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May 17, 2005

SOUTHERN COMPANY
Energy to Serve Your World℠

Docket Nos.: 50-348
50-364

NL-05-0740

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Joseph M. Farley Nuclear Plant
Technical Specifications Revision
Spent Fuel Cask Loading Requirements

In accordance with the provisions of 10 CFR 50.90, Southern Nuclear Operating Company (SNC) hereby proposes a change to the Joseph M. Farley Nuclear Plant (FNP) Unit 1 and Unit 2 Technical Specifications, Appendix A to operating licenses NPF-2 and NPF-8, respectively. Specifically, this request proposes to revise Plant Systems Section 3.7 and Design Features Section 4.3 to add technical specification requirements to the 10 CFR 50 license that establish cask storage area boron concentration limits and restrict the minimum burnup of spent fuel assemblies associated with spent fuel cask loading operations. Approval of these changes is needed to support a dry storage loading campaign which SNC plans to conduct at FNP in accordance with the general license provisions of 10 CFR 72, Subpart K, beginning July 1, 2005.

The Nuclear Regulatory Commission (NRC) issued Regulatory Issue Summary (RIS) 2005-05, "Regulatory Issues Regarding Criticality Analyses for Spent Fuel Pools and Independent Spent Fuel Storage Installations," on March 23, 2005. RIS 2005-05 highlighted differences in the NRC Part 50 criticality requirements for the spent fuel pool and Part 72 requirements for spent fuel storage casks and emphasized that licensees are expected to comply with both Part 50 and Part 72 during cask loading operations. This request is consistent with the regulatory direction provided in RIS 2005-05.

A new criticality analysis has been performed for FNP using a methodology previously approved by the NRC for spent fuel rack storage for R. E. Ginna Nuclear Power Plant (Amendment 79 to Facility Operating License DPR-18, dated December 7, 2000), Diablo Canyon Nuclear Power Plant (Amendment 154 to Facility Operating Licenses DPR-80 and DPR-82, dated September 25, 2002), and Millstone Power Station, Unit 2 (Amendment 274 to Facility Operating License DPR-65, dated April 1, 2003), that demonstrates acceptable subcriticality margins for cask loading operations in the cask storage area in accordance with Part 50. Accordingly, new technical specification requirements have been developed that are consistent with those contained in the FNP Technical Specifications for spent fuel in the spent fuel storage racks, and are hereby proposed for NRC approval.

A001

Enclosure 1 provides a description and justification for the proposed change. Enclosure 2 contains the 10 CFR 50.92 evaluation and the justification for the categorical exclusion from performing an environmental assessment. Enclosure 3 provides the marked-up Technical Specifications and corresponding Bases pages. Enclosure 4 provides the clean typed Technical Specifications and corresponding Bases pages. Enclosure 5 provides proposed marked-up Final Safety Analysis Report pages for information that are referenced in the proposed Bases. Enclosure 6 provides the new criticality analysis for the FNP spent fuel cask.

SNC requests approval of the proposed license amendments by July 1, 2005, to support the dry storage loading campaign. The proposed changes will be implemented prior to loading spent fuel in a spent fuel storage cask.

In accordance with the requirements of 10 CFR 50.91, a copy of this letter and all applicable enclosures will be sent to the designated State official of the Alabama Department of Public Health.

Mr. L. M. Stinson states he is a Vice President of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

This letter contains no NRC commitments. If you have any questions, please advise.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

L. M. Stinson

Sworn to and subscribed before me this 17th *day of* May, *2005.*

Notary Public

My commission expires: 10/9/2005

LMS/TMM/sdl

Enclosures:
1. Description and Justification for Proposed Change
2. 10 CFR 50.92 Evaluation and Environmental Assessment
3. Marked-up Technical Specifications and Corresponding Bases Pages
4. Clean Typed Technical Specifications and Corresponding Bases Pages
5. Marked-up Final Safety Analysis Report Pages
6. Westinghouse Calculation Note CN-CRIT-207

cc: Southern Nuclear Operating Company
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U. S. Nuclear Regulatory Commission
Dr. W. D. Travers, Regional Administrator
Mr. J. J. Shea, NRR Project Manager – Farley
Mr. C. A. Patterson, Senior Resident Inspector – Farley

Alabama Department of Public Health
Dr. D. E. Williamson, State Health Officer

Enclosure 1

Joseph M. Farley Nuclear Plant
Technical Specifications Revision
Spent Fuel Cask Loading Requirements

Description and Justification for Proposed Change

Description

Southern Nuclear Operating Company (SNC) is planning to operate an independent spent fuel storage installation (ISFSI) facility at Joseph M. Farley Nuclear Plant (FNP) in accordance with the general license provisions of 10 CFR 72, Subpart K, using the Holtec HI-STORM 100 Cask System Multi-Purpose Canister (MPC)-32. To support the activity, this request proposes to revise the FNP Unit 1 and Unit 2 Technical Specifications, Section 3.7, Plant Systems, including corresponding Bases, and Section 4.3, Design Features, to add technical specification requirements that establish cask storage area boron concentration limits for spent fuel cask operations, and that restrict the minimum burnup of spent fuel assemblies that can be loaded into a spent fuel cask. These proposed spent fuel cask loading operation requirements are consistent with those contained in the FNP Technical Specifications for spent fuel in the spent fuel storage racks.

Justification

The Nuclear Regulatory Commission (NRC) criteria for criticality control during spent fuel cask loading operations have been historically governed by the requirements of 10 CFR 72. Similarly, the criteria for criticality control of spent fuel stored in the spent fuel pool storage racks are governed by the requirements of 10 CFR 50. Part 50 and Part 72 have different acceptance criteria that provide adequate assurance that the spent fuel will remain subcritical, and separate Technical Specifications (TS) requirements applicable to spent fuel in the spent fuel storage racks and in the spent fuel cask during loading operations.

Part 50 requires that spent fuel in the spent fuel storage racks remain subcritical (i.e., $k_{eff} < 1.0$) when fully flooded with unborated water (i.e., boron dilution event). In order to maintain $k_{eff} < 1.0$ when flooded with unborated water, the NRC allows licensees to credit the reduced reactivity of the spent fuel associated with burnup during operation. However, Part 72 requires that all fuel in the cask be considered to be fresh fuel at the maximum enrichment allowed by the Certificate of Compliance (CoC) for the spent fuel cask system. As a result, Part 72 requires soluble boron credit to maintain spent fuel in the cask subcritical during cask loading operations. These differences, and the need to comply with both Part 50 and Part 72 during cask loading operations, are described in Regulatory Issue Summary (RIS) 2005-05, "Regulatory Issues Regarding Criticality Analyses for Spent Fuel Pools and Independent Spent Fuel Storage Installation," dated March 23, 2005. In addition, the minimum soluble boron concentration required by the Part 50 and Part 72 TS is also impacted by differences in the geometry and credit allowed for the performance of the fixed neutron absorber in the spent fuel storage racks and spent fuel cask.

Consequently, SNC determined that a new Part 50 criticality analysis was needed for FNP to demonstrate acceptable subcriticality margins for cask loading operations in the cask storage area given a boron dilution event, to address RIS 2005-05. Therefore, a new analysis was performed, as provided in Enclosure 6, using the same methodology as previously approved by the NRC for R. E. Ginna Nuclear Power Plant (Amendment 79 to Facility Operating License DPR-18, dated

December 7, 2000), Diablo Canyon Nuclear Power Plant (Amendment 154 to Facility Operating Licenses DPR-80 and DPR-82, dated September 25, 2002), and Millstone Power Station, Unit 2 (Amendment 274 to Facility Operating License DPR-65, dated April 1, 2003) for spent fuel rack storage. The methodology employed the same limiting axial burnup distribution employed for discharged fuel assemblies, the same method for calculating biases and uncertainties, the same method (full geometrical simulation) of modeling fuel mishandling events, and the same procedure for calculating soluble boron concentrations. Likewise, reactivity equivalence was not employed. Accordingly, the analysis provided in Enclosure 6 demonstrates acceptable subcriticality margins for FNP cask loading operations and postulated cask loading events.

The following discussion summarizes the Part 50 requirements relative to a boron dilution event associated with the current FNP spent fuel storage rack criticality analysis. SNC submitted a boron dilution analysis which was approved by the NRC in FNP license amendments 133 and 125, for Unit 1 and Unit 2 respectively, dated January 23, 1998. FNP TS 3.7.14, applicable to the spent fuel storage racks, requires a minimum spent fuel pool boric acid concentration $\geq$ 2000 ppm any time spent fuel is stored in the pool. TS Bases for LCO 3.7.14 states that a spent fuel pool boron concentration of 400 ppm will ensure that k_{eff} will be $\leq$ 0.95 for all analyzed combinations of storage patterns, enrichments, and burnups. Based on the potential dilution sources in the vicinity of the spent fuel pool, the Applicable Safety Analyses associated with TS Bases for LCO 3.7.14 related to the spent fuel pool states that the volume of water to dilute the spent fuel pool from the LCO limit of 2000 ppm to 400 ppm (i.e., $k_{eff} \leq 0.95$) is approximately 480,000 gallons and states that a spent fuel pool dilution of this volume is not a credible event. In its Safety Evaluation Report for license amendments 133 and 125 the NRC found the change to be acceptable on the basis that the change conformed to the following NRC acceptance criteria for preventing criticality outside the reactor:

(1) k_{eff} shall be less than 1.0 if fully flooded with unborated water, which includes an allowance for uncertainties at a 95% probability, 95% confidence (95/95) level as described in WCAP-14416-NP-A; and

(2) k_{eff} shall be less than or equal to 0.95 if fully flooded with borated water, which includes an allowance for uncertainties at a 95/95 level as described in WCAP-14416-NP-A.

It should be noted that WCAP-14416-P-A, applicable to the spent fuel storage racks, was not used as the basis for the methodology presented in Enclosure 6 for the spent fuel cask. It is referenced here as the documented basis for the acceptance criteria for crediting soluble boron in the FNP spent fuel pool criticality analyses.

The criticality analysis provided in Enclosure 6 provides the basis for the proposed Technical Specifications changes necessary for cask loading operations to be consistent with the Part 50 licensing bases for spent fuel in the spent fuel storage racks. The results demonstrate that the spent fuel pool boron concentration limits associated with the existing Part 50 boron dilution analysis for the spent fuel storage racks remain bounding for cask loading operations. For the purposes of addressing spent fuel pool boron dilution events, the cask storage area is considered part of the spent fuel pool volume except during movement of the spent fuel cask when the cask storage area is isolated from the spent fuel pool. Accordingly, k_{eff} will be ≤ 0.95 in the spent fuel cask in the event the spent fuel pool is flooded with borated water to 400 ppm. Additionally, k_{eff} will be < 1.0 in the spent fuel cask in the event the spent fuel pool is flooded with unborated water.

During cask loading operations, the active volume of the spent fuel pool will be increased by the volume of the transfer canal and cask storage area. This has the effect of reducing the rate of dilution of the pool. Therefore, the dilution evaluation for the spent fuel pool remains bounding for cask loading operations. As an added precaution to assure the boron dilution evaluation remains bounding, the spent fuel transfer canal gate and the cask storage area gate will be kept open during cask loading operations, except during the brief period that the spent fuel cask is moved into and out of the cask storage area. During that time, at least one gate will be closed as an added defense-in-depth measure to protect against a postulated heavy load cask drop to preclude a breach of the spent fuel pool, even though the cask crane is a single-failure proof design and a cask drop event is not considered credible.

Derived from the new criticality analysis are new technical specification requirements for cask loading operations in the cask storage area as provided in Enclosures 3 and 4. Proposed TS 3.7.17 is a new Plant Systems specification that establishes a boron concentration limit of ≥ 2000 ppm for the cask storage area. It also includes the precautions discussed above regarding opening and closing the spent fuel transfer canal gate and the cask storage area gate. Additionally, proposed TS 3.7.18 is a new Plant Systems specification that incorporates a burnup versus enrichment curve that establishes minimum fuel burnup limits for spent fuel that can be stored in a cask. Consistent with these changes, proposed TS 4.3.1.3 has also been added to the Design Features specification that establish criticality requirements to support cask loading operations.

Criticality considerations associated with postulated fuel mishandling events during cask loading operations were included in the scope of the new criticality analysis provided in Enclosure 6. The required boron concentration necessary to mitigate the most severe event was determined to be 659 ppm. This is well below the existing Limiting Condition for Operation (LCO) 3.7.14 limit of 2000 ppm for the spent fuel pool, and the LCO limit of 2000 ppm in proposed LCO 3.7.17 for cask loading operations provided in Enclosures 3 and 4.

The radiological consequences of a fuel handling accident are described in FSAR Section 15.4.5. FSAR Section 15.4.5.1 describes the fuel handling accident in the spent fuel pool as the drop of a spent-fuel assembly onto the spent-fuel pool floor. Per FSAR Figures 1.2-8, the bottom of the spent fuel pool is at elevation 114'-5". Per FSAR Figure 9.1-16, the bottom of the spent fuel cask storage area is also at elevation 114'-5". Therefore, the radiological consequences of a spent fuel handling accident in the spent fuel cask storage area are bounded by the spent fuel handling accident in the spent fuel pool.

Enclosure 2

Joseph M. Farley Nuclear Plant
Technical Specifications Revision
Spent Fuel Cask Loading Requirements

10 CFR 50.92 Significant Hazards Evaluation and Environmental Assessment

Proposed Change

Southern Nuclear Operating Company (SNC) proposes to revise the Joseph M. Farley Nuclear Plant (FNP) Unit 1 and Unit 2 Technical Specifications, Section 3.7, Plant Systems, including corresponding Bases, and Section 4.3, Design Features, to add technical specification requirements that establish boron concentration limits for spent fuel cask loading operations, and that restrict the minimum burnup of spent fuel assemblies that can be loaded into a spent fuel cask. These changes are needed to operate an independent spent fuel storage installation (ISFSI) facility at FNP in accordance with the general license provisions of 10 CFR 72, Subpart K, using the Holtec HI-STORM 100 Cask System Multi-Purpose Canister (MPC)-32.

10 CFR 50.92 Evaluation

In 10 CFR 50.92(c), the NRC provides the following standards to be used in determining the existence of a significant hazards consideration:

> ...a proposed amendment to an operating license for a facility licensed under §50.21(b) or §50.22 or for a testing facility involves no significant hazards consideration, if operation of the facility in accordance with the proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

Southern Nuclear Operating Company (SNC) has reviewed the proposed license amendment request and has determined that its adoption does not involve a significant hazards consideration based upon the following discussion:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Cask loading operations will not require any physical changes to Part 50 structures, systems, or components, nor will their performance requirements be altered. The potential to handle a spent fuel cask was considered in the original design of the plant. Therefore, the response of the plant to previously analyzed Part 50 accidents and related radiological releases will not be adversely impacted, and will bound those postulated during cask loading activities in the cask storage area. Accordingly, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Existing fuel handling procedures and associated administrative controls remain applicable for cask loading operations. Additionally, the soluble boron concentration required to maintain $k_{eff} \leq 0.95$ for postulated criticality accidents associated with cask loading operations was also evaluated. The results of the analyses, using a methodology previously approved by the NRC, demonstrate that the amount of soluble boron required to compensate for the positive reactivity associated with these postulated accidents (659 ppm) remains well below the existing spent fuel pool minimum boron concentration limit of 2000 ppm. Accordingly, the same limit has been proposed for cask loading operations in the cask storage area. Therefore, the possibility of a new or different kind of accident from any accident previously evaluated is not created.

3. Does the proposed change involve a significant reduction in a margin of safety?

   An NRC approved methodology was used to perform the criticality analysis which provides the basis to incorporate a new burnup versus enrichment curve into the plant Technical Specifications to ensure criticality requirements are met during spent fuel cask loading. Accordingly, the existing minimum boron concentration limit for the spent fuel of 2000 ppm will continue to remain bounding during cask loading operations. Existing criticality limits will also be maintained should it be postulated that the spent fuel pool be flooded when connected to the cask storage area with unborated water ($k_{eff} < 1.0$) or should it become flooded with borated water to 400 ppm ($k_{eff} \leq 0.95$) during cask loading operations. This determination accounts for uncertainties at a 95-percent/95-percent probability/confidence level. Proposed Technical Specification 3.7.17 requires that the spent fuel transfer canal gate and the cask storage area gate be open except when moving the spent fuel cask into or out of the cask storage area. The cask storage area will be isolated from the spent fuel pool volume during movement of the cask into and out of the cask storage area. Due to the minimal time that spent fuel will be stored in the cask storage area with the cask storage area isolated from the spent fuel pool volume, a boron dilution event is not considered credible while the cask storage area is isolated. However, should it be postulated that a boron dilution event does occur during this time period, k_{eff} will remain less than 1.0 should the cask storage area become fully flooded with unborated water. Therefore, there will not be a significant reduction in a margin of safety.

Based upon the preceding information, SNC has concluded that the requested license amendment does not involve a significant hazards consideration.

Environmental Assessment

SNC has evaluated the proposed changes and determined the changes do not involve (1) a significant hazards consideration, (2) a significant change in the types or significant increase in the amounts of any effluents that may be released off-site, or (3) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed changes meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9), and an environmental assessment of the proposed changes is not required.

Enclosure 3

Joseph M. Farley Nuclear Plant
Technical Specifications Revision
Spent Fuel Cask Loading Requirements

Marked-up Technical Specifications and Corresponding Bases Pages

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PROPOSED NEW SPECIFICATION

3.7 PLANT SYSTEMS

3.7.17 Cask Storage Area Boron Concentration — Cask Loading Operations

LCO 3.7.17 The cask storage area boron concentration shall be ≥ 2000 ppm.

--NOTE--
During cask loading operations, the spent fuel transfer canal gate and the cask storage area gate shall both be open except when moving the spent fuel cask into or out of the cask storage area.

APPLICABILITY: Whenever any fuel assembly is stored in the cask storage area.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask storage area boron concentration not within limit.	------------------NOTE------------------ LCO 3.0.3 is not applicable. ---	
	A.1 Suspend movement of fuel assemblies in the cask storage area.	Immediately
	AND	
	A.2 Initiate action to restore cask storage area boron concentration to within limit.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.17.1	Verify the cask storage area boron concentration is within limit.	Once within 4 hours prior to entering the Applicability of this LCO. AND Every 48 hours thereafter.

PROPOSED NEW SPECIFICATION

3.7 PLANT SYSTEMS

3.7.18 Spent Fuel Assembly Storage—Cask Loading Operations

LCO 3.7.18 The combination of initial enrichment and burnup of each spent fuel assembly stored in the cask storage area shall be within the Acceptable Burnup Domain of Figure 3.7.18-1.

APPLICABILITY: Whenever any fuel assembly is stored in the cask storage area.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of the LCO not met.	A.1 -------------NOTE-------------- LCO 3.0.3 is not applicable. ------------------------------------ Initiate action to move the noncomplying fuel assembly to an acceptable storage location.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.18.1	Verify by administrative means the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.7.18-1.	Prior to placing fuel assemblies in the spent fuel cask.

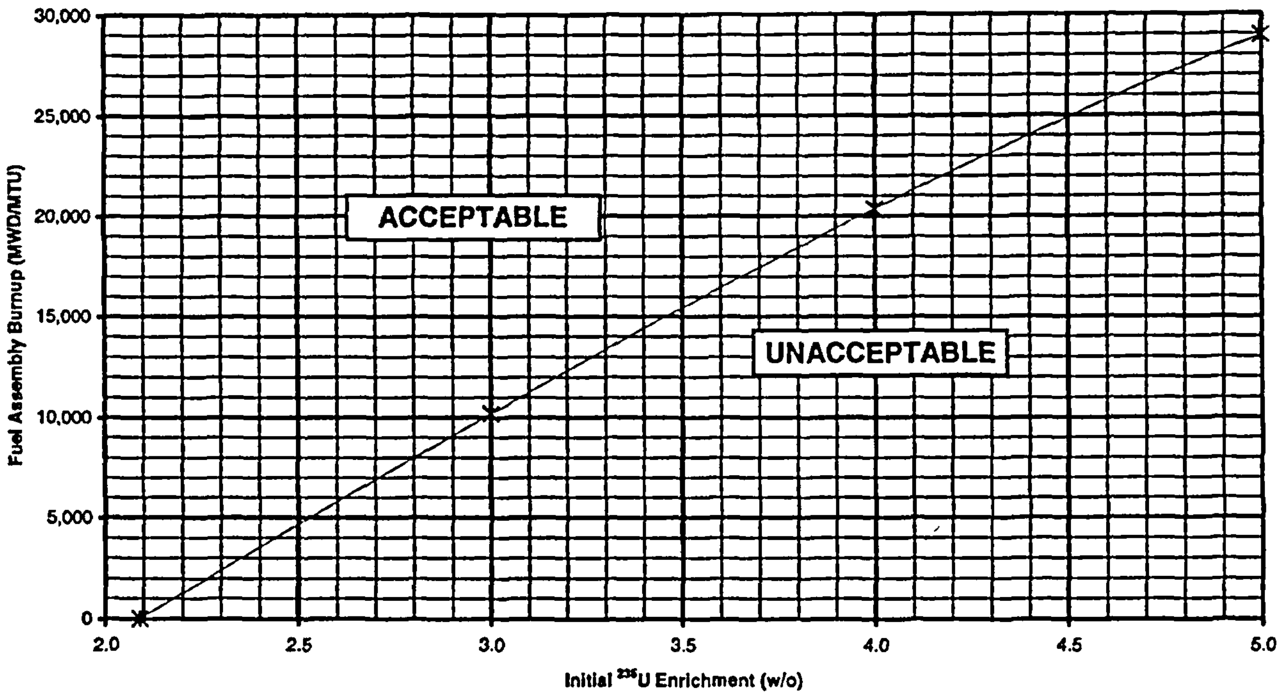

Figure 3.7.18-1 Fuel Assembly Burnup Limit Requirements for Cask Storage

4.0 DESIGN FEATURES

4.3.1.2 (continued)

b. Fuel assemblies with Optimized Fuel Assembly fuel rod diameters having a maximum nominal U-235 enrichment of 5.0 weight percent. Fuel assemblies with Optimized Fuel Assembly fuel rod diameters having a maximum nominal U-235 enrichment > 3.9 weight percent shall contain sufficient integral burnable absorbers such that a maximum reference fuel assembly $K_{\infty} \leq 1.455$ at 68°F is maintained;

c. $k_{eff} \leq 0.95$ if fully flooded with unborated water;

d. $k_{eff} \leq 0.98$ if moderated by aqueous foam; and

e. A nominal 21 inch center to center distance between fuel assemblies placed in the storage racks.

See 4.3.1.3 Insert

4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 149 ft.

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1407 fuel assemblies.

4.3.1.3 Insert

4.3.1.3 The spent fuel casks are designed and shall be maintained with:

a. Fuel assemblies having a maximum nominal U-235 enrichment of 5.0 weight percent;

b. $k_{eff} < 1.0$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 4.3.2.7.2.3 of the FSAR;

c. $k_{eff} \leq 0.95$ if fully flooded with water borated to 400 ppm, which includes an allowance for uncertainties and biases as described in Section 4.3.2.7.2.3 of the FSAR;

d. A nominal 9.218 inch center to center distance between fuel assemblies placed in the spent fuel cask; and

e. Spent fuel assemblies with a combination of discharge burnup and initial enrichment in the "acceptable range" of Figure 3.7.18-1.

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PROPOSED NEW SPECIFICATION BASES

B 3.7 PLANT SYSTEMS

B 3.7.17 Cask Storage Area Boron Concentration — Cask Loading Operations

BASES

BACKGROUND

The cask storage area is connected to the spent fuel pool when the spent fuel transfer canal gate and the cask storage area gate are removed and is used to facilitate cask loading operations. The spent fuel cask contains storage locations for 32 fuel assemblies. Westinghouse 17X17 fuel assemblies with initial enrichments less than or equal to 5.0 weight percent U-235 can be stored in the spent fuel cask provided the fuel burnup-enrichment combinations are within the limits specified in Figure 3.7.18-1 of the Technical Specifications. Westinghouse Calculation Note CN-CRIT-207, "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," (Ref. 4) provides the basis for acceptability to conduct cask loading operations in the cask storage area.

The above methodology ensures that the spent fuel cask multiplication factor, K_{eff}, is less than or equal to 0.95, as recommended by ANSI 57.2-1983 (Ref. 3) and NRC Guidance (Refs. 1, 2, and 6). A storage configuration is defined using K_{eff} calculations to ensure that K_{eff} will be less than 1.0 with no soluble boron under normal storage conditions including tolerances and uncertainties. Soluble boron credit is then used to maintain K_{eff} less than or equal to 0.95. The treatment of reactivity uncertainties, as well as the calculation of postulated accidents crediting soluble boron is described in Ref.4.

The above methodology was used to evaluate cask loading of Westinghouse 17X17 fuel assemblies with initial enrichments less than or equal to 5.0 weight percent U-235 in the spent fuel cask during loading operations in the cask storage area. The resulting enrichment and burnup limits are shown in Figure 3.7.18-1.

A cask storage area boron concentration of 2000 ppm ensures that no credible boron dilution event will result in a K_{eff} greater than 0.95.

PROPOSED NEW SPECIFICATION BASES

BASES

APPLICABLE SAFETY ANALYSES

The soluble boron concentration required to maintain $K_{eff} \leq 0.95$ under accident conditions was determined by evaluating all credible events which increase the K_{eff} value of the spent fuel cask (Ref. 4). The accident event which produces the largest increase in the spent fuel cask K_{eff} value is employed to determine the required soluble boron concentration necessary to mitigate this and all less severe accident events. The list of accident cases considered includes:

- Dropped fresh fuel assembly on top of the spent fuel cask,
- Misloaded fresh fuel assembly outside of the spent fuel cask,
- Spent fuel cask assembly-to-assembly pitch reduction due to seismic event,
- Spent fuel cask water temperature greater than 180 °F, and
- Misloaded fresh fuel assembly into a spent fuel cask location.

It is possible to drop a fresh fuel assembly on top, or immediately outside, of the spent fuel cask. In this case, the physical separation (approximately 20 inches) between the fuel assemblies loaded inside the spent fuel cask and the assembly lying on top or outside is sufficient to neutronically decouple the accident. This accident will produce a very small positive reactivity increase. This small increase will not be as limiting as the reactivity increase associated with a fuel misloading event inside the spent fuel cask.

For the accident due to a seismic event, the assembly-to-assembly pitch is reduced such that the condition can be approximated by that of the off-center assembly case (performed as part of the uncertainty analysis). An increase of 0.00304 ΔK_{eff} (not accounting for uncertainties) is determined for this case, and this is significantly less than the reactivity increase due to a fuel misloading event inside the spent fuel cask.

The nominal water temperature range addressed for the spent fuel cask in this analysis is 50 °F to 180 °F. It is possible to increase the spent fuel cask water temperature above 180 °F. However, an increase to 180 °F is determined to actually decrease reactivity (as part of the uncertainty analysis). Based on the response of the reactivity to increasing temperature up to 180 °F, any increase in reactivity above 180 °F will be minimal as compared to the fuel mishandling event. Therefore, at higher temperatures, the fuel mishandling event remains limiting.

The fuel assembly misloading accident represents the most severe postulated event for reactivity increase in K_{eff} and involves the

(continued)

PROPOSED NEW SPECIFICATION BASES

BASES

APPLICABLE SAFETY ANALYSES (continued)

placement of a fresh Westinghouse Optimized Fuel Assembly (OFA) fuel assembly enriched to 5.0 weight percent (containing no burnable poisons) into a cask center cell storage location. This misload would result in a positive reactivity addition increasing K_{eff} toward 0.95. The amount of soluble boron required to compensate for the positive reactivity added is 659 ppm, which is well below the LCO limit of 2000 ppm.

As described in Bases for LCO 3.7.14, a spent fuel pool boron dilution evaluation determined that the volume of water necessary to dilute the spent fuel pool from the LCO limit of 2000 ppm to 400 ppm (the boron concentration required to maintain K_{eff} less than or equal to 0.95) is approximately 480,000 gallons. A spent fuel pool dilution of this volume is not a credible event, since it would require this large volume of water to be transferred from a source to the spent fuel pool, ultimately overflowing the pool. This event would be detected and terminated by plant personnel prior to exceeding a K_{eff} of 0.95.

During cask loading operations, the active volume of the spent fuel pool will be increased by the volume of the transfer canal and the cask storage area. This has the effect of reducing the rate of dilution of the pool, therefore, the dilution evaluation for the spent fuel pool remains bounding for cask loading operations.

The concentration of dissolved boron in the cask storage area satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The cask storage area boron concentration is required to be ≥ 2000 ppm. The specified concentration of dissolved boron in the fuel storage pool preserves the assumptions used in the analyses of the potential criticality accident scenarios as described in Reference 5. The specified boron concentration of 2000 ppm ensures that the spent fuel cask K_{eff} will remain less than or equal to 0.95 due to a postulated fuel assembly misload accident (659 ppm) or boron dilution event (400 ppm).

The LCO is modified by a note that requires the spent fuel transfer canal gate and the cask storage area gate to both be open during cask loading operations except during the brief period when moving the spent fuel cask into or out of the cask storage area. This is to ensure that the boron dilution evaluation for the spent fuel pool remains bounding for cask loading operations.

PROPOSED NEW SPECIFICATION BASES

BASES

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the cask storage area of the spent fuel pool.

ACTIONS

A.1 and A.2

The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.

When the concentration of boron in the fuel storage pool (including the transfer canal and cask storage area) is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies. Action is also initiated to restore the concentration of boron simultaneously with suspending movement of fuel assemblies.

If the LCO is not met while moving irradiated fuel assemblies in MODE 5 or 6, LCO 3.0.3 would not be applicable. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.17.1

The boron concentration in the spent fuel cask storage area water must be verified to be within limit within four hours prior to entering the Applicability of the LCO. For loading operations, this means within four hours of loading the first fuel assembly into the cask.

For unloading operations, this means verifying the concentration of the borated water source to be used to re-flood the spent fuel cask within four hours of commencing re-flooding operations. This ensures that when the LCO is applicable (upon introducing water into the spent fuel cask), the LCO will be met.

The frequency of every 48 hours thereafter applies if cask loading operations continue for 48 hours or more and continue until the spent fuel cask is removed from the cask storage area.

When both the transfer canal gate and the cask storage area gate are open, the boron concentration measurement may be performed by sampling in accordance with SR 3.7.14.1. When at least one gate is closed, the sample is to be taken in the cask storage area.

PROPOSED NEW SPECIFICATION BASES

BASES

REFERENCES

1. USNRC Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition, NUREG-0800, June, 1987.
2. USNRC Spent Fuel Storage Facility Design Bases (for Comment) Proposed Revision 2, 1981.
3. ANS, "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations," ANSI/ANS-57.2-1983.
4. "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," CN-CRIT-207.
5. FSAR, Section 4.3.2.7.2.3.
6. NRC, Letter to all Power Reactor Licensees from B.K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," April 14, 1978.

PROPOSED NEW SPECIFICATION BASES

B 3.7 PLANT SYSTEMS

B 3.7.18 Spent Fuel Assembly Storage—Cask Loading Operations

BASES

BACKGROUND

The cask storage area is connected to the spent fuel pool when the spent fuel transfer canal gate and the cask storage area gate are removed and is used to facilitate cask loading operations. The spent fuel cask contains storage locations for 32 fuel assemblies. Westinghouse 17X17 fuel assemblies with initial enrichments less than or equal to 5.0 weight percent U-235 can be stored in the spent fuel cask provided the fuel burnup-enrichment combinations are within the limits specified in Figure 3.7.18-1 of the Technical Specifications. Westinghouse Calculation Note CN-CRIT-207, "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," (Ref. 1) provides the basis for acceptability to conduct cask loading operations in the cask storage area assuming a postulated boron dilution event.

Westinghouse 17X17 fuel assemblies with nominal enrichments less than or equal to 5.0 weight percent U-235 can be stored in the spent fuel cask. The fuel assemblies must satisfy the minimum burnup requirement as shown in Figure 3.7.18-1.

APPLICABLE SAFETY ANALYSES

The soluble boron concentration required to maintain $K_{eff} \leq 0.95$ under accident conditions was determined by evaluating all credible events which increase the K_{eff} value of the spent fuel cask (Ref. 1). The accident event which produces the largest increase in the spent fuel cask K_{eff} value is employed to determine the required soluble boron concentration necessary to mitigate this and all less severe accident events. The list of accident cases considered includes:

- Dropped fresh fuel assembly on top of the spent fuel cask,
- Misloaded fresh fuel assembly outside of the spent fuel cask,
- Spent fuel cask assembly-to-assembly pitch reduction due to seismic event,
- Spent fuel cask water temperature greater than 180 °F, and
- Misloaded fresh fuel assembly into a spent fuel cask location.

It is possible to drop a fresh fuel assembly on top, or immediately outside, of the spent fuel cask. In this case, the physical separation (approximately 20 inches) between the fuel assemblies loaded inside the spent fuel cask and the assembly lying on top or outside is

(continued)

PROPOSED NEW SPECIFICATION BASES

BASES

APPLICABLE SAFETY ANALYSES (continued)

sufficient to neutronically decouple the accident. This accident will produce a very small positive reactivity increase. This small increase will not be as limiting as the reactivity increase associated with a fuel misloading event inside the spent fuel cask.

For the accident due to a seismic event, the assembly-to-assembly pitch is reduced such that the condition can be approximated by that of the off-center assembly case (performed as part of the uncertainty analysis). An increase of 0.00304 ΔK_{eff} (not accounting for uncertainties) is determined for this case, and this is significantly less than the reactivity increase due to a fuel misloading event inside the spent fuel cask.

The nominal water temperature range addressed for the spent fuel cask in this analysis is 50 °F to 180 °F. It is possible to increase the spent fuel cask water temperature above 180 °F. However, an increase to 180 °F is determined to actually decrease reactivity (as part of the uncertainty analysis). Based on the response of the reactivity to increasing temperature up to 180 °F, any increase in reactivity above 180 °F will be minimal as compared to the fuel mishandling event. Therefore, at higher temperatures, the fuel mishandling event remains limiting.

The fuel assembly misloading accident represents the most severe postulated event for reactivity increase in K_{eff} and involves the placement of a fresh Westinghouse Optimized Fuel Assembly (OFA) fuel assembly enriched to 5.0 weight percent (containing no burnable poisons) into a cask center cell storage location. This misload would result in a positive reactivity addition increasing K_{eff} toward 0.95. The amount of soluble boron required to compensate for the positive reactivity added is 659 ppm, which is well below the LCO limit of 2000 ppm.

The configuration of fuel assemblies in the cask storage area satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The K_{eff} of the spent fuel cask will always remain $\leq$ 0.95, assuming the spent fuel pool, including the cask storage area, to be flooded with borated water. The combination of initial enrichment and burnup are specified in Figure 3.7.18-1 for the Cask Storage Configuration.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the cask storage area of the spent fuel pool.

PROPOSED NEW SPECIFICATION BASES

BASES

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the configuration of fuel assemblies stored in the cask storage area is not in accordance with the acceptable combination of initial enrichments and burnup, the immediate action is to initiate action to make the necessary fuel assembly movement(s) to bring the configuration into compliance with Figure 3.7.18-1.

If unable to move irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not be applicable. If unable to move irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the action is independent of reactor operation. Therefore, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.18.1

This SR verifies by administrative means (e.g., Cask Loading Plan, Tote computer code output or TrackWorks program) that the initial enrichment and burnup of the fuel assembly is within the acceptable burnup domain of Figure 3.7.18-1. This surveillance must be completed prior to placing any fuel assembly in the spent fuel cask.

REFERENCES

1. "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," CN-CRIT-207.

Enclosure 4

Joseph M. Farley Nuclear Plant
Technical Specifications Revision
Spent Fuel Cask Loading Requirements

Clean Typed Technical Specifications and Corresponding Bases Pages

3.7 PLANT SYSTEMS

3.7.17 Cask Storage Area Boron Concentration — Cask Loading Operations

LCO 3.7.17 The cask storage area boron concentration shall be ≥ 2000 ppm.

--NOTE--
During cask loading operations, the spent fuel transfer canal gate and the cask storage area gate shall both be open except when moving the spent fuel cask into or out of the cask storage area.

APPLICABILITY: Whenever any fuel assembly is stored in the cask storage area.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask storage area boron concentration not within limit.	------------------NOTE------------------ LCO 3.0.3 is not applicable. --	
	A.1 Suspend movement of fuel assemblies in the cask storage area.	Immediately
	<u>AND</u>	
	A.2 Initiate action to restore cask storage area boron concentration to within limit.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.17.1	Verify the cask storage area boron concentration is within limit.	Once within 4 hours prior to entering the Applicability of this LCO. AND Every 48 hours thereafter.

3.7 PLANT SYSTEMS

3.7.18 Spent Fuel Assembly Storage—Cask Loading Operations

LCO 3.7.18 The combination of initial enrichment and burnup of each spent fuel assembly stored in the cask storage area shall be within the Acceptable Burnup Domain of Figure 3.7.18-1.

APPLICABILITY: Whenever any fuel assembly is stored in the cask storage area.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Requirements of the LCO not met.	A.1	-------------NOTE-------------- LCO 3.0.3 is not applicable. ---------------------------------- Initiate action to move the noncomplying fuel assembly to an acceptable storage location.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.18.1	Verify by administrative means the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.7.18-1.	Prior to placing fuel assemblies in the spent fuel cask.

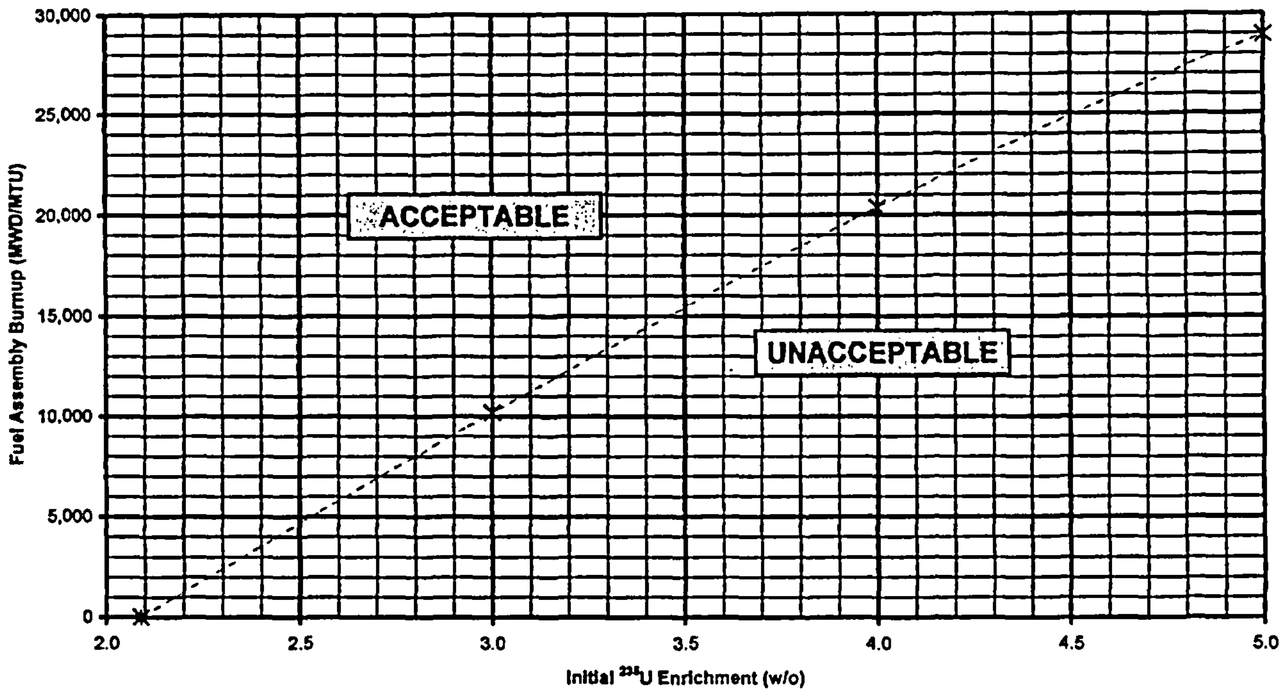


Figure 3.7.18-1 Fuel Assembly Burnup Limit Requirements For Cask Storage

4.0 DESIGN FEATURES

4.3.1.2 (continued)

b. Fuel assemblies with Optimized Fuel Assembly fuel rod diameters having a maximum nominal U-235 enrichment of 5.0 weight percent. Fuel assemblies with Optimized Fuel Assembly fuel rod diameters having a maximum nominal U-235 enrichment > 3.9 weight percent shall contain sufficient integral burnable absorbers such that a maximum reference fuel assembly $K_{\infty} \leq 1.455$ at 68°F is maintained;

c. $k_{eff} \leq 0.95$ if fully flooded with unborated water;

d. $k_{eff} \leq 0.98$ if moderated by aqueous foam; and

e. A nominal 21 inch center to center distance between fuel assemblies placed in the storage racks.

4.3.1.3 The spent fuel casks are designed and shall be maintained with:

a. Fuel assemblies having a maximum nominal U-235 enrichment of 5.0 weight percent;

b. $k_{eff} < 1.0$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 4.3.2.7.2.3 of the FSAR;

c. $k_{eff} \leq 0.95$ if fully flooded with water borated to 400 ppm, which includes an allowance for uncertainties and biases as described in Section 4.3.2.7.2.3 of the FSAR;

d. A nominal 9.218 inch center to center distance between fuel assemblies placed in the spent fuel cask; and

e. Spent fuel assemblies with a combination of discharge burnup and initial enrichment in the "acceptable range" of Figure 3.7.18-1.

4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 149 ft.

4.0 DESIGN FEATURES

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1407 fuel assemblies.

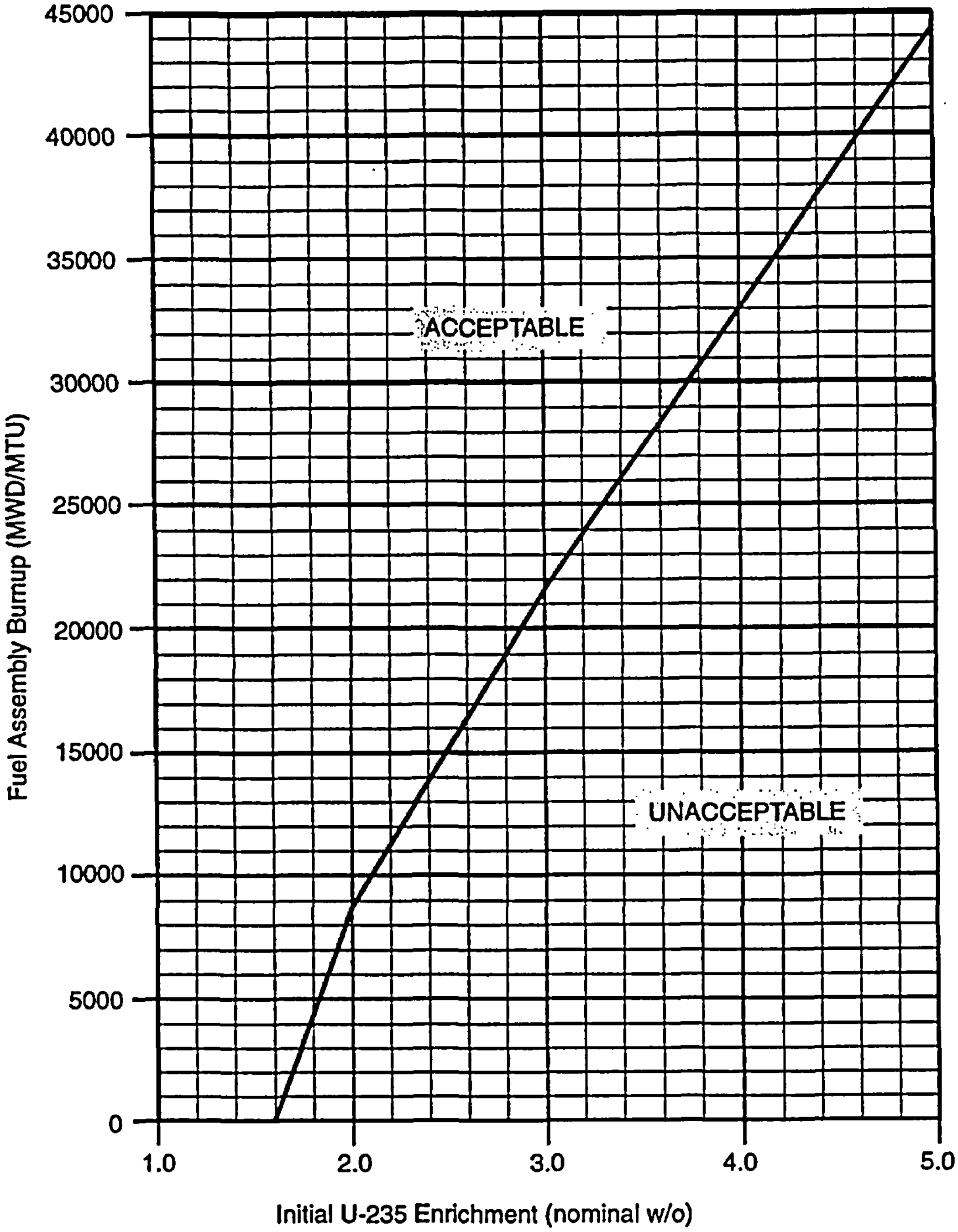
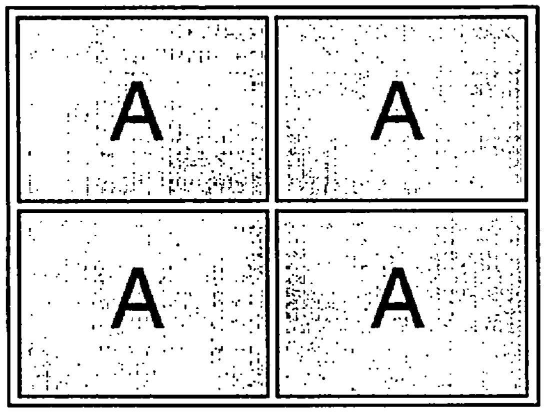
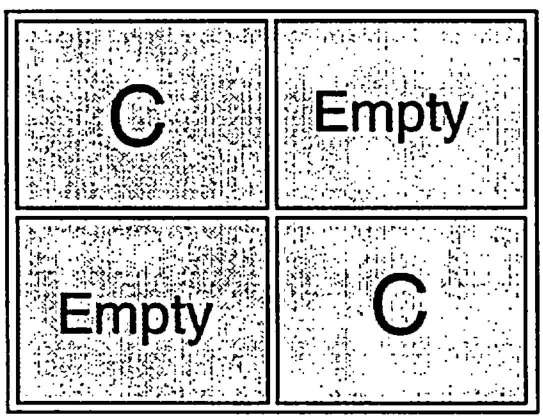


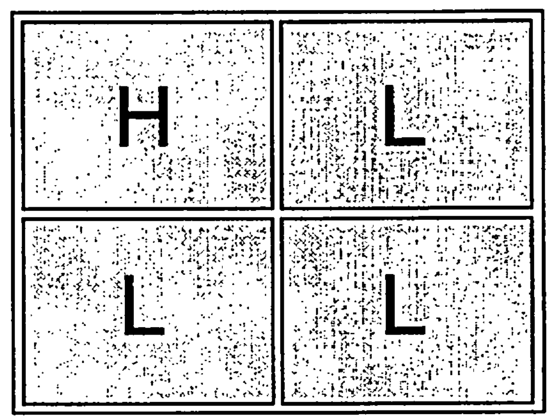
Figure 4.3-1
Fuel Assembly Burnup Limit Requirements for Low Enrichment (L)
Assembly of the Burned/Fresh Checkerboard Storage (see Figure 4.3-2)



All Cell Storage



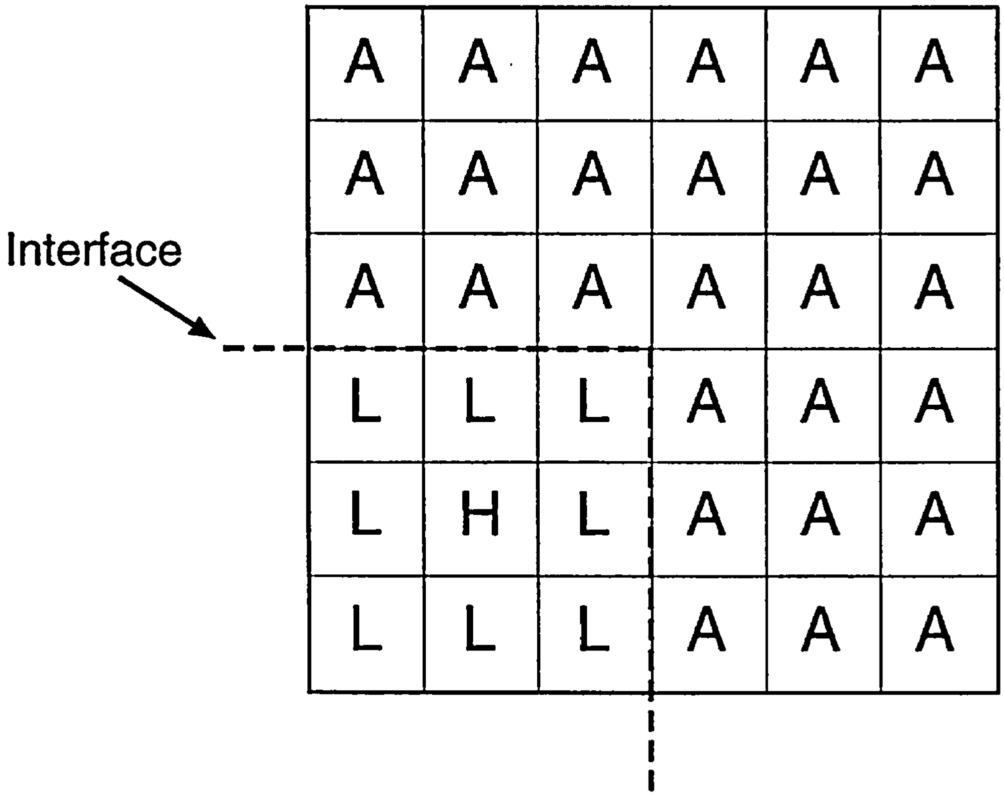
2-out-of-4 Storage



Burned/Fresh Storage

Note:
A = All Cell Enrichment (Figure 3.7.15-1)
C = 2-out-of-4 Enrichment (No restriction on enrichment or burnup)
L = Low Enrichment of Burned/Fresh (Figure 4.3-1)
H = High Enrichment of Burned/Fresh (See section 4.3.1.1.f for IFBA requirement)
Empty = Empty Cell

Figure 4.3-2
Spent Fuel Storage Configurations

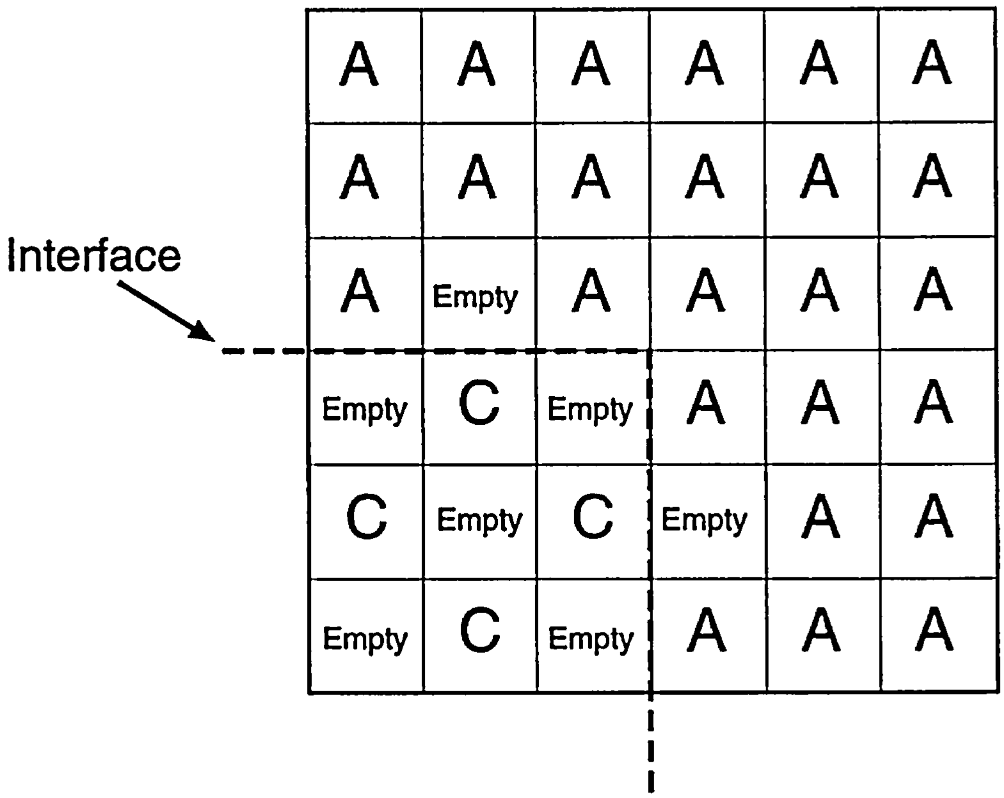


Note:
A = All Cell Enrichment
L = Low Enrichment of Burned/Fresh
H = High Enrichment of Burned/Fresh

Boundary Between All Cell Storage and Burned/Fresh Storage

Note:
1. A row of empty cells can be used at the interface to separate the configurations.
2. It is acceptable to replace an assembly with an empty cell.

Figure 4.3-3
Interface Requirements

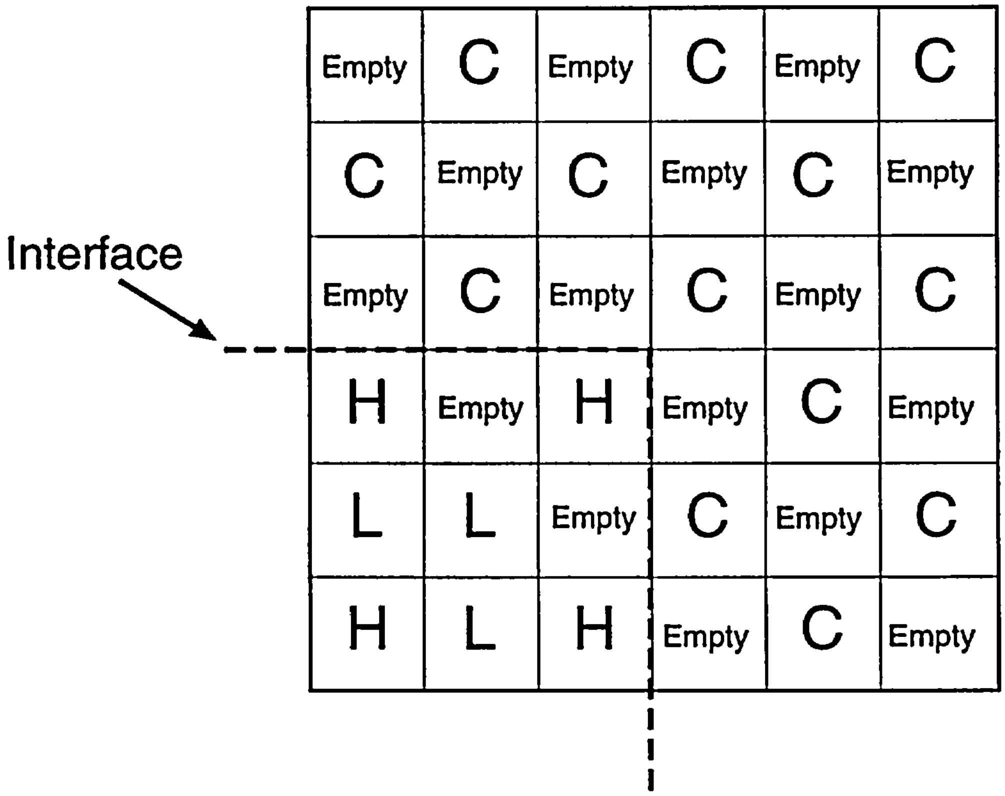


Note:
A = All Cell Enrichment
C = 2-out-of-4 Enrichment
Empty = Empty Cell

Boundary Between All Cell Storage and 2-out-of-4 Storage

Note:
1. A row of empty cells can be used at the interface to separate the configurations.
2. It is acceptable to replace an assembly with an empty cell.

Figure 4.3-4
Interface Requirements

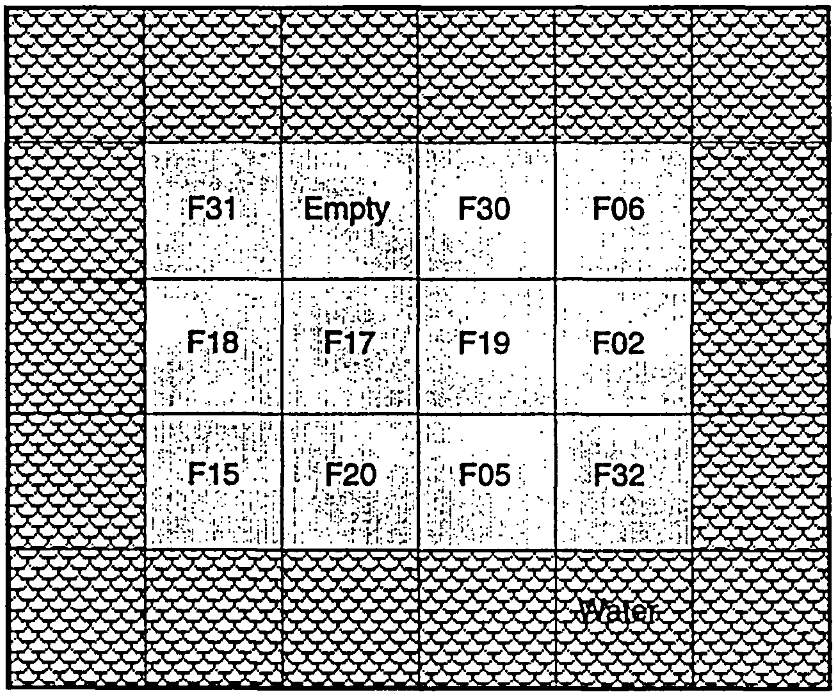


Note:
C = 2-out-of-4 Enrichment
L = Low Enrichment of Burned/Fresh
H = High Enrichment of Burned/Fresh
Empty = Empty Cell

Boundary Between 2-out-of-4 Storage and Burned/Fresh Storage

Note:
1. A row of empty cells can be used at the interface to separate the configurations.
2. It is acceptable to replace an assembly with an empty cell.

Figure 4.3-5
Interface Requirements



Note: All Assemblies are 3.0 w/o ^{235}U nominal enrichment

Figure 4.3-6
Damaged Fuel Assembly Configuration
(Unit 1 Only)

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B 3.7 PLANT SYSTEMS

B 3.7.17 Cask Storage Area Boron Concentration — Cask Loading Operations

BASES

BACKGROUND

The cask storage area is connected to the spent fuel pool when the spent fuel transfer canal gate and the cask storage area gate are removed and is used to facilitate cask loading operations. The spent fuel cask contains storage locations for 32 fuel assemblies. Westinghouse 17X17 fuel assemblies with initial enrichments less than or equal to 5.0 weight percent U-235 can be stored in the spent fuel cask provided the fuel burnup-enrichment combinations are within the limits specified in Figure 3.7.18-1 of the Technical Specifications. Westinghouse Calculation Note CN-CRIT-207, "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," (Ref. 4) provides the basis for acceptability to conduct cask loading operations in the cask storage area.

The above methodology ensures that the spent fuel cask multiplication factor, K_{eff}, is less than or equal to 0.95, as recommended by ANSI 57.2-1983 (Ref. 3) and NRC Guidance (Refs. 1, 2, and 6). A storage configuration is defined using K_{eff} calculations to ensure that K_{eff} will be less than 1.0 with no soluble boron under normal storage conditions including tolerances and uncertainties. Soluble boron credit is then used to maintain K_{eff} less than or equal to 0.95. The treatment of reactivity uncertainties, as well as the calculation of postulated accidents crediting soluble boron is described in Ref.4.

The above methodology was used to evaluate cask loading of Westinghouse 17X17 fuel assemblies with initial enrichments less than or equal to 5.0 weight percent U-235 in the spent fuel cask during loading operations in the cask storage area. The resulting enrichment and burnup limits are shown in Figure 3.7.18-1.

A cask storage area boron concentration of 2000 ppm ensures that no credible boron dilution event will result in a K_{eff} greater than 0.95.

BASES

APPLICABLE SAFETY ANALYSES

The soluble boron concentration required to maintain $K_{eff} \leq 0.95$ under accident conditions was determined by evaluating all credible events which increase the K_{eff} value of the spent fuel cask (Ref. 4). The accident event which produces the largest increase in the spent fuel cask K_{eff} value is employed to determine the required soluble boron concentration necessary to mitigate this and all less severe accident events. The list of accident cases considered includes:

- Dropped fresh fuel assembly on top of the spent fuel cask,
- Misloaded fresh fuel assembly outside of the spent fuel cask,
- Spent fuel cask assembly-to-assembly pitch reduction due to seismic event,
- Spent fuel cask water temperature greater than 180 °F, and
- Misloaded fresh fuel assembly into a spent fuel cask location.

It is possible to drop a fresh fuel assembly on top, or immediately outside, of the spent fuel cask. In this case, the physical separation (approximately 20 inches) between the fuel assemblies loaded inside the spent fuel cask and the assembly lying on top or outside is sufficient to neutronically decouple the accident. This accident will produce a very small positive reactivity increase. This small increase will not be as limiting as the reactivity increase associated with a fuel misloading event inside the spent fuel cask.

For the accident due to a seismic event, the assembly-to-assembly pitch is reduced such that the condition can be approximated by that of the off-center assembly case (performed as part of the uncertainty analysis). An increase of 0.00304 ΔK_{eff} (not accounting for uncertainties) is determined for this case, and this is significantly less than the reactivity increase due to a fuel misloading event inside the spent fuel cask.

The nominal water temperature range addressed for the spent fuel cask in this analysis is 50 °F to 180 °F. It is possible to increase the spent fuel cask water temperature above 180 °F. However, an increase to 180 °F is determined to actually decrease reactivity (as part of the uncertainty analysis). Based on the response of the reactivity to increasing temperature up to 180 °F, any increase in reactivity above 180 °F will be minimal as compared to the fuel mishandling event. Therefore, at higher temperatures, the fuel mishandling event remains limiting.

The fuel assembly misloading accident represents the most severe postulated event for reactivity increase in K_{eff} and involves the

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

placement of a fresh Westinghouse Optimized Fuel Assembly (OFA) fuel assembly enriched to 5.0 weight percent (containing no burnable poisons) into a cask center cell storage location. This misload would result in a positive reactivity addition increasing K_{eff} toward 0.95. The amount of soluble boron required to compensate for the positive reactivity added is 659 ppm, which is well below the LCO limit of 2000 ppm.

As described in Bases for LCO 3.7.14, a spent fuel pool boron dilution evaluation determined that the volume of water necessary to dilute the spent fuel pool from the LCO limit of 2000 ppm to 400 ppm (the boron concentration required to maintain K_{eff} less than or equal to 0.95) is approximately 480,000 gallons. A spent fuel pool dilution of this volume is not a credible event, since it would require this large volume of water to be transferred from a source to the spent fuel pool, ultimately overflowing the pool. This event would be detected and terminated by plant personnel prior to exceeding a K_{eff} of 0.95.

During cask loading operations, the active volume of the spent fuel pool will be increased by the volume of the transfer canal and the cask storage area. This has the effect of reducing the rate of dilution of the pool, therefore, the dilution evaluation for the spent fuel pool remains bounding for cask loading operations.

The concentration of dissolved boron in the cask storage area satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The cask storage area boron concentration is required to be ≥ 2000 ppm. The specified concentration of dissolved boron in the fuel storage pool preserves the assumptions used in the analyses of the potential criticality accident scenarios as described in Reference 5. The specified boron concentration of 2000 ppm ensures that the spent fuel cask K_{eff} will remain less than or equal to 0.95 due to a postulated fuel assembly misload accident (659 ppm) or boron dilution event (400 ppm).

The LCO is modified by a note that requires the spent fuel transfer canal gate and the cask storage area gate to both be open during cask loading operations except during the brief period when moving the spent fuel cask into or out of the cask storage area. This is to ensure that the boron dilution evaluation for the spent fuel pool remains bounding for cask loading operations.

BASES

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the cask storage area of the spent fuel pool.

ACTIONS

A.1 and A.2

The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.

When the concentration of boron in the fuel storage pool (including the transfer canal and cask storage area) is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies. Action is also initiated to restore the concentration of boron simultaneously with suspending movement of fuel assemblies.

If the LCO is not met while moving irradiated fuel assemblies in MODE 5 or 6, LCO 3.0.3 would not be applicable. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.17.1

The boron concentration in the spent fuel cask storage area water must be verified to be within limit within four hours prior to entering the Applicability of the LCO. For loading operations, this means within four hours of loading the first fuel assembly into the cask.

For unloading operations, this means verifying the concentration of the borated water source to be used to re-flood the spent fuel cask within four hours of commencing re-flooding operations. This ensures that when the LCO is applicable (upon introducing water into the spent fuel cask), the LCO will be met.

The frequency of every 48 hours thereafter applies if cask loading operations continue for 48 hours or more and continue until the spent fuel cask is removed from the cask storage area.

When both the transfer canal gate and the cask storage area gate are open, the boron concentration measurement may be performed by sampling in accordance with SR 3.7.14.1. When at least one gate is closed, the sample is to be taken in the cask storage area.

BASES

REFERENCES

1. USNRC Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition, NUREG-0800, June, 1987.
2. USNRC Spent Fuel Storage Facility Design Bases (for Comment) Proposed Revision 2, 1981.
3. ANS, "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations," ANSI/ANS-57.2-1983.
4. "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," CN-CRIT-207.
5. FSAR, Section 4.3.2.7.2.3.
6. NRC, Letter to all Power Reactor Licensees from B.K. Grimes, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," April 14, 1978.

B 3.7 PLANT SYSTEMS

B 3.7.18 Spent Fuel Assembly Storage — Cask Loading Operations

BASES

BACKGROUND

The cask storage area is connected to the spent fuel pool when the spent fuel transfer canal gate and the cask storage area gate are removed and is used to facilitate cask loading operations. The spent fuel cask contains storage locations for 32 fuel assemblies. Westinghouse 17X17 fuel assemblies with initial enrichments less than or equal to 5.0 weight percent U-235 can be stored in the spent fuel cask provided the fuel burnup-enrichment combinations are within the limits specified in Figure 3.7.18-1 of the Technical Specifications. Westinghouse Calculation Note CN-CRIT-207, "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," (Ref. 1) provides the basis for acceptability to conduct cask loading operations in the cask storage area assuming a postulated boron dilution event.

Westinghouse 17X17 fuel assemblies with nominal enrichments less than or equal to 5.0 weight percent U-235 can be stored in the spent fuel cask. The fuel assemblies must satisfy the minimum burnup requirement as shown in Figure 3.7.18-1.

APPLICABLE SAFETY ANALYSES

The soluble boron concentration required to maintain $K_{eff} \leq 0.95$ under accident conditions was determined by evaluating all credible events which increase the K_{eff} value of the spent fuel cask (Ref. 1). The accident event which produces the largest increase in the spent fuel cask K_{eff} value is employed to determine the required soluble boron concentration necessary to mitigate this and all less severe accident events. The list of accident cases considered includes:

- Dropped fresh fuel assembly on top of the spent fuel cask,
- Misloaded fresh fuel assembly outside of the spent fuel cask,
- Spent fuel cask assembly-to-assembly pitch reduction due to seismic event,
- Spent fuel cask water temperature greater than 180 °F, and
- Misloaded fresh fuel assembly into a spent fuel cask location.

It is possible to drop a fresh fuel assembly on top, or immediately outside, of the spent fuel cask. In this case, the physical separation (approximately 20 inches) between the fuel assemblies loaded inside the spent fuel cask and the assembly lying on top or outside is

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

sufficient to neutronically decouple the accident. This accident will produce a very small positive reactivity increase. This small increase will not be as limiting as the reactivity increase associated with a fuel misloading event inside the spent fuel cask.

For the accident due to a seismic event, the assembly-to-assembly pitch is reduced such that the condition can be approximated by that of the off-center assembly case (performed as part of the uncertainty analysis). An increase of 0.00304 ΔK_{eff} (not accounting for uncertainties) is determined for this case, and this is significantly less than the reactivity increase due to a fuel misloading event inside the spent fuel cask.

The nominal water temperature range addressed for the spent fuel cask in this analysis is 50 °F to 180 °F. It is possible to increase the spent fuel cask water temperature above 180 °F. However, an increase to 180 °F is determined to actually decrease reactivity (as part of the uncertainty analysis). Based on the response of the reactivity to increasing temperature up to 180 °F, any increase in reactivity above 180 °F will be minimal as compared to the fuel mishandling event. Therefore, at higher temperatures, the fuel mishandling event remains limiting.

The fuel assembly misloading accident represents the most severe postulated event for reactivity increase in K_{eff} and involves the placement of a fresh Westinghouse Optimized Fuel Assembly (OFA) fuel assembly enriched to 5.0 weight percent (containing no burnable poisons) into a cask center cell storage location. This misload would result in a positive reactivity addition increasing K_{eff} toward 0.95. The amount of soluble boron required to compensate for the positive reactivity added is 659 ppm, which is well below the LCO limit of 2000 ppm.

The configuration of fuel assemblies in the cask storage area satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The K_{eff} of the spent fuel cask will always remain ≤ 0.95, assuming the spent fuel pool, including the cask storage area, to be flooded with borated water. The combination of initial enrichment and burnup are specified in Figure 3.7.18-1 for the Cask Storage Configuration.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the cask storage area of the spent fuel pool.

BASES

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the configuration of fuel assemblies stored in the cask storage area is not in accordance with the acceptable combination of initial enrichments and burnup, the immediate action is to initiate action to make the necessary fuel assembly movement(s) to bring the configuration into compliance with Figure 3.7.18-1.

If unable to move irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not be applicable. If unable to move irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the action is independent of reactor operation. Therefore, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.18.1

This SR verifies by administrative means (e.g., Cask Loading Plan, Tote computer code output or TrackWorks program) that the initial enrichment and burnup of the fuel assembly is within the acceptable burnup domain of Figure 3.7.18-1. This surveillance must be completed prior to placing any fuel assembly in the spent fuel cask.

REFERENCES

1. "MPC-32 Criticality Analysis for the J. M. Farley Nuclear Plant," CN-CRIT-207.