9.0 Auxiliary Systems

9.1 Fuel Storage and Handling

The New Fuel Storage Facility (NFSF), Spent Fuel Storage Facility (SFSF), and associated handling systems and equipment are designed to accommodate both new fuel assemblies and spent fuel assemblies.

9.1.1 Criticality Safety of New and Spent Fuel Storage and Handling

9.1.1.1 Design Bases

Criticality safety is a part of the safety design basis. There are no non-safety design bases associated with this section.

New and spent fuel assemblies are maintained in a geometrically safe subcritical array during all credible storage and handling conditions (GDC 62). Adequate spacing is provided to prevent criticality during earthquakes or other natural phenomena. In addition, criticality is prevented for the new fuel storage area assuming flooding of the new fuel storage area with optimum moderation.

In lieu of the installation of a criticality monitoring system, design and analysis requirements specified in 10 CFR 50.68(b) are followed to prevent criticality.

9.1.1.2 Facilities Description

The NFSF includes the new fuel assembly storage racks, the concrete storage vault containing those storage racks, and auxiliary components. The SFSF includes the spent fuel storage racks, the spent fuel storage pool containing those racks, and the associated equipment storage pits. The design and layout of the NFSF and SFSF are described in Section 9.1.2. As described in Section 9.1.2.2, the design of the new and spent fuel storage racks is the responsibility of the COL applicant.

9.1.1.3 Safety Evaluation

A COL applicant that references the U.S. EPR design certification will demonstrate that the design satisfies the criticality analysis requirements for the new and spent fuel storage racks, and describe the results of the analyses for normal and credible abnormal conditions, including a description of the methods used, approximations and assumptions made, and handling of design tolerances and uncertainties.

The criticality analysis performed by the COL applicant will demonstrate that the geometric configuration of the racks in combination with the integral neutron absorbing material is sufficient to maintain the fuel matrix in a subcritical condition. The value of the effective multiplication factor (k_{eff}) must be less than or equal to 0.95 with new fuel of the highest anticipated enrichment (5 percent U-235 by weight) and

assuming the area is flooded with potential moderators (e.g., high-pressure water spray). For a postulated accident (PA) condition in which the new fuel storage area is subject to optimum moderation and there are full storage racks of the maximum enrichment fuel assemblies, the value of k_{eff} must not exceed 0.98.

The COL applicant will show that the U.S. EPR design complies with the guidance of ANSI/ANS 57.1 (Reference 1) and ANSI/ANS 57.3 (Reference 2) with regards to criticality prevention for fresh fuel storage and handling. In addition, the COL applicant will demonstrate that the U.S. EPR complies with ANS 57.1, 57.2 (Reference 3), and RG 1.13 with regard to criticality prevention for spent fuel storage and handling.

The criticality analyses performed by the COL applicant will demonstrate that the fuel remains subcritical under normal and credible abnormal conditions (GDC 62). The fuel rack design and resulting criticality analyses will prevent an increase in effective multiplication factor (k_{eff}) beyond safe limits based on the requirements in 10 CFR 50.68(b). For dry storage of new fuel assemblies, k_{eff} will not exceed 0.95 if the storage area is flooded with unborated water. In addition, k_{eff} will not exceed 0.98 if the storage area is filled with an optimum moderator (e.g., fire extinguishing foam), assuming fuel of the maximum reactivity. Therefore, a criticality monitor will not be required.

9.1.1.4 References

1. ANSI/ANS-57.1-1992; R1998; R2005 (R=Reaffirmed): "Design Requirements for Light Water Reactor Fuel Handling Systems," American National Standards Institute/American Nuclear Society, 2005.

2. ANSI/ANS-57.3-1983: "Design Requirements for New Fuel Storage Facilities at Light Water Reactor Plants," American National Standards Institute/American Nuclear Society, 1983.

3. ANSI/ANS-57.2-1983: "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants," American National Standards Institute/American Nuclear Society, 1983.

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