Industry/TSTF Standard Technical Specification Change Traveler

Revise Steam Generator Requirements in ITS 3.4.5, 3.4.6, and 3.4.7

NUREGs Affected: ☑ 1430 ☑ 1431 ☑ 1432 ☐ 1433 ☐ 1434

Classification: 1) Technical Change Recommended for CLIIP?: No

Priority: 2)Medium

Simple or Complex Change: Complex

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1.0 Description

Revise the ITS 3.4.5, 3.4.6, and 3.4.7 requirements on Steam Generators. The ITS currently only requires the Steam Generators to have sufficient level in MODES 3, 4, and 5 (loops filled) in order to be considered OPERABLE. This change revises SR 3.4.5.2, SR 3.4.6.2, SR 3.4.7.2, LCO 3.4.7, and Condition 3.4.7.A to require the Steam Generator(s) to be capable of removing decay heat. The Bases are expanded to describe the conditions necessary for the Steam Generator(s) to be capable of removing decay heat.

2.0 Proposed Change

ITS LCO 3.4.7 is revised to state, "[Two] steam generators (SGs) shall be capable of removing heat," instead of "The secondary side water level of at least [two] steam generators shall be [3] [17]%." The Bases are revised to state that the ability to remove decay heat is dependant on the ability to sustain natural circulation. The Bases lists the items from Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation," as necessary prerequisites for sustaining natural circulation.

In a related change, ITS LCO 3.4.5 and LCO 3.4.6 require RCS loops to be OPERABLE. However, SR 3.4.5.2 and SR 3.4.6.2 only require verification of SG secondary side water level. These Surveillances are revised to require the SG to be capable of removing decay heat. The Bases state that the ability to remove heat requires sufficient SG secondary side water level, the availability of a supply of water, and the availability of injecting water into the SG. The IN item on the ability to pressurize and control pressure in the RCS is not needed in this instance as LCO 3.4.5 applies in MODE 3 and ITS 3.4.6 applies in MODE 4. In these MODES, sufficient pressure exists to support natural circulation.

SRs 3.4.5.2, 3.4.6.2 and 3.4.7.2 are revised to state "Verify required SG . . .". The word "required" is needed because the LCOs require less than all RCS loops. Without the word "required," the SRs must be performed on SGs whether or not they are being credited to meet the LCO.

Information Notice 95-35 is added as a reference in ITS 3.4.5 and 3.4.6 Bases.

3.0 Background

TSTF-114, Rev. 0 was approved by the NRC on 12/31/1996. This Traveler modified the Bases for ITS 3.4.7, RCS Loops - MODE 5, Loops Filled" to reference Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation" in the Bases whenever removal of decay heat by the SGs was discussed.

IN 95-35 discussed two incidents when the SGs were being relied on for decay heat removal in MODE 5 with loops filled per the Technical Specifications, but the SGs were not capable of performing that function because the RCS could not be pressurized. The IN states, "Adding the [RCS to SG] differential temperature of 28 °C [50 °F] to [the secondary side boiling temperature of] 100 °C [212 °F] results in a minimum RCS temperature of 128 °C [262 °F] to maintain sufficient natural circulation flow. The lowest pressure point in the RCS, at the top of the SG tubes, should therefore be maintained above the saturation pressure for 128 °C [262 °F]. If the RCS pressure at the top of the SG tubes is allowed to fall below the primary fluid saturation temperature, flashing and steam voiding may occur, interrupting or degrading the natural circulation flow path. Additionally, when system pressure is dropped with elevated water temperatures, gases may come out of solution." The IN concluded that when relying on SGs for decay heat removal, the following items must be considered:

1. The ability to pressurize and control pressure in the RCS,
2. The secondary side water level in the SGs relied on for decay heat removal,
3. The availability of a supply of water, and
4. The availability of a pump capable of injecting water into the relied on SGs.

The current ITS is incomplete and misleading. TSTF-114 revised the Bases for LCO 3.4.7 and incorporated a reference to IN 95-35, but it did not include sufficient information for an operator to recognize the additional requirements discussed in the IN. The ITS LCO 3.4.7 requirement that the secondary side water level of at least [two] steam generators (SGs) be ^{3} [17]% is insufficient to ensure the SGs can be relied on to remove heat from the RCS in the applicable conditions. The wording of the LCO and the referencing of the IN create a condition in which the document referenced in the Bases contains additional requirements necessary to meet the intent of the LCO. In addition, the concern raised in IN 95-35 does not only apply in MODE 5 - Loops Filled. The concern applies equally to MODE 3 and MODE 4.

4.0 Technical Analysis

The Bases Background of ITS 3.4.7, as modified by TSTF-114, state, "While the principal means for decay heat removal is via the RHR System, the SGs via natural circulation (Ref. 1) are specified as a backup means for redundancy." Reference 1 is Information Notice 95-35. The ITS 3.4.7 LCO Bases state, "Should the operating RHR loop fail, the SGs could be used to remove decay heat via natural circulation." ITS 3.4.7 does not contain sufficient controls to ensure that SGs can be used to remove decay heat via natural circulation. As described in Information Notice 95-35, failure to ensure that all of the requirements for establishing and maintaining natural circulation can result in a situation in which failure of the operating RHR loop leads to a complete loss of decay heat removal and potential core damage.

The IN describes two events in which Technical Specifications requirements similar to those in the ITS were misapplied and the steam generators were unable to be used to remove decay heat via natural circulation while being relied on to meet the LCO. These events illustrate the need to clarify the ITS requirements to ensure that the assumptions supporting the LCO are met.

The changes to SR 3.4.5.2 and SR 3.4.6.2 are necessary to maintain a consistent set of requirements on steam generator heat removal during MODE changes between MODE 3, MODE 4, and MODE 5 - loops filled.

5.0 Regulatory Analysis

5.1 No Significant Hazards Consideration

The TSTF has evaluated whether or not a significant hazards consideration is involved with the proposed generic change by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed change revises the Improved Technical Specifications to explicitly require the required SGs to be able to remove decay heat via natural circulation. The accident analyses assume that the SGs can be used to remove heat via natural circulation. These changes clarify that requirement. Consequently, the probability of an accident previously evaluated is not significantly increased. This change will not affect the ability of the SGs to remove decay heat. Therefore, the consequences of an accident previously evaluated are not significantly increased by this change. Therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed change revises the Improved Technical Specifications to explicitly require the required SGs to be able to remove decay heat via natural circulation. The proposed change does not involve a physical alteration of the plant (no new or different type of equipment will be installed) or a change in the methods governing normal plant operation. Thus, this change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The proposed change revises the Improved Technical Specifications to explicitly require the required SGs to be able to remove decay heat via natural circulation. This change explicitly states the requirements for SGs to be able to remove decay heat via natural circulation and reduces the likelihood that the existing requirements could be misinterpreted. Therefore, this change does not involve a significant reduction in a margin of safety.

Based on the above, the TSTF concludes that the proposed change presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

The proposed changes do not relax any regulatory requirements but impose a more strict interpretation of existing requirements in order to ensure the LCO is met. Therefore, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the approval of the proposed change will not be inimical to the common defense and security or to the health and safety of the public

6.0 Environmental Consideration

A review has determined that the proposed change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed change does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed change.

7.0 References

1. TSTF-114, Revision 0, "Revise Bases for 3.4.7 to Address DHR via Natural Circulation."

2. Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation."

Revision History

OG Revision 0 **Revision Status: Active** **Next Action: NRC**

Revision Proposed by: North Anna

Revision Description:
Original Issue

Owners Group Review Information

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Owners Group Comments:
(No Comments)

Owners Group Resolution: Approved Date: 18-Jul-01

TSTF Review Information

TSTF Received Date: 01-Nov-01 Date Distributed for Review: 01-Nov-01

OG Review Completed: ☑ BWOG ☑ WOG ☑ CEOG ☑ BWROG

TSTF Comments:

OG Revision 0 **Revision Status: Active** **Next Action: NRC**

Issued for prioritization.3/1/2002.

TSTF Resolution: Approved Date: 05-Feb-02

NRC Review Information

NRC Received Date: 03-Jun-02

Affected Technical Specifications

LCO 3.4.7	RCS Loops - MODE 5 - Loops Filled	
LCO 3.4.7 Bases	RCS Loops - MODE 5 - Loops Filled	
Action 3.4.7.A	RCS Loops - MODE 5 - Loops Filled	
Action 3.4.7.A Bases	RCS Loops - MODE 5 - Loops Filled	
Action 3.4.7.B	RCS Loops - MODE 5 - Loops Filled	
SR 3.4.7.2	RCS Loops - MODE 5 - Loops Filled	
SR 3.4.7.2 Bases	RCS Loops - MODE 5 - Loops Filled	
Ref. 3.4.7 Bases	RCS Loops - MODE 5 - Loops Filled	NUREG(s)- 1430 Only
LCO 3.4.5 Bases	RCS Loops - MODE 3	NUREG(s)- 1431 1432 Only
Ref. 3.4.5 Bases	RCS Loops - MODE 3	NUREG(s)- 1431 1432 Only
SR 3.4.5.2	RCS Loops - MODE 3	NUREG(s)- 1431 1432 Only
SR 3.4.5.2 Bases	RCS Loops - MODE 3	NUREG(s)- 1431 1432 Only
LCO 3.4.6 Bases	RCS Loops - MODE 4	NUREG(s)- 1431 1432 Only
Ref. 3.4.6 Bases	RCS Loops - MODE 4	NUREG(s)- 1431 1432 Only
SR 3.4.6.2	RCS Loops - MODE 4	NUREG(s)- 1431 1432 Only
SR 3.4.6.2 Bases	RCS Loops - MODE 4	NUREG(s)- 1431 1432 Only
Bkgnd 3.4.7 Bases	RCS Loops - MODE 5 - Loops Filled	NUREG(s)- 1431 1432 Only
SR 3.4.7.3 Bases	RCS Loops - MODE 5 - Loops Filled	NUREG(s)- 1431 1432 Only
Appl. 3.4.7 Bases	RCS Loops - MODE 5 - Loops Filled	NUREG(s)- 1431 Only

INSERT 1

SR 3.4.5.2 requires verification that the required SG(s) have the capability to remove decay heat. The ability to remove decay heat requires the ability to pressurize and control pressure in the RCS, sufficient secondary side water level in the SGs required for decay heat removal, an available supply of water, and an available pump capable of injecting the water into the required SGs (Ref. 1). The 12 hour Frequency is considered adequate in view of the other indications available in the control room to alert the operator to a loss of capability of the SG(s) to remove heat.

INSERT 2

SR 3.4.6.2 requires verification that the required SG(s) have the capability to remove decay heat. The ability to remove decay heat requires the ability to pressurize and control pressure in the RCS, sufficient secondary side water level in the SGs required for decay heat removal, an available supply of water, and an available pump capable of injecting the water into the required SG(s) (Ref. 1). The 12 hour Frequency is considered adequate in view of the other indications available in the control room to alert the operator to a loss of capability of the SG(s) to remove heat.

INSERT 3

A SG is capable of removing decay heat via natural circulation when: 1) there is the ability to pressurize and control pressure in the RCS; 2) there is sufficient secondary side water level in the SGs required for decay heat removal; 3) there is an available supply of water; and 4) there is an available pump capable of injecting the water into the required SGs (Ref. 1).

INSERT 4

SR 3.4.7.2 requires verification that the required SGs have the capability to remove decay heat via natural circulation. This provides an alternate decay heat removal method in the event that the second RHR loop is not OPERABLE. The ability to remove decay heat requires the ability to pressurize and control pressure in the RCS, sufficient secondary side water level in the SGs required for decay heat removal, an available supply of water, and an available pump capable of injecting the water into the required SGs (Ref. 1). The 12 hour Frequency is considered adequate in view of the other indications available in the control room to alert the operator to a loss of capability of the SG(s) to remove heat.

INSERT 5

1. NRC Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation."

INSERT 6

SR 3.4.7.2 requires verification that the required SGs have the capability to remove decay heat via natural circulation. This provides an alternate decay heat removal method in the event that the second DHR loop is not OPERABLE. The ability to remove decay heat requires the ability to pressurize and control pressure in the RCS, sufficient secondary side water level in the SGs required for decay heat removal, an available supply of water, and an available pump capable of injecting the water into the required SGs (Ref. 1). The 12 hour Frequency is considered adequate in view of the other indications available in the control room to alert the operator to a loss of capability of the SG(s) to remove heat.

INSERT 7

SR 3.4.7.2 requires verification that the required SGs have the capability to remove decay heat via natural circulation. This provides an alternate decay heat removal method in the event that the second SDC loop is not OPERABLE. The ability to remove decay heat requires the ability to pressurize and control pressure in the RCS, sufficient secondary side water level in the SGs required for decay heat removal, an available supply of water, and an available pump capable of injecting the water into the required SGs (Ref. 1). The 12 hour Frequency is considered adequate in view of the other indications available in the control room to alert the operator to a loss of capability of the SG(s) to remove heat.

INSERT 8

SR 3.4.5.2 requires verification that the required SGs have the capability to remove decay heat. The ability to remove decay heat requires the ability to pressurize and control pressure in the RCS, sufficient secondary side water level in the SGs required for decay heat removal, an available supply of water, and an available pump capable of injecting the water into the required SGs (Ref. 1). The 12 hour Frequency is considered adequate in view of the other indications available in the control room to alert the operator to a loss of capability of the SGs to remove heat.

TSTF-435

3.4.7 RCS Loops - MODE 5, Loops Filled

LCO 3.4.7 One decay heat removal (DHR) loop shall be OPERABLE and in operation, and either:

a. One additional DHR loop shall be OPERABLE or

b. The secondary side water level of each steam generator (SG) shall be ≥ [50]%.

Each steam generator (SG) shall be capable of removing heat.

- NOTES -

1. The DHR pump of the loop in operation may be not in operation for ≤ 1 hour per 8 hour period provided:

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

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

2. One required DHR loop may be inoperable for up to 2 hours for surveillance testing provided that the other DHR loop is OPERABLE and in operation.

3. All DHR loops may not be in operation during planned heatup to MODE 4 when at least one RCS loop is in operation.

APPLICABILITY: MODE 5 with RCS loops filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required DHR loop inoperable. AND One DHR loop OPERABLE.	A.1 Initiate action to restore a second DHR loop to OPERABLE status. OR A.2 Initiate action to restore required SGs secondary side water levels to within limits.	Immediately Immediately
B. One or more required SGs with secondary side water level not within limit. AND One DHR loop OPERABLE.	B.1 Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1. OR B.2 Initiate action to restore required SGs secondary side water level to within limit.	Immediately Immediately
C. No required DHR loop OPERABLE. OR Required DHR loop not in operation.	C.1 Suspend all operations involving a reduction in RCS boron concentration. AND C.2 Initiate action to restore one DHR loop to OPERABLE status and operation.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.7.1	Verify required DHR loop is in operation.	12 hours
SR 3.4.7.2	Verify required SG secondary side water levels are ≥ [50]%.	12 hours
SR 3.4.7.3	---------- **- NOTE -** Not required to be performed until 24 hours after a required pump is not in operation. ---------- Verify correct breaker alignment and indicated power available to each required DHR pump.	7 days

required SG(s) capable of removing decay heat.

BASES

APPLICABLE SAFETY ANALYSES

No safety analyses are performed with initial conditions in MODE 5.

RCS Loops - MODE 5 (Loops Filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least one of the DHR loops be OPERABLE and in operation with an additional DHR loop OPERABLE or both SGs ~~with secondary side water level ≥ [50]%~~ capable of removing decay heat. One DHR loop provides sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. The second DHR loop is normally maintained as a backup to the operating DHR loop to provide redundancy for decay heat removal. However, if the standby DHR loop is not OPERABLE, a sufficient alternate method of providing redundant heat removal paths is to provide both SGs ~~with their secondary side water~~ levels ≥ [50]% capable of removing decay heat via natural circulation. Should the operating DHR loop fail, the SGs could be used to remove the decay heat.

Note 1 permits the DHR pumps to not be in operation for up to 1 hour per 8 hour period. The circumstances for stopping both DHR trains are to be limited to situations where: (a) Pressure and temperature increases can be maintained well within the allowable pressure (P/T and low temperature overpressure protection) and 10°F subcooling limits or (b) Alternate heat paths through the SGs are in operation.

The Note prohibits boron dilution with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1 is maintained when DHR forced flow is stopped because an even concentration distribution cannot be ensured. Core outlet temperature is to be maintained at least 10°F below saturation temperature so that no vapor bubble would form and possibly cause a natural circulation flow obstruction. In this MODE, the generators are used as a backup for decay heat removal and, to ensure their availability, the RCS loop flow path is to be maintained with subcooled liquid.

In MODE 5, it is sometimes necessary to stop all RCP or DHR pump forced circulation. This is permitted to change operation from one DHR train to the other, perform surveillance or startup testing, perform the transition to and from the DHR System, or to avoid operation below the RCP minimum NPSH limit. The time period is acceptable because natural circulation is acceptable for heat removal, the reactor coolant temperature can be maintained subcooled, and boron stratification affecting reactivity control is not expected.

BASES

LCO (continued)

Note 2 allows one DHR loop to be inoperable for a period of up to 2 hours provided that the other loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when such testing is safe and possible.

Note 3 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting DHR loops to not be in operation when at least one RCP is in operation. This Note provides for the transition to MODE 4 where an RCP is permitted to be in operation and replaces the RCS circulation function provided by the DHR loops.

An OPERABLE DHR loop is composed of an OPERABLE DHR pump and an OPERABLE DHR heat exchanger.

Insert 3

DHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. An OPERABLE SG can perform as a heat sink when it has an adequate water level and is OPERABLE in accordance with the Steam Generator Tube Surveillance Program.

APPLICABILITY

In MODE 5 with loops filled, forced circulation is provided by this LCO to remove decay heat from the core and to provide proper boron mixing. One loop of DHR provides sufficient circulation for these purposes.

Operation in other MODES is covered by:

LCO 3.4.4,	"RCS Loops - MODES 1 and 2,"
LCO 3.4.5,	"RCS Loops - MODE 3,"
LCO 3.4.6,	"RCS Loops - MODE 4,"
LCO 3.4.8,	"RCS Loops - MODE 5, Loops Not Filled,"
LCO 3.9.4,	"Decay Heat Removal (DHR) and Coolant Circulation - High Water Level" (MODE 6), and
LCO 3.9.5,	"Decay Heat Removal (DHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1, A.2, B.1, and B.2

the required SGs are not capable of removing decay heat

If one DHR loop is OPERABLE and any required SG has secondary side water level < [50]%, redundancy for heat removal is lost. Action must be initiated to restore the inoperable (non-operating) DHR loop to OPERABLE status or initiate action to restore the secondary side water level in the SGs and action must be taken immediately. Either Required Action will restore redundant decay heat removal paths. The immediate

Capability to remove decay heat for the required

BASES

ACTIONS (continued)

Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

C.1 and C.2

If no required DHR loop is in operation, except as provided in Note 1, or no required DHR loop is OPERABLE, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore a DHR loop to OPERABLE status and operation must be initiated. The required margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Time reflects the importance of maintaining operation for decay heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification every 12 hours that the required DHR loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation. In addition, control room indication and alarms will normally indicate loop status.

SR 3.4.7.2

Insert 6 →

Verifying the SGs are OPERABLE by ensuring their secondary side water levels are ≥ [50]% ensures that redundant heat removal paths are available if the second DHR loop is not OPERABLE. If both DHR loops are OPERABLE, this Surveillance is not needed. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions.

SR 3.4.7.3

Verification that each required DHR pump is OPERABLE ensures that redundant paths for heat removal are available. The requirement also ensures that the additional loop can be placed in operation if needed to

BASES

SURVEILLANCE REQUIREMENTS (continued)

maintain decay heat removal and reactor coolant circulation. If the secondary side water level is ≥ [50]% in both SGs, this Surveillance is not needed. Verification is performed by verifying proper breaker alignment and power available to each required pump. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES None.

Insert 5

capable of removing decay heat.

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.4.5.2	Verify steam generator secondary side water levels are > [17]% for required RCS loops.	12 hours
SR 3.4.5.3	---------- **- NOTE -** Not required to be performed until 24 hours after a required pump is not in operation. ---------- Verify correct breaker alignment and indicated power are available to each required pump.	7 days

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
	A.2	---------- **- NOTE -** Only required if RHR loop is operable. ---------- Be in Mode 5.	24 hours
B. Two required loops inoperable. OR Required loop not in operation.	B.1	Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1	Immediately
	AND		
	B.2	Initiate action to restore one loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify required RHR or RCS loop is in operation.	12 hours
SR 3.4.6.2	Verify ~~SG~~ secondary ~~side~~ water ~~levels~~ are ~~> [17]%~~ for ~~required RCS~~ loops.	12 hours
SR 3.4.6.3	---------- **- NOTE -** Not required to be performed until 24 hours after a required pump is not in operation. ---------- Verify correct breaker alignment and indicated power are available to each required pump.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops - MODE 5, Loops Filled

LCO 3.4.7 One residual heat removal (RHR) loop shall be OPERABLE and in operation, and either:

a. The non-operating RHR loop shall be OPERABLE or

b. The secondary side water level of at least [two] steam generators (SGs) shall be ≥ [17]%.

[TWO] Steam generators (SGs) shall be capable of removing decay heat.

- NOTES -

1. The RHR pump of the loop in operation may be not in operation for ≤ 1 hour per 8 hour period provided:

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

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

2. One required RHR loop may be inoperable for up to 2 hours for surveillance testing provided that the other RHR loop is OPERABLE and in operation.

3. No reactor coolant pump shall be started with one or more RCS cold leg temperatures ≤ [275°F] [Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR] unless the secondary side water temperature of each SG is ≤ [50]°F above each of the RCS cold leg temperatures.

4. All RHR loops may be removed from operation during planned heatup to MODE 4 when at least one RCS loop is in operation.

APPLICABILITY: MODE 5 with RCS Loops Filled

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required RHR loop inoperable. AND One RHR loop OPERABLE.	A.1 Initiate action to restore a second RHR loop to OPERABLE status. OR A.2 Initiate action to restore required SGs secondary side water level to within limit.	Immediately Immediately
B. One or more required SGs with secondary side water level not within limit. AND One RHR loop OPERABLE.	B.1 Initiate action to restore a second RHR loop to OPERABLE status. OR B.2 Initiate action to restore required SGs secondary side water level to within limit.	Immediately Immediately
C. No required RHR loops OPERABLE. OR Required RHR loop not in operation.	C.1 Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1. AND C.2 Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.7.1	Verify required RHR loop is in operation.	12 hours
SR 3.4.7.2	Verify SG secondary side water level is ≥ [17]% in required SGs.	12 hours
SR 3.4.7.3	---------- **- NOTE -** Not required to be performed until 24 hours after a required pump is not in operation. ---------- Verify correct breaker alignment and indicated power are available to each required RHR pump.	7 days

required SG(s) capable of removing decay heat.

BASES

LCO (continued)

shown that boron stratification is not a problem during this short period with no forced flow.

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

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

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

is capable of removing decay heat as

An OPERABLE RCS loop consists of one OPERABLE RCP and one OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program, which ~~has the minimum water level~~ specified in SR 3.4.5.2. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 3, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. The most stringent condition of the LCO, that is, two RCS loops OPERABLE and two RCS loops in operation, applies to MODE 3 with the Rod Control System capable of rod withdrawal. The least stringent condition, that is, two RCS loops OPERABLE and one RCS loop in operation, applies to MODE 3 with the Rod Control System not capable of rod withdrawal.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2,"
LCO 3.4.6, "RCS Loops - MODE 4,"
LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled,"
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled,"
LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6), and

BASES

ACTIONS (continued)

D.1, D.2, and D.3

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

SURVEILLANCE REQUIREMENTS

SR 3.4.5.1

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

SR 3.4.5.2

Insert 1

SR 3.4.5.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ [17]% for required RCS loops. If the SG secondary side narrow range water level is < [17]%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink for removal of the decay heat. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to a loss of SG level.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.5.3

Verification that each required RCP is OPERABLE ensures that safety analyses limits are met. The requirement also ensures that an additional RCP can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power availability to each required RCP. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES ~~None.~~

Insert 5

BASES

LCO (continued)

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

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

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

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

Note 2 requires that the secondary side water temperature of each SG be ≤ [50]°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature ≤ [275°F] [Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR]. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

An OPERABLE RCS loop comprises an OPERABLE RCP and an OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program, which ~~has the minimum water level~~ is capable of removing decay heat as specified in SR 3.4.6.2.

Similarly for the RHR System, an OPERABLE RHR loop comprises an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RCPs and RHR pumps are

BASES

ACTIONS (continued)

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

B.1 and B.2

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

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

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

SR 3.4.6.2

Insert 2

SR 3.4.6.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ [17]%. If the SG secondary side narrow range water level is < [17]%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The 12 hour Frequency is considered adequate in view of other

BASES

SURVEILLANCE REQUIREMENTS (continued)

indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.6.3

Verification that each required pump is OPERABLE ensures that an additional RCS or RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to each required pump. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES None.

Insert 5

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.7 RCS Loops - MODE 5, Loops Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops filled, the primary function of the reactor coolant is the removal of decay heat and transfer this heat either to the steam generator (SG) secondary side coolant via natural circulation (Ref. 1) or the component cooling water via the residual heat removal (RHR) heat exchangers. While the principal means for decay heat removal is via the RHR System, the SGs via natural circulation (Ref. 1) are specified as a backup means for redundancy. Even though the SGs cannot produce steam in this MODE, they are capable of being a heat sink due to their large contained volume of secondary water. As long as the SG secondary side water is at a lower temperature than the reactor coolant, heat transfer will occur. The rate of heat transfer is directly proportional to the temperature difference. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 5 with RCS loops filled, the reactor coolant is circulated by means of two RHR loops connected to the RCS, each loop containing an RHR heat exchanger, an RHR pump, and appropriate flow and temperature instrumentation for control, protection, and indication. One RHR pump circulates the water through the RCS at a sufficient rate to prevent boric acid stratification.

The number of loops in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one RHR loop for decay heat removal and transport. The flow provided by one RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that a second path be available to provide redundancy for heat removal.

The LCO provides for redundant paths of decay heat removal capability. The first path can be an RHR loop that must be OPERABLE and in operation. The second path can be another OPERABLE RHR loop or maintaining two SGs ~~with secondary side water~~ levels ≥ ~~[17]%~~ to provide an alternate method for decay heat removal via natural circulation (Ref.1).

capable of removing decay heat

BASES

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The RHR loops provide this circulation.

RCS Loops - MODE 5 (Loops Filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least one of the RHR loops be OPERABLE and in operation with an additional RHR loop OPERABLE or two SGs ~~with secondary side water level ≥ [17]%~~. One RHR loop provides sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. An additional RHR loop is required to be OPERABLE to meet single failure considerations. However, if the standby RHR loop is not OPERABLE, an acceptable alternate method is two SGs ~~with their secondary side water levels~~ ≥ [17]%. Should the operating RHR loop fail, the SGs could be used to remove the decay heat via natural circulation.

capable of removing decay heat via natural circulation

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

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

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

BASES

LCO (continued)

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

Note 2 allows one RHR loop to be inoperable for a period of up to 2 hours, provided that the other RHR loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when such testing is safe and possible.

Note 3 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 a reactor coolant pump (RCP) with an RCS cold leg temperature ≤ [275°F] [Low Temperature Overpressure Protection (LTOP) arming temperature specified in the PTLR]. This restriction is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 4 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting removal of RHR loops from operation when at least one RCS loop is in operation. This Note provides for the transition to MODE 4 where an RCS loop is permitted to be in operation and replaces the RCS circulation function provided by the RHR loops.

Insert 3

RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. An OPERABLE SG can perform as a heat sink via natural circulation when it has an adequate water level and is OPERABLE in accordance with the Steam Generator Tube Surveillance Program.

APPLICABILITY

In MODE 5 with RCS loops filled, this LCO requires forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of RHR provides sufficient circulation for these purposes. However, one additional RHR loop is required to be OPERABLE, or the secondary side water level of at least [two] SGs is required to be ≥ [17]%.

are capable of removing decay heat.

Operation in other MODES is covered by:

LCO 3.4.4, "RCS Loops - MODES 1 and 2;"
LCO 3.4.5, "RCS Loops - MODE 3;"
LCO 3.4.6, "RCS Loops - MODE 4;"
LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled;"

BASES

APPLICABILITY (continued)

LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level" (MODE 6), and
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

A.1, A.2, B.1 and B.2

are not capable of removing decay heat

If one RHR loop is OPERABLE and the required SGs have secondary side water levels < [17%], redundancy for heat removal is lost. Action must be initiated immediately to restore a second RHR loop to OPERABLE status or to restore the secondary side water levels to within limits for the required SGs. Either Required Action will restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

Capability to remove decay heat

C.1 and C.2

If a required RHR loop is not in operation, except during conditions permitted by Note 1, or if no required loop is OPERABLE, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore one RHR loop to OPERABLE status and operation must be initiated. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Times reflect the importance of maintaining operation for heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

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

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.7.2

Insert 4

Verifying that at least two SGs are OPERABLE by ensuring their secondary side narrow range water levels are ≥ [17]% ensures an alternate decay heat removal method via natural circulation in the event that the second RHR loop is not OPERABLE. If both RHR loops are OPERABLE, this Surveillance is not needed. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.7.3

Verification that each required RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to each required RHR pump. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. If secondary side water level is ≥ [17]% in at least two SGs, this Surveillance is not needed. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES

1. NRC Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation."

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
	C.2 Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.5.1	Verify one RCS loop is in operation.	12 hours
SR 3.4.5.2	Verify secondary side water level in each steam generator ≥ [25]%.	12 hours
SR 3.4.5.3	--- **- NOTE -** Not required to be performed until 24 hours after a required pump is not in operation. --- Verify correct breaker alignment and indicated power available to each required pump.	7 days

Verify required steam generators capable of removing decay heat.

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
		---------- **- NOTE -** Only required if SDC train is OPERABLE. ----------	
	A.2	Be in MODE 5.	24 hours
B. Two required loops or trains inoperable. OR Required loop or train not in operation.	B.1	Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately
	AND		
	B.2	Initiate action to restore one loop or train to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify required RCS loop or SDC train is in operation.	12 hours
SR 3.4.6.2	Verify secondary side water level in required SG(s) is ≥ [25]%.	12 hours
SR 3.4.6.3	---------- **- NOTE -** Not required to be performed until 24 hours after a required pump is not in operation. ----------	
	Verify correct breaker alignment and indicated power available to each required pump.	7 days

Verify required steam generators capable of removing decay heat.

TSTF-435

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops - MODE 5, Loops Filled

LCO 3.4.7 One shutdown cooling (SDC) train shall be OPERABLE and in operation and either:

a. The non-operating SDC train shall be OPERABLE or

b. The secondary side water level of each steam generator (SG) shall be ≥ [25%].

Each steam generator (SG) shall be capable of removing decay heat.

- NOTES -

1. The SDC pump of the train in operation may be not in operation for ≤ 1 hour per 8 hour period provided:

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

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

2. One SDC train may be inoperable for up to 2 hours for surveillance testing provided that the other SDC train is OPERABLE and in operation.

3. No reactor coolant pump (RCP) shall be started with any RCS cold leg temperature ≤ [285]°F unless:

   a. The pressurizer water level is < [60]% or

   b. The secondary side water temperature in each SG is < [100]°F above each of the RCS cold leg temperatures.

4. Both SDC trains may be not in operation during planned heatup to MODE 4 when at least one RCS loop is in operation.

APPLICABILITY: MODE 5 with RCS loops filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required SDC train inoperable. AND One SDC train OPERABLE.	A.1 Initiate action to restore a second SDC train to OPERABLE status. OR A.2 Initiate action to restore required SGs secondary side water level to within limit.	Immediately Immediately
B. One or more required SGs with secondary side water level not within limit. AND One SDC train OPERABLE.	B.1 Initiate action to restore a second SDC train to OPERABLE status. OR B.2 Initiate action to restore required SGs secondary side water level to within limit.	Immediately Immediately
C. No required SDC trains OPERABLE. OR Required SDC train not in operation.	C.1 Suspend operations that would cause introduction into the RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1. AND C.2 Initiate action to restore one SDC train to OPERABLE status and operation.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.7.1	Verify required SDC train is in operation.	12 hours
SR 3.4.7.2	Verify required SG secondary side water level is ≥ [25]%.	12 hours
SR 3.4.7.3	---------- **- NOTE -** Not required to be performed until 24 hours after a required pump is not in operation. ---------- Verify correct breaker alignment and indicated power available to each required SDC pump.	7 days

SG capable of removing decay heat.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.5 RCS Loops - MODE 3

BASES

BACKGROUND

The primary function of the reactor coolant in MODE 3 is removal of decay heat and transfer of this heat, via the steam generators (SGs), to the secondary plant fluid. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 3, reactor coolant pumps (RCPs) are used to provide forced circulation heat removal during heatup and cooldown. The MODE 3 decay heat removal requirements are low enough that a single RCS loop with one RCP is sufficient to remove core decay heat. However, [two] RCS loops are required to be OPERABLE to provide redundant paths for decay heat removal. Only one RCP needs to be OPERABLE to declare the associated RCS loop OPERABLE.

Reactor coolant natural circulation is not normally used but is sufficient for core cooling. However, natural circulation does not provide turbulent flow conditions. Therefore, boron reduction in natural circulation is prohibited because mixing to obtain a homogeneous concentration in all portions of the RCS cannot be ensured.

APPLICABLE SAFETY ANALYSES

Analyses have shown that the rod withdrawal event from MODE 3 with one RCS loop in operation is bounded by the rod withdrawal initiated from MODE 2.

Failure to provide heat removal may result in challenges to a fission product barrier. The RCS loops are part of the primary success path that functions or actuates to prevent or mitigate a Design Basis Accident or transient that either assumes the failure of, or presents a challenge to, the integrity of a fission product barrier.

RCS Loops - MODE 3 satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require both RCS loops to be available for heat removal, thus providing redundancy. The LCO requires both loops to be OPERABLE with the intent of requiring both SGs to be capable (~~> 25% water level~~) of transferring heat from the reactor coolant at a controlled rate. Forced reactor coolant flow is the required way to transport heat, although natural circulation flow provides adequate removal. A minimum of one running RCP meets the LCO requirement for one loop in operation.

BASES

LCO (continued)

The Note permits a limited period of operation without RCPs. All RCPs may be not in operation for ≤ 1 hour per 8 hour period. This means that natural circulation has been established. When in natural circulation, a reduction in boron concentration with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1 is maintained is prohibited because an even concentration distribution throughout the RCS cannot be ensured. Core outlet temperature is to be maintained at least 10°F below the saturation temperature so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

In MODES 3, 4, and 5, it is sometimes necessary to stop all RCPs or shutdown cooling (SDC) pump forced circulation (e.g., to change operation from one SDC train to the other, to perform surveillance or startup testing, to perform the transition to and from SDC System cooling, or to avoid operation below the RCP minimum net positive suction head limit). The time period is acceptable because natural circulation is adequate for heat removal, or the reactor coolant temperature can be maintained subcooled and boron stratification affecting reactivity control is not expected.

, which is capable of removing decay heat as specified in SR 3.4.5.2

An OPERABLE RCS loop consists of at least one OPERABLE RCP and a SG that is OPERABLE in accordance with the Steam Generator Tube Surveillance Program. A RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 3, the heat load is lower than at power; therefore, one RCS loop in operation is adequate for transport and heat removal. A second RCS loop is required to be OPERABLE but not in operation for redundant heat removal capability.

Operation in other MODES is covered by:

LCO 3.4.4,	"RCS Loops - MODES 1 and 2,"
LCO 3.4.6,	"RCS Loops - MODE 4,"
LCO 3.4.7,	"RCS Loops - MODE 5, Loops Filled,"
LCO 3.4.8,	"RCS Loops - MODE 5, Loops Not Filled,"
LCO 3.9.4,	"Shutdown Cooling (SDC) and Coolant Circulation - High Water Level" (MODE 6), and
LCO 3.9.5,	"Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level" (MODE 6).

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.5.2

Insert 8 →

This SR requires verification every 12 hours that the secondary side water level in each SG is ≥ [25]%. An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the reactor coolant. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within the safety analyses assumptions.

SR 3.4.5.3

Verification that each required RCP is OPERABLE ensures that the single failure criterion is met and that an additional RCS loop can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power availability to each required RCP. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES None. ← Insert 5

BASES

LCO (continued)

higher heat loads will cause the reactor coolant temperature and pressure to increase at a rate proportional to the decay heat load. Because pressure can increase, the applicable system pressure limits (pressure and temperature (P/T) limits or low temperature overpressure protection (LTOP) limits) must be observed and forced SDC flow or heat removal via the SGs must be re-established prior to reaching the pressure limit. The circumstances for stopping both RCPs or SDC pumps are to be limited to situations where:

a. Pressure and temperature increases can be maintained well within the allowable pressure (P/T limits and LTOP) and 10°F subcooling limits or

b. An alternate heat removal path through the SGs is in operation.

Note 2 requires that either of the following two conditions be satisfied before an RCP may be started with any RCS cold leg temperature ≤ 285°F:

a. Pressurizer water level is < [60]% or

b. Secondary side water temperature in each SG is < [100]°F above each of the RCS cold leg temperatures.

Satisfying either of the above conditions will preclude a large pressure surge in the RCS when the RCP is started.

An OPERABLE RCS loop consists of at least one OPERABLE RCP and an SG that is OPERABLE in accordance with the Steam Generator Tube Surveillance Program and ~~has the minimum water level~~ is capable of removing decay heat as specified in SR 3.4.6.2.

Similarly, for the SDC System, an OPERABLE SDC train is composed of the OPERABLE SDC pump(s) capable of providing forced flow to the SDC heat exchanger(s). RCPs and SDC pumps are OPERABLE if they are capable of being powered and are able to provide flow if required.

APPLICABILITY In MODE 4, this LCO applies because it is possible to remove core decay heat and to provide proper boron mixing with either the RCS loops and SGs or the SDC System.

Operation in other MODES is covered by:

BASES

ACTIONS (continued)

with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended and action to restore one RCS loop or SDC train to OPERABLE status and operation must be initiated. The required margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Times reflect the importance of decay heat removal. The action to restore must continue until one loop or train is restored to operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that the required loop or train is in operation. This ensures forced flow is providing heat removal. Verification includes flow rate, temperature, or pump status monitoring. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess RCS loop status. In addition, control room indication and alarms will normally indicate loop status.

SR 3.4.6.2

Insert 8 →

This SR requires verification every 12 hours of secondary side water level in the required SG(s) $\geq$ [25]%. An adequate SG water level is required in order to have a heat sink for removal of the core decay heat from the reactor coolant. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions.

SR 3.4.6.3

Verification that each required pump is OPERABLE ensures that an additional RCS loop or SDC train can be placed in operation, if needed to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to each required pump. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

BASES

SURVEILLANCE REQUIREMENTS (continued)

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES ~~None.~~ Insert 5

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.7 RCS Loops - MODE 5, Loops Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops filled, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat either to the steam generator (SG) secondary side coolant via natural circulation (Ref. 1) or the component cooling water via the shutdown cooling (SDC) heat exchangers. While the principal means for decay heat removal is via the SDC System, the SGs via natural circulation are specified as a backup means for redundancy. Even though the SGs cannot produce steam in this MODE, they are capable of being a heat sink due to their large contained volume of secondary side water. As long as the SG secondary side water is at a lower temperature than the reactor coolant, heat transfer will occur. The rate of heat transfer is directly proportional to the temperature difference. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 5 with RCS loops filled, the SDC trains are the principal means for decay heat removal. The number of trains in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one SDC train for decay heat removal and transport. The flow provided by one SDC train is adequate for decay heat removal. The other intent of this LCO is to require that a second path be available to provide redundancy for decay heat removal.

The LCO provides for redundant paths of decay heat removal capability. The first path can be an SDC train that must be OPERABLE and in operation. The second path can be another OPERABLE SDC train, or through the SGs via natural circulation (Ref. 1), ~~each having an adequate water level~~.

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The SDC trains provide this circulation.

RCS Loops - MODE 5 (Loops Filled) satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

two SGs capable of removing decay heat

The purpose of this LCO is to require at least one of the SDC trains be OPERABLE and in operation with the other SDC train OPERABLE or ~~secondary side~~ water level ~~of each~~ SG ~~shall be~~ ≥ [25]%. One SDC train provides sufficient forced circulation to perform the safety functions of the

BASES

LCO (continued)

reactor coolant under these conditions. The second SDC train is normally maintained OPERABLE as a backup to the operating SDC train to provide redundant paths for decay heat removal. However, if the standby SDC train is not OPERABLE, a sufficient alternate method to provide redundant paths for decay heat removal is two SGs with their secondary ~~side~~ water ~~levels~~ ≥ [25%]. Should the operating SDC train fail, the SGs could be used to remove the decay heat via natural circulation.

Capable of removing decay heat

Note 1 permits all SDC pumps to not be in operation ≤ 1 hour per 8 hour period. The circumstances for stopping both SDC trains are to be limited to situations where pressure and temperature increases can be maintained well within the allowable pressure (pressure and temperature and low temperature overpressure protection) and 10°F subcooling limits, or an alternate heat removal path through the SG(s) is in operation.

This LCO is modified by a Note that prohibits boron dilution with coolant at boron concentrations less than required to assure the SDM of LCO 3.1.1 is maintained when SDC forced flow is stopped because an even concentration distribution cannot be ensured. Core outlet temperature is to be maintained at least 10°F below saturation temperature, so that no vapor bubble would form and possibly cause a natural circulation flow obstruction. In this MODE, the SG(s) can be used as the backup for SDC heat removal. To ensure their availability, the RCS loop flow path is to be maintained with subcooled liquid.

In MODE 5, it is sometimes necessary to stop all RCP or SDC forced circulation. This is permitted to change operation from one SDC train to the other, perform surveillance or startup testing, perform the transition to and from the SDC, or to avoid operation below the RCP minimum net positive suction head limit. The time period is acceptable because natural circulation is acceptable for decay heat removal, the reactor coolant temperature can be maintained subcooled, and boron stratification affecting reactivity control is not expected.

Note 2 allows one SDC train to be inoperable for a period of up to 2 hours provided that the other SDC train is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable train during the only time when such testing is safe and possible.

Note 3 requires that either of the following two conditions be satisfied before an RCP may be started with any RCS cold leg temperature ≤ [285]°F:

BASES

LCO (continued)

a. Pressurizer water level must be < [60]% or

b. Secondary side water temperature in each SG must be < [100]°F above each of the RCS cold leg temperatures.

Satisfying either of the above conditions will preclude a low temperature overpressure event due to a thermal transient when the RCP is started.

Note 4 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting SDC trains to not be in operation when at least one RCP is in operation. This Note provides for the transition to MODE 4 where an RCP is permitted to be in operation and replaces the RCS circulation function provided by the SDC trains.

An OPERABLE SDC train is composed of an OPERABLE SDC pump and an OPERABLE SDC heat exchanger.

Insert 3

SDC pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. An OPERABLE SG can perform as a heat sink via natural circulation when it has an adequate water level and is OPERABLE in accordance with the SG Tube Surveillance Program.

APPLICABILITY

In MODE 5 with RCS loops filled, this LCO requires forced circulation to remove decay heat from the core and to provide proper boron mixing. One SDC train provides sufficient circulation for these purposes.

Operation in other MODES is covered by:

LCO 3.4.4,	"RCS Loops - MODES 1 and 2,"
LCO 3.4.5,	"RCS Loops - MODE 3," LCO 3.4.6, "RCS Loops - MODE 4,"
LCO 3.4.8,	"RCS Loops - MODE 5, Loops Not Filled,"
LCO 3.9.4,	"Shutdown Cooling (SDC) and Coolant Circulation - High Water Level" (MODE 6), and
LCO 3.9.5,	"Shutdown Cooling (SDC) and Coolant Circulation - Low Water Level" (MODE 6).

ACTIONS

are not capable of removing decay heat

A.1, A.2, B.1 and B.2

If one SDC train is OPERABLE and the required SGs has secondary side water levels < [25%], redundancy for heat removal is lost. Action must be initiated immediately to restore a second SDC train to

BASES

ACTIONS (continued)

capability to remove decay heat

OPERABLE status or to restore the water level in ~~both~~ SGs. Either Required Action will restore redundant decay heat removal paths. The immediate Completion Times reflect the importance of maintaining the availability of two paths for decay heat removal.

C.1 and C.2

If a required SDC train is not in operation, or no required SDC train is OPERABLE, except as permitted in Note 1, all operations involving introduction of coolant into the RCS with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 must be suspended. Action to restore one SDC train to OPERABLE status and operation must be initiated. The required margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS of coolant with boron concentration less than required to meet the minimum SDM of LCO 3.1.1 is required to assure continued safe operation. With coolant added without forced circulation, unmixed coolant could be introduced to the core, however coolant added with boron concentration meeting the minimum SDM maintains acceptable margin to subcritical operations. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification every 12 hours that one SDC train is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing decay heat removal. The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify operation is within safety analyses assumptions. In addition, control room indication and alarms will normally indicate loop status.

The SDC flow is established to ensure that core outlet temperature is maintained sufficiently below saturation to allow time for swapover to the standby SDC train should the operating train be lost.

SR 3.4.7.2

Insert 7 →

Verifying the SGs are OPERABLE by ensuring their secondary side water levels are ≥ [25%] ensures that redundant heat removal paths are available if the second SDC train is inoperable. The Surveillance is required to be performed when the LCO requirement is being met by use of the SGs. If both SDC trains are OPERABLE, this SR is not needed.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The 12 hour Frequency has been shown by operating practice to be sufficient to regularly assess degradation and verify operation within safety analyses assumptions.

SR 3.4.7.3

Verification that each required SDC train is OPERABLE ensures that redundant paths for decay heat removal are available. The requirement also ensures that the additional train can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to each required pump. Alternatively, verification that a pump is in operation also verifies proper breaker alignment and power availability. The Surveillance is required to be performed when the LCO requirement is being met by one of two SDC trains, e.g., both SGs have < [25]% water level. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a required pump is not in operation.

REFERENCES

1. NRC Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation."