(3) Low pressurizer pressure - $\geq$ 1865 psig

(4) Overtemperature ΔT

$$\leq \Delta T_o \left(K_1 - K_2(T-T') \frac{(1+\tau_1 S)}{1+\tau_2 S} + K_3 (P-P') - f(\Delta I)\right)$$

where

ΔT_o = indicated ΔT at rated power, °F

T = average temperature, °F

T' = 574.2 °F

P = pressurizer pressure, psig

P' = 2235 psig

K_1 $\leq$ 1.117 for operation at 2250 psia primary system pressure
$\leq$ 1.30 for operation at 2000 psia primary system pressure

K_2 = 0.0150

K_3 = 0.000791

τ_1 = 25 sec

τ_2 = 3 sec

and $f(\Delta I)$ is an even function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during plant startup tests, where q_t and q_b are the percent power in the top and bottom halves of the core respectively, and $q_t + q_b$ is total core power in percent of rated power, such that:

(a) for $q_t - q_b$ within -17, +9 percent, $f(\Delta I) = 0$.

(b) for each percent that the magnitude of $q_t - q_b$ exceeds +9 percent the ΔT trip set point shall be automatically reduced by an equivalent of two percent of rated power.

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15.3 LIMITING CONDITIONS FOR OPERATION

15.3.1 REACTOR COOLANT SYSTEM

Applicability

Applies to the operating status of the Reactor Coolant System.

Objective

To specify those limiting conditions for operation of the Reactor Coolant System which must be met to ensure safe reactor operation.

Specification

A. OPERATIONAL COMPONENTS

Specification:

1. Coolant Pumps

   a. At least one reactor coolant pump or the residual heat removal system shall be in operation when a reduction is made in the boron concentration of the reactor coolant.

   b. When the reactor is critical and above 1% thermal power, except for natural circulation tests, at least one reactor coolant pump shall be in operation.

   c. (1) Reactor power shall not be maintained above 10% of rated power unless both reactor coolant pumps are in operation.

      (2) If either reactor coolant pump ceases operating, immediate power reduction shall be initiated under administrative control as necessary to reduce power to less than 10% of rated power.

2. Steam Generator

   a. One steam generator shall be operable whenever the average reactor coolant temperature is above 350°F.

3. Safety Valves

   a. At least one pressurizer safety valve shall be operable whenever the reactor head is on the vessel.

   b. Both pressurizer safety valves shall be operable whenever the reactor is critical.

Basis:

When the boron concentration of the reactor coolant system is to be reduced the process must be uniform to prevent sudden reactivity changes in the reactor. Mixing of the reactor coolant will be sufficient to maintain a uniform boron concentration if at least one reactor coolant pump or one residual heat removal pump is running while the change is taking place. The residual heat removal pump will circulate the primary system volume in approximately one half hour. The pressurizer is of little concern because of the low pressurizer volume and because pressurizer boron concentration normally will be higher than that of the rest of the reactor coolant.

Part 1 of the specification requires that a sufficient number of reactor coolant pumps be operating to provide core cooling in the event that a loss of flow occurs. The flow provided in each case will keep DNBR well above 1.30 as discussed in FFDSAR Section 14.1.9. Therefore, cladding damage and release of fission products to the reactor coolant will not occur. Heat transfer analyses (1) show that reactor heat equivalent to 10% of rated power can be removed with natural circulation only; hence, the specified upper limit of 1% rated power without operating pumps provides a substantial safety factor.

Each of the pressurizer safety valves is designed to relieve 288,000 lbs. per hr. of saturated steam at set point. Below 350°F and 350 psig in the reactor coolant system, the residual heat removal system can remove decay heat and thereby control system temperature and pressure. If no residual heat is removed by any of the means available the amount of steam which could be generated at safety valve relief pressure would be less than half the valves' capacity. One valve therefore provides adequate defense against over-pressurization. Part 1 c(2) permits an orderly reduction in power if a reactor coolant pump is lost during operation between 10% and 50% of rated power. Above 50% power, an automatic reactor trip will occur if either pump is lost. The power-to-flow ratio will be maintained equal to or less than 1.0 which ensures that the minimum DNB ratio increases at lower flow since the maximum enthalpy rise does not increase above its normal full-flow maximum value.(2)

Reference

(1) FSAR Section 14.1.6

(2) FSAR Section 7.2.3

G. OPERATIONAL LIMITATIONS

The following DNB related parameters shall be maintained within the limits shown during Rated Power operation:

1. T_{AVG} shall be maintained at or below 578°F.
2. Reactor coolant system pressure shall be maintained:

   $\geq$ 2205 psig during operation at 2250 psia or,

   $\geq$ 1955 psig during operation at 2000 psia.
3. Reactor Coolant System Total Flow Rate $\geq$ 178,000 gpm.

Basis:

Although the operational limitations above require reactor coolant system total flow be maintained above a minimum rate, no direct means of measuring absolute flow during operation exist However, during initial startup reactor coolant flow was measured and correlated to core ΔT. Therefore monitoring of ΔT may be used to verify the above minimum flow requirement is met. If a change in steady state full power ΔT greater than 3°F is observed, the actual flow measurements will be taken.

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15.4.3 PRIMARY SYSTEM TESTING FOLLOWING OPENING

Applicability

Applies to test requirements for primary system integrity.

Objective

To specify tests for primary system integrity after the system is closed following normal opening, modification or repair.

Specification

a) When the primary system is closed after it has been opened, the system will be leak tested at:

   1) Not less than 2335 psig for operation at 2250 psia primary system pressure, or

   2) Not less than 2085 psig for operation at 2000 psia primary system pressure.

b) When primary system modifications or repairs have been made which involved new strength welds on components greater than 2 in. diameter, the new welds will receive both a surface and 100% volumetric non-destructive examination.

c) When primary system modifications or repairs have been made which involve new strength welds on components 2 in. diameter or smaller, the new welds will receive a surface examination.

Basis

F · normal opening the integrity of the system, in terms of strength, is unchanged. If the system does not leak at 2335 psig (operating pressure + 100 psi: ± 100 psi is normal system pressure fluctuation), it should be leak tight during normal operation at 2250 psia. If the system does not leak at 2085 it should be leak tight during normal operation at 2000 psia.

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