LIMITING CONDITION FOR OPERATION (Continued)

b. The SHUTDOWN MARGIN requirement of Specification 3.1.1.1.1 is determined at least once per 12 hours, and

c. A power distribution map is obtained from the incore detection system and F_Q and $F^N \Delta H$ are verified to be within their limits within 72 hours.

d. The THERMAL POWER level is reduced to ≤75% of RATED THERMAL POWER within one hour and within the next 4 hours the Power Range and Intermediate Power Range Neutron Flux high trip setpoint is reduced to ≤108% of the 75% of allowable THERMAL POWER, or

e. The remainder of the rods in the group with the inoperable rod are aligned to within ±8 inches of the inoperable rod within one hour while maintaining the rod sequence and insertion limits of Figure 3.1-2. The THERMAL POWER level shall be restricted pursuant to Specification 3.1.3.5 during subsequent operation.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each control rod shall be determined to be within the limit by verifying the individual rod positions at least once per 4 hours.

4.1.3.1.2 Each control rod not fully inserted shall be determined to be OPERABLE by movement of at least 4 inches in any one direction at least once per 31 days.

4.1.3.1.3 The maximum reactivity insertion rate due to withdrawal of the highest worth control rod group shall be determined not to exceed 1.5×10^{-4} $\Delta k/k$ per second at least once per 18 months.

8804140029 880404
PDR ADOCK 05000029
P DCD

POSITION INDICATOR CHANNELS

LIMITING CONDITION FOR OPERATION

3.1.3.2 All control rod primary and secondary position indicator channels shall be OPERABLE and capable of determining the control rod positions within ±3 inches.

APPLICABILITY: MODES 1 and 2.

ACTION:

a. With a maximum of one primary rod position indicator channel per group inoperable either:

   1. Determine the position of the non-indicating rod(s) indirectly by the incore detection system at least once per 24 hours and immediately after any motion of the non-indicating rod which exceeds 8 inches in one direction since the last determination of the rod's position, or

   2. Reduce THERMAL POWER to <50% of THERMAL POWER allowable for the main coolant pump combination within 8 hours.

b. With a maximum of one secondary position indicator per group inoperable either:

   1. Verify that all primary rod position indicators for the affected group are OPERABLE, or

   2. Reduce THERMAL POWER to <50% of THERMAL POWER allowable for the main coolant pump combination within 8 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.2 Each rod position indicator channel shall be determined to be OPERABLE by verifying the primary position indication system and the secondary position indicator channels agree within 3 inches at least once per 4 hours.

PEAK LINEAR HEAT GENERATION RATE

LIMITING CONDITION FOR OPERATION

3.2.1 The peak linear heat generation rate (LHGR) shall not exceed the limits of Figure 3.2-1 during steady state operation.

APPLICABILITY: MODE 1.

ACTION:

With the peak LHGR exceeding the limits of Figure 3.2-1:

a. Within 15 minutes reduce THERMAL POWER to not more than that fraction of the RATED THERMAL POWER as expressed below:

$$\text{Fraction of RATED THERMAL POWER} = \frac{\text{Limiting LHGR}}{\text{Peak Full Power LHGR}}$$

b. Within 4 hours reduce the Power Range and Intermediate Power Range Neutron Flux high trip setpoint to ≤108% of the fraction of RATED THERMAL POWER.

SURVEILLANCE REQUIREMENTS

4.2.1.1 The peak LHGR shall be determined to be within the limits of Figure 3.2-1 using the incore detection system to obtain a power distribution map:

a. Prior to initial operation above 75% of RATED THERMAL POWER after each fuel loading, and

b. At least once per 1,000 EFPH,

c. The provisions of Specification 4.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS (Continued)

4.2.1.2 The below factors shall be included in the calculation of peak full power LHGR:

a. Heat flux power peaking factor, F_q^N, measured using the incore detection system at a power $\geq$10%.

b. The multiplier for xenon redistribution is a function of core lifetime as given in Figure 3.2-3. In addition, if Control Rod Group C is inserted below 80 inches, allowable power may not be regained until power has been at a reduced level defined below for a least twenty-four hours with Control Rod Group C between 80 and 90 inches.

Reduced Power = Allowable fraction of full power times multiplier given in Figure 3.2-4.

Exceptions:

1. If the rods are inserted below 80 inches and power does not go below the reduced power calculated above, hold at the lowest attained power level for at least twenty-four hours with Control Rod Group C between 80 and 90 inches before returning to allowable power.

2. If the rods are inserted below 80 inches and zero power is held for more than forty-eight hours, no reduced power level need be held on the way to the allowable fraction of full power.

c. Shortened stack height factor, 1.009.

d. Measurement uncertainty:*

1. 1.05, when at least 17 incore detection system neutron detector thimbles are OPERABLE, or

2. 1.068, when less than 17, and greater than or equal to 12, incore detection system neutron detector thimbles are OPERABLE.

HEAT FLUX HOT CHANNEL FACTOR-F_q

LIMITING CONDITION FOR OPERATION

3.2.2 F_q shall be limited by the following relationships:

$$F_q \leq [\frac{2.76}{P}] \text{ for } P > 0.5$$

$$F_q \leq [5.52] \text{ for } P \leq 0.5$$

where $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

APPLICABILITY: MODE 1

ACTION:

With F_q exceeding its limits:

a. Reduce THERMAL POWER at least 1% for each 1% F_q exceeds the limit within 15 minutes and similarly reduce the Power Range and Intermediate Power Range Neutron Flux-High Trip Setpoints within the next 4 hours.

b. Identify and correct the cause of the out of limit condition prior to increasing THERMAL POWER above the reduced limit required by a, above; THERMAL POWER may then be increased provided F_q is demonstrated through measurement with the incore detection system to be within its limit.

SURVEILLANCE REQUIREMENTS

4.2.2.1 F_q shall be determined to be within its limit by:

a. Using the incore detection system to obtain a power distribution map:

1. Prior to initial operation above 75% of RATED THERMAL POWER after each fuel loading, and

2. At least once per 1000 Effective Full Power Hours.

b. Increasing the measured F_q component of the power distribution map by:

1. 4% to account for engineering tolerances,

2. 5% when at least 17 incore detection system neutron detector thimbles are OPERABLE, to account for measurement uncertainty,

3. 6.8% when less than 17, and greater than or equal to 12, incore detection system neutron detector thimbles are OPERABLE, to account for measurement uncertainty, and

4. 3% to account for fuel densification.

4.2.2.2 When F_q is measured pursuant to Specification 4.10.2.2, an overall measured F_q shall be obtained from a power distribution map and increased by:

1. 4% to account for engineering tolerances,

2. 5% when at least 17 incore detection system neutron detector thimbles are OPERABLE, to account for measurement uncertainty,

3. 6.8% when less than 17, and greater than or equal to 12, incore detection system neutron detector thimbles are OPERABLE, to account for measurement uncertainty, and

4. 3% to account for fuel densification.

4.2.2.3 The provisions of Specification 4.0.4 are not applicable.

NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR - $F^N_{\Delta H}$

LIMITING CONDITION FOR OPERATION

3.2.3 $F^N_{\Delta H}$ shall be limited by the following relationship:

$$F^N_{\Delta H} \leq 1.80\ [1.0 + 0.2\ (1-P)]$$

$$\text{where } P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

APPLICABILITY: MODE 1

ACTION:

With $F^N_{\Delta H}$ exceeding its limit:

a. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 2 hours and reduce the Power Range and Intermediate Power Range Neutron Flux-high trip setpoints to ≤55% of RATED THERMAL POWER within the next 4 hours,

b. Demonstrate through measurement with the incore detection system that $F^N_{\Delta H}$ is within its limit within 24 hours after exceeding the limit or reduce THERMAL POWER to less than 5% of RATED THERMAL POWER within the next 2 hours, and

c. Identify and correct the cause of the out of limit condition prior to increasing THERMAL POWER above the reduced limit required by a or b, above; subsequent POWER OPERATION may proceed provided that $F^N_{\Delta H}$ is demonstrated through measurement with the incore detection system to be within its limit at a nominal 50% of RATED THERMAL POWER prior to exceeding this THERMAL POWER, at a nominal 75% of RATED THERMAL POWER prior to exceeding this THERMAL power and within 24 hours after attaining 95% or greater RATED THERMAL POWER.

SURVEILLANCE REQUIREMENTS

4.2.3.1 $F^N_{\Delta H}$ shall be determined to be within its limit by using the incore detection system to obtain a power distribution map:

a. Prior to operation above 75% RATED THERMAL POWER after each fuel loading, and

b. At least once per 1000 Effective Full Power Hours.

c. The provisions of Specification 4.0.4 are not applicable.

4.2.3.2 The measured $F^N_{\Delta H}$ of 4.2.3.1 above shall be increased, for measurement uncertainty, by:

a. 5%, when at least 17 incore detection system neutron detector thimbles are OPERABLE; or

b. 6.8%, when less than 17, and greater than or equal to 12, incore detection system neutron detector thimbles are OPERABLE.

INCORE DETECTION SYSTEM

LIMITING CONDITIONS FOR OPERATION

3.3.3.2 The incore detection system shall be OPERABLE with:

a. At least twelve (12) neutron detector thimbles OPERABLE.

b. A minimum of two (2) OPERABLE neutron detector thimbles per core quadrant, and

c. Sufficient OPERABLE incore neutron detectors, with:

1. Sufficient drive and readout equipment to map the OPERABLE movable neutron detector thimbles, and/or

2. Sufficient readout equipment to map the OPERABLE fixed neutron detector thimbles.

APPLICABILITY: When the incore detection system is used for core power distribution measurements.

ACTION

With the incore detection system inoperable, do not use the system for the above applicable monitoring or calibration functions. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.2 The incore neutron detectors shall be demonstrated OPERABLE by:

a. Normalizing each movable detector output to be used within 24 hours prior to its use for core power distribution measurements.

b. Having three out of five OPERABLE fixed neutron detectors per string.

BASES (Continued)

The limits on power level and control rod position following control rod insertion were selected to prevent exceeding the maximum allowable linear heat generation rate limits in Figure 3.2-1 within the first few hours following return to power after the insertion. With Yankee's highly damped core, the 24 hour hold allows sufficient time for the initial xenon maldistribution to accommodate itself to the new power distribution. The restriction on control rod location during these 24 hours assures that the return to allowable fraction of full power will not cause additional redistribution due to rod motion.

After 48 hours at zero power, the average xenon concentration has decayed to about 20% of the full power concentration. Since the xenon concentrations are so low, an increase in power directly to maximum allowable power creates transient peaking well below the value imposed by the xenon redistribution multiplier. Thus, any increase in power peaking due to this operation is below the value accounted for in the calculation of the LHGR.

These conclusions are based on plant tests and on calculations performed with the SIMULATE three dimensional nodal code used in the analysis of Core XI (reference cycle) described in Proposed Change No. 115, dated March 29, 1974.

The Factors d, e, and f in Specification 4.2.1.2 will be combined statistically as the "root-sum-square" of the individual parameters. This method for combining parameter uncertainties is valid due to the independence of the parameters involved. Factor d accounts for uncertainty in the power distribution measurement with the incore detection system. Factor e accounts for uncertainty in the calorimetric measurement for determining core power level. Factor f accounts for uncertainty in engineering and fabrication tolerances of the fuel. Together these factors, when combined statistically, yield an uncertainty of 8.5% for less than 17 and greater than or equal to 12 operating incore thimbles, and 7.1% for greater than or equal to 17 operating thimbles. This factor and Factors a, b, c, and g will be combined multiplicatively to obtain peak LHGR values.

3/4.2.2 and 3/4.2.3 HEAT FLUX HOT CHANNEL FACTOR AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR

The limits on heat flux and enthalpy hot channel factors ensure that 1) the design limits on peak local power density and minimum DNBR are not exceeded, and 2) in the event of a LOCA the peak fuel clad temperature will not exceed the 2200°F ECCS acceptance criteria limit.

Each of these hot channel factors are measurable but will normally only be determined periodically as specified in Specification 4.2.2.1 and 4.2.3.1. This periodic surveillance is sufficient to insure that the hot channel factor limits are maintained provided:

BASES (Continued)

a. Control rods in a single group move together with no individual rod insertion differing by more than ±8 inches from any other rod in the group.

b. Control rod groups are sequenced with overlapping groups as described in Specification 3.1.3.5.

c. The control rod insertion limits of Specification 3.1.3.5 is maintained.

The relaxation in $F^N_{\Delta H}$ as a function of THERMAL POWER allows changes in the radial power shape for all permissible rod insertion limits. $F^N_{\Delta H}$ will be maintained with its limits provided Conditions a through c above are maintained.

When an F_q measurement is taken, experimental error, engineering tolerance, and fuel densification must be allowed for. 5% is the appropriate allowance for a full core map taken with the incore detection system, 4% is the appropriate allowance for engineering tolerance and 3% is the appropriate allowance for fuel densification.

When $F^N_{\Delta H}$ is measured, experimental error must be allowed for and 5% is the appropriate allowance for a full core map taken with the incore detection system.

3/4.2.4 DNB PARAMETERS

The limits on the DNB related parameters assure that each of the parameters are maintained within the normal steady state envelope of operation assumed in the transient and accident analyses. The limits are consistent with the accident analysis assumptions and have been analytically demonstrated adequately to maintain a minimum DNBR of 1.30 throughout each analyzed transient. The Main Coolant System inlet temperature assumed in the analysis is conservatively 4°F in excess of the limit to allow for uncertainty in plant measurement. The Main Coolant System pressure assumed in the analysis is 1925 psig, conservatively 25 psig less than the limit to allow for uncertainty in plant measurement. The assumed operating deadband of ±50 psig is applied to the nominal 2000 psig limit, yielding a minimum operation limit of 1950 psig.

The 12 hour periodic surveillance of these parameters through instrument readout is sufficient to ensure that the parameters are restored within their limits following load changes and other expected transient operation. The 18 month periodic measurement of the Main Coolant System total flow rate is adequate to detect flow degradation and ensure correlation of the flow indication channels with measured flow such that the indicated percent flow will provide sufficient verification of flow rate on a 12 hour basis.