Advanced Passive 1000 (AP1000)
Generic Technical Specification Traveler (GTST)

Title: Changes Related to LCO 3.7.12, Spent Fuel Pool Storage

I. Technical Specifications Task Force (TSTF) Travelers, Approved Since Revision 2 of STS NUREG-1431, and Used to Develop this GTST

TSTF Number and Title:

None

STS NUREGs Affected:

Not Applicable

NRC Approval Date:

Not Applicable

TSTF Classification:

Not Applicable

II. Reference Combined License (RCOL) Standard Departures (Std. Dep.), RCOL COL Items, and RCOL Plant-Specific Technical Specifications (PTS) Changes Used to Develop this GTST

RCOL Std. Dep. Number and Title:

There are no Vogtle departures applicable to Specification 3.7.12.

RCOL COL Item Number and Title:

There are no Vogtle COL items applicable to Specification 3.7.12.

RCOL PTS Change Number and Title:

VEGP LAR DOC A003:	References to various Chapters and Sections of the Final Safety Analysis Report (FSAR) are revised to include FSAR.
VEGP LAR DOC A105:	Correct references to Spent Fuel Pool
VEGP LAR DOC A111:	Revision of Figure 3.7.12-1
VEGP LAR DOC L05:	TS LCO 3.0.8 is eliminated

III. Comments on Relations Among TSTFs, RCOL Std. Dep., RCOL COL Items, and RCOL PTS Changes

This section discusses the considered changes that are: (1) applicable to operating reactor designs, but not to the AP1000 design; (2) already incorporated in the GTS; or (3) superseded by another change.

None

IV. Additional Changes Proposed as Part of this GTST (modifications proposed by NRC staff and/or clear editorial changes or deviations identified by preparer of GTST)

For added clarity, revise the second sentence of the first paragraph in the "ASA" section of the Bases to state (NRC Staff Comment):

> For ~~these accident occurrences~~**the occurrence of this accident**, the presence of soluble boron in the spent fuel ~~storage~~ pool (controlled by LCO 3.7.11, "**Spent** Fuel ~~Storage~~ Pool Boron Concentration") prevents criticality. . . .

Revise the second sentence of the first paragraph in the "Actions" section of the Bases as follows to correct grammar (NRC Staff Comment):

> Since spent fuel pool storage requirements apply in all MODES when fuel is stored in Region 2, the ACTIONS have been modified by a Note stating ~~the~~**that** LCO 3.0.3 is not applicable.

APOG Recommended Changes to Improve the Bases

In the "Background" section of the Bases, delete sentence: "Use of the IFE fuel rod storage canister is subject to the same storage requirements as the fuel assemblies." This is the only mention of "canister" in TS or TS Bases, and the TS do not impose any "same storage requirements." Furthermore, "IFE" is not mentioned in AP1000 DCD Chapter 9. Fuel assembly storage requirements are unchanged by this TS Bases deletion.

Revise the second sentence of the second paragraph in the "Background" section of the Bases to state:

> . . . For storage of fuel in the spent fuel racks, the design basis for preventing criticality outside the reactor is that there is a 95**%** ~~percent~~ probability at a 95**%** ~~percent~~ confidence level, without soluble boron, that the effective multiplication factor (k_{eff}) of the fuel assembly array will be less than 0.997, including uncertainties and tolerances. . . .

Revise the first sentence of the first paragraph in the "ASA" section of the Bases to state:

> The ~~hypothetical~~ fuel handling accident~~s~~ can only take place during or as a result of the movement of an assembly (Refs. 2 and 3).

These non-technical changes provide improved clarity, consistency, and operator usability.

Throughout the Bases, references to Sections and Chapters of the FSAR do not include the "FSAR" clarifier. Since these Section and Chapter references are to an external document, it is appropriate to include the "FSAR" modifier. (DOC A003)

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.7.12, Spent Fuel Pool Storage

Changes to the Generic Technical Specifications and Bases:

The GTS 3.7.12 Applicability statement is revised to provide consistent terminology for the Spent Fuel Pool system. (DOC A105)

The GTS 3.7.12 Action Note is revised to eliminate reference to AP1000 GTS LCO 3.0.8. (DOC L05)

GTS Figure 3.7.12-1 is revised by adding area labels to provide clarity. (DOC A111)

The last sentence of the first paragraph in the “Background” section of the Bases is deleted. (APOG Comment)

The second sentence of the second paragraph in the “Background” section of the Bases is revised to improve clarity, consistency, and operator usability. (APOG Comment)

The first and second sentences of the first paragraph in the “ASA” section of the Bases are revised to improve clarity, consistency, and operator usability. (APOG Comment and NRC Staff Comment)

The second sentence of the first paragraph in the “Actions” section of the Bases is revised to correct grammar. (NRC Staff Comment)

The acronym “FSAR” is added to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003) (APOG Comment)

VI. Traveler Information

Description of TSTF changes:

Not Applicable

Rationale for TSTF changes:

Not Applicable

Description of changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

DOC A105 provides consistent references to the “Spent Fuel Pool” throughout the GTS 3.7.12 LCO Specification and bases.

DOC A111 annotates the acceptable and unacceptable regions for loading on Table 3.7.12-1.

DOC L05 removes reference to AP1000 GTS LCO 3.0.8, which is eliminated.

A more detailed description of each DOC can be found in Reference 2, VEGP TSU LAR Enclosure 1, and the NRC staff safety evaluation can be found in Reference 3, VEGP LAR SER. The VEGP TSU LAR was modified in response to NRC staff RAIs in Reference 5 and the Southern Nuclear Operating Company RAI Response in Reference 6.

Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

DOC A105 provides consistent terminology with respect to the Spent Fuel Pool.

DOC A111 provides clarity in interpretation of Table 3.7.12-1.

DOC L05 notes that considerations of AP1000 GTS LCO 3.0.8 are adequately addressed within individual LCO referencing GTS LCO 3.0.8 or by TS 5.4.1.b to Monitor Safety System Shutdown Monitoring Trees parameters. AP1000 GTS LCO 3.0.8 is eliminated.

Description of additional changes proposed by NRC staff/preparer of GTST:

The last sentence of the first paragraph in the “Background” section of the Bases is deleted: “Use of the IFE fuel rod storage canister is subject to the same storage requirements as the fuel assemblies.” (APOG Comment)

The second sentence of the second paragraph in the “Background” section of the Bases is revised to state (APOG Comment):

> . . . For storage of fuel in the spent fuel racks, the design basis for preventing criticality outside the reactor is that there is a 95**%** ~~percent~~ probability at a 95**%** ~~percent~~ confidence level, without soluble boron, that the effective multiplication factor (k_{eff}) of the fuel assembly array will be less than 0.997, including uncertainties and tolerances. . . .

The first two sentences of the first paragraph in the “ASA” section of the Bases are revised to state (APOG Comment and NRC Staff Comment):

> The ~~hypothetical~~ fuel handling accident~~s~~ can only take place during or as a result of the movement of **a fuel** ~~an~~ assembly (Refs. 2 and 3). For ~~these accident occurrences~~**the occurrence of this accident**, the presence of soluble boron in the spent fuel ~~storage~~ pool (controlled by LCO 3.7.11, “**Spent** Fuel ~~Storage~~ Pool Boron Concentration”) prevents criticality. . . .

The second sentence of the first paragraph in the “Actions” section of the Bases is revised to state (NRC Staff Comment):

> Since spent fuel pool storage requirements apply in all MODES when fuel is stored in Region 2, the ACTIONS have been modified by a Note stating ~~the~~**that** LCO 3.0.3 is not applicable.

The acronym “FSAR” is added to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003) (APOG Comment)

Rationale for additional changes proposed by NRC staff/preparer of GTST:

The last sentence includes the only mention of “canister” in TS or TS Bases, and the TS do not impose any “same storage requirements.” Furthermore, “IFE” is not mentioned in AP1000 DCD Chapter 9. Fuel assembly storage requirements are unchanged by this TS Bases deletion.

The non-technical changes to the “Background” section of the Bases provide improved clarity, consistency, and operator usability.

The non-technical changes to the “ASA” section of the Bases provide improved clarity, consistency, and operator usability.

The non-technical change to the “Actions” section of the Bases corrects grammar.

Since Bases references to FSAR Sections and Chapters are to an external document, it is appropriate to include the “FSAR” modifier.

VII. GTST Safety Evaluation

Technical Analysis:

DOC L05 eliminates GTS LCO 3.0.8. In conjunction with the change to eliminate LCO 3.0.8, all Notes and references are no longer necessary and are administratively eliminated. The elimination of GTS LCO 3.0.8 is discussed in detail in GTS O01-LCO 3.0.

The remaining changes are editorial, clarifying, grammatical, or otherwise considered administrative. These changes do not affect the technical content, but improve the readability, implementation, and understanding of the requirements, and are therefore acceptable.

Having found that this GTST's proposed changes to the GTS and Bases are acceptable, the NRC staff concludes that AP1000 STS Subsection 3.7.12 is an acceptable model Specification for the AP1000 standard reactor design.

References to Previous NRC Safety Evaluation Reports (SERs):

None

VIII. Review Information

Evaluator Comments:

None

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Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on 5/19/2014.

APOG Comments (Ref. 7) and Resolutions:

1. (Internal # 3) Throughout the Bases, references to Sections and Chapters of the FSAR do not include the “FSAR” clarifier. Since these Section and Chapter references are to an external document, it is appropriate (DOC A003) to include the “FSAR” modifier. This is resolved by adding the FSAR modifier as appropriate.

2. (Internal # 6) The GTST sections often repeat VEGP LAR DOCs, which reference “existing” and “current” requirements. The inclusion in the GTST of references to “existing” and “current,” are not always valid in the context of the GTS. Each occurrence of “existing” and “current” should be revised to be clear and specific to GTS, MTS, or VEGP COL TS (or other), as appropriate. Noted ambiguities are corrected in the GTST body.

3. (Internal # 7) Section VII, GTST Safety Evaluation, inconsistently completes the subsection “References to Previous NRC Safety Evaluation Reports (SERs)” by citing the associated SE for VEGP 3&4 COL Amendment 13. It is not clear whether there is a substantive intended difference when omitting the SE citation. This is resolved by removing the SE citation in Section VII of the GTST and ensuring that appropriate references to the consistent citation of this reference in Section X of the GTST are made.

4. (Internal # 441) In GTST for Subsection 3.7.2, Section VI, under the heading “Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes,” DOC A109 is discussed. This should be DOC A111. Change “DOC A109” to “DOC A111.” This is resolved by making the recommended change.

5. (Internal # 442) In the “Background” section of the Bases, delete the last sentence of the first paragraph: “Use of the IFE fuel rod storage canister is subject to the same storage requirements as the fuel assemblies.” This is the only mention of “canister” in TS or TS Bases, and the TS do not impose any “same storage requirements.” Furthermore, “IFE” is not mentioned in AP1000 DCD Chapter 9. Fuel assembly storage requirements are unchanged by this TS Bases deletion. This non-technical change provides improved clarity, consistency, and operator usability. This is resolved by making the recommended change.

6. (Internal # 443) In the “Background” section of the Bases, revise the fifth paragraph as follows:

> . . . For storage of fuel in the spent fuel racks, the design basis for preventing criticality outside the reactor is that there is a 95**%** ~~percent~~ probability at a 95**%** ~~percent~~ confidence level, without soluble boron, that the effective multiplication factor (k_{eff}) of the fuel assembly array will be less than 0.997, including uncertainties and tolerances. . . .

This non-technical change provides improved clarity, consistency, and operator usability. This is resolved by making the recommended change.

6. (Internal # 444) In the "ASA" section of the Bases, revise the first sentence of the first paragraph as follows:

> The ~~hypothetical~~ **fuel handling** accident~~s~~ can only take place during or as a result of the movement of an assembly (Refs. 2 and 3).

This non-technical change provides improved clarity, consistency, and operator usability. This is resolved by making the recommended change with additional edits. The NRC staff recommends editing the first and second sentences of the first paragraph of the "ASA" section of the Bases as follows for additional clarity:

> The ~~hypothetical~~ **fuel handling** accident~~s~~ can only take place during or as a result of the movement of **a fuel** ~~an~~ assembly (Refs. 2 and 3). For ~~these accident occurrences~~**the occurrence of this accident**, the presence of soluble boron in the spent fuel ~~storage~~ pool (controlled by LCO 3.7.11, "**Spent** Fuel ~~Storage~~ Pool Boron Concentration") prevents criticality. . . .

The NRC staff recommends editing the second sentence of the first paragraph of the "Actions" section of the Bases as follows to correct grammar:

> Since spent fuel pool storage requirements apply in all MODES when fuel is stored in Region 2, the ACTIONS have been modified by a Note stating ~~the~~**that** LCO 3.0.3 is not applicable.

NRC Final Approval Date: June 26, 2015

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IX. Evaluator Comments for Consideration in Finalizing Technical Specifications and Bases

None

X. References Used in GTST

1. AP1000 DCD, Revision 19, Section 16, “Technical Specifications,” June 2011 (ML11171A500).

2. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Technical Specifications Upgrade License Amendment Request, February 24, 2011 (ML12065A057).

3. NRC Safety Evaluation (SE) for Amendment No. 13 to Combined License (COL) No. NPF-91 for Vogtle Electric Generating Plant (VEGP) Unit 3, and Amendment No. 13 to COL No. NPF-92 for VEGP Unit 4, September 9, 2013, ADAMS Package Accession No. ML13238A337, which contains:

ML13238A355	Cover Letter - Issuance of License Amendment No. 13 for Vogtle Units 3 and 4 (LAR 12-002).
ML13238A359	Enclosure 1 - Amendment No. 13 to COL No. NPF-91
ML13239A256	Enclosure 2 - Amendment No. 13 to COL No. NPF-92
ML13239A284	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13)
ML13239A287	Enclosure 4 - Safety Evaluation (SE), and Attachment 1 - Acronyms
ML13239A288	SE Attachment 2 - Table A - Administrative Changes
ML13239A319	SE Attachment 3 - Table M - More Restrictive Changes
ML13239A333	SE Attachment 4 - Table R - Relocated Specifications
ML13239A331	SE Attachment 5 - Table D - Detail Removed Changes
ML13239A316	SE Attachment 6 - Table L - Less Restrictive Changes

   The following documents were subsequently issued to correct an administrative error in Enclosure 3:

ML13277A616	Letter - Correction To The Attachment (Replacement Pages) - Vogtle Electric Generating Plant Units 3 and 4-Issuance of Amendment Re: Technical Specifications Upgrade (LAR 12-002) (TAC No. RP9402)
ML13277A637	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13) (corrected)

4. TSTF-GG-05-01, “Writer's Guide for Plant-Specific Improved Technical Specifications,” June 2005.

5. RAI Letter No. 01 Related to License Amendment Request (LAR) 12-002 for the Vogtle Electric Generating Plant Units 3 and 4 Combined Licenses, September 7, 2012 (ML12251A355).

6. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Response to Request for Additional Information Letter No. 01 Related to License Amendment Request LAR-12-002, ND-12-2015, October 04, 2012 (ML12286A363 and ML12286A360)

7. APOG-2014-008, APOG (AP1000 Utilities) Comments on AP1000 Standardized Technical Specifications (STS) Generic Technical Specification Travelers (GTSTs), Docket ID NRC-2014-0147, September 22, 2014 (ML14265A493).

XI. MARKUP of the Applicable GTS Subsection for Preparation of the STS NUREG

The entire section of the Specifications and the Bases associated with this GTST is presented next.

Changes to the Specifications and Bases are denoted as follows: Deleted portions are marked in strikethrough red font, and inserted portions in bold blue font.

3.7 PLANT SYSTEMS

3.7.12 Spent Fuel Pool Storage

LCO 3.7.12 The combination of initial enrichment and burnup of each fuel assembly stored in Region 2 shall be within the limits specified in Figure 3.7.12-1.

APPLICABILITY: Whenever any fuel assembly is stored in Region 2 of the spent fuel ~~storage~~ pool.

ACTIONS

----------NOTE----------
LCO~~s~~ 3.0.3 **is** ~~and 3.0.8 are~~ not applicable.

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.12.1	Verify by administrative means the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.7.12-1	Prior to storing the fuel assembly in Region 2

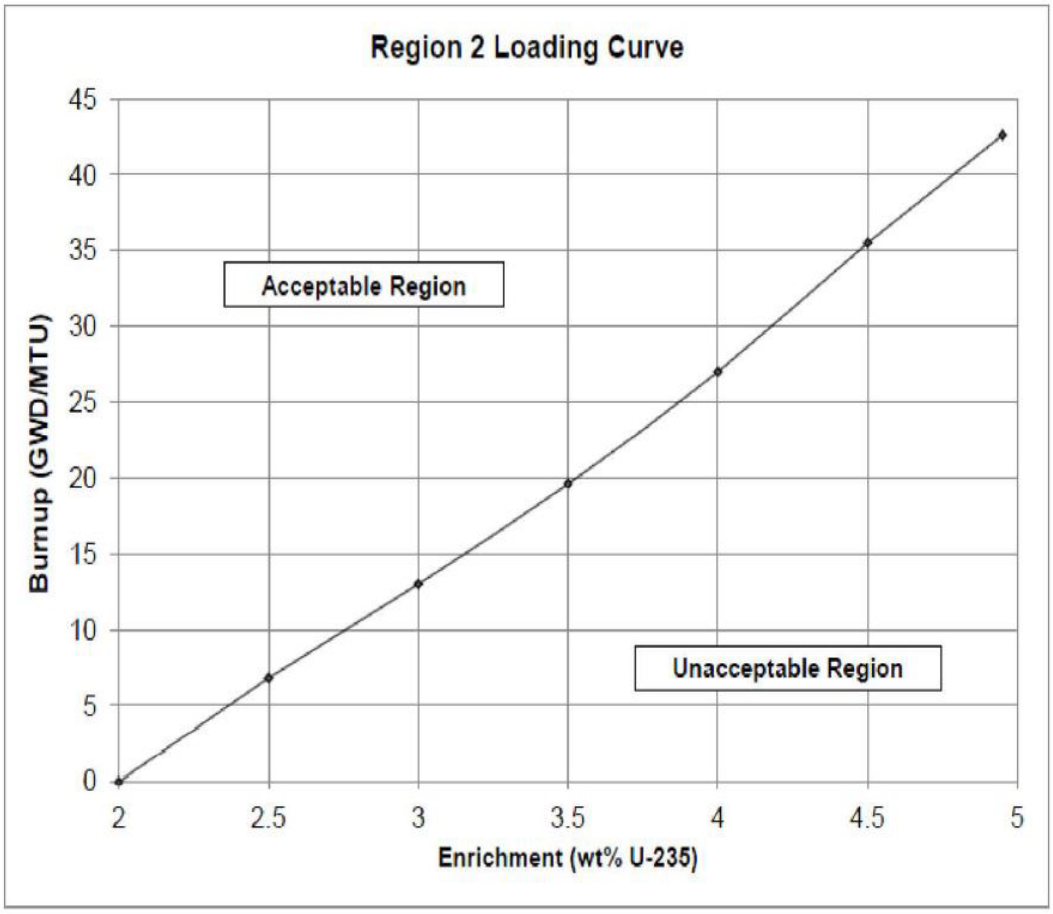

Figure 3.7.12-1 (page 1 of 1)
Minimum Fuel Assembly Burnup Versus Initial Enrichment for Region 2 Spent Fuel Cells

B 3.7 PLANT SYSTEMS

B 3.7.12 Spent Fuel Pool Storage

BASES

BACKGROUND

The high density spent fuel storage racks are divided into two separate and distinct regions and include locations for storage of defective fuel as shown in Figure 4.3-1. Region 1, with a maximum of 243 storage locations and the Defective Fuel Cells, with 5 storage locations are designed to accommodate new fuel assemblies with a maximum enrichment of 4.95 weight percent U-235, or spent fuel assemblies regardless of the combination of initial enrichment and burnup. Region 2, with a maximum of 641 storage locations is designed to accommodate spent fuel assemblies in all locations which comply with the combination of initial enrichment and burnup specified in LCO Figure 3.7.12-1, Minimum Fuel Assembly Burnup Versus Initial Enrichment for Region 2 Spent Fuel Cells. ~~Use of the IFE fuel rod storage canister is subject to the same storage requirements as the fuel assemblies.~~

The water in the spent fuel ~~storage~~ pool normally contains soluble boron, which would result in large subcriticality margins under actual operating conditions. For storage of fuel in the spent fuel racks, the design basis for preventing criticality outside the reactor is that there is a 95**%** ~~percent~~ probability at a 95**%** ~~percent~~ confidence level, without soluble boron, that the effective multiplication faction (k_{eff}) of the fuel assembly array will be less than 0.997, including uncertainties and tolerances. The NRC guidelines specify a limiting k_{eff} of 1.0 for normal storage in the absence of soluble boron. Hence, the design is based on the use of unborated water, which maintains a subcritical condition for the allowed loading patterns.

The double contingency principle discussed in ANSI N-16.1-1975 and the April 1978 NRC letter (Ref. 1) allows credit for soluble boron under other abnormal and accident conditions, since only a single independent accident need be considered at one time. For example, the only accident scenario that has the potential for more than negligible positive reactivity effect is an inadvertent misplacement of a new fuel assembly. This accident has the potential for exceeding the limiting reactivity, should there be a concurrent and independent accident condition resulting in the loss of all soluble poison. To mitigate these postulated criticality related accidents, boron is dissolved in the pool water. Safe operation with unborated water and no movement of assemblies may, therefore, be achieved by controlling the combination of initial enrichment and burnup

BASES

BACKGROUND (continued)

in accordance with the accompanying LCO. Prior to movement of an assembly, it is necessary to perform SR 3.7.12.1.

APPLICABLE SAFETY ANALYSES

The **fuel handling** ~~hypothetical~~ accident~~s~~ can only take place during or as a result of the movement of **a fuel** ~~an~~ assembly (Refs. 2 and 3). For **the occurrence of this** ~~these~~ accident ~~occurrences~~, the presence of soluble boron in the spent fuel ~~storage~~ pool (controlled by LCO 3.7.11, "**Spent** Fuel ~~Storage~~ Pool Boron Concentration") prevents criticality. By closely controlling the movement of each assembly and by checking the location of each assembly after movement, the time period for potential accidents may be limited to a small fraction of the total operating time. During the remaining time period with no potential for accidents, the operation may be under the auspices of the accompanying LCO.

The configuration of fuel assemblies in the **spent** fuel ~~storage~~ pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The restrictions on the placement of fuel assemblies within Region 2 of the spent fuel pool in the accompanying LCO, ensure the k_{eff} of the spent fuel ~~storage~~ pool will always remain < 0.997, assuming the pool to be flooded with unborated water and ≤ 0.95, with a boron concentration of greater than or equal to 800 ppm.

Region 2 permits storage of spent fuel assemblies in any cell location provided the assembly meets the combination of initial enrichment and burnup shown in LCO Figure 3.7.12-1, Minimum Fuel Assembly Burnup Versus Initial Enrichment for Region 2 Spent Fuel Cells. **The Acceptable Region of the Figure is to the left and above the curve.**

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in Region 2 of this **spent** fuel ~~storage~~ pool.

ACTIONS

LCO 3.0.3 is applicable while in MODE 1, 2, 3, or 4. Since spent fuel pool storage requirements apply in all MODES when fuel is stored in Region 2, the ACTIONS have been modified by a Note stating **that** ~~the~~ LCO 3.0.3 is not applicable. Spent fuel pool storage requirements are independent of reactor operations. Entering LCO 3.0.3 while in MODE 1, 2, 3, or 4 would require the unit to be shutdown unnecessarily.

BASES

ACTIONS (continued)

~~LCO 3.0.8 is applicable while in MODE 5 or 6. Since spent fuel pool storage requirements apply in all MODES when fuel is stored in Region 2, the ACTIONS have been modified by a Note stating the LCO 3.0.8 is not applicable. Spent fuel pool storage requirements are independent of shutdown reactor operations. Entering LCO 3.0.8 while in MODE 5 or 6 would require the optimization of plant safety, unnecessarily.~~

A.1

The LCO is not met if spent fuel assemblies stored in Region 2 spent fuel assembly storage locations do not meet the applicable initial enrichment and burnup limits in accordance with Figure 3.7.12-1.

When the LCO is not met, action must be initiated immediately to make the necessary fuel assembly movement(s) in Region 2 to bring the storage configuration into compliance with Figure 3.7.12-1 by moving the affected fuel assemblies to Region 1 or the Defective Fuel Cells.

SURVEILLANCE REQUIREMENTS

SR 3.7.12.1

This SR verifies by administrative means that the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.7.12-1. Fuel assemblies stored in Region 2 that do not meet the Figure 3.7.12-1 enrichment and burnup limits shall be stored in Region 1-or Defective Fuel Cells.

REFERENCES

1. Double contingency principle 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).

2. APP-GW-GLR-029P, “AP1000 Spent Fuel Storage Racks Criticality Analysis,” Westinghouse Electric Company LLC (Westinghouse Proprietary).

3. **FSAR** Sections 9.1.2, “Spent Fuel Storage” and 15.7.4, “Fuel Handling Accident.”

XII. Applicable STS Subsection After Incorporation of this GTST's Modifications

The entire subsection of the Specifications and the Bases associated with this GTST, following incorporation of the modifications, is presented next.

3.7 PLANT SYSTEMS

3.7.12 Spent Fuel Pool Storage

LCO 3.7.12 The combination of initial enrichment and burnup of each fuel assembly stored in Region 2 shall be within the limits specified in Figure 3.7.12-1.

APPLICABILITY: Whenever any fuel assembly is stored in Region 2 of the spent fuel pool.

ACTIONS

----------NOTE----------
LCO 3.0.3 is not applicable.

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.12.1	Verify by administrative means the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.7.12-1	Prior to storing the fuel assembly in Region 2

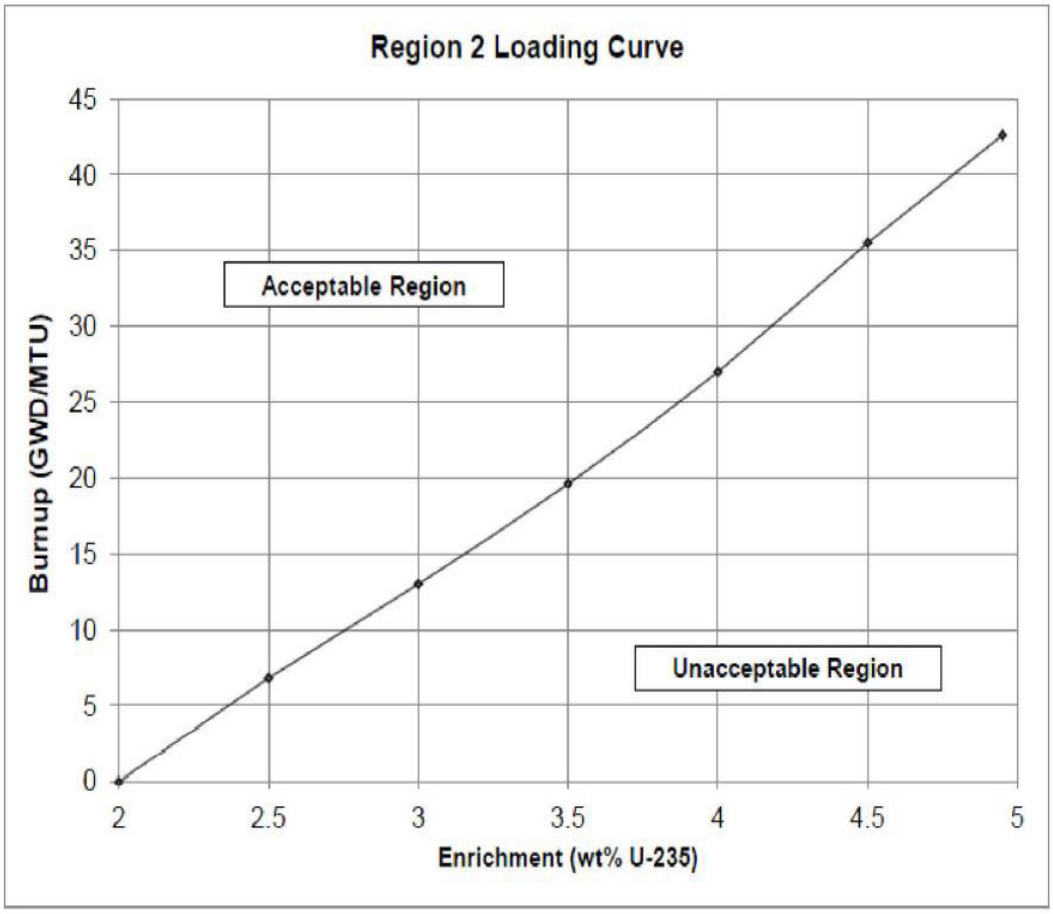

Figure 3.7.12-1 (page 1 of 1)
Minimum Fuel Assembly Burnup Versus Initial Enrichment for Region 2 Spent Fuel Cells

B 3.7 PLANT SYSTEMS

B 3.7.12 Spent Fuel Pool Storage

BASES

BACKGROUND

The high density spent fuel storage racks are divided into two separate and distinct regions and include locations for storage of defective fuel as shown in Figure 4.3-1. Region 1, with a maximum of 243 storage locations and the Defective Fuel Cells, with 5 storage locations are designed to accommodate new fuel assemblies with a maximum enrichment of 4.95 weight percent U-235, or spent fuel assemblies regardless of the combination of initial enrichment and burnup. Region 2, with a maximum of 641 storage locations is designed to accommodate spent fuel assemblies in all locations which comply with the combination of initial enrichment and burnup specified in LCO Figure 3.7.12-1, Minimum Fuel Assembly Burnup Versus Initial Enrichment for Region 2 Spent Fuel Cells.

The water in the spent fuel pool normally contains soluble boron, which would result in large subcriticality margins under actual operating conditions. For storage of fuel in the spent fuel racks, the design basis for preventing criticality outside the reactor is that there is a 95% probability at a 95% confidence level, without soluble boron, that the effective multiplication faction (k_{eff}) of the fuel assembly array will be less than 0.997, including uncertainties and tolerances. The NRC guidelines specify a limiting k_{eff} of 1.0 for normal storage in the absence of soluble boron. Hence, the design is based on the use of unborated water, which maintains a subcritical condition for the allowed loading patterns.

The double contingency principle discussed in ANSI N-16.1-1975 and the April 1978 NRC letter (Ref. 1) allows credit for soluble boron under other abnormal and accident conditions, since only a single independent accident need be considered at one time. For example, the only accident scenario that has the potential for more than negligible positive reactivity effect is an inadvertent misplacement of a new fuel assembly. This accident has the potential for exceeding the limiting reactivity, should there be a concurrent and independent accident condition resulting in the loss of all soluble poison. To mitigate these postulated criticality related accidents, boron is dissolved in the pool water. Safe operation with unborated water and no movement of assemblies may, therefore, be achieved by controlling the combination of initial enrichment and burnup in accordance with the accompanying LCO. Prior to movement of an assembly, it is necessary to perform SR 3.7.12.1.

BASES

APPLICABLE SAFETY ANALYSES

The fuel handling accident can only take place during or as a result of the movement of a fuel assembly (Refs. 2 and 3). For the occurrence of this accident, the presence of soluble boron in the spent fuel pool (controlled by LCO 3.7.11, “Spent Fuel Pool Boron Concentration”) prevents criticality. By closely controlling the movement of each assembly and by checking the location of each assembly after movement, the time period for potential accidents may be limited to a small fraction of the total operating time. During the remaining time period with no potential for accidents, the operation may be under the auspices of the accompanying LCO.

The configuration of fuel assemblies in the spent fuel pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The restrictions on the placement of fuel assemblies within Region 2 of the spent fuel pool in the accompanying LCO, ensure the k_{eff} of the spent fuel pool will always remain < 0.997, assuming the pool to be flooded with unborated water and ≤ 0.95, with a boron concentration of greater than or equal to 800 ppm.

Region 2 permits storage of spent fuel assemblies in any cell location provided the assembly meets the combination of initial enrichment and burnup shown in LCO Figure 3.7.12-1, Minimum Fuel Assembly Burnup Versus Initial Enrichment for Region 2 Spent Fuel Cells. The Acceptable Region of the Figure is to the left and above the curve.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in Region 2 of this spent fuel pool.

ACTIONS

LCO 3.0.3 is applicable while in MODE 1, 2, 3, or 4. Since spent fuel pool storage requirements apply in all MODES when fuel is stored in Region 2, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. Spent fuel pool storage requirements are independent of reactor operations. Entering LCO 3.0.3 while in MODE 1, 2, 3, or 4 would require the unit to be shutdown unnecessarily.

BASES

ACTIONS (continued)

A.1

The LCO is not met if spent fuel assemblies stored in Region 2 spent fuel assembly storage locations do not meet the applicable initial enrichment and burnup limits in accordance with Figure 3.7.12-1.

When the LCO is not met, action must be initiated immediately to make the necessary fuel assembly movement(s) in Region 2 to bring the storage configuration into compliance with Figure 3.7.12-1 by moving the affected fuel assemblies to Region 1 or the Defective Fuel Cells.

SURVEILLANCE REQUIREMENTS

SR 3.7.12.1

This SR verifies by administrative means that the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.7.12-1. Fuel assemblies stored in Region 2 that do not meet the Figure 3.7.12-1 enrichment and burnup limits shall be stored in Region 1-or Defective Fuel Cells.

REFERENCES

1. Double contingency principle 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).

2. APP-GW-GLR-029P, “AP1000 Spent Fuel Storage Racks Criticality Analysis,” Westinghouse Electric Company LLC (Westinghouse Proprietary).

3. FSAR Sections 9.1.2, “Spent Fuel Storage” and 15.7.4, “Fuel Handling Accident.”