

SECTION 2

SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 SAFETY LIMIT - FUEL CLADDING INTEGRITY

Applicability: Applies to the interrelated variables associated with fuel thermal behavior.

Objective: To establish limits on the important thermal hydraulic variables to assure the integrity of the fuel cladding.

Specifications:

- A. When the reactor pressure is greater than or equal to 800 psia and the core flow is greater than or equal to 10% of rated, the existence of a minimum critical power ratio (MCPR) less than 1.07 shall constitute violation of the fuel cladding integrity safety limit.
- B. When the reactor pressure is less than 800 psia or the core flow is less than 10% of rated, the core thermal power shall not exceed 25% of rated thermal power.
- C. In the event that reactor parameters exceed the limiting safety system settings in specification 2.3 and a reactor scram is not initiated by the associated protective instrumentation, the reactor shall be brought to, and remain in, the cold shutdown condition until an analysis is performed to determine whether the safety limit established in specification 2.1.A and 2.1.B was exceeded.
- D. During all modes of reactor operation with irradiated fuel in the reactor vessel, the water level shall not be less than 4'8" above the top of active fuel.

Bases:

The fuel cladding integrity safety limit is set such that no fuel damage is calculated to occur if the limit is not violated. Since the parameters which result in fuel damage are not directly observable during reactor operation the thermal and hydraulic conditions resulting in a departure from nucleate boiling have been used to mark the beginning of the region where fuel damage could occur. Although it is recognized that a departure from nucleate boiling would not necessarily result in damage to BWR fuel rods, the critical power at which boiling transition is calculated to occur has been adopted as a convenient limit. However, the uncertainties in monitoring the core operating state and in the procedure used to calculate the

cooling capability could lead to elevated cladding temperatures and clad perforation. With a water level above the top of the active fuel, adequate cooling is maintained and the decay heat can easily be accommodated. It should be noted that during power generation there is no clearly defined water level inside the shroud and what actually exists is a mixture level. This mixture begins within the active fuel region and extends up through the moisture separators. For the purpose of this specification water level is defined to include mixture level during power operations.

The lowest point at which the water level can presently be monitored is 4'8" above the top of active fuel. Although the lowest reactor water level limit which ensures adequate core cooling is the top of the active fuel, the safety limit has been conservatively established at 4'8" above the top of active fuel.

REFERENCES

- (1) NEDC-24195, General Electric Reload Fuel Application for Oyster Creek.

E. Reactor Coolant Quality

1. The reactor coolant quality during power operation with steaming rates to the turbine-condenser of less than 100,000 pounds per hour shall be limited to:

conductivity 2 uS/cm (S = mhos at 25°C(77°F))
chloride ion 0.1 ppm

2. When the conductivity and chloride concentration limits given in 3.3.E.1 are exceeded, an orderly shutdown shall be initiated immediately, and the reactor coolant temperature shall be reduced to less than 212°F within 24 hours.
3. The reactor coolant quality during power operation with steaming rates to the turbine-condenser of greater than or equal to 100,000 pounds per hour shall be limited to:

conductivity 10 uS/cm (S = mhos at 25°C(77°F))
chloride ion 0.5 ppm

4. When the maximum conductivity or chloride concentration limits given in 3.3.E.3 are exceeded, an orderly shutdown shall be initiated immediately, and the reactor coolant temperature shall be reduced to less than 212°F within 24 hours.
5. During power operation with steaming rates on the turbine-condenser of greater than or equal to 100,000 pounds per hour, the time limit above 1.0 uS/cm at 25°C (77°F) and 0.2 ppm chloride shall not exceed 72 hours for any single incident.
6. When the time limits for 3.3.E.5 are exceeded, an orderly shutdown shall be initiated within 4 hours.

F. Recirculation Loop Operability

1. During POWER OPERATION, all five recirculation loops shall be OPERATING except as specified in Specification 3.3.F.2.
2. POWER OPERATION with one idle recirculation loop is permitted provided that the idle loop is not isolated from the reactor vessel.
3. If Specifications 3.3.F.1 and 3.3.F.2 are not met, an orderly shutdown shall be initiated immediately until all operable control rods are fully inserted and the reactor is in either the REFUEL MODE or SHUTDOWN CONDITION within 12 hours.
4. With reactor coolant temperature greater than 212°F and irradiated fuel in the reactor vessel, at least one recirculation loop discharge valve and its associated suction valve shall be in the full open position.
5. If Specification 3.3.F.4 is not met, immediately open one recirculation loop discharge valve and its associated suction valve.

5. With reactor coolant temperature less than 212°F and irradiated fuel in the reactor vessel, at least one recirculation loop discharge valve and its associated suction valve shall be in the full open position unless the reactor vessel is flooded to a level above 185 inches TAF or unless the steam separator and dryer are removed.

pH, chloride, and other chemical parameters are made to determine the cause of the unusual conductivity and instigate proper corrective action. These can be done before limiting conditions, with respect to variables affecting the boundaries of the reactor coolant, are exceeded. Several techniques are available to correct off-standard reactor water quality conditions including removal of impurities from reactor water by the cleanup system, reducing input of impurities causing off-standard conditions by reducing power and reducing the reactor coolant temperature to less than 212°F. The major benefit of reducing the reactor coolant temperature to less than 212°F is to reduce the temperature dependent corrosion rates and thereby provide time for the cleanup system to re-establish proper water quality.

Specifications 3.3.F.1 and 3.3.F.2 require a minimum of four OPERATING recirculation loops during reactor POWER OPERATION. Core parameters have not been established for POWER OPERATION with less than four OPERATING loops. Therefore, Specification 3.3.F.3 requires reactor POWER OPERATION to be terminated and the reactor placed in the REFUEL MODE or SHUTDOWN CONDITION within 12 hours. During four loop POWER OPERATION the idle loop is required to have its discharge valve closed and its discharge bypass and suction valves open. This minimizes the occurrence of a severe cold water addition transient during startup of an idle loop. In addition, with the discharge bypass and suction valves in an idle loop open the coolant inventory in the loop is available during LOCA blowdown.

Specifications 3.3.F.4 and 3.3.F.6 assure that an adequate flow path exists from the annular space, between the pressure vessel wall and the core shroud, to the core region. This provides sufficient hydraulic communication between these areas, thus assuring that reactor water level instrument readings are indicative of the water level in the core region. For the bounding loss of feedwater transient, a single fully open recirculation loop transfers coolant from the annulus to the core region at approximately five times the boiloff rate with no forced circulation. With the reactor vessel flooded to a level above 185 inches TAF or when the steam separator and dryer are removed, the core region is in hydraulic communication with the annulus above the core region and all recirculation loops can therefore be isolated. When the steam separator and dryer are removed, safety limit 2.1.D ensures water level is maintained above the core shroud.

References

- (1) FDSAR, Volume I, Section IV-2
- (2) Letter to NRC dated May 19, 1979, "Transient of May 2, 1979"
- (3) General Electric Co. Letter G-EN-9-55, "Revised Natural Circulation Flow Calculation", dated May 29, 1979
- (4) Licensing Application Amendment 16, Design Requirements Section
- (5) (Deleted)
- (6) FDSAR, Volume I, Section IV-2.3.3 and Volume II, Appendix H
- (7) FDSAR, Volume I, Table IV-2-1
- (8) Licensing Application Amendment 34, Question 14

- (9) Licensing Application Amendment 28, Item III-B-2
- (10) Licensing Application Amendment 32, Question 15
- (11) (Deleted)
- (12) Licensing Application Amendment 68, Supplement No. 6 Addendum 3
- (13) Licensing Application Amendment 16, Page 1