1.12 <u>Frequency Notation</u>

The frequency notation specified for the performance of surveillance requirements shall correspond to the intervals defined below.

Notation	Frequency
S, Each Shift	At least once per 12 hours
D, Daily	At least once per 24 hours
Twice per week	At least once per 4 days and at least twice per 7 days
W, Weekly	At least once per 7 days
B/W, Biweekly	At least once per 14 days
M, Monthly	At least once per 31 days
B/M, Bimonthly	At least once per 62 days
Q, Quarterly	At least once per 92 days
SA, Semiannually	At least once per 6 months
A, Annually	At least once per 12 months
1.i R	At least once per 18 months
S/U	Prior to each startup
N.A.	Not Applicable
P	Prior to each startup if not done previous week
PR	Within 12 hours prior to each release

1.13 <u>Offsite Dose Calculation Manual (ODCM)</u>

The ODCM is a manual containing the methodology and parameters to be used for calculating the offsite

13.v

~~3.3 Emergency Core Cooling System, Auxiliary Cooling Systems, Air Recirculation Fan Coolers, Containment Spray, and Charcoal/HEPA Filters~~

~~Objective~~

~~To define those conditions for operation that are necessary: (1) to remove decay heat from the core in emergency or normal shutdown situations, (2) to remove heat from containment in normal operating and emergency situations, (3) to remove airborne iodine from the containment atmosphere following a postulated Design Basis Accident, and (4) to minimize containment leakage to the environment subsequent to a Design Basis Accident.~~

~~Specification~~

3.3.1 Safety Injection and Residual Heat Removal Systems

3.3.1.1 The reactor shall not be taken above the mode indicated unless the following conditions are met:

13.ii LCO 3.5.4 SR 3.5.4.1 SR 3.5.4.2

a. Above cold shutdown, the refueling water storage tank contains not less than 300,000 gallons of water, with a boron concentration of at least 2000 ppm.

LCO 3.5.1 13.i 13.vi 13.vii

b. Above a reactor coolant system pressure of 1600 psig, except during performance of RCS hydro test, each accumulator is pressurized to at least 700 psig with an indicated level of at least 50% and a maximum of 82% with a boron concentration of at least 1800 ppm.

LCO 3.5.2 13.iii

c. At or above a reactor coolant system temperature of 350°F, three safety injection pumps are operable.

LCO 3.5.2

d. At or above an RCS temperature of 350°F, two residual heat removal pumps are operable.

LCO 3.5.2

e. At or above an RCS temperature of 350°F, two residual heat removal heat exchangers are operable.

LCO 3.5.1
LCO 3.5.2
LCO 3.5.4

f. At the conditions required in a through e above, all valves, interlocks and piping associated with the above components which are required to function during accident conditions are operable.

LCO 3.5.2
13.viii

g. At or above an RCS temperature of 350°F, A.C. power shall be removed from the following valves with the valves in the open position: safety injection cold leg injection valves 878B and D. A.C. power shall be removed from safety injection hot leg injection valves 878A and C with the valves closed. D.C. control power shall be removed from refueling water storage tank delivery valves 896A, 896B and 856 with the valves open.

h. At or above an RCS temperature of 350°F, check valves 853A, 853B, 867A, 867B, 878G, and 878J shall be operable with less than 5.0 gpm leakage each. The leakage requirements of Technical Specification 3.1.5.2.1 are still applicable.

LCO 3.5.1
SR 3.5.1.5

i. Above a reactor coolant system pressure of 1600 psig, except during performance of RCS hydro test, A.C. power shall be removed from accumulator isolation valves 841 and 865 with the valves open.

LCO 3.5.2

j. At or above an RCS temperature of 350° F, A.C. power shall be removed from Safety Injection suction valves 825A and B with the valves in the open position, and from valves 826A, B, C, D with the valves in the closed position.

3.3.1.2 If the conditions of 3.3.1.1a are not met, then satisfy the condition within 1 hour or be at hot shutdown in the next 6 hours and at least cold shutdown within an additional 30 hours.

LCO 3.5.4

13.ii

3.3.1.3 The requirements of 3.3.1.1b and 3.3.1.1i may be modified to allow one accumulator to be inoperable or isolated for up to one hour. If the accumulator is not operable or is still isolated after one hour, the reactor shall be placed in hot shutdown within the following 6 hours and below a RCS pressure of 1600 psig within an additional 6 hours.

LCO 3.5.1

13.i

3.3.1.4 The requirements of 3.3.1.1c may be modified to allow one safety injection pump to be inoperable for up to 72 hours. If the pump is not operable after 72 hours, the reactor shall be placed in hot shutdown within the following 6 hours and below a RCS temperature less than 350°F within an additional 6 hours.

LCO 3.5.2

3.3.1.5 The requirements of 3.3.1.1d through h. may be modified to allow components to be inoperable at any one time. More than one component may be inoperable at any one time provided that one train of the ECCS is operable. If the requirements of 3.3.1.1d through h. are not satisfied within the time period specified below, the reactor shall be placed in hot shutdown within 6 hours and at an RCS temperature less than 350°F in an additional 6 hours.

LCO 3.5.2

a. One residual heat removal pump may be out of service provided the pump is restored to operable status within 72 hours.

LCO 3.5.2

b. One residual heat removal heat exchanger may be out of service for a period of no more than 72 hours.

LCO 3.5.2

c. Any valve, interlock, or piping required for the functioning of one safety injection train and/or one low head safety injection train (RHR) may be inoperable provided repairs are completed within 72 hours (except as specified in e. below).

LCO 3.5.2

d. Power may be restored to any valve referenced in 3.3.1.1g for the purposes of valve testing provided no more than one such valve has power restored and provided testing is completed and power removed within 12 hours.

LCO 3.5.2 (Note)

13.iv

e. Those check valves specified in 3.3.1.1h may be inoperable (greater than 5.0 gpm leakage) provided the inline MOVs are de-energized closed and repairs are completed within 12 hours.

~~3.3.1.6 Deleted~~

The facility has four service water pumps. Only one is needed during the injection phase, and two are required during the recirculation phase of a postulated loss-of-coolant accident.[8] The control room emergency air treatment system is designed to filter the control room atmosphere during periods when the control room is isolated and to maintain radiation levels in the control room at acceptable levels following the Design Basis Accident.[9] Reactor operation may continue for a limited time while repairs are being made to the air treatment system since it is unlikely that the system would be needed. Technical Specification 3.3.5 applies only to the equipment necessary to filter the control room atmosphere. Equipment necessary to initiate isolation of the control room is covered by another specfication.

The limits for the accumulator pressure and volume assure the required amount of water injection during an accident, and are based on values used for the accident analyses. The indicated level of 50% corresponds to 1108 cubic feet of water in the accumulator and the indicated level of 82% corresponds to 1134 cubic feet.

The limitation of no more than one safety injection pump to be operable when overpressure protection is being provided by a RCS vent of ≥ 1.1 sq. in. insures

that the mass addition from the inadvertent operation of safety injection will not result in RHR system pressure exceeding design limits. The limitation on no safety injection pumps operable and the discharge lines isolated when overpressure protection is provided by the pressurizer PORV's removes mass injection from inadvertent safety injection as an event for which this configuration of overpressure protection must be designed to protect. Inoperability of a safety injection pump may be verified from the main control board with the pump control switch in pull stop, or the pump breaker in the test racked out position such that the pump could not start from an inadvertent safety injection signal. Isolation of a safety injection pump discharge path to the RCS may be verified from the main control board by the discharge MOV switch position indicating closed, or the discharge valve closed with A.C. power removed, or a manual discharge path isolation valve closed such that operation of the associated safety injection pump would not result in mass injection to the RCS.

High concentration boric acid is not needed to mitigate the consequences of a design basis accident. Reference (10) demonstrates that the design basis accidents can be mitigated by safety injection flow of RWST concentration. Therefore, SI pump suction is taken from the RWST. Requiring that the safety injection suction valves (825A and B, 826A, B, C and D) are aligned with A.C. power removed insures that the safety injection system would not be exposed to high concentration boric acid and the assumptions of the accident analysis are satisfied.

References

(1) Deleted

(2) UFSAR Section 6.3.3.1

(3) UFSAR Section 6.2.2.1

(4) UFSAR Section 15.6.4.3

(5) UFSAR Section 9.2.2.4

(6) UFSAR Section 9.2.2.4

(7) Deleted

(8) UFSAR Section 9.2.1.2

(9) UFSAR Section 6.2.1.1 (Containment Integrity) and UFSAR Section 6.4 (CR Emergency Air Treatment)

(10) Westinghouse Report, "R.E. Ginna Boric Acid Storage Tank Boron Concentration Reduction Study" dated Nov. 1992 by C.J. McHugh and J.J. Spryshak

TABLE 4.1-1 (Continued)

	Channel Description	Check	Calibrate	Test	Remarks
	10. Rod Position Bank Counters	S(1,2)	N.A.	N.A.	1) With rod position indication 2) Log rod position indications each 4 hours when rod deviation monitor is out of service
	11. Steam Generator Level	S	R	M	
	12. Charging Flow	N.A.	R	N.A.	
	13. Residual Heat Removal Pump Flow	N.A.	R	N.A.	
	14. Boric Acid Storage Tank Level	D	R	N.A.	Note 4
SR 3.5.4.1	15. Refueling Water Storage Tank Level	N.A.	R	N.A.	
	16. Volume Control Tank Level	N.A.	R	N.A.	
	17. Reactor Containment Pressure	D	R	M(1)	1) Isolation Valve signal
	18. Radiation Monitoring System	D	R	M	Area Monitors R1 to R9, System Monitor R17
	19. Boric Acid Control	N.A.	R	N.A.	
SR 3.4.15.3	20. Containment Drain Sump Level	N.A.	R	N.A.	
	21. Valve Temperature Interlocks	N.A.	N.A.	R	
	22. Pump-Valve Interlock	R	N.A.	N.A.	
	23. Turbine Trip Set-Point	N.A.	R	M(1)	1) Block Trip
SR 3.5.1.2 SR 3.5.1.3 22.c.a	24. Accumulator Level and Pressure	S	R	N.A.	

28.ii

TABLE 4.1-2

MINIMUM FREQUENCIES FOR EQUIPMENT AND SAMPLING TESTS

		Test	Frequency
1.	Reactor Coolant Chemistry Samples	Chloride and Fluoride	3 times/week and at least every third day
		Oxygen	5 times/week and at least every second day except when below 250°F
2.	Reactor Coolant Boron	Boron Concentration	Weekly
SR 3.5.4.2 (28.ii.d) 3.	Refueling Water Storage Tank Water Sample	Boron Concentration	Weekly
4.	Boric Acid Storage Tank	Boron Concentration	Twice/Week(4)
5.	Control Rods	Rod drop times of all full length rods	After vessel head removal and at least once per 18 months (1)
6a.	Full Length Control Rod	Move any rod not fully inserted a sufficient number of steps in any one direction to cause a change of position as indicated by the rod position indication system	Monthly
6b.	Full Length Control Rod	Move each rod through its full length to verify that the rod position indication system transitions occur	Each Refueling Shutdown
7.	Pressurizer Safety Valves	Set point	Each Refueling Shutdown
8.	Main Steam Safety Valves	Set point	Each Refueling Shutdown
9.	Containment Isolation Trip	Functioning	Each Refueling Shutdown
10.	Refueling System Interlocks	Functioning	Prior to Refueling Operations

		Test	Frequency	
11.	Service Water System	Functioning	Each Refueling Shutdown	
12.	Fire Protection Pump and Power Supply	Functioning	Monthly	
13.	Spray Additive Tank	NaOH Concent	Monthly	
SR 3.5.1.4 14.	Accumulator	Boron Concentration	Bi-Monthly	28.ii.a 28.ii.b 28.ii.c
15.	Primary System Leakage	Evaluate	Daily	
16.	Diesel Fuel Supply	Fuel Inventory	Daily	
17.	Spent Fuel Pit	Boron Concentration	Monthly	
18.	Secondary Coolant Samples	Gross Activity	72 hours (2) (3)	
19.	Circulating Water Flood Protection Equipment	Calibrate	Each Refueling Shutdown	

Notes:

(1) Also required for specifically affected individual rods following any maintenance on or modification to the control rod drive system which could affect the drop time of those specific rods.

(2) Not required during a cold or refueling shutdown.

(3) An isotopic analysis for I-131 equivalent activity is required at least monthly whenever the gross activity determination indicates iodine concentration greater than 10% of the allowable limit but only once per 6 months whenever the gross activity determination indicates iodine concentration below 10% of the allowable limit.

(4) When BAST is required to be operable.

32.iv

4.5 **Safety Injection, Containment Spray and Iodine Removal Systems Tests**

Applicability:

Applies to testing of the Safety Injection System, the Containment Spray System, and the Air Filtration System inside Containment.

Objective:

To verify that the subject systems will respond promptly and perform their intended functions, if required.

Specification:

4.5.1 **Safety Tests**

4.5.1.1 **Safety Injection System**

a. System tests shall be performed at each reactor refueling interval. The test shall be performed in accordance with the following:

SR 3.5.2.5

32.i

With the reactor coolant system pressure less than or equal to 350 psig and temperature less than or equal to 350°F, a test safety injection signal will be applied to initiate operation of the system. The safety injection and residual heat removal pump motors are prevented from starting during the test.

SR 3.5.2.5

b. The system test will be considered satisfactory if control board indication and visual observations indicate that all valves have received the Safety Injection signal and have completed their travel. The proper sequence and timing of the rotating components are to be verified in conjunction with Section 4.6.1 b.

4.5.1.2 Containment Spray System

a. System tests shall be performed at each reactor refueling interval. The test shall be performed with the isolation valves, in the spray supply lines, at the containment blocked closed. Operation of the system is initiated by tripping the normal actuation instrumentation.

b. The spray nozzles shall be checked for proper functioning at least every five years.

c. The test will be considered satisfactory if visual observations indicate all components have operated satisfactorily.

4.5.2 Component Tests

4.5.2.1 Pumps

SR 3.5.2.4

32.ii

a. Except during cold or refueling shutdowns the safety injection pumps, residual heat removal pumps, and containment spray pumps shall be started at intervals not to exceed one month. The pumps shall be tested prior to startup if the time since the last test exceeds 1 month.

SR 3.5.2.4

32.ii

b. Acceptable levels of performance for the pumps shall be that the pumps start, operate, and develop the minimum discharge pressure for the flows listed in the table below:

PUMPS	RECYCLE FLOW RATE	DISCHARGE PRESSURE	Notes
Containment Spray Pumps	35 gpm	240 psig	
Residual Heat Removal Pumps	[200 gpm] 450 gpm	[140 psig] 138 psig	(1)
Safety Injection Pumps	[50 gpm] 150 gpm	[1420 psig] 1356 psig	(2)

Table 4.5-1

Notes

(1) Items in square brackets are effective until the installation of the new residual heat removal minimum flow recirculation system.

(2) Items in square brackets are effective until installation of the new safety injection minimum flow recirculation system.

4.5.2.2 Valves

a. Except during cold or refueling shutdowns the spray additive valves shall be tested at intervals not to exceed one month. With the pumps shut down and the valves upstream and downstream

of the spray additive valves closed, each valve will be opened and closed by operator action. This test shall be performed prior to startup if the time since the last test exceeds one month.

c. The accumulator check valves shall be checked for operability during each refueling shutdown.

32.iii

4.5.2.3 Air Filtration System

4.5.2.3.1 At least once every 18 months or after every 720 hours of charcoal filtration system operation since the last test, or following painting, fire or chemical release in any ventilation zone communicating with the system, the post accident charcoal system shall have the following conditions demonstrated

a. The pressure drop across the charcoal adsorber bank is less than 3 inches of water at design flow rate ($\pm$ 10%).

b. In place Freon testing, under ambient conditions, shall show at least 99% removal.

c. The iodine removal efficiency of at least one charcoal filter cell shall be measured. The filter cell to be tested shall be selected randomly from those cells with the longest in-bank residence time. The minimum acceptable value for filter efficiency is 90% for removal of methyl iodide when tested at at least 286°F and 95% RH and at 1.5 to 2.0 mg/m^3 loading with tagged CH_3I.

ATTACHMENT C

Proposed Revised R.E. Ginna Nuclear Power Plant
Improved Technical Specifications

Revise the pages as follows:

Remove	Insert
Table of Contents	Ginna Station ITS Table of Contents
Entire Section 1.0	Ginna Station ITS Section 1.0
Entire Section 2.0	Ginna Station ITS Section 2.0
Entire Section 3.0	Ginna Station ITS Section 3.0
Entire Section 4.0	---
Entire Section 5.0	Ginna Station ITS Section 4.0
Entire Section 6.0	Ginna Station ITS Section 5.0

ONLY SECTION 3.5 IS PROVIDED AT THIS TIME

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Accumulators

LCO 3.5.1 Two ECCS accumulators shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODE 3 with pressurizer pressure > 1600 psig.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One accumulator inoperable due to boron concentration not within limits.	A.1 Restore boron concentration to within limits.	72 hours
B. One accumulator inoperable for reasons other than Condition A.	B.1 Restore accumulator to OPERABLE status.	1 hour
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Reduce pressurizer pressure to ≤ 1600 psig.	6 hours 12 hours
D. Two accumulators inoperable.	D.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.1.1	Verify each accumulator motor operated isolation valve is fully open.	12 hours
SR 3.5.1.2	Verify borated water volume in each accumulator is ≥ 1120 cubic feet (50%) and ≤ 1190 cubic feet (82%).	12 hours
SR 3.5.1.3	Verify nitrogen cover pressure in each accumulator is ≥ 700 psig and ≤ 790 psig.	12 hours
SR 3.5.1.4	Verify boron concentration in each accumulator is ≥ 1800 ppm and ≤ 2900 ppm.	31 days on a STAGGERED TEST BASIS
SR 3.5.1.5	Verify power is removed from each accumulator motor operated isolation valve operator when pressurizer pressure is > 1600 psig.	31 days

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.2 ECCS — Operating

LCO 3.5.2 Two ECCS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

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

1. In MODE 3, both safety injection (SI) pump flow paths may be isolated by closing the isolation valves for up to 2 hours to perform pressure isolation valve testing per SR 3.4.14.1. Power may be restored to motor operated isolation valves 878A, 878B, 878C, and 878D for up to 12 hours for the purpose of testing per SR 3.4.14.1 provided that power is restored to only one valve at a time.

2. Operation in MODE 3 with ECCS pumps declared inoperable pursuant to LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," is allowed for up to 4 hours or until the temperature of both RCS cold legs exceeds 375°F, whichever comes first.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One train inoperable. <u>AND</u> At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available.	A.1 Restore train to OPERABLE status.	72 hours

(continued)

[illegible]

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours
C. Two trains inoperable.	C.1 Enter LCO 3.0.3	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.1	Verify the following valves are in the listed position. Number / Position / Function 825A Open RWST Suction to SI Pumps 825B Open RWST Suction to SI Pumps 826A Closed BAST Suction to SI Pumps 826B Closed BAST Suction to SI Pumps 826C Closed BAST Suction to SI Pumps 826D Closed BAST Suction to SI Pumps 851A Open Sump B to RHR Pumps 851B Open Sump B to RHR Pumps 856 Open RWST Suction to RHR Pumps 878A Closed SI Injection to RCS Hot Leg 878B Open SI Injection to RCS Cold Leg 878C Closed SI Injection to RCS Hot Leg 878D Open SI Injection to RCS Cold Leg 896A Open RWST Suction to SI and Containment Spray 896B Open RWST Suction to SI and Containment Spray	12 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.2.2	Verify each ECCS manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.5.2.3	Verify each breaker or key switch, as applicable, for each valve listed in SR 3.5.2.1, is in the correct position.	31 days
SR 3.5.2.4	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.5.2.5	Verify each ECCS automatic valve in the flow path that is not locked, sealed, or otherwise secured in position actuates to the correct position on an actual or simulated actuation signal.	24 months
SR 3.5.2.6	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	24 months

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.3 ECCS — Shutdown

LCO 3.5.3 One ECCS train shall be OPERABLE.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required ECCS residual heat removal (RHR) subsystem inoperable.	A.1 Initiate action to restore required ECCS RHR subsystem to OPERABLE status.	Immediately
B. Required ECCS Safety injection (SI)subsystem inoperable.	B.1 Restore required ECCS SI subsystem to OPERABLE status.	1 hour
C. Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 5.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.3.1	------------------NOTE------------------ An RHR train may be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned to the ECCS mode of operation. -- The following SR is applicable for all equipment required to be OPERABLE: SR 3.5.2.4	In accordance with applicable SR

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.4 Refueling Water Storage Tank (RWST)

LCO 3.5.4 The RWST shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RWST boron concentration not within limits.	A.1 Restore RWST to OPERABLE status.	8 hours
B. RWST water volume not within limits.	B.1 Restore RWST to OPERABLE status.	1 hour
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify RWST borated water volume is ≥ 300,000 gallons (88%).	7 days
SR 3.5.4.2	Verify RWST boron concentration is ≥ 2000 ppm and ≤ 2900 ppm.	7 days

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.1 Accumulators

BASES

BACKGROUND

The functions of the ECCS accumulators are to supply water to the reactor vessel during the blowdown phase of a large break loss of coolant accident (LOCA), to provide inventory to help accomplish the refill phase that follows thereafter, and to provide Reactor Coolant System (RCS) makeup for a small break LOCA.

The blowdown phase of a large break LOCA is the initial period of the transient during which the RCS departs from equilibrium conditions, and heat from fission product decay, hot internals, and the vessel continues to be transferred to the reactor coolant. The reactor coolant inventory is vacating the core during this phase through steam flashing and ejection out through the break. The blowdown phase of the transient ends when the RCS pressure falls to a value approaching that of the containment atmosphere.

In the refill phase of a LOCA, which immediately follows the blowdown phase, the core is essentially in adiabatic heatup. The balance of accumulator inventory is available to reflood the core and help fill voids in the lower plenum and reactor vessel downcomer so as to establish a recovery level at the bottom of the core.

The accumulators are pressure vessels partially filled with borated water and pressurized with nitrogen gas. The accumulators are passive components, since no operator or control actions are required in order for them to perform their function. Internal accumulator tank pressure is sufficient to discharge the accumulator contents to the RCS, if RCS pressure decreases below the accumulator pressure.

(continued)

BASES (continued)

BACKGROUND (continued)

Each accumulator is piped into an RCS cold leg via an accumulator line and is isolated from the RCS by a motor operated isolation valve and two check valves in series. The motor operated isolation valves (841 and 865) are maintained open with AC power removed under administrative control when pressurizer pressure is > 1600 psig. This feature ensures that the valves meet the single failure criterion of manually-controlled electrically operated valves per Branch Technical Position (BTP) ICSB-18 (Ref. 1). This is also discussed in References 2 and 3.

The accumulator size, water volume, and nitrogen cover pressure are selected so that one of the two accumulators is sufficient to partially cover the core before significant clad melting or zirconium water reaction can occur following a LOCA. The need to ensure that one accumulator is adequate for this function is consistent with the LOCA assumption that the entire contents of one accumulator will be lost via the RCS pipe break during the blowdown phase of the LOCA.

APPLICABLE SAFETY ANALYSES

The accumulators are assumed OPERABLE in both the large and small break LOCA analyses at full power (Ref. 4). These are the Design Basis Accidents (DBAs) that establish the acceptance limits for the accumulators. Reference to the analyses for these DBAs is used to assess changes in the accumulators as they relate to the acceptance limits.

In performing the LOCA calculations, conservative assumptions are made concerning the availability of ECCS flow. In the early stages of a large break LOCA, with or without a loss of offsite power, the accumulators provide the sole source of makeup water to the RCS. The assumption of loss of offsite power is required by regulations and conservatively imposes a delay wherein the ECCS pumps cannot deliver flow until the emergency diesel generators start, come to rated speed, and go through their timed loading sequence. In cold leg break scenarios, the entire contents of one accumulator are assumed to be lost through the break.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES (continued)

The limiting large break LOCA is a double ended guillotine break at the discharge of the reactor coolant pump. During this event, the accumulators discharge to the RCS as soon as RCS pressure decreases to below accumulator pressure. As a conservative estimate, no credit is taken for ECCS pump flow until an effective delay has elapsed. This delay accounts for SI signal generation, the diesels starting, and the pumps being loaded and delivering full flow. During this time, the accumulators are analyzed as providing the sole source of emergency core cooling. No operator action is assumed during the blowdown stage of a large break LOCA.

The worst case small break LOCA analyses also assume a time delay before pumped flow reaches the core. For the larger range of small breaks, the rate of blowdown is such that the increase in fuel clad temperature is terminated solely by the accumulators, with pumped flow then providing continued cooling. As break size decreases, the accumulators and safety injection pumps both play a part in terminating the rise in clad temperature. As break size continues to decrease, the role of the accumulators continues to decrease until they are not required and the safety injection pumps become solely responsible for terminating the temperature increase.

This LCO helps to ensure that the following acceptance criteria established for the ECCS by 10 CFR 50.46 (Ref. 5) will be met following a LOCA:

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

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

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

d. Core is maintained in a coolable geometry.

Since the accumulators discharge during the blowdown phase of a LOCA, they do not contribute to the long term cooling requirements of 10 CFR 50.46.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES (continued)

For both the large and small break LOCA analyses, a nominal contained accumulator water volume is used. The contained water volume is the same as the deliverable volume for the accumulators, since the accumulators are emptied, once discharged. For small breaks, an increase in water volume is a peak clad temperature penalty due to the reduced gas volume. A peak clad temperature penalty is an assumed increase in the calculated peak clad temperature due to a change in an input parameter. For large breaks, an increase in water volume can be either a peak clad temperature penalty or benefit, depending on downcomer filling and subsequent spill through the break during the core reflooding portion of the transient. The analysis uses a nominal accumulator volume and includes the line water volume from the accumulator to the check valve due to these competing effects.

The minimum boron concentration setpoint is used in the post LOCA boron concentration calculation. The calculation is performed to assure reactor subcriticality in a post LOCA environment. Of particular interest is the large break LOCA, since no credit is taken for control rod assembly insertion. A reduction in the accumulator minimum boron concentration would produce a subsequent reduction in the available containment sump concentration for post LOCA shutdown and an increase in the maximum sump pH. The maximum boron concentration is used in determining the time frame in which boron precipitation is addressed post LOCA. The maximum boron concentration limit is based on the coldest expected temperature of the accumulator water volume and on chemical effects resulting from operation of the ECCS and the Containment Spray System. A value of 2,900 ppm would not create the potential for boron precipitation in the accumulator assuming a containment temperature of 40°F (Ref. 6). Analyses performed in response to 10 CFR 50.49 (Ref. 7) assumed a chemical spray solution of 2000 to 3000 ppm boron concentration (Ref. 6) which provides a margin of 100 ppm. The chemical spray solution impacts sump pH and the resulting effect of chloride and caustic stress corrosion on mechanical systems and components. The sump pH also affects the rate of hydrogen generation within containment due to the interaction of Containment Spray and sump fluid with aluminum components.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES (continued)

The large and small break LOCA analyses are performed at the minimum nitrogen cover pressure, since sensitivity analyses have demonstrated that higher nitrogen cover pressure results in a computed peak clad temperature benefit. The maximum nitrogen cover pressure limit prevents accumulator relief valve actuation at 800 psig, and ultimately preserves accumulator integrity.

The effects on containment mass and energy releases from the accumulators are accounted for in the appropriate analyses (Refs. 8 and 9).

The accumulators satisfy Criterion 3 of the NRC Policy Statement.

LCO

The LCO establishes the minimum conditions required to ensure that the accumulators are available to accomplish their core cooling safety function following a LOCA. Two accumulators are required to ensure that 100% of the contents of one accumulator will reach the core during a LOCA. This is consistent with the assumption that the contents of one accumulator spill through the break. If less than one accumulator is injected during the blowdown phase of a LOCA, the ECCS acceptance criteria of 10 CFR 50.46 (Ref. 5) could be violated.

For an accumulator to be considered OPERABLE, the motor-operated isolation valve must be fully open, power removed above 1600 psig, and the limits established in the SRs for contained volume, boron concentration, and nitrogen cover pressure must be met.

APPLICABILITY

In MODES 1 and 2, and in MODE 3 with RCS pressure > 1600 psig, the accumulator OPERABILITY requirements are based on full power operation. Although cooling requirements decrease as power decreases, the accumulators are still required to provide core cooling as long as elevated RCS pressures and temperatures exist.

(continued)

BASES (continued)

APPLICABILITY (continued)

This LCO is only applicable at pressures > 1600 psig. At pressures ≤ 1600 psig, the rate of RCS blowdown is such that the ECCS pumps can provide adequate injection to ensure that peak clad temperature remains below the 10 CFR 50.46 (Ref. 5) limit of 2200°F.

In MODE 3, with RCS pressure ≤ 1600 psig, and in MODES 4, 5, and 6, the accumulator motor operated isolation valves are closed to isolate the accumulators from the RCS. This allows RCS cooldown and depressurization without discharging the accumulators into the RCS or requiring depressurization of the accumulators.

ACTIONS

A.1

If the boron concentration of one accumulator is not within limits, it must be returned to within the limits within 72 hours. In this Condition, ability to maintain subcriticality or minimum boron precipitation time may be reduced. The boron in the accumulators contributes to the assumption that the combined ECCS water in the partially recovered core during the early reflooding phase of a large break LOCA is sufficient to keep that portion of the core subcritical. One accumulator below the minimum boron concentration limit, however, will have no effect on available ECCS water and an insignificant effect on core subcriticality during reflood since the accumulator water volume is very small when compared to RCS and RWST inventory. Boiling of ECCS water in the core during reflood concentrates boron in the saturated liquid that remains in the core. In addition, current analysis techniques demonstrate that the accumulators are not expected to discharge following a large main steam line break. Even if they do discharge, their impact is minor and not a design limiting event. Thus, 72 hours is allowed to return the boron concentration to within limits.

(continued)

BASES (continued)

ACTIONS (continued)

B.1

If one accumulator is inoperable for a reason other than boron concentration, the accumulator must be returned to OPERABLE status within 1 hour. In this Condition, the required contents of one accumulator cannot be assumed to reach the core during a LOCA. Due to the severity of the consequences should a LOCA occur in these conditions, the 1 hour Completion Time to open the valve, remove power to the valve, or restore the proper water volume or nitrogen cover pressure ensures that prompt action will be taken to return the inoperable accumulator to OPERABLE status. The Completion Time minimizes the potential for exposure of the plant to a LOCA under these conditions.

C.1 and C.2

If the accumulator cannot be returned to OPERABLE status 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 MODE 3 within 6 hours and pressurizer pressure reduced to ≤ 1600 psig 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.

D.1

If both accumulators are inoperable, the plant is in a condition outside the accident analyses; therefore, LCO 3.0.3 must be entered immediately.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.5.1.1

Each accumulator motor-operated isolation valve should be verified to be fully open every 12 hours. Use of control board indication for valve position is an acceptable verification. This verification ensures that the accumulators are available for injection and ensures timely discovery if a valve should be less than fully open. If an isolation valve is not fully open, the rate of injection to the RCS would be reduced. Although a motor operated valve position should not change with power removed, a closed valve could result in not meeting accident analyses assumptions. This Frequency is considered reasonable in view of other administrative controls that ensure a mispositioned isolation valve is unlikely.

SR 3.5.1.2 and SR 3.5.1.3

The borated water volume and nitrogen cover pressure should be verified every 12 hours for each accumulator. This Frequency is sufficient to ensure adequate injection during a LOCA. Because of the static design of the accumulator, a 12 hour Frequency usually allows the operator to identify changes before limits are reached. Main control board alarms are also available for these accumulator parameters. Operating experience has shown this Frequency to be appropriate for early detection and correction of off normal trends.

SR 3.5.1.4

The boron concentration should be verified to be within required limits for each accumulator every 31 days on a STAGGERED TEST Frequency since the static design of the accumulators limits the ways in which the concentration can be changed. The 31 day STAGGERED TEST Frequency is adequate to identify changes that could occur from mechanisms such as stratification or inleakage.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.5

Verification every 31 days that power is removed from each accumulator isolation valve operator when the pressurizer pressure is > 1600 psig ensures that an active failure could not result in the undetected closure of an accumulator motor operated isolation valve. If this were to occur, no accumulators would be available for injection if the LOCA were to occur in the cold leg containing the only OPERABLE accumulator. Since power is removed under administrative control and valve position is verified every 12 hours, the 31 day Frequency will provide adequate assurance that power is removed.

REFERENCES

1. Branch Technical Position (BTP) ICSB-18 "Application of the Single Failure Criterion to Manually-Controlled Electrically Operated Valves."

2. Letter from D. M. Crutchfield, NRC, to J. E. Maier, RG&E, Subject: "SEP Topics VI-7.F, VII-3, VII-6, and VIII-2," dated June 24, 1981.

3. Letter from R. A. Purple, NRC, to L. D. White, RG&E, Subject: "Issuance of Amendment 7 to Provisional Operating License No. DPR-18," dated May 14, 1975.

4. UFSAR, Section 6.3.

5. 10 CFR 50.46.

6. UFSAR, Section 3.11.

7. 10 CFR 50.49.

8. UFSAR, Section 6.2.

9. UFSAR, Section 15.6.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.2 ECCS — Operating

BASES

BACKGROUND

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

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

b. Rod ejection accident;

c. Loss of secondary coolant accident, including uncontrolled steam release or loss of feedwater; and

d. Steam generator tube rupture (SGTR).

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

There are two phases of ECCS operation: cold leg injection and cold leg recirculation. In the injection phase, water is taken from the refueling water storage tank (RWST) and injected into the Reactor Coolant System (RCS) through the cold legs and reactor vessel upper plenum. When sufficient water is removed from the RWST to ensure that enough boron has been added to maintain the reactor subcritical and the containment sump has enough water to supply the required net positive suction head to the ECCS pumps, suction is switched to Containment Sump B for cold leg recirculation. After approximately 20 hours, simultaneous ECCS injection is used to reduce the potential for boiling in the top of the core and any resulting boron precipitation.

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

(continued)

BASES (continued)

BACKGROUND (continued)

The ECCS flow paths which comprise the redundant trains consist of piping, valves, heat exchangers, and pumps such that water from the RWST can be injected into the RCS following the accidents described in this LCO. The major components of each subsystem are the RHR pumps, heat exchangers, and the SI pumps. The RHR subsystem consists of two 100% capacity trains that are interconnected and redundant such that either train is capable of supplying 100% of the flow required to mitigate the accident consequences. The SI subsystem consists of three redundant, 50% capacity pumps which supply two RCS cold leg injection lines. Each injection line is capable of providing 100% of the flow required to mitigate the consequences of an accident. These interconnecting and redundant subsystem designs provide the operators with the ability to utilize components from opposite trains to achieve the required 100% flow to the core.

During the injection phase of LOCA recovery, suction headers supply water from the RWST to the ECCS pumps. A common supply header is used from the RWST to the safety injection (SI) and Containment Spray System pumps. This common supply header is provided with two in-series motor-operated isolation valves (896A and 896B) that receive power from separate sources for single failure considerations. These isolation valves are maintained open with DC control power removed via a key switch located in the control room. The removal of DC control power eliminates the most likely causes for spurious valve actuation while maintaining the capability to manually close the valves from the control room during the recirculation phase of the accident (Ref. 1). The SI pump supply header also contains two parallel motor-operated isolation valves (825A and 825B) which are maintained open by removing AC power. The removal of AC power to these isolation valves is an acceptable design against single failures that could result in undesirable component actuation (Ref. 2).

(continued)

BASES (continued)

BACKGROUND (continued)

A separate supply header is used for the residual heat removal (RHR) pumps. This supply header is provided with a check valve (854) and motor operated isolation valve (856) which is maintained open with DC control power removed via a key switch located in the control room. The removal of DC control power eliminates the most likely causes for spurious valve actuation while maintaining the capability to manually close the valve from the control room during the recirculation phase of the accident (Ref. 3).

The three SI pumps feed two RCS cold leg injection lines. SI Pumps A and B each feeds one of the two injection lines while SI Pump C can feed both injection lines. The discharge of SI Pump C is controlled through use of two normally open parallel motor operated isolation valves (871A and 871B). These isolation valves are designed to close based on the operating status of SI Pumps A and B to ensure that SI Pump C provides the necessary flow through the RCS cold leg injection line containing the failed pump.

The discharges of the two RHR pumps and heat exchangers feed a common injection line which penetrates containment. This line then divides into two redundant core deluge flow paths each containing a normally closed motor operated isolation valve (852A and 852B) and check valve (853A and 853B) which provide injection into the reactor vessel upper plenum.

For LOCAs that are too small to depressurize the RCS below the shutoff head of the SI pumps, the steam generators provide core cooling until the RCS pressure decreases below the SI pump shutoff head.

During the recirculation phase of LOCA recovery, RHR pump suction is manually transferred to Containment Sump B (Refs. 4 and 5). This transfer is accomplished by stopping the RHR pumps, isolating RHR from the RWST by closing motor operated isolation valve 856, opening the Containment Sump B motor operated isolation valves to RHR (850A and 850B) and then starting the RHR pumps. The SI and Containment Spray System pumps are then stopped and the RWST isolated by closing motor operated isolation valve 896A and 896B for the SI and Containment Spray System pump common supply header and closing motor operated isolation valve 897 or 898 for the SI pumps recirculation line.

(continued)

[illegible]

BASES (continued)

BACKGROUND (continued)

The RHR pumps then supply the SI and Containment Spray System pumps (as needed for pressure control purposes) if the RCS pressure remains above the RHR pump shutoff head (Ref. 6). This high-head recirculation path is provided through RHR motor operated isolation valves 857A, 857B, and 857C. These isolation valves are interlocked with valves 896A, 896B, 897, and 898. This interlock prevents opening of the RHR high-head recirculation isolation valves unless either 896A or 896B are closed and either 897 or 898 are closed. If RCS pressure is less than approximately 140 psig, the SI and Containment Spray pumps remain in pull-stop and only RHR is used to provide core cooling. During recirculation, flow is discharged through the same paths as the injection phase. After approximately 20 hours, simultaneous injection by the SI and RHR pumps is used to prevent boron precipitation (Ref. 7). This consists of providing SI through the RCS cold legs and into the lower plenum while providing RHR through the core deluge valves into the upper plenum.

The two redundant flow paths from Containment Sump B to the RHR pumps also contain a motor operated isolation valve located within the sump (851A and 851B). These isolation valves are maintained open with power removed to improve the reliability of switchover to the recirculation phase. The operators for isolation valves 851A and 851B are also not qualified for containment post accident conditions. The removal of AC power to these isolation valves is an acceptable design against single failures that could result in an undesirable actuation (Ref. 2).

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

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

(continued)

BASES (continued)

BACKGROUND (continued)

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

The active ECCS components, along with the passive accumulators and the RWST covered in LCO 3.5.1, "Accumulators," and LCO 3.5.4, "Refueling Water Storage Tank (RWST)," provide the cooling water necessary to meet AIF-GDC 44 (Ref. 8).

APPLICABLE SAFETY ANALYSIS

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. 9), will be met following a LOCA:

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

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

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

d. Core is maintained in a coolable geometry; and

e. Adequate long term core cooling capability is maintained.

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

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSIS (continued)

Both ECCS subsystems are taken credit for in a large break LOCA event at full power (Refs. 6 and 10). This event establishes the requirement for runout flow for the ECCS pumps, as well as the maximum response time for their actuation. The SI pumps are credited in a small break LOCA event. This event establishes the flow and discharge head at the design point for the pumps. The SGTR and MSLB events also credit the SI pumps. The OPERABILITY requirements for the ECCS are based on the following LOCA analysis assumptions:

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

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

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

The effects on containment mass and energy releases are accounted for in appropriate analyses (Refs. 10 and 11). The LCO ensures that an ECCS train will deliver sufficient water to match boiloff rates quickly enough to minimize the consequences of the core being uncovered following a large LOCA. It also ensures that the SI pumps will deliver sufficient water and boron during a small LOCA to maintain core subcriticality. For smaller LOCAs, the SI pumps deliver sufficient fluid to maintain RCS inventory. For a small break LOCA, the steam generators continue to serve as the heat sink, providing part of the required core cooling.

The ECCS trains satisfy Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

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

In MODES 1, 2, and 3, an ECCS train consists of an SI subsystem and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and transferring suction to Containment Sump B. This includes securing the motor operated isolation valves as specified in SR 3.5.2.1 in position by removing the power sources as listed below.

EIN	Position	Secured in Position By
825A	Open	Removal of AC Power
825B	Open	Removal of AC Power
826A	Closed	Removal of AC power
826B	Closed	Removal of AC Power
826C	Closed	Removal of AC Power
826D	Closed	Removal of AC Power
851A	Open	Removal of AC power
851B	Open	Removal of AC Power
856	Open	Removal of DC Control Power
878A	Closed	Removal of AC Power
878B	Open	Removal of AC Power
878C	Closed	Removal of AC Power
878D	Open	Removal of AC Power
896A	Open	Removal of DC Control Power
896B	Open	Removal of DC Control Power

The major components of an ECCS train consists of an RHR pump and heat exchanger taking suction from the RWST (and eventually Containment Sump B), and capable of injecting through one of the two isolation valves to the reactor vessel upper plenum and one of the two lines which provide high-head recirculation to the SI and Containment Spray System pumps.

(continued)

BASES (continued)

LCO (continued)

Also included within the ECCS train are two of three SI pumps capable of taking suction from the RWST and Containment Sump B (via RHR), and injecting through one of the two RCS cold leg injection lines. In the case where SI Pump C is inoperable, both RCS cold leg injection lines must be OPERABLE to provide 100% of the ECCS flow equivalent to to a single train of SI due to the location of check valves 870A and 870B.

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

APPLICABILITY

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

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

As indicated in Note 1, the flow path may be isolated for 2 hours in MODE 3, under controlled conditions, to perform pressure isolation valve testing per SR 3.4.14.1. The flow path is readily restorable from the control room or field test personnel. The note also allows an SI isolation MOV to be powered for up to 12 hours for the performance of this testing.

As indicated in Note 2, operation in MODE 3 with ECCS trains declared inoperable pursuant to LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," is necessary since the LTOP arming temperature is near the MODE 3 boundary temperature of 350°F. LCO 3.4.12 requires that certain pumps be rendered inoperable at and below the LTOP arming temperature. When this temperature is near the MODE 3

(continued)

BASES (continued)

APPLICABILITY (continued)

boundary temperature, time is needed to restore the inoperable pumps to OPERABLE status.

In MODES 4, 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Mode 4 core cooling requirements are addressed by LCO 3.4.6, "RCS Loops - Mode 4," and LCO 3.5.3, "ECCS - Shutdown." Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops — MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops — MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation — High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation — Low Water Level."

ACTIONS

A.1

With one train inoperable and at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on an NRC reliability evaluation (Ref. 12) and is a reasonable time for repair of many ECCS components.

An ECCS train is inoperable if it is not capable of delivering 100% design flow to the RCS. Individual components are inoperable if they are not capable of performing their design function or necessary supporting systems are not available.

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. The intent of this Condition is to maintain a combination of equipment such that 100% of the ECCS flow equivalent to a single OPERABLE ECCS train remains available. This allows increased flexibility in plant operations under circumstances when components in opposite trains are inoperable.

(continued)

BASES (continued)

ACTIONS (continued)

In the case where SI Pump C is inoperable, both RCS cold leg injection lines must be OPERABLE to provide 100% of the ECCS flow equivalent to a single train of SI due to the location of check valves 870A and 870B.

An event accompanied by a loss of offsite power and the failure of an EDG can disable one ECCS train until power is restored. A reliability analysis (Ref. 2) has shown that the impact of having one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.

B.1 and B.2

If the inoperable train cannot be returned to OPERABLE status 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 MODE 3 within 6 hours and 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.

C.1

If both trains of ECCS are inoperable, the plant is in a condition outside the accident analyses; therefore, LCO 3.0.3 must be immediately entered. With one or more component(s) inoperable such that 100% of the flow equivalent to a single OPERABLE ECCS train is not available, the facility is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be immediately entered.

(continued)

[illegible]

[illegible]

[illegible]

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.5.2.1

Verification of proper valve position ensures that the flow path from the ECCS pumps to the RCS is maintained. Use of control board indication for valve position is an acceptable verification. Misalignment of these valves could render both ECCS trains inoperable. The listed valves are secured in position by removal of AC power or key locking the DC control power. These valves are operated under administrative controls such that any changes with respect to the position of the valve breakers or key locks is unlikely. The verification of the valve breakers and key locks is performed by SR 3.5.2.3. Mispositioning of these valves can disable the function of both ECCS trains and invalidate the accident analyses. A 12 hour Frequency is considered reasonable in view of other administrative controls that ensure a mispositioned valve is unlikely.

SR 3.5.2.2

Verifying the correct alignment for manual, power operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a nonaccident position provided the valve will automatically reposition within the proper stroke time. This Surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being mispositioned are in the correct position. The 31 day Frequency is appropriate because the valves are operated under administrative control, and an improper valve position in most cases, would only affect a single train. This Frequency has been shown to be acceptable through operating experience.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.3

Verification every 31 days that AC or DC power is removed, as appropriate, for each valve specified in SR 3.5.2.1 ensures that an active failure could not result in an undetected misposition of a valve which affects both trains of ECCS. If this were to occur, no ECCS injection or recirculation would be available. Since power is removed under administrative control and valve position is verified every 12 hours, the 31 day Frequency will provide adequate assurance that power is removed.

SR 3.5.2.4

Periodic surveillance testing of ECCS pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by Section XI of the ASME Code. This type of testing may be accomplished by measuring the pump developed head at a single point of the pump characteristic curve. This verifies both that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code. Section XI of the ASME Code provides the activities and Frequencies necessary to satisfy the requirements.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.2.5 and SR 3.5.2.6

These Surveillances demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated SI signal and that each ECCS pump starts on receipt of an actual or simulated SI signal. This surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 24 month Frequency is based on the need to perform these Surveillances under the conditions that apply during a plant outage and the potential for unplanned plant transients if the Surveillances were performed with the reactor at power. The 24 month Frequency is also acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment. The actuation logic is tested as part of ESF Actuation System testing, and equipment performance is monitored as part of the Inservice Testing Program.

REFERENCES

1. Letter from R. A. Purple, NRC, to L. D. White, RG&E, Subject: "Issuance of Amendment 7 to Provisional Operating License No. DPR-18," dated May 14, 1975.

2. Branch Technical Position (BTP) ICSB-18, "Application of the Single Failure Criterion to Manually-Controlled Electrically Operated Valves."

3. Letter from A. R. Johnson, NRC, to R. C. Mecredy, RG&E, Subject: "Issuance of Amendment No. 42 to Facility Operating License No. DPR-18, R. E. Ginna Nuclear Power Plant (TAC No. 79829)," dated June 3, 1991.

4. Letter from D. M. Crutchfield, NRC, to J. E. Maier, RG&E, Subject: "SEP Topic VI-7.B: ESF Switchover from Injection to Recirculation Mode, Automatic ECCS Realignment, Ginna," dated December 31, 1981.

5. NUREG-0821.

6. UFSAR, Section 6.3.

(continued)

[illegible]

BASES (continued)

REFERENCES (continued)

7. Letter from D. M. Crutchfield, NRC, to J. E. Maier, RG&E, Subject: "SEP Topic IX-4, Boron Addition System, R. E. Ginna," dated August 26, 1981.

8. Atomic Industrial Forum (AIF) GDC 44, Issued forcomment July 10, 1967.

9. 10 CFR 50.46.

10. UFSAR, Section 15.6.

11. UFSAR, Section 6.2.

12. NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.3 ECCS — Shutdown

BASES

BACKGROUND

The Background section for Bases 3.5.2, "ECCS — Operating," is applicable to these Bases, with the following modifications.

In MODE 4, the required ECCS train consists of two separate subsystems: safety injection (SI) and residual heat removal (RHR).

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the refueling water storage tank (RWST) can be injected into the Reactor Coolant System (RCS) following the accidents described in Bases 3.5.2. The RHR subsystem must also be capable of taking suction from containment Sump B to provide recirculation.

APPLICABLE SAFETY ANALYSES

The Applicable Safety Analyses section of Bases 3.5.2 also applies to this Bases section.

Due to the stable conditions associated with operation in MODE 4 and the reduced probability of occurrence of a Design Basis Accident (DBA), the ECCS operational requirements are reduced. It is understood in these reductions that certain automatic safety injection (SI) actuation is not available. In this MODE, sufficient time exists for manual actuation of the required ECCS to mitigate the consequences of a DBA (Ref. 1).

Only one train of ECCS is required for MODE 4. This requirement dictates that single failures are not considered during this MODE of operation. The ECCS trains satisfy Criterion 3 of the NRC Policy Statement.

LCO

In MODE 4, one of the two independent (and redundant) ECCS trains is required to be OPERABLE to ensure that sufficient ECCS flow is available to the core following a DBA.

(continued)

BASES (continued)

LCO (continued)

In MODE 4, an ECCS train consists of an SI subsystem and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST and transferring suction to the containment sump. The major components of an ECCS train during MODE 4 consists of an RHR pump and heat exchanger, capable of taking suction from the RWST (and eventually Containment Sump B), and able to inject through one of the two isolation valves to the reactor vessel upper plenum. Also included within the ECCS train are one of three SI pumps capable of taking suction from the RWST and injecting through one of the two RCS cold leg injection lines. The high-head recirculation flow path from RHR to the SI pumps is not required in the MODE 4 since there is no accident scenario which prevents depressurization to the RHR pump shutoff head prior to depletion of the RWST.

Based on the time available to respond to accident conditions during MODE 4, ECCS components are OPERABLE if they are capable of being reconfigured to the injection mode from the control room within 10 minutes. This includes taking credit for an RHR pump and heat exchanger as being OPERABLE if they are being used for shutdown cooling purposes.

APPLICABILITY

In MODES 1, 2, and 3, the OPERABILITY requirements for ECCS are covered by LCO 3.5.2.

In MODE 4 with RCS temperature below 350°F, one OPERABLE ECCS train is acceptable without single failure consideration, on the basis of the stable reactivity of the reactor and the limited core cooling requirements.

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops — MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops — MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation — High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation — Low Water Level."

(continued)

BASES (continued)

ACTIONS

A.1

With no ECCS RHR subsystem OPERABLE, the plant is not prepared to respond to a loss of coolant accident or to continue a cooldown using the RHR pumps and heat exchangers. The Completion Time of immediately to initiate actions that would restore at least one ECCS RHR subsystem to OPERABLE status ensures that prompt action is taken to restore the required cooling capacity. Normally, in MODE 4, reactor decay heat is removed from the RCS by an RHR loop. If no RHR loop is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generators. The alternate means of heat removal must continue until the inoperable RHR loop components can be restored to operation so that decay heat removal is continuous.

With both RHR pumps and heat exchangers inoperable, it would be unwise to require the plant to go to MODE 5, where the only available heat removal system is the RHR. Therefore, the appropriate action is to initiate measures to restore one ECCS RHR subsystem and to continue the actions until the subsystem is restored to OPERABLE status.

B.1

With no ECCS SI subsystem OPERABLE, due to the inoperability of the SI pump or flow path from the RWST, the plant is not prepared to provide high pressure response to Design Basis Events requiring SI. The 1 hour Completion Time to restore at least one SI subsystem to OPERABLE status ensures that prompt action is taken to provide the required cooling capacity or to initiate actions to place the plant in MODE 5, where an ECCS train is not required.

C.1

When the Required Actions of Condition B cannot be completed within the required Completion Time, a controlled shutdown should be initiated. Twenty-four hours is a reasonable time, based on operating experience, to reach MODE 5 in an orderly manner and without challenging plant systems or operators.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.5.3.1

The applicable Surveillance description from Bases 3.5.2 apply. This SR is modified by a Note that allows an RHR train to be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned (remote or local) to the ECCS mode of operation and not otherwise inoperable. This allows operation in the RHR mode during MODE 4, if necessary.

REFERENCES

The applicable references from Bases 3.5.2 apply.

1. WCAP-12476, "Evaluation of LOCA During Mode 3 and Mode 4 Operation for Westinghouse NSSS," November 1991.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.4 Refueling Water Storage Tank (RWST)

BASES

BACKGROUND

The RWST supplies borated water to both trains of the ECCS and the Containment Spray System during the injection phase of a loss of coolant accident (LOCA) recovery. A common supply header is used from the RWST to the safety injection (SI) and Containment Spray System pumps. A separate supply header is used for the residual heat removal (RHR) pumps. Isolation valves and check valves are used to isolate the RWST from the ECCS and Containment Spray System prior to transferring to the recirculation mode. The recirculation mode is entered when pump suction is transferred to the containment sump based on RWST level. Use of a single RWST to supply both trains of the ECCS and Containment Spray System is acceptable since the RWST is a passive component, and passive failures are not required to be assumed to occur coincidentally with Design Basis Events.

The RWST is located in the Auxiliary Building which is normally maintained between 50°F and 104°F (Ref. 1). These moderate temperatures provide adequate margin with respect to potential freezing or overheating of the borated water contained in the RWST.

During normal operation in MODES 1, 2, and 3, the safety injection (SI) and residual heat removal (RHR) and Containment Spray System pumps are aligned to take suction from the RWST.

The ECCS and Containment Spray System pumps are provided with recirculation lines that ensure each pump can maintain minimum flow requirements when operating at or near shutoff head conditions. The recirculation lines for the RHR and Containment Spray System pumps are directed from the discharge of the pumps to the pump suction. The recirculation lines for the SI pumps are directed back to the RWST.

(continued)

BASES (continued)

BACKGROUND (continued)

When the suction for the ECCS and Containment Spray System pumps is transferred to the containment sump, the RWST and SI pump recirculation flow paths must be isolated to prevent a release of the containment sump contents to the RWST, which could result in a release of contaminants to the Auxiliary Building and the eventual loss of suction head for the ECCS pumps.

This LCO ensures that:

a. The RWST contains sufficient borated water to support the ECCS during the injection phase;

b. Sufficient water volume exists in the containment sump to support continued operation of the ECCS and Containment Spray System pumps at the time of transfer to the recirculation mode of cooling; and

c. The reactor remains subcritical following a LOCA.

Insufficient water in the RWST could result in inadequate NPSH for the RHR pumps when the transfer to the recirculation mode occurs. Improper boron concentrations could result in a reduction of SDM or excessive boric acid precipitation in the core following the LOCA, as well as excessive caustic stress corrosion of mechanical components and systems inside the containment.

APPLICABLE SAFETY ANALYSES

During accident conditions, the RWST provides a source of borated water to the ECCS and Containment Spray System pumps. As such, it provides containment cooling and depressurization, core cooling, and replacement inventory and is a source of negative reactivity for reactor shutdown (Ref. 3). The design basis transients and applicable safety analyses concerning each of these systems are discussed in the Applicable Safety Analyses section of B 3.5.2, "ECCS — Operating"; B 3.5.3, "ECCS — Shutdown"; and B 3.6.6, "Containment Spray and Cooling Systems." These analyses are used to assess changes to the RWST in order to evaluate their effects in relation to the acceptance limits in the analyses.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSIS (continued)

The RWST must also meet volume, boron concentration, and temperature requirements for non-LOCA events. The volume is not an explicit assumption in non-LOCA events since the volume required for Reactor Coolant System (RCS) makeup is a small fraction of the available RCS volume. The deliverable volume limit is set by the LOCA and containment analyses. For the RWST, the deliverable volume is selected such that switchover to recirculation does not occur until sufficient water has been pumped into containment to provide necessary NPSH for the RHR pumps. The minimum boron concentration is an explicit assumption in the main steam line break (MSLB) analysis to ensure the required shutdown capability. The maximum boron concentration is an explicit assumption in the evaluation of chemical effects resulting from the operation of the Containment Spray System.

For a large break LOCA analysis, the minimum water volume limit of 300,000 gallons and the lower boron concentration limit of 2000 ppm are used to compute the post LOCA sump boron concentration necessary to assure subcriticality. The large break LOCA is the limiting case since the safety analysis assumes that all control rods are out of the core.

The upper limit on boron concentration of 2900 ppm is used to determine the time frame in which boron precipitation is addressed post LOCA. The maximum boron concentration limit is based on the coldest expected temperature of the RWST water volume and on chemical effects resulting from operation of the ECCS and the Containment Spray System. A value of 2,900 ppm would not create the potential for boron precipitation in the RWST assuming an Auxiliary Building temperature of 50°F (Ref. 1). Analyses performed in response to 10 CFR 50.49 (Ref. 2) assumed a chemical spray solution of 2000 to 3000 ppm boron concentration (Ref. 1) which provides a margin of 100 ppm. The chemical spray solution impacts sump pH and the resulting effect of chloride and caustic stress corrosion on mechanical systems and components. The sump pH also affects the rate of hydrogen generation within containment due to the interaction of Containment Spray and sump fluid with aluminum components.

The RWST satisfies Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

The RWST ensures that an adequate supply of borated water is available to cool and depressurize the containment in the event of a Design Basis Accident (DBA), to cool and cover the core in the event of a LOCA, to maintain the reactor subcritical following a DBA, and to ensure adequate level in the containment sump to support ECCS and Containment Spray System pump operation in the recirculation mode.

To be considered OPERABLE, the RWST must meet the water volume and boron concentration limits established in the SRs.

APPLICABILITY

In MODES 1, 2, 3, and 4, RWST OPERABILITY requirements are dictated by ECCS and Containment Spray System OPERABILITY requirements. Since both the ECCS and the Containment Spray System must be OPERABLE in MODES 1, 2, 3, and 4, the RWST must also be OPERABLE to support their operation. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops — MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops — MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation — High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation — Low Water Level."

ACTIONS

A.1

With RWST boron concentration not within limits, it must be returned to within limits within 8 hours. Under these conditions neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE condition. The 8 hour limit to restore the RWST boron concentration to within limits was developed considering the time required to change the boron concentration and the fact that the contents of the tank are still available for injection.

(continued)

BASES (continued)

ACTIONS (continued)

B.1

With the RWST water volume not within limits, it must be restored to OPERABLE status within 1 hour. In this Condition, neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE status or to place the plant in a MODE in which the RWST is not required. The short time limit of 1 hour to restore the RWST to OPERABLE status is based on this condition simultaneously affecting redundant trains.

C.1 and C.2

If the RWST cannot be returned to OPERABLE status 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 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

The RWST water volume should be verified every 7 days to be above the required minimum level in order to ensure that a sufficient initial supply is available for injection and to support continued ECCS and Containment Spray System pump operation on recirculation. Since the RWST volume is normally stable and the RWST is located in the Auxiliary Building which provides sufficient leak detection capability, a 7 day Frequency is appropriate and has been shown to be acceptable through operating experience.

(continued)

[illegible]

BASES (continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.4.2

The boron concentration of the RWST should be verified every 7 days to be within the required limits. This SR ensures that the reactor will remain subcritical following a LOCA. Further, it assures that the resulting sump pH will be maintained in an acceptable range so that boron precipitation in the core will not occur and the effect of chloride and caustic stress corrosion on mechanical systems and components will be minimized. Since the RWST volume is normally stable, a 7 day sampling Frequency to verify boron concentration is appropriate and has been shown to be acceptable through operating experience.

REFERENCES

1. UFSAR, Section 3.11.
2. 10 CFR 50.49.
3. UFSAR, Section 6.3 and Chapter 15.

ATTACHMENT D

Marked Up Copy of Improved Technical Specifications (NUREG-1431)

Included pages:

All pages contained in NUREG-1431.

ONLY ITS 3.5 IS PROVIDED AT THIS TIME

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Accumulators

LCO 3.5.1 Two ~~[Four]~~ ECCS accumulators shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODE 3 with pressurizer pressure > 1600 ~~[1000]~~ psig.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One accumulator inoperable due to boron concentration not within limits.	A.1 Restore boron concentration to within limits.	72 hours
B. One accumulator inoperable for reasons other than Condition A.	B.1 Restore accumulator to OPERABLE status.	1 hour
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Reduce pressurizer pressure to ≤ 1600 ~~[1000]~~ psig.	6 hours 12 hours
D. Two ~~or more~~ accumulators inoperable.	D.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
51.i SR 3.5.1.1	Verify each accumulator motor operated isolation valve is fully open.	12 hours
51.ii SR 3.5.1.2	Verify borated water volume in each accumulator is ≥ ~~[7853 gallons ( )%]~~ 1120 cubic feet (50%) and ≤ ~~8171 gallons ( )%]~~ 1190 cubic feet (22%)	12 hours
SR 3.5.1.3	Verify nitrogen cover pressure in each accumulator is ≥ ~~[385]~~ 700 psig and ≤ ~~[481]~~ 790 psig.	12 hours
SR 3.5.1.4	Verify boron concentration in each accumulator is ≥ ~~[1900]~~ 1800 ppm and ≤ ~~[2100]~~ 2,900 ppm.	31 days on a STAGGERED TEST BASIS 51.iii ~~AND~~ ~~-----NOTE----- Only required to be performed for affected accumulators ---------------~~ ~~Once within 6 hours after each solution volume increase of ≥ [[ ] gallons, ( )% of indicated level] that is not the result of addition from the refueling water storage tank~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.1.5	Verify power is removed from each accumulator motor operated isolation valve operator when pressurizer pressure is ~~≥ [2000]~~ > 1600 psig.	31 days

51.i

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.2 ECCS — Operating

LCO 3.5.2 Two ECCS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

52.vi.b

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

1. In MODE 3, both safety injection (SI) pump flow paths may be isolated by closing the isolation valves for up to 2 hours to perform pressure isolation valve testing per SR 3.4.14.1. ← Insert 3.5.14

~~2.~~ 1. Operation in MODE 3 with ~~ECCS~~ SI pumps declared inoperable pursuant to LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," is allowed for up to 4 hours or until the temperature of ~~all~~ both RCS cold legs exceeds ~~[~~375~~]~~°F, whichever comes first.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
52.vi.a A. One ~~or more~~ train~~s~~ inoperable. AND At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available.	A.1 Restore train~~(s)~~ to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours

Insert 3.5.3

52.i

Insert 3.5.3

C. Two trains inoperable.	C.1 Enter LCO 3.0.3	Immediately

Insert 3.5.14

52.vii

Power may be restored to motor operated isolation valves 878A, 878B, 878C, and 878D for up to 12 hours for the purpose of testing per SR 3.4.14.1 provided that power is restored to only one valve at a time.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
[SR 3.5.2.1 52.ii	Verify the following valves are in the listed position ~~with power to the valve operator removed~~. Number / Position / Function Insert 3.5.4 → [ ] [ ] [ ] [ ] [ ] [ ] . . . [ ] [ ] [ ]	12 hours]
SR 3.5.2.2	Verify each ECCS manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position. Insert .15 →	31 days
52.iii ~~[SR 3.5.2.3~~	~~Verify ECCS piping is full of water.~~	~~31 days]~~
SR 3.5.2.4	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
52.ix SR 3.5.2.5	Verify each ECCS automatic valve in the flow path that is not locked, sealed, or otherwise secured in position actuates to the correct position on an actual or simulated actuation signal.	~~[18]~~ 24 months
SR 3.5.2.6	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	~~[18]~~ 24 months

(continued)

Insert 3.5.4

52.viii

EIN	Position	Function
825A	Open	RWST Suction to SI Pumps
825B	Open	RWST Suction to SI Pumps
826A	Closed	BAST Suction to SI Pumps
826B	Closed	BAST Suction to SI Pumps
826C	Closed	BAST Suction to SI Pumps
826D	Closed	BAST Suction to SI Pumps
851A	Open	Sump B Suction to RHR Pumps
851B	Open	Sump B Suction to RHR Pumps
856	Open	RWST Suction to RHR Pumps
878A	Closed	SI Injection to RCS Hot Leg
878B	Open	SI Injection to RCS Cold Leg
878C	Closed	SI Injection to RCS Hot Leg
878D	Open	SI Injection to RCS Cold Leg
896A	Open	RWST Suction to SI and Spray
896B	Open	RWST Suction to SI and Spray

Insert 3.5.15

52.viii

SR 3.5.2.3	Verify the breaker or key switch, as applicable, for each valve listed in SR 3.5.2.1, is in the correct position.	31 days

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.2.7	Verify, for each ECCS throttle valve listed below, each position stop is in the correct position. Valve Number [ ] [ ] . . . [ ]	[18] months
SR 3.5.2.8	Verify, by visual inspection, each ECCS train containment ~~sump suction inlet~~ is not restricted by ~~debris and the suction~~ inlet ~~trash racks~~ and screens show no evidence of structural distress or abnormal corrosion.	~~[18]~~ months

(52.iv)

(52.v)

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.3 ECCS — Shutdown

LCO 3.5.3 One ECCS train shall be OPERABLE.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
[A. Required ECCS residual heat removal (RHR) subsystem inoperable.	A.1	Initiate action to restore required ECCS RHR subsystem to OPERABLE status.	Immediately]
S2 vi.b B. Required ECCS safety injection (SI) ~~[high head~~ subsystem] inoperable.	B.1	Restore required ECCS SI ~~[high head~~ subsystem] to OPERABLE status.	1 hour
C. Required Action and associated Completion Time [of Condition B] not met.	C.1	Be in MODE 5.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.3.1	-------------------NOTE-------------------- An RHR train may be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned to the ECCS mode of operation. --	
S3.i S2.iii S2.iv S2.v	The following ~~SRs are~~ is applicable for all equipment required to be OPERABLE: ~~[SR 3.5.2.1]~~ ~~[SR 3.5.2.7]~~ ~~[SR 3.5.2.3]~~ ~~SR 3.5.2.8~~ SR 3.5.2.4	In accordance with applicable ~~SRs~~ SR

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.4 Refueling Water Storage Tank (RWST)

LCO 3.5.4 The RWST shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RWST boron concentration not within limits. ~~OR~~ ~~RWST borated water temperature not within limits.~~ 54.i	A.1 Restore RWST to OPERABLE status.	8 hours
B. RWST ~~inoperable for reasons other than Condition A.~~ water volume not within limits 54.i	B.1 Restore RWST to OPERABLE status.	1 hour
C. Required Action and associated Completion Time of Condition A or B not met. 54.iv	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
54.i ~~SR 3.5.4.1~~	~~-------------------NOTE-------------------~~ ~~Only required to be performed when ambient air temperature is < [35]°F or > [100]°F.~~ ~~---~~ ~~Verify RWST borated water temperature is ≥ [35]°F and ≤ [100]°F.~~	~~24 hours~~
SR 3.5.4.~~2~~ 1	Verify RWST borated water volume is ~~≥ [466,200 gallons ( )%].~~ ≥ 300,000 gallons (88%)	7 days
SR 3.5.4.~~3~~ 2	Verify RWST boron concentration is ≥ ~~[~~2000~~]~~ ppm and ≤ ~~[2200]~~ 2,900 ppm.	7 days

55

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.5 Seal Injection Flow

LCO 3.5.5 Reactor coolant pump seal injection flow shall be ≤ [40] gpm with [centrifugal charging pump discharge header] pressure ≥ [2480] psig and the [charging flow] control valve full open.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Seal injection flow not within limit.	A.1	Adjust manual seal injection throttle valves to give a flow within limit with [centrifugal charging pump discharge header] pressure ≥ [2480] psig and the [charging flow] control valve full open.	4 hours
B. Required Action and associated Completion Time not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 4.	12 hours

(55)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.5.1	-------------------NOTE------------------- Not required to be performed until 4 hours after the Reactor Coolant System pressure stabilizes at ≥ [2215 psig and ≤ 2255 psig]. --- Verify manual seal injection throttle valves are adjusted to give a flow within limit with [centrifugal charging pump discharge header] pressure ≥ [2480] psig and the [charging flow] control valve full open.	31 days

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.6 Boron Injection Tank (BIT)

LCO 3.5.6 The BIT shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. BIT inoperable.	A.1	Restore BIT to OPERABLE status.	1 hour
B. Required Action and associated Completion Time of Condition A not met.	B.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	B.2	Borate to an SDM equivalent to [1]% $\Delta k/k$ at 200°F.	6 hours
	<u>AND</u>		
	B.3	Restore BIT to OPERABLE status.	7 days
C. Required Action and associated Completion Time of Condition B not met.	C.1	Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.6.1	Verify BIT borated water temperature is ≥ [145]°F.	24 hours
[SR 3.5.6.2	Verify BIT borated water volume is ≥ [1100] gallons.	7 days]
SR 3.5.6.3	Verify BIT boron concentration is ≥ [20,000] ppm and ≤ [22,500] ppm.	7 days

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.1 Accumulators

BASES

BACKGROUND

The functions of the ECCS accumulators are to supply water to the reactor vessel during the blowdown phase of a large break loss of coolant accident (LOCA), to provide inventory to help accomplish the refill phase that follows thereafter, and to provide Reactor Coolant System (RCS) makeup for a small break LOCA. 51.iv.c

The blowdown phase of a large break LOCA is the initial period of the transient during which the RCS departs from equilibrium conditions, and heat from fission product decay, hot internals, and the vessel continues to be transferred to the reactor coolant. The reactor coolant inventory is vacating the core during this phase through steam flashing and ejection out through the break. The blowdown phase of the transient ends when the RCS pressure falls to a value approaching that of the containment atmosphere.

51.iv.e

In the refill phase of a LOCA, which immediately follows the blowdown phase, ~~reactor coolant inventory has vacated the core through steam flashing and ejection out through the break.~~ The core is essentially in adiabatic heatup. The balance of accumulator inventory is ~~then~~ available to reflood the core and help fill voids in the lower plenum and reactor vessel downcomer so as to establish a recovery level at the bottom of the core. ~~and ongoing reflood of the core with the addition of safety injection (SI) water.~~

The accumulators are pressure vessels partially filled with borated water and pressurized with nitrogen gas. The accumulators are passive components, since no operator or control actions are required in order for them to perform their function. Internal accumulator tank pressure is sufficient to discharge the accumulator contents to the RCS, if RCS pressure decreases below the accumulator pressure.

Each accumulator is piped into an RCS cold leg via an accumulator line and is isolated from the RCS by a motor operated isolation valve and two check valves in series. Insert 3.5.1 ~~The motor operated isolation valves are interlocked by P-11 with the pressurizer pressure measurement channels to ensure that the valves will automatically open as RCS pressure increases to above the permissive circuit P-11 setpoint.~~

51.iv.b

(continued)

Insert 3.5.1

51.iv.b

(841 and 865) are maintained open with AC power removed under administrative control when pressurizer pressure is > 1600 psig. This feature ensures that the valves meet the single failure criterion of manually-controlled electrically operated valves per Branch Technical Position (BTP) ICSB-18 (Ref. 1) This is also discussed in References 2 and 3.

BASES

BACKGROUND (continued)

~~This interlock also prevents inadvertent closure of the valves during normal operation prior to an accident. The valves will automatically open, however, as a result of an SI signal. These features ensure that the valves meet the requirements of the Institute of Electrical and Electronic Engineers (IEEE) Standard 279-1971 (Ref. 1) for "operating bypasses" and that the accumulators will be available for injection without reliance on operator action.~~

51.iv.a

The accumulator size, water one volume, and two nitrogen cover pressure are selected so that ~~three~~ of the ~~four~~ accumulators is ~~are~~ sufficient to partially cover the core before significant clad melting or zirconium water reaction can occur following a LOCA. The need to ensure that ~~three~~ one accumulator~~s~~ ~~are~~ is adequate for this function is consistent with the LOCA assumption that the entire contents of one accumulator will be lost via the RCS pipe break during the blowdown phase of the LOCA.

APPLICABLE SAFETY ANALYSES

The accumulators are assumed OPERABLE in both the large and small break LOCA analyses at full power (Ref. ~~2~~ 4). These are the Design Basis Accidents (DBAs) that establish the acceptance limits for the accumulators. Reference to the analyses for these DBAs is used to assess changes in the accumulators as they relate to the acceptance limits.

In performing the LOCA calculations, conservative assumptions are made concerning the availability of ECCS flow. In the early stages of a large break LOCA, with or without a loss of offsite power, the accumulators provide the sole source of makeup water to the RCS. The assumption of loss of offsite power is required by regulations and conservatively imposes a delay wherein the ECCS pumps cannot deliver flow until the emergency diesel generators start, come to rated speed, and go through their timed loading sequence. In cold leg break scenarios, the entire contents of one accumulator are assumed to be lost through the break.

51.iv.e

The limiting large break LOCA is a double ended guillotine break at the discharge of the reactor coolant pump. During this event, the accumulators discharge to the RCS as soon as RCS pressure decreases to below accumulator pressure.

(continued)

BASES

move up to preceding paragraph

SI signal generation

APPLICABLE SAFETY ANALYSES (continued)

51.iv.e

As a conservative estimate, no credit is taken for ECCS pump flow until an effective delay has elapsed. This delay accounts for the diesels starting, and the pumps being loaded and delivering full flow. ~~The delay time is conservatively set with an additional 2 seconds to account for SI signal generation.~~ During this time, the accumulators are analyzed as providing the sole source of emergency core cooling. No operator action is assumed during the blowdown stage of a large break LOCA.

51.iv.a

The worst case small break LOCA analyses also assume a time delay before pumped flow reaches the core. For the larger range of small breaks, the rate of blowdown is such that the increase in fuel clad temperature is terminated solely by the accumulators, with pumped flow then providing continued cooling. As break size decreases, the accumulators and ~~centrifugal charging~~ safety injection pumps both play a part in terminating the rise in clad temperature. As break size continues to decrease, the role of the accumulators continues to decrease until they are not required and the ~~centrifugal charging~~ safety injection pumps become solely responsible for terminating the temperature increase.

This LCO helps to ensure that the following acceptance criteria established for the ECCS by 10 CFR 50.46 (Ref. ~~3~~ 5) will be met following a LOCA:

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

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

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

d. Core is maintained in a coolable geometry.

Since the accumulators discharge during the blowdown phase of a LOCA, they do not contribute to the long term cooling requirements of 10 CFR 50.46.

For both the large and small break LOCA analyses, a nominal contained accumulator water volume is used. The contained

(continued)

due to the reduced gas volume. A peak clad temperature penalty is an assumed increase in the calculated peak clad temperature due to a change in an input parameter

52.iv.e

uses a nominal accumulator volume and includes the

BASES

APPLICABLE SAFETY ANALYSES (continued)

water volume is the same as the deliverable volume for the accumulators, since the accumulators are emptied, once discharged. For small breaks, an increase in water volume is a peak clad temperature penalty. For large breaks, an increase in water volume can be either a peak clad temperature penalty or benefit, depending on downcomer filling and subsequent spill through the break during the core reflooding portion of the transient. The analysis ~~makes a conservative assumption with respect to ignoring or taking credit for~~ line water volume from the accumulator to the check valve. The safety analysis assumes ~~values of [6468] gallons and [6879] gallons.~~ To allow for instrument inaccuracy, ~~values of~~ [6520] gallons ~~and [6820] gallons are specified.~~

52.iv.e

due to these competing effects

51.iv.c

The minimum boron concentration setpoint is used in the post LOCA boron concentration calculation. The calculation is performed to assure reactor subcriticality in a post LOCA environment. Of particular interest is the large break LOCA, since no credit is taken for control rod assembly insertion. A reduction in the accumulator minimum boron concentration would produce a subsequent reduction in the available containment sump concentration for post LOCA shutdown and an increase in the maximum sump pH. The maximum boron concentration is used in determining ~~the cold leg to hot leg recirculation injection switchover time and minimum sump pH.~~ ← Insert 3.5.2

51.iv.d

The large and small break LOCA analyses are performed at the minimum nitrogen cover pressure, since sensitivity analyses have demonstrated that higher nitrogen cover pressure results in a computed peak clad temperature benefit.

51.v

The maximum nitrogen cover pressure limit prevents accumulator relief valve actuation, at 200 psig and ultimately preserves accumulator integrity.

51.iv.e

The effects on containment mass and energy releases from the accumulators are accounted for in the appropriate analyses (Refs. ~~2~~ 8 and ~~4~~ 9).

The accumulators satisfy Criterion 3 of the NRC Policy Statement.

(continued)

Insert 3.5.2

51.iv.d

the time frame in which boron precipitation is addressed post LOCA. The maximum boron concentration limit is based on the coldest expected temperature of the accumulator water volume and on chemical effects resulting from operation of the ECCS and the Containment Spray System. A value of 2,900 ppm would not create the potential for boron precipitation in the accumulator assuming a Containment temperature of 60°F (Ref. 6). Analyses performed in response to 10 CFR 50.49 (Ref. 7) assumed a chemical spray solution of 2000 to 3000 ppm boron concentration (Ref. 6) which provides a margin of 100 ppm. The chemical spray solution impacts sump pH and the resulting effect of chloride and caustic stress corrosion on mechanical systems and components. The sump pH also affects the rate of hydrogen generation within containment due to the interaction of Containment Spray and sump fluid with aluminum components.

BASES (continued)

LCO

The LCO establishes the minimum conditions required to ensure that the accumulators are available to accomplish their core cooling safety function following a LOCA. ~~Four~~ Two accumulators are required to ensure that 100% of the contents of ~~three of the~~ one accumulators ~~will~~ will reach the core during a LOCA. This is consistent with the assumption that the contents of one accumulator spill through the break. If less than ~~three~~ one accumulator~~s are~~ is injected during the blowdown phase of a LOCA, the ECCS acceptance criteria of 10 CFR 50.46 (Ref. ~~3~~ 5) could be violated.

51.iv.a

For an accumulator to be considered OPERABLE, above 1600 psig the motor-operated isolation valve must be fully open, ~~with~~ power removed~~,~~ and the limits established in the SRs for contained volume, boron concentration, and nitrogen cover pressure must be met.

51.vi

APPLICABILITY

In MODES 1 and 2, and in MODE 3 with RCS pressure > ~~1000~~ 1600 psig, the accumulator OPERABILITY requirements are based on full power operation. Although cooling requirements decrease as power decreases, the accumulators are still required to provide core cooling as long as elevated RCS pressures and temperatures exist.

This LCO is only applicable at pressures > ~~1000~~ 1600 psig. At pressures ≤ ~~1000~~ 1600 psig, the rate of RCS blowdown is such that the ECCS pumps can provide adequate injection to ensure that peak clad temperature remains below the 10 CFR 50.46 (Ref. ~~3~~ 5) limit of 2200°F.

51.iv.a

In MODE 3, with RCS pressure ≤ ~~1000~~ 1600 psig, and in MODES 4, 5, and 6, the accumulator motor operated isolation valves are closed to isolate the accumulators from the RCS. This allows RCS cooldown and depressurization without discharging the accumulators into the RCS or requiring depressurization of the accumulators.

ACTIONS

A.1

If the boron concentration of one accumulator is not within limits, it must be returned to within the limits within 72 hours. In this Condition, ability to maintain subcriticality or minimum boron precipitation time may be

(continued)

BASES

ACTIONS

A.1 (continued)

reduced. The boron in the accumulators contributes to the assumption that the combined ECCS water in the partially recovered core during the early reflooding phase of a large break LOCA is sufficient to keep that portion of the core subcritical. One accumulator below the minimum boron concentration limit, however, will have no effect on available ECCS water and an insignificant effect on core subcriticality during reflood ~~.~~ Since the accumulator water volume is very small when compared to RCS and RWST inventory. Boiling of ECCS water in the core during reflood concentrates boron in the saturated liquid that remains in the core. In addition, current analysis techniques demonstrate that the accumulators ~~do~~ are not expected to discharge following a large main steam line break ~~for the majority of plants~~. Even if they do discharge, their impact is minor and not a design limiting event. Thus, 72 hours is allowed to return the boron concentration to within limits.

51.iv.e

B.1

If one accumulator is inoperable for a reason other than boron concentration, the accumulator must be returned to OPERABLE status within 1 hour. In this Condition, the required contents of ~~three~~ one accumulator~~s~~ cannot be assumed to reach the core during a LOCA. Due to the severity of the consequences should a LOCA occur in these conditions, the 1 hour Completion Time to open the valve, remove power to the valve, or restore the proper water volume or nitrogen cover pressure ensures that prompt action will be taken to return the inoperable accumulator to OPERABLE status. The Completion Time minimizes the potential for exposure of the plant to a LOCA under these conditions.

C.1 and C.2

If the accumulator cannot be returned to OPERABLE status 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 MODE 3 within 6 hours and pressurizer pressure reduced to ≤ ~~1000~~ 1600 psig 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.

51.iv.a

(continued)

BASES

ACTIONS (continued)

51.iv.a

D.1

If both ~~more than one~~ accumulators ~~is~~ are inoperable, the plant is in a condition outside the accident analyses; therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

51.iv.e

SR 3.5.1.1

Each accumulator motor-operated isolation valve should be verified to be fully open every 12 hours. This verification ensures that the accumulators are available for injection and ensures timely discovery if a valve should be less than fully open. If an isolation valve is not fully open, the rate of injection to the RCS would be reduced. Although a motor operated valve position should not change with power removed, a closed valve could result in not meeting accident analyses assumptions. This Frequency is considered reasonable in view of other administrative controls that ensure a mispositioned isolation valve is unlikely.

51.iv.e

Use of control board indication for valve position is an acceptable verification.

SR 3.5.1.2 and SR 3.5.1.3

~~Every 12 hours,~~ The borated water volume and nitrogen cover pressure ~~are verified~~ for each accumulator. This Frequency is sufficient to ensure adequate injection during a LOCA. Because of the static design of the accumulator, a 12 hour Frequency usually allows the operator to identify changes before limits are reached. Operating experience has shown this Frequency to be appropriate for early detection and correction of off normal trends.

should be verified every 12 hours

51.iv.e

51.iv.a

Main control board alarms are also available for these accumulator parameters.

SR 3.5.1.4

on a STAGGERED TEST Frequency

51.iii

The boron concentration should be verified to be within required limits for each accumulator every 31 days since the static design of the accumulators limits the ways in which the concentration can be changed. The 31 day STAGGERED TEST Frequency is adequate to identify changes that could occur from mechanisms such as stratification or inleakage. ~~Sampling the affected~~ accumulator within ~~6 hours~~ after a 1% volume increase will ~~identify whether~~ inleakage has caused a ~~reduction in~~ boron concentration to below ~~the required~~

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.1.4 (continued)

~~limit. It is not necessary to verify boron concentration if the added water inventory is from the refueling water storage tank (RWST), because the water contained in the RWST is within the accumulator boron concentration requirements. This is consistent with the recommendation of NUREG-1366 (Ref. 5).~~

SR 3.5.1.5

Verification every 31 days that power is removed from each accumulator isolation valve operator when the pressurizer pressure is ~~≥ 2000~~ > 1600 psig ensures that an active failure could not result in the undetected closure of an accumulator motor operated isolation valve. If this were to occur, ~~only two~~ no accumulators would be available for injection ~~given a single failure coincident with a LOCA.~~ if the LOCA were to occur in the cold leg containing the only OPERABLE accumulator. Since power is removed under administrative control and valve position is verified every 12 hours, the 31 day Frequency will provide adequate assurance that power is removed.

SI.iv.F

~~This SR allows power to be supplied to the motor operated isolation valves when pressurizer pressure is < 2000 psig, thus allowing operational flexibility by avoiding unnecessary delays to manipulate the breakers during plant startups or shutdowns. Even with power supplied to the valves, inadvertent closure is prevented by the RCS pressure interlock associated with the valves.~~

~~Should closure of a valve occur in spite of the interlock, the SI signal provided to the valves would open a closed valve in the event of a LOCA.~~

REFERENCES

1\. Branch Technical Position (BTP) ICSB-18 "Application of the Single Failure Criterion to Manually-Controlled Electrically Operated Valves."

2 ~~1.~~ ~~IEEE Standard 279-1971.~~ Letter from D.M. Crutchfield, NRC, to J.E. Maier, RG&E, Subject: "SEP Topics VI-7.F, VII-3, VII-6, and VIII-2," dated June 24, 1981.

3\. Letter from R.A. Purple, NRC, to L.D. White, RG&E, Subject: "Issuance of Amendment 7 to Provisional Operating License No. DPR-18," dated May 14, 1975.

4 ~~2.~~ UFSAR, ~~Chapter [6].~~ Section 6.3

5 ~~3.~~ 10 CFR 50.46.

6\. UFSAR, Section 3.11

7\. 10 CFR 50.49.

8 ~~4.~~ UFSAR, Chapter ~~[15]~~ 6.2.

~~5. NUREG-1366, February 1990.~~

9\. UFSAR, Section 15.6.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.2 ECCS — Operating

BASES

BACKGROUND

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

52.iv.e

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

b. Rod ejection accident;

c. Loss of secondary coolant accident, including uncontrolled steam release or loss of feedwater; and

d. Steam generator tube rupture (SGTR).

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

52.vi.a

There are two ~~three~~ phases of ECCS operation: cold leg injection~~,~~ and cold leg recirculation~~, and hot leg recirculation~~. In the injection phase, water is taken from the refueling water storage tank (RWST) and injected into the Reactor Coolant System (RCS) through the cold legs and reactor vessel upper plenum. When sufficient water is removed from the RWST to ensure that enough boron has been added to maintain the reactor subcritical and ~~the~~ containment sump~~s~~ ~~have~~ has enough water to supply the required net positive suction head to the ECCS pumps, suction is switched to ~~the~~ containment sump B for cold leg recirculation. After approximately ~~24~~ 2 hours, ~~the ECCS flow is shifted to the hot leg recirculation phase to provide a backflush, which would reduce the~~ simultaneous ECCS injection is used to reduce the potential for boiling in the top of the core and any resulting boron precipitation.

52.vi.a

52.vi.b

The ECCS consists of ~~three~~ two separate subsystems: ~~centrifugal charging (high head),~~ safety injection (SI) ~~(intermediate head),~~ and residual heat removal (RHR) ~~(low head).~~ Each subsystem consists of two redundant, 100% capacity trains. The ECCS accumulators and the RWST are also part of the

(continued)

BASES

BACKGROUND (continued)

ECCS, but are not considered part of an ECCS flow path as described by this LCO.

which comprise the redundant trains 52.vi.e

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the RWST can be injected into the RCS following the accidents described in this LCO. The major components of each subsystem are the ~~centrifugal charging pumps,~~ the RHR pumps, heat exchangers, and the SI pumps. ~~Each of the three~~ subsystems consists of two 100% capacity trains that are interconnected and redundant such that either train is capable of supplying 100% of the flow required to mitigate the accident consequences. This interconnecting and redundant subsystem design provides the operators with the ability to utilize components from opposite trains to achieve the required 100% flow to the core.

52.vi.b The RHR

Insert 3.5.5

During the injection phase of LOCA recovery, ~~a~~ suction header supplies water from the RWST to the ECCS pumps. ~~Separate piping supplies each subsystem and each train within the subsystem. The discharge from the centrifugal charging pumps combines prior to entering the boron injection tank (BIT) (if the plant utilizes a BIT) and then divides again into four supply lines, each of which feeds the injection line to one RCS cold leg. The discharge from the SI and RHR pumps divides and feeds an injection line to each of the RCS cold legs. Control valves are set to balance the flow to the RCS. This balance ensures sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the RCS cold legs.~~

Insert 3.5.6

52.vi.a

56.i

For LOCAs that are too small to depressurize the RCS below the shutoff head of the SI pumps, the ~~centrifugal charging pumps supply water~~ until the RCS pressure decreases below the SI pump shutoff head. ~~During this period, the steam generators are used to provide part of the core cooling function.~~

steam generators provide core cooling

52.vi.b

manually

During the recirculation phase of LOCA recovery, RHR pump suction is transferred to ~~the~~ containment sump. The RHR pumps then supply the ~~other ECCS pumps~~. ~~Initially,~~ recirculation ~~is~~ through the same paths as the injection phase. ~~Subsequently, recirculation alternates injection between the hot and cold legs.~~

Insert 3.5.7

Insert 3.5.8

52.vi.a

flow discharge

Insert 3.5.9

(continued)

Insert 3.5.5

52.vi.a

The SI subsystem consists of three redundant, 50% capacity pumps which supply two RCS cold leg injection lines. Each injection line is capable of providing 100% of the flow required to mitigate the accident consequences.

Insert 3.5.6

A common supply header is used from the RWST to the safety injection (SI) and Containment Spray System pumps. This common supply header is provided with two in-series motor-operated isolation valves (896A and 896B) that receive power from separate sources for single failure considerations. These isolation valves are maintained open with DC control power removed via a key switch located in the control room. The removal of DC control power eliminates the most likely causes for spurious valve actuation while maintaining the capability to manually close the valves from the control room during the recirculation phase of the accident (Ref. 1). The SI pump supply header also contains two parallel motor-operated isolation valves (825A and 825B) which are maintained open by removing AC power. The removal of AC power to these isolation valves is an acceptable design against single failures that could result in undesirable component actuation (Ref. 2).

52.vi.a

A separate supply header is used for the residual heat removal (RHR) pumps. This supply header is provided with a check valve (854) and motor operated isolation valve (856) which is maintained open with DC control power removed via a key switch located in the control room. The removal of DC control power eliminates the most likely causes for spurious valve actuation while maintaining the capability to manually close the valve from the control room during the recirculation phase of the accident.

The three SI pumps feed two RCS cold leg injection lines. SI Pumps A and B each feeds one of the two injection lines while SI Pump C can feed both injection lines. The discharge of SI Pump C is controlled through use of two normally open parallel motor operated isolation valves (871A and 871B). These isolation valves are designed to close based on the operating status of SI Pumps A and B to ensure that SI Pump C provides the necessary flow through the RCS cold leg injection line containing the failed pump.

The discharges of the two RHR pumps and heat exchangers feed a common injection line which penetrates containment. This line then divides into two redundant core deluge flow paths each containing a normally closed motor operated isolation valve (852A and 852B) and check valve (853A and 853B) which provide injection into the reactor vessel upper plenum.

Insert 3.5.7

B (Refs. 4 and 5). This transfer is accomplished by stopping the RHR pumps, isolating RHR from the RWST by closing motor operated isolation valve 856, opening the Containment Sump B motor operated isolation valves to RHR (850A and 850B) and then starting the RHR pumps. The SI and Containment Spray System pumps are then stopped and the RWST isolated by closing motor operated isolation valve 896A or 896B for the SI and Containment Spray System pump common supply header and closing motor operated isolation valve 897 or 898 for the SI pump recirculation line.

52.vi.a

Insert 3.5.8

SI and Containment Spray System pumps (as needed for pressure control purposes) if the RCS pressure remains above the RHR pump shutoff head (Ref. 6). This high-head recirculation path is provided through RHR motor operated isolation valves 857A, 857B, and 857C. These isolation valves are interlocked with valves 896A, 896B, 897, and 898. This interlock prevents opening of the RHR high-head recirculation isolation valves unless either 896A or 896B are closed and either 897 or 898 are closed. If RCS pressure is less than approximately 140 psig, the SI and Containment Spray System pumps remain in pull-stop and only RHR is used to provide core cooling. During

52.vi.a

Insert 3.5.9

After approximately 20 hours, simultaneous injection by the SI and RHR pumps is used to prevent boron precipitation (Ref. 7). This consists of providing SI through the RCS cold legs and into the lower plenum while providing RHR through the core deluge valves into the upper plenum.

52.vi.a

The two redundant flow paths from Containment Sump B to the RHR pumps also contain a motor operated isolation valve located within the sump (851A and 851B). These isolation valves are maintained open with power removed to improve the reliability of switchover to the recirculation phase. The operators for isolation valves 851A and 851B are also not qualified for containment post accident conditions.

BASES

S2.vi.b

BACKGROUND (continued)

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

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

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

S2.vi.c

The active ECCS components, along with the passive accumulators and the RWST covered in LCO 3.5.1, "Accumulators," and LCO 3.5.4, "Refueling Water Storage Tank (RWST)," provide the cooling water necessary to meet ~~GDC 35~~ A.F-GDC 44 (Ref. ~~1~~ 8).

APPLICABLE SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. ~~2~~ 9), will be met following a LOCA:

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

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

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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

d. Core is maintained in a coolable geometry; and

e. Adequate long term core cooling capability is maintained.

52.iv.c

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

52.vi.b

Both ~~Each~~ ECCS subsystems ~~is~~ are taken credit for in a large break LOCA event at full power (Refs. ~~3~~ 2 and ~~4~~ 10). This event establishes the requirement for runout flow for the ECCS pumps, as well as the maximum response time for their actuation. The ~~centrifugal charging pumps and~~ SI pumps are credited in a small break LOCA event. This event establishes the flow and discharge head at the design point for the ~~centrifugal charging~~ pumps. The SGTRs and MSLB events also credit the ~~centrifugal charging~~ pumps. The OPERABILITY requirements for the ECCS are based on the following LOCA analysis assumptions:

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

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

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

52.vi.a

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

The effects on containment mass and energy releases are accounted for in appropriate analyses (Refs. ~~3~~ 10 and ~~4~~ 11). The LCO ensures that an ECCS train will deliver sufficient water to match boiloff rates quickly ~~soon~~ enough to minimize the consequences of the core being uncovered following a large LOCA. It also ensures that the ~~centrifugal charging and~~ SI pumps will deliver sufficient water and boron during a small LOCA to maintain core subcriticality. For smaller LOCAs, the SI pumps ~~centrifugal charging pump~~ deliver~~s~~ sufficient fluid to maintain RCS inventory. For a small break LOCA, the steam generators continue to serve as the heat sink, providing part of the required core cooling.

52.vi.b

The ECCS trains satisfy Criterion 3 of the NRC Policy Statement.

LCO

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

52.vi.b

In MODES 1, 2, and 3, an ECCS train consists of ~~a centrifugal charging subsystem,~~ an SI subsystem~~,~~ and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and ~~automatically~~ transferring suction to ~~the~~ Containment Sump C. ← Insert 3.5.10

52.vi.a

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

52.vi.a

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

(continued)

Insert 3.5.10

This includes securing the motor operated isolation valves as specified in SR 3.5.2.1 in position by removing the power sources as listed below.

52.vi.a

EIN	Position	Secured in Position By
825A	Open	Removal of AC Power
825B	Open	Removal of AC Power
826A	Closed	Removal of AC Power
826B	Closed	Removal of AC Power
826C	Closed	Removal of AC Power
826D	Closed	Removal of AC Power
851A	Open	Removal of AC Power
851B	Open	Removal of AC Power
856	Open	Removal of DC Control Power
878A	Closed	Removal of AC Power
878B	Open	Removal of AC Power
878C	Closed	Removal of AC Power
878D	Open	Removal of AC Power
896A	Open	Removal of DC Control Power
896B	Open	Removal of DC Control Power

The major components of an ECCS train consists of an RHR pump and heat exchanger capable of taking suction from the RWST (and eventually Containment Sump B), and able to inject through one of the two isolation valves to the reactor vessel upper plenum and one of the two lines which provide high-head recirculation to the SI and Containment Spray System pumps. Also included within the ECCS train are two of three SI pumps capable of taking suction from the RWST and Containment Sump B (via RHR), and injecting through one of the two RCS cold leg injection lines. In the case where SI Pump C is inoperable, both RCS cold leg injection lines must be OPERABLE to provide 100% of the ECCS flow equivalent to a single train of SI due to the location of check valves 870A and 870B.

BASES (continued)

APPLICABILITY

In MODES 1, 2, and 3, the ECCS OPERABILITY requirements for the limiting Design Basis Accident, a large break LOCA, are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. ~~The centrifugal charging pump performance is based on a small break LOCA, which establishes the pump performance curve and has less dependence on power.~~ The SI pump performance requirements are based on a small break LOCA. MODE 2 and MODE 3 requirements are bounded by the MODE 1 analysis.

52.vi.b

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

52.vii

As indicated in Note 1, the flow path may be isolated for 2 hours in MODE 3, under controlled conditions, to perform pressure isolation valve testing per SR 3.4.14.1. The flow path is readily restorable from the control room

or field test personnel. The note also allows an SI isolation MOV to be powered for up to 12 hours for the performance of this testing.

As indicated in Note 2, operation in MODE 3 with ECCS trains declared inoperable pursuant to LCO 3.4.12, "Low Temperature Overpressure Protection (LTOP) System," is necessary ~~for plants with an~~ since the LTOP arming temperature is ~~at or~~ near the MODE 3 boundary temperature of 350°F. LCO 3.4.12 requires that certain pumps be rendered inoperable at and below the LTOP arming temperature. When this temperature is ~~at or~~ near the MODE 3 boundary temperature, time is needed to restore the inoperable pumps to OPERABLE status.

52.vi.c

In MODES 4, 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops — MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops — MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation — High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation — Low Water Level."

52.vi.d

Mode 4 core cooling requirements are addressed by LCO 3.4.6, "RCS Loops - Mode 4," and LCO 3.5.3, "ECCS - Shutdown."

(continued)

BASES (continued)

ACTIONS

A.1

(52.vi.a)

With one ~~or more~~ trains ~~s~~ inoperable and at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72 hour Completion Time is based on an NRC reliability evaluation (Ref. 12 ~~5~~) and is a reasonable time for repair of many ECCS components.

(52.vi.a)

An ECCS (100%) train is inoperable if it is not capable of delivering design flow to the RCS. Individual components are inoperable if they are not capable of performing their design function or (necessary) supporting systems are not available.

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. The intent of this Condition is to maintain a combination of equipment such that 100% of the ECCS flow equivalent to a single OPERABLE ECCS train remains available. This allows increased flexibility in plant operations under circumstances when components in opposite trains are inoperable.

Insert (3.5.21)

An event accompanied by a loss of offsite power and the failure of an EDG can disable one ECCS train until power is restored. A reliability analysis (Ref. 12 ~~5~~) has shown that the impact of having one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.

(52.i)

~~Reference 6 describes situations in which one component, such as an RHR crossover valve, can disable both ECCS trains. With one or more component(s) inoperable such that 100% of the flow equivalent to a single OPERABLE ECCS train is not available, the facility is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be immediately entered.~~

(continued)

Insert 3.5.21

52.vi.a

In the case where SI Pump C is inoperable, both RCS cold leg injection lines must be OPERABLE to provide 100% of the ECCS flow equivalent to a single train of SI due to the location of check valves 870A and 870B.

BASES

ACTIONS (continued)

52.vi.a

B.1 and B.2

If the inoperable train~~s~~ cannot be returned to OPERABLE status 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 MODE 3 within 6 hours and 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.

Insert 3.5.11

SURVEILLANCE REQUIREMENTS

SR 3.5.2.1

52.ii

Insert 3.5.12

52.vi.f

52.iv.e

Use of control board indication for valve position is an acceptable verification.

Verification of proper valve position ensures that the flow path from the ECCS pumps to the RCS is maintained. Misalignment of these valves could render both ECCS trains inoperable. Securing these valves in position ~~by removal of power or by key locking the control in the~~ correct position ensures that ~~they cannot~~ change position as a ~~result of an active failure or be inadvertently misaligned.~~ These valves ~~are of the type, described in Reference 6, that~~ can disable the function of both ECCS trains and invalidate the accident analyses. A 12 hour Frequency is considered reasonable in view of other administrative controls that ~~will~~ ensure a mispositioned valve is unlikely.

SR 3.5.2.2

Verifying the correct alignment for manual, power operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a nonaccident position provided the valve will automatically reposition within the proper stroke time. This Surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being mispositioned are in the correct position. The 31 day Frequency is appropriate because the valves are operated

(continued)

Insert 3.5.11

C.1

(52.i) If both trains of ECCS are inoperable, the plant is in a condition outside the accident analyses; therefore, LCO 3.0.3 must be immediately entered. With one or more component(s) inoperable such that 100% of the flow equivalent to a single OPERABLE ECCS train is not available, the facility is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be immediately entered.

Insert 3.5.12

(52.ii) The listed valves are secured in position by removal of AC power or key locking the DC control power. These valves are operated under administrative controls such that any changes with respect to the position of the valve breakers or key locks is unlikely. The verification of the valve breakers and key locks is performed by SR 3.5.2.3.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.2.2 (continued)

under administrative control, and an improper valve position in most cases, would only affect a single train. This Frequency has been shown to be acceptable through operating experience.

Insert 3.5.17

52.iii

~~SR 3.5.2.3~~

~~With the exception of the operating centrifugal charging pump, the ECCS pumps are normally in a standby, nonoperating mode. As such, flow path piping has the potential to develop voids and pockets of entrained gases. Maintaining the piping from the ECCS pumps to the RCS full of water ensures that the system will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent water hammer, pump cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling. The 31 day Frequency takes into consideration the gradual nature of gas accumulation in the ECCS piping and the procedural controls governing system operation.~~

SR 3.5.2.4

52.iv.e

Periodic surveillance testing of ECCS pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by Section XI of the ASME Code. This type of testing may be accomplished by measuring the pump developed head at ~~only one~~ a single point of the pump characteristic curve. This verifies both that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code. Section XI of the ASME Code provides the activities and Frequencies necessary to satisfy the requirements.

SR 3.5.2.5 and SR 3.5.2.6

These Surveillances demonstrate that each automatic ECCS valve actuates to the required position on an actual or

(continued)

Insert 3.5.17

SR 3.5.2.3

52.ii Verification every 31 days that AC or DC power is removed, as appropriate, for each valve specified in SR 3.5.2.1 ensures that an active failure could not result in an undetected misposition of a valve which affects both trains of ECCS. if this were to occur, no ECCS injection or recirculation would be available. Since power is removed under administrative control and valve position is verified every 12 hours, the 31 day Frequency will provide adequate assurance that power is removed.

52.ix

This surveillance is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.2.5 and SR 3.5.2.6 (continued)

simulated SI signal and that each ECCS pump starts on receipt of an actual or simulated SI signal. The ~~18~~ 24 month Frequency is based on the need to perform these Surveillances under the conditions that apply during a plant outage and the potential for unplanned plant transients if the Surveillances were performed with the reactor at power. The ~~18~~ 24 month Frequency is also acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment. The actuation logic is tested as part of ESF Actuation System testing, and equipment performance is monitored as part of the Inservice Testing Program.

52.iv

~~SR 3.5.2.7~~

~~Realignment of valves in the flow path on an SI signal is necessary for proper ECCS performance. These valves have stops to allow proper positioning for restricted flow to a ruptured cold leg, ensuring that the other cold legs receive at least the required minimum flow. This Surveillance is not required for plants with flow limiting orifices. The 18 month Frequency is based on the same reasons as those stated in SR 3.5.2.5 and SR 3.5.2.6.~~

52.v

~~SR 3.5.2.8~~

~~Periodic inspections of the containment sump suction inlet ensure that it is unrestricted and stays in proper operating condition. The 18 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage, on the need to have access to the location, and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. This Frequency has been found to be sufficient to detect abnormal degradation and is confirmed by operating experience.~~

Insert 3.5.13

REFERENCES

8 ~~1.~~ ~~10 CFR 50, Appendix A, GDC 35.~~ Atomic Industrial Forum (AIF) GDC 44, Issued for comment July 10, 1967.

9 ~~2.~~ 10 CFR 50.46.

(continued)

Insert 3.5.13

1. Letter from R.A. Purple, NRC, to L.D. White, RG&E, Subject: "Issuance of Amendment 7 to Provisional Operating License No. DPR-18," dated May 14, 1975.

2. Branch Technical Position (BTP) ICSB-18, "Application of the Single Failure Criterion to Manually-Controlled Electrically Operated Valves."

3. Letter from A.R. Johnson, NRC, to R.C. Mecredy, RG&E, Subject: "Issuance of Amendment No. 42 to Facility Operating License No. DPR-18 - R.E. Ginna Nuclear Power Plant (TAC No. 79829)," dated June 3, 1991.

4. Letter from D.M. Crutchfield, NRC, to J.E. Maier, RG&E, Subject: "SEP Topic VI-7.B: ESF Switchover from Injection to Recirculation Mode, Automatic ECCS Realignment, Ginna," dated December 31, 1981.

5. NUREG-0821.

7. Letter from D.M. Crutchfield, NRC, to J.E. Maier, RG&E, Subject: "SEP Topic IX-4, Boron Addition System, R.E. Ginna," dated August 26, 1981.

11. UFSAR, Section 6.2.

BASES

REFERENCES (continued)

6 ~~3.~~ 4 FSAR, Section 6.3 ~~[ ]~~.

10 ~~4.~~ ~~FSAR, Chapter [15], "Accident Analysis."~~ UFSAR, Section 15.6

12 ~~5.~~ NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.

~~6. IE Information Notice No. 87-01.~~

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.3 ECCS — Shutdown

BASES

BACKGROUND

The Background section for Bases 3.5.2, "ECCS — Operating," is applicable to these Bases, with the following modifications.

52.vi.b

In MODE 4, the required ECCS train consists of two separate subsystems: safety injection (SI) ~~centrifugal charging (high head)~~ and residual heat removal (RHR) ~~(low head)~~.

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the refueling water storage tank (RWST) can be injected into the Reactor Coolant System (RCS) following the accidents described in Bases 3.5.2. The RHR subsystem must also be capable of taking suction from Containment Sump B to provide recirculation.

53.ii

APPLICABLE SAFETY ANALYSES

The Applicable Safety Analyses section of Bases 3.5.2 also applies to this Bases section.

Due to the stable conditions associated with operation in MODE 4 and the reduced probability of occurrence of a Design Basis Accident (DBA), the ECCS operational requirements are reduced. It is understood in these reductions that certain automatic safety injection (SI) actuation is not available. In this MODE, sufficient time exists for manual actuation of the required ECCS to mitigate the consequences of a DBA (Ref. 1).

53.ii

Only one train of ECCS is required for MODE 4. This requirement dictates that single failures are not considered during this MODE of operation. The ECCS trains satisfy Criterion 3 of the NRC Policy Statement.

LCO

In MODE 4, one of the two independent (and redundant) ECCS trains is required to be OPERABLE to ensure that sufficient ECCS flow is available to the core following a DBA.

52.vi.b

In MODE 4, an ECCS train consists of an ~~centrifugal charging~~ SI subsystem and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow

(continued)

BASES

LCO (continued)

path capable of taking suction from the RWST and transferring suction to the containment sump. ← Insert 3.5.16

53.ii

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

APPLICABILITY

In MODES 1, 2, and 3, the OPERABILITY requirements for ECCS are covered by LCO 3.5.2.

In MODE 4 with RCS temperature below 350°F, one OPERABLE ECCS train is acceptable without single failure consideration, on the basis of the stable reactivity of the reactor and the limited core cooling requirements.

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops — MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops — MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation — High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation — Low Water Level."

ACTIONS

A.1

With no ECCS RHR subsystem OPERABLE, the plant is not prepared to respond to a loss of coolant accident or to continue a cooldown using the RHR pumps and heat exchangers. The Completion Time of immediately to initiate actions that would restore at least one ECCS RHR subsystem to OPERABLE status ensures that prompt action is taken to restore the required cooling capacity. Normally, in MODE 4, reactor decay heat is removed from the RCS by an RHR loop. If no RHR loop is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generators. The alternate means of heat removal must

(continued)

53.ii

Insert 3.5.16

The major components of an ECCS train during MODE 4 normally consists of an RHR pump and heat exchanger, capable of taking suction from the RWST (and eventually Containment Sump B), and able to inject through one of the two isolation valves to the reactor vessel upper plenum. Also included within the ECCS train are one of three SI pumps capable of taking suction from the RWST and injecting through one of the two RCS cold leg injection lines. The high-head recirculation flowpath from RHR to the SI pumps is not required in MODE 4 since there is no accident scenario which prevents depressurization to RHR pump shutoff head prior to depletion of the RWST.

Based on the time available to respond to accident conditions during MODE 4, ECCS components are OPERABLE if they are capable of being reconfigured to the injection mode from the control room within 10 minutes. This includes taking credit for an RHR pump and heat exchanger as being OPERABLE if they are being used for shutdown cooling purposes.

BASES

ACTIONS

A.1 (continued)

continue until the inoperable RHR loop components can be restored to operation so that decay heat removal is continuous.

With both RHR pumps and heat exchangers inoperable, it would be unwise to require the plant to go to MODE 5, where the only available heat removal system is the RHR. Therefore, the appropriate action is to initiate measures to restore one ECCS RHR subsystem and to continue the actions until the subsystem is restored to OPERABLE status.

B.1

S2.vi.b

With no ECCS ~~high head~~ SI subsystem OPERABLE, due to the inoperability of the ~~centrifugal charging~~ SI pump or flow path from the RWST, the plant is not prepared to provide high pressure response to Design Basis Events requiring SI. The 1 hour Completion Time to restore at least one ~~ECCS high head~~ SI subsystem to OPERABLE status ensures that prompt action is taken to provide the required cooling capacity or to initiate actions to place the plant in MODE 5, where an ECCS train is not required.

C.1

When the Required Actions of Condition B cannot be completed within the required Completion Time, a controlled shutdown should be initiated. Twenty-four hours is a reasonable time, based on operating experience, to reach MODE 5 in an orderly manner and without challenging plant systems or operators.

SURVEILLANCE REQUIREMENTS

S3.i

SR 3.5.3.1

The applicable Surveillance description~~s~~ from Bases 3.5.2 apply. This SR is modified by a Note that allows an RHR train to be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned (remote or local) to the ECCS mode of

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.3.1 (continued)

operation and not otherwise inoperable. This allows operation in the RHR mode during MODE 4, if necessary.

REFERENCES

The applicable references from Bases 3.5.2 apply.

1. WCAP-12476, "Evaluation of LOCA During Mode 3 and Mode 4 Operation for Westinghouse NSSS," November 1991.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.4 Refueling Water Storage Tank (RWST)

BASES

BACKGROUND

54.ii.a

The RWST supplies borated water to ~~the Chemical and Volume Control System (CVCS) during abnormal operating conditions, to the refueling pool during refueling, and to the ECCS and the Containment Spray System during accident conditions.~~

54.ii.b

Insert 3.5.18

~~The RWST supplies~~ both trains of the ECCS and the Containment Spray System ~~through separate, redundant supply headers~~ during the injection phase of a loss of coolant accident (LOCA) recovery. ~~A motor operated isolation valve is provided in each header to isolate the RWST from the ECCS once the system has been transferred to the recirculation mode.~~ The recirculation mode is entered when pump suction is transferred to the containment sump ~~following receipt of the RWST — Low Low (Level 1) signal.~~ based on RWST level. Use of a single RWST to supply both trains of the ECCS and Containment Spray System is acceptable since the RWST is a passive component, and passive failures are not required to be assumed to occur coincidentally with Design Basis Events.

54.ii.b

~~The switchover from normal operation to the injection phase of ECCS operation requires changing centrifugal charging pump suction from the CVCS volume control tank (VCT) to the RWST through the use of isolation valves. Each set of isolation valves is interlocked so that the VCT isolation valves will begin to close once the RWST isolation valves are fully open. Since the VCT is under pressure, the preferred pump suction will be from the VCT until the tank is isolated. This will result in a delay in obtaining the RWST borated water. The effects of this delay are discussed in the Applicable Safety Analyses section of these Bases.~~

Insert 3.5.19

During normal operation in MODES 1, 2, and 3, the safety injection (SI) and residual heat removal (RHR) and Containment Spray System pumps are aligned to take suction from the RWST.

54.ii.b

The ECCS and Containment Spray System pumps are provided with recirculation lines that ensure each pump can maintain minimum flow requirements when operating at or near shutoff head conditions. The recirculation lines for the the RHR and Containment Spray System pumps are directed from the discharge of the pumps to the pump suction. The recirculation lines for the SI pumps are directed back to the RWST.

(continued)

Insert 3.5.18

54.ii.b

A common supply header is used from the RWST to the safety injection (SI) and Containment Spray System pumps. A separate supply header is used for the residual heat removal (RHR) pumps. Isolation valves and check valves are used to isolate the RWST from the ECCS and Containment Spray System prior to transferring to the recirculation mode.

Insert 3.5.19

54.i

The RWST is located in the Auxiliary Building which is normally maintained between 50°F and 104°F (Ref. 1). These moderate temperatures provide adequate margin with respect to potential freezing or overheating of the borated water contained in the RWST.

BASES

and SI pump recirculation

BACKGROUND (continued)

54.ii.b

When the suction for the ECCS and Containment Spray System pumps is transferred to the containment sump, the RWST flow paths must be isolated to prevent a release of the containment sump contents to the RWST, which could result in a release of contaminants to the ~~atmosphere~~ Auxiliary Building and the eventual loss of suction head for the ECCS pumps.

This LCO ensures that:

a. The RWST contains sufficient borated water to support the ECCS during the injection phase;

b. Sufficient water volume exists in the containment sump to support continued operation of the ECCS and Containment Spray System pumps at the time of transfer to the recirculation mode of cooling; and

54.ii.b

c. The reactor remains subcritical following a LOCA.

inadequate NPSH for the RHR pumps

Insufficient water in the RWST could result in ~~insufficient cooling capacity~~ when the transfer to the recirculation mode occurs. Improper boron concentrations could result in a reduction of SDM or excessive boric acid precipitation in the core following the LOCA, as well as excessive caustic stress corrosion of mechanical components and systems inside the containment.

APPLICABLE SAFETY ANALYSES

During accident conditions, the RWST provides a source of borated water to the ECCS and Containment Spray System pumps. As such, it provides containment cooling and depressurization, core cooling, and replacement inventory and is a source of negative reactivity for reactor shutdown (Ref. ~~1~~ 3). The design basis transients and applicable safety analyses concerning each of these systems are discussed in the Applicable Safety Analyses section of B 3.5.2, "ECCS — Operating"; B 3.5.3, "ECCS — Shutdown"; and B 3.6.6, "Containment Spray and Cooling Systems." These analyses are used to assess changes to the RWST in order to evaluate their effects in relation to the acceptance limits in the analyses.

The RWST must also meet volume, boron concentration, and temperature requirements for non-LOCA events. The volume is not an explicit assumption in non-LOCA events since the

(continued)

BASES 54.ii.d

for Reactor Coolant System (RCS) makeup

APPLICABLE SAFETY ANALYSES (continued)

Volume required ~~volume~~ is a small fraction of the available RCS volume. The deliverable volume limit is set by the LOCA and containment analyses. For the RWST, the deliverable volume ~~is different from the total volume contained since, due to the design of the tank, more water can be contained than can be delivered.~~ Insert 3.5.20 The minimum boron concentration is an explicit assumption in the main steam line break (MSLB) and analysis to ensure the required shutdown capability. ~~The importance of its value is small for units with a boron injection tank (BIT) with a high boron concentration. For units with no BIT or reduced BIT boron requirements, the minimum boron concentration limit~~ is an important assumption in ensuring the required shutdown capability. The maximum boron concentration is an explicit assumption in the ~~inadvertent ECCS actuation analysis, although it is typically a nonlimiting event and the results are very insensitive to boron concentrations. The maximum temperature ensures that the amount of cooling provided from the RWST during the heatup phase of a feedline break is consistent with safety analysis assumptions; the minimum is an assumption in both the MSLB and inadvertent ECCS actuation analyses, although the inadvertent ECCS actuation event is typically nonlimiting.~~

evaluation of chemical effects resulting from the operation of the Containment Spray System.

56.i

56.i

54.ii.b

~~The MSLB analysis has considered a delay associated with the interlock between the VCT and RWST isolation valves, and the results show that the departure from nucleate boiling design basis is met. The delay has been established as [27] seconds, with offsite power available, or [37] seconds without offsite power. This response time includes [2] seconds for electronics delay, a [15] second stroke time for the RWST valves, and a [10] second stroke time for the VCT valves. Plants with a BIT need not be concerned with the delay since the BIT will supply highly borated water prior to RWST switchover, provided the BIT is between the pumps and the core.~~

54.iii

For a large break LOCA analysis, the minimum water volume limit of 300,000 ~~[466,200]~~ gallons and the lower boron concentration limit of ~~[~~2000~~]~~ ppm are used to compute the post LOCA sump boron concentration necessary to assure subcriticality. The large break LOCA is the limiting case since the safety analysis assumes that all control rods are out of the core.

The upper limit on boron concentration of 2,900 ~~[2200]~~ ppm is used to determine ~~the maximum allowable time to switch to hot leg~~

Insert 3.5.22

(continued)

Insert 3.5.20

S4.ii.b

is selected such that switchover to recirculation does not occur until sufficient water has been pumped into containment to provide necessary NPSH for the RHR pumps.

Insert 3.5.22

S4.ii.c

the time frame in which boron precipitation is addressed post LOCA. The maximum boron concentration limit is based on the coldest expected temperature of the RWST water volume and on chemical effects resulting from operation of the ECCS and the Containment Spray System. A value of 2,900 ppm would not create the potential for boron precipitation in the RWST assuming an Auxiliary Building temperature of 50°F (Ref. 1). Analyses performed in response to 10 CFR 50.49 (Ref. 2) assumed a chemical spray solution of 2000 to 3000 ppm boron concentration (Ref. 1) which provides a margin of 100 ppm. The chemical spray solution impacts sump pH and the resulting effect of chloride and caustic stress corrosion on mechanical systems and components. The sump pH also affects the rate of hydrogen generation within containment due to the interaction of Containment Spray and sump fluid with aluminum components.

BASES

APPLICABLE SAFETY ANALYSES (continued)

recirculation following a LOCA. The purpose of switching from cold leg to hot leg injection is to avoid boron precipitation in the core following the accident.

54.i

In the ECCS analysis, the containment spray temperature is assumed to be equal to the RWST lower temperature limit of [35]°F. If the lower temperature limit is violated, the containment spray further reduces containment pressure, which decreases the rate at which steam can be vented out the break and increases peak clad temperature. The upper temperature limit of [100]°F is used in the small break LOCA analysis and containment OPERABILITY analysis. Exceeding this temperature will result in a higher peak clad temperature, because there is less heat transfer from the core to the injected water for the small break LOCA and higher containment pressures due to reduced containment spray cooling capacity. For the containment response following an MSLB, the lower limit on boron concentration and the upper limit on RWST water temperature are used to maximize the total energy release to containment.

The RWST satisfies Criterion 3 of the NRC Policy Statement.

LCO

The RWST ensures that an adequate supply of borated water is available to cool and depressurize the containment in the event of a Design Basis Accident (DBA), to cool and cover the core in the event of a LOCA, to maintain the reactor subcritical following a DBA, and to ensure adequate level in the containment sump to support ECCS and Containment Spray System pump operation in the recirculation mode.

54.i

To be considered OPERABLE, the RWST must meet the water volume and boron concentration~~, and temperature~~ limits established in the SRs.

APPLICABILITY

In MODES 1, 2, 3, and 4, RWST OPERABILITY requirements are dictated by ECCS and Containment Spray System OPERABILITY requirements. Since both the ECCS and the Containment Spray System must be OPERABLE in MODES 1, 2, 3, and 4, the RWST must also be OPERABLE to support their operation. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops — MODE 5, Loops Filled," and LCO 3.4.8, "RCS

(continued)

BASES

APPLICABILITY (continued)

Loops — MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation — High Water Level," and LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation — Low Water Level."

ACTIONS

A.1

54.i

With RWST boron concentration ~~or borated water temperature~~ not within limits, ~~they~~ must be returned to within limits within 8 hours. Under these conditions neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE condition. The 8 hour limit to restore the RWST ~~temperature or~~ boron concentration to within limits was developed considering the time required to change ~~either~~ the boron concentration ~~or temperature~~ and the fact that the contents of the tank are still available for injection.

B.1

water volume not within limits

54.i

With the RWST inoperable for reasons other than Condition A (e.g., water volume), it must be restored to OPERABLE status within 1 hour.

In this Condition, neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE status or to place the plant in a MODE in which the RWST is not required. The short time limit of 1 hour to restore the RWST to OPERABLE status is based on this condition simultaneously affecting redundant trains.

C.1 and C.2

If the RWST cannot be returned to OPERABLE status 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 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

54.i

~~SR 3.5.4.1~~

~~The RWST borated water temperature should be verified every 24 hours to be within the limits assumed in the accident analyses band. This Frequency is sufficient to identify a temperature change that would approach either limit and has been shown to be acceptable through operating experience.~~

~~The SR is modified by a Note that eliminates the requirement to perform this Surveillance when ambient air temperatures are within the operating limits of the RWST. With ambient air temperatures within the band, the RWST temperature should not exceed the limits.~~

SR 3.5.4.~~2~~ 1

54.ii.d

The RWST water volume should be verified every 7 days to be above the required minimum level in order to ensure that a sufficient initial supply is available for injection and to support continued ECCS and Containment Spray System pump operation on recirculation. Since the RWST volume is normally stable and the RWST is located in the Auxiliary Building which provides sufficient leak detection capability ~~is protected by an alarm~~, a 7 day Frequency is appropriate and has been shown to be acceptable through operating experience.

SR 3.5.4.~~3~~ 2

The boron concentration of the RWST should be verified every 7 days to be within the required limits. This SR ensures that the reactor will remain subcritical following a LOCA. Further, it assures that the resulting sump pH will be maintained in an acceptable range so that boron precipitation in the core will not occur and the effect of chloride and caustic stress corrosion on mechanical systems and components will be minimized. Since the RWST volume is normally stable, a 7 day sampling Frequency to verify boron

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.5.4.3 (continued)

concentration is appropriate and has been shown to be acceptable through operating experience.

REFERENCES

1. UFSAR, Section 3.11
2. 10 CFR 50.49

3 ~~1.~~ U FSAR, ~~Chapter [6]~~ Section 6.3 and Chapter ~~[15]~~ 15.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.5 Seal Injection Flow

BASES

BACKGROUND

This LCO is applicable only to those units that utilize the centrifugal charging pumps for safety injection (SI). The function of the seal injection throttle valves during an accident is similar to the function of the ECCS throttle valves in that each restricts flow from the centrifugal charging pump header to the Reactor Coolant System (RCS).

The restriction on reactor coolant pump (RCP) seal injection flow limits the amount of ECCS flow that would be diverted from the injection path following an accident. This limit is based on safety analysis assumptions that are required because RCP seal injection flow is not isolated during SI.

APPLICABLE SAFETY ANALYSES

All ECCS subsystems are taken credit for in the large break loss of coolant accident (LOCA) at full power (Ref. 1). The LOCA analysis establishes the minimum flow for the ECCS pumps. The centrifugal charging pumps are also credited in the small break LOCA analysis. This analysis establishes the flow and discharge head at the design point for the centrifugal charging pumps. The steam generator tube rupture and main steam line break event analyses also credit the centrifugal charging pumps, but are not limiting in their design. Reference to these analyses is made in assessing changes to the Seal Injection System for evaluation of their effects in relation to the acceptance limits in these analyses.

This LCO ensures that seal injection flow of ≤ [40] gpm, with centrifugal charging pump discharge header pressure ≥ [2480] psig and charging flow control valve full open, will be sufficient for RCP seal integrity but limited so that the ECCS trains will be capable of delivering sufficient water to match boiloff rates soon enough to minimize uncovering of the core following a large LOCA. It also ensures that the centrifugal charging pumps will deliver sufficient water for a small LOCA and sufficient boron to maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to overcome the loss and maintain RCS inventory. Seal

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)	injection flow satisfies Criterion 2 of the NRC Policy Statement.
LCO	The intent of the LCO limit on seal injection flow is to make sure that flow through the RCP seal water injection line is low enough to ensure that sufficient centrifugal charging pump injection flow is directed to the RCS via the injection points (Ref. 2). The LCO is not strictly a flow limit, but rather a flow limit based on a flow line resistance. In order to establish the proper flow line resistance, a pressure and flow must be known. The flow line resistance is determined by assuming that the RCS pressure is at normal operating pressure and that the centrifugal charging pump discharge pressure is greater than or equal to the value specified in this LCO. The centrifugal charging pump discharge header pressure remains essentially constant through all the applicable MODES of this LCO. A reduction in RCS pressure would result in more flow being diverted to the RCP seal injection line than at normal operating pressure. The valve settings established at the prescribed centrifugal charging pump discharge header pressure result in a conservative valve position should RCS pressure decrease. The additional modifier of this LCO, the control valve (charging flow for four loop units and air operated seal injection for three loop units) being full open, is required since the valve is designed to fail open for the accident condition. With the discharge pressure and control valve position as specified by the LCO, a flow limit is established. It is this flow limit that is used in the accident analyses. The limit on seal injection flow, combined with the centrifugal charging pump discharge header pressure limit and an open wide condition of the charging flow control valve, must be met to render the ECCS OPERABLE. If these conditions are not met, the ECCS flow will not be as assumed in the accident analyses.
APPLICABILITY	In MODES 1, 2, and 3, the seal injection flow limit is dictated by ECCS flow requirements, which are specified for

(continued)

BASES

APPLICABILITY (continued)

MODES 1, 2, 3, and 4. The seal injection flow limit is not applicable for MODE 4 and lower, however, because high seal injection flow is less critical as a result of the lower initial RCS pressure and decay heat removal requirements in these MODES. Therefore, RCP seal injection flow must be limited in MODES 1, 2, and 3 to ensure adequate ECCS performance.

ACTIONS

A.1

With the seal injection flow exceeding its limit, the amount of charging flow available to the RCS may be reduced. Under this Condition, action must be taken to restore the flow to below its limit. The operator has 4 hours from the time the flow is known to be above the limit to correctly position the manual valves and thus be in compliance with the accident analysis. The Completion Time minimizes the potential exposure of the plant to a LOCA with insufficient injection flow and provides a reasonable time to restore ~~ensures that~~ seal injection flow ~~is~~, within ~~either restored to or below its~~ limits. This time is conservative with respect to the Completion Times of other ECCS LCOs; it is based on operating experience and is sufficient for taking corrective actions by operations personnel.

B.1 and B.2

When the Required Actions cannot be completed within the required Completion Time, a controlled shutdown must be initiated. The Completion Time of 6 hours for reaching MODE 3 from MODE 1 is a reasonable time for a controlled shutdown, based on operating experience and normal cooldown rates, and does not challenge plant safety systems or operators. Continuing the plant shutdown begun in Required Action B.1, an additional 6 hours is a reasonable time, based on operating experience and normal cooldown rates, to reach MODE 4, where this LCO is no longer applicable.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.5.5.1

Verification every 31 days that the manual seal injection throttle valves are adjusted to give a flow within the limit ensures that proper manual seal injection throttle valve position, and hence, proper seal injection flow, is maintained. The Frequency of 31 days is based on engineering judgment and is consistent with other ECCS valve Surveillance Frequencies. The Frequency has proven to be acceptable through operating experience.

As noted, the Surveillance is not required to be performed until 4 hours after the RCS pressure has stabilized within a ± 20 psig range of normal operating pressure. The RCS pressure requirement is specified since this configuration will produce the required pressure conditions necessary to assure that the manual valves are set correctly. The exception is limited to 4 hours to ensure that the Surveillance is timely.

REFERENCES

1. FSAR, Chapter [6] and Chapter [15].
2. 10 CFR 50.46.

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B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.6 Boron Injection Tank (BIT)

BASES

BACKGROUND

The BIT is part of the Boron Injection System, which is the primary means of quickly introducing negative reactivity into the Reactor Coolant System (RCS) on a safety injection (SI) signal.

The main flow path through the Boron Injection System is from the discharge of the centrifugal charging pumps through lines equipped with a flow element and two valves in parallel that open on an SI signal. The valves can be operated from the main control board. The valves and flow elements have main control board indications. Downstream of these valves, the flow enters the BIT (Ref. 1).

The BIT is a stainless steel tank containing concentrated boric acid. Two trains of strip heaters are mounted on the tank to keep the temperature of the boric acid solution above the precipitation point. The strip heaters are controlled by temperature elements located near the bottom of the BIT. The temperature elements also activate High and Low alarms on the main control board. In addition to the strip heaters on the BIT, there is a recirculation system with a heat tracing system, including the piping section between the motor operated isolation valves, which further ensures that the boric acid stays in solution. The BIT is also equipped with a High Pressure alarm on the main control board. The entire contents of the BIT are injected when required; thus, the contained and deliverable volumes are the same.

During normal operation, one of the two BIT recirculation pumps takes suction from the boron injection surge tank (BIST) and discharges to the BIT. The solution then returns to the BIST. Normally, one pump is running and one is shut off. On receipt of an SI signal, the running pump shuts off and the air operated valves close. Flow to the BIT is then supplied from the centrifugal charging pumps. The solution of the BIT is injected into the RCS through the RCS cold legs.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

During a main steam line break (MSLB) or loss of coolant accident (LOCA), the BIT provides an immediate source of concentrated boric acid that quickly introduces negative reactivity into the RCS.

The contents of the BIT are not credited for core cooling or immediate boration in the LOCA analysis, but for post LOCA recovery. The BIT maximum boron concentration of [22,500] ppm is used to determine the minimum time for hot leg recirculation switchover. The minimum boron concentration of [20,000] ppm is used to determine the minimum mixed mean sump boron concentration for post LOCA shutdown requirements.

For the MSLB analysis, the BIT is the primary mechanism for injecting boron into the core to counteract any positive increases in reactivity caused by an RCS cooldown. The analysis uses the minimum boron concentration of the BIT, which also affects both the departure from nucleate boiling and containment design analyses. Reference to the LOCA and MSLB analyses is used to assess changes to the BIT to evaluate their effect on the acceptance limits contained in these analyses.

The minimum temperature limit of [145]°F for the BIT ensures that the solution does not reach the boric acid precipitation point. The temperature of the solution is monitored and alarmed on the main control board.

The BIT boron concentration limits are established to ensure that the core remains subcritical during post LOCA recovery. The BIT will counteract any positive increases in reactivity caused by an RCS cooldown.

The BIT minimum water volume limit of [1100] gallons is used to ensure that the appropriate quantity of highly borated water with sufficient negative reactivity is injected into the RCS to shut down the core following an MSLB, to determine the hot leg recirculation switchover time, and to safeguard against boron precipitation.

The BIT satisfies Criteria 2 and 3 of the NRC Policy Statement.

(continued)

56

BASES (continued)

LCO

This LCO establishes the minimum requirements for contained volume, boron concentration, and temperature of the BIT inventory (Ref. 2). This ensures that an adequate supply of borated water is available in the event of a LOCA or MSLB to maintain the reactor subcritical following these accidents.

To be considered OPERABLE, the limits established in the SR for water volume, boron concentration, and temperature must be met.

If the equipment used to verify BIT parameters (temperature, volume, and boron concentration) is determined to be inoperable, then the BIT is also inoperable.

APPLICABILITY

In MODES 1, 2, and 3, the BIT OPERABILITY requirements are consistent with those of LCO 3.5.2, "ECCS — Operating."

In MODES 4, 5, and 6, the respective accidents are less severe, so the BIT is not required in these lower MODES.

ACTIONS

A.1

If the required volume is not present in the BIT, both the hot leg recirculation switchover time analysis and the boron precipitation analysis would not be met. Under these conditions, prompt action must be taken to restore the volume to above its required limit to declare the tank OPERABLE, or the plant must be placed in a MODE in which the BIT is not required.

The BIT boron concentration is considered in the hot leg recirculation switchover time analysis, the boron precipitation analysis, and the reactivity analysis for an MSLB. If the concentration were not within the required limits, these analyses could not be relied on. Under these conditions, prompt action must be taken to restore the concentration to within its required limits, or the plant must be placed in a MODE in which the BIT is not required.

The BIT temperature limit is established to ensure that the solution does not reach the boric acid crystallization point. If the temperature of the solution drops below the

(continued)

ACTIONS

A.1 (continued)

minimum, prompt action must be taken to raise the temperature and declare the tank OPERABLE, or the plant must be placed in a MODE in which the BIT is not required.

The 1 hour Completion Time to restore the BIT to OPERABLE status is consistent with other Completion Times established for loss of a safety function and ensures that the plant will not operate for long periods outside of the safety analyses.

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

When Required Action A.1 cannot be completed within the required Completion Time, a controlled shutdown should be initiated. Six hours is a reasonable time, based on operating experience, to reach MODE 3 from full power conditions and to be borated to the required SDM without challenging plant systems or operators. Borating to the required SDM assures that the plant is in a safe condition, without need for any additional boration.

After determining that the BIT is inoperable and the Required Actions of B.1 and B.2 have been completed, the tank must be returned to OPERABLE status within 7 days. These actions ensure that the plant will not be operated with an inoperable BIT for a lengthy period of time. It should be noted, however, that changes to applicable MODES cannot be made until the BIT is restored to OPERABLE status pursuant to the provisions of LCO 3.0.4.

C.1

Even though the RCS has been borated to a safe and stable condition as a result of Required Action B.2, either the BIT must be restored to OPERABLE status (Required Action C.1) or the plant must be placed in a condition in which the BIT is not required (MODE 4). The 12 hour Completion Time to reach MODE 4 is reasonable, based on operating experience and normal cooldown rates, and does not challenge plant safety systems or operators.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.5.6.1

Verification every 24 hours that the BIT water temperature is at or above the specified minimum temperature is frequent enough to identify a temperature change that would approach the acceptable limit. The solution temperature is also monitored by an alarm that provides further assurance of protection against low temperature. This Frequency has been shown to be acceptable through operating experience.

SR 3.5.6.2

Verification every 7 days that the BIT contained volume is above the required limit is frequent enough to assure that this volume will be available for quick injection into the RCS. If the volume is too low, the BIT would not provide enough borated water to ensure subcriticality during recirculation or to shut down the core following an MSLB. Since the BIT volume is normally stable, a 7 day Frequency is appropriate and has been shown to be acceptable through operating experience.

SR 3.5.6.3

Verification every 7 days that the boron concentration of the BIT is within the required band ensures that the reactor remains subcritical following a LOCA; it limits return to power following an MSLB, and maintains the resulting sump pH in an acceptable range so that boron precipitation will not occur in the core. In addition, the effect of chloride and caustic stress corrosion on mechanical systems and components will be minimized.

The BIT is in a recirculation loop that provides continuous circulation of the boric acid solution through the BIT and the boric acid tank (BAT). There are a number of points along the recirculation loop where local samples can be taken. The actual location used to take a sample of the solution is specified in the plant Surveillance procedures. Sampling from the BAT to verify the concentration of the BIT is not recommended, since this sample may not be homogenous and the boron concentration of the two tanks may differ.

(continued)

56

BASES

SURVEILLANCE REQUIREMENTS	SR 3.5.6.3 (continued) The sample should be taken from the BIT or from a point in the flow path of the BIT recirculation loop.
REFERENCES	1. FSAR, Chapter [6] and Chapter [15]. 2. 10 CFR 50.46.

ATTACHMENT E

Cross Reference Between Ginna Station Technical Specifications and NUREG-1431

ONLY RELEVANT SECTIONS ARE PROVIDED AT THIS TIME

GINNA STATION TS CROSS REFERENCE TO NUREG-1431

GINNA STATION TS #	NUREG-1431	ATTACH. A NOTES*
3.3.1.1.A	LCO 3.5.4	13.II
3.3.1.1.A	SR 3.5.4.1	
3.3.1.1.A	SR 3.5.4.2	
3.3.1.1.B		13.VII
3.3.1.1.B		13.VI
3.3.1.1.B	LCO 3.5.1	13.I
3.3.1.1.C	LCO 3.5.2	13.III
3.3.1.1.D	LCO 3.5.2	
3.3.1.1.E	LCO 3.5.2	
3.3.1.1.F	LCO 3.5.1	
3.3.1.1.F	LCO 3.5.2	
3.3.1.1.F	LCO 3.5.4	
3.3.1.1.G	LCO 3.5.2	13.VIII
3.3.1.1.I	LCO 3.5.1	
3.3.1.1.I	SR 3.5.1.5	
3.3.1.1.J	LCO 3.5.2	
3.3.1.2	LCO 3.5.4	13.II
3.3.1.3	LCO 3.5.1	13.I
3.3.1.4	LCO 3.5.2	
3.3.1.5	LCO 3.5.2	
3.3.1.5.A	LCO 3.5.2	
3.3.1.5.B	LCO 3.5.2	
3.3.1.5.C	LCO 3.5.2	
3.3.1.5.D	LCO 3.5.2	13.IV
4.5		32.IV
4.5.1.1.A	SR 3.5.2.5	32.I
4.5.1.1.B	SR 3.5.2.5	
4.5.2.1.A	SR 3.5.2.4	32.II
4.5.2.1.B	SR 3.5.2.4	32.II
4.5.2.2.C		32.III
TABLE 4.1-1, 15	SR 3.5.4.1	
TABLE 4.1-1, 24	SR 3.5.1.2	
TABLE 4.1-1, 24	SR 3.5.1.3	28.I.A
TABLE 4.1-2, 14		28.II.C
TABLE 4.1-2, 14		28.II.A
TABLE 4.1-2, 14	SR 3.5.1.4	28.II.B
TABLE 4.1-2, 3	SR 3.5.4.2	28.II.D
TABLE 4.5-1	SR 3.5.2.3	32.II

* Attachment A, Section C.2 note number which discusses and justifies all changes to the Ginna TS section.