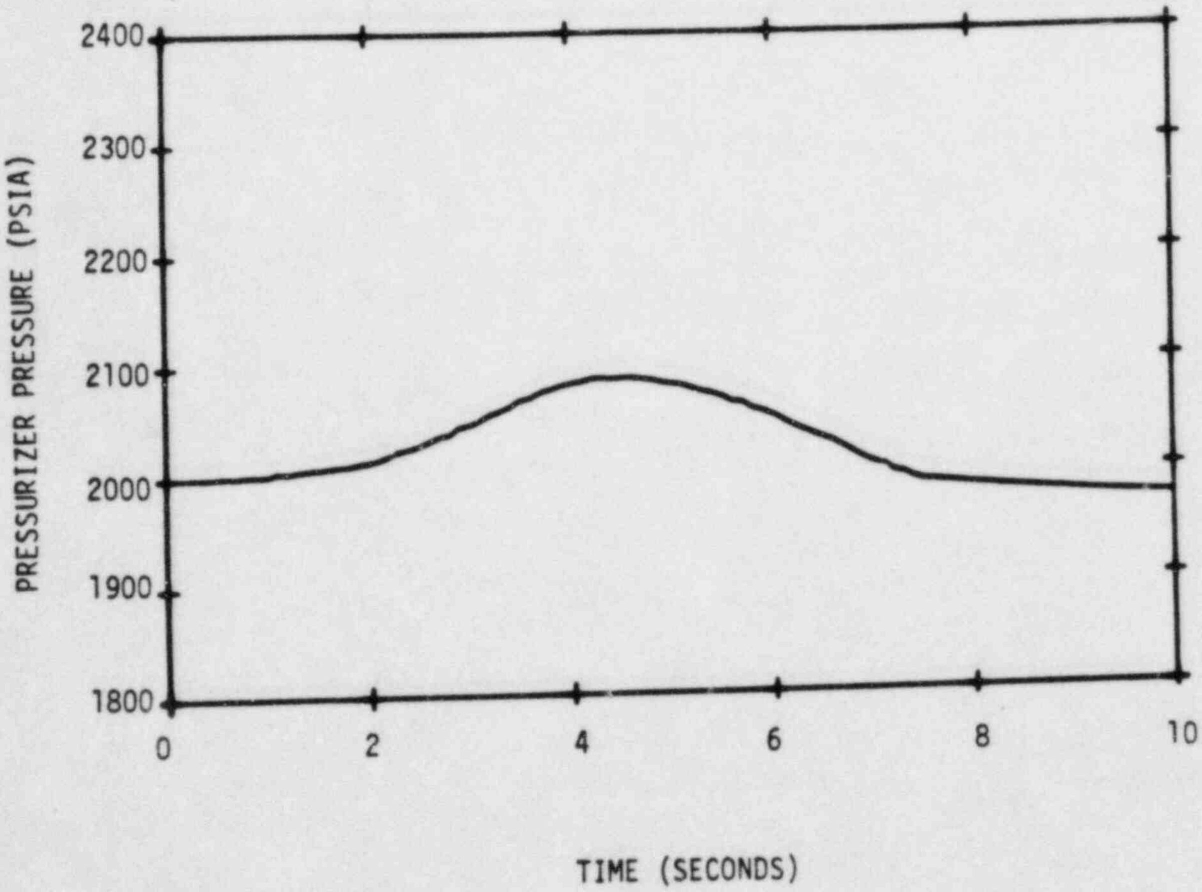

FIGURE 14.1.8-2

TWO LOOPS IN OPERATION
TWO LOOPS FLOW DECAYING
PRESSURIZER PRESSURE VS. TIME

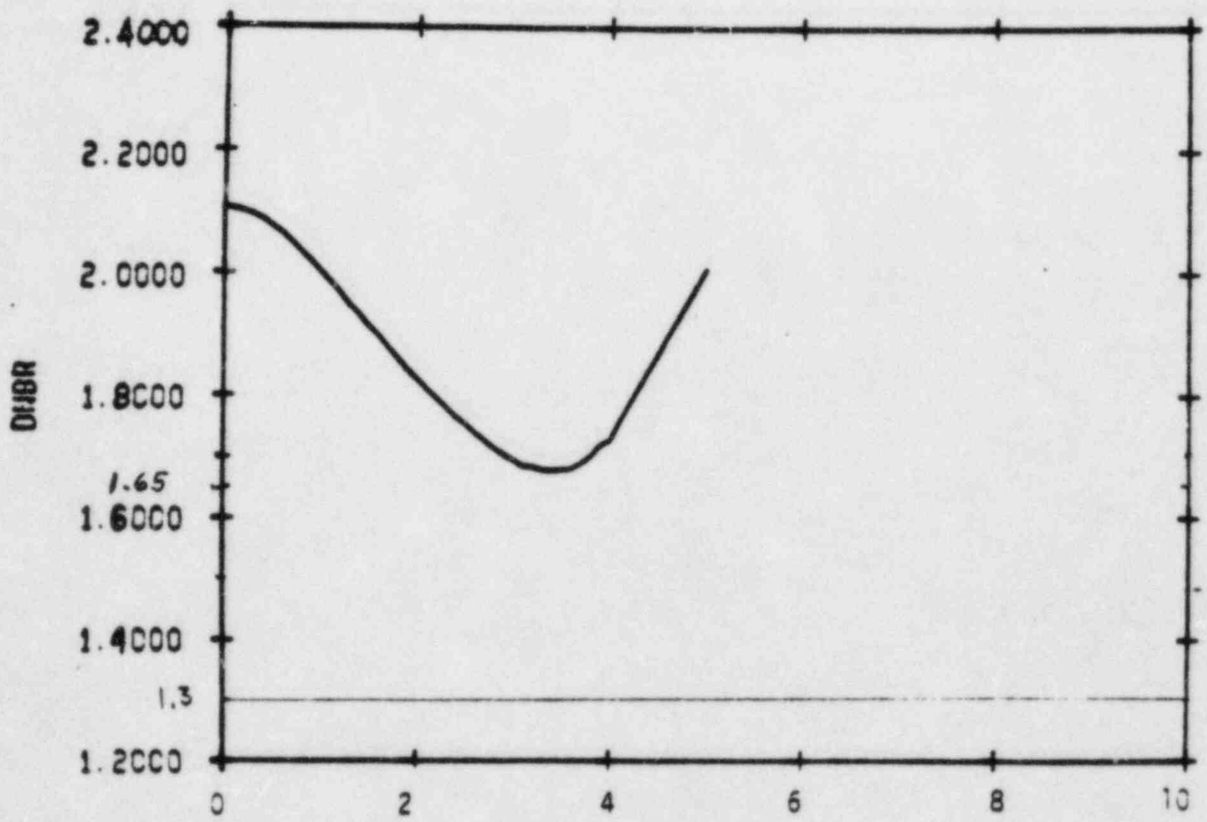

FIGURE 14.1.8-4

TWO LOOPS IN OPERATION, TWO LOOPS
FLOW DECAYING
DNBR VS. TIME

TABLE 14.1.8-12

TIME SEQUENCE OF EVENTS
FOR LOSS OF REACTOR COOLANT FLOW

Case	Event	Time of Each Event (Seconds)
Linear reduction of forced reactor coolant flow	Both operating pumps experience frequency reduction and flow decays linearly	0
	Reactor coolant pump under-frequency trip point reached	1.1
	Rods begin to drop	1.7
	Minimum DNBR occurs	3.4

ATTACHMENT 2

(c) for each percent that the magnitude of $q_t - q_b$ exceeds -17 percent, the ΔT trip setpoint shall be automatically reduced by an equivalent of two percent of rated power.

[1.B. (5)] Overpower ΔT

$$\leq \Delta T_o \left[K_4 - K_5 \frac{\tau_3 S}{\tau_3 S + 1} T - K_6 (T-T') - f(\Delta I)\right]$$

where

ΔT_o	=	indicated ΔT at rated power, °F
T	=	average temperature, °F
T'	=	574.2
K_4	$\leq$	1.089 of rated power
K_5	=	0.0262 for increasing T
	=	0.0 for decreasing T
K_6	=	0.00123 for $T \geq T'$
	=	0.0 for $T < T'$
$\tau 3$	=	10 sec

f (ΔI) as defined in (4) above,

(6) Undervoltage - ≥75% of normal voltage

(7) Low indicated reactor coolant flow per loop- ≥90% of normal indicated loop flow

(8) Reactor coolant pump motor breaker open

(a) Low frequency set point ≥55.0 HZ

(b) Low voltage setpoint ≥75% of normal voltage

(c) for each percent that the magnitude of $q_t - q_b$ exceeds -17 percent, the ΔT setpoint shall be automatically reduced by an equivalent of 2.0 percent of rated power.

(5)] Overpower ΔT $\left(\frac{1}{1+\tau_3 S}\right)$

$$\leq \Delta To \left[K_4 - K_5\left(\frac{\tau_5 S}{\tau_5 S + 1}\right)\left(\frac{1}{1+\tau_4 S}\right) T - K_6\left[T\left(\frac{1}{1+\tau_4 S}\right) - T'\right] - f(\Delta I)\right.$$

where

ΔT_o	=	indicated ΔT at rated power, °F
T	=	average temperature, °F
T'	=	574.2°F
K_4	≤	1.089 of rated power
K_5	=	0.0262 for increasing T
	=	0.0 for decreasing T
K_6	=	0.00123 for T ≥ T
	=	0.0 for T < T'
τ5	=	10 sec
		f (ΔI) as defined in (4) above,
τ3	=	2 sec. for Rosemont or equivalent RTD
		0 sec for Sostman or equivalent RTD
τ4	=	2 sec for Rosemont or equivalent RTD
		0 sec for Sostman or equivalent RTD

(6) Undervoltage - ≥75 percent of normal voltage

(7) Low indicated reactor coolant flow per loop - ≥90 percent of normal indicated loop flow

(8) Reactor coolant pump motor breaker open

(a) Low frequency set point ≥55.0 HZ

(b) Low voltage set point ≥75 percent of normal voltage the reactor coolant pump breaker opening as actuated by either high current, low supply voltage or low electrical frequency, or by a manual control switch. The significant feature of the breaker trip is the frequency setpoint, 55.0 HZ which assures a trip signal before the pump inertia is reduced to an unacceptable value. The high pressure water level reactor trip protects the pressurizer safety valves against water relief. The specified setpoint allows adequate operating instrument error[2] and transient overshoot in level before the reactor trips.

The low-low steam generator water level reactor trip protects against loss of feedwater flow accidents. The specified setpoint assures that there will be sufficient water inventory in the steam generators at the time of trip to allow for starting delays for the auxiliary feedwater system[9]

Numerous reactor trips are blocked at low power where they are not required for protection and would otherwise interfere with normal plant operations. The prescribed setpoint above which these trips are unblocked assures their availability in the power range where needed. Specifications 15.2.3.2.A(1) and 15.2.3.2.C have a ±1% tolerance to allow for a 2% deadband of the P10 bistable which is used to set the limit of both items.

Sustained operation with only one pump will not be permited above 10% power. If a pump is lost while operating between 10% and 50% power, an orderly and immediate reduction in power level to below 10% is allowed. The power-to-flow ratio will be maintained equal to or less than unity, which ensures that the minimum DNB ratio increases at lower flow because the maximum enthalpy rise does not increase above the maximum enthalpy rise which occurs during full power and full flow operation.

References

(1) FSAR 14.1.1
(2) FSAR, Page 14-3
(3) FSAR 14.2.6
(4) FSAR 14.3.1
(5) FSAR 14.1.2
(6) FSAR 7.2, 7.3
(7) FSAR 3.2.1
(8) FSAR 14.1.9
(9) FSAR 14.1.11

the reactor coolant pump breaker opening as actuated by either high current, low supply voltage or low electrical frequency, or by a manual control switch. The significant feature of the breaker trip is the frequency setpoint, 55.0 HZ which assures a trip signal before the pump inertia is reduced to an unacceptable value. The high pressure water level reactor trip protects the pressurizer safety valves against water relief. The specified setpoint allows adequate operating instrument error[(2)] and transient overshoot in level before the reactor trips.

The low-low steam generator water level reactor trip protects against loss of feedwater flow accidents. The specified setpoint assures that there will be sufficient water inventory in the steam generators at the time of trip to allow for starting delays for the auxiliary feedwater system[(9)]

Numerous reactor trips are blocked at low power where they are not required for protection and would otherwise interfere with normal plant operations. The prescribed setpoint above which these trips are unblocked assures their availability in the power range where needed. Specifications 15.2.3.2.A(1) and 15.2.3.2.C have a ±1% tolerance to allow for a 2% deadband of the P10 bistable which is used to set the limit of both items. The difference between the nominal and maximum allowed value (or minimum allowed value) is to account for "as measured" rack drift effects.

Sustained operation with only one pump will not be permited above 10 percent power. If a pump is lost while operating between 10 percent and 50 percent power, an orderly and immediate reduction in power level to below 10 percent is allowed. The power-to-flow ratio will be maintained equal to or less than unity, which ensures that the minimum DNB ratio increases at lower flow because the maximum enthalpy rise does not increase above the maximum enthalpy rise which occurs during full power and full flow operation.

References

(1) FSAR 14.1.1
(2) FSAR, Page 14-3
(3) FSAR 14.2.6
(4) FSAR 14.3.1
(5) FSAR 14.1.2
(6) FSAR 7.2, 7.3
(7) FSAR 3.2.1
(8) FSAR 14.1.9
(9) FSAR 14.1.11

Item 15.3.1.A.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)]

Specification 15.3.1.A.3 provides limiting conditions for operation to ensure that redundancy in decay heat removal methods is provided. A single reactor coolant loop with its associated steam generator and a reactor coolant pump or a single residual heat removal loop provides sufficient heat removal capacity for removing the reactor core decay heat; however, single-failure considerations require that at least two decay heat removal methods be available. Operability of a steam generator for decay heat removal includes two sources of water, water level indication in the steam generator, a vent path to atmosphere, and the Reactor Coolant System filled and vented so thermal convection cooling of the core is possible. If the steam generators are not available for decay heat removal, this Specification requires both residual heat removal loops to be operable unless the reactor system is in the refueling shutdown condition with the refueling cavity flooded and no operations in progress which could cause an increase in reactor decay heat load or a decrease in boron concentration. In this condition, the reactor vessel is essentially a fuel storage pool and removing a RHR loop from service provides conservative conditions should operability problems develop in the other RHR loop. Also, one residual heat removal loop may be temporarily out of service due to surveillance testing, calibration, or inspection requirements. The surveillance procedures follow administrative controls which allow for timely restoration of the residual heat removal loop to service if required.

Each of the pressurizer safety valves is designed to relieve 288,000 lbs. per hour of saturated steam at setpoint. 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 overpressurization. Below 350°F and 400 psig in the Reactor Coolant System, the residual heat removal system can remove decay heat and thereby control system temperature and pressure.