SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	-------------------------NOTE------------------------- Only required to be performed when ambient air temperature is < 45°F or > 115°F. -- Verify BWST borated water temperature is ≥ 45°F and ≤ 115°F.	24 hours
SR 3.5.4.2	Verify BWST borated water volume is ≥ 350,000 gallons.	7 days
SR 3.5.4.3	Verify BWST boron concentration is: a. Within limits specified in the COLR; AND b. ≥ 2220 ppm.	7 days

3.7 PLANT SYSTEMS

3.7.12 Spent Fuel Pool Boron Concentration

LCO 3.7.12 The spent fuel pool boron concentration limit shall be within limits.

APPLICABILITY: When fuel assemblies are stored in the spent fuel pool.

ACTIONS

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.12.1	Verify the spent fuel pool boron concentration is: a. Within limits specified in the COLR; AND b. $\geq$ 2220 ppm.	7 days

3.7 PLANT SYSTEMS

3.7.13 Fuel Assembly Storage

LCO 3.7.13 The combination of initial enrichment and burnup of each new or spent fuel assembly stored in the spent fuel pool storage racks shall be within the following configurations:

a. Fuel may be stored in the spent fuel pool shared between Units 1 and 2 in accordance with these limits:

1. Unrestricted storage meeting the criteria of Table 3.7.13-1.

2. Restricted storage in accordance with Figure 3.7.13-1 of fuel which meets the criteria of Table 3.7.13-2 (Restricted Fuel assemblies) and Table 3.7.13-3 (Filler Fuel assemblies).

3. Checkerboard storage in accordance with Figure 3.7.13-2 of fuel which does not meet the criteria of Table 3.7.13-2.

b. Fuel may be stored in the spent fuel pool for Unit 3 in accordance with these limits:

1. Unrestricted storage meeting the criteria of Table 3.7.13-4.

2. Restricted storage in accordance with Figure 3.7.13-3 of fuel which meets the criteria of Table 3.7.13-5 (Restricted Fuel assemblies) and Table 3.7.13-6 (Filler Fuel assemblies).

2. Checkerboard storage in accordance with Figure 3.7.13-4 of fuel which does not meet the criteria of Table 3.7.13-5.

APPLICABILITY: Whenever any fuel assembly is stored in the spent fuel pool.

ACTIONS

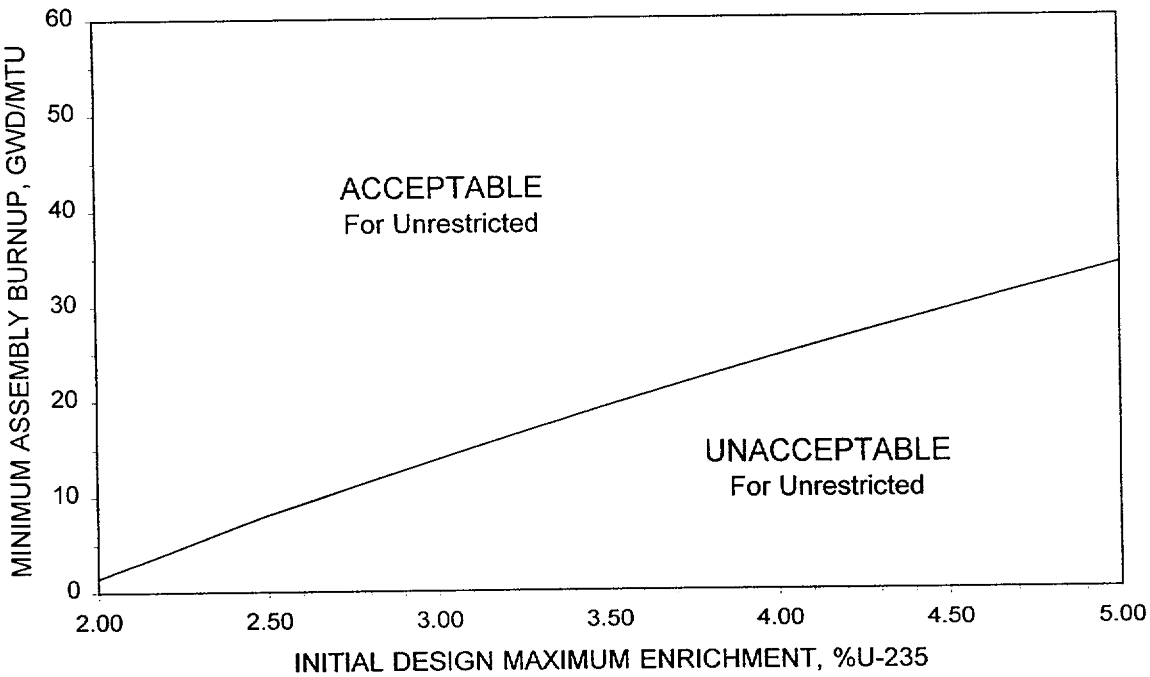
CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Requirements of the LCO not met.	A.1	-----------NOTE----------- LCO 3.0.3 is not applicable. ------------------------------ Initiate action to move the noncomplying fuel assembly to the correct location.	 Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.13.1	Verify by administrative means the planned spent fuel pool location is acceptable for the fuel assembly being stored.	Prior to storing the fuel assembly in the spent fuel pool

Table 3.7.13-1 (page 1 of 1)
Minimum Qualifying Burnup versus Design Maximum Enrichment
for Unrestricted Storage in the Units 1 and 2 Spent Fuel Pool

Initial Design Maximum Enrichment (Weight% U-235)	Minimum Assembly Burnup (GWD/MTU)
1.91 (or less)	0
2.00	1.43
2.50	8.08
3.00	13.85
3.50	19.30
4.00	24.47
4.50	29.35
5.00	34.07



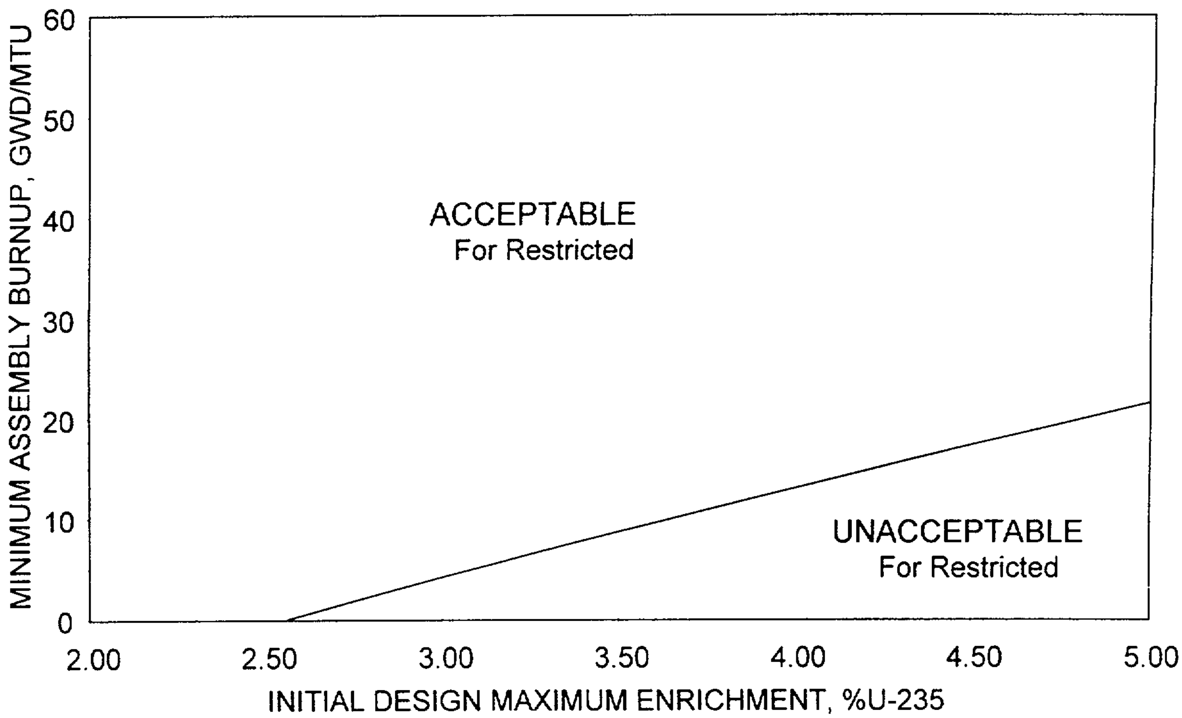
NOTES:

The Design Maximum enrichment indicated above is the nominal maximum enrichment of any fuel pin in the fuel assembly being considered. The as-built enrichment of a fuel assembly may exceed its specified Design Maximum by up to 0.05 wt % U-235 and still be stored in accordance with the above burnup limits for that Design Maximum enrichment.

Fuel which differs from those designs used to determine the requirements of Table 3.7.13-1 may be qualified for Unrestricted storage by means of an analysis using NRC approved methodology to assure that k_{eff} is less than 1.0 with no boron and less than or equal to 0.95 with credit for soluble boron.

Table 3.7.13-2 (page 1 of 1)
Minimum Qualifying Burnup versus Design Maximum Enrichment for Restricted Storage in the Units 1 and 2 Spent Fuel Pool

Initial Design Maximum Enrichment (Weight% U-235)	Minimum Assembly Burnup (GWD/MTU)
2.56 (or less)	0
3.00	4.19
3.50	8.68
4.00	13.02
4.50	17.31
5.00	21.53



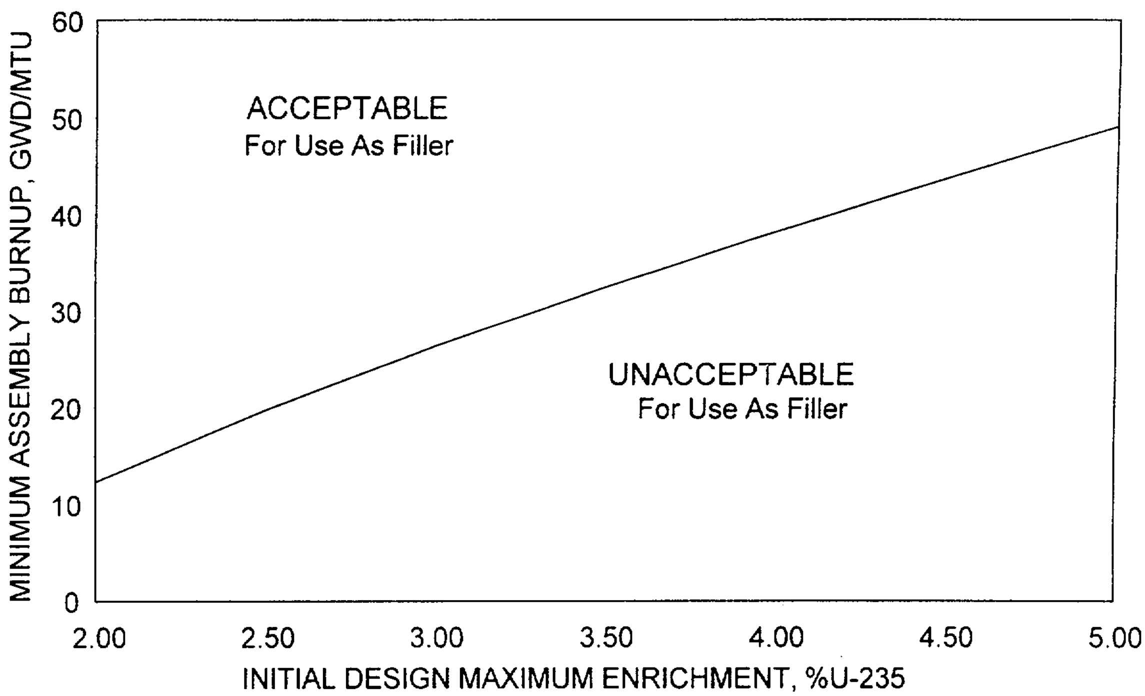
NOTES:

The Design Maximum enrichment indicated above is the nominal maximum enrichment of any fuel pin in the fuel assembly being considered. The as-built enrichment of a fuel assembly may exceed its specified Design Maximum by up to 0.05 wt % U-235 and still be stored in accordance with the above burnup limits for that Design Maximum enrichment.

Fuel which differs from those designs used to determine the requirements of Table 3.7.13-2 may be qualified for use as a Restricted Assembly by means of an analysis using NRC approved methodology to assure that k_{eff} is less than 1.0 with no boron and less than or equal to 0.95 with credit for soluble boron.

Table 3.7.13-3 (page 1 of 1)
Minimum Qualifying Burnup Versus Design Maximum Enrichment
for Filler Assemblies in the Unit 1 and 2 Spent Fuel Pool

Initial Design Maximum Enrichment (Weight% U-235)	Minimum Assembly Burnup (GWD/MTU)
1.41 (or less)	0
2.00	12.28
2.50	19.68
3.00	26.28
3.50	32.39
4.00	38.18
4.50	43.73
5.00	49.09



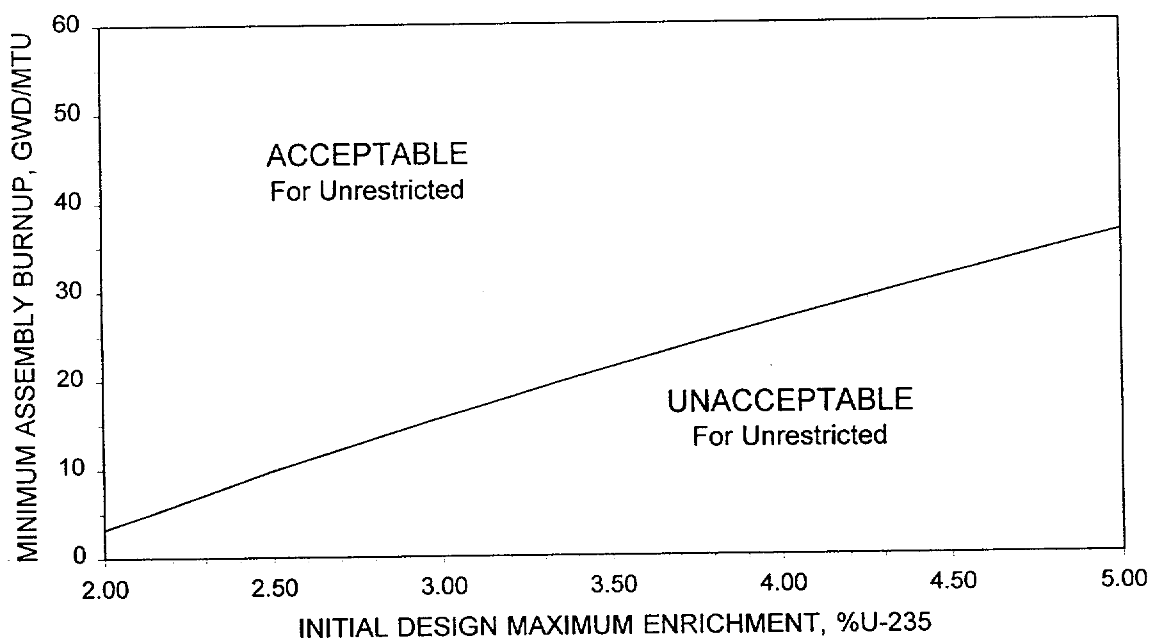
NOTES:

The Design Maximum enrichment indicated above is the nominal maximum enrichment of any fuel pin in the fuel assembly being considered. The as-built enrichment of a fuel assembly may exceed its specified Design Maximum by up to 0.05 wt % U-235 and still be stored in accordance with the above burnup limits for that Design Maximum enrichment.

Fuel which differs from those designs used to determine the requirements of Table 3.7.13-3 may be qualified for use as a Filler Assembly by means of an analysis using NRC approved methodology to assure that k_{eff} is less than 1.0 with no boron and less than or equal to 0.95 with credit for soluble boron.

Table 3.7.13-4 (page 1 of 1)
Minimum Qualifying Burnup versus Design Maximum Enrichment
for Unrestricted Storage in the Unit 3 Spent Fuel Pool

Initial Design Maximum Enrichment (Weight% U-235)	Minimum Assembly Burnup (GWD/MTU)
1.81 (or less)	0
2.00	3.16
2.50	9.79
3.00	15.72
3.50	21.30
4.00	26.54
4.50	31.50
5.00	36.30



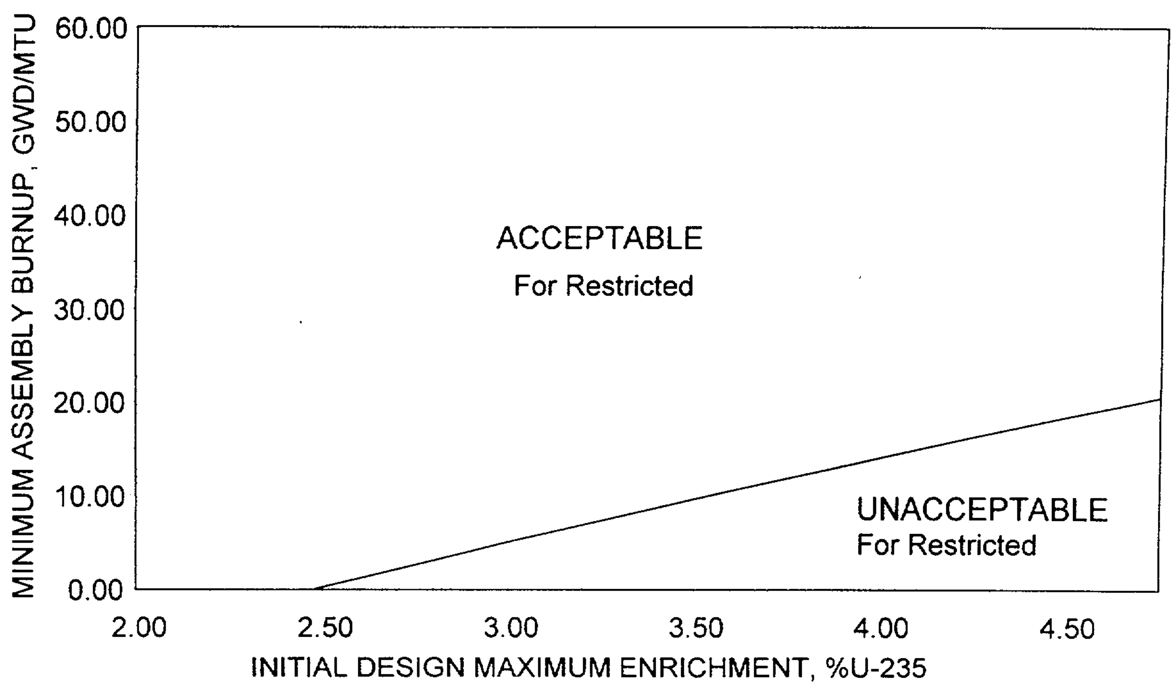
NOTES:

The Design Maximum enrichment indicated above is the nominal maximum enrichment of any fuel pin in the fuel assembly being considered. The as-built enrichment of a fuel assembly may exceed its specified Design Maximum by up to 0.05 wt % U-235 and still be stored in accordance with the above burnup limits for that Design Maximum enrichment.

Fuel which differs from those designs used to determine the requirements of Table 3.7.13-4 may be qualified for Unrestricted storage by means of an analysis using NRC approved methodology to assure that k_{eff} is less than 1.0 with no boron and less than or equal to 0.95 with credit for soluble boron.

Table 3.7.13-5 (page 1 of 1)
Minimum Qualifying Burnup Versus Design Maximum Enrichment
for Restricted Assemblies in the Unit 3 Spent Fuel Pool

Initial Design Maximum Enrichment (Weight% U-235)	Minimum Assembly Burnup (GWD/MTU)
2.48 (or less)	0
3.00	5.00
3.50	9.59
4.00	14.01
4.50	18.38
5.00	22.60



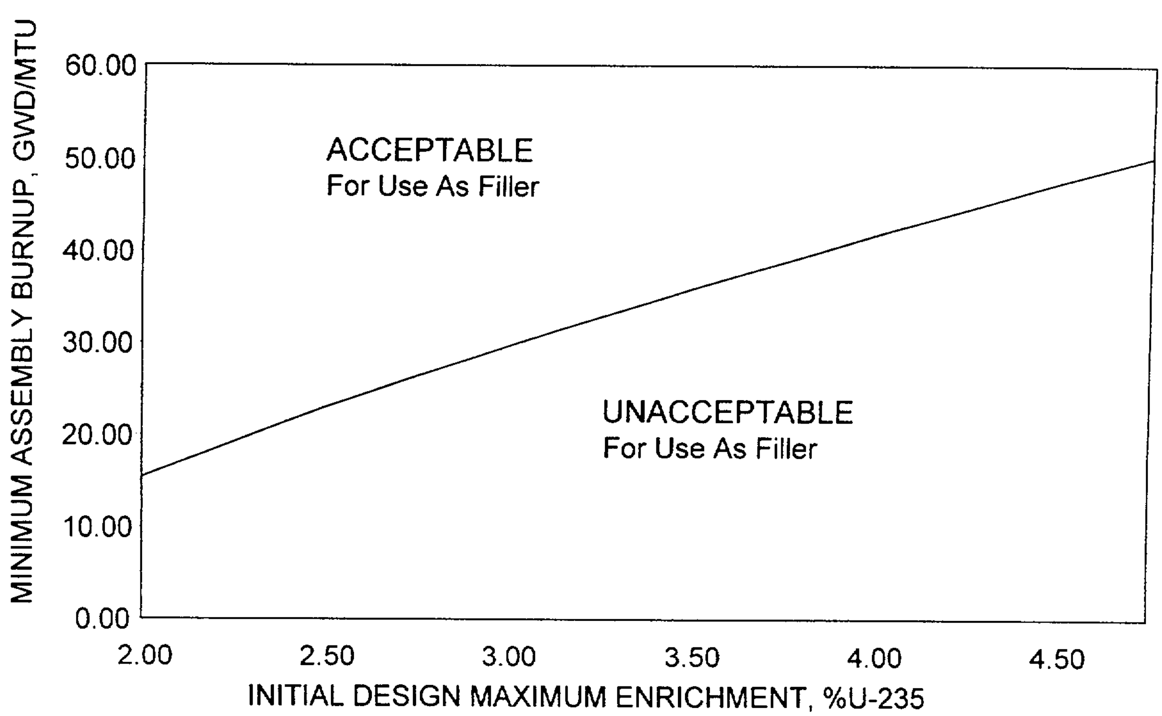
NOTES:

The Design Maximum enrichment indicated above is the nominal maximum enrichment of any fuel pin in the fuel assembly being considered. The as-built enrichment of a fuel assembly may exceed its specified Design Maximum by up to 0.05 wt % U-235 and still be stored in accordance with the above burnup limits for that Design Maximum enrichment.

Fuel which differs from those designs used to determine the requirements of Table 3.7.13-5 may be qualified for use as a Restricted Assembly by means of an analysis using NRC approved methodology to assure that k_{eff} is less than 1.0 with no boron and less than or equal to 0.95 with credit for soluble boron.

Table 3.7.13-6 (page 1 of 1)
Minimum Qualifying Burnup Versus Design Maximum Enrichment
for Filler Assemblies in the Unit 3 Spent Fuel Pool

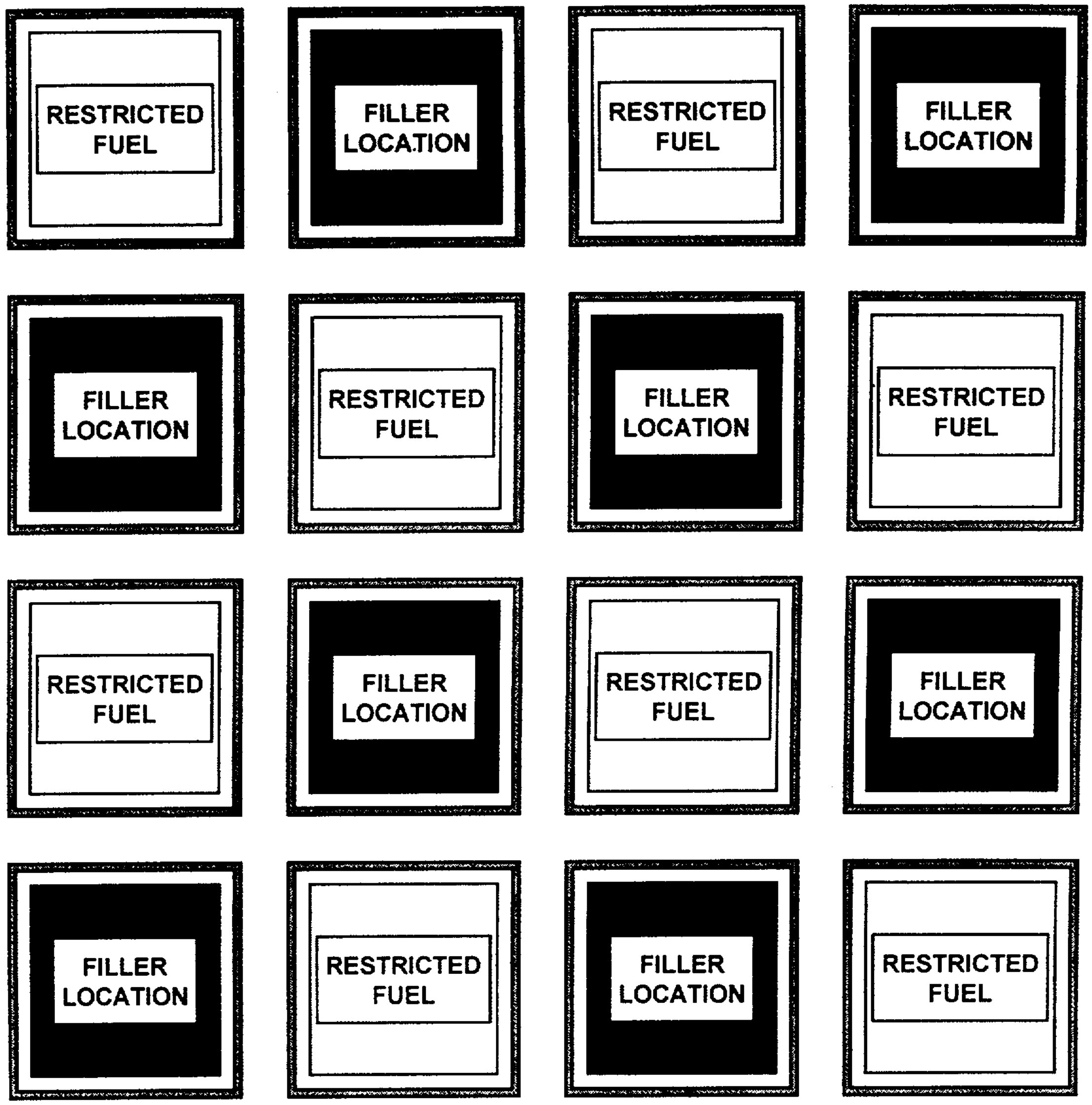
Initial Design Maximum Enrichment (Weight% U-235)	Minimum Assembly Burnup (GWD/MTU)
1.31 (or less)	0
2.00	15.40
2.50	22.96
3.00	29.59
3.50	35.82
4.00	41.76
4.50	47.45
5.00	52.93



NOTES:

The Design Maximum enrichment indicated above is the nominal maximum enrichment of any fuel pin in the fuel assembly being considered. The as-built enrichment of a fuel assembly may exceed its specified Design Maximum by up to 0.05 wt % U-235 and still be stored in accordance with the above burnup limits for that Design Maximum enrichment.

Fuel which differs from those designs used to determine the requirements of Table 3.7.13-6 may be qualified for use as a Filler Assembly by means of an analysis using NRC approved methodology to assure that k_{eff} is less than 1.0 with no boron and less than or equal to 0.95 with credit for soluble boron.

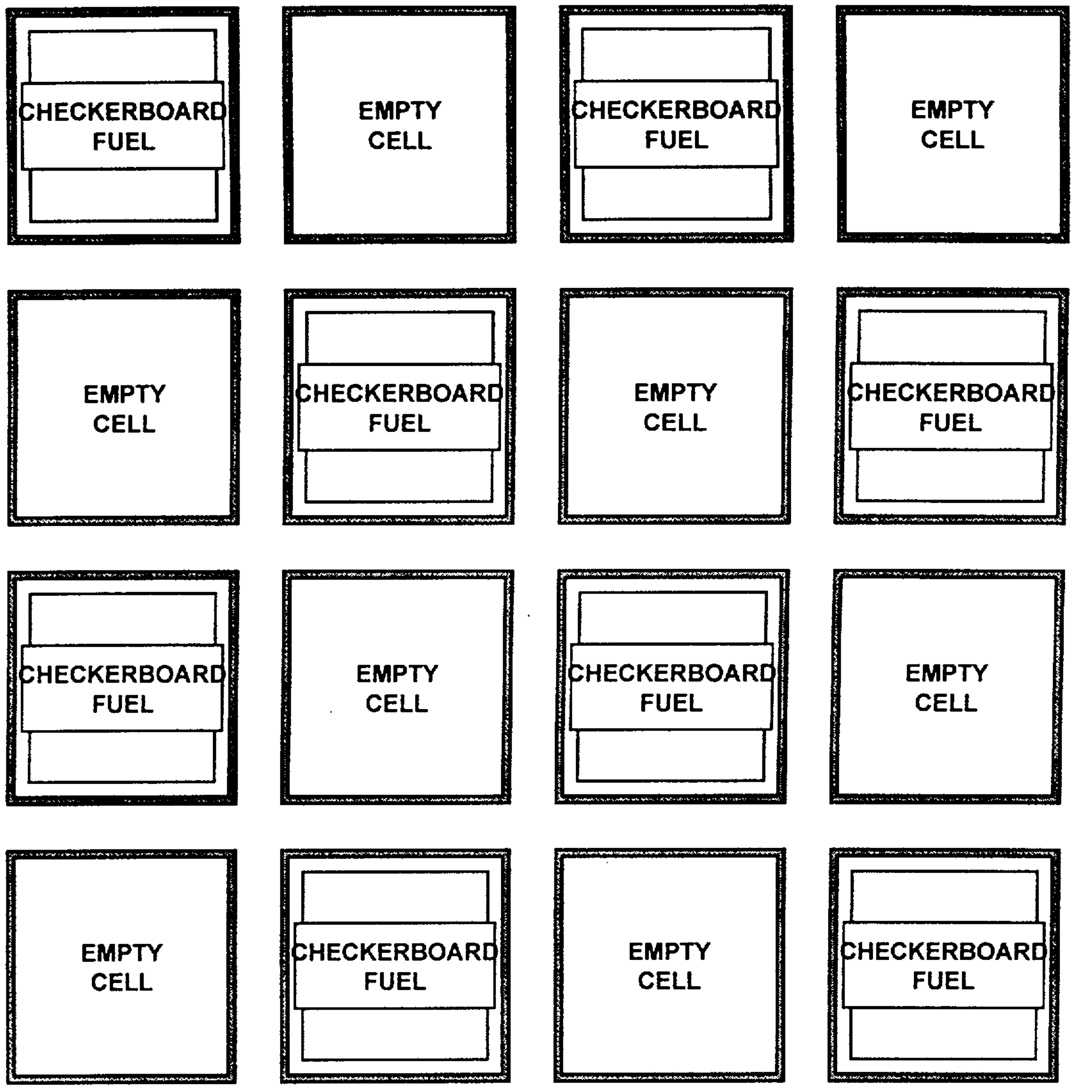


Restricted Fuel: Fuel which meets the minimum burnup requirements of Table 3.7.13-2, or non-fuel components or an empty cell.

Filler Location: Either fuel which meets the minimum burnup requirements of Table 3.7.13-3, or non-fuel components or an empty cell.

Boundary Condition: Storage regions of Restricted Fuel shall not be bounded by Checkerboard Fuel regions. Therefore, Restricted Fuel regions must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool.

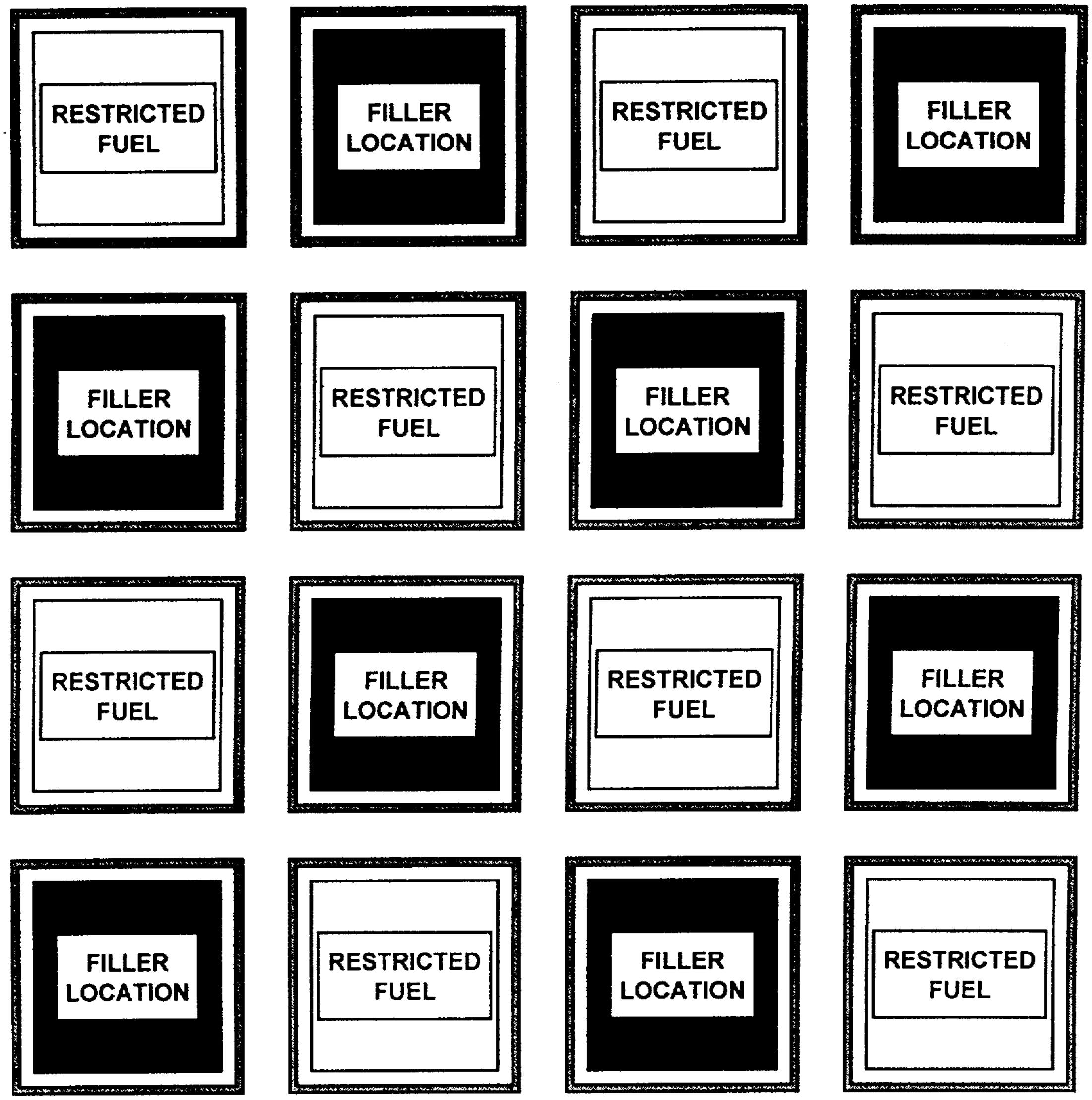
Figure 3.7.13-1 (page 1 of 1)
Required Loading Pattern for Restricted Storage
in the Units 1 and 2 Spent Fuel Pool



Checkerboard Fuel: Fuel which does not meet the minimum burnup requirements of Table 3.7.13-2. (Fuel which does meet the requirements of Table 3.7.13-2, or non-fuel components, or an empty cell may be placed in checkerboard fuel locations as needed)

Boundary Condition: Storage regions of Checkerboard Fuel shall not be bounded by Restricted Fuel regions. Therefore, Checkerboard Fuel regions must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool. In addition, at least three of the four faces of each Checkerboard Fuel assembly must be adjacent to an empty cell at all boundaries between storage regions.

Figure 3.7.13-2 (page 1 of 1)
Required Loading Pattern for Checkerboard Storage
in the Units 1 and 2 Spent Fuel Pool

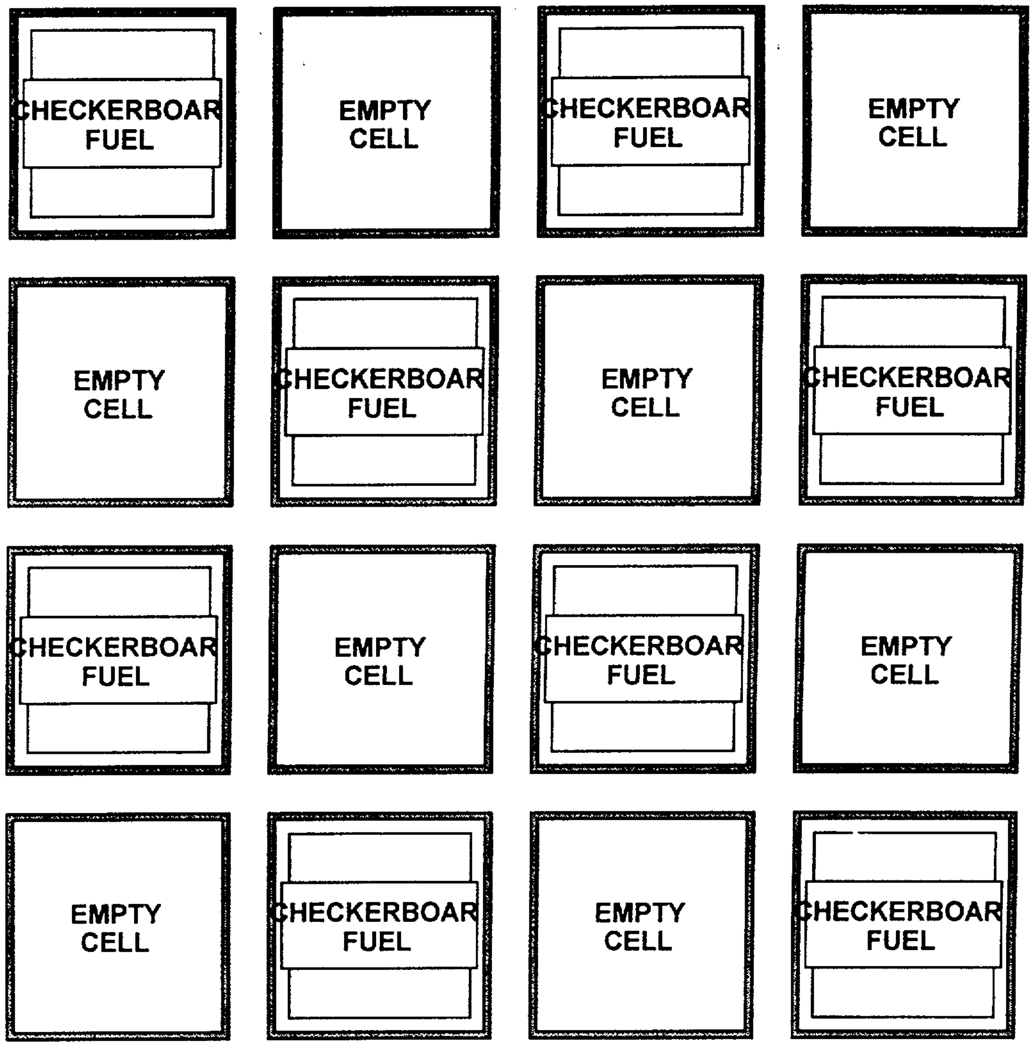


Restricted Fuel: Fuel which meets the minimum burnup requirements of Table 3.7.13-5, or non-fuel components or an empty cell.

Filler Location: Either fuel which meets the minimum burnup requirements of Table 3.7.13-6, or non-fuel components or an empty cell.

Boundary Condition: Storage regions of Restricted Fuel shall not be bounded by Checkerboard Fuel regions. Therefore, Restricted Fuel regions must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool.

Figure 3.7.13-3 (page 1 of 1)
Required Loading Pattern for Restricted Storage
in the Unit 3 Spent Fuel Pool



Checkerboard Fuel: Fuel which does not meet the minimum burnup requirements of Table 3.7.13-5. (Fuel which does meet the requirements of Table 3.7.13-5, or non-fuel components, or an empty cell may be placed in checkerboard fuel locations as needed)

Boundary Condition: Storage regions of Checkerboard Fuel shall not be bounded by Restricted Fuel regions. Therefore, Checkerboard Fuel regions must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool. In addition, at least three of the four faces of each Checkerboard Fuel assembly must be adjacent to an empty cell at all boundaries between storage regions.

Figure 3.7.13-4 (page 1 of 1)
Required Loading Pattern for Checkerboard Storage
in the Unit 3 Spent Fuel Pool

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

b. k_{eff} < 1.0 if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR;

c. $k_{eff} \leq 0.95$ if fully flooded with water borated to 430 ppm, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR. Maintaining the normal spent fuel pool boron concentration within the TS limits assures $k_{eff} \leq 0.95$ for any accident condition;

d. A nominal 10.65 inch center to center distance between fuel assemblies placed in spent fuel storage racks serving Units 1 and 2;

e. A nominal 10.60 inch center to center distance between fuel assemblies placed in spent fuel storage racks serving Unit 3;

f. A nominal 25.75 inch center to center spacing between fuel assemblies placed in the fuel transfer canal.

4.3.2 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1312 fuel assemblies in the spent fuel storage racks serving Units 1 and 2 and 825 fuel assemblies in the spent fuel storage racks serving Unit 3. In addition, up to 4 assemblies and/or 1 failed fuel container may be stored in each fuel transfer canal when the canal is at refueling level. Spent fuel may also be stored in the Oconee Nuclear Station Independent Spent Fuel Storage Installation.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.4 Borated Water Storage Tank (BWST)

BASES

BACKGROUND

The BWST supports the ECCS and the Reactor Building Spray System by providing a source of borated water for ECCS and reactor building spray pump operation. In addition, the BWST supplies borated water to the refueling canal for refueling operations.

A normally open, motor operated isolation valve is provided in each LPI line to allow the operator to isolate the BWST from the LPI System after the LPI pump suction has been transferred to the reactor building sump following depletion of the BWST during a loss of coolant accident (LOCA). Use of a single BWST to supply both ECCS trains is acceptable because the BWST is a passive component, and passive failures are not assumed to occur coincidentally with a LOCA.

This LCO ensures that:

a. The BWST contains sufficient borated water to support the ECCS during the injection phase;

b. Sufficient water volume exists in the reactor building sump to support continued operation of the ECCS and reactor building spray pumps at the time of transfer to the recirculation mode of cooling; and

c. The reactor remains subcritical following a LOCA and returns subcritical following a MSLB once borated water from the ECCS reaches the core.

Insufficient water inventory in the BWST could result in insufficient cooling capacity by the ECCS when the transfer to the recirculation mode occurs.

Improper boron concentrations could result in a reduction of SDM or excessive boric acid precipitation in the core following a LOCA, as well as excessive caustic stress corrosion of mechanical components and systems inside containment.

The minimum boron concentration limit assures that when water from the BWST is added to the SFP or the refueling cavity with the refueling cavity and the SFP connected by the open fuel transfer tube, the minimum boron concentration limit of the SFP is met.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The limit for minimum boron concentration of the COLR was established to ensure that, following a LOCA, with a minimum BWST level, the reactor will remain subcritical in the cold condition following mixing of the BWST and Reactor Coolant System (RCS) water volumes. Large break LOCAs assume that all CONTROL RODS remain withdrawn from the core until reflood. At this time, the analysis assumes one half of the CONTROL ROD worth is available.

The minimum and maximum concentration limits both ensure that the long term solution in the sump following a LOCA is within a specified pH range that will minimize the evolution of iodine and the effect of chloride and caustic stress corrosion cracking on the mechanical systems and components.

The maximum limit for boron concentration in the BWST of the COLR is also based on the potential for boron precipitation in the core during the long term cooling period following a LOCA. For a cold leg break, the core dissipates heat by pool boiling. Because of this boiling phenomenon in the core, the boric acid concentration will increase in this region. If allowed to proceed in this manner, a point may be reached where boron precipitation will occur in the core. Post LOCA emergency procedures direct the operator to establish dilution flow paths in the LPI System to prevent this condition by establishing a forced flow path through the core regardless of break location. These procedures are based on the minimum time in which precipitation could occur, assuming that maximum boron concentrations exist in the borated water sources used for injection following a LOCA.

Boron concentrations in the BWST in excess of the limit could result in precipitation earlier than assumed in the analysis.

The 45°F lower limit on the temperature of the solution in the BWST was established to ensure that the solution will not freeze. This temperature also helps prevent boron precipitation and ensures that water injection in the reactor vessel will not be colder than the lowest temperature assumed in reactor vessel stress analysis. The 115°F upper limit on the temperature of the BWST contents is consistent with the maximum injection water temperature assumed in the accident analysis.

The numerical values of the volume and temperature parameters stated in the SRs are actual values and do not include allowance for instrument errors.

BASES

Applicable Safety Analyses (continued)

The numerical value of the SR 3.5.4.3 minimum boron concentration limit (≥ 2220 ppm) includes allowances for analytical, mechanical and instrument measurement uncertainties.

The BWST satisfies Criterion 3 of 10 CFR 50.36 (Ref. 1).

LCO

The BWST exists to ensure that an adequate supply of borated water is available to cool and depressurize the reactor building in the event of an accident; to cool and cover the core in the event of a LOCA, thereby ensuring the reactor remains subcritical following an accident; and to ensure an adequate level exists in the reactor building sump to support ECCS and reactor building spray pump operation in the recirculation MODE. To be considered OPERABLE, the BWST must meet the limits for water volume, boron concentration, and temperature established in the SRs.

APPLICABILITY

In MODES 1, 2, 3, and 4, the BWST OPERABILITY requirements are dictated by the ECCS and Reactor Building Spray System OPERABILITY requirements. Since all or portions of the ECCS and Reactor Building Spray System must be OPERABLE in MODES 1, 2, 3, and 4, the BWST must be OPERABLE to support their operation.

Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops – MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops – MODE 5, Loops Not Filled," respectively. MODE 6 core cooling requirements are addressed by LCO 3.9.4, "DHR and Coolant Circulation – High Water Level," and LCO 3.9.5, "DHR and Coolant Circulation – Low Water Level."

ACTIONS

A.1

With either the BWST boron concentration or borated water temperature not within limits, the condition must be corrected within 8 hours. In this condition, the ECCS cannot perform its design functions. Therefore, prompt action must be taken to restore the tank to OPERABLE status or to place the unit in a MODE in which these systems are not required. The 8 hour limit to restore the temperature or boron concentration to within limits was developed considering the time required to change boron concentration or temperature and assuming that the contents of the tank are still available for injection.

BASES

ACTIONS (continued)

B.1

With the BWST inoperable for reasons other than Condition A (e.g., water volume), the BWST must be restored to OPERABLE status within 1 hour. In this condition, neither the ECCS nor the Reactor Building Spray System can perform its design functions. Therefore, prompt action must be taken to restore the BWST to OPERABLE status or to place the unit in a MODE in which the BWST is not required. The allowed Completion Time of 1 hour to restore the BWST to OPERABLE status is based on this condition simultaneously affecting multiple redundant trains.

C.1 and C.2

If the Required Action and associated Completion Time are not met, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 12 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

Verification every 24 hours that the BWST water temperature is within the specified temperature band ensures that the fluid will not freeze and that the fluid temperature entering the reactor vessel will not be colder than assumed in the reactor vessel stress analysis; and the fluid temperature entering the reactor vessel will not be hotter than assumed in the LOCA analysis. The 24 hour Frequency is sufficient to identify a temperature change that would approach either temperature limit and has been shown to be acceptable through operating experience.

The SR is modified by a Note that requires the Surveillance to be performed only when ambient air temperatures are outside the operating temperature limits of the BWST. With ambient temperature within this band, the BWST temperature should not exceed the limits.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.4.2

Verification every 7 days that the BWST contained volume is ≥ 350,000 gallons (46.0 ft.) ensures that a sufficient initial supply is available for injection and to support continued ECCS pump operation on recirculation. Since the BWST volume is normally stable, a 7 day Frequency has been shown to be appropriate through operating experience.

SR 3.5.4.3

Verification every 7 days that the boron concentration of the BWST fluid is within the required band ensures that the reactor will remain subcritical following a LOCA. Since the BWST volume is normally stable, a 7 day sampling Frequency is appropriate and has been shown to be acceptable through operating experience. The COLR revision process assures that the minimum boron concentration specified in the COLR bounds the limit specified by this SR.

REFERENCES

1. 10 CFR 50.36.

B 3.7 PLANT SYSTEMS

B 3.7.12 Spent Fuel Pool Boron Concentration

BASES

BACKGROUND

The Oconee spent fuel storage racks contain Boraflex neutron-absorbing panels that surround each storage cell on all four sides (except for peripheral sides). The function of these Boraflex panels is to ensure that the reactivity of the stored fuel assemblies is maintained within required limits. Boraflex, as manufactured, is a silicon rubber material that retains a powder of boron carbide (B_4C) neutron absorbing material. The Boraflex panels are enclosed in a formed stainless steel wrapper sheet that is spot-welded to the storage tube. The wrapper sheet is bent at each end to complete the enclosure of the Boraflex panel. The Boraflex panel is contained in the plenum area between the storage tube and the wrapper plate. Since the wrapper plate enclosure is not sealed, spent fuel pool water is free to circulate through the plenum. It has been observed that after Boraflex receives a high gamma dose from the stored irradiated fuel ($>10^{10}$ rads) it can begin to degrade and dissolve in the wet environment. Thus, the B_4C poison material can be removed, thereby reducing the poison worth of the Boraflex sheets. This phenomenon is documented in NRC Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks".

To address this degradation, the Oconee spent fuel storage racks have been analyzed taking credit for soluble boron as allowed in Reference 1. The methodology ensures that the spent fuel rack multiplication factor, k_{eff}, is less than or equal to 0.95 as recommended in ANSI/ANS-57.2-1983 (Ref. 2) and NRC guidance (Ref. 3). The spent fuel storage racks are analyzed to allow storage of fuel assemblies with enrichments up to a maximum nominal enrichment of 5.00 weight percent (wt %) Uranium-235 while maintaining $k_{eff} \leq 0.95$, including uncertainties, tolerances, biases, and credit for soluble boron. Note that the criticality analysis accounts for a maximum as-built enrichment tolerance of 0.05 wt % U-235. For example, for a specified maximum design enrichment of 5.00 wt % U-235, an as-built enrichment up to 5.05 weight percent is acceptable. Soluble boron credit is used to offset uncertainties, tolerances, and off-normal conditions and to provide subcritical margin such that the spent fuel pool $k_{eff} \leq 0.95$. The soluble boron concentration required to maintain $k_{eff} \leq 0.95$ under normal conditions is 430 ppm. In addition, sub-criticality of the pool ($k_{eff} < 1.0$) is assured on a 95/95 basis without the presence of the soluble boron in the pool (excluding certain burnup-related uncertainties described in the criticality analysis). The criticality

BASES

BACKGRUND (continued)

analysis performed shows that the acceptance criteria for criticality are met for the storage of fuel assemblies when credit is taken for reactivity depletion due to fuel burnup, no credit for the Boraflex neutron absorber panels, and storage configurations and enrichment limits specified by LCO 3.7.13.

APPLICABLE SAFETY ANALYSES

Most accident conditions do not result in an increase in reactivity in the spent fuel pool. Examples of these accident conditions are the drop of a fuel assembly on top of a rack, the drop of a fuel assembly between rack modules (rack design precludes this condition), and the drop of a fuel assembly between rack modules and the pool wall. However, four accidents can be postulated which could result in an increase in reactivity in the spent fuel storage pools. The first is a drop or placement of a fuel assembly into the cask loading area. The second is a loss of normal cooling to the spent fuel pool water which causes an increase in the pool water temperature. The third is the misloading of a fuel assembly into a location in which the restrictions on location, enrichment and burnup are not satisfied. The fourth is a drop of a heavy load onto the spent fuel racks.

For an occurrence of these postulated accidents, the double contingency principle discussed in ANSI N-16.1-1975 and the April 1978 NRC letter (Ref. 4) can be applied. This states that one is not required to assume two unlikely, independent, concurrent events to ensure protection against a criticality accident. Thus, for these postulated accident conditions, the presence of additional soluble boron in the spent fuel pool water (above the 430 ppm required to maintain $k_{eff} \leq$ to 0.95 under normal storage conditions) can be assumed as a realistic initial condition, since not assuming its presence would be a second unlikely event.

Calculations were performed to determine the amount of soluble boron required to offset the highest reactivity increase caused by these postulated accidents, to maintain $k_{eff} \leq 0.95$. It was found that a spent fuel pool boron concentration of 2220 ppm was sufficient to maintain $k_{eff} \leq 0.95$ for the worst-case postulated criticality-related accident (the heavy load drop event). Specification 3.7.12 ensures the spent fuel pool contains adequate dissolved boron to compensate for the increased reactivity caused by these postulated accidents.

The minimum boron concentration limit ensures the SFP boron concentration is adequate to meet the sub-criticality requirements of fuel stored in the SFP for the most limiting accident in the SFP: A cask drop onto fuel in the SFP.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Note that it is plausible that the "loss of normal cooling" accident could occur in conjuction with a spent fuel pool boron dilution event. Criticality calculations show that the soluble boron needed to maintain $k_{eff} \leq 0.95$ for the "loss of normal cooling" accident (500 ppm) is still less than the boron concentration following the worst-case credible dilution event (825 ppm).

Therefore, maintaining the spent fuel pool boron concentration within the limits assures $k_{eff} \leq 0.95$ for any accident condition. For normal storage conditions, Specification 4.3.1 c. requires that the spent fuel rack k_{eff} be $\leq$ 0.95 when flooded with water borated to 430 ppm. A spent fuel pool boron dilution analysis was performed which confirmed that sufficient time is available to detect and mitigate a dilution of the spent fuel pool before the 0.95 k_{eff} design basis is exceeded. The spent fuel pool boron dilution analysis concluded that an unplanned or inadvertent event which could result in the dilution of the spent fuel pool boron concentration to 430 ppm is not a credible event.

The numerical value of the SR 3.7.12.1 minimum boron concentration limit ($\geq$ 2220 ppm) includes allowance for analytical mechanical and instrument measurement uncertainties.

The concentration of dissolved boron in the spent fuel pool satisfies Criterion 2 of 10 CFR 50.36 (Ref. 5).

LCO

The dissolved boron concentration limits for in spent fuel pool preserves the assumption used in the analyses of the potential accident scenarios described above. This concentration of dissolved boron is the minimum required concentration for fuel assembly storage and movement within the fuel storage pool.

APPLICABILITY

This LCO applies whenever fuel assemblies are stored in 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.

BASES

ACTIONS

A.1 and A.2 (continued)

If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. 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 a sufficient reason to require a reactor shutdown.

When the concentration of boron in the fuel storage pool 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 achieved by immediately suspending the movement of the fuel assemblies. This does not preclude movement of a fuel assembly to a safe position. Immediate action is also required to initiate action to restore the SFP boron concentration to within limits.

SURVEILLANCE REQUIREMENTS

SR 3.7.12.1

This SR verifies that the concentration of boron in the fuel storage pool is within the required limit. As long as this SR is met, the analyzed incidents are fully addressed. The 7 day Frequency is appropriate because no major replenishment of pool water is expected to take place over a short period of time. The COLR revision process assures that the minimum boron concentration specified in the COLR bounds the limit specified by this SR.

REFERENCES

1. WCAP-14416-NP-A, Westinghouse Spent Fuel Rack Criticality Analysis Methodology, Revision 1, November 1996.

2. American Nuclear Society, "American National Standard Design Requirements for Light Water Reactor Fuel Storage Facilities at Nuclear Power Plants," ANSI/ANS-57.2-1983, October 7, 1983.

3. Nuclear Regulatory Commission, Memorandum to Timothy Collins from Laurence Kopp, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light Water Reactor Power Plants," August 19, 1998.

BASES

REFERENCES (continued)

4. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A).

5. 10 CFR 50.36.

B 3.7 PLANT SYSTEMS

B 3.7.13 Fuel Assembly Storage

BASES

BACKGROUND

The spent fuel pool is designed to store either new (nonirradiated) nuclear fuel assemblies, or burned (irradiated) fuel assemblies in a vertical configuration underwater. The shared spent fuel pool between Unit 1 and Unit 2 is sized to store 1312 fuel assemblies. The Unit 1 and Unit 2 spent fuel storage cells are installed in parallel rows with center to center spacing of 10.65 inches. The Unit 3 storage pool is sized to store 825 fuel assemblies. The Unit 3 spent fuel storage cells are installed in parallel rows with center to center spacing of 10.60 inches.

The Oconee spent fuel storage racks contain Boraflex neutron-absorbing panels that surround each storage cell on all four sides (except for peripheral sides). The function of these Boraflex panels is to ensure that the reactivity of the stored fuel assemblies is maintained within required limits. Boraflex, as manufactured, is a silicon rubber material that retains a powder of boron carbide (B_4C) neutron absorbing material. The Boraflex panels are enclosed in a formed stainless steel wrapper sheet that is spot-welded to the storage tube. The wrapper sheet is bent at each end to complete the enclosure of the Boraflex panel. The Boraflex panel is contained in the plenum area between the storage tube and the wrapper plate. Since the wrapper plate enclosure is not sealed, spent fuel pool water is free to circulate through the plenum. It has been observed that after Boraflex receives a high gamma dose from the stored irradiated fuel (>10^{10} rads) it can begin to degrade and dissolve in the wet environment. Thus, the B_4C poison material can be removed, thereby reducing the poison worth of the Boraflex sheets. This phenomenon is documented in NRC Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks".

To address this degradation, the Oconee spent fuel storage racks have been analyzed taking credit for soluble boron as allowed in Reference 1. The methodology ensures that the spent fuel rack multiplication factor, k_{eff}, is $\leq$ 0.95 as recommended in ANSI/ANS-57.2-1983 (Ref. 2) and NRC guidance (Ref. 3). The spent fuel storage racks are analyzed to allow storage of fuel assemblies with enrichments up to a maximum nominal enrichment of 5.00 weight percent (wt %) Uranium-235 while maintaining $k_{eff} \leq$ 0.95, including uncertainties, tolerances, biases, and credit for soluble boron. Note that the criticality analysis accounts for a maximum as-built enrichment tolerance of 0.05 wt % U-235. For example, for a specified maximum design enrichment of 5.00 wt % U-235, an as-built

BASES

BACKGROUND (continued)

enrichment up to 5.05 weight percent is acceptable. Soluble boron credit is used to offset uncertainties, tolerances, and off-normal conditions and to provide subcritical margin such that the spent fuel pool k_{eff} is maintained $\leq$ 0.95. The soluble boron concentration required to maintain $k_{eff} \leq 0.95$ under normal conditions is 430 ppm. In addition, sub-criticality of the pool ($k_{eff} < 1.0$) is assured on a 95/95 basis, without the presence of the soluble boron in the pool (excluding certain burnup-related uncertainties described in the criticality analysis). The criticality analysis performed shows that the acceptance criteria for criticality are met for the storage of fuel assemblies when credit is taken for reactivity depletion due to fuel burnup, no credit for the Boraflex neutron absorber panels and storage configurations and enrichment limits Specified by LCO 3.7.13.

Three storage configurations are defined for each region; Unrestricted, Restricted and Checkerboard storage. The storage conditions for each region are described below.

- Unrestricted storage allows storage in all cells without restriction on the storage configuration.
- Restricted storage allows storage of higher reactivity, slightly burned fuel when restricted to a certain storage configuration with lower reactivity fuel. Restricted Fuel regions must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool.
- Checkerboard storage allows storage of the highest reactivity fuel when checkerboarded with empty storage cells. Checkerboard Fuel regions must be bounded by either i) one row of fuel qualifying as Unrestricted Fuel (including empty cells as necessary), ii) one row of empty cells, or iii) a wall of the spent fuel pool. In addition, at least three of the four faces of each Checkerboard fuel assembly must be adjacent to an empty cell at all boundaries between storage regions.

APPLICABLE SAFETY ANALYSES

Most accident conditions do not result in an increase in reactivity of the racks in the spent fuel pool. Examples of these accident conditions are the drop of a fuel assembly on top of a rack, the drop of a fuel assembly between rack modules (rack design precludes this condition), and the drop of a fuel assembly between rack modules and the pool wall. However, four accidents can be postulated which could result in an increase in reactivity in the spent fuel storage pools. The first is a drop or placement of a fuel assembly into the cask loading area. The second is a loss of normal cooling to the spent fuel pool water which causes an

BASES (continued)

APPLICABLE SAFETY ANALYSES (continued)

loss of normal cooling to the spent fuel pool water which causes an increase in the pool water temperature. The third is the misloading of a fuel assembly into a location in which the restrictions on location, enrichment and burnup are not satisfied. The fourth is a drop of a heavy load onto the spent fuel racks.

For an occurrence of these postulated accidents, the double contingency principle discussed in ANSI N-16.1-1975 and the April 1978 NRC letter (Ref. 4) can be applied. This double contingency principle does not require assuming two unlikely, independent, concurrent events to ensure protection against a criticality accident. Thus, for these postulated accident conditions, the presence of additional soluble boron in the spent fuel pool water (above the 430 ppm required to maintain $k_{eff} \leq 0.95$ under normal storage conditions) can be assumed as a realistic initial condition since not assuming its presence would be a second unlikely event.

Calculations were performed to determine the amount of soluble boron required to offset the highest reactivity increase caused by these postulated accidents, to maintain $k_{eff} \leq 0.95$. It was found that a spent fuel pool boron concentration of 2220 ppm was sufficient to maintain $k_{eff} \leq$ 0.95 for the worst-case postulated criticality-related accident (the heavy load drop event). Specification 3.7.12 ensures the spent fuel pool contains adequate dissolved boron to compensate for the increased reactivity caused by these postulated accidents.

Note that it is plausible that the "loss of normal cooling" accident could occur in conjuction with a spent fuel pool boron dilution event. Criticality calculations show that the soluble boron needed to maintain $k_{eff} \leq .95$ for the "loss of normal cooling" accident (500 ppm) is still less than the boron concentration following the worst-case credible dilution event (825 ppm).

Therefore, maintaining the spent fuel pool boron concentration within the limits specified in the COLR assures k_{eff} is $\leq .95$ for any accident condition.

For normal storage conditions, Specification 4.3.1 c. requires that the spent fuel rack k_{eff} be ≤ 0.95 when flooded with water borated to 430 ppm. A spent fuel pool boron dilution analysis was performed which confirmed that sufficient time is available to detect and mitigate a dilution of the spent fuel pool before the 0.95 k_{eff} design basis is exceeded. The spent fuel pool boron dilution analysis concluded that an unplanned or inadvertent event which could result in the dilution of the spent fuel pool boron concentration to 430 ppm is not a credible event.

The fuel assembly storage and concentration of dissolved boron in the spent fuel pool satisfy Criterion 2 of 10 CFR 50.36 (Ref. 5).

BASES (continued)

LCO

a. Units 1 and 2

The restrictions on the placement of fuel assemblies within the spent fuel pool serving Units 1 and 2, which have accumulated burnup greater than or equal to the minimum qualified burnups in Table 3.7.13-1 in the accompanying LCO, ensures the k_{eff} of the spent fuel pool will always remain $\leq$ 0.95, assuming the pool to be flooded with water borated to 430 ppm. Fuel assemblies not meeting the criteria of Table 3.7.13-1 shall be stored in accordance with either Figure 3.7.13-1 and Tables 3.7.13-2 and 3.7.13-3 for Restricted/Filler storage, or Figure 3.7.13-2 for Checkerboard storage.

b. Unit 3

The restrictions on the placement of fuel assemblies within the spent fuel pool serving Unit 3, which have accumulated burnup greater than or equal to the minimum qualified burnups in Table 3.7.13-4 in the accompanying LCO, ensures the k_{eff} of the spent fuel pool will always remain $\leq$ 0.95, assuming the pool to be flooded with water borated to 430 ppm. Fuel assemblies not meeting the criteria of Table 3.7.13-4 shall be stored in accordance with either Figure 3.7.13-3 and Tables 3.7.13-5 and 3.7.13-6 for Restricted/Filler storage, or Figure 3.7.13-4 for Checkerboard storage.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the spent fuel pool.

ACTIONS

A.1

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

If moving fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operation. Therefore, in either case, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

BASES

ACTIONS	A.1 (continued) When the configuration of fuel assemblies stored in the spent fuel pool is not in accordance with the LCO, immediate action must be taken to make the necessary fuel assembly movement(s) to bring the configuration into compliance with the LCO.
SURVEILLANCE REQUIREMENTS	SR 3.7.13.1 This SR verifies by administrative means that the initial enrichment and burnup of the fuel assembly is in accordance with the appropriate Figure in the accompanying LCO.

REFERENCES

1. WCAP-14416-NP-A, Westinghouse Spent Fuel Rack Criticality Analysis Methodology, Revision 1, November 1996.
2. American Nuclear Society, "American National Standard Design Requirements for Light Water Reactor Fuel Storage Facilities at Nuclear Power Plants," ANSI/ANS-57.2-1983, October 7, 1983.
3. Nuclear Regulatory Commission, Memorandum to Timothy Collins from Laurence Kopp, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light Water Reactor Power Plants," August 19, 1998.
4. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A).
5. 10 CFR 50.36