PACKAGE 3.4

REACTOR COOLANT SYSTEM (RCS)

PART E

MARKUP OF NUREG-1431
IMPROVED STANDARD TECHNICAL SPECIFICATIONS
AND BASES

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PRAIRIE ISLAND NUCLEAR GENERATING PLANT
UNITS 1 AND 2

Improved Technical Specifications
Conversion Submittal

 PA3.4-101

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 RCS Pressure, Temperature, and Flow – Departure from Nucleate Boiling (DNB) Limits

PA3.4-101

LCO 3.4.1 RCS DNB parameters for pressurizer pressure, RCS average temperature, and RCS total flow rate shall be within the limits specified below:

a. Pressurizer pressure is greater than or equal to the limit specified in the COLR~~≥ [2200] psig~~;

TA3.4-109

b. RCS average temperature is less than or equal to the limit specified in the COLR~~≤ [581]°F~~; and

c. RCS total flow rate~~≥~~ greater than or equal to the value specified in the COLR~~[284,000] gpm~~.

CL3.4-102

APPLICABILITY: MODE 1.

---NOTE---

Pressurizer pressure limit does not apply during:

a. THERMAL POWER ramp > 5% RTP per minute; or

b. THERMAL POWER step > 10% RTP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more RCS DNB parameters not within limits.	A.1 Restore RCS DNB parameter(s) to within limit.	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	Verify pressurizer pressure is greater than or equal to the limit specified in the COLR ~~≥ [2200] psig~~.	12 hours TA3.4-109
SR 3.4.1.2	Verify RCS average temperature is less than or equal to the limit specified in the COLR ~~≤ [581]°F~~.	12 hours TA3.4-109
~~SR 3.4.1.3~~	~~Verify RCS total flow rate is ≥ [284,000] gpm.~~	~~12 hours~~ CL3.4-103
SR 3.4.1.34	-------------------NOTE------------------- ~~Not~~ Required to be performed within 7 days~~until 24 hours~~ after ≥ ~~[~~90~~]~~% RTP. -- Verify ~~by precision heat balance that~~ RCS total flow rate is within the limit specified in the COLR~~≥ [284,000] gpm~~.	~~[~~24~~18]~~ months X3.4-104 PA3.4-106 X3.4-107 CL3.4-102

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.2 RCS Minimum Temperature for Criticality

LCO 3.4.2 Each RCS loop average temperature (T_{avg}) shall be ≥ ~~[~~540~~541]~~°F.

APPLICABILITY: MODE 1,
MODE 2 with k_{eff} ≥ 1.0.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. T_{avg} in one or more RCS loops not within limit.	A.1	Be in MODE 2 with k_{eff} < 1.0~~3~~.	30 minutes

TA3.4-108

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.2.1 Verify RCS T_{avg} in each loop ≥ ~~[~~540~~541]~~°F.	12 hours ~~-----NOTE-----~~ ~~Only required if [T_{avg} — T_{ref} deviation, low low T_{avg}] alarm not reset and any RCS loop T_{avg} < [547]°F~~ ~~-----------------~~ ~~30 minutes thereafter~~

TA3.4-111

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.3 RCS Pressure and Temperature (P/T) Limits

LCO 3.4.3 RCS pressure, RCS temperature, and RCS heatup and cooldown rates shall be maintained within the limits specified in the PTLR.

APPLICABILITY: At all times.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ---------NOTE--------- Required Action A.2 shall be completed whenever this Condition is entered. --------------------- Requirements of LCO not met in MODE 1, 2, 3, or 4.	A.1 Restore parameter(s) to within limits. AND A.2 Determine RCS is acceptable for continued operation.	30 minutes 72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5 with RCS pressure < [500] psig.	6 hours 36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. ---------NOTE--------- Required Action C.2 shall be completed whenever this Condition is entered. --------------------- Requirements of LCO not met any time in other than MODE 1, 2, 3, or 4.	C.1 Initiate action to restore parameter(s) to within limits. <u>AND</u> C.2 Determine RCS is acceptable for continued operation.	Immediately Prior to entering MODE 4

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.3.1	-------------------NOTE------------------- Only required to be performed during RCS heatup and cooldown operations and RCS inservice leak and hydrostatic testing. -- Verify RCS pressure, RCS temperature, and RCS heatup and cooldown rates are within the limits specified in the PTLR.	30 minutes

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.4 RCS Loops – MODES 1 and 2

LCO 3.4.4 [TwoFour] RCS loops shall be OPERABLE and in operation. CL3.4-112

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of LCO not met.	A.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.4.1	Verify each RCS loop is in operation.	12 hours

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.5 RCS Loops – MODE 3

LCO 3.4.5 ~~{~~Two~~}~~ RCS loops shall be OPERABLE, and either: CL3.4-113

a. ~~{~~Two~~}~~ RCS loops shall be in operation when the Rod Control System is capable of rod withdrawal; or

b. One RCS loop shall be in operation when the Rod Control System is not capable of rod withdrawal.

---------------------------NOTE---------------------------
-- CL3.4-114

Both~~All~~ reactor coolant pumps may not be in operation~~de-energized~~ for ≤ 12 hours ~~per 8 hour period~~ to perform preplanned work activities provided: TA3.4-116 CL3.4-117

a. No operations are permitted that would cause introduction into~~reduction of~~ the RCS, coolant with boron concentration less than required to meet the SDM of LCO 3.1.1; and TA3.4-115

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

APPLICABILITY: MODE 3.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One ~~required~~ RCS loop inoperable.	A.1	Restore inoperable~~required~~ RCS loop to OPERABLE status.	72 hours CL3.4-113
B. Required Action and associated Completion Time of Condition A not met.	B.1	Be in MODE 4.	12 hours

(continued)

C. One ~~required~~ RCS loop not in operation with ~~, and reactor trip breakers closed and~~ Rod Control System capable of rod withdrawal.	C.1	Restore ~~required~~ RCS loop to operation.	1 hour CL3.4-113 TA3.4-118
	<u>OR</u>		
	C.2	Place the Rod Control System in a condition incapable of rod withdrawal~~De-energize all control rod drive mechanisms (CRDMs)~~.	1 hour

ACTIONS

CONDITION (continued)	REQUIRED ACTION		COMPLETION TIME
D. [Two] RCS loops inoperable. OR No RCS loop in operation.	D.1	Place the Rod Control System in a condition incapable of rod withdrawal ~~De-energize all CRDMs~~.	Immediately TA3.4-118
	AND		
	D.2	Suspend ~~all~~ operations that would cause introduction into the ~~involving a reduction of~~ RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately TA3.4-115
	AND		
	D.3	Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.5.1 Verify required RCS loops are in operation.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.5.2	Verify steam generator secondary side water levels are ≥ 60~~[17]~~% (Wide Range) for both~~required~~ RCS loops.	12 hours X3.4-121
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~~the~~ required pump~~ that is not in operation~~.	TA3.4-125 7 days CL3.4-113

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.6 RCS Loops – MODE 4

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

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

1. All reactor coolant pumps (RCPs) and RHR pumps may not be in operation~~de-energized~~ for ≤ 1 hour per 8 hour period to perform tests provided: TA3.4-116 PA3.4-120

   a. No operations are permitted that would cause introduction into~~reduction of~~ the RCS, coolant with boron concentration less than required to meet the SDM of LCO 3.1.1; and TA3.4-115

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

2. No RCP shall be started with any RCS cold leg temperature ≤ the Over Pressure Protection System (OPPS) enable temperature specified in the PTLR~~[275]°F~~ unless: TA3.4-119

   a. T~~t~~he secondary side water temperature of each steam generator (SG) is ≤ ~~[~~50~~]~~°F above each of the RCS cold leg temperatures; ~~or~~

   b. There is a steam or gas bubble in the pressurizer. CL3.4-123

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ~~required~~ RCS loop inoperable. AND Two RHR loops inoperable.	A.1 Initiate action to restore a second loop to OPERABLE status.	Immediately CL3.4-113
B. One ~~required~~ RHR loop inoperable. AND Two ~~required~~ RCS loops inoperable.	-------------------NOTE------------------- Required Action B.1 is not applicable if all RCS and RHR loops are inoperable and Condition C is entered. --- B.1 Be in MODE 5.	X3.4-124 24 hours CL3.4-113

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. All ~~Required~~ RCS and~~or~~ RHR loops inoperable. OR No RCS or RHR loop in operation.	C.1	Suspend ~~all~~ operations that would cause introduction into the ~~involving a reduction of~~ RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately CL3.4-113 TA3.4-115
	AND		
	C.2	Initiate action to restore one loop to OPERABLE status and operation.	Immediately

ACTIONS (continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify one RHR or RCS loop is in operation.	12 hours
SR 3.4.6.2	Verify SG secondary side water level~~s~~ is~~are~~ ≥ 60~~[17]~~% (Wide Range) for each required RCS loop~~s~~.	12 hours X3.4-121
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~~the~~ required pump~~ that is not in operation~~.	TA3.4-125 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. One additional RHR loop shall be OPERABLE; or

b. The secondary side water level of at least [onetwo] steam generators (SGs) shall be ≥ 60[17]% (Wide Range). CL3.4-126 X3.4-121

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

1. The RHR pump of the loop in operation may not be in operationde-energized for ≤ 1 hour per 8 hour period to perform tests provided: TA3.4-116 PA3.4-120

   a. No operations are permitted that would cause introduction intoreduction of the RCS, coolant with boron concentration less than required to meet the SDM of LCO 3.1.1; and TA3.4-115

   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. PA3.4-127

3. No reactor coolant pump shall be started with one or more RCS cold leg temperatures ≤ the Over Pressure Protection System (OPPS) enable temperature specified in the PTLR[275]°F unless: TA3.4-119

   a. [the secondary side water temperature of each SG is ≤ [50]°F above each of the RCS cold leg temperatures; or.

   b. There is a steam or gas bubble in the pressurizer. CL3.4-123

4. ~~Both~~All RHR loops may be removed from operation during planned heatup to MODE 4 when at least one RCS loop is in operation. CL3.4-128

APPLICABILITY: MODE 5 with RCS loops filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RHR loop inoperable. AND ~~Both~~Required SGs secondary side water levels not within limits.	A.1 Initiate action to restore a second RHR loop to OPERABLE status. OR A.2 Initiate action to restore required SG secondary side water levels to within limits.	Immediately CL3.4-113 Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Both~~Required~~ RHR loops inoperable. OR No RHR loop in operation.	B.1 Suspend ~~all~~ operations that would cause introduction into the~~involving a reduction of~~ RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1.	Immediately CL3.4-128 TA3.4-115
	AND	
	B.2 Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.7.1	Verify one RHR loop is in operation.	12 hours
SR 3.4.7.2	Verify SG secondary side water level is ≥ 60[17]% (Wide Range) in the required SGs.	X3.4-121 12 hours

(continued)

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 eachthe required RHR pump that is not in operation.	TA3.4-125 7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.8 RCS Loops – MODE 5, Loops Not Filled

LCO 3.4.8 Two residual heat removal (RHR) loops shall be OPERABLE and one RHR loop shall be in operation.

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

1. All RHR pumps may not be in operation~~de-energized~~ for ≤ 15 minutes ~~when switching from one loop to another~~ provided: TA3.4-116 CL3.4-131

   a~~b~~. No operations are permitted that would cause introduction into~~a reduction of~~ the RCS, coolant with boron concentration less than required to meet the SDM of LCO 3.1.1; ~~and~~ TA3.4-115

   b~~a~~. ~~[~~The core outlet temperature is maintained > 10°F below saturation temperature; and~~.]~~

   c. No draining operations to further reduce the RCS water volume are permitted.

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

APPLICABILITY: MODE 5 with RCS loops not filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RHR loop inoperable.	A.1 Initiate action to restore RHR loop to OPERABLE status.	Immediately

(continued)

B. <u>Both</u>~~Required~~ RHR loops inoperable. <u>OR</u> No RHR loop in operation.	B.1 Suspend ~~all~~ operations that would cause introduction into the~~involving reduction in~~ RCS, coolant with boron concentration less than required to meet SDM of LCO 3.1.1. <u>AND</u> -----------NOTE----------- A Safety Injection pump may be run as required to maintain adequate core cooling and RCS inventory. --------------------------- B.2 Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately CL3.4-128 TA3.4-115 CL3.4-132 Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.8.1	Verify one RHR loop is in operation.	12 hours
SR 3.4.8.2	-----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 eachthe required RHR pump that is not in operation.	TA3.4-125 7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.9 Pressurizer

LCO 3.4.9 The pressurizer shall be OPERABLE with:

a. Pressurizer water level ≤ ~~[~~9~~0~~2~~]~~%; and CL3.4-133

b. Two groups of pressurizer heaters OPERABLE ~~with the capacity of each group ≥ [125] kW [~~and capable of being powered from an emergency power supply~~]~~. CL3.4-134

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Pressurizer water level not within limit.	A.1	Be in MODE 3~~with reactor trip breakers open~~.	6 hours
	<u>AND</u>		
	A.2	Fully insert all rods.	6 hours TA3.4-118
	<u>AND</u>		
	A.3	Place Rod Control system in a condition incapable of rod withdrawal.	6 hours
	<u>AND</u>		
	A.4	Be in MODE 4.	12 hours
B. One ~~required~~ group of pressurizer heaters inoperable.	B.1	Restore ~~required~~ group of pressurizer heaters to OPERABLE status.	72 hours CL3.4-110
C. Required Action and associated Completion Time of Condition B not met.	C.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	C.2	Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.9.1	Verify pressurizer water level is ≤ [902]%.	12 hours CL3.4-133
~~SR 3.4.9.2~~	~~Verify capacity of each required group of pressurizer heaters is ≥ [125] kW.~~	~~92 days~~ CL3.4-137
SR 3.4.9.23	Verify required pressurizer heaters are capable of being powered from an emergency power supply.	24~~[18]~~ months X3.4-136

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.10 Pressurizer Safety Valves

LCO 3.4.10 [TwoThree] pressurizer safety valves shall be OPERABLE with lift settings ≥ [241060] psig and ≤ [256010] psig. CL3.4-138

APPLICABILITY: MODES 1, 2, and 3, TA3.4-119
MODE 4 with all RCS cold leg temperatures > the Over Pressure Protection System (OPPS) enable temperature specified in the PTLR[275]°F.

-----NOTE-----
The lift settings are not required to be within the LCO limits during MODES 3 and 4 for the purpose of setting the pressurizer safety valves under ambient (hot) conditions. This exception is allowed for 36[54] hours following entry into MODE 3 provided a preliminary cold setting was made prior to heatup. PA3.4-141

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One pressurizer safety valve inoperable.	A.1 Restore valve to OPERABLE status.	15 minutes

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Required Action and associated Completion Time not met. OR Both~~Two or more~~ pressurizer safety valves inoperable.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 4 with any RCS cold leg temperatures ≤ the OPPS enable temperature specified in the PTLR ~~[275]°F~~.	24~~12~~ hours TA3.4-139 CL3.4-142 TA3.4-119

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.10.1	Verify each pressurizer safety valve is OPERABLE in accordance with the Inservice Testing Program. Following testing, lift settings shall be within 2460 to 2510 psig ~~± 1%~~.	In accordance with the Inservice Testing Program PA3.4-143

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.11 Pressurizer Power Operated Relief Valves (PORVs)

LCO 3.4.11 Each PORV and associated block valve shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

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

1. Separate Condition entry is allowed for each PORV and each block valve.

TA3.4-144

2. LCO 3.0.4 is not applicable.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or ~~both~~more PORVs inoperable due to excessive seat leakage~~and capable of being manually cycled~~.	A.1	Close and maintain power to associated block valve(s).	1 hour.

CL3.4-146

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One [or two] PORV[s] inoperable for reasons other than Condition A and not capable of being manually cycled.	B.1	Close associated block valve[s].	1 hour
	AND		
	B.2	Remove power from associated block valve[s].	1 hour
	AND		
	B.3	Restore PORV[s] to OPERABLE status.	72 hours

CL3.4-147

(continued)

C. One block valve inoperable.	------------NOTE------------ Required Actions C.1 and C.2 do not apply when block valve is inoperable solely as a result of complying with Required Actions B.2 or E.2 ----------------------------		
	C.1	Place associated PORV in manual control.	1 hour
	AND		
	C.2	Restore block valve to OPERABLE status.	72 hours

TA3.4-148

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.	6 hours
	<u>AND</u>	
	D.2 Be in MODE 4.	12 hours
E. Both~~Two~~ ~~[or three]~~ PORVs inoperable for reasons other than Condition A~~and not capable of being manually cycled~~.	E.1 Close associated block valves.	1 hour CL3.4-152
	<u>AND</u>	
	E.2 Remove power from associated block valves.	1 hour
	<u>AND</u>	
	E.3 Be in MODE 3.	6 hours
	<u>AND</u>	
	E.4 Be in MODE 4.	12 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Both~~More than one~~ block valve~~s~~ inoperable.	---NOTE--- Required Action F.1 does not apply when block valve is inoperable solely as a result of complying with Required Actions B.2 or E.2. --- ~~F.1 Place associated PORVs in manual control.~~ ~~AND~~	TA3.4-144 TA3.4-148 ~~1 hour~~ (continued)
F. (continued)	F.12 Restore one block valve to OPERABLE status ~~[if three block valves are inoperable]~~. ~~AND~~ ~~F.3 Restore remaining block valve(s) to OPERABLE status.~~	2 hours ~~72 hours~~ TA3.4-144

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
G. Required Action and associated Completion Time of Condition F not met.	G.1 Be in MODE 3. AND G.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.11.1	-------------------NOTES------------------- 1. Not required to be performed~~met~~ with block valve closed in accordance with the Required Actions of this LCO~~Condition B or E~~. 2. Only required to be performed in MODES 1 and 2. --- Perform a complete cycle of each block valve.	TA3.4-157 92 days
SR 3.4.11.2	-------------------NOTE------------------- Only required to be performed in MODES 1 and 2. --- Perform a complete cycle of each PORV.	TA3.4-157 X3.4-136 ~~[24]~~ ~~8]~~ months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.4.11.3~~	~~Perform a complete cycle of each solenoid air control valve and check valve on the air accumulators in PORV control systems.~~	~~[18] months~~ CL3.4-158
~~SR 3.4.11.4~~	~~Verify PORVs and block valves are capable of being powered from emergency power sources.~~	CL3.4-161 ~~[18] months~~

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 Low Temperature Overpressure Protection (LTOP) ~~System~~ ≥ Safety Injection (SI) Pump Disable Temperature

CL3.4-162

LCO 3.4.12 ~~An~~ LTOP ~~System~~ shall be provided~~OPERABLE~~ with:

a) a maximum of ~~[one] [high pressure injection~~ SI ~~(HPI)]~~ pump ~~[and one charging pump]~~ capable of injecting into the RCS,

b) ~~and~~ the emergency core cooling system (ECCS) accumulators isolated, CL3.4-163

c) an OPERABLE Over Pressure Protection System (OPPS), and ~~either a or b below.~~

~~a. Two RCS relief valves, as follows:~~

~~1.~~ d) t~~T~~wo OPERABLE pressurizer power operated relief valves (PORVs) with lift settings within the limits specified in the PTLR. ~~, or~~

~~[2. Two residual heat removal (RHR) suction relief valves with setpoints ≥ [436.5] psig and ≤ [463.5] psig, or]~~

~~[3. One PORV with a lift setting within the limits specified in the PTLR and one RHR suction relief valve with a setpoint ≥ [436.5] psig and ≤ [463.5] psig].~~

~~b. The RCS depressurized and an RCS vent of ≥ [2.07] square inches.~~

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

1. Both SI pumps may be run for ≤ 1 hour while conducting SI system testing providing there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut. CL3.4-164

2. ECCS accumulator may be unisolated when accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR. TA3.4-166

APPLICABILITY: MODE 4 when any~~all~~ RCS cold leg temperature is ≤ the OPPS enable temperature specified in the PTLR~~[275]°F~~, and > the SI pump disable temperature specified in the PTLR. TA3.4-165 TA3.4-119
~~MODE 5,~~
~~MODE 6 when the reactor vessel head is on.~~ CL3.4-167

~~NOTE~~
~~Accumulator isolation is only required when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.~~ TA3.4-166

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Two ~~or more~~ SI~~[HPI]~~ pumps capable of injecting into the RCS.	A.1 Initiate action to assure~~verify~~ a maximum of ~~[one]~~ SI~~[HPI]~~ pump is capable of injecting into the RCS.	Immediately PA3.4-159 CL3.4-163

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B. Two or more charging pumps capable of injecting into the RCS.~~	~~B.1 -----NOTE----- Two charging pumps may be capable of injecting into the RCS during pump swap operation for ≤ 15 minutes.~~ ----- ~~Initiate action to verify a maximum of [one] charging pump is capable of injecting into the RCS.~~	CL3.4-163 ~~Immediately~~
B~~C~~. An ECCS accumulator not isolated when the accumulator pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	B~~C~~.1 Isolate affected ECCS accumulator.	1 hour CL3.4-163

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
CD. Required Action and associated Completion Time of Condition B[C] not met.	CD.1 Increase RCS cold leg temperature to > the OPPS enable temperature specified in the PTLR[275]°F. OR CD.2 Depressurize affected ECCS accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours TA3.4-119 12 hours CL3.4-163
DE. One required PORVRCS relief valve inoperable in MODE 4.	DE.1 Restore required PORVRCS relief valve to OPERABLE status.	7 days CL3.4-163
F. One required RCS relief valve inoperable in MODE 5 or 6.	F.1 Restore required RCS relief valve to OPERABLE status.	24 hours CL3.4-167

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
EG. Two ~~required~~ PORVs~~RCS relief valves~~ inoperable. OR Required Action and associated Completion Time of Condition A, C, or ~~[B.]~~ D~~, E, or F~~ not met. OR OPPS~~LTOP System~~ inoperable ~~for any reason other than Condition A, [B.] C, D, E, or F~~.	EG.1 Be in MODE 5. AND E.2 Depressurize RCS and establish RCS vent of ≥ 8~~[2.07]~~ square inches.	8 hours PA3.4-168 CL3.4-169 128 hours TA3.4-139

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.12.1	Verify a maximum of ~~[one]~~ SI~~[HPI]~~ pumps is capable of injecting into the RCS.	CL3.4-163 12 hours
~~[SR 3.4.12.2~~	~~Verify a maximum of one charging pump is capable of injecting into the RCS.~~	CL3.4-163 ~~12 hours~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.12.23	------------------NOTE------------------ Only required to be performed when ECCS accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR. -- Verify each ECCS accumulator is isolated.	X3.4-171 Once within 12 hours and every 12 hours thereafter
~~SR 3.4.12.4~~	~~Verify RHR suction valve is open for each required RHR suction relief valve.~~	~~12 hours~~ CL3.4-163
~~SR 3.4.12.5~~	~~------------------NOTE------------------~~ ~~Only required to be performed when complying with LCO 3.4.12.b.~~ ~~--~~ ~~Verify RCS vent ≥ [2.07] square inches open.~~	~~12~~ CL3.4-163 ~~hours for unlocked open vent valve(s)~~ ~~AND~~ ~~31 days for locked open vent valve(s)~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.12.3~~6~~	Verify PORV block valve is open for each required PORV.	72 hours
~~SR 3.4.12.7~~	~~Verify associated RHR suction isolation valve is locked open with operator power removed for each required RHR suction relief valve.~~	~~31 days~~ CL3.4-163
SR 3.4.12.4~~8~~	-------------------NOTE------------------- Not required to be performed~~met~~ until 12 hours after decreasing RCS cold leg temperature to ≤ the OPPS enable temperature specified in the PTLR~~[275]°F~~. -- Perform a COT on OPPS~~each required PORV, excluding actuation~~.	TA3.4-157 TA3.4-119 31 days CL3.4-162

(continued)

SR 3.4.12.5~~9~~	Perform CHANNEL CALIBRATION for each OPPS ~~required PORV~~ actuation channel.	~~24[18]~~ months X3.4-107 CL3.4-162

3.4 REACTOR COOLANT SYSTEM (RCS)

CL3.4-172

3.4.13 Low Temperature Overpressure Protection (LTOP) ≤ Safety Injection (SI) Pump Disable Temperature

LCO 3.4.13

LTOP shall be provided with: 1) no SI Pumps capable of injecting into the RCS; 2) the emergency core cooling system (ECCS) accumulators isolated; and 3) one of the following pressure relief capabilities:

a. An Over Pressure Protection System (OPPS) shall be OPERABLE with two pressurizer power operated relief valves (PORVs) with lift settings within the limits specified in the PTLR, or

b. The RCS depressurized and an RCS vent of ≥ 3 square inches.

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

1. Both SI pumps may be run for ≤ 1 hour while conducting SI system testing provided there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut.

2. During reduced inventory conditions an SI pump may be run as required to maintain adequate core cooling and RCS inventory.

3. ECCS accumulator may be unisolated when accumulator pressure is less than the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

APPLICABILITY:

MODE 4 when any RCS cold leg temperature is ≤ the SI pump disable temperature specified in the PTLR;
MODE 5 when the steam generator (SG) primary system manways and pressurizer manway are closed and secured in position.

MODE 6 when the reactor vessel head is on and the SG primary system manway and pressurizer manway are closed and secured in position.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or both SI pump(s) capable of injecting into the RCS.	A.1 Initiate action to assure no SI pump is capable of injecting into the RCS.	Immediately
B. An ECCS accumulator not isolated when the accumulator pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	B.1 Isolate affected ECCS accumulator.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition B not met.	C.1 Increase RCS cold leg temperature to > the OPPS enable temperature specified in the PTLR.	12 hours
	OR	
	C.2 Depressurize affected ECCS accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours
D. -----NOTE----- Only applicable in LCO 3.4.13.a ------------------ One required PORV inoperable.	D.1 Restore required PORV to OPERABLE status.	24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Two PORVs inoperable for LCO 3.4.13.a. OR Required Action and associated Completion Time of Condition A, C, or D not met. OR OPPS inoperable.	E.1 Depressurize RCS and establish RCS vent of ≥ 3 square inches.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.13.1	Verify no SI pumps are capable of injecting into the RCS.	12 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.13.2	-------------------NOTE------------------- Only required to be performed when ECCS accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR. -- Verify each ECCS accumulator is isolated.	Once within 12 hours and every 12 hours thereafter
SR 3.4.13.3	Verify required RCS vent ≥ 3 square inches open.	12 hours for unlocked open vent valve(s) AND 31 days for other vent path(s)
SR 3.4.13.4	Verify PORV block valve is open for each required PORV.	72 hours

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.13.5	-------------------NOTE------------------- 1. Not required to be performed until 12 hours after decreasing RCS cold leg temperature to ≤ the OPPS enable temperature specified in the PTLR. 2. Only required to be performed when complying with LCO 3.4.13.a. --- Perform a COT on OPPS.	31 days
SR 3.4.13.6	Perform CHANNEL CALIBRATION for OPPS actuation channel.	24 months

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14~~3~~ RCS Operational LEAKAGE

LCO 3.4.14~~3~~ RCS operational LEAKAGE shall be limited to:

a. No pressure boundary LEAKAGE;

b. 1 gpm unidentified LEAKAGE;

c. 10 gpm identified LEAKAGE; and

CL3.4-173

~~d. 1 gpm total primary to secondary LEAKAGE through all steam generators (SGs); and~~

~~e.~~ 150~~[500]~~ gallons per day primary to secondary LEAKAGE through any one steam generator (SG).

CL3.4-175

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS unidentified LEAKAGE not within limits~~ for reasons other than pressure boundary LEAKAGE~~.	A.1 Reduce LEAKAGE to within limits.	4 hours

CL3.4-174

CONDITION	REQUIRED ACTION	COMPLETION TIME	
B. Required Action and associated Completion Time of Condition A not met. OR ~~Pressure boundary LEAKAGE exists.~~	B.1 Be in MODE 3. AND B.2.1 Identify LEAKAGE~~Be in MODE 5~~. OR B.2.2 Be in MODE 5.	6 hours 54~~36~~ hours 84 hours	CL3.4-174
C. RCS identified LEAKAGE not within limit for reasons other than pressure boundary LEAKAGE.	C.1 Be in MODE 3. AND C.2.1 Reduce LEAKAGE to within limits. OR C.2.2 Be in MODE 5.	6 hours 14 hours 44 hours	CL3.4-174
D. Pressure boundary LEAKAGE exists. OR SG LEAKAGE not within limit.	D.1 Be in MODE 3. AND D.2 Be in MODE 5.	6 hours 36 hours	CL3.4-174

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.14~~3~~.1	------------------NOTE------------------ Not required to be performed ~~in MODE 3 or 4~~ until 12 hours after establishment of steady state operation. -- Verify RCS operational leakage within limits by performance of~~Perform~~ RCS water inventory balance.	~~-----NOTE-----~~ TA3.4-176 ~~Only required to be performed during steady state operation~~ ------------ 72 hours TA3.4-177
SR 3.4.14~~3~~.2	Verify steam generator tube integrity is in accordance with the Steam Generator ~~Tube Surveillance~~ Program.	In accordance with the Steam Generator ~~Tube Surveillance~~ Program PA3.4-179

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.154 RCS Pressure Isolation Valve (PIV) Leakage

LCO 3.4.154 Leakage from each RCS PIV shall be within limit.

APPLICABILITY: MODES 1, 2, ~~and~~ 3, and 4. CL3.4-178
~~MODE 4, except valves in the residual heat removal (RHR) flow path when in, or during the transition to or from, the RHR mode of operation.~~

ACTIONS

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

1. Separate Condition entry is allowed for each flow path.

2. Enter applicable Conditions and Required Actions for systems made inoperable by an inoperable PIV.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more flow paths with leakage from one or more RCS PIVs not within limit.	------------NOTE------------ Each valve used to satisfy Required Action A.1 ~~and Required Action A.2~~ must have been verified to meet SR 3.4.154.1 and be in the ~~reactor coolant pressure boundary [or the~~ high pressure portion of the system~~]~~. ----------------------------	X3.4-181 CL3.4-192 (continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.1 Isolate the high pressure portion of the affected system from the low pressure portion by use of one closed manual, deactivated automatic, or check valve. AND ~~A.2 Isolate the high pressure portion of the affected system from the low pressure portion by use of a second closed manual, deactivated automatic, or check valve.~~ ~~OR~~ A.2 Restore RCS PIV to within limits.	4 hours ~~72 hours~~ X3.4-181 72 hours
B. Required Action and associated Completion Time ~~for Condition A~~ not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours PA3.4-182 36 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~C. RHR System autoclosure interlock function inoperable.~~	~~C.1 Isolate the affected penetration by use of one closed manual or deactivated automatic valve.~~	~~4 hours~~ CL3.4-186

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.154.1	-------------------NOTES------------------- ~~1.~~ Not required to be performed in MODES 3 and 4. ~~2. Not required to be performed on the RCS PIVs located in the RHR flow path when in the shutdown cooling mode of operation.~~ ~~3. RCS PIVs actuated during the performance of this Surveillance are not required to be tested more than once if a repetitive testing loop cannot be avoided.~~ --- Verify leakage from each RCS PIV is equivalent to ≤ 0.5 gpm per nominal inch of valve size up to a maximum of 5 gpm at an RCS pressure ≥ ~~[~~2215~~]~~ psig and ≤ ~~[~~2255~~]~~ psig.	CL3.4-178 CL3.4-191 ~~In accordance with the Inservice Testing Program, and~~ CL3.4-184 24~~[18]~~ months <u>AND</u> Prior to entering MODE 2 whenever the unit has been in MODE 5 for 7 days or more, if leakage testing has not been performed in the previous 9 months <u>AND</u>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.154.1 (continued)	Prior to returning the valve to service after maintenance, repair, or replacement work is performed~~Within 24 hours following valve actuation due to automatic or manual action or flow through the valve~~ CL3.4-184
~~SR 3.4.14.2 -----NOTE----- Not required to be met when the RHR System autoclosure interlock is disabled in accordance with SR 3.4.12.7. ----------~~ ~~Verify RHR System autoclosure interlock prevents the valves from being opened with a simulated or actual RCS pressure signal ≥ [425] psig.~~	~~[18] months~~ CL3.4-186

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
~~SR 3.4.14.3 ------------------------------NOTE------------------------------ Not required to be met when the RHR System autoclosure interlock is disabled in accordance with SR 3.4.12.7.~~ ~~---~~ ~~Verify RHR System autoclosure interlock causes the valves to close automatically with a simulated or actual RCS pressure signal ≥ [600] psig.~~	CL3.4-186 ~~[18] months~~

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.165 RCS Leakage Detection Instrumentation

LCO 3.4.165 The following RCS leakage detection instrumentation shall be OPERABLE:

a. One containment sump A monitor (~~level or~~ pump run time instrumentation~~discharge flow) monitor~~; and CL3.4-188

b. One containment radionuclide~~atmosphere radioactivity~~ monitor ~~(gaseous or particulate); [and~~

~~c. One containment air cooler condensate flow rate monitor]~~. CL3.4-189

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

---NOTE--- TA3.4-194
LCO 3.0.4 is not applicable.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Required containment sump monitor inoperable.	~~-----NOTE-----~~ ~~LCO 3.0.4 is not applicable.~~ --------------------		TA3.4-194
	A.1	-----NOTE----- Not required until 12 hours after establishment of steady state operation. -------------------- Perform SR 3.4.14~~3~~.1.	TA3.4-176 Once per 24 hours
	AND		
	A.2	Restore required containment sump monitor to OPERABLE status.	30 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required containment radionuclide ~~atmosphere radioactivity~~ monitor inoperable.	~~NOTE~~ ~~LCO 3.0.4 is not applicable.~~	CL3.4-188 TA3.4-194
	B.1.1 Analyze grab samples of the containment atmosphere.	Once per 24 hours
	OR	
	B.1.2 NOTE Not required until 12 hours after establishment of steady state operation. Perform SR 3.4.143.1.	TA3.4-176 Once per 24 hours
	AND	
	B.2.~~1~~ Restore required containment radionuclide ~~atmosphere radioactivity~~ monitor to OPERABLE status.	30 days
	~~OR~~	
	~~B.2.2 Verify containment air cooler condensate flow rate monitor is OPERABLE.~~	~~30 days~~ CL3.4-189

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~C. Required containment air cooler condensate flow rate monitor inoperable.~~	~~C.1 Perform SR 3.4.15.1.~~ ~~OR~~ ~~C.2 Perform SR 3.4.13.1.~~	~~Once per 8 hours~~ CL3.4-189 ~~Once per 24 hours~~
~~D. Required containment atmosphere radioactivity monitor inoperable.~~ ~~AND~~ ~~Required containment air cooler condensate flow rate monitor inoperable.~~	~~D.1 Restore required containment atmosphere radioactivity monitor to OPERABLE status.~~ ~~OR~~ ~~D.2 Restore required containment air cooler condensate flow rate monitor to OPERABLE status.~~	~~30 days~~ CL3.4-189 ~~30 days~~
C~~E~~. Required Action and associated Completion Time not met.	C~~E~~.1 Be in MODE 3. AND C~~E~~.2 Be in MODE 5.	6 hours 36 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
DF. All required monitors inoperable.	DF.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.165.1 Perform CHANNEL CHECK of the required containment radionuclide ~~atmosphere radioactivity~~ monitor.	12 hours CL3.4-188
SR 3.4.165.2 Perform COT of the required containment radionuclide ~~atmosphere radioactivity~~ monitor.	92 days CL3.4-188
SR 3.4.165.3 Perform CHANNEL CALIBRATION of the required containment sump monitor.	24 ~~[18]~~ months X3.4-187

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.4.1[6]~~5~~.4 Perform CHANNEL CALIBRATION of the required containment radionuclide ~~atmosphere radioactivity~~ monitor.	~~[~~24 ~~[18]~~ months CL3.4-188 X3.4-107
~~SR 3.4.15.5 Perform CHANNEL CALIBRATION of the required containment air cooler condensate flow rate monitor.~~	~~[18] months~~ CL3.4-189

CL3.4-204

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.17 RCS Loop Isolation Valves

LCO 3.4.17 Each RCS hot and cold leg loop isolation valve shall be open with power removed from each isolation valve operator.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

---------------------------------------NOTE---------------------------------------
Separate Condition entry is allowed for each RCS loop isolation valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Power available to one or more loop isolation valve operators.	A.1 Remove power from loop isolation valve operators.	30 minutes
B. ----------NOTE---------- All Required Actions shall be completed whenever this Condition is entered. ------------------------------ One or more RCS loop isolation valves closed.	B.1 Maintain valve(s) closed. AND B.2 Be in MODE 3. AND B.3 Be in MODE 5.	Immediately 6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.17.1	Verify each RCS loop isolation valve is open and power is removed from each loop isolation valve operator.	31 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1~~7~~6 RCS Specific Activity

LCO 3.4.1~~7~~6 The specific activity of the reactor coolant shall be within the following limits: PA3.4-197

a. Dose Equivalent I-131 specific activity ≤ 1.0 μCi/gm; and

b. Gross specific activity ≤ 100/Ē μCi/gm.

APPLICABILITY: MODES 1 and 2,
MODE 3 with RCS average temperature (T_{avg}) ≥ 500°F.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 specific activity not within limit ~~> 1.0 μCi/gm~~.	------------Note------------ LCO 3.0.4 is not applicable. ----------------------------	PA3.4-197
	A.1 Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.1~~7~~6-1.	Once per 4 hours
	AND	
	A.2 Restore DOSE EQUIVALENT I-131 to within limit.	48 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
B. Gross specific activity of the reactor coolant not within limit.	~~B.1 Perform SR 3.4.16.2.~~ ~~AND~~ B.[1]~~2~~ Be in MODE 3 with T_{avg} < 500°F.	~~4 hours~~ 6 hours	TA3.4-201
C. Required Action and associated Completion Time of Condition A not met. OR DOSE EQUIVALENT I-131 specific activity in the unacceptable region of Figure 3.4.1[7]~~6~~-1.	C.1 Be in MODE 3 with T_{avg} < 500°F.	6 hours	PA3.4-202

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1[7]~~6~~.1	Verify reactor coolant gross specific activity ≤ 100/Ē μCi/gm.	7 days

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.176.2	-------------------NOTE------------------- Only required to be performed in MODE 1. --- Verify reactor coolant DOSE EQUIVALENT I-131 specific activity ≤ 1.0 μCi/gm.	14 days <u>AND</u> Between 2 and 6 hours after a THERMAL POWER change of ≥ 15% RTP within a 1 hour period

(continued)

SR 3.4.176.3	-------------------NOTE------------------- Not required to be performed until 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for ≥ 48 hours. --- Determine Ē from a reactor coolant sample ~~taken in MODE 1 after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for ≥ 48 hours~~.	PA3.4-203 184 days

~~Replace with PI specific figure.~~

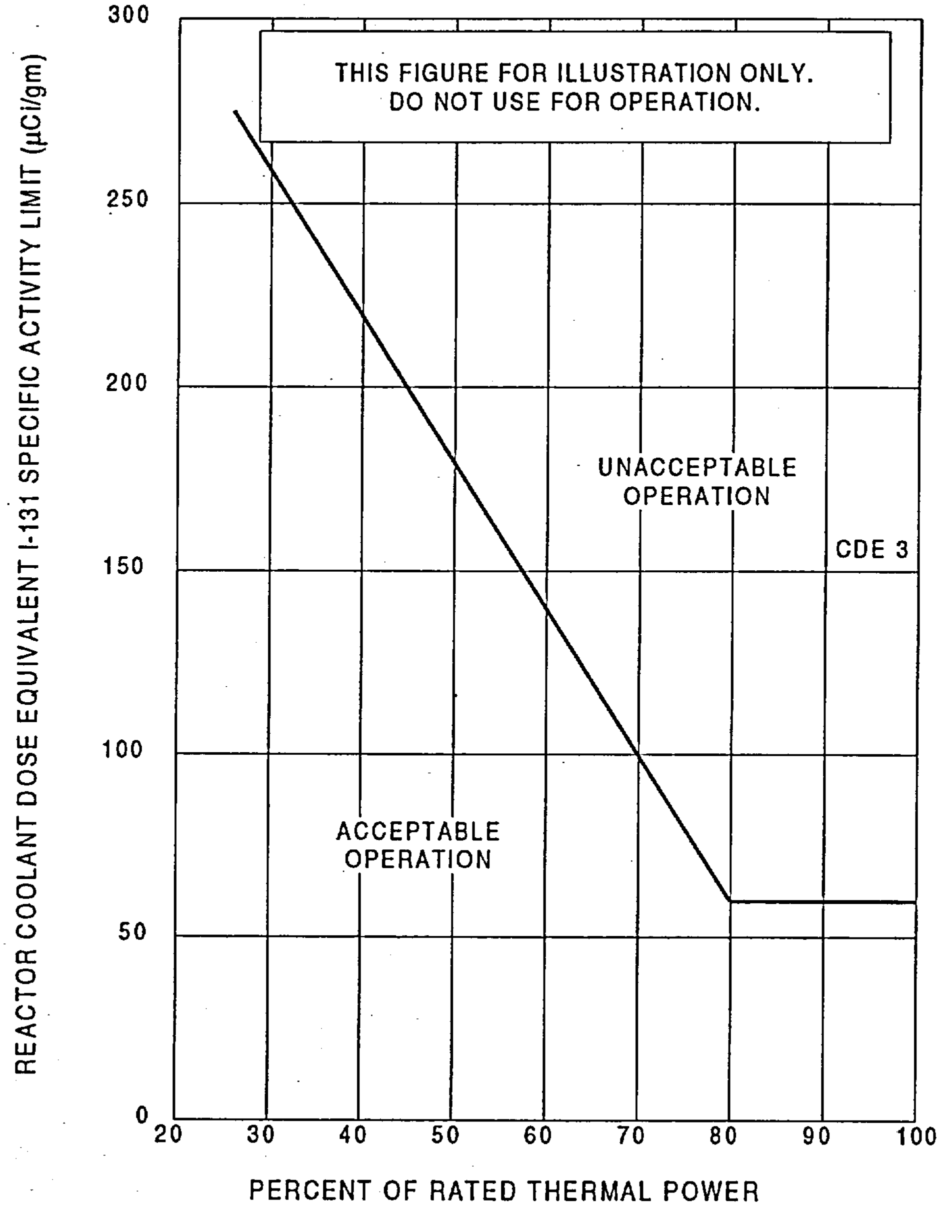

Figure 3.4.16-1 (page 1 of 1)
Reactor Coolant DOSE EQUIVALENT I-131 Specific Activity Limit Versus Percent of RATED THERMAL POWER

CL3.4-204

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.18 RCS Isolated Loop Startup

LCO 3.4.18 Each RCS isolated loop shall remain isolated with:

a. The hot and cold leg isolation valves closed if boron concentration of the isolated loop is less than boron concentration of the operating loops; and

b. The cold leg isolation valve closed if the cold leg temperature of the isolated loop is > [20]°F below the highest cold leg temperature of the operating loops.

APPLICABILITY: MODES 5 and 6.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Isolated loop hot or cold leg isolation valve open with LCO requirements not met.	A.1 ---------NOTE---------- Only required if boron concentration requirement not met. ------------------------- Close hot and cold leg isolation valves.	Immediately
	OR	
	A.2 ---------NOTE---------- Only required if temperature requirement not met. ------------------------- Close cold leg isolation valve.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.18.1	Verify cold leg temperature of isolated loop is ≤ [20]°F below the highest cold leg temperature of the operating loops.	Within 30 minutes prior to opening the cold leg isolation valve in isolated loop
SR 3.4.18.2	Verify boron concentration of isolated loop is greater than or equal to boron concentration of the operating loops.	Within 2 hours prior to opening the hot or cold leg isolation valve in isolated loop

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1~~8~~9 RCS Loops — Test Exceptions

LCO 3.4.1~~8~~9 The requirements of LCO 3.4.4, "RCS Loops — MODES 1 and 2," may be suspended, with THERMAL POWER < P-7.

APPLICABILITY: MODES 1 and 2 during startup and PHYSICS TESTS.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. THERMAL POWER ≥ P-7.	A.1 Open reactor trip breakers.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.1~~8~~9.1 Verify THERMAL POWER is < P-7.	1 hour
SR 3.4.1~~8~~9.2 Perform a COT for each power range neutron flux — low and intermediate range neutron flux channel and P-7.	~~Within 12 hours~~ ~~P~~prior to initiation of startup and PHYSICS TESTS

TA3.4-206

PA3.4-101

B 3.4 REACTOR COOLANT SYSTEM (RCS)

PA3.4-211

B 3.4.1 RCS Pressure, Temperature, and Flow▒ Departure from Nucleate Boiling (DNB) Limits

BASES

BACKGROUND

These Bases address requirements for maintaining RCS pressure, temperature, and flow rate within limits assumed in the safety analyses. The safety analyses (Ref. 1) of normal operating conditions and anticipated operational occurrences assume initial conditions within the normal steady state envelope. The limits placed on RCS pressure, temperature, and flow rate ensure that the minimum departure from nucleate boiling ratio (DNBR) will be met for each of the transients analyzed.

The RCS pressure limit is consistent with operation within the nominal operational envelope. Pressurizer pressure indications are averaged to come up with a value for comparison to the limit. A lower pressure will cause the reactor core to approach DNB limits.

The RCS coolant average temperature limit is consistent with full power operation within the nominal operational envelope. Indications of temperature are averaged to determine a value for comparison to the limit. A higher average temperature will cause the core to approach DNB limits.

The RCS flow rate normally remains constant during an operational fuel cycle with both ~~all~~ pumps running. The minimum RCS flow limit specified in the COLR corresponds to that assumed for DNB analyses. Flow rate indications are averaged to come up with a value for comparison to the limit. A lower RCS flow will cause the core to approach DNB limits. CL3.4-102

PA3.4-101 PA3.4-211

BASES

Backround (continued)

Operation for significant periods of time outside these DNB limits increases the likelihood of a fuel cladding failure in a DNB limited event.

APPLICABLE SAFETY ANALYSES

The requirements of this LCO represent the initial conditions for DNB limited transients analyzed in the plant safety analyses (Ref. 1). The safety analyses have shown that transients initiated from the limits of this LCO will result in meeting the DNBR criterion of ≥ [1.3]. This is the acceptance limit for the RCS DNB parameters. Changes to the unit that could impact these parameters must be assessed for their impact on the DNBR criteria. The transients analyzed for include loss of coolant flow events and dropped or stuck rod events. A key assumption for the analysis of these events is that the core power distribution is within the limits of LCO 3.1.67, "Control Bank Insertion Limits"; LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)"; and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)." CL3.4-212 TA3.4-213

The pressurizer pressure limit of [2200] psig and the RCS average temperature limit specified in the COLR of [581]°F are based on transient analyses assumptions correspond to analytical limits of [2205] psig and [595]°F used in the safety analyses, with allowance for steady state fluctuation, deadband and measurement errors uncertainty. The measured RCS flow rate is decreased approximately 2.3% for conservatism when being compared to the limit specified in the COLR. TA3.4-109 CL3.4-214 CL3.4-215

The RCS DNB parameters satisfy Criterion 2 of the NRC Policy Statement 10 CFR 50.36(c)(2)(ii).

(continued)

PA3.4-101 PA3.4-211

LCO

This LCO specifies limits on the monitored process variables—pressurizer pressure, RCS average temperature, and RCS total flow rate—to ensure the core operates within the limits assumed in the safety analyses. These variables are contained in the COLR to provide operating and analysis flexibility from cycle to cycle. Operating within these limits will result in meeting the DNBR criterion in the event of a DNB limited transient. TA3.4-109

CL3.4-215

~~RCS total flow rate contains a measurement error of [2.0]% based on performing a precision heat balance and using the result to calibrate the RCS flow rate indicators. Potential fouling of the feedwater venturi, which might not be detected, could bias the result from the precision heat balance in a nonconservative manner. Therefore, a penalty of [0.1]% for undetected fouling of the feedwater venturi~~

BASES

LCO (continued)

~~raises the nominal flow measurement allowance to [2.1]% for no fouling.~~

~~Any fouling that might bias the flow rate measurement greater than [0.1]% can be detected by monitoring and trending various plant performance parameters. If detected, either the effect of the fouling shall be quantified and compensated for in the RCS flow rate measurement or the venturi shall be cleaned to eliminate the fouling.~~

TA3.4-109

The ~~LCO~~ numerical values for pressure, temperature, and flow rate specified in the COLR are given for the measurement location and ~~but~~ have ~~not~~ been adjusted for instrument error.

(continued)

PA3.4-101 PA3.4-211

APPLICABILITY

In MODE 1, the limits on pressurizer pressure, RCS coolant average temperature, and RCS flow rate must be maintained during steady state operation in order to ensure DNBR

BASES

APPLICABILITY (continued)

criteria will be met in the event of an unplanned loss of forced coolant flow or other DNB limited transient. In all other MODES, the power level is low enough that DNB is not a concern.

A Note has been added to indicate the limit on pressurizer pressure is not applicable during short term operational transients such as a THERMAL POWER ramp ~~increase~~ > 5% RTP per minute or a THERMAL POWER step ~~increase~~ > 10% RTP. These conditions represent short term perturbations where actions to control pressure variations might be counterproductive. ~~Also, S~~since increasing power ~~they represent~~ transients are initiated from power levels < 100% RTP, an increased DNBR margin exists to offset the temporary pressure variations. Decreasing power transients are in the direction which provides increased DNBR margin. PA3.4-216

Another set of limits on DNB related parameters is provided in SL 2.1.1, "Reactor Core SLs." Those limits are less restrictive than the limits of this LCO, but violation of a Safety Limit (SL) merits a stricter, more severe Required Action. ~~Should a violation of this LCO occur, the operator must check whether or not an SL may have been exceeded.~~ PA3.4-219

ACTIONS

A.1

RCS pressure and RCS average temperature are controllable and measurable parameters. With one or both of these

(continued)

PA3.4-101 PA3.4-211

parameters not within LCO limits, action must be taken to restore parameter(s).

RCS total flow rate is not a controllable parameter and is not expected to vary during steady state operation. If the indicated RCS total flow rate is below the LCO limit, power must be reduced, as required by Required Action B.1, to

BASES

ACTIONS

A.1 (continued)

restore DNB margin and eliminate the potential for violation of the accident analysis bounds.

The 2 hour Completion Time for restoration of the parameters provides sufficient time to adjust plant parameters, to determine the cause for the off normal condition, and to restore the readings within limits, and is based on plant operating experience.

B.1

If Required Action A.1 is not met within the associated 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 2 within 6 hours. In MODE 2, the reduced power condition eliminates the potential for violation of the accident analysis bounds. The Completion Time of 6 hours is reasonable to reach the required plant conditions in an orderly manner.

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits,

(continued)

PA3.4-101 PA3.4-211

the 12 hour Surveillance Frequency for pressurizer pressure is sufficient to ensure the pressure can be restored to a normal operation, steady state condition following load changes and other expected transient operations. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.2 (continued)

Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits, the 12 hour Surveillance Frequency for RCS average temperature is sufficient to ensure the temperature can be restored to a normal operation, steady state condition following load changes and other expected transient operations. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.

~~SR 3.4.1.3~~ CL3.4-103

~~The 12 hour Surveillance Frequency for RCS total flow rate is performed using the installed flow instrumentation. The 12 hour interval has been shown by operating practice to be sufficient to regularly assess potential degradation and to verify operation within safety analysis assumptions.~~

SR 3.4.1.~~3~~4

Measurement of RCS total flow rate ~~by performance of a precision calorimetric heat balance~~ once every 24~~[18]~~ months allows the installed RCS flow instrumentation PA3.4-106 X3.4-107

(continued)

PA3.4-101 PA3.4-211

to be calibrated and verifies the actual RCS flow rate is greater than or equal to the minimum required RCS flow rate. This verification may be performed via a precision calorimetric heat balance or other means.

The Frequency of 24~~[18]~~ months reflects the importance of verifying flow after a refueling outage when the core has been altered, which may have caused an alteration of flow resistance.

This SR is modified by a Note that allows entry into MODE 1, without having performed the SR, and placement of the unit in the best condition for performing the SR. The Note states that the SR is ~~not~~ required to be performed within 7 days~~until 24 hours~~ after reaching~~≥~~ ~~[90%]~~ RTP. This exception is appropriate since the heat balance requires the plant to be at X3.4-104

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.64 (continued)

a minimum of ~~[90%]~~ RTP to obtain accurate~~the stated~~ RCS flow data~~accuracies~~. ~~The Surveillance shall be performed within 24 hours after reaching [90%] RTP.~~

REFERENCES

1. UFSAR, Section 14~~[15]~~.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.2 RCS Minimum Temperature for Criticality

BASES

BACKGROUND

This LCO is based upon meeting several major considerations before the reactor can be made critical and while the reactor is critical.

CL3.4-217
TA3.4-213

The first consideration is Isothermal ~~moderator~~ temperature coefficient (IMTC), LCO 3.1.~~B~~4, "Isothermal ~~Moderator~~ Temperature Coefficient (IMTC)." In the transient and accident analyses, the IMTC is assumed to be in a range from slightly positive to negative and the operating temperature is assumed to be within the nominal operating envelope while the reactor is critical. The LCO on minimum temperature for criticality helps ensure the plant is operated consistent with these assumptions.

The second consideration is the protective instrumentation. Because certain protective instrumentation (e.g., excore neutron detectors) can be affected by moderator temperature, a temperature value within the nominal operating envelope is chosen to ensure proper indication and response while the reactor is critical.

The third consideration is the pressurizer operating characteristics. The transient and accident analyses assume that the pressurizer is within its normal startup and operating range (i.e., saturated conditions and steam bubble present). It is also assumed that the RCS temperature is within its normal expected range for startup and power operation. Since the density of the RCS water, and hence the response of the pressurizer to transients, depends upon the initial temperature of the moderator, a minimum value for moderator temperature within the nominal operating

(continued)

PA3.4-211

BASES

BACKROUND (continued)

envelope is chosen for criticality.

The fourth consideration is that the reactor vessel is above its minimum nil ductility reference temperature when the reactor is critical.

APPLICABLE SAFETY ANALYSES

Although the RCS minimum temperature for criticality is not itself an initial condition assumed in Design Basis Accidents (DBAs), the closely aligned temperature for hot zero power (HZP) is a process variable that is an initial condition of DBAs, such as the rod cluster control assembly (RCCA) withdrawal, RCCA ejection, and main steam line break accidents performed at zero power that either assumes the failure of, or presents a challenge to, the integrity of a fission product barrier.

All low power safety analyses assume initial RCS loop temperatures are within the nominal operating envelope around ~~≥~~ the HZP temperature of 547°F (Ref. 1). The minimum temperature for criticality limitation provides a small band, [6°F, for critical operation below HZP. This band allows critical operation below HZP during plant startup and does not adversely affect any safety analyses since the [MTC is not significantly affected by the small temperature difference between HZP and the minimum temperature for criticality. PA3.4-218

The RCS minimum temperature for criticality satisfies Criterion 2 of ~~the NRC Policy Statement~~ 10 CFR 50.36(c)(2)(ii).

LCO

Compliance with the LCO ensures that the reactor will not be made or maintained critical ($k_{eff} \geq 1.0$) at a temperature

(continued)

PA3.4-211

less than a small band below the HZP temperature, which is

BASES

LCO (continued)

assumed in the safety analysis. Failure to meet the requirements of this LCO may produce initial conditions inconsistent with the initial conditions assumed in the safety analysis.

APPLICABILITY

In MODE 1 and MODE 2 with $k_{eff} \geq 1.0$, LCO 3.4.2 is applicable since the reactor can only be critical ($k_{eff} \geq 1.0$) in these MODES.

The special test exception of LCO 3.1.8~~10~~, "~~MODE 2~~ PHYSICS TESTS Exceptions—MODE 2," permits PHYSICS TESTS to be performed at ≤ 5% RTP with RCS loop average temperatures slightly lower than normally allowed so that fundamental nuclear characteristics of the core can be verified. In order for nuclear characteristics to be accurately measured, it may be necessary to operate outside the normal restrictions of this LCO. For example, to measure the MTC at beginning of cycle, it is necessary to allow RCS loop average temperatures to fall below $T_{no\ load}$, which may cause RCS loop average temperatures to fall below the temperature limit of this LCO. TA3.4-213

ACTIONS

A.1

If the parameters that are outside the limit cannot be restored, 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 MODE ~~3~~2 with k_{eff} < 1.0 within 30 minutes. Rapid reactor shutdown can be readily and practically achieved within a 30 minute period. The allowed time is TA3.4-108

(continued)

PA3.4-211

reasonable, based on operating experience, to reach MODE ~~3~~2 with k_{eff} < 1.0 in an orderly manner and without challenging plant systems.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.2.1

TA3.4-111

RCS loop average temperature is required to be verified at or above ~~[~~540~~1]~~°F every 12 hours~~30 minutes when [T_{avg} - T_{ref} deviation, low low T_{avg}] alarm not reset and any RCS loop T_{avg} < [547]°F.~~

~~The Note modifies the SR. When any RCS loop average temperature is < [547]°F and the [T_{avg} — T_{ref} deviation, low low T_{avg}] alarm is alarming, RCS loop average temperatures could fall below the LCO requirement without additional warning~~. The SR to verify RCS loop average temperatures every ~~30 minutes is frequent enough to prevent the inadvertent violation of the LCO~~ 12 hours takes into account indications and alarms that are continuously available to the operator in the control room and are consistent with other routine Surveillances which are typically performed once per shift. In addition, operators are trained to be sensitive to RCS temperature during approach to criticality and will ensure that the minimum temperature for criticality is met as criticality is approached.

REFERENCES

1. UFSAR, Section 14~~[15.0.3]~~.

PA3.4-211

B 3.4 REACTOR COOLANT SYSTEM (RCS)

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

BASES

BACKGROUND

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

The PTLR contains P/T limit curves for heatup, cooldown, inservice leak and hydrostatic (ISLH) testing, and data for the maximum rate of change of reactor coolant temperature, based on Reference 1 (Ref. 1).

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

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

10 CFR 50, Appendix G (Ref. 2), requires the establishment of P/T limits for specific material fracture toughness requirements of the RCPB materials. Reference 2, and

(continued)

PA3.4-211

BASES

BACKROUND (continued)

requires an adequate margin to brittle failure during normal operation, anticipated operational occurrences, and system hydrostatic tests. It mandates the use of the American Society of Mechanical Engineers (ASME) Code, Section III, Appendix G~~ (Ref. 3)~~.

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

The actual shift in the RT_{NDT} of the vessel material has been~~will be~~ established by periodically~~ by~~ removing and evaluating~~ the~~ irradiated reactor vessel material specimens~~, in accordance with ASTM E 185 (Ref. 4) and Appendix H of 10 CFR 50 (Ref. 5)~~. The operating P/T limit curves have been~~will be~~ adjusted~~, as necessary,~~ based on the evaluation findings and the recommendations of the program prescribed in Reference 2~~Regulatory Guide 1.99 (Ref. 6)~~. CL3.4-222

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

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

The criticality limit curve includes the Reference 2 requirement that it be ≥ 40°F above the heatup curve or the

(continued)

BASES

BACKROUND (continued)

cooldown curve, and not less than the minimum permissible temperature for ISLH testing. However, the criticality curve is not operationally limiting; a more restrictive limit exists in LCO 3.4.2, "RCS Minimum Temperature for Criticality."

The consequence of violating the LCO limits is that the RCS has been operated under conditions that can result in brittle failure of the RCPB, possibly leading to a nonisolable leak or loss of coolant accident. In the event these limits are exceeded, an evaluation must be performed to determine the effect on the structural integrity of the RCPB components. The ASME Code, Section XI, Appendix E ~~(Ref. 7)~~, provides a recommended methodology for evaluating an operating event that causes an excursion outside the limits.

APPLICABLE SAFETY ANALYSES

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

RCS P/T limits satisfy Criterion 2 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).

(continued)

BASES

LCO

The two elements of this LCO are:

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

b. Limits on the rate of change of temperature.

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

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

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

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

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

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

(continued)

BASES

APPLICABILITY

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

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

ACTIONS

A.1 and A.2

Operation outside the P/T limits during MODE 1, 2, 3, or 4 must be corrected so that the RCPB is returned to a condition that has been verified by stress analyses.

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

Besides restoring operation within limits, an evaluation is

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

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

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

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

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

B.1 and B.2

If a Required Action and associated Completion Time of Condition A are not met, the plant must be placed in a lower MODE because either the RCS remained in an unacceptable P/T region for an extended period of increased stress or a

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

sufficiently severe event caused entry into an unacceptable region. Either possibility indicates a need for more careful examination of the event, best accomplished with the RCS at reduced pressure and temperature. In reduced pressure ~~and temperature~~ conditions, which requires reduced temperature, the possibility of propagation of ~~with~~ undetected flaws is decreased.

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

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

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

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

(continued)

BASES

ACTIONS (continued)

C.1 and C.2

Actions must be initiated immediately to correct operation outside of the P/T limits at times other than when in MODE 1, 2, 3, or 4, so that the RCPB is returned to a condition that has been verified by stress analysis.

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

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

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

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

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.3.1

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

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

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

REFERENCES

1. WCAP-14040-NP-A, January 1996~~WCAP-7924-A, April 1975~~.
2. USAR, Section 4.7~~10 CFR 50, Appendix G.~~ CL3.4-222
~~3. ASME, Boiler and Pressure Vessel Code, Section III, Appendix G.~~
~~4. ASTM E 185-82, July 1982.~~
~~5. 10 CFR 50, Appendix H.~~
~~6. Regulatory Guide 1.99, Revision 2, May 1988.~~
~~7. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix E.~~

PA3.4-211

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.4 RCS Loops – MODES 1 and 2

BASES

BACKGROUND

The primary function of the RCS is removal of the heat generated in the fuel due to the fission process, and transfer of this heat, via the steam generators (SGs), to the secondary plant.

The secondary functions of the RCS include:

a. Moderating the neutron energy level to the thermal state, to increase the probability of fission;

b. Improving the neutron economy by acting as a reflector;

c. Carrying the soluble neutron poison, boric acid; and

d. Providing a second barrier against fission product release to the environment~~; and~~.

PA3.4-223

~~e. Removing the heat generated in the fuel due to fission product decay following a unit shutdown.~~

The reactor coolant is circulated through two~~[four]~~ loops connected in parallel to the reactor vessel, each containing a~~n~~ SG, a reactor coolant pump (RCP), and appropriate flow and temperature instrumentation for both control and protection. The reactor vessel contains the clad fuel. The SGs provide the heat sink to the isolated secondary coolant. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and prevent fuel damage. This forced circulation of the reactor coolant ensures mixing of the coolant for proper boration and chemistry control.

(continued)

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BASES

APPLICABLE SAFETY ANALYSES

Safety analyses contain various assumptions for the design bases accident initial conditions including RCS pressure, RCS temperature, reactor power level, core parameters, and safety system setpoints. The important aspect for this LCO is the reactor coolant forced flow rate, which is represented by the number of RCS loops in service.

Both transient and steady state analyses include~~have been performed~~ ~~to establish~~ the effect of flow on the departure from nucleate boiling ratio (DNBR). The transient and accident analyses for the plant have been performed assuming both~~[four]~~ RCS loops are in operation. The majority of the plant safety analyses are based on initial conditions at high core power or zero power. The accident analyses that are most important to RCP operation are the two~~[four]~~ pump coastdown, single pump locked rotor, misaligned rod~~single pump (broken shaft or coastdown)~~, and rod withdrawal events (Ref. 1). CL3.4-224

~~Steady state DNB analysis has been performed for the [four] RCS loop operation. For [four] RCS loop operation, the steady state DNB analysis, which generates the pressure and temperature Safety Limit (SL) (i.e., the departure from nucleate boiling ratio (DNBR) limit) assumes a maximum power level of 109% RTP. This is the design overpower condition for [four] RCS loop operation. The value for the accident analysis setpoint of the nuclear overpower (high flux) trip is 107% and is based on an analysis assumption that bounds possible instrumentation errors. The DNBR limit defines a locus of pressure and temperature points that result in a minimum DNBR greater than or equal to the critical heat flux correlation limit.~~

The plant is designed to operate with both~~all~~ RCS loops in operation to maintain DNBR ~~above the SL,~~ during all normal

(continued)

PA3.4-211

BASES

APPLICABLE SAFETY ANALYSES (continued)

operations and anticipated transients. By ensuring heat transfer in the nucleate boiling region, adequate heat transfer is provided between the fuel cladding and the reactor coolant.

RCS Loops – MODES 1 and 2 satisf~~y~~ies Criterion 2 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require an adequate forced flow rate for core heat removal. Flow is represented by the number of RCPs in operation for removal of heat by the SGs. To meet safety analysis acceptance criteria for DNB, two~~[four]~~ pumps are required at ~~rated~~ power.

An OPERABLE RCS loop consists of an OPERABLE RCP in operation providing forced flow for heat transport and an OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program.

APPLICABILITY

In MODES 1 and 2, the reactor is critical and thus has the potential to produce maximum THERMAL POWER. Thus, to ensure that the assumptions of the accident analyses remain valid, both~~all~~ RCS loops are required to be OPERABLE and in operation in these MODES to prevent DNB and core damage.

The decay heat production rate is much lower than the full power heat rate. As such, the forced circulation flow and heat sink requirements are reduced for lower, noncritical MODES as indicated by the LCOs for MODES 3, 4, and 5.

Operation in other MODES is covered by:

LCO 3.4.5, "RCS Loops – MODE 3";

(continued)

PA3.4-211

BASES

APPLICABILITY (continued)

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

ACTIONS

A.1

If the requirements of the LCO are not met, the Required Action is to reduce power and bring the plant to MODE 3. This lowers power level and thus reduces the core heat removal needs and minimizes the possibility of violating DNB limits.

The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging safety systems.

SURVEILLANCE REQUIREMENTS

SR 3.4.4.1

This SR requires verification every 12 hours that each RCS loop is in operation. Verification may include~~s~~ flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal while maintaining the margin to DNB. 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.

PA3.4-211

BASES

REFERENCES	1.	UFSAR Section [14].

PA3.4-211

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.5 RCS Loops – MODE 3

BASES

BACKGROUND

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

The reactor coolant is circulated through two~~[four]~~ RCS loops, connected in parallel to the reactor vessel, each containing a~~n~~ SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The reactor vessel contains the clad fuel. The SGs provide the heat sink. The RCPs circulate the water through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and prevent fuel damage.

In MODE 3, RCPs are normally used to provide forced circulation for heat removal during heatup and cooldown. The MODE 3 decay heat removal requirements are low enough that a single RCS loop with one RCP running is sufficient to remove core decay heat in response to transients or operational events. However, [two] RCS loops are required to be OPERABLE to ensure redundant capability for decay heat removal. CL3.4-117

The MODE 3 decay heat removal requirements are low enough that natural circulation is sufficient to remove core decay heat when the potential for operational events is minimized (Ref. 1). CL3.4-117

(continued)

PA3.4-211

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APPLICABLE SAFETY ANALYSES

Whenever the reactor trip breakers (RTBs) are in the closed position and the control rod drive mechanisms (CRDMs) are energized, an inadvertent rod withdrawal from subcritical, resulting in a power excursion, is possible. CL3.4-226 Such a transient could be caused by a malfunction of the rod control system. ~~In addition, the possibility of a power excursion due to the ejection of an inserted control rod is possible with the breakers closed or open. Such a transient could be caused by the mechanical failure of a CRDM.~~

Therefore, in MODE 3 with ~~RTBs in~~ the ~~closed position and~~ TA3.4-118 Rod Control System capable of rod withdrawal, accidental control rod withdrawal from subcritical is postulated and requires ~~at least~~ ~~[~~two~~]~~ RCS loops to be OPERABLE and in operation to ensure that the accident analyses input assumptions ~~limits~~ are met. ~~For those conditions when the Rod Control System is not capable of rod withdrawal, two RCS loops are required to be OPERABLE, but only one RCS loop is required to be in operation to be consistent with MODE 3 accident analyses.~~ CL3.4-227

APPLICABLE SAFETY ANALYSES (continued)

CL3.4-117

Failure to provide decay heat removal by forced circulation, when control rods may be withdrawn, 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 satisf~~y~~ies Criterion 3 of ~~the NRC Policy Statement~~ 10 CFR 50.36(c)(2)(ii).

(continued)

BASES

PA3.4-211

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LCO

The purpose of this LCO is to require that bothat least [two] RCS loops be OPERABLE. In MODE 3 with the RTBs in the closed position and Rod Control System capable of rod withdrawal, both[two] RCS loops must be in operation. [Two] RCS loops are required to be in operation in MODE 3 with theRTBs closed and Rod Control System capable of rod withdrawal due to the postulation of a power excursion because of an inadvertent control rod withdrawal. The required number of RCS loops in operation ensures that the transient analysis acceptanceSafety Limit criteria will be met for all of the postulated accidents. TA3.4-118 CL3.4-227

WhenWith the RTBs in the open position, or the CRDMs de-energized, the Rod Control System is not capable of rod withdrawal; therefore, only one RCS loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. An additional RCS loop is required to be OPERABLE to ensure redundant capability for decay heat removal that safety analyses limits are met. TA3.4-118 CL3.4-227

The Note permits bothall RCPs to not be in operation de-energized for ≤ 12 hours per 8 hour periodto perform preplanned work activities.— TA3.4-116 CL3.4-117

OneThe purpose of the Note is to allow performance of tests that are designed to validate various accident analyses values. One of these tests is validation of the pump coastdown curve used as input to a number of accident analyses including a loss of flow accident. This test wasis generally performed in MODE 3 during the initial startup testing program, and would normallyas such should only be performed once. If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input PA3.4-228

LCO (continued)

values of the coastdown curve must be revalidated by conducting the test again. Another test performed during

(continued)

PA3.4-211

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the startup testing program was ~~is~~ the validation of rod drop times ~~during cold conditions~~, both with and without flow.

Any future ~~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 ~~de-energizing of~~ the pumps in order to perform this test and validate the assumed analysis values. ~~As with the validation of the pump coastdown curve, this test should be performed only once unless the flow characteristics of the RCS are changed. The 1 hour time period specified is adequate to perform the desired tests, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.~~ TA3.4-116 PA3.4-228 CL3.4-117

Another purpose of the Note is to allow stopping of both RCP's for a sufficient time to perform station electrical lineup changes without transition to MODE 4. Transition to MODE 4 would put the plant through unnecessary cooldown and heatup transients. The 12 hour time period specified is adequate to perform the necessary load shedding, switching and load restoration activities and restart an RCP without requiring transition to MODE 4.

Utilization of the Note is permitted provided the following conditions are met ~~, along with any other conditions imposed by initial startup test procedures~~: PA3.4-228

a. No operations are permitted that would dilute the RCS boron concentration with coolant with boron concentration less than required to meet 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 to preclude the need for a boration, due to the time required to achieve ~~because~~ a uniform ~~concentration~~ distribution ~~throughout the RCS cannot be ensured~~ when in natural circulation (Ref. 1); and TA3.4-115 CL3.4-117

(continued)

BASES

PA3.4-211

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.

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. PA3.4-232

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 ~~RTBs in the closed position~~. 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 ~~RTBs open~~. TA3.4-118

APPLICABILITY (continued)

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

(continued)

BASES

PA3.4-211

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ACTIONS

A.1

CL3.4-113

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

B.1

If restoration is not possible within 72 hours, the unit must be brought to MODE 4. In MODE 4, the unit may be placed on the Residual Heat Removal System. The additional Completion Time of 12 hours is compatible with required operations to achieve cooldown and depressurization from the existing plant conditions in an orderly manner and without challenging plant systems.

C.1 and C.2

If one~~the required~~ RCS loop is not in operation, and the ~~RTBs are closed and~~ Rod Control System is capable of rod withdrawal, TA3.4-118

ACTIONS

C.1 and C.2 (continued)

CL3.4-113

the Required Action is either to restore the~~ required~~ RCS loop to operation or place the Rod Control System in a condition incapable of rod withdrawal (e.g., to TA3.4-118

(continued)

de-energize all CRDMs by opening the RTBs or de-energizing the motor generator (MG) sets]. When the RTBs are in the closed position and Rod Control System is capable of rod withdrawal, it is postulated that a power excursion could occur in the event of an inadvertent control rod withdrawal. This mandates having the heat transfer capacity of two RCS loops in operation. If only one loop is in operation, the Rod Control System must be rendered incapable of rod withdrawal RTBs must be opened. The Completion Times of 1 hour to restore the required RCS loop to operation or defeat the Rod Control System de-energize all CRDMs is adequate to perform these operations in an orderly manner without exposing the unit to risk for an undue time period. TA3.4-118

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

If both [two] RCS loops are inoperable or no RCS loop is in operation, except as during conditions permitted by the Note in the LCO section, the Rod Control System all CRDMs must be placed in a condition incapable of rod withdrawal (e.g., all CRDM's de-energized by opening the RTBs or de-energizing the MG sets]. All operations involving a reduction 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 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

TA3.4-118
TA3.4-115
CL3.4-117
PA3.4-229

(continued)

PA3.4-211

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 may includes flow rate, temperature, orand pump status monitoring, which helps ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS loop performance.

SR 3.4.5.2

SR 3.4.5.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is ≥ 60[17]% wide range or equivalent narrow range level for bothrequired RCS loops. If the SG secondary side narrow range water level is < 60[17]% wide range equivalent water level, 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. X3.4-121

SR 3.4.5.3

Verification that eachthe required RCPs areis 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 TA3.4-125 CL3.4-227

(continued)

BASES

PA3.4-211

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performed by verifying proper breaker alignment and power availability to eachthe required RCPs. 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 pump is not in operation. TA3.4-125

REFERENCES

1. License Amendment Request Dated November 19, 1999. None. (Approved by License Amendment 152/143, July 14, 2000.) CL3.4-117

PA3.4-211

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.6 RCS Loops – MODE 4

BASES

BACKGROUND

In MODE 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary side coolant or the component cooling water via the residual heat removal (RHR) heat exchangers. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through two~~[four]~~ RCS loops connected in parallel to the reactor vessel, each ~~loop~~ containing a~~n~~ SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs or RHR pumps circulate the coolant through the reactor vessel and SGs or the RHR heat exchangers at a sufficient rate to ensure proper heat transfer and ~~to prevent~~ boric acid mixing~~stratification~~.

In MODE 4, either RCPs or RHR pumps~~loops~~ can be used to provide forced circulation. The intent of this LCO is to provide forced flow from at least one RCPS loop or one RHR loop for decay heat removal and transport. The flow provided by one RCPS loop or RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that two paths be available to provide redundancy for decay heat removal.

(continued)

PA3.4-211

BASES

APPLICABLE SAFETY ANALYSES

In MODE 4, RCS circulation increases~~is considered in the determination of~~ the time available for mitigation of an~~the~~ accidental boron dilution event. The RCS and RHR loops provide this circulation. CL3.4-237

RCS Loops – MODE 4 ~~have been identified in the NRC Policy Statement as important contributors to risk reduction~~satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

The purpose of this LCO is to require that at least two loops be OPERABLE in MODE 4 and that one of these loops be in operation. The LCO allows the two loops that are required to be OPERABLE to consist of any combination of RCS loops and RHR loops. Any one loop in operation provides enough flow to remove the decay heat from the core with forced circulation. An additional loop is required to be OPERABLE to provide redundancy for heat removal.

LCO (continued)

Note 1 permits all RCPs or RHR pumps to not be in operation~~de-energized~~ for ≤ 1 hour per 8 hour period. The purpose of the Note is to permit tests that are designed to validate various accident analyses values. One of the tests performed during the startup testing program was~~is the~~ validation of rod drop times during cold conditions, both with and without flow. If changes are made to the RCS that would cause a change in flow characteristics of the RCS, the input values must be revalidated by conducting the test again. Any future~~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~~the de-energizing 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~~ TA3.4-116 PA3.4-228

(continued)

PA3.4-211

BASES

~~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: PA3.4-228

a. No operations are permitted that would dilute the RCS boron concentration with coolant with boron concentration 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 to preclude the need for a boration, due to the time required to achieve ~~because~~ a uniform ~~concentration~~ distribution ~~throughout the RCS cannot be ensured~~ when in natural circulation (Ref. 1); and TA3.4-115 CL3.4-117

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 a steam or gas bubble in the pressurizer or 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 ≤ the OPPS enable temperature specified in the PTLR ~~275°F~~. A steam or gas bubble ensures that the pressurizer will accommodate the swell resulting from an RCP start. Either of these ~~This~~ restraints ~~is to~~ prevents a low temperature overpressure event due to a thermal transient when an RCP is started. CL3.4-123 TA3.4-119

(continued)

PA3.4-211

BASES

~~LCO~~ (continued)

An OPERABLE RCS loop consists of~~comprises~~ an OPERABLE RCP and an OPERABLE SG~~ in accordance with the Steam Generator Tube Surveillance Program,~~ which has the minimum water level specified in SR 3.4.6.2. PA3.4-232

Similarly for the RHR System, an OPERABLE RHR loop consists of~~comprises~~ an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RCPs and RHR pumps are OPERABLE if they are capable of being powered and are able to provide forced flow if required.

APPLICABILITY

In MODE 4, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing.~~ One loop of either RCS or RHR provides sufficient circulation for these purposes. However, two loops consisting of any combination of RCS and RHR loops are required to be OPERABLE to meet single failure considerations.~~ PA3.4-238

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 3.4.7, "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
LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation – Low Water Level" (MODE 6).

(continued)

BASES

ACTIONS

A.1 CL3.4-113

If one ~~required~~ RCS loop is inoperable and two RHR loops are inoperable, redundancy for heat removal is lost. Action must be initiated to restore a second RCS or RHR loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal. Entry to a reduced MODE (MODE 5 or 6) requires RHR availability for long term decay heat removal. Remaining in MODE 4, with RCS loop operation, is conservative. PA3.4-239

B.1 CL3.4-113

If one ~~required~~ RHR loop is OPERABLE and in operation and there are no RCS loops OPERABLE, an inoperable RCS or RHR

ACTIONS B.1 (continued)

loop must be restored to OPERABLE status to provide a redundant means for decay heat removal.

If the parameters that are outside the limits cannot be restored, the unit must be brought to MODE 5 within 24 hours. Bringing the unit to MODE 5 is a conservative action with regard to decay heat removal. With only one RHR loop OPERABLE, redundancy for decay heat removal is lost and, in the event of a loss of the remaining RHR loop, it would be safer to initiate that loss from MODE 5 (≤ 200°F) rather than MODE 4 (200 to 35~~0~~0°F). The Completion Time of 24 hours is a reasonable time, based on operating experience, to reach MODE 5 from MODE 4 in an orderly manner and without challenging plant systems.

(continued)

PA3.4-211

BASES

The Note directs operations to Condition C if all RCS loops and RHR loops are inoperable, to ensure recognition of the correct Required Action. X3.4-124

C.1 and C.2

If no loop is OPERABLE or in operation, except during conditions permitted by Note 1 in the LCO section, all operations involving ~~a reduction~~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. ~~Boron dilution requires forced circulation for proper mixing, and t~~The margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS 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. TA3.4-115

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that one RCS or RHR loop is in operation. Verification may include~~s~~ flow rate, temperature, or pump status monitoring, which helps ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other

(continued)

indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.6.2

SR 3.4.6.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side ~~narrow range~~ water level is ≥ 60~~[17]~~% wide range or equivalent narrow range level. If the SG secondary side ~~narrow range water level~~ is < 60~~[17]~~% wide range equivalent water level, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The 12 hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level. X3.4-121

SR 3.4.6.3

Verification that each~~the~~ 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~~the~~ 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. TA3.4-125

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a pump is not in operation. TA3.4-125

(continued)

PA3.4-211

BASES

REFERENCES

1. License Amendment Request Dated November 19, 1999. None. (Approved by License Amendment 152/143, July 14, 2000.)

CL3.4-117

PA3.4-211

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 of 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 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 RCS must be intact to support natural circulation. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid. TA3.4-246

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. CL3.4-247

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

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(continued)

PA3.4-211

BASES (continued)

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 ~~a~~two SGs with secondary side water levels above 60~~[17]~~% wide range to provide an alternate method for decay heat removal via natural circulation. TA3.4-246

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation increases~~is considered in the determination of~~ the time available for mitigation of an~~the~~ accidental boron dilution event. The RHR loops provide this circulation. CL3.4-237

RCS Loops — MODE 5 (Loops Filled) ~~have been identified in the NRC Policy Statement as important contributors to risk reduction~~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 loop~~s~~ be OPERABLE and in operation with an additional RHR loop OPERABLE or ~~a~~two SGs with secondary side water level ≥ 60~~[17]~~% wide range. 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 provide redundancy~~meet single failure considerations~~. However, if the standby RHR loop is not OPERABLE, an acceptable alternate method is ~~a~~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. TA3.4-246

(continued)

PA3.4-211

BASES (continued)

Note 1 permits all RHR pumps to not be in operation de-energized ≤ 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 was is the validation of rod drop times during cold conditions, both with and without flow. If changes are made to the RCS that would cause a change in flow characteristics of the RCS, the input values must be revalidated by conducting the test again. Any future 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 de-energizing 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. TA3.4-116 PA3.4-228

Utilization of Note 1 is permitted provided the following conditions are met, along with any other conditions imposed by initial startup test procedures: PA3.4-228

LCO (continued)

a. No operations are permitted that would dilute the RCS boron concentration with coolant with boron concentration 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 to preclude the need for a boration, due to the time required to achieve because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation (Ref. 2); and TA3.4-115 CL3.4-117

(continued)

PA3.4-211

BASES

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 a steam or gas bubble in the pressurizer or 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 ≤ the OPPS enable temperature specified in the PTLR~~[275]°F~~. A steam or gas bubble ensures that the pressurizer will accommodate the swell resulting from an RCP start. Either of these restraints~~This restriction is to~~ prevents a low temperature overpressure event due to a thermal transient when an RCP is started. CL3.4-123 TA3.4-119

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.

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~~the minimum water level ~~and is OPERABLE in accordance with the Steam Generator Tube Surveillance Program~~specified in SR 3.4.7.2. TA3.4-246 PA3.4-232

(continued)

PA3.4-211

BASES

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 a~~t least [two]~~ SG~~s~~ is required to be ≥ 60~~[17]~~% wide range.

APPLICABILITY (continued)

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 3.9.5, "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 and A.2

If one RHR loop is inoperable and the ~~required~~ SGs have secondary side water levels < 60~~[17]~~% wide range, redundancy for heat removal is lost. Action must be initiated immediately to restore a second RHR loop to OPERABLE status or to restore a~~the required~~ SG secondary side water level~~s~~. Either Required Action A.1 or Required Action A.2 will restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

(continued)

PA3.4-211

BASES (continued)

B.1 and B.2

If no RHR loop is in operation, except during conditions permitted by Note 1, or if no loop is OPERABLE, all operations involving ~~a reduction~~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. ~~To prevent boron dilution, forced circulation is required to provide proper mixing and preserve the margin to criticality in this type of operation~~ Suspending the introduction of coolant into the RCS 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. TA3.4-115

SURVEILLANCE REQUIREMENTS

SR 3.4.7.1

This SR requires verification every 12 hours that the required loop is in operation. Verification may include~~s~~ flow rate, temperature, or pump status monitoring, which helps 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.

SR 3.4.7.2

Verifying that at least one~~two~~ SG~~s are~~ is OPERABLE by ensuring its~~their~~ secondary side ~~narrow range~~ water level~~s~~ is~~are~~ ≥ 60~~[17]~~% wide range or equivalent narrow range level ensures an alternate decay heat removal method via natural circulation in the event that the second RHR loop X3.4-121 TA3.4-246

PA3.4-211

BASES (continued)

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 requireda second 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 theeach 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 ≥ 60[17]% wide range in at least onetwo 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. TA3.4-125

This SR is modified by a Note that states the SR is not required to be performed until 24 hours after a pump is not in operation. TA3.4-125

REFERENCES

1. NRC Information Notice 95-35, "Degraded Ability of Steam Generators to Remove Decay Heat by Natural Circulation"None. TA3.4-246

2. License Amendment Request Dated November 19, 1999. (Approved by License Amendment 152/143, July 14, 2000.) CL3.4-117

PA3.4-211

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.8 RCS Loops – MODE 5, Loops Not Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops not filled, the primary function of the reactor coolant is the removal of decay heat ~~generated in the fuel,~~ and the transfer of this heat to the component cooling water via the residual heat removal (RHR) heat exchangers. The steam generators (SGs) are not available as a heat sink when the loops are not filled. The secondary function of the reactor coolant is to act as a carrier for the soluble neutron poison, boric acid.

In MODE 5 with loops not filled, only RHR pumps can be used for coolant circulation. The number of pumps in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one RHR pump for decay heat removal and transport and to require that two paths be available to provide redundancy for heat removal. The flow provided by one RHR loop is adequate for heat removal and for boron mixing.

APPLICABLE SAFETY ANALYSES

In MODE 5, RCS circulation increases~~is considered in the determination of~~ the time available for mitigation of an~~the~~ accidental boron dilution event. The RHR loops provide this circulation. ~~The flow provided by one RHR loop is adequate for heat removal and for boron mixing.~~ CL3.4-237

RCS ~~[~~ ~~l~~Loops ~~]~~ ~~in~~ MODE 5 (~~[~~ ~~l~~Loops N~~n~~ot ~~f~~Filled) ~~have been identified in the NRC Policy Statement as important contributors to risk reduction~~satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

(continued)

PA3.4-211

BASES

LCO

The purpose of this LCO is to require that at least two RHR loops be OPERABLE and one of these loops be in operation to. An OPERABLE loop is one that has the capability of transferring heat from the reactor coolant at a controlled rate. Heat cannot be removed via the RHR System unless forced flow is used. A minimum of one operatingrunning RHR pump meets the LCO requirement for one loop in operation. An additional RHR loop is required to be OPERABLE to provide redundancymeet single failure considerations.

LCO (continued)

Note 1 permits all RHR pumps to not be in operation de-energized for ≤ 15 minutes when switching from one loop to another. The circumstances for stopping both RHR pumps are to be limited to situations when the outage time is short [and core outlet temperature is maintained > 10°F below saturation temperature]. The Note prohibits boron dilution with coolant at boron concentrations less than required to assure SDM is maintained or draining operations when RHR forced flow is stopped. TA3.4-116 CL3.4-131 TA3.4-115

Note 2 allows one RHR loop to be inoperable for a period of ≤ 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 these tests are safe and possible.

An OPERABLE RHR loop is comprised of an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required.

(continued)

PA3.4-211

BASES

APPLICABILITY

In MODE 5 with loops not filled, this LCO requires core heat removal and coolant circulation by the RHR System.

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 3.4.7, "RCS Loops – MODE 5, Loops Filled";
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

<u>A.1</u>

If only one RHR loop is OPERABLE and in operation, redundancy for RHR is lost. Action must be initiated to restore a second loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

ACTIONS (continued)

<u>B.1 and B.2</u>

If no ~~required~~ RHR loops are OPERABLE or in operation, except during conditions permitted by Note 1, all operations involving ~~a reduction~~ 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 must be initiated immediately to restore an RHR loop to OPERABLE status and operation. ~~Boron dilution requires forced circulation for uniform dilution, and t~~The margin to criticality must not be reduced in this type of operation. Suspending the introduction of coolant into the RCS with boron concentration less than required to meet the minimum TA3.4-115

PA3.4-211

BASES

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 continue until one loop is restored to OPERABLE status and operation.

The Note in Required Action B.2 allows the use of one safety injection pump to provide heat removal in the event of a loss of RHR system cooling during reduced RCS inventory conditions. CL3.4-132

SURVEILLANCE REQUIREMENTS

SR 3.4.8.1

This SR requires verification every 12 hours that one loop is in operation. Verification may include~~s~~ flow rate, temperature, or pump status monitoring, which helps 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.

SR 3.4.8.2

Verification that each ~~the~~ required ~~number of~~ pump~~s~~ is ~~are~~ OPERABLE ensures that an additional pump~~s~~ 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 ~~the~~each required pump~~s~~. 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 TA3.4-125

PA3.4-211

BASES

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 pump is not in operation. TA3.4-125

REFERENCES None.

PA3.4-211

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.9 Pressurizer

BASES

BACKGROUND

The pressurizer provides a point in the RCS where liquid and vapor are maintained in equilibrium under saturated conditions for pressure control purposes to prevent bulk boiling in the remainder of the RCS. Key functions include maintaining required primary system pressure during steady state operation, and limiting the pressure changes caused by reactor coolant thermal expansion and contraction during normal load transients.

The pressure control components addressed by this LCO include the pressurizer water level, the required heaters, and their ~~controls and~~ emergency power supplies. Pressurizer safety valves and pressurizer power operated relief valves are addressed by LCO 3.4.10, "Pressurizer Safety Valves," and LCO 3.4.11, "Pressurizer Power Operated Relief Valves (PORVs)," respectively.

The intent of the LCO is to ensure that a steam bubble exists in the pressurizer prior to power operation to minimize the consequences of potential overpressure transients. The presence of a steam bubble is consistent with analytical assumptions. Relatively small amounts of noncondensible gases are typically present in the RCS and can inhibit the condensation heat transfer between the pressurizer spray and the steam, and diminish the spray effectiveness for pressure control. These small amounts of noncondensible gases can be ignored if the steam bubble is present. PA3.4-257

Electrical immersion heaters, located in the lower section of the pressurizer vessel, keep the water in the pressurizer at saturation temperature and maintain a constant operating

(continued)

PA3.4-211

BASES

BACKGROUND (continued)

pressure. ~~A minimum required available capacity of pressurizer heaters ensures that the RCS pressure can be maintained.~~ The capability to maintain and control system pressure is important for maintaining subcooled conditions in the RCS and ensuring the capability to remove core decay heat by either forced or natural circulation of reactor coolant. ~~Unless adequate heater capacity is available, the hot, high pressure condition cannot be maintained indefinitely and still provide the required subcooling margin in the primary system.~~ Inability to control the system pressure and maintain subcooling under conditions of natural circulation flow in the primary system could lead to a loss of single phase natural circulation and decreased capability to remove core decay heat. One group of pressurizer heaters is adequate to maintain natural circulation conditions during a loss of offsite power. Two groups are required to be available to ensure redundant capability. CL3.4-134

APPLICABLE SAFETY ANALYSES

In MODES 1, 2, and 3, the LCO requirement for a steam bubble is reflected implicitly in the accident analyses. Safety analyses performed for lower MODES are not limiting with respect to pressurizer parameters. All analyses performed from a critical reactor condition assume the existence of a steam bubble and saturated conditions in the pressurizer. In making this assumption, the analyses neglect the small fraction of noncondensible gases normally present.

Safety analyses presented in the UFSAR (Ref. 1) do not take credit for pressurizer heater operation; however, an implicit initial condition assumption of the safety analyses is that the RCS is operating at normal pressure.

The maximum pressurizer water level limit which ensures that a steam bubble exists in the pressurizer satisfies TA3.4-256

(continued)

Criterion 2 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii). Although the heaters are not specifically used in accident analysis, the need to maintain subcooling in the long term during loss of offsite power, as indicated in NUREG-0737 ~~(Ref. 2)~~, is the reason for providing an LCO.

LCO

The LCO requirement for the pressurizer to be OPERABLE with ~~a water volume ≤ [1240] cubic feet, which is equivalent to [9~~02~~]~~% level~~,~~ ensures that a steam bubble exists. Limiting the LCO maximum operating water level preserves the steam space for pressure control. The level limit is specified to agree with the high pressurizer level trip allowable value. The LCO has been established to ensure the capability to establish and maintain pressure control for steady state operation and to minimize the consequences of potential overpressure transients. Requiring the presence of a steam bubble is also consistent with analytical assumptions. CL3.4-133

The LCO requires two groups of OPERABLE pressurizer heaters, ~~each with a capacity ≥ [125] kW,~~ capable of being powered from ~~either the offsite power source or the~~an emergency power supply. These are Groups A and B. One group of pressurizer heaters with a capacity ≥ 100 kW is adequate to maintain natural circulation conditions during a loss of offsite power (Ref. 2). Two groups are required to be OPERABLE to ensure redundant capability. ~~The minimum heater capacity required is sufficient to maintain the RCS near normal operating pressure when accounting for heat losses through the pressurizer insulation. By maintaining the pressure near the operating~~ CL3.4-134

LCO (continued)

~~conditions, a wide margin to subcooling can be obtained in the loops. The exact design value of [125 kW is derived from the use of seven heaters rated at 17.9 kW each]. The amount needed to maintain pressure is dependent on the heat~~

(continued)

PA3.4-211

BASES

~~losses.~~

APPLICABILITY

The need for pressure control is most pertinent when core heat can cause the greatest effect on RCS temperature, resulting in the greatest effect on pressurizer level and RCS pressure control. Thus, applicability has been designated for MODES 1 and 2. The applicability is also provided for MODE 3. The purpose is to prevent solid water RCS operation during heatup and cooldown to avoid rapid pressure rises caused by normal operational perturbation, such as reactor coolant pump startup.

In MODES 1, 2, and 3, there is need to maintain the availability of pressurizer heaters, capable of being powered from an emergency power supply. In the event of a loss of offsite power, the initial conditions of these MODES give the greatest demand for maintaining the RCS in a hot pressurized condition with loop subcooling for an extended period. For MODE 4, 5, or 6, it is not necessary to control pressure (by heaters) to ensure loop subcooling for heat transfer when the Residual Heat Removal (RHR) System is in service, and therefore, the LCO is not applicable.

ACTIONS

A.1, A.2, A.3 and A.42

Pressurizer water level control malfunctions or other plant evolutions may result in a pressurizer water level above the nominal upper limit, even with the plant at steady state conditions. Normally the plant will trip in this event since the upper limit of this LCO is the same as the Allowable Value for Pressurizer High Water Level – ~~High~~Reactor Trip.

(continued)

PA3.4-211

BASES

If the pressurizer water level is not within the limit, action must be taken to bring the unit to a MODE in which the LCO does not apply~~restore the plant to operation within the bounds of the safety analyses~~. To achieve this status, within 6 hours the unit must be brought to MODE 3, with all rods fully inserted and incapable of withdrawal. Additionally the unit must be brought~~the reactor trip breakers open, within 6 hours and~~ to MODE 4 within 12 hours. This takes the unit out of the applicable MODES. TA3.4-256 TA3.4-118

ACTIONS

A.1, A.2, A.3 and A.4~~2~~ (continued)

~~and restores the unit to operation within the bounds of the safety analyses.~~ TA3.4-256

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.

B.1

CL3.4-110

If one~~ required~~ group of pressurizer heaters is inoperable, restoration is required within 72 hours. The Completion Time of 72 hours is reasonable considering the anticipation that a demand caused by loss of offsite power would be unlikely in this period. Pressure control may be maintained during this time using normal station powered heaters.

C.1 and C.2

If one group of pressurizer heaters is~~are~~ inoperable and cannot be restored in the allowed Completion Time of Required Action B.1, 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 MODE 3 within 6 hours and to MODE 4

(continued)

PA3.4-211

BASES

within 12 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.

SURVEILLANCE REQUIREMENTS

SR 3.4.9.1

This SR requires that during steady state operation, pressurizer level is maintained below the nominal upper limit to provide a minimum space for a steam bubble. The Surveillance is performed by observing the indicated level. The Frequency of 12 hours ~~corresponds to verifying the parameter each shift. The 12 hour interval~~ has been shown by operating practice to be sufficient to regularly assess level for any deviation ~~and verify that operation is within~~

~~SURVEILLANCE REQUIREMENTS~~ ~~SR 3.4.9.1 (continued)~~ PA3.4-258

~~safety analyses assumptions~~. Alarms are also available for early detection of abnormal level indications.

~~SR 3.4.9.2~~ CL3.4-137

~~The SR is satisfied when the power supplies are demonstrated to be capable of producing the minimum power and the associated pressurizer heaters are verified to be at their design rating. This may be done by testing the power supply output and by performing an electrical check on heater element continuity and resistance. The Frequency of 92 days is considered adequate to detect heater degradation and has been shown by operating experience to be acceptable.~~

(continued)

BASES

SR 3.4.9.23

This SR is not applicable for the Group Aif the heaters since this group isare permanently powered by a Class 1E power supplyies.

This Surveillance demonstrates that the Group B heaters can be manually transferred from the normal to the emergency power supply and energized. The Frequency of 2418 months is based on a typical fuel cycle and is consistent with similar verifications of emergency power supplies. X3.4-136

REFERENCES

1. UFSAR, Section [14].
2. USAR, Section 4NUREG-0737, November 1980.

PA3.4-211

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.10 Pressurizer Safety Valves

BASES

BACKGROUND

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

Because the safety valves are totally enclosed and self actuating, they are considered independent components. The required relief capacity for each valve, ~~[~~325~~80~~,000~~]~~ lb/hr, is based on postulated overpressure transient conditions resulting from a complete loss of steam flow to the turbine. This event results in the maximum surge rate into the pressurizer, which specifies the minimum relief capacity for the safety valves. The discharge flow from the pressurizer safety valves is directed to the pressurizer relief tank. This discharge flow is indicated by an increase in temperature downstream of the pressurizer safety valves or increase in the pressurizer relief tank temperature or level.

Overpressure protection is required in MODES 1, 2, 3, 4, and 5; however, in MODE 4, with one or more RCS cold leg temperatures ≤ the OPPS enable temperature specified in the PTLR~~[275]°F~~, and MODE 5 and MODE 6 with the reactor vessel head on, overpressure protection is provided by operating procedures and by meeting the requirements of LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) > Safety Injection (SI) Pump Disable Temperature~~System.~~", and LCO TA3.4-119 CL3.4-162

(continued)

B 3.4.13 Low Temperature Overpressure Protection (LTOP) ≤ Safety Injection (SI) Pump Disable Temperature

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

BACKGROUND (continued)

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

APPLICABLE SAFETY ANALYSES

All accident and safety analyses in the UFSAR (Ref. 2) that require safety valve actuation assume operation of both

three pressurizer safety valves to limit increases in RCS pressure. The overpressure protection analysis (Ref. 3) is also based on operation of both[three] safety valves. TransientsAccidents that could result in overpressurization if not properly terminated include:

a. Uncontrolled rod withdrawal from full power;

b. Loss of reactor coolant flow;

c. Loss of external electrical load;

d. Loss of normal feedwater;

(continued)

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

f. Locked rotor.

Detailed analyses of the above transients are contained in Reference 2. ~~Safety valve actuation is required in events c, d, and e (above) to limit the pressure increase.~~ Compliance with this LCO is consistent with the design bases and accident analyses assumptions. CL3.4-261

Pressurizer safety valves satisfy Criterion 3 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).

LCO

The two~~[three]~~ pressurizer safety valves are set to open at the RCS design pressure (24852500 psig~~a~~), ~~and~~ within ±~~the ASME specified~~ 3% tolerance, to avoid exceeding the maximum design pressure SL, to maintain accident analyses assumptions, and to comply with ASME requirements. The upper and lower pressure tolerance limits following testing are based on the ± 1% tolerance requirements (Ref. 1) for lifting pressures above 1000 psig.

LCO
(continued)

The limit protected by this Specification is the reactor coolant pressure boundary (RCPB) SL of 110% of design pressure. Inoperability of one or more valves could result in exceeding the SL if a transient were to occur. The consequences of exceeding the ASME pressure limit could include damage to one or more RCS components, increased leakage, or additional stress analyse~~i~~s being required prior to resumption of reactor operation.

APPLICABILITY

In MODES 1, 2, and 3, and portions of MODE 4 above the OPPS enable~~LTOP arming~~ temperature, OPERABILITY of both~~[three]~~ valves is required because the combined capacity is required

(continued)

PA3.4-211

BASES

to keep reactor coolant pressure below 110% of its design value during certain accidents. MODE 3 and portions of MODE 4 are conservatively included, although the listed accidents may not require the safety valves for protection.

The LCO is not applicable in MODE 4 when any~~all~~ RCS cold leg temperatures are ≤ the OPPS enable temperature specified in the PTLR~~[275]°F~~ or in MODE 5 because LTOP is provided. Overpressure protection is not required in MODE 6 with reactor vessel head detensioned. TA3.4-119

The Note allows entry into MODES 3 and 4 with the lift settings outside the LCO limits. This permits testing and examination of the safety valves at high pressure and temperature near their normal operating range, but only after the valves have had a preliminary cold setting. The cold setting gives assurance that the valves are OPERABLE near their design condition. Only one valve at a time will be removed from service for testing. The 36~~[54]~~ hour exception is based on 18 hour outage time for each of the two~~[three]~~ valves. The 18 hour period is derived from operating experience that hot testing can be performed in this timeframe.

ACTIONS

A.1

With one pressurizer safety valve inoperable, restoration must take place within 15 minutes. The Completion Time of 15 minutes reflects the importance of maintaining ~~the~~ RCS o~~O~~verpressure p~~P~~rotection ~~System~~. An inoperable safety valve

(continued)

PA3.4-211

BASES

ACTIONS

A.1 (continued)

coincident with an RCS overpressure event could challenge the integrity of the pressure boundary.

B.1 and B.2

If the Required Action of A.1 cannot be met within the required Completion Time or if bothtwo or more pressurizer safety valves are inoperable, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 with any RCS cold leg temperatures ≤ the OPPS enable temperature specified in the PTLR[275]°F within 2412 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. With any RCS cold leg temperatures at or below the OPPS enable temperature specified in the PTLR[275]°F, overpressure protection is provided by the LTOP functionSystem. The change from MODE 1, 2, or 3 to MODE 4 reduces the RCS energy (core power and pressure), lowers the potential for large pressurizer insurges, and thereby removes the need for overpressure protection by both[three] pressurizer safety valves. TA3.4-119 TA3.4-139

SURVEILLANCE REQUIREMENTS

SR 3.4.10.1

SRs are specified in the Inservice Testing Program. Pressurizer safety valves are to be tested in accordance with the requirements of Section XI of the ASME Code (Ref. 4), which provides the activities and Frequencies

(continued)

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BASES

necessary to satisfy the SRs. No additional requirements are specified.

The pressurizer safety valve setpoint is ± [3]% for OPERABILITY; however, the valves are reset to ± 1% during the Surveillance to allow for drift.

REFERENCES

1. ASME, Boiler and Pressure Vessel Code, Section III, with the 1968 Winter Addendum.

2. UFSAR, ~~Chapter~~ Section 14~~[15]~~.

REFERENCES (continued)

3. WCAP-7769, Rev. 1, June 1972.

~~4. ASME, Boiler and Pressure Vessel Code, Section XI.~~

(continued)

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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.11 Pressurizer Power Operated Relief Valves (PORVs)

BASES

BACKGROUND

The pressurizer is equipped with two types of devices for pressure relief: pressurizer safety valves and PORVs. The PORVs are air operated valves that are controlled to open at a specific set pressure when the pressurizer pressure increases and close when the pressurizer pressure decreases. The PORVs may also be manually operated from the control room.

Block valves, which are normally open, are located between the pressurizer and the PORVs. The block valves are used to isolate the PORVs in case of excessive leakage or a stuck open PORV. Block valve closure is accomplished manually using controls in the control room. A stuck open PORV is, in effect, a small break loss of coolant accident (LOCA). As such, block valve closure terminates the RCS depressurization and coolant inventory loss.

The PORVs and their associated block valves may be used by plant operators to depressurize the RCS to recover from certain transients if normal pressurizer spray is not available. Additionally, the series arrangement of the PORVs and their block valves permits performance of surveillances on the valves during power operation.

The PORVs may also be used for feed and bleed core cooling in the case of multiple equipment failure events that are not within the design basis, such as a total loss of feedwater.

The PORVs, their block valves, and their controls are powered from the vital buses that normally receive power from offsite power sources, but are also capable of being

(continued)

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BACKGROUND (continued)

powered from emergency power sources in the event of a loss of offsite power. TheTwo PORVs and their associated block valves are powered from two separate safety trains (Ref. 1).

The plant has two PORVs, each haveing a relief capacity of 179210,000 lb/hr at 2335 psig. The functional design of the PORVs is based on maintaining pressure below the Pressurizer High Pressure - High Rreactor Ttrip setpoint following a step reduction of 47.550% of full load with steam dump. In addition,
the PORVs minimize challenges to the pressurizer safety valves and also may be used for low temperature overpressure protection (LTOP). See LCO 3.4.12 and LCO 3.4.13 for, "Low Temperature Overpressure Protection (LTOP) requirementsSystem." CL3.4-162

APPLICABLE SAFETY ANALYSES

Plant operators employ the PORVs to depressurize the RCS in response to certain plant transients if normal pressurizer spray is not available. For the Steam Generator Tube Rupture (SGTR) event, the safety analysis assumes that manual operator actions are required to mitigate the event. A loss of offsite power is assumed to accompany the event, and thus, normal pressurizer spray is unavailable to reduce RCS pressure. The PORVs are assumed to be used for RCS depressurization, which is one of the steps performed to equalize the primary and secondary pressures in order to terminate the primary to secondary break flow and the radioactive releases from the affected steam generator.

The PORVs are also modeledused in safety analyses for events that result in increasing RCS pressure for which departure from nucleate boiling ratio (DNBR) criteria are critical (Ref. 1). By assuming PORV manual actuation, the primary pressure remains below the high pressurizer pressure trip setpoint; thus, the DNBR calculation is more TA3.4-267

(continued)

BASES

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conservative. As such, this actuation is not required to mitigate these events, and PORV automatic operation is, therefore, not an assumed safety function~~Events that assume this condition include a turbine trip and the loss of normal feedwater (Ref. 2)~~. TA3.4-267

Pressurizer PORVs satisfy Criterion 3 of ~~the NRC Policy Statement~~10 CFR 50.36(c)(2)(ii).

LCO

The LCO requires the PORVs and their associated block valves to be OPERABLE for manual operation to mitigate the effects associated with an SGTR.

By maintaining two PORVs and their associated block valves OPERABLE, the single failure criterion is satisfied. ~~The block valves are available to isolate the flow path through either a failed open PORV or a PORV with excessive leakage.~~ An OPERABLE block valve may be either open, or closed and energized with the capability to be opened, since the required safety function is accomplished by manual operation. Although typically open to allow PORV operation, the block valves may be OPERABLE when closed to isolate the flow path of an inoperable PORV that is capable of being manually cycled (i.e., as in the case of excessive PORV leakage). Similarly, isolation of an OPERABLE PORV does not render that PORV or block valve inoperable provided the relief function remains available with manual action. TA3.4-267

An OPERABLE PORV is required to be capable of manually opening and closing and not experiencing excessive seat leakage. Excessive seat leakage, although not associated with a specific acceptance criteria, exists when conditions dictate closure of the block valve to limit leakage. Satisfying the LCO helps minimize challenges to fission product barriers. TA3.4-267

(continued)

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BASES

APPLICABILITY

In MODES 1, 2, and 3, the PORVs ~~and its block valve~~ are required to be OPERABLE for manual actuation to mitigate a SGTR ~~to limit the potential for a small break LOCA through the flow path. The most likely cause for a PORV small break LOCA is a result of a pressure increase transient that causes the PORV to open. Imbalances in the energy output of the core and heat removal by the secondary system can cause the RCS pressure to increase to the PORV opening setpoint. The most rapid increases will occur at the higher operating power and pressure conditions of MODES 1 and 2.~~ The PORV~~s~~ and its block valve are also required to be OPERABLE in MODES 1, 2, and 3 to maintain the integrity of the reactor coolant pressure boundary. This requires the ability to manually control the block valve to isolate a PORV with excessive seat leakage or a stuck open PORV ~~minimize challenges to the pressurizer safety valves~~. TA3.4-267 PA3.4-268

Pressure increases are less prominent in MODE 3 because the core input energy is reduced, but the RCS pressure is high. Therefore, the LCO is applicable in MODES 1, 2, and 3 when RCS pressure is high and there is potential for a SGTR. The LCO is not applicable in MODES 4 and 5, and MODE 6 with the reactor vessel head in place, when both pressure and core energy are decreased and a SGTR can not occur ~~the pressure surges become much less significant. The PORV setpoint is reduced for LTOP in MODES 4, 5, and 6 with the reactor~~ PA3.4-268 TA3.4-267

APPLICABILITY

~~vessel head in place.~~ LCO 3.4.12 and LCO 3.4.13 addresses the PORV requirements in these MODES. CL3.4-162

ACTIONS

Note 1 has been added to clarify that each ~~all~~ pressurizer PORV~~s~~ and each block valve are treated as separate entities. TA3.4-144

(continued)

BASES

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each with separate Completion Times (i.e., the Completion Time is on a component basis) for Conditions A, B and C. The exception for LCO 3.0.4, Note 2, permits entry into MODES 1, 2, and 3 to perform cycling of the PORVs or block valves to verify their OPERABLE status~~.~~ in the event that ~~T~~testing wa~~i~~s not satisfactorily performed in lower MODES. TA3.4-157

A.1

~~With the~~ PORVs may be inoperable ~~and capable of being manually cycled,~~ due to excessive seat leakage. In this condition, either the PORVs must be restored or the flow path isolated within 1 hour. The associated block valve~~s~~ is required to ~~should~~ be closed, but power must be maintained to the associated block valve~~s~~, since removal of power would render the block valve inoperable. ~~Although a PORV may be designated inoperable, it may be able to be manually opened and closed, and therefore, able to perform its function. PORV inoperability may be due to seat leakage, instrumentation problems, automatic control problems, or other causes that do not prevent manual use and do not create a possibility for a small break LOCA. For these reasons, the block valve may be closed but the Action requires power be maintained to the valve.~~ This ~~Condition is only intended to~~ permits operation of the plant until ~~for a limited period of time not to exceed~~ the next refueling outage (MODE 6) so that maintenance can be performed on the PORVs to eliminate the problem condition. ~~Normally, the PORVs should be available for automatic mitigation of overpressure events and should be~~ CL3.4-146 TA3.4-267

ACTIONS

A.1 (continued)

~~returned to OPERABLE status prior to entering startup (MODE 2).~~

(continued)

Quick access to the PORV for pressure control can be made when power remains on the closed block valve. The Completion Time of 1 hour is based on plant operating experience that has shown that minor problems can be corrected or closure accomplished in this time period.

B.1, B.2, and B.3

If one ~~[or two]~~ PORV~~[s]~~ is inoperable for reasons other than Condition A ~~and not capable of being manually cycled~~, it must be either restored or isolated by closing the associated block valve and removing the power to the associated block valve. The Completion Times of 1 hour are reasonable, based on the small potential for challenges to the PORVs during this time period, and provide the operator adequate time to correct the situation. If the inoperable valve cannot be restored to OPERABLE status, it must be isolated within the specified time. Because there is at least one PORV that remains OPERABLE, an additional 72 hours is provided to restore the inoperable PORV to OPERABLE status. If the PORV cannot be restored within this additional time, the plant must be brought to a MODE in which the LCO does not apply, as required by Condition D. CL3.4-147

C.1 and C.2

If one block valve is inoperable, then it is necessary to either restore the block valve to OPERABLE status within the Completion Time of 1 hour or place the associated PORV in manual control. The prime importance for the capability to close the block valve is to isolate a stuck open PORV. Therefore, if the block valve cannot be restored to OPERABLE status within 1 hour, the Required Action is to place the PORV in manual control to preclude its automatic opening for an overpressure event and to avoid the potential for a stuck

(continued)

open PORV at a time that the block valve is inoperable. The Completion Time of 1 hour is reasonable, based on the small

ACTIONS

C.1 and C.2 (continued)

potential for challenges to the system during this time period, and provides the operator time to correct the situation. Because at least one PORV remains OPERABLE, the operator is permitted a Completion Time of 72 hours to restore the inoperable block valve to OPERABLE status. The time allowed to restore the block valve is based upon the Completion Time for restoring an inoperable PORV in Condition B, since the PORVs may~~are~~ not be capable of mitigating an ~~overpressure~~ event if the inoperable block valve is not full open~~when placed in manual control~~. If the block valve is restored within the Completion Time of 72 hours, ~~the power will be restored and~~ the PORV may be restored to automatic operation~~OPERABLE status~~. If it cannot be restored within this additional time, the plant must be brought to a MODE in which the LCO does not apply, as required by Condition D. TA3.4-267

The Required Actions C.1 and C.2 are modified by a Note stating that the Required Actions do not apply if the sole reason for the block valve being declared inoperable is as a result of power being removed to comply with other Required Actions. In this event, the Required Actions for inoperable PORV(s) (which require the block valve power to be removed once it is closed) are adequate to address the condition. While it may be desirable to also place the PORV(s) in manual control, this may not be possible for all causes of Condition B or E entry with PORV(s) inoperable and not capable of being manually cycled (e.g., as a result of failed control power fuse(s) or control switch malfunction(s)). TA3.4-148

(continued)

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BASES

D.1 and D.2

If the Required Action of Condition A, B, or C is not met, then 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 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. In MODES 4 and 5, automatic~~maintaining~~ PORV OPERABILITY may be required. See LCO 3.4.12 and LCO 3.4.13. TA3.4-267 CL3.4-162

E.1, E.2, E.3, and E.4

If both~~more than one~~ PORVs are ~~is~~ inoperable for reasons other than Condition A~~and not capable of being manually cycled~~, it is necessary to either restore at least one valve within the Completion Time of 1 hour or isolate the flow path by closing and removing the power to the associated block valves. The Completion Time of 1 hour is reasonable, based on the small potential for challenges to the system during this time and provides the operator time CL3.4-152

ACTIONS E.1, E.2, E.3, and E.4 (continued)

to correct the situation. ~~If one PORV is restored and one PORV remains inoperable, then the plant will be in Condition B with the time clock started at the original declaration of having two [or three] PORVs inoperable.~~ If no PORVs are restored within the Completion Time, then 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 within 12 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 TA3.4-267

(continued)

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BASES

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and without challenging plant systems. In MODES 4 and 5, automatic~~maintaining~~ PORV OPERABILITY may be required. See LCO 3.4.12 and LCO 3.4.13. CL3.4-162

F.1~~, F.2, and F.3~~

If both~~more than one~~ block valves are ~~is~~ inoperable, it is necessary to ~~either restore the block valves within the Completion Time of 1 hour, or place the associated PORVs in manual control and~~ restore at least one block valve within 2 hours ~~[and restore the remaining block valve within 72 hours]~~. The Completion Time~~s~~ is ~~are~~ reasonable, based on the small potential for challenges to the system during this time and provides the operator time to correct the situation. TA3.4-144

The Required Action F.1 is modified by a Note stating that the Required Action does not apply if the sole reason for the block valve being declared inoperable is as a result of power being removed to comply with other Required Actions. In this event, the Required Actions for inoperable PORV(s) (which require the block valve power to be removed once it is closed) are adequate to address the condition. While it may be desirable to also place the PORV(s) in manual control, this may not be possible for all causes of Condition B or E entry with PORV(s) inoperable and not capable of being manually cycled (e.g., as a result of failed control power fuse(s) or control switch malfunction(s)). TA3.4-148

G.1 and G.2

If the Required Actions of Condition F are not met, then 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

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(continued)

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BASES

at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. In MODES 4 and 5, automatic~~maintaining~~ PORV OPERABILITY may be required. See LCO 3.4.12 and LCO 3.4.13. TA3.4-267 CL3.4-162

SURVEILLANCE REQUIREMENTS

SR 3.4.11.1

Block valve cycling verifies that the valve(s) can be opened and closed if needed. The basis for the Frequency of 92 days is the ASME Code, Section XI~~(Ref. 3). If the block valve is closed to isolate a PORV that is capable of being manually cycled, the OPERABILITY of the block valve is of importance, because opening the block valve is necessary to permit the PORV to be used for manual control of reactor pressure. If the block valve is closed to isolate an otherwise inoperable PORV, the maximum Completion Time to restore the PORV and open the block valve is 72 hours, which is well within the allowable limits (25%) to extend the block valve Frequency of 92 days. Furthermore, these test requirements would be completed by the reopening of a recently closed block valve upon restoration of the PORV to OPERABLE status (i.e., completion of the Required Actions fulfills the SR).~~ TA3.4-267 TA3.4-157

~~The~~This SR is modified by two Notes. Note 1 modifies this SR by stating that it is not required to be performed~~met~~ with the block valve closed~~,~~ in accordance with the Required Action of Condition B or E~~this LCO~~. Opening the block valve in this condition increases the risk of an unisolable leak from the RCS since the PORV is already inoperable. TA3.4-157

Note 2 modifies this SR to allow entry into and operation in MODE 3 prior to performing the SR. This allows the TA3.4-157

(continued)

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BASES (continued)

test to be performed in MODE 3 under operating temperature and pressure conditions, prior to entering MODE 1 or 2.

SR 3.4.11.2

SR 3.4.11.2 requires a complete cycle of each PORV. Operating a PORV through one complete cycle ensures that the PORV can be manually actuated for mitigation of an SGTR. The Frequency of 24~~[18]~~ months is based on a typical refueling cycle and industry accepted practice. X3.4-136

The Note modifies this SR to allow entry into and operation in MODE 3 prior to performing the SR. This allows the test to be performed in MODE 3 under operating temperature and pressure conditions prior to entering MODE 1 or 2. TA3.4-157

~~SR 3.4.11.3~~

CL3.4-158

~~Operating the solenoid air control valves and check valves on the air accumulators ensures the PORV control system actuates properly when called upon. The Frequency of [18] months is based on a typical refueling cycle and the Frequency of the other Surveillances used to demonstrate PORV OPERABILITY.~~

~~SR 3.4.11.4~~ CL3.4-161

~~This Surveillance is not required for plants with permanent 1E power supplies to the valves.~~

~~SURVEILLANCE REQUIREMENTS~~

~~SR 3.4.11.4 (continued)~~

~~The Surveillance demonstrates that emergency power can be provided and is performed by transferring power from normal~~

(continued)

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BASES (continued)

~~to emergency supply and cycling the valves. The Frequency of [18] months is based on a typical refueling cycle and industry accepted practice.~~

REFERENCES

1. USAR, Section 14~~Regulatory Guide 1.32, February 1977~~.

~~2. FSAR, Section [15.2].~~

~~3. ASME, Boiler and Pressure Vessel Code, Section XI.~~

(continued)

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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.12 Low Temperature Overpressure Protection (LTOP) ~~System~~≥ Safety Injection (SI) Pump Disable Temperature

BASES

BACKGROUND

The LTOP function limits~~System controls~~ RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G (Ref. 1). The reactor vessel is the limiting RCPB component for demonstrating such protection. The Over Pressure Protection System (OPPS) and the pressurizer power operated relief valves (PORVs) provide the LTOP function (Ref. 2). The PTLR provides the maximum allowable OPPS actuation~~ logic~~ setpoints for the ~~power operated relief valves (~~PORVs~~)~~ and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Reference 1 requirements during the LTOP MODES. The LTOP MODES are the MODES as defined in the Applicability statement of LCO 3.4.12 and LCO 3.4.13.

The pressurizer safety valves and PORVs at their normal setpoints do not provide overpressure protection for certain low temperature operational transients. Inadvertent pressurization of the RCS at temperatures below the OPPS enable temperature specified in the PTLR could result in exceeding the ASME Appendix G (Ref. 3) brittle fracture P/T limits. ~~The reactor vessel material is less tough at low temperatures than at normal operating temperature. As the vessel neutron exposure accumulates, the material toughness decreases and becomes less resistant to pressure stress at low temperatures (Ref. 2). RCS pressure, therefore, is maintained low at low temperatures and is increased only as temperature is increased.~~ CL3.4-272

(continued)

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

This LCO provides RCS overpressure protection by restricting~~having a minimum~~ coolant input capability and ensuring~~having~~ adequate pressure relief capacity. In MODE 4, above the safety injection (SI) pump disable temperature, l~~L~~imiting coolant input capability requires ~~all but [one]~~ ~~[high pressure injection (~~SI~~HPI)]~~ pump ~~[and one charging pump]~~ incapable of injection into the RCS and isolating the emergency core cooling system (ECCS) accumulators. ~~The pressure relief capacity requires either two redundant RCS relief valves or a depressurized RCS and an RCS vent of sufficient size.~~ In MODE 4, above the SI pump disable temperature, o~~O~~ne PORV~~RCS relief valve or the open RCS vent~~ is the overpressure protection device that acts to terminate an increasing pressure event. CL3.4-163

BACKGROUND (continued)

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

(continued)

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The LTOP System for In MODE 4 above the SI pump disable temperature, pressure relief consists of two PORVs with reduced lift settings, or two residual heat removal (RHR) suction relief valves, or one PORV and one RHR suction relief valve, or a depressurized RCS and an RCS vent of sufficient size. Two PORVsRCS relief valves are required for redundancy. One PORVRCS relief valve has adequate relieving capability to preventkeep from overpressurization for the required coolant input capability. CL3.4-272

PORV Requirements

As designed for the LTOP functionSystem, each PORV is signaled to open by OPPS if the RCS pressure approaches the lift setpoint provided when OPPS is enableda limit determined by the LTOP actuation logic. The OPPSLTOP actuation logic monitors both RCS temperature and RCS pressure and indicates determines when a condition not acceptable in the PTLR limits is approached. The wide range RCS temperature setpoints indicate conditions requiring enabling OPPSions are auctioneered to select the lowest temperature signal.

The lowest temperature signal is processed through a function generator that calculates a pressure limit for that temperature. The calculated pressure limit is then compared with the indicated RCS pressure from a wide range pressure channel. If the indicated pressure meets or exceeds the calculated value, a PORV is signaled to open.

The PTLR presents the OPPSPORV setpoints for LTOP. The setpoints are normally staggered so only one valve opens during a low temperature overpressure transient. Having the setpoints of both valves within the limits in the PTLR ensures that the Reference 1 limits will not be exceeded in any analyzed event.

(continued)

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BACKGROUND PORV Requirements (continued)

When a PORV is opened in an increasing pressure transient, the release of coolant will cause the pressure increase to slow and reverse. As the PORV releases coolant, the RCS pressure decreases until a reset pressure is reached and the valve is signaled to close. The pressure continues to decrease below the reset pressure as the valve closes.

RHR Suction Relief Valve Requirements CL3.4-272

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

The RHR suction isolation valves and the RHR suction valves must be open to make the RHR suction relief valves OPERABLE for RCS overpressure mitigation. Autoclosure interlocks are not permitted to cause the RHR suction isolation valves to close. The RHR suction relief valves are spring loaded, bellows type water relief valves with pressure tolerances and accumulation limits established by Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 3) for Class 2 relief valves.

RCS Vent Requirements CL3.4-272

Once the RCS is depressurized, a vent exposed to the containment atmosphere will maintain the RCS at containment ambient pressure in an RCS overpressure transient, if the

(continued)

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relieving requirements of the transient do not exceed the capabilities of the vent. Thus, the vent path must be capable of relieving the flow resulting from the limiting LTOP mass or heat input transient, and maintaining pressure below the P/T limits. The required vent capacity may be provided by one or more vent paths.

For an RCS vent to meet the flow capacity requirement, it requires removing a pressurizer safety valve, removing a PORV's internals, and disabling its block valve in the open

BACKGROUND RCS Vent Requirements (continued)

position, or similarly establishing a vent by opening an RCS vent valve. The vent path(s) must be above the level of reactor coolant, so as not to drain the RCS when open.

APPLICABLE SAFETY ANALYSES

Safety analyses (Ref. 24) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with RCS cold leg temperature exceeding the OPPS enable temperature specified in the PTLR[275]°F, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. At about the OPPS enable temperature specified in the PTLR[275]°F and below, overpressure prevention falls to two OPERABLE PORVsRCS relief valves or to a depressurized RCS and a sufficiently sized RCS vent. Each of these means has a limited overpressure relief capability. LCO 3.4.13, "LTOP ≤ SI Pump Disable Temperature," provides the requirements for overpressure prevention at the lower temperatures. TA3.4-119 CL3.4-167

The actual temperature at which the pressure in the P/T limit curve falls below the pressurizer safety valve

(continued)

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setpoint increases as the reactor vessel material toughness decreases due to neutron embrittlement. Each time the PTLR curves are revised, the LTOP System must be re-evaluated to ensure its functional requirements can still be met using the PORVRCS relief valve method or the depressurized and vented RCS condition. CL3.4-272

The PTLR contains the acceptance limits that define the LTOP requirements. Any change to the RCS must be evaluated against the Reference 24 analyses to determine the impact of the change on the LTOP acceptance limits.

Transients that are capable of overpressurizing the RCS are categorized as either mass or heat input transients., The bounding mass input transient examples of which follow: CL3.4-272

Mass Input Type Transients

a. is iInadvertent safety injection; or

b. with injection from one SI pump and three c Charging pumps, and /letdown isolatedflow mismatch.

The bounding heat input transient is

APPLICABLE SAFETY ANALYSES (continued)

Heat Input Type Transients

a. Inadvertent actuation of pressurizer heaters;

b. Loss of RHR cooling; or

c. rReactor coolant pump (RCP) startup with temperature asymmetry within the RCS or between the RCS and steam generators.

The following limitations are required during the Applicability of this specification LTOP MODES to ensure CL3.4-272

(continued)

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that mass and heat input transients in excess of analysis assumptions do not occur, which either of the LTOP overpressure protection means cannot handle:

a. Rendering all but [one] [HPSI] pump [and one charging pump] incapable of injection;

b. Deactivating the ECCS accumulator discharge isolation valves in their closed positions; and

c. Disallowing start of an RCP if secondary temperature is more than [50]°F above primary temperature in any one loop. LCO 3.4.6, "RCS Loops – MODE 4," and LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled," provides this protection.

The Reference 24 analyses demonstrate that either one PORVRCS relief valve or the depressurized RCS and RCS vent can maintain RCS pressure below limits when only one S[HPI] pump [and allone charging pumps are] is [are] actuated. Thus, the LCO allows only [one] S[HPI] pump [and one charging pump] OPERABLE during the Applicability of this specificationLTOP MODES. CL3.4-272

Since neither one PORVRCS relief valve nor the RCS vent cannot handle the pressure transient resultingneed from ECCS accumulator injection, when RCS temperature is low, the LCO also requires the accumulators isolation when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR.

The isolated ECCS accumulators must have their discharge valves closed and the valve power supply breakers fixed in their open positions. The analyses show the effect of accumulator discharge is over a narrower RCS temperature CL3.4-272

(continued)

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range ([175]°F and below) than that of the LCO ([275]°F and below).

APPLICABLE SAFETY ANALYSES

Heat Input Type Transients (continued)

TA3.4-119

Fracture mechanics analyses established the temperature of LTOP Applicability at the OPPS enable temperature specified in the PTLR[275]°F.

The consequences of a small break loss of coolant accident (LOCA) in LTOP MODE 4 above the SI pump disable temperature conform to 10 CFR 50.46 and 10 CFR 50, Appendix K (Refs. 5 and 6), requirements by having a maximum of [one] [HPSI] pump [and one charging pump] OPERABLE and SI actuation enabled.

PORV Performance

The fracture mechanics analyses show that the vessel is protected when the PORVs are set to open at or below the limit shown in the PTLR. The OPPS setpoints are derived by analyses that model the performance of the LTOP Ssystem, assuming the limiting LTOP transient of [one] [HPSI] pump [and allone charging pumpS] injecting into the RCS. These analyses consider pressure overshoot and undershoot beyond the PORV opening and closing, resulting from signal processing and valve stroke times. The OPPSPORV setpoints at or below the derived limit ensures the Reference 1 P/T limits will be met.

The OPPSPORV setpoints in the PTLR will be updated when the revised P/T limits conflict with the LTOP analysis limits. The P/T limits are periodically modified as the reactor vessel material toughness decreases due to neutron embrittlement caused by neutron irradiation. Revised limits are determined using neutron fluence projections and the

(continued)

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results of examinations of the reactor vessel material irradiation surveillance specimens. The Bases for LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," discuss these examinations.

The PORVs are considered active components. Thus, the failure of one PORV is assumed to represent the worst case, single active failure.

CL3.4-272
CL3.4-163

APPLICABLE SAFETY ANALYSES (continued)

[RHR Suction Relief Valve Performance]

The RHR suction relief valves do not have variable pressure and temperature lift setpoints like the PORVs. Analyses must show that one RHR suction relief valve with a setpoint at or between [436.5] psig and [463.5] psig will pass flow greater than that required for the limiting LTOP transient while maintaining RCS pressure less than the P/T limit curve. Assuming all relief flow requirements during the limiting LTOP event, an RHR suction relief valve will maintain RCS pressure to within the valve rated lift setpoint, plus an accumulation ≤ 10% of the rated lift setpoint.

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

(continued)

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relief valves must be analyzed to still accommodate the design basis transients for LTOP.

The RHR suction relief valves are considered active components. Thus, the failure of one valve is assumed to represent the worst case single active failure.

RCS Vent Performance

CL3.4-272

With the RCS depressurized, analyses show a vent size of 2.07 square inches is capable of mitigating the allowed LTOP overpressure transient. The capacity of a vent this size is greater than the flow of the limiting transient for the LTOP configuration, [one] HPI pump [and one charging pump] OPERABLE, maintaining RCS pressure less than the maximum pressure on the P/T limit curve.

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

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

APPLICABLE SAFETY ANALYSES

RCS Vent Performance (continued)

The LTOP functionSystem satisfies Criterion 2 of the NRC Policy Statement10 CFR 50.36(c)(2)(ii).

LCO

This LCO requires that the LTOP System is OPERABLE. The LTOP System is OPERABLE when the minimumbe provided by limiting coolant input capability and by OPERABLE pressure relief capabilityies are OPERABLE. Violation of this LCO

(continued)

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could lead to the loss of low temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient.

To limit the coolant input capability, the LCO requires that a maximum of [one] [HPSI] pump [and one charging pump] be capable of injecting into the RCS, and all ECCS accumulator discharge isolation valves be closed and deenergized immobilized. [wWhen accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR]. TA3.4-166 CL3.4-163

The LCO is modified by two Notes. Note 1 allows operation of both SI pumps for ≤ 1 hour for conducting SI system testing providing there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut. The purpose of this note is to permit the conduct of the integrated SI test and other SI system tests and operations that may be performed in MODE 4. In this case, pressurizer level is maintained at less than 50% and a positive means of isolation is provided between the SI pumps and the RCS to prevent fluid injection to the RCS. This isolation is accomplished by either a closed manual valve or motor operated valve with the power removed. This combination of conditions under strict administrative control assure that overpressurization cannot occur. TA3.4-166 CL3.4-164

Note 2 states that ECCS accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR (less allowance for instrument uncertainty). This Note permits the accumulator discharge isolation valve surveillance to be performed only under these pressure and temperature conditions. TA3.4-166

(continued)

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The elements of the LCO that To provide low temperature overpressure mitigation through pressure relief, the LCO requires an OPERABLE OPPS with two OPERABLE pressurizer PORVs. are:

a. Two RCS relief valves, as follows:

1. Two OPERABLE PORVs; or

A PORV is OPERABLE for LTOP when its block valve is open, its low pressure lift setpoint is set to the limit required by the PTLR has been selected (OPPS enabled) and testing proves its ability to open at this setpoint, and the backup air supply is charged motive power is available to the two valves and their control circuits.

[2. Two OPERABLE RHR suction relief valves; or] CL3.4-163

An RHR suction relief valve is OPERABLE for LTOP when its RHR suction isolation valve and its RHR suction valve are open, its setpoint is at or between [436.5] psig and [463.5] psig, and testing has proven its ability to open at this setpoint.

LCO (continued)

3. One OPERABLE PORV and one OPERABLE RHR suction relief valve; or

b. A depressurized RCS and an RCS vent. CL3.4-272

An RCS vent is OPERABLE when open with an area of ≥ [2.07] square inches.

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

(continued)

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APPLICABILITY

This LCO is applicable in MODE 4 when any RCS cold leg temperature is ≤ the OPPS enable temperature specified in the PTLR and > the SI pump disable temperature specified in the PTLR[275]°F, in MODE 5, and in MODE 6 when the reactor vessel head is on. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above the OPPS enable temperature specified in the PTLR[275]°F. When the reactor vessel head is off, overpressurization cannot occur. TA3.4-119 CL3.4-167

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above the OPPS enable temperature specified in the PTLR[275]°F. LCO 3.4.13 provides the LTOP requirements in MODE 4 ≤ SI pump disable temperature and in MODES 5 and 6. TA3.4-119 CL3.4-167

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

The Applicability is modified by a Note stating that accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing temperature, as allowed by the P/T limit curves. This Note permits the accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions. TA3.4-166

(continued)

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ACTIONS

A.1 ~~[and B.1]~~

With two ~~or more HP~~SI pumps capable of injecting into the RCS, RCS overpressurization is possible.

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

~~Required Action B.1 is modified by a Note that permits two charging pumps capable of RCS injection for ≤ 15 minutes to allow for pump swaps.~~ TA3.4-166

BC.1, CD.1, and DD.2

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

If isolation is needed and cannot be accomplished in 1 hour, Required Action CD.1 and Required Action CD.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > the OPPS enable temperature specified in the PTLR ~~[275]°F~~, an accumulator pressure of ~~[600]~~ psig cannot exceed the LTOP analysis limits if the accumulators are fully injected. Depressurizing the accumulators below the LTOP limit from the PTLR also gives this protection. TA3.4-119

The Completion Times are based on operating experience that these activities can be accomplished in these time periods

(continued)

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and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

DE.1

In MODE 4 when any RCS cold leg temperature is ≤ the OPPS enable temperature specified in the PTLR[275]°F, with one required PORVRCS relief valve inoperable, the PORVRCS relief valve must be restored to OPERABLE status within a Completion Time of 7 days. Two PORVsRCS relief valves [in any combination of the PORVS and the RHR suction relief valves] are required to provide low temperature overpressure mitigation while withstanding a single failure of an active component. TA3.4-119 CL3.4-163

ACTIONS

DE.1 (continued)

The Completion Time considers the facts that only one of the PORVsRCS relief valves is required to mitigate an overpressure transient and that the likelihood of an active failure of the remaining valve path during this time period is very low.

EF.1

The consequences of operational events that will overpressurize the RCS are more severe at lower temperature (Ref. 7). Thus, with one of the two RCS relief valves inoperable in MODE 5 or in MODE 6 with the head on, the Completion Time to restore two valves to OPERABLE status is 24 hours. CL3.4-167

The Completion Time represents a reasonable time to investigate and repair several types of relief valve

(continued)

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failures without exposure to a lengthy period with only one OPERABLE RCS relief valve to protect against overpressure events.

G.1

MODE 5 must be entered, tThe RCS must be depressurized and a vent must be established within 128 hours when: PA3.4-168 TA3.4-139

a. Both required PORVSRCS relief valves are inoperable; or

b. A Required Action and associated Completion Time of Condition A, C[B,] D, E, or DF is not met; or

c. The OPPSLTOP System is inoperable for any reason other than Condition A, [B,] C, D, E, or F.

The vent must be sized ≥ 3[2.07] square inches to ensure that the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. The vent opening is based on the cross sectional flow area of a PORV. A PORV maintained in the open position satisfies the vent requirement. This action is needed to protect the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel. CL3.4-169

ACTIONS

EG.1 (continued)

The Completion Time considers the time required to place the plant in this Condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

(continued)

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SURVEILLANCE REQUIREMENTS

SR 3.4.12.1, [SR 3.4.12.2,] and SR 3.4.12.23

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, a maximum of [one] [HPSI] pump is [and a maximum of one charging pump] are verified incapable of injecting into the RCS and the ECCS accumulator discharge isolation valves are verified closed and deenergized locked out. CL3.4-163

The [HPSI] pump[s] and charging pump[s] are is rendered incapable of injecting into the RCS through removing the power from the pumps by racking the breakers out under administrative control. An alternate method of LTOP control may be employed using by employing at least two independent means to prevent a pump start such that a single failure or single action will not result in an injection into the RCS. This may be accomplished through the pump control switch being placed in [pull out to lock] and at least one valve in the discharge flow path being closed with a blocking device installed over the control switch that would prevent an unplanned pump start. CL3.4-273

The ECCS accumulator motor operated isolation valves can be verified closed and deenergized by use of control board indication. SR 3.4.12.2 is modified by a Note specifying that this verification is only required when the accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR. If accumulator pressure is less than this limit, no verification is required since the accumulator cannot pressurize the RCS to or above the OPPS setpoint. CL3.4-273 X3.4-171

The Frequency of 12 hours is sufficient, considering other indications and alarms available to the operator in the

(continued)

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control room, to verify the required status of the equipment.

~~SR 3.4.12.4~~ CL3.4-163

~~Each required RHR suction relief valve shall be demonstrated OPERABLE by verifying its RHR suction valve and RHR suction isolation valves are open and by testing it in accordance with the Inservice Testing Program. (Refer to SR 3.4.12.7 for the RHR suction isolation valve Surveillance.) This Surveillance is only required to be performed if the RHR suction relief valve is being used to meet this LCO.~~

~~SURVEILLANCE REQUIREMENTS~~ ~~SR 3.4.12.4 (continued)~~

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

~~The ASME Code, Section XI (Ref. 8), test per Inservice Testing Program verifies OPERABILITY by proving proper relief valve mechanical motion and by measuring and, if required, adjusting the lift setpoint.~~

~~SR 3.4.12.5~~ CL3.4-272

~~The RCS vent of ≥ [2.07] square inches is proven OPERABLE by verifying its open condition either:~~

~~a. Once every 12 hours for a valve that cannot be locked.~~

(continued)

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~~b. Once every 31 days for a valve that is locked, sealed, or secured in position. A removed pressurizer safety valve fits this category.~~

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

SR 3.4.12.~~8~~6

The PORV block valve must be verified open every 72 hours to provide the flow path for each required PORV to perform its function when actuated. The valve may~~must~~ be remotely verified open in the main control room. ~~[This Surveillance is performed if the PORV satisfies the LCO.]~~

The block valve is a remotely controlled, motor operated valve. The power to the valve operator is not required to be removed, and the manual operator is not required to be locked in the inactive position. Thus, the block valve can be closed in the event the PORV develops excessive leakage or does not close (sticks open) after relieving an overpressure situation.

SURVEILLANCE REQUIREMENTS

SR 3.4.12.~~8~~6 (continued)

The 72 hour Frequency is considered adequate in view of other administrative controls available to the operator in the control room, such as valve position indication, that verify that the PORV block valve remains open.

~~SR 3.4.12.7~~ CL3.4-163

(continued)

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~~Each required RHR suction relief valve shall be demonstrated OPERABLE by verifying its RHR suction valve and RHR suction isolation valve are open and by testing it in accordance with the Inservice Testing Program. (Refer to SR 3.4.12.4 for the RHR suction valve Surveillance and for a description of the requirements of the Inservice Testing Program.) This Surveillance is only performed if the RHR suction relief valve is being used to satisfy this LCO.~~

~~Every 31 days the RHR suction isolation valve is verified locked open, with power to the valve operator removed, to ensure that accidental closure will not occur. The "locked open" valve must be locally verified in its open position with the manual actuator locked in its inactive position. The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve position.~~

SR 3.4.12.~~4~~8

Performance of a COT is required ~~within 12 hours after decreasing RCS temperature to ≤ [275]°F and~~ every 31 days on ~~each required PORV~~OPPS to verify and, as necessary, adjust the PORV~~its~~ lift setpoints. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. The COT will verify the setpoints are~~is~~ within the PTLR allowed maximum limits in the PTLR. PORV actuation during this testing could depressurize the RCS and is not required. TA3.4-313

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The 12 hour Frequency considers the unlikelihood of a low temperature overpressure event during this time.

A Note has been added indicating that this SR is required to be performedmet 12 hours after decreasing RCS cold leg temperature to ≤ the OPPS enable temperature specified in the PTLR[275]°F. The COT may not have beencannot be performed before entry intountil in the LTOP MODES when the PORV lift setpoint can be reduced to the LTOP TA3.4-157 TA3.4-119

SURVEILLANCE REQUIREMENTS

SR 3.4.12.8 (continued)

setting. The test must be performed within 12 hours after entering the LTOP MODES. The 12 hour initial time considers the unlikehood of a low temperature overpressure event during this time.

SR 3.4.12.59

Performance of a CHANNEL CALIBRATION on OPPSeach required PORV actuation channel is required every 24[18] months to adjust the whole channel so that it responds and the valve opens within the required range and accuracy to known input. X3.4-107

REFERENCES

1. 10 CFR 50, Appendix G.

2. USAR, Section 4.4.

B. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix G, with ASME Code Case N-514Generic Letter 88-11.

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

4. FSAR, Chapter [15]

5. 10 CFR 50, Section 50.46.

BASES (continued)

6. ~~10 CFR 50, Appendix K.~~

7. ~~Generic Letter 90-06.~~

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

CL3.4-172

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.13 Low Temperature Overpressure Protection (LTOP) ≤ Safety Injection (SI) Pump Disable Temperature

BASES

BACKGROUND

The LTOP function limits RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G (Ref. 1). The reactor vessel is the limiting RCPB component for demonstrating such protection. The Over Pressure Protection System (OPPS) provides the actuation setpoints for the pressurizer power operated relief valves (PORVs) for the LTOP function (Ref.2). The PTLR provides the maximum allowable OPPS actuation setpoints and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Reference 1 requirements during the LTOP MODES. The LTOP MODES are the MODES as defined in the Applicability statement of LCO 3.4.12 and LCO 3.4.13.

The pressurizer safety valves and PORVs at their normal setpoints do not provide overpressure protection for certain low temperature operational transients. Inadvertent pressurization of the RCS at temperatures below the OPPS enable temperature specified in the PTLR could result in exceeding the ASME Appendix G (Ref. 3) brittle fracture P/T limits. Exceeding the RCS P/T limits by a significant amount could cause brittle cracking of the reactor vessel. LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the PTLR limits.

This LCO provides RCS overpressure protection by restricting coolant input capability and ensuring adequate pressure

(continued)

BASES

relief capacity. In MODE 4, at or below the safety injection (SI) pump disable temperature, limiting coolant input capability requires both SI pumps incapable of injection into the RCS and isolating the emergency core cooling system (ECCS) accumulators. The pressure relief capacity requires either two redundant RCS relief valves or a depressurized RCS and an RCS vent of sufficient size. One PORV or the open RCS vent is the overpressure protection device that acts to terminate an increasing pressure event.

BACKGROUND (continued)

Limiting coolant input capability reduces the ability to provide core coolant addition. The LCO does not require the makeup control system deactivated or the SI actuation circuits blocked. Due to the lower pressures in the LTOP MODES and the expected core decay heat levels, the charging system can provide adequate flow. If conditions require the use of an SI pump for makeup in the event of loss of inventory, the pump can be made available through manual actions.

The LTOP pressure relief consists of two PORVs with reduced lift settings or a depressurized RCS and an RCS vent of sufficient size. Two PORVs are required for redundancy. One PORV has adequate relieving capability to prevent overpressurization for the required coolant input capability.

OPPS and PORV Requirements

As designed for the LTOP function, each PORV is signaled to open by OPPS if the RCS pressure approaches the lift setpoint provided when OPPS is enabled. The OPPS monitors both RCS temperature and RCS pressure and indicates when a condition not acceptable in the PTLR limits is approached. The wide range RCS temperature setpoints indicate conditions

(continued)

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requiring enabling OPPS. The PTLR presents the OPPS setpoints for LTOP.

RCS Vent Requirements

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

APPLICABLE SAFETY ANALYSES

Safety analyses (Ref. 2) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with RCS cold leg temperature exceeding the OPPS enable temperature specified in the PTLR, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. At about the OPPS enable temperature specified in the PTLR and below, overpressure prevention falls to two OPERABLE PORVs or to a depressurized RCS and a sufficiently sized RCS vent. Each of these means has a limited overpressure relief capability. LCO 3.4.12, "LTOP > SI Pump Disable Temperature," provides the requirements for overpressure prevention at temperatures above the SI Pump disable temperature.

The actual temperature at which the pressure in the P/T limit curve falls below the pressurizer safety valve setpoint increases as the reactor vessel material toughness

(continued)

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decreases due to neutron embrittlement. Each time the PTLR curves are revised, LTOP must be re-evaluated to ensure its functional requirements can still be met using the PORV method or the depressurized and vented RCS condition.

The PTLR contains the acceptance limits that define the LTOP requirements. Any change to the RCS must be evaluated against the Reference 2 analyses to determine the impact of the change on the LTOP acceptance limits.

Transients that are capable of overpressurizing the RCS are categorized as either mass or heat input transients. The bounding mass input transient is inadvertent safety injection with injection from one SI pump and three charging pumps, and letdown isolated. The bounding heat input transient is reactor coolant pump (RCP) startup with temperature asymmetry within the RCS or between the RCS and steam generators.

The following limitations are required during the Applicability of this specification to ensure that mass and heat input transients in excess of analysis assumptions do not occur:

a. Rendering both SI pumps incapable of injection;

b. Deactivating the ECCS accumulator discharge isolation valves in their closed positions; and

c. Disallowing start of an RCP if secondary temperature is more than 50°F above primary temperature in any one loop. LCO 3.4.6, "RCS Loops - MODE 4," provides this protection.

The Reference 2 analyses demonstrate that either one PORV or the depressurized RCS and RCS vent can maintain RCS pressure below limits when all charging pumps are actuated. Neither

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APPLICABLE SAFETY ANALYSES (continued)

one PORV nor the RCS vent can handle the pressure transient resulting from inadvertant SI pump or ECCS accumulator injection when the RCS is below the SI pump disable temperature. Thus, the LCO requires both SI pumps to be disabled below the temperature specified in the PTLR.

The LCO also requires accumulator isolation when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR. The isolated ECCS accumulators must have their discharge valves closed and the valve power supply breakers fixed in their open positions.

Fracture mechanics analyses established the temperature of LTOP Applicability at the OPPS enable temperature specified in the PTLR. The fracture mechanics analyses show that the vessel is protected when the PORVs are set to open at or below the limit shown in the PTLR. The OPPS setpoints are derived by analyses that model the performance of the system, assuming the limiting LTOP transient of all charging pumps injecting into the RCS. These analyses consider pressure overshoot and undershoot beyond the PORV opening and closing, resulting from signal processing and valve stroke times. The OPPS setpoints at or below the derived limit ensures the Reference 1 P/T limits will be met.

The OPPS setpoints in the PTLR will be updated when the revised P/T limits conflict with the LTOP analysis limits. The P/T limits are periodically modified as the reactor vessel material toughness decreases due to neutron embrittlement caused by neutron irradiation. Revised limits are determined using neutron fluence projections and the results of examinations of the reactor vessel material irradiation surveillance specimens. The Bases for LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," discuss these examinations.

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With the RCS depressurized, analyses show a vent size equivalent to the cross sectional flow area of a PORV is capable of mitigating the allowed LTOP overpressure transient. The capacity of a vent this size is greater than the flow of the limiting transient for the LTOP configuration, both SI pumps disabled and all charging pumps OPERABLE when the RCS is below the SI pump disable temperature, maintaining RCS pressure less than the maximum pressure on the P/T limit curve.

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

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

LCO

This LCO requires that LTOP be provided, by limiting coolant input capability and by OPERABLE pressure relief capability. Violation of this LCO could lead to the loss of low temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient.

To limit the coolant input capability, the LCO requires both SI pumps be incapable of injecting into the RCS, and all ECCS accumulator discharge isolation valves be closed and deenergized (when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR).

The LCO is modified by three Notes. Note 1 allows operation of both SI pumps for ≤ 1 hour for conducting SI system testing providing there is a steam or gas bubble in the pressurizer and at least one isolation valve between the SI pump and the RCS is shut. The purpose of this note is to permit the conduct of the integrated SI test and other SI

(continued)

BASES

system tests and operations that may be performed in MODES 4, 5 or 6. In this case, pressurizer level is maintained at less than 50% and a positive means of isolation is provided between the SI pumps and the RCS to prevent fluid injection to the RCS. This isolation is accomplished by either a closed manual valve or motor operated valve with the power removed. This combination of conditions under strict administrative control assure that overpressurization cannot occur.

Note 2 allows operation of an SI pump during reduced inventory conditions as required to maintain adequate core cooling and RCS inventory. The purpose of this note is to allow use of an SI pump in the event of a loss of other injection capability (e.g., loss of Residual Heat Removal System cooling while in reduced inventory conditions). The operation of an SI pump under such conditions would be controlled by an approved emergency operating procedure.

Note 3 states that ECCS accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR (less allowance for instrument uncertainty). This Note permits the accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions.

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

a. An OPERABLE OPPS with two PORVs.

   A PORV is OPERABLE for LTOP when its block valve is open, its low pressure lift setpoint has been selected (OPPS enabled), and the backup air supply is charged.

(continued)

BASES

b. A depressurized RCS and an RCS vent.

An RCS vent is OPERABLE when open with an area of ≥ 3 square inches. Because the RCS vent opening specification is based on the flow capacity of a PORV, a PORV maintained in the open position satisfies the RCS vent requirement.

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

APPLICABILITY

This LCO is applicable in MODE 4 when any RCS cold leg temperature is ≤ the SI pump disable temperature specified in the PTLR, in MODE 5, and in MODE 6 when the reactor vessel head is on and the SG primary system manways and pressurizer manway are closed and secured. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above the OPPS enable temperature specified in the PTLR. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above the OPPS enable temperature specified in the PTLR. LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) ≤ Safety Injection (SI) Pump Disable Temperature," provides the requirements for MODE 4 below the OPPS enable temperature and above the SI pump disable temperature.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS

(continued)

BASES

pressure when little or no time allows operator action to mitigate the event.

ACTIONS

A.1

With one or more SI pumps capable of injecting into the RCS, RCS overpressurization is possible.

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

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

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

If isolation is needed and cannot be accomplished in 1 hour, Required Action C.1 and Required Action C.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > the OPPS enable temperature specified in the PTLR, an accumulator pressure of 800 psig cannot exceed the LTOP analysis limits if the accumulators are fully injected. Depressurizing the accumulators below the LTOP limit from the PTLR also gives this protection.

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

(continued)

BASES (continued)

D.1

The consequences of operational events that will overpressurize the RCS are more severe at lower temperature. Thus, with one PORV inoperable in MODE 4 when any RCS cold leg temperature is ≤ the SI Pump disable temperature specified in the PTLR, MODE 5 or in MODE 6 with the head on, the Completion Time to restore two valves to OPERABLE status is 24 hours. A Note clarifies that Condition D is only applicable when the OPPS and PORVs are being used to satisfy the pressure relief requirements of LCO 3.4.13.a.

The Completion Time represents a reasonable time to investigate and repair several types of relief valve failures without exposure to a lengthy period with only one OPERABLE PORV to protect against overpressure events.

ACTIONS (continued)

E.1

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

a. Both required PORVs are inoperable; or

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

c. The OPPS is inoperable.

The vent must be sized ≥ 3 square inches to ensure that the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. The vent opening is based on the cross sectional flow area of a PORV. A PORV maintained in the open position satisfies the vent requirement. This action is needed to

(continued)

BASES (continued)

protect the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time considers the time required to place the plant in this Condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

SURVEILLANCE REQUIREMENTS

SR 3.4.13.1 and SR 3.4.13.2

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, both SI pumps are verified incapable of injecting into the RCS and the ECCS accumulator discharge isolation valves are verified closed and deenergized.

The SI pumps are rendered incapable of injecting into the RCS by employing at least two independent means to prevent a pump start such that a single failure or single action will not result in an injection into the RCS. This may be accomplished through the pump control switch being placed in pullout with a blocking device installed over the control switch that would prevent an unplanned pump start.

The ECCS accumulator motor operated isolation valves can be verified closed and deenergized by use of control board indication. SR 3.4.13.2 is modified by a Note specifying that this verification is only required when the accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in the PTLR. If accumulator pressure is less than this limit, no verification is required since the accumulator cannot pressurize the RCS to or above the OPPS setpoint.

(continued)

BASES (continued)

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

SR 3.4.13.3

The required RCS vent of ≥ 3 square inches is proven OPERABLE by verifying its open condition either:

a. Once every 12 hours for a valve that is not locked, sealed, or secured in the open position.

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

The passive vent path arrangement must only be open to be OPERABLE. This Surveillance need only be performed if the vent is being used to satisfy the pressure relief requirements of this LCO.

SR 3.4.13.4

The PORV block valve must be verified open every 72 hours to provide the flow path for each required PORV to perform its function when actuated. The valve may be remotely verified open in the main control room. This Surveillance is performed if the PORV satisfies the LCO.

The block valve is a remotely controlled, motor operated valve. The power to the valve operator is not required to be removed, and the manual operator is not required to be locked in the inactive position. Thus, the block valve can be closed in the event the PORV develops excessive leakage

(continued)

BASES (continued)

or does not close (sticks open) after relieving an overpressure situation.

SURVEILLANCE REQUIREMENTS

SR 3.4.13.4 (continued)

The 72 hour Frequency is considered adequate in view of other administrative controls available to the operator in the control room, such as valve position indication, that verify that the PORV block valve remains open.

SR 3.4.13.5

Performance of a COT is required every 31 days on OPPS to verify and, as necessary, adjust the PORV lift setpoints. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. The COT will verify the setpoints are within the PTLR allowed maximum limits in the PTLR. PORV actuation during this testing could depressurize the RCS and is not required.

Note 1 has been added indicating that this SR is not required to be performed until 12 hours after decreasing RCS cold leg temperature to ≤ the OPPS enable temperature specified in the PTLR. The COT may not have been performed before entry into the LTOP MODES. The 12 hour initial time considers the unlikehood of a low temperature overpressure event during this time.

Note 2 has been added to specify that this SR is only required to be performed when OPPS and PORVs are providing the LTOP function per LCO 3.4.13.a.

(continued)

BASES (continued)

SR 3.4.13.6

Performance of a CHANNEL CALIBRATION on OPPS is required every 24 months to adjust the whole channel so that it responds and the valve opens within the required range and accuracy to known input.

REFERENCES

1. 10 CFR 50, Appendix G.

2. USAR, Section 4.4.

3. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix G, with ASME Code Case N-514.

(continued)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.143 RCS Operational LEAKAGE

PA3.4-211

BASES

BACKGROUND

Components that contain or transport the coolant to or from the reactor core make up the RCS. RCS cComponent joints are made by welding, bolting, rolling, or pressure loading., and Vvalves isolate connecting systems from the RCS.

During plant life, the joint and valve interfaces can produce varying amounts of reactor coolant LEAKAGE, through either normal operational wear or mechanical deterioration. The purpose of the RCS Operational LEAKAGE LCO is to limit system operation in the presence of LEAKAGE from these sources to amounts that do not compromise safety. This LCO specifies the types and amounts of LEAKAGE.

AEC GDC Criterion 16 10 CFR 50, Appendix A, GDC 30 (Ref. 1), requires means for monitoring detecting and, to the extent practical, identifying the source of reactor coolant pressure boundary to detect LEAKAGE. Regulatory Guide 1.45 (Ref. 2) LCO 3.4.16, "RCS Leakage Detection Instrumentation," describes acceptable methods requirements for selecting leakage detection instrumentation systems. CL3.4-221 CL3.4-301

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting and monitoring reactor coolant LEAKAGE into the containment area is necessary. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE is necessary to provide quantitative information to the operators, allowing them to take corrective action should a leak occur that is detrimental to the safety of the facility and the public.

(continued)

PA3.4-211

BASES (continued)

A limited amount of leakage inside containment is expected from auxiliary systems that cannot be made 100% leaktight. Leakage from these systems should be detected, located, and isolated from the containment atmosphere, if possible, to not interfere with RCS leakage detection.

~~This LCO deals with protection of the reactor coolant pressure boundary (RCPB) from degradation and the core from inadequate cooling, in addition to preventing the accident analyses radiation release assumptions from being exceeded. The consequences of violating this LCO include the possibility of a loss of coolant accident (LOCA).~~ PA3.4-298

APPLICABLE SAFETY ANALYSES

Except for primary to secondary LEAKAGE, the safety analyses do not address operational LEAKAGE. However, other operational LEAKAGE is related to the safety analyses for LOCA; the amount of leakage can affect the probability of such an event. The safety analysis for an event resulting in steam discharge to the atmosphere assumes a 1 gpm primary to secondary LEAKAGE as the initial condition.

Primary to secondary LEAKAGE is a factor in the dose releases outside containment resulting from a steam line break (SLB) accident. To a lesser extent, other accidents or transients involve secondary steam release to the atmosphere, such as a steam generator tube rupture (SGTR). The leakage contaminates the secondary fluid.

The UFSAR (Ref. 2~~3~~) analysis for SGTR assumes the plant has been operating with a 5 gpm primary to secondary leak rate for a period of time sufficient to establish radionuclide equilibrium in the secondary loop. ~~contaminated secondary fluid is only briefly released via safety valves and the majority is steamed to the condenser.~~ Following the tube rupture, t~~T~~he initial ~~1 gpm~~ CL3.4-299 X3.4-173

(continued)

PA3.4-211

BASES (continued)

primary to secondary LEAKAGE is relatively inconsequential when compared to the mass transfer through the ruptured tube. CL3.4-299

The SLB is more limiting for site radiation releases. The safety analysis for the SLB accident assumes 1 gpm (at 70 °F) primary to secondary LEAKAGE in one generator as an initial condition. The dose consequences resulting from the SLB accident are well within the limits defined in 10 CFR 100 or the staff approved licensing basis (i.e., a small fraction of these limits).

The RCS operational LEAKAGE satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii)~~the NRC Policy Statement~~.

LCO

RCS operational LEAKAGE shall be limited to:

a. <u>Pressure Boundary LEAKAGE</u>

No pressure boundary LEAKAGE is allowed, being indicative of material deterioration. LEAKAGE of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher LEAKAGE. Violation of this LCO could result in continued degradation of the reactor coolant pressure boundary (RCPB). LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE.

Seal welds are provided at the threaded joints of all reactor vessel head penetrations (spare penetrations, full-length Control Rod Drive Mechanisms, and thermocouple columns). Although these seals are part of the RCPB as defined in 10CFR50 Section 50.2, minor leakage past the seal weld is not a fault in the RCPB or a structural integrity concern. CL3.4-304

(continued)

PA3.4-211

BASES

Pressure retaining components are differentiated from leakage barriers in the ASME Boiler and Pressure Vessel Code. In all cases, the joint strength is provided by the threads of the closure joint. CL3.4-304

LCO (continued)

b. Unidentified LEAKAGE

One gallon per minute (gpm) of unidentified LEAKAGE is allowed as a reasonable minimum detectable amount that the containment air monitoring and containment sump level monitoring equipment can detect within a reasonable time period. Violation of this LCO could result in continued degradation of the RCPB, if the LEAKAGE is from the pressure boundary.

c. Identified LEAKAGE

Up to 10 gpm of identified LEAKAGE is considered allowable because LEAKAGE is from known sources that do not interfere with detection of unidentified LEAKAGE and is well within the capability of the RCS Makeup System. TA3.4-302 Identified leakage must be evaluated to assure that continued operation is safe. CL3.4-305 Identified LEAKAGE includes LEAKAGE to the containment from specifically known and located sources, but does not include pressure boundary LEAKAGE or controlled reactor coolant pump (RCP) seal leakoff (a normal function not considered LEAKAGE). Violation of this LCO could result in continued degradation of a component or system.

d. ~~Primary to Secondary LEAKAGE through All Steam Generators (SGs)~~ CL3.4-173

~~Total primary to secondary LEAKAGE amounting to 1 gpm through all SGs produces acceptable offsite doses in~~

(continued)

BASES (continued)

the SLB accident analysis. Violation of this LCO could exceed the offsite dose limits for this accident. Primary to secondary LEAKAGE must be included in the total allowable limit for identified LEAKAGE.

e. Primary to Secondary LEAKAGE through Any One Steam Generator (SG)

The [500] 150 gallons per day (gpd) limit on one SG is based on the assumption that a single crack leaking this amount would not propagate to a SGTR under the stress conditions of a LOCA or a main steam line rupture. If leaked through many cracks, the cracks are very small, and the above assumption is conservative. implementation of the Steam Generator Voltage Based Alternate Repair Criteria and is more restrictive than standard operating leakage limits to provide additional margin to accommodate a crack which might grow at greater than the expected rate or unexpectedly extend outside the thickness of the tube support plate. CL3.4-175 CL3.4-303

APPLICABILITY

In MODES 1, 2, 3, and 4, the potential for RCPB LEAKAGE is greatest when the RCS is pressurized.

In MODES 5 and 6, LEAKAGE limits are not required because the reactor coolant pressure is far lower, resulting in lower stresses and reduced potentials for LEAKAGE.

LCO 3.4.154, "RCS Pressure Isolation Valve (PIV) Leakage," measures leakage through each individual PIV and can impact this LCO. Of the two PIVs in series in each isolated line, leakage measured through one PIV does not result in RCS LEAKAGE when the other is leak tight. If both valves leak and result in a loss of mass from the RCS, the loss must be included in the allowable identified LEAKAGE.

(continued)

BASES (continued)

ACTIONS

A.1

Unidentified LEAKAGE, identified LEAKAGE, or primary to secondary LEAKAGE in excess of the LCO limits must be identified or reduced to within limits within 4 hours. This Completion Time allows time to verify leakage rates and either identify unidentified LEAKAGE or reduce LEAKAGE to within limits before the reactor must be shut down. This action is necessary to prevent further deterioration of the RCPB. CL3.4-174

B.1, and B.2.1, and B.2.2

If any pressure boundary LEAKAGE exists, or if unidentified LEAKAGE, identified LEAKAGE, or primary to secondary LEAKAGE cannot be identified or cannot be reduced to within limits within 4 hours, the reactor must be brought to lower pressure conditions to reduce the severity of the LEAKAGE and its potential consequences. It should be noted that LEAKAGE past seals, and gaskets, and pressurizer safety valves seats is not pressure boundary LEAKAGE. The reactor must be brought to MODE 3 within 6 hours. If the LEAKAGE source cannot be identified within 54 hours, then the reactor must be placed in and MODE 5 within 8436 hours. This action reduces the LEAKAGE and also reduces the factors that tend to degrade the pressure boundary. CL3.4-174 PA3.4-300 CL3.4-174

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. In MODE 5, the pressure stresses

(continued)

PA3.4-211

BASES

ACTIONS

B.1 and B.2 (continued)

acting on the RCPB are much lower, and further deterioration is much less likely.

C.1, C2.1, and C2.2

CL3.4-174

If RCS identified LEAKAGE, other than pressure boundary leakage, is not within limits, then the reactor must be placed in MODE 3 within 6 hours. In this condition, 14 hours are allowed to reduce the identified leakage to within limits. If the identified LEAKAGE is not within limits within this time, the reactor must be placed in MODE 5 within 44 hours.

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

D.1 and D.2

If RCS pressure boundary LEAKAGE exists or if SG LEAKAGE (150 gpd limit) is not within limits, the reactor must be placed in MODE 3 within 6 hours and in MODE 5 within 36 hours.

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

CL3.4-174

SURVEILLANCE REQUIREMENTS

SR 3.4.143.1

Verifying RCS LEAKAGE to be within the LCO limits ensures the integrity of the RCPB is maintained. Pressure boundary

(continued)

PA3.4-211

BASES

LEAKAGE would at first appear as unidentified LEAKAGE and can only be positively identified by inspection. It should be noted that LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE. Unidentified LEAKAGE and identified LEAKAGE are determined by performance of an RCS water inventory balance. Primary to secondary LEAKAGE is also measured by performance of an RCS water inventory balance in conjunction with effluent monitoring within the secondary steam and feedwater systems.

The RCS water inventory balance must be met with the reactor at steady state operating condition (stable temperature, power level, equilibrium xenon, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows) ~~and near operating pressure~~. Therefore, a Note is added allowing that this SR is not required to be performed ~~in MODES 3 and 4~~ until 12 hours after establishing~~of~~ steady state operation ~~near operating pressure have been established~~. The 12 hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established. TA3.4-176

Steady state operation is required to perform a proper inventory balance since~~;~~ calculations during maneuvering are not useful ~~and a Note requires the Surveillance to be met when steady state is established~~. For RCS operational LEAKAGE determination by water inventory balance, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows. TA3.4-176

An early warning of pressure boundary LEAKAGE or unidentified LEAKAGE is provided by ~~the automatic systems that~~ monitoring ~~the~~ containment atmosphere radioactivity ~~and the containment sump level~~. It should be CL3.4-188

(continued)

PA3.4-211

BASES

noted that LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE. These leakage detection systems are specified in LCO 3.4.165, "RCS Leakage Detection Instrumentation."

The 72 hour Frequency is a reasonable interval to trend LEAKAGE and recognizes the importance of early leakage

SURVEILLANCE REQUIREMENTS SR 3.4.13.1 (continued)

detection in the prevention of accidents. A Note under the Frequency column states that this SR is required to be performed during steady state operation. TA3.4-176

SR 3.4.143.2

This SR provides the means necessary to determine SG OPERABILITY in an operational MODE. The requirement to demonstrate SG tube integrity in accordance with the Steam Generator Tube Surveillance Program emphasizes the importance of SG tube integrity, even though this Surveillance cannot be performed at normal operating conditions. PA3.4-179

REFERENCES

1. 10 CFR 50, Appendix A, GDC 30AEC "General Design Criteria for Nuclear Power Plant Construction Permits," Criterion 16, issued for comment July 10, 1967, as referenced in USAR Section 1.2. CL3.4-221

2. Regulatory Guide 1.45, May 1973.

3. UFSAR, Section 14.5[15].

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.15~~4~~ RCS Pressure Isolation Valve (PIV) Leakage

PA3.4-211

BASES

BACKGROUND

CL3.4-297

~~10 CFR 50.2, 10 CFR 50.55a(c), and GDC 55 of 10 CFR 50, Appendix A (Refs. 1, 2, and 3), define~~ RCS PIVs ~~as any two normally closed valves in series within the reactor coolant pressure boundary (RCPB), which~~ separate the high pressure RCS from an attached low pressure system. During their lives, these valves can produce varying amounts of reactor coolant leakage through either normal operational wear or mechanical deterioration. The RCS PIV Leakage LCO allows RCS high pressure operation when leakage through these valves exists in amounts that do not compromise safety.

The PIV leakage limit applies to each individual valve. Leakage through both series PIVs in a line must be included as part of the identified LEAKAGE, governed by LCO 3.4.14~~3~~, "RCS Operational LEAKAGE." This is true during operation only when the loss of RCS mass through two series valves is determined by a water inventory balance (SR 3.4.14~~3~~.1). A known component of the identified LEAKAGE before operation begins is the least of the two individual leak rates determined for leaking series PIVs during the required surveillance testing; leakage measured through one PIV in a line is not RCS operational LEAKAGE if the other is leaktight.

Although this specification provides a limit on allowable PIV leakage rate, its main purpose is to prevent overpressure failure of the low pressure portions of connecting systems. The leakage limit is an indication that the PIVs between the RCS and the connecting systems are degraded or degrading. PIV leakage could lead to overpressurization~~e~~ of the low pressure piping or

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BASES

components. Failure consequences could be a loss of coolant accident (LOCA) outside of containment, an unanalyzed accident, that could degrade the ability for low pressure injection.

The basis for this LCO is the 1975 NRC "Reactor Safety Study" (Ref. 14) that identified potential intersystem LOCAs as a significant contributor to the risk of core melt. A subsequent study (Ref. 25) evaluated various PIV configurations to determine the probability of intersystem LOCAs.

BACKGROUND ~~(continued)~~

PIVs are provided to isolate the RCS from ~~the following typically connected systems:~~ low pressure systems susceptible to intersystem LOCAs.

CL3.4-309

~~a. Residual Heat Removal (RHR) System;~~

~~b. Safety Injection System; and~~

~~c. Chemical and Volume Control System.~~

The PIVs are listed in the LCO section of these Bases~~FSAR, Section [ ] (Ref. 6)~~.

Violation of this LCO could result in continued degradation of a PIV, which could lead to overpressurization of a low pressure system and the loss of the integrity of a fission product barrier.

APPLICABLE SAFETY ANALYSES

Reference 14 identified potential intersystem LOCAs as a significant contributor to the risk of core melt. The dominant accident sequence in the intersystem LOCA category is the failure of the low pressure portion of the Residual Heat Removal (RHR) System outside of containment. The accident is the result

PA3.4-211

BASES

of a postulated failure of the PIVs, which are part of the RCPB, and the subsequent pressurization of the RHR System downstream of the PIVs from the RCS. ~~Because~~ Tthe low pressure portion of the RHR System is ~~typically~~ designed for 600 psig. ~~,~~ An overpressurization failure of the RHR low pressure line would result in a LOCA outside containment and subsequent increased risk of core melt.

Reference 25 evaluated various PIV configurations, leakage testing of the valves, and operational changes to determine the effect on the probability of intersystem LOCAs. This study concluded that periodic leakage testing of the PIVs can substantially reduce the probability of an intersystem LOCA. A plant specific review against the NRC criteria for intersystem LOCAs was performed to identify the most risk significant configurations (Ref. 3). Valves identified in this study are listed in the LCO discussion in these Bases. CL3.4-309

RCS PIV leakage satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii)~~the NRC Policy Statement~~.

RCS PIV OPERABILITY protects the low pressure systems attached to the RCS from potential failure due to overpressurization. This protection (that is, RCS PIV OPERABILITY) is provided by the leak tight PIVs. CL3.4-317

LCO

RCS PIV leakage is identified LEAKAGE into closed systems connected to the RCS. Isolation valve leakage is usually on the order of drops per minute. Leakage that increases

BASES

~~LCO~~
~~(continued)~~

significantly suggests that something is operationally wrong and corrective action must be taken. This LCO only applies to the following PIVs which were determined to be in the most risk significant configurations (Ref. 3): CL3.4-306

a. Residual Heat Removal (RHR) System, RHR to loop B accumulator injection line:

Unit 1	SI-6-2
Unit 2	2SI-6-2

b. Safety Injection (SI) System, low pressure SI to upper plenum:

Unit 1	SI-9-3, SI-9-4, SI-9-5, SI-9-6
Unit 2	2SI-9-3, 2SI-9-4, 2SI-9-5, 2SI-9-6

The LCO PIV leakage limit is 0.5 gpm per nominal inch of valve size with a maximum limit of 5 gpm. The previous criterion of 1 gpm for all valve sizes imposed an unjustified penalty on the larger valves without providing information on potential valve degradation and resulted in higher personnel radiation exposures. A study concluded a leakage rate limit based on valve size was superior to a single allowable value.

Reference 47 permits leakage testing at a lower pressure differential than between the specified maximum RCS pressure and the normal pressure of the connected system during RCS operation (the maximum pressure differential) in those types of valves in which the higher service pressure will tend to diminish the overall leakage channel opening. In such cases, the observed rate may be adjusted to the maximum pressure differential by assuming leakage is directly proportional to the pressure differential to the one half power.

APPLICABILITY

In MODES 1, 2, 3, and 4, this LCO applies because the PIV leakage potential is greatest when the RCS is pressurized. ~~In MODE 4, valves in the RHR flow path are not required to meet the requirements of this LCO when in, or during the transition to or from, the RHR mode of operation.~~ CL3.4-178

In MODES 5 and 6, leakage limits are not provided because the lower reactor coolant pressure results in a reduced potential for leakage and for a LOCA outside the containment.

ACTIONS

The Actions are modified by two Notes. Note 1 provides clarification that each flow path allows separate entry into a Condition. This is allowed based upon the functional independence of the flow path. Note 2 requires an evaluation of affected systems if a PIV is inoperable. The leakage may have affected system operability, or isolation of a leaking flow path with an alternate valve may have degraded the ability of the interconnected system to perform its safety function.

ACTIONS (continued)

A.1 and A.2

The flow path must be isolated by two valves. Required Action~~s~~ A.1 ~~and A.2 are~~ is modified by a Note that the valves used for isolation must meet the same leakage requirements as the PIVs and must be within ~~the RCPB [or~~ the high pressure portion of the system~~]~~. CL3.4-192

Required Action A.1 requires that the isolation with one valve must be performed within 4 hours. Four hours provides time to reduce leakage in excess of the allowable limit and to isolate the affected system if leakage cannot be reduced. The 4 hour Completion Time allows the actions and restricts the operation with leaking isolation valves.

PA3.4-211

BASES

Required Action A.2 specifies that the ~~double isolation barrier of two valves be restored by closing some other valve qualified for isolation or restoring one~~ leaking PIV be restored within limits. ~~The 72 hour Completion Time after exceeding the limit considers the time required to complete the Action and the low probability of a second valve failing during this time period.~~ X3.4-181

~~or~~

The 72 hour Completion Time after exceeding the limit allows for the restoration of the leaking PIV to OPERABLE status. This timeframe considers the time required to complete this Action and the low probability of a second valve failing during this period. ~~(Reviewer Note: Two options are provided for Required Action A.2. The second option (72 hour restoration) is appropriate if isolation of a second valve would place the unit in an unanalyzed condition.)~~

<u>B.1 and B.2</u>

If leakage cannot be reduced, ~~[~~the system isolated,~~]~~ or the other Required Actions accomplished, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to MODE 3

~~ACTIONS~~ ~~B.1 and B.2 (continued)~~

within 6 hours and MODE 5 within 36 hours. This Action may reduce the leakage and also reduces the potential for a LOCA outside the containment. 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.

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BASES

~~C.1~~

~~The inoperability of the RHR autoclosure interlock renders the RHR suction isolation valves incapable of isolating in response to a high pressure condition and preventing inadvertent opening of the valves at RCS pressures in excess of the RHR systems design pressure. If the RHR autoclosure interlock is inoperable, operation may continue as long as the affected RHR suction penetration is closed by at least one closed manual or deactivated automatic valve within 4 hours. This Action accomplishes the purpose of the autoclosure function.~~ CL3.4-186

SURVEILLANCE REQUIREMENTS

SR 3.4.1~~5~~4.1

Performance of leakage testing on each RCS PIV or isolation valve used to satisfy Required Action A.1 ~~and Required Action A.2~~ is required to verify that leakage is below the specified limit and to identify each leaking valve. X3.4-181

The leakage limit of 0.5 gpm per inch of nominal valve diameter up to 5 gpm maximum applies to each valve. Leakage testing requires a stable pressure condition of at least 150 psid. CL3.4-307

For the two PIVs in series, the leakage requirement applies to each valve individually and not to the combined leakage across both valves. If the PIVs are not individually leakage tested, one valve may have failed completely and not be detected if the other valve in series meets the leakage requirement. In this situation, the protection provided by redundant valves would be lost.

Testing is to be performed at the following times: CL3.4-184

a. Eevery ~~[18]~~24 months, a typical refueling cycle~~;~~.

b. Prior to entering MODE 2 whenever the unit has been in MODE 5 for 7 days or more, if leakage testing has not been performed in the previous 9 months; and

c. Prior to returning a PIV to service after maintenance, repair, or replacement work has been performed. ~~if the plant does not go into MODE 5 for at least 7 days.~~

The ~~[18~~ 24 month~~]~~ Frequency is consistent with 10 CFR 50.55a(g) ~~(Ref. 8)~~ as contained in the Inservice Testing Program, is within the frequency allowed by ~~the American Society of Mechanical Engineers (ASME) Code, Section XI~~ ~~(~~Reference 4~~. 7)~~, and is based on the need to perform such surveillances under the conditions that apply during an outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. To satisfy ALARA requirements, leakage may be measured indirectly (as from the performance of pressure indicators) if accomplished in accordance with approved procedures and supported by computations showing that the method is capable of demonstrating valve compliance with the leakage criteria. CL3.4-305

In addition, testing must be performed once after the valve has been worked on (maintenance, repair, or replacement) ~~opened by flow or exercised~~ to ensure tight reseating. ~~PIVs disturbed in the performance of this Surveillance should also be tested unless documentation shows that an infinite testing loop cannot practically be avoided. Testing must be performed within 24 hours after the valve has been reseated. Within 24 hours is a reasonable and practical time limit for performing this test after opening or reseating a valve.~~ CL3.4-184

The leakage limit is to be met at the RCS pressure associated with MODES 1 and 2. This permits leakage testing at high differential pressures with stable conditions not possible in the MODES with lower pressures. A CL3.4-307

BASES

differential pressure of at least 150 psid is sufficient to ensure the valves are seated.

Entry into MODES 3 and 4 is allowed to establish the necessary differential pressures and stable conditions to allow for performance of this Surveillance. The Note that allows this provision is complementary to the Frequency of prior to entry into MODE 2 whenever the unit has been in MODE 5 for 7 days or more, if leakage testing has not been performed in the previous 9 months. ~~In addition, this Surveillance is not required to be performed on the RHR System when the RHR System is aligned to the RCS in the shutdown cooling mode of operation.~~ PIVs contained in the RHR shutdown cooling flow path must be leakage rate tested after RHR is secured and stable unit conditions and the necessary differential pressures are established. CL3.4-178

SURVEILLANCE ~~REQUIREMENTS~~

~~SR 3.4.14.2 and SR 3.4.14.3~~ CL3.4-186

~~Verifying that the RHR autoclosure interlocks are OPERABLE ensures that RCS pressure will not pressurize the RHR system beyond 125% of its design pressure of [600] psig. The interlock setpoint that prevents the valves from being opened is set so the actual RCS pressure must be < [425] psig to open the valves. This setpoint ensures the RHR design pressure will not be exceeded and the RHR relief valves will not lift. The [18] month Frequency is based on the need to perform the Surveillance under conditions that apply during a plant outage. The [18] month Frequency is also acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment.~~

~~These SRs are modified by Notes allowing the RHR autoclosure function to be disabled when using the RHR System suction relief valves for cold overpressure protection in accordance with SR 3.4.12.7.]~~ CL3.4-186

PA3.4-211

BASES

REFERENCES

1. ~~10 CFR 50.2.~~

~~2. 10 CFR 50.55a(c).~~

~~3. 10 CFR 50, Appendix A, Section V, GDC 55.~~

~~4.~~ WASH-1400 (NUREG-75/014), Appendix V, October 1975.

2~~5~~. NUREG-0677, May 1980.

3~~6~~. Letter from Robert A. Clark, NRC, to L. O. Mayer, NSP, Subject: "Order for Modification of License Concerning Primary Coolant System Pressure Isolation Valves," dated April 20, 1981 ~~[Document containing list of PIVs.]~~

4~~7~~. American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section XI.

~~8. 10 CFR 50.55a(g).~~

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.165 RCS Leakage Detection Instrumentation

PA3.4-211

BASES

BACKGROUND

AEC GDC 16 30 of Appendix A to 10 CFR 50 (Ref. 1) requires that means be provided for monitoring reactor coolant pressure boundary (RCPB) to for detecting and, to the extent practical, identifying the location of the source of RCS LEAKAGE. Regulatory Guide 1.45(Refe̶rence - 2) describes acceptable methods used for selecting RCS leakage detection systems. CL3.4-221 CL3.4-310

Leakage detection systems must have the capability to detect significant reactor coolant pressure boundary (RCPB) degradation as soon after occurrence as practical to minimize the potential for propagation to a gross failure. Thus, an early indication or warning signal is necessary to permit proper evaluation of all unidentified LEAKAGE.

Industry practice has shown that water flow changes of 0.5 to 1.0 gpm can be readily detected in contained volumes by monitoring changes in water level, in flow rate, or in the operating frequency of a pump. The containment sump A pump run time instrumentation used to collect unidentified LEAKAGE [is] [(or) and air cooler condensate flow rate monitor] [are] instrumented to alarm for increases of 0.5 to 1.0 gpm in the normal flow rates. This sensitivity is acceptable for may be used to detecting increases in unidentified LEAKAGE. CL3.4-311

The reactor coolant contains radioactivity that, when released to the containment, can be detected by radiation monitoring instrumentation. Reactor coolant radioactivity levels will be low during initial reactor startup and for a few weeks thereafter, until activated corrosion products have been formed and fission products appear from fuel element cladding contamination or cladding defects.

(continued)

BASES PA3.4-211

Instrument sensitivities of 10^{-9} μCi/cc radioactivity for particulate monitoring and of 10^{-6} μCi/cc radioactivity for gaseous monitoring are practical for these leakage detection systems. Radioactivity detection systems are included for monitoring both particulate and gaseous activities because of their sensitivities and rapid responses to RCS LEAKAGE.

An increase in humidity of the containment atmosphere would indicate release of water vapor to the containment. ~~Dew point temperature~~Humidity measurements can ~~thus~~ be used ~~to monitor humidity levels of the containment atmosphere~~ as a~~n~~ CL3.4-319

BACKGROUND (continued)

less sensitive indicator of potential RCS LEAKAGE (Ref. 2). ~~A 1°F increase in dew point is well within the sensitivity range of available instruments.~~ CL3.4-319

Since the humidity level is influenced by several factors, a quantitative evaluation of an indicated leakage rate by this means may be questionable and should be compared to observed changes in ~~increases in liquid flow into or from the~~ containment sump A pump run time ~~[and condensate flow from air coolers]~~. Humidity level monitoring is considered most useful as an indirect alarm or indication to alert the operator to a potential problem. Humidity monitors are not required by this LCO. CL3.4-311

Air temperature and pressure monitoring methods may also be used to infer unidentified LEAKAGE to the containment. Containment temperature and pressure fluctuate slightly during plant operation, but a rise above the normally indicated range of values may indicate RCS leakage into the containment. The relevance of temperature and pressure measurements are affected by containment free volume and, for temperature, detector location. Alarm signals from these instruments can be valuable in recognizing rapid and

(continued)

PA3.4-211

BASES

sizable leakage to the containment. Temperature and pressure monitors are not required by this LCO.

APPLICABLE SAFETY ANALYSES

The need to evaluate the severity of an alarm or an indication is important to the operators, and the ability to compare and verify with indications from other systems is necessary. The system response times and sensitivities are described in the UFSAR (Refs. 2 and 3). Multiple instrument locations are utilized, if needed, to ensure that the transport delay time of the leakage from its source to an instrument location yields an acceptable overall response time.

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting and monitoring RCS LEAKAGE into ~~the~~ containment ~~area~~ is necessary. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE provides quantitative information to the operators, allowing them to take corrective action should a leakage occur detrimental to the safety of the unit and the public.

APPLICABLE SAFETY ANALYSES (continued)

Containment radionuclide monitoring used for RCS leakage detection instrumentation satisfies Criterion 1 of 10 CFR 50.36(c)(2)(ii) ~~the NRC Policy Statement~~. Containment sump A monitoring used for RCS leakage detection instrumentation satifies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

CL3.4-321

LCO

One method of protecting against large RCS leakage derives from the ability of instruments to rapidly detect extremely

(continued)

PA3.4-211

BASES

small leaks. This LCO requires instruments of diverse monitoring principles to be OPERABLE to provide a high degree of confidence that extremely small leaks are detected in time to allow actions to place the plant in a safe condition, when RCS LEAKAGE indicates possible RCPB degradation.

The LCO is satisfied when monitors of diverse measurement means are available to provide indication of RCS leakage. Thus, the containment sump A monitor (pump run time instrumentation), in combination with a containment radionuclide~~gaseous or particulate radioactivity~~ monitor ~~[and a containment air cooler condensate flow rate monitor]~~, provides an acceptable minimum. CL3.4-188 CL3.4-189

One of the containment atmosphere (gaseous and particulate) radiation monitoring channels, R-11 or R-12, normally provides the required monitoring. CL3.4-323

APPLICABILITY

Because of elevated RCS temperature and pressure in MODES 1, 2, 3, and 4, RCS leakage detection instrumentation is required to be OPERABLE.

In MODE 5 or 6, the temperature is to be ≤ 200°F and pressure is maintained low or at atmospheric pressure. Since the temperatures and pressures are far lower than those for MODES 1, 2, 3, and 4, the likelihood of leakage and crack propagation are much smaller. Therefore, the requirements of this LCO are not applicable in MODES 5 and 6.

(continued)

BASES

PA3.4-211

ACTIONS

The Actions are modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when the containment sump and required radionuclide monitors are inoperable. This allowance is provided because other instrumentation is available to monitor RCS leakage. TA3.4-194

A.1 and A.2

With the required containment sump monitor inoperable, no other form of sampling can provide the equivalent information; however, the containment radionuclide ~~atmosphere radioactivity~~ monitor will provide indications of changes in leakage. Together with the radionuclide ~~atmosphere~~ monitor, the periodic surveillance for RCS water inventory balance, SR 3.4.143.1. CL3.4-188

ACTIONS

A.1 and A.2 (continued)

must be performed at an increased frequency of 24 hours to provide information that is adequate to detect leakage. A Note is added allowing that SR 3.4.14.1 is not required to be performed until 12 hours after establishing steady state operation (stable temperature, power level, equilibrium xenon, pressurizer and makeup tank levels, makeup and letdown, and reactor coolant pump seal injection and return flows). The 12 hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established. TA3.4-176

Restoration of the required sump monitor to OPERABLE status within a Completion Time of 30 days is required to regain the function after the monitor's failure. This time is acceptable, considering the Frequency and adequacy of the RCS water inventory balance required by Required Action A.1.

(continued)

BASES

PA3.4-211

~~Required Action A.1 is modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when the containment sump monitor is inoperable. This allowance is provided because other instrumentation is available to monitor RCS leakage.~~ TA3.4-194

B.1.1, B.1.2, and B.2~~.1, and B.2.2~~

When the required ~~With both gaseous and particulate~~ containment radionuclide ~~atmosphere radioactivity~~ monitoring instrumentation channel~~s~~ is inoperable, alternative action is required. Either grab samples of the containment atmosphere must be taken and analyzed or water inventory balances, in accordance with SR 3.4.143.1, must be performed to provide alternate periodic information. CL3.4-188

With a sample obtained and analyzed or water inventory balance performed every 24 hours, the reactor may be operated for up to 30 days to allow restoration of the required containment radionuclide ~~atmosphere radioactivity~~ monitor~~s~~. ~~Alternatively, continued operation is allowed if the air cooler condensate flow rate monitoring system is OPERABLE, provided grab samples are taken every 24 hours.~~ CL3.4-188 CL3.4-189

The 24 hour interval provides periodic information that is adequate to detect leakage. The 30 day Completion Time recognizes at least one other form of leakage detection is available.

~~Required Action B.1 and Required Action B.2 are modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when the gaseous and particulate containment~~ TA3.4-194

(continued)

PA3.4-211

BASES

atmosphere radioactivity monitor channel is inoperable. This allowance

TA3.4-194

ACTIONS B.1.1, B.1.2, B.2.1, and B.2.2 (continued)

is provided because other instrumentation is available to monitor for RCS LEAKAGE.

C.1 and C.2

With the required containment air cooler condensate flow rate monitor inoperable, alternative action is again required. Either SR 3.4.15.1 must be performed or water inventory balances, in accordance with SR 3.4.13.1, must be performed to provide alternate periodic information. Provided a CHANNEL CHECK is performed every 8 hours or a water inventory balance is performed every 24 hours, reactor operation may continue while awaiting restoration of the containment air cooler condensate flow rate monitor to OPERABLE status.

CL3.4-189

The 24 hour interval provides periodic information that is adequate to detect RCS LEAKAGE.

D.1 and D.2

With the required containment atmosphere radioactivity monitor and the required containment air cooler condensate flow rate monitor inoperable, the only means of detecting leakage is the containment sump monitor. This Condition does not provide the required diverse means of leakage detection. The Required Action is to restore either of the inoperable required monitors to OPERABLE status within 30 days to regain the intended leakage detection diversity. The 30 day Completion Time ensures that the plant will not

CL3.4-189

(continued)

PA3.4-211

BASES

~~be operated in a reduced configuration for a lengthy time period.~~

C~~E~~.1 and C~~E~~.2

If a Required Action of Condition A~~,~~ or B~~, [C], or [D]~~ cannot be met, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the

~~ACTIONS~~ ~~E.1 and E.2 (continued)~~

required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

D~~F~~.1

With all required monitors inoperable, no automatic means of monitoring leakage are available, and immediate plant shutdown in accordance with LCO 3.0.3 is required.

SURVEILLANCE REQUIREMENTS

SR 3.4.16~~5~~.1

SR 3.4.16~~5~~.1 requires the performance of a CHANNEL CHECK of the required containment radionuclide ~~atmosphere radioactivity~~ monitor. The check gives reasonable confidence that the channel is operating properly. The Frequency of 12 hours is based on instrument reliability and is reasonable for detecting off normal conditions. CL3.4-188

(continued)

BASES PA3.4-211

SR 3.4.16~~5~~.2

SR 3.4.16~~5~~.2 requires the performance of a COT on the required containment radionuclide ~~atmosphere radioactivity~~ monitor. The test ensures that the monitor can perform its function in the desired manner. A successful test of the reqired contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. The test verifies the alarm setpoint and relative accuracy of the instrument string. The Frequency of 92 days considers instrument reliability, and operating experience has shown that it is proper for detecting degradation. CL3.4-188 TA3.4-313

SR 3.4.16~~5~~.3~~, [SR 3.4.15.4,~~ and SR 3.4.16~~.45.5]~~ CL3.4-189

These SRs require the performance of a CHANNEL CALIBRATION for each of the RCS leakage detection instrumentation channels. The calibration verifies the accuracy of the instrument string, including the instruments located inside containment. The Frequency of 24~~[18]~~ months is a typical refueling cycle and considers channel reliability. ~~Again, operating experience has proven that this Frequency is acceptable.~~ X3.4-187 CL3.4-322

(continued)

PA3.4-211

BASES (continued)

REFERENCES

1. AEC "General Design Criteria for Nuclear Power Plant Construction Permits," Criterion 16, issued for comment July 10, 1967, as referenced in USAR Section 1.210 CFR 50, Appendix A, Section IV, GDC 30. CL3.4-221

2. USAR, Section 6.5Regulatory Guide 1.45.

3. UFSAR, Section 7.5[ ].

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.167 RCS Specific Activity

PA3.4-211

BASES

BACKGROUND

The maximum dose to the whole body and the thyroid that an individual at the site boundary can receive for 2 hours during an accident is specified in 10 CFR 100 (Ref. 1). The limits on specific activity ensure that the doses are held to a small fraction of the 10 CFR 100 limits during analyzed transients and accidents.

The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite radioactivity dose consequences in the event of a steam generator tube rupture (SGTR) accident.

The LCO contains specific activity limits for both DOSE EQUIVALENT I-131 and gross specific activity.The allowable levels are intended to limit the 2 hour dose at the site boundary to a small fraction of the 10 CFR 100 dose guideline limits. The limits in the LCO are standardized, based on parametric evaluations of offsite radioactivity dose consequences for typical site locations.

The parametric evaluations showed the potential offsite dose levels for a SGTR accident were an appropriately small fraction of the 10 CFR 100 dose guideline limits. Each evaluation assumes a broad range of site applicable atmospheric dispersion factors in a parametric evaluation.

APPLICABLE SAFETY ANALYSES

The LCO limits on the specific activity of the reactor coolant ensures that the resulting 2 hour doses at the site boundary will not exceed a small fraction of the 10 CFR 100

(continued)

PA3.4-211

BASES

dose guideline limits following a SGTR accident with. The SGTR safety analysis (Ref. 2) assumes the specific activity of the reactor coolant at the LCO limit and an existing reactor coolant steam generator (SG) tube leakage rate of 1 gpm. The values for the limits on specific activity represent limits based upon a parametric evaluation by the NRC of typical site locations. These values are conservative in that specific site parameters of the Prairie Island site, such as site boundary location and meteorological conditions, were not considered in this evaluation (Ref. 2). The safety analysis assumes the specific activity of the secondary coolant at its limit of 0.1 μCi/gm DOSE EQUIVALENT I-131 from LCO 3.7.6, "Secondary Specific Activity." CL3.4-324

APPLICABLE SAFETY ANALYSES (continued)

The analysis for the SGTR accident establishes the acceptance limits for RCS specific activity. Reference to this analysis is used to assess changes to the unit that could affect RCS specific activity, as they relate to the acceptance limits. CL3.4-324

The analysis is for two cases of reactor coolant specific activity. One case assumes specific activity at 1.0 μCi/gm DOSE EQUIVALENT I-131 with a concurrent large iodine spike that increases the I-131 activity in the reactor coolant by a factor of about 50 immediately after the accident. The second case assumes the initial reactor coolant iodine activity at 60.0 μCi/gm DOSE EQUIVALENT I-131 due to a pre-accident iodine spike caused by an RCS transient. In both cases, the noble gas activity in the reactor coolant assumes 1% failed fuel, which closely equals the LCO limit of 100/Ē μCi/gm for gross specific activity. CL3.4-324

The analysis also assumes a loss of offsite power at the same time as the SGTR event. The SGTR causes a reduction in reactor coolant inventory. The reduction initiates a

(continued)

PA3.4-211

BASES

~~reactor trip from a low pressurizer pressure signal or an RCS overtemperature ΔT signal.~~

~~The coincident loss of offsite power causes the steam dump valves to close to protect the condenser. The rise in pressure in the ruptured SG discharges radioactively contaminated steam to the atmosphere through the SG power operated relief valves and the main steam safety valves. The unaffected SGs remove core decay heat by venting steam to the atmosphere until the cooldown ends.~~ CL3.4-324

~~The safety analysis shows the radiological consequences of an SGTR accident are within a small fraction of the Reference 1 dose guideline limits. Operation with iodine specific activity levels greater than the LCO limit is permissible, if the activity levels do not exceed the limits shown in Figure 3.4.16-1, in the applicable specification, for more than 48 hours. The safety analysis has concurrent and pre-accident iodine spiking levels up to 60.0 μCi/gm DOSE EQUIVALENT I-131.~~

~~The remainder of the above limit permissible iodine levels shown in Figure 3.4.16-1 are acceptable because of the low probability of a SGTR accident occurring during the established 48 hour time limit. The occurrence of an SGTR~~ CL3.4-324

~~APPLICABLE SAFETY ANALYSES (continued)~~

~~accident at these permissible levels could increase the site boundary dose levels, but still be within 10 CFR 100 dose guideline limits.~~

The limits on RCS specific activity are also used for establishing standardization in radiation shielding and plant personnel radiation protection practices.

RCS specific activity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii) ~~the NRC Policy Statement~~.

(continued)

PA3.4-211

BASES

LCO

The specific iodine activity is limited to 1.0 μCi/gm DOSE EQUIVALENT I-131, and the gross specific activity in the reactor coolant is limited to the number of μCi/gm equal to 100 divided by Ē (average disintegration energy of the sum of the average beta and gamma energies of the coolant nuclides). The limit on DOSE EQUIVALENT I-131 ensures the 2 hour thyroid dose to an individual at the site boundary during the Design Basis Accident (DBA) will be a small fraction of the allowed thyroid dose. The limit on gross specific activity ensures the 2 hour whole body dose to an individual at the site boundary during the DBA will be a small fraction of the allowed whole body dose.

The SGTR accident analysis (Ref. 32) shows that the 2 hour site boundary dose levels are within acceptable limits. Violation of the LCO may result in reactor coolant radioactivity levels that could, in the event of an SGTR, lead to site boundary doses that exceed the 10 CFR 100 dose guideline limits.

APPLICABILITY

In MODES 1 and 2, and in MODE 3 with RCS average temperature ≥ 500°F, operation within the LCO limits for DOSE EQUIVALENT I-131 and gross specific activity are necessary to contain the potential consequences of an SGTR to within the acceptable site boundary dose values.

For operation in MODE 3 with RCS average temperature < 500°F, and in MODES 4 and 5, the release of radioactivity in the event of a SGTR is unlikely since the saturation pressure of the reactor coolant is below the lift pressure settings of the main steam safety valves.

(continued)

PA3.4-211

BASES (continued)

ACTIONS

~~A Note to the ACTIONS excludes the MODE change restriction of LCO 3.0.4. This exception allows entry into the applicable MODE(S) while relying on the ACTIONS even though the ACTIONS may eventually require plant shutdown. This exception is acceptable due to the significant conservatism incorporated into the specific activity limit, the low probability of an event which is limiting due to exceeding this limit, and the ability to restore transient specific activity excursions while the plant remains at, or proceeds to power operation.~~ TA3.4-314

A.1 and A.2

With the DOSE EQUIVALENT I-131 specific activity greater than the LCO limit, samples at intervals of 4 hours must be taken to demonstrate that the limits of Figure 3.4.167-1 are not exceeded. The Completion Time of 4 hours is required to obtain and analyze a sample. Sampling is done to continue to provide a trend. PA3.4-197

The DOSE EQUIVALENT I-131 specific activity must be restored to within limits within 48 hours. The Completion Time of 48 hours is required, if the limit violation resulted from normal iodine spiking.

Permitting POWER OPERATION to continue for limited time periods with the primary coolant's specific activity greater than 1.0 μCi/gm DOSE EQUIVALENT I-131, but within the allowable limit shown on Figure 3.4.17-1, accommodates the possible iodine spiking phenomenon which may occur following changes in THERMAL POWER. Operation with specific activity levels exceeding 1.0 μCi/gm DOSE EQUIVALENT I-131 but within the limits shown on Figure 3.4.17-1 should be minimuzed since the activity levels allowed by the figure increase the dose at the site boundary following a postulated steam generator tube rupture. CL3.4-325

(continued)

BASES (continued) PA3.4-211

A Note to the ACTIONS excludes the MODE change restriction of LCO 3.0.4. This exception allows entry into the applicable MODE(S) while relying on the ACTIONS even though the ACTIONS may eventually require plant shutdown. This exception is acceptable due to the significant conservatism incorporated into the specific activity limit, the low probability of an event which is limiting due to exceeding this limit, and the ability to restore transient specific activity excursions while the plant remains at, or proceeds to power operation. TA3.4-314

B.1~~-and B.2~~

With the gross specific activity in excess of the allowed limit, the reactor must be placed in a MODE in which the requirement does not apply~~an analysis must be performed within 4 hours to determine DOSE EQUIVALENT I-131. The Completion Time of 4 hours is required to obtain and analyze a sample~~. TA3.4-201

The change within 6 hours to MODE 3 and RCS average temperature < 500°F lowers the saturation pressure of the reactor coolant below the setpoints of the main steam safety valves and prevents venting the SG to the environment in an SGTR event. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 below 500°F from full power conditions in an orderly manner ~~and~~ without challenging plant systems.

ACTIONS (continued)

C.1

If a Required Action and the associated Completion Time of Condition A is not met or if the DOSE EQUIVALENT I-131 PA3.4-202

(continued)

BASES

PA3.4-211

specific activity is in the unacceptable region of Figure 3.4.167-1, the reactor must be brought to MODE 3 with RCS average temperature < 500°F within 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 below 500°F from full power conditions in an orderly manner ~~and~~ without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.4.167.1

SR 3.4.167.1 requires performing a gamma isotopic analysis as a measure of the gross specific activity of the reactor coolant at least once every 7 days. While basically a quantitative measure of radionuclides with half lives longer than 15 minutes, excluding iodines, this measurement is the sum of the degassed gamma activities and the gaseous gamma activities in the sample taken. This Surveillance provides an indication of any increase in gross specific activity.

Trending the results of this Surveillance allows proper remedial action to be taken before reaching the LCO limit under normal operating conditions. The Surveillance is applicable in MODES 1 and 2, and in MODE 3 with T_{avg} at least 500°F. The 7 day Frequency considers the unlikelihood of a gross fuel failure during the time.

SR 3.4.167.2

This Surveillance is performed in MODE 1 only to ensure ~~iodine~~DOSE EQUIVALENT I-131 specific activity remains within limit during normal operation and following fast power changes when fuel failure is more apt to occur. The 14 day Frequency is adequate to trend changes in the PA3.4-197

(continued)

PA3.4-211

BASES (continued)

~~iodine~~DOSE EQUIVALENT I-131 specific activity level, considering gross activity is monitored every 7 days. The Frequency, between 2 and 6 hours after a power change ≥ 15% RTP within a 1 hour period, is established because the iodine levels peak during this time following fuel failure; samples at other times would provide inaccurate results.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.167.3

A radiochemical analysis for $\bar{E}$ determination is required every 184 days (6 months) with the plant operating in MODE 1 equilibrium conditions. The $\bar{E}$ determination directly relates to the LCO and is required to verify plant operation within the specified gross activity LCO limit. The analysis for $\bar{E}$ is a measurement of the average energies per disintegration for isotopes with half lives longer than 15 minutes, excluding iodines. The Frequency of 184 days recognizes $\bar{E}$ does not change rapidly.

This SR has been modified by a Note that indicates sampling is required to be performed within 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for at least 48 hours. This ensures that the radioactive materials are at equilibrium so the analysis for $\bar{E}$ is representative and not skewed by a crud burst or other similar abnormal event.

REFERENCES

1. 10 CFR 100.11, 1973.

2. Letter from Dominic C. DiIanni, NRC, to L. O. Mayer, NSP, dated December 4, 1981. CL3.4-324

3. UFSAR, Section 14.5~~[15.6.3]~~.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.189 RCS Loops – Test Exceptions

PA3.4-211

BASES

BACKGROUND

The primary purpose of this test exception is to provide an exception to LCO 3.4.4, "RCS Loops – MODES 1 and 2," to permit reactor criticality under no flow conditions during certain PHYSICS TESTS (natural circulation demonstration, station blackout, and loss of offsite power) to be performed while at low THERMAL POWER levels. Section XI of 10 CFR 50, Appendix B ~~(Ref. 1)~~, requires that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service. All functions necessary to ensure that the specified design conditions are not exceeded during normal operation and anticipated operational occurrences must be tested. This testing is an integral part of the design, construction, and operation of the power plant as specified in AEC GDC Criterion 1~~, "Quality Standards and Records"~~ (Ref. 12). CL3.4-221

The key objectives of a test program are to provide assurance that the facility has been adequately designed to validate the analytical models used in the design and analysis, to verify the assumptions used to predict plant response, to provide assurance that installation of equipment at the unit has been accomplished in accordance with the design, and to verify that the operating and emergency procedures are adequate. Testing is performed prior to initial criticality, during startup, and following low power operations.

~~The tests will include verifying the ability to establish and maintain natural circulation following a plant trip between 10% and 20% RTP, performing natural circulation cooldown on emergency power, and during the cooldown,~~ PA3.4-327

(continued)

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BASES

~~showing that adequate boron mixture occurs and that pressure can be controlled using auxiliary spray and pressurizer heaters powered from the emergency power sources.~~ PA3.4-327

APPLICABLE SAFETY ANALYSES

~~The tests described above require~~ Operating the plant without forced convection flow is ~~and as such are~~ not bounded by any safety analyses. However, operating experience has demonstrated this exception to be safe under the present applicability.

APPLICABLE SAFETY ANALYSES (continued)

~~RCS loops – test exceptions satisfy Criterion 3 of the NRC Policy Statement.~~ As described in LCO 3.0.7, compliance with Test Exception LCOs is optional, and therefore no criteria of 10 CFR 50.36(c)(2)(ii) apply. Test Exception LCOs provide flexibility to perform certain operations by appropriately modifying requirements of other LCOs. A discussion of the criteria for the other LCOs is provided in their respective Bases. TA3.4-316

LCO

This LCO provides an exemption to the requirements of LCO 3.4.4.

The LCO is provided to allow for the performance of PHYSICS TESTS in MODE 2 (after a refueling), where the core cooling requirements are significantly different than after the core has been operating. Without the LCO, plant operations would be held bound to the normal operating LCOs for reactor coolant loops and circulation (MODES 1 and 2), and the appropriate tests could not be performed.

In MODE 2, where core power level is considerably lower and the associated PHYSICS TESTS must be performed, operation is

(continued)

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BASES (continued)

allowed under no flow conditions provided THERMAL POWER is ≤ P-7 and the reactor trip setpoints of the OPERABLE power level channels are set ≤ the allowable value of Table 3.3.1-1, Function 2.b ~~25% RTP~~. This ensures, if some problem caused the plant to enter MODE 1 and start increasing plant power, the Reactor Trip System (RTS) would automatically shut it down before power became too high, and thereby prevent violation of fuel design limits. CL3.4-326

The exemption is allowed even though there are no bounding safety analyses. However, these tests are performed under close supervision during the test program and provide valuable information on the plant's capability to cool down without offsite power available to the reactor coolant pumps.

APPLICABILITY

This LCO is applicable when performing low power PHYSICS TESTS without any forced convection flow. This testing is performed to establish that heat input from nuclear heat does not exceed the natural circulation heat removal capabilities. Therefore, no safety or fuel design limits will be violated as a result of the associated tests.

ACTIONS

A.1

When THERMAL POWER is ≥ the P-7 interlock setpoint ~~10%~~, the only acceptable action is to ensure the reactor trip breakers (RTBs) are opened immediately in accordance with Required Action A.1 to prevent operation of the fuel beyond its design limits. Opening the RTBs will shut down the reactor and prevent operation of the fuel outside of its design limits. CL3.4-326

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BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.189.1

Verification that the power level is < the P-7 interlock setpoint ~~(10%)~~ will ensure that the fuel design criteria are not violated during the performance of the PHYSICS TESTS. The Frequency of once per hour is adequate to ensure that the power level does not exceed the limit. Plant operations are conducted slowly during the performance of PHYSICS TESTS and monitoring the power level once per hour is sufficient to ensure that the power level does not exceed the limit. CL3.4-326

SR 3.4.189.2

The power range and intermediate range neutron channels~~detectors~~ and the P-7 interlock setpoint must be verified to be OPERABLE and adjusted to the proper value. A COT is performed ~~within 12 hours~~ prior to initiation of the PHYSICS TESTS. This will ensure that the RTS is properly aligned to provide the required degree of core protection during the performance of the PHYSICS TESTS. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL OPERATIONAL TEST of a relay. This is acceptable because all of the required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions. ~~The time limit of 12 hours is sufficient to ensure that the instrumentation is OPERABLE shortly before initiating PHYSICS TESTS.~~ TA3.4-206 TA3.4-313

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BASES (continued)

REFERENCES

1. AEC "General Design Criteria for Nuclear Power Plant Construction," Criterion 1, issued for comment July 10, 1967, as referenced in USAR Section 1.2 ~~10 CFR 50, Appendix B, Section XI~~. CL3.4-221

~~2. 10 CFR 50, Appendix A, GDC 1, 1988.~~