3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Accumulators

LCO 3.5.1 Two Safety Injection Accumulators shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODE 3 with RCS pressure > 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.	24 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1	Be in MODE 3.	6 hours
	AND		
	C.2	Reduce RCS pressure to ≤ 1000 psig.	12 hours
D. Two accumulators inoperable.	D.1	Enter LCO 3.0.3.	Immediately

BASES

BACKGROUND (continued)

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 (Ref. 1). 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 design basis accident calculations, conservative assumptions are made concerning the availability of ECCS flow, offsite power, and initial plant conditions.

The limiting large break LOCA is a double ended guillotine break at the discharge of the reactor coolant pump. The limiting large break LOCA analysis (Ref. 3) assumes availability of offsite power. In addition, the contents of one accumulator are assumed to be lost through the break. The main effects of maintaining offsite power are in the modeling of the containment pressure response, and operation of the reactor coolant pumps. By maintaining offsite power, both containment spray systems and all four containment fan cooler units are assumed to operate, and the worst case single failure becomes the loss of the largest ECCS Pump (a residual heat removal (RHR) pump). By maintaining full containment cooling capability, containment pressure is minimized which increases RCS blowdown rate, while the loss of a RHR pump decreases the amount of injection flow available to reflood the core. These assumptions result in an increase in core reflood time leading to higher peak clad temperatures. Operation of the reactor coolant pumps during the blowdown phase increases the rate of RCS blowdown while lowering mass flow through the core, also leading to higher peak clad temperatures. During the reflood phase, the reactor coolant pumps are assumed to cease operation, obtaining a locked rotor flow resistance to delay core reflood, which contributes to a higher peak clad temperature. While this may in fact be the most limiting case relative to peak clad temperature, it is clear that the availability of the emergency diesel generators, buses and safeguards equipment, are key to mitigating the consequences of a large break LOCA in the event of a loss-of-offsite power. No operator action is assumed during the blowdown stage of a large break LOCA.

The limiting small break LOCA analysis (Ref. 3) assume loss of offsite power with the limiting single failure conservatively taken to be loss of one train of ECCS due to loss of an emergency diesel generator. Accordingly, the worst case small break LOCA analyses 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

BASES

APPLICABILITY (continued)

In MODE 3, with RCS pressure ≤ 1000 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. Thus, 72 hours is allowed to return the boron concentration to within limits.

B.1

If one accumulator is inoperable for a reason other than boron concentration, the accumulator must be returned to OPERABLE status within 24 hours. 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 24 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. The 24 hours allowed to restore an inoperable accumulator to OPERABLE status is justified in WCAP-15049-A, Rev. 1 (Ref. 4).

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 RCS pressure reduced to ≤ 1000 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.

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ACTIONS (continued) D.1

If both accumulators are inoperable, the water volume and boron concentrations assumed in the various accident analyses may not be delivered to the RCS therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 3.5.1.1

Each accumulator 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.

SR 3.5.1.2 and SR 3.5.1.3

Every 12 hours, 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.

SR 3.5.1.4

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 Frequency is adequate to identify changes that could occur from mechanisms such as stratification or inleakage. Sampling the affected accumulator within 24 hours after a 5% volume increase will identify whether inleakage has caused a reduction in boron concentration to below the required limit. It is not necessary to verify boron concentration if the added water inventory is from the refueling water storage tank (RWST), and the water contained in the RWST is within the accumulator boron concentration requirements. This is consistent with the recommendation of NUREG-1366 (Ref. 5).

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.5

Verification every 31 days that power is removed from each accumulator isolation valve operator when the RCS pressure is > 1000 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 in the event of a LOCA. Since power is removed under administrative control, the 31 day Frequency will provide adequate assurance that power is removed.

This SR allows power to be supplied to the motor operated isolation valves when RCS pressure is ≤ 1000 psig, thus allowing operational flexibility by avoiding unnecessary delays to manipulate the breakers during plant startups or shutdowns.

REFERENCES

1. FSAR, Section 6.2.
2. 10 CFR 50.46.
3. FSAR, Chapter 14.
4. WCAP-15049-A, Rev. 1, April 1999.
5. NUREG-1366, February 1990.