operation. ---------- Verify one Loop 1 RCP is in operation.	12 hours
SR 3.5.4.5	Verify power is removed from the PRHR HX inlet motor operated isolation valve.	31 days
SR 3.5.4.6	Verify both PRHR HX air operated outlet isolation valves stroke open and both IRWST gutter isolation valves stroke closed.	In accordance with the Inservice Testing Program
SR 3.5.4.7	Verify by visual inspection that the IRWST gutters are not restricted by debris.	24 months
SR 3.5.4.8	Verify both PRHR HX air operated outlet isolation valves actuate to the open position and both IRWST gutter isolation valves actuate to the isolation position on an actual or simulated actuation signal.	24 months

SR 3.5.4.9	Verify PRHR HX heat transfer performance in accordance with the System Level OPERABILITY Testing Program.	10 years

B 3.5 PASSIVE CORE COOLING SYSTEM (PXS)

B 3.5.4 Passive Residual Heat Removal Heat Exchanger (PRHR HX) – Operating

BASES

BACKGROUND

The normal heat removal mechanism is the steam generators, which are supplied by the startup feedwater system. However, this path utilizes non-safety related components and systems, so its failure must be considered. In the event the steam generators are not available to remove decay heat for any reason, including loss of startup feedwater, the heat removal path is the PRHR HX (Ref. 1).

The principle component of the PRHR HX is a 100% capacity heat exchanger mounted in the In-containment Refueling Water Storage Tank (IRWST). The heat exchanger is connected to the Reactor Coolant System (RCS) by a inlet line from one RCS hot leg, and an outlet line to the associated steam generator cold leg channel head. The inlet line to the passive heat exchanger contains a normally open, motor operated isolation valve. The outlet line is isolated by two parallel, normally closed air operated valves, which fail open on loss of air pressure or control signal. There is a vertical collection point at the top of the common inlet piping high point which serves as a gas collector. It is provided with level detectors that indicate when noncondensible gases have collected in this area. There are provisions to manually vent these gases to the IRWST.

In order to preserve the IRWST water for long term PRHR HX operation, a gutter is provided to collect and return water to the IRWST that has condensed on the inside surface of the containment shell. During normal plant operation any water collected by the gutter is directed to the normal containment sump. During PRHR HX operation, redundant series air operated valves are actuated to block the draining of condensate to the normal sump and to force the condensate into the IRWST. These valves fail closed on loss of air pressure or control signal.

The PRHR HX size and heat removal capability is selected to provide adequate core cooling for the limiting non-LOCA heatup Design Basis Accidents (DBAs) (Ref. 2). The Probability Risk Assessment (PRA) (Ref. 3) shows that PRHR HX is not required assuming that passive feed and bleed is available. Passive feed and bleed uses the Automatic Depressurization System (ADS) for bleed and the CMTs/accumulators/ IRWST for feed.

BASES

APPLICABLE SAFETY ANALYSES

In the event of a non-LOCA DBA during normal operation, the PRHR HX is automatically actuated to provide decay heat removal path in the event the normal path through the steam generators is not available (Ref. 2).

The non-LOCA events which establish the PRHR HX parameters are those involving a decrease in heat removal by the secondary system, such as loss of main feedwater or other failure in the feedwater system. Since the PRHR HX is passive, it will mitigate the consequences of these events with a complete loss of all AC power sources. The PRHR HX actuates when the CMTs are actuated during LOCA events.

The PRHR HX satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that the PRHR HX be OPERABLE so that it can respond appropriately to the DBAs which may require its operation. Since this is a passive component, it does not require the actuation of active components such as pumps for its OPERABILITY and will be OPERABLE if the inlet valves are in their normally open position, and the normally closed, fail open outlet valves open on receipt of an actuation signal.

In addition to the appropriate valve configuration, OPERABILITY may be impaired by noncondensible gases collecting in the system. OPERABILITY is not expected to be challenged due to small gas accumulations in the high point, and rapid gas accumulations are not expected during plant operation. However, a relatively small gas volume was incorporated into the design for alerting operators to provide sufficient time to initiate venting operations before the gas volume would be expected to increase to a sufficient volume that might potentially challenge the OPERABILITY of natural circulation flow. Therefore, noncondensible gas accumulation in the inlet line high point that causes the water level to drop below the sensor will require operator action to investigate the cause of the gas accumulation and to vent the associated high point(s).

A reactor coolant pump (RCP) is required to be operating in the loop with the PRHR HX, Loop 1, if any RCPs are operating. If RCPs are only operating in Loop 2 and no RCPs are operating in Loop 1, there is a possibility there may be reverse flow in the PRHR HX.

BASES

APPLICABILITY

The PRHR HX must be OPERABLE in MODES 1, 2, 3, and 4 with the RCS not cooled by the Normal Residual Heat Removal System (RNS) if a plant cooldown is required and the normal cooldown path is not available. Under these conditions, the PRHR HX may be actuated to provide core cooling and to mitigate the consequences of a DBA.

The PRHR HX requirements in MODE 4 with RCS cooling provided by the RNS and in MODE 5 with the RCS pressure boundary intact are specified in LCO 3.5.5, “Passive Residual Heat Removal Heat Exchanger (PRHR HX) - Shutdown, RCS Intact.”

The PRHR HX is not capable of natural circulation cooling of the RCS in MODE 5 with the RCS pressure boundary open or in MODE 6.

ACTIONS

A.1

The outlet line from the PRHR HX is controlled by a pair of normally closed, fail open, air operated valves, arranged in parallel. Thus they are redundant and, if either valve is OPERABLE, the system can function at 100% capacity, assuming other OPERABILITY conditions are met.

If one valve is inoperable, a Completion Time of 72 hours has been allowed to restore the inoperable valve(s) to OPERABLE status. This Completion Time is consistent with the Completion Times specified for other parallel redundant safety related systems.

B.1

With one air operated IRWST gutter isolation valve inoperable, the remaining isolation valve can function to drain the gutter to the IRWST. Action must be taken to restore the inoperable gutter isolation valve to OPERABLE status within 72 hours. The 72 hour Completion Time is acceptable based on the capability of the remaining valve to perform 100% of the required safety function assumed in the safety analyses.

C.1

Excessive amounts of noncondensible gases in the PRHR HX inlet line may interfere with the natural circulation flow of reactor coolant through the PRHR HX. The presence of some noncondensible gases does not mean that the PRHR HX is immediately inoperable, but that gases are

ACTIONS (continued)

collecting and should be vented. The venting of these gases requires containment entry to manually operate the appropriate vent valves. A Completion Time of 24 hours is acceptable considering that passive feed and bleed cooling is available to remove heat from the RCS.

The level sensor location has been selected to permit additional gas accumulation before natural circulation flow is significantly affected so that sufficient time may be provided to permit containment entry for venting the gas. Anticipated noncondensible gas accumulation in this piping segment is expected to be relatively slow.

The venting of these gases requires containment entry to manually operate the appropriate vent valves. A Completion Time of 24 hours is acceptable considering that passive feed and bleed cooling is available to remove heat from the RCS.

D.1 and D.2

If any of the above Required Actions have not been accomplished in the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4, with the RCS cooled by the RNS, within 24 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.

E.1

With the LCO not met for reasons other than Condition A, B, or C, the PRHR HX must be restored within 8 hours. The 8 hour Completion Time is based on the availability of passive feed and bleed cooling to provide RCS heat removal. The effectiveness of feed and bleed cooling has been demonstrated in analysis and evaluations performed to justify PRA success criteria (Ref. 3). The analysis contained in this reference shows that for a range of events including loss of main feedwater, SGTR, and small LOCA (as small as 1/2") that feed and bleed cooling provides adequate core cooling.

These analyses and evaluations provide a high confidence that with the unavailability of the PRHR HX the core can be cooled following design bases accidents.

ACTIONS (continued)

F.1 and F.2

If the PRHR HX is not restored in accordance with Action E.1 within 8 hours, the plant must be placed in a MODE in which the LCO does not apply. This is accomplished by placing the plant in MODE 3 within 6 hours and in MODE 5 within 36 hours.

Action F.1 is modified by a Note which requires that prior to initiating cooldown of the plant to MODE 3, redundant means of providing SG feedwater be verified as available. Possible means include main feedwater and startup feedwater pumps. With the PRHR HX inoperable and redundant means of feeding the SGs not available, the unit is in a seriously degraded condition with no means for conducting a controlled cooldown. In such a condition, the unit should not be perturbed by any action, including a power change, that might result in a trip. If redundant means of feeding the SGs are not available, the plant should be maintained in the current MODE until redundant means are restored. LCO 3.0.3 and all other Required Actions shall be suspended until the redundant means are restored, because they could force the unit into a less safe condition.

The Completion Time for Required Action F.1 is intended to allow the operator time to evaluate availability of redundant means. In this Required Action, the Completion Time only begins on discovery that redundant means of feeding the SGs is available.

Action F.2 is modified by a Note which requires that prior to stopping SG feedwater, redundant means of cooling the RCS to cold shutdown conditions must be verified as available. One redundant means of cooling the RCS to cold shutdown includes the normal residual heat removal system (RNS) and its necessary support system (both component cooling system pumps and heat exchangers, and both service water system pumps and fans). Without availability of these redundant cooling means, the unit is in a seriously degraded condition with no means for continuing the controlled cooldown. Until the redundant cooling means are restored, heat removal using SG feedwater should be maintained. LCO 3.0.3 and all other Required Actions shall be suspended until the systems and equipment required for further cooldown are restored, because they could force the unit into a less safe condition.

BASES

ACTIONS (continued)

The Completion Time for Required Action F.2 is intended to allow the operator time to evaluate availability of redundant means. In this Required Action, the Completion Time only begins on discovery that redundant means of cooling the RCS to cold shutdown conditions is available.

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

Verification, using remote indication, that the common PRHR HX outlet manual isolation valve is fully open ensures that the flow path from the heat exchangers to the RCS is available. Misalignment of this valve could render the heat exchanger inoperable. A 12 hour Frequency is reasonable considering that the valve is manually positioned and has control room position indication and alarm.

SR 3.5.4.2

Verification that the motor operated PRHR HX inlet valve is fully open, as indicated in the main control room, ensures timely discovery if the valve is not fully open. The 12 hour Frequency is consistent with the ease of verification, confirmatory open signals, and redundant series valve controls that prevent spurious closure.

SR 3.5.4.3

Verification that excessive amounts of noncondensible gases have not caused the water level to drop below the sensor in the inlet line is required every 24 hours. The inlet line of the PRHR HX has a vertical section of pipe which serves as a high point collection point for noncondensible gases. The thermal dispersion sensor location on the vertical pipe section has have been selected to permit additional gas accumulation before natural circulation flow is significantly affected so that sufficient time may be provided to permit containment entry for venting the gas.

Control room indication of the water level in this high point collection point is available to verify that noncondensible gases have not collected to the extent that the water level is depressed below the allowable level. The 24 hour Frequency is based on the expected low rate of gas accumulation and the availability of control room indication.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.4.4

Verification is required to confirm that one Loop 1 RCP is in operation, if any RCPs are operating. If RCPs are only operating in Loop 2 and no RCPs are operating in Loop 1, there is a possibility there may be reverse flow in the PRHR HX. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the main control room to monitor RCS loop performance.

The SR is modified by a Note which only requires that the Surveillance be met if one or more RCPs are in operation. If no RCPs are in operation, there is no need to verify one Loop 1 RCP is in operation.

SR 3.5.4.5

Verification is required to confirm that power is removed from the motor operated PRHR HX inlet isolation valve every 31 days. Removal of power from this valve reduces the likelihood that the valve will be inadvertently closed as a result of a fire. The 31 day Frequency is acceptable considering the frequent surveillance of valve position and that the valve has a confirmatory open signal.

SR 3.5.4.6

Verification that both air operated PRHR HX outlet valves stroke open and both IRWST gutter isolation valves stroke closed ensures that the PRHR HX will actuate on command, with return flow from the gutter to the IRWST. Since these valves are redundant, if one valve is inoperable, the system can function at 100% capacity. Verification requires the actual operation of each PRHR HX outlet valve to open and each IRWST gutter isolation valve to close. The Surveillance Frequency is provided in the Inservice Testing Program.

SR 3.5.4.7

This surveillance requires visual inspection of the IRWST gutters to verify that the return flow to the IRWST will not be restricted by debris. A Frequency of 24 months is adequate, since there are no known sources of debris with which the gutters could become restricted.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.4.8

This SR verifies that both PRHR HX air operated outlet isolation valves and both IRWST gutter isolation valves actuate to the correct position on an actual or simulated actuation signal. The ACTUATION LOGIC TEST overlaps this Surveillance to provide complete testing of the assumed safety function. The Frequency of 24 months is based on the need to perform this surveillance during periods in which the plant is shutdown for refueling to prevent any upsets of plant operation.

SR 3.5.4.9

This SR requires performance of a system performance test of the PRHR HX to verify system heat transfer capabilities. The system performance test demonstrates that the PRHR HX heat transfer assumed in accident analyses is maintained. Although the likelihood that system performance would degrade with time is low, it is considered prudent to periodically verify system performance. The System Level Operability Testing Program provides specific test requirements and acceptance criteria.

REFERENCES

1. Section 6.3, “Passive Core Cooling System.”
2. Chapter 15, “Safety Analysis.”
3. AP1000 PRA.