5.3 AUXILIARY EQUIPMENT

5.3.1 Fuel Storage

A. Normal storage for unirradiated fuel assemblies is in critically-safe new fuel storage racks in the reactor building storage vault; otherwise, fuel shall be stored in arrays which have a K_{eff} less than 0.95 under optimum conditions of moderation or in NRC-approved shipping containers.

B. The spent fuel shall be stored in the spent fuel storage facility which shall be designed to maintain fuel in a geometry providing a K_{∞} less than or equal to 0.95.

C. The fuel to be stored in spent fuel storage facility shall not exceed a maximum average planar enrichment of 3.01 w/o U-235.

D. Loads greater than the weight of one fuel assembly shall not be moved over stored irradiated fuel in the spent fuel storage facility.

E. The 30 ton spent fuel shipping cask shall not be lifted more than 6 inches above the top plate of the cask drop protection system. Vertical limit switches shall be operable to assure the 6 inch vertical limit is met when the cask is above the top plate.

F. The temperature of the water in the spent fuel storage pool, measured at or near the surface, shall not exceed 125°F.

G. Prior to Cycle 11 operation, 10.5 inches of insulation with a thermal conductivity of k=0.02 BTU/FtHr-°F shall be installed at the bottom surface of the spent fuel pool slab.

H. The maximum amount of spent fuel assemblies stored in the spent fuel storage pool shall be 2600.

BASIS

The specification of K_{∞} less than or equal to 0.95 in the spent fuel storage facility assures an ample margin from criticality. Criticality analysis was performed on the poison racks to insure that a K_{∞} of 0.95 would not be exceeded. The basis for this analysis assumed an average planar lattice enrichment of 3.01 w/o U-235 and includes manufacturing tolerances.

The effects of a dropped fuel bundle onto stored fuel in the spent fuel storage facility has been analyzed. This analysis shows that the fuel bundle drop would not cause doses resulting from ruptured fuel pins that exceed 10 CFR 100 limits (1,2,3) and that dropped waste cans will not damage the pool liner.

The elevation limitation of the spent fuel shipping cask to no more than 6 inches above the top plate of the cask drop protection system prevents loss of the pool integrity resulting from postulated drop accidents. An analysis of the effects of a 100 ton cask drop from 6 inches has been done (4) which showed that the pool structure is capable of sustaining the loads imposed during such a drop. Limit switches on the crane restrict the elevation of the cask to less than or equal to 6 inches when it is above the top plate.

Detailed structural analysis of the spent fuel pool was performed using loads resulting from the dead weight of the structural elements, the building loads, hydrostatic loads from the pool water, the weight of fuel and racks stored in the pool, seismic loads, loads due to thermal gradients in the pool floor and walls, and dynamic load from the cask drop accident. Thermal gradients result in two loading conditions; normal operating and the accident conditions with the loss of spent fuel pool cooling. For the normal condition, the containment air temperature was assumed to vary between 65°F and 110°F while the pool water temperature varied between 85°F and 125°F. The most severe loading from the normal operating thermal gradient results with containment air temperature at 65°F and the water temperature at 125°F. Air temperature measurements made during all phases of plant operation in the shutdown heat exchanger room, which is directly beneath part of the spent fuel pool floor slab, show that 65°F is the appropriate minimum air temperature. The spent fuel pool water temperature will alarm in the control room before the water temperature reaches 120°F. In order to ensure the section capacity of the fuel pool floor, the thermal gradient across the slab should not exceed 21°F (6). The installation of insulation at the bottom surface of the spent fuel pool will help control the thermal gradient across the pool floor and will ensure the integrity of the slab 24 hours after a loss of fuel pool cooling.

Results of the structural analysis show that the pool structure is structurally adequate for the loadings associated with the normal operation and the condition resulting from the postulated cask drop accident (5). The floor framing was also found to be capable of withstanding the steady state thermal gradient conditions with the pool water temperature at 150°F without exceeding ACI Code requirements. The walls are also capable of operation at a steady state condition with the pool water temperature at 140°F (5).

Since the cooled fuel pool water returns at the bottom of the pool and the heated water is removed from the surface, the average of the surface temperature and the fuel pool cooling return water is an appropriate estimate of the average bulk temperature, alternately the pool surface temperature could be conservatively used.

References

1. Amendment No. 78 to the FDSAR (Section 7)
2. Supplement No. 1 to Amendment No. 78 to the FDSAR (Question 12)
3. Supplement No. 1 to Amendment No. 78 of the FDSAR (Question 40)
4. Supplement No. 1 to Amendment No. 68 of the FDSAR.
5. Revision No. 1 to Addendum 2 to Supplement No. 1 to Amendment No. 78 of the FDSAR (Questions 5 and 10)
6. FDSAR Amendment No.79