FPL

10 CFR 50.90
L-2005-247
January 27, 2006

U. S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, D.C. 20555

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
License Amendment Request No. 178
Spent Fuel Pool Boraflex Remedy

In accordance with the provisions of 10 CFR 50.90, Florida Power and Light Company (FPL) requests that Appendix A of Facility Operating Licenses DPR-31 and DPR-41 for Turkey Point Units 3 and 4 be amended to incorporate the enclosed Technical Specification (TS) revisions. The proposed amendments would revise TS Sections 3/4.9.1-Boron Concentration, 3/4.9.14 – Spent Fuel Storage, and 5.5.1 – Criticality, to include new spent fuel storage patterns and the use of Metamic™ rack inserts. These amendments were discussed in a public pre-application meeting with NRC Staff on October 19, 2005.

The proposed license amendment removes reliance on Boraflex® as a neutron absorber in Turkey Point Units 3 and 4 spent fuel pool (SFP) storage racks. To preclude continued loss of reactivity margin due to the ongoing degradation of Boraflex, the neutron absorbing function currently performed by Boraflex will be replaced by some combination of rod cluster control assemblies, Metamic rack inserts, and administrative controls that require mixing higher-reactivity fuel with lower-reactivity fuel.

Attachment 1 contains an evaluation of the proposed changes. Attachment 2 contains the Determination of No Significant Hazards Consideration. Attachment 3 contains a statement of Environmental Impact Consideration. Attachment 4 contains the affected TS pages marked-up to show the proposed changes. Attachment 5 contains the affected TS pages retyped to show the proposed changes. Attachment 6 contains the affected TS Bases pages marked-up for your information. Attachment 7 contains a list of regulatory commitments resulting from the proposed changes.

Attachment 8 provides the affidavit required by 10 CFR 2.390 to define the proprietary content of the Holtec International report which is Attachment 9. FPL requests that the proprietary version (Attachment 9) be withheld from public viewing. The non-proprietary version of the Holtec International report is contained in Attachment 10. Attachment 10 is appropriately redacted so that it may be disclosed to the public.

Continued operability of the spent fuel storage racks has been assured through a Boraflex surveillance program first described in FPL letter L-2000-144, dated July 5, 2000. In subsequent letter L-2001-115, dated May 16, 2001, FPL reported Boraflex surveillance results using areal density (Boron-10 Areal Density Gage for Evaluating Racks - BADGER) testing methods. FPL also described therein the method used to project Boraflex degradation using EPRI's RACKLIFE™ program. At that time, FPL established a conservative gamma dose threshold above which a storage cell would be subject to administrative controls to limit its use.

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FPL performed BADGER testing again in March 2004 consistent with the 3-year surveillance interval determined from the first testing reported in 2001. Evaluation of the March 2004 test results provides reasonable assurance that Boraflex panels continue to meet their design basis requirements. Experience gained from the two surveillance campaigns demonstrated that use of the RACKLIFE prediction of remaining boron-10 areal density in Boraflex panels is a better indicator of Boraflex degradation in the SFPs than the dose threshold limit for the Region II racks. Accordingly, FPL has extended its use of EPRI's RACKLIFE model to establish when to implement administrative controls to limit the use of SFP cells over the Boraflex surveillance interval in the Region II storage racks. In addition, RACKLIFE will continue to be used to predict Boraflex degradation in the Region I racks.

Although the March 2004 BADGER testing results have provided reasonable assurance of the current viability of Boraflex panels in the Turkey Point SFPs, Boraflex panels exhibit evidence of continuing degradation. To address the continuing loss of Boraflex, FPL is submitting this license amendment request to allow fuel storage in the SFPs without crediting Boraflex.

The proposed license amendments have been reviewed by the Turkey Point Plant Nuclear Safety Committee and the FPL Company Nuclear Review Board. In accordance with 10 CFR 50.91(b)(1), a copy of these proposed license amendments is being forwarded to the State Designee for the State of Florida.

Regarding the proposed schedule for this amendment, it is requested that issuance be no later than January 31, 2007; however, it is anticipated that regular interactions with the NRC staff can improve that schedule. It is also anticipated that discussion with the NRC staff at the time of issuance will be needed to establish an appropriate implementation date.

Should there be any questions on this request, please contact Mr. Walter Parker at 305-246-6632.

Very truly yours,

Terry Jones

Terry O. Jones
Vice President
Turkey Point Nuclear Plant

Enclosure

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant
Florida Department of Health

Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
License Amendment Request No. 178
Spent Fuel Pool Boraflex Remedy

STATE OF FLORIDA)
)ss.
COUNTY OF MIAMI-DADE)

Terry O. Jones being first duly sworn, deposes and says:

That he is Vice President, Turkey Point Nuclear Plant, of Florida Power and Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

Terry O. Jones

Subscribed and sworn to before me this
27 day of January, 2006.

Notary Public

Luci A. Noble
My Commission DD275536
Expires December 18, 2007

Terry O. Jones is personally known to me.

Enclosure

License Amendment Request No. 178

Note Regarding Pagination:

The documents included in this enclosure are controlled by the page-count indicated in the Table of Contents below. To preserve the integrity of the documents as suitable for use by NRC Staff the header and pagination notations (such as appears on this page) are not used on every page of the enclosure.

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Attachment 1

Evaluation of Proposed Changes

Table of Contents

1 Background Information

This license amendment request (LAR) proposes to eliminate reliance on Boraflex® as a neutron absorber in Turkey Point Units 3 and 4 spent fuel pool (SFP) storage racks. Boraflex is a neutron absorber material currently used in the spent fuel storage racks to ensure that the subcriticality requirements of Technical Specifications (TS) and 10 CFR 50.68 (b)(4) are met. However, Boraflex has exhibited continual degradation in light-water-reactor (LWR) spent fuel pools. This degradation is being monitored at Turkey Point, and is not severe enough at this time to create an operability concern. However, further degradation could reduce neutron absorber performance below the racks' design basis requirements and, if unmitigated, prompt compensatory measures that would restrict use of storage cells. To preclude the loss of storage capacity, the neutron absorbing function currently performed by Boraflex will be replaced by some combination of rod control cluster assemblies, Metamic™ rack inserts, and administrative controls that disperse the higher-reactivity fuel.

This LAR proposes changes to the Technical Specifications and Design Features related to spent fuel storage requirements and spent fuel pool boron concentration. In addition, the LAR requires a Metamic surveillance program that would replace the existing Boraflex surveillance program.

This LAR does not change or modify the fuel, fuel handling processes, spent fuel racks, number of fuel assemblies that may be stored in the pool, decay heat generation rate, or the spent fuel pool cooling and cleanup system. The Boraflex panels will remain in place providing additional (albeit diminished) neutron absorption in the storage array. However, for the purposes of this evaluation, it is assumed that no Boraflex is available for reactivity control.

Turkey Point Unit 3 and Unit 4 spent fuel pools (SFP) currently use a "Distinct Zone Two Region" rack design described fully in the Holtec Report (Attachment 9). Region I was designed for storing fresh fuel (i.e., high reactivity fuel) while Region II was designed for storing irradiated fuel (i.e., low reactivity fuel). Each of the Unit 3 and Unit 4 spent fuel pools is currently licensed for a storage capacity limited to no more than 1404 assemblies in the two region storage racks and no more than 131 fuel assemblies in the Cask Area Rack. The total spent fuel pool storage capacity is limited to no more than 1535 fuel assemblies. The existing racks (not the new Cask Area Rack) use Boraflex as the neutron absorber. Boraflex is a silicone-based polymer material that contains the neutron absorber boron-10 in the form of small particles of boron carbide (B_4C). When Boraflex is subjected to the high gamma doses and cooling water flow of a SFP environment, the polymer degrades and boron-10 is removed from the rack panel. The reduction in the amount of boron-10 below the design basis areal density requirement will adversely affect the operability of those storage cells.

The Electric Power Research Institute (EPRI) has been studying the phenomenon of Boraflex degradation for several years, and has identified two issues with respect to using Boraflex in spent fuel storage racks. The first issue is gamma radiation-induced shrinkage of Boraflex and the potential to develop tears or gaps in the material. The second issue is long-term Boraflex performance throughout the intended service life of the racks because of irradiation and exposure to the wet pool environment. Degradation of Boraflex was previously addressed by the NRC in Generic Letter 96-04.

FPL committed to evaluate the condition of the Boraflex at Turkey Point every 3 years after the first BADGER (Boron-10 Areal Density Gage for Evaluating Racks) test performed in the Unit 3 SFP in 2001. The most recent test was performed in March 2004 in the Unit 3 SFP. The results show that the degradation is bounded by the conservative assumptions in the current design basis criticality analysis, and that TS requirements continue to be met. Future Boraflex degradation is estimated using the computer program RACKLIFE™ and BADGER test results.

As noted, the neutron absorption function of Boraflex is proposed to be performed partly by Metamic inserts. The Metamic insert is a borated aluminum neutron absorber that is designed to be installed in storage cells in an existing rack when a fuel assembly is already present in the cell. These inserts are fully described in Attachment 9, Section 2. This insert is a discrete component that can be installed and removed using a special handling tool. As such, the inserts are ideally suited as a neutron absorber in existing racks because they can be installed without requiring rack modifications or spent fuel movements.

License amendments 226 (Unit 3) and 222 (Unit 4) were recently granted for installing an additional storage rack in the Cask Area of each Unit's spent fuel pool. The new Cask Area Racks use Boral® as a neutron absorber material, so they are not affected by issues related to Boraflex or Metamic. The Cask Area Rack criticality analyses demonstrated that, for the most reactive fuel, with or without Boraflex present in the existing racks, the existing racks do not increase the effective neutron multiplication factor (k_{eff}) of the Cask Area Rack. Conversely, the Cask Area Rack does not increase the k_{eff} of the existing racks. For these reasons, the Cask Area Rack Technical Specifications are not revised in the proposed amendments. Furthermore, the proposed Technical Specifications do not preclude the storage or placement of Metamic inserts in the Cask Area Racks.

Besides the Technical Specification changes proposed herein, some physical changes and processes will be revised in the course of implementing the amendments. This evaluation and the Determination of No Significant Hazards Consideration (Attachment 2) address the TS changes as well as the collateral physical effects.

Precedent Licensing Actions:

This LAR has been prepared with deference to licensing precedent and has incorporated to the extent practical, information that should preclude the kinds of RAIs (Requests for Additional Information) that were issued for preceding licensing actions. The following precedents were most influential in preparation of this LAR:

Administratively Controlled Fuel Loading Patterns - Licensing precedent has already been established for eliminating reliance on Boraflex and taking credit for administratively controlled fuel loading patterns, empty rack cells, and fuel assembly inserts. St. Lucie Unit 1 license amendment 193, issued September 23, 2004, provided the most influential precedent in this area.

Use of Metamic in Spent Fuel Pools – Licensing precedent for use of Metamic in spent fuel pools has been established since 2003 when NRC issued its topical safety evaluation[1]. This NRC SER required that subsequent applications using Metamic discuss the factors listed below. The factors and the applicable LAR sections that address those factors are listed below:

1) establishment of a coupon sampling program [Attachment 1, Section 3.8.2],
2) size and types of surveillance coupons to be used (similar in fabrication and layout as the proposed insert including welds and proximity to stainless steel) [Attachment 1, Section 3.8.2],
3) technique for measuring the initial boron carbide content in the coupons [covered in Attachment 9 Section 3.3.1 to the extent that the initial boron content of the insert is ensured through the QA program, with the proviso that the Metamic Surveillance Program will use actual inserts rather than coupons],
4) simulation of scratches on the coupons [Covered in Attachment 1, Section 3.8.2 to the extent that scratches will be monitored with the Metamic Surveillance Program on actual inserts rather than coupons],
5) frequency of coupon sampling and its justification [Attachment 1, Section 3.8.2],

[1] NRC Letter to Entergy, Arkansas Nuclear One, Units 1 and 2 – Review of Holtec Report RE: Use of Metamic in Fuel Pool Applications, dated June 17, 2003

6) tests to be performed on the coupons; these tests should also address, as a minimum, any bubbling, blistering, cracking, flaking, or areal density changes of the coupons, any dose changes to the coupons, or the effects of any fluid movement and temperature fluctuations of the pool water [Attachment 1, Section 3.8.2],
7) description of the anodizing process if used [not applicable],
8) description of the cleaning technique to ensure sufficient removal of surface contaminants prior to installation [Attachment 9, Section 3.3.1]
9) limitation of 31 weight percent boron carbide [Attachment 7].

Insofar as Turkey Point's Metamic inserts will be inserted around fuel assemblies (contrary to the Arkansas Nuclear One (ANO) Unit 1 design that was inserted into rack flux traps), due consideration was given to precedent established in the topical report related to monitoring scratches in the Metamic.

Use of Rack Inserts in Spent Fuel Pools – Some licensing precedent has been established for the use of inserts installed in spent fuel pool racks. Although Entergy ultimately withdrew their LAR, ANO Unit 1 made some progress in licensing rack inserts[2]. One salient precedent from that licensing action was the need for a thorough analysis of the seismic response of the rack with consideration of the inserts. In this regard, FPL and Holtec addressed the RAI concerns posed by NRC Staff on the ANO application (as it related to Holtec analyses).

2 Description of Proposed Changes

2.1 Technical Specification Changes - To provide a high-level overview, the proposed TS changes are described below in broad terms:

3/4.9.1, Refueling Operations - Boron Concentration. The Surveillance Requirement (SR) for SFP boron concentration is being removed because it is redundant.

3/4.9.14 Refueling Operations – Spent Fuel Storage. The Limiting Condition for Operation (LCO), SR, and Actions are being revised to accomplish the following:

- Add cooling time to the list of parameters that constrain fuel storage in Region II, and refer to Specification 5.5.1 rather than Table 3.9.1 for the description of loading restrictions.
- Relocate the maximum fuel enrichment limit to the Design Features.

2 Entergy letter to NRC, Supplement to Amendment Request To Changes for the Spent Fuel Pool Loading Restrictions Arkansas Nuclear One, Unit 1, dated November 21, 2003.

- Clarify that reactor shutdown actions pursuant to Specification 3.0.3 are not applicable to the Spent Fuel Pool.
- Add new SR to perform visual inspection of a representative sample of Metamic inserts.

5.5.1 Design Features – Fuel Storage – Criticality. The Design Features are being revised to accomplish the following:

- Establish fuel assembly categories to rank their reactivity for use in the proposed rack loading patterns defined in the Design Features. The category of a fuel assembly is based on its initial enrichment, its burnup history, cooling time, and the presence or absence of fuel blankets in the design.
- Establish fuel loading restrictions,
- Establish the use of Metamic inserts, full-length rod control cluster assemblies (RCCAs), and water-filled rack cells in the rack loading configurations to meet subcriticality requirements, and
- Establish the opportunity to use alternative loading configurations that conform to the NRC-approved methodology.

To provide more specific description of the proposed amendments, the Technical Specification (TS) mark-ups are provided in Attachment 4 and retyped TS pages are provided in Attachment 5. An item-by-item description is provided below along with a brief justification for each change:

Surveillance Requirement (SR) 4.9.1.4

SR 4.9.1.4 is being revised to remove the SFP boron concentration surveillance requirement from the Reactor Coolant System Specifications.

Justification: This SR is a duplicate of the surveillance requirement in TS Section 4.9.14, Spent Fuel Storage. This change is consistent with Westinghouse Improved Standard Technical Specifications - ISTS (NUREG-1431, Rev. 3), which places the SFP boron surveillance requirement in TS 3.7.16 [Fuel Storage Pool Boron Concentration].

LCO 3.9.14.a

LCO 3.9.14.a is revised to move the spent fuel storage enrichment limit to TS 5.5.1.1.d.

Justification: This change is consistent with Westinghouse ISTS, which places the enrichment limit in TS 4.3.1.1.a, which is under 4.3, Fuel Storage in TS 4.0, Design Features.

LCO 3.9.14.b

LCO 3.9.14.b is renumbered to 3.9.14.a. Justification: This change is editorial.

LCO 3.9.14.c

LCO 3.9.14.c is revised as follows: (1) renumbered to 3.9.14.b, (2) expanded to include all storage racks including the Cask Area Rack, (3) expanded to include cooling time to the list of parameters that constrain fuel storage in Region II, and (4) refers to Specification 5.5.1 rather than Table 3.9-1 for the description of loading restrictions.

Justification: These changes are editorial. Based on the volume of information necessary to describe the new loading patterns, the burnup and enrichment limits were relocated to the Design Features (TS Section 5.5). This location is consistent with St. Lucie Unit 1 TS amendment 193.

Action 3.9.14.a

Action 3.9.14.a is deleted and replaced by new Action 3.9.14.b. Justification: This change is made to place the Actions of this section in the same order as the LCOs, and eliminate the reference to the maximum enrichment LCO, which was moved to TS 5.5.1.1d. Thereby, these changes are editorial.

Action 3.9.14.b

Old Action 3.9.14.b is renumbered to 3.9.14.a. Justification: This is an editorial change only and has no effect on Action 3.9.14.b. New Action 3.9.14.b is added to place the Action for LCO 3.9.14.b in the same order as the LCOs.

Action 3.9.14.c

A new Action Item, 3.9.14.c is added to explicitly segregate spent fuel pool conditions that are unrelated to reactor operations, and prevent them from affecting reactor operations.

Justification: This change is consistent with Westinghouse ISTS, which have the same statement under "Required Action" for LCO 3.7.17 [Spent Fuel Pool Storage], i.e., "LCO 3.0.3 is not applicable."

SR 4.9.14

Renumbered SR 4.9.14 to SR 4.9.14.1 to distinguish it from a new SR to be added as 4.9.14.2. Justification: This is an editorial change only.

SR 4.9.14.2

SR 4.9.14.2 is added to perform visual inspection of a representative sample of Metamic inserts. Justification: As evident in Westinghouse ISTS (NUREG-1431, Vol. 1, Rev. 3), a spent fuel storage rack's poison material does not meet the 50.36(c)(3) criterion for inclusion in Technical Specifications. However, based on the first-of-a-kind application of this Metamic material, NRC Staff suggested during a pre-application meeting October 19, 2005 that a Technical Specification program may be appropriate. Accordingly, SR 4.9.14.2 is included to establish a nominal program. The parameters of the program, including the bases, the methods, and the surveillance frequency will be managed in the program controlled under the provisions of 10 CFR 50.59. The basis for the program is described in Section 3.8.2 of this Attachment and will be described in the UFSAR.

Table 3.9-1

Table 3.9-1 is deleted and replaced as follows; (1) the burnup and enrichment requirements are moved to Section 5.5.1, and (2) the burnup and enrichment requirements are expanded to two tables to include axial blanketed fuel in one table (Table 5.5-1) and non-axial blanketed fuel in a second table (Table 5.5-2).

Justification: The new limits are developed in, and supported by, the new criticality analyses, a summary of which will be placed in UFSAR Chapter 9. Expanding from one table to two tables is for clarity of presentation. The fuel categories established by these tables align with the criticality analyses described in this evaluation and in Attachment 9.

Design Feature 5.5.1.1

The introductory text of 5.5.1.1 is revised to be the same as Westinghouse ISTS. Justification: This change editorially conforms to ISTS.

Design Feature 5.5.1.1.a

The text is revised for clarity and to note the discussion of biases and uncertainties in UFSAR Chapter 9. Justification: This change editorially conforms with Westinghouse ISTS.

Design Feature 5.5.1.1.b

The text is revised for clarity and to note the discussion of biases and uncertainties in UFSAR Chapter 9. Justification: This change editorially conforms with Westinghouse ISTS.

Design Feature 5.5.1.1.d

The text is revised for clarity. Justification: This change is editorial.

Design Feature 5.5.1.1.e

5.5.1.1.e is added to differentiate the Cask Area Rack storage requirements from the storage requirements for racks that contain Boraflex. Justification: The Cask Area Rack uses Boral for neutron absorption, and is not subject to the restrictions that apply to the Region I and Region II racks as part of the Boraflex remedy.

Design Feature 5.5.1.1.f

5.5.1.1.f is added to require that spent fuel storage configurations meet the requirements of 5.5.1.3 which contains the storage configurations, enrichment, burnup, and cooling time requirements that the criticality analyses have determined meet the requirements of 5.5.1.1.a and 5.5.1.1.b. A statement is also added to provide for exceptions to be specifically analyzed using an NRC-approved methodology.

Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9. The provision for alternative analyses is consistent with Westinghouse ISTS 4.3.1.1.f, and will be subject to the regulatory thresholds for prior NRC approval as given by 10 CFR 50.59.

Design Feature 5.5.1.3

The introductory paragraph of 5.5.1.3 is revised to delete discussion of administering burnup values and insert the requirement that new or irradiated fuel be stored in accordance with the restrictions and limitations in TSs 5.5.1.3.a through 5.5.1.3.d.

Justification: Removal of the administrative controls pertaining to calculation of burnup values is consistent with Westinghouse ISTS, which do not discuss spent fuel storage administrative controls or procedures such as this. The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

5.5.1.3.a

5.5.1.3.a is added to limit Region I storage configurations to those that have been analyzed. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

5.5.1.3.b

5.5.1.3.b is added to limit Region II storage configurations to those that have been analyzed. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

5.5.1.3.c

5.5.1.3.c is added to restrict the Region II storage configurations that may be placed next to Region I racks to those that meet the requirements of Figure 5.5-3.

Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

5.5.1.3.d

5.5.1.3.d is added to describe specific additional Region II storage configurations that were analyzed for cells adjacent to the SFP wall. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

Table 5.5-1

Table 5.5-1 is added to replace Table 3.9-1 for axial-blanketed fuel. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

Table 5.5-2

Table 5.5-2 is added to replace Table 3.9-1 for non-axial blanketed fuel. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

Table 5.5-3

Table 5.5-3 is added to provide the information required to comply with TS 5.5.1.3.a. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

Figure 5.5-1

Figure 5.5-1 is added to limit Region I storage arrays to those that have been analyzed for Region I racks. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

Figure 5.5-2

Figure 5.5-2 is added to limit Region II storage arrays to those that have been analyzed for Region II racks. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

Figure 5.5-3

Figure 5.5-3 is added to describe allowable interfaces between Region II and Region I storage arrays. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

Figure 5.5-4

Figure 5.5-4 is added to describe allowable Region II storage configurations adjacent to SFP walls. Justification: The revised spent fuel storage configurations align with the criticality analyses described in this evaluation and in Attachment 9.

5.6 Component Cyclic or Transient Limit

Section 5.6 and its associated table will be relocated to follow the new tables and figures inserted in Section 5.5. This relocation is purely editorial.

2.2 Physical Changes and Process Changes - Besides the Technical Specification changes discussed above, some physical changes and processes will be revised in the course of implementing the proposed amendments. A list of such physical effects is provided below and evaluated fully in this evaluation and/or the Holtec Report (Attachment 9) :

- The proposed fuel loading patterns are more complex than the existing two-region scheme; however, the same level of diligent administrative controls will be applied to the proposed changes to ensure compliance with loading restrictions.

- To implement the proposed TS amendments, a significant fuel movement and insert loading campaign will be required. During this campaign, all fuel loading configurations will continue to comply with the current TS (i.e., with Boraflex credit) while being reconfigured to comply with the amended TS (i.e., with no Boraflex credit). This campaign could involve several hundred fuel assembly relocations; some requiring use of the "nozzle-less" fuel handling tool to preclude top nozzle separation on susceptible Westinghouse fuel assemblies. The campaign will introduce the following effects:
    - Potential for a fuel handling accident,
    - Potential for dropping a Metamic insert,
    - Potential for misplacing a fuel assembly or poison insert, and
    - Radiological exposure to workers from the fuel movement and insert handling.

- The installation of Metamic inserts will reduce the inventory of spent fuel pool water (assuming SFP water level is adjusted to remain constant); reducing the response time to a boron dilution event. This water displacement also reduces the response time to bulk temperature excursions (e.g., spent fuel pool time-to-boil).

- The installation of Metamic inserts around a fuel assembly will interfere with the cooling channel between the fuel assembly and two sides of the rack cell; reducing the flow area for local convective heat removal.

- The installation of Metamic inserts will incrementally increase the weight load on the spent fuel pool structure and may change the seismic response of the storage racks.

- The introduction of Metamic to the borated water of the spent fuel pool may promote some adverse chemical reaction.

- The insertion of Metamic inserts around a stored fuel assembly may impose physical damage to the fuel assembly.

- Implementation of a Metamic insert surveillance program will necessitate some periodic insert removal and inspection.

2.3 Unaffected Systems – As discussed above, the proposed project will impose a small flow resistance in individual flow channels, but will otherwise have no net effect on the spent fuel pool cooling system or its associated purification system. Also, the proposed project does not increase the spent fuel pool storage capacity, so it will not further challenge the cooling capacity of the spent fuel pool cooling system.

3 Basis / Justification for Proposed Changes

The bases and justifications for the proposed changes are provided herein. Above, a description was provided for each change along with justification for the administrative changes. Below, more detailed discussion is provided for the more complex changes. The analyses/evaluations discussed below are provided to justify the proposed changes and address the collateral effects of implementing the proposed changes. Key topics include:

3.1 principal design criteria
3.2 criticality of stored fuel including a boron dilution evaluation,

3.3 thermal-hydraulic considerations on spent fuel and the pool structure,
3.4 structural integrity of stored fuel, storage racks, and the pool structure,
3.5 radiological impact of the project,
3.6 fuel handling accidents and other dropped loads,
3.7 evaluation of Metamic in a borated water environment and other material effects, and
3.8 Metamic surveillance program

This evaluation relies significantly on Holtec Report HI-2043149, "Boraflex Remedy at Turkey Point Nuclear Plant" (L-2005-0xx Attachment 9, hereafter referenced as "Attachment 9"). The following text will provide a roadmap of all the requisite evaluations with substantial reference to Attachment 9; providing supplementary information that may not be discussed in the Holtec Report (Attachment 9).

3.1 Principal Design Criteria

The principal design criteria for spent fuel pool projects of this nature are defined by the Turkey Point UFSAR, the Standard Review Plan (NUREG-0800 Section 9.1.2, Spent Fuel Storage), and the USNRC memorandum entitled "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications", dated April 14, 1978 as modified by amendment dated January 18, 1979. Attachment 9 (Section 2.3) describes all of the applicable design codes and standards, and explains how the proposed changes will conform to the applicable requirements and guidelines.

The newly-developed fuel loading arrays were designed to accommodate the existing inventory of stored irradiated fuel, future fuel discharges, as well as the routine pre-staging of fresh fuel prior to refueling outages (considering the Cask Area Rack). A feasibility review was conducted to illustrate the acceptability of the proposed fuel loading arrays and to illustrate the range of economic impact for choosing one type of array over another. The proposed fuel loading arrays and soluble boron requirements are similar to spent fuel storage arrays previously licensed at other nuclear power plants, including St. Lucie Unit 1.

Because of the similarity between the spent fuel rack configurations for each unit, one single set of analyses is applicable for both units.

3.2 Criticality Evaluation

The proposed amendments create new loading patterns in the spent fuel pool storage racks, including credit for Metamic inserts, fuel assembly inserts (full-length RCCAs), and vacant cells. Section 4 of Attachment 9 describes the criticality analyses that demonstrate that the new fuel configurations will continue to meet the same subcriticality criteria required of the current spent fuel pool. The following subsections are provided to supplement the Holtec Report and address specific topics associated with NRC questions that have been asked previously on the topic of criticality. Further discussion of this topic is provided below:

3.2.1 Loading Patterns / Storage Arrays

The storage patterns are shown in proposed TS Figures 5.5-1 through 5.5-4. These loading patterns were developed to most efficiently store the existing inventory of spent fuel while considering the characteristics of projected future discharges and fresh (i.e., new) fuel. The fuel loading patterns and loading rules are supported by the new criticality analyses. The new analyses define the loading patterns in the following terms:

(a) 2 x 2 storage arrays,
(b) fuel categories (based on enrichment, burnup, and post-irradiation cooling time), and
(c) rules for combining the 2 x 2 arrays and fuel categories to create acceptable loading patterns.

Each 2 x 2 array is explicitly defined for the fuel category (or categories) that has the maximum allowable reactivity for that array. Each 2 x 2 array contains a specific fuel category (or categories) and may contain either (a) Metamic inserts (or full length RCCAs in the assemblies), or (b) empty (water-filled) cells. An acceptable loading pattern may consist of several different defined 2 x 2 arrays, a single defined 2 x 2 array (4 cells total), or multiple copies of a single defined 2 x 2 array. (See TS Figures 5.5-1 and 5.5-2.)

Nine[3] different 2 x 2 arrays have been defined in the TS and analyzed. The analyses confirmed the acceptability of each array-fuel category combination, and determined what limitations should be placed on the use of each array. It is important to note that each 2 x 2 array was analyzed with fuel of the maximum allowable reactivity such that fuel of a lower reactivity may also be placed in the array without penalty. It is not necessary to use all defined arrays, and in

[3] Proposed Technical Specifications and supporting criticality analyses also include an additional array wherein an RCCA is examined (and qualified) as a replacement for a Metamic insert.

fact, it is expected that the initial fuel positioning and Metamic installation campaign will not use all of the defined arrays.

Because the storage patterns are defined in terms of 2 x 2 arrays, each fuel assembly can anchor up to four 2 x 2 arrays. That is, each assembly belongs to the 2 x 2 array that includes it as the lower right hand corner, lower left hand corner, upper right hand corner and upper left hand corner. Technical Specifications require that each fuel assembly be acceptable for storage in each and every one of the four 2 x 2 arrays to which it belongs.

The Fuel Categories are shown, in order of decreasing reactivity, in TS Tables 5.5-1, 5.5-2 and 5.5-3. Each individual fuel assembly is placed in a fuel category based on enrichment, burnup and cooling time. Turkey Point will administratively control the placement of fuel assemblies and classification of fuel assemblies (based on the TS and guidance developed by Engineering). Prior to repositioning an assembly, the acceptable destination locations (i.e., locations acceptable with the assembly's reactivity classification) will be identified. The entire process for placement and classification will be independently verified by a qualified individual.

Another distinguishing feature considered in establishing fuel categories is the presence of rods having axially zoned enrichment loadings. The current inventory of irradiated fuel at Turkey Point contains fuel assemblies with axial blankets, as well as fuel assemblies without axial blankets. In addition, the inventory of stored irradiated fuel encompasses wide variations in post-irradiation cooling time; some assemblies are freshly discharged, others have cooled more than 20 years. Therefore, functional relationships (i.e., polynomials) to characterize assembly reactivity were developed for each fuel type, considering relevant post-irradiation cooling times of up to 20 years. The resulting coefficients are compiled in Table 5.5-1 for blanketed fuel and Table 5.5-2 for non-blanketed fuel.

Note: To correlate the nomenclature of the criticality analyses described in Attachment 9 with the nomenclature used in the Technical Specifications, the following table is provided:

Table 3.2.1-1: Correlation of Vendor Nomenclature with TS

Analysis Case[a]	SFP Region[b]	Analysis Case Description[a]	Analysis Case Fuel	TS Table 5.5-1 and 5.5-2 Fuel Category[c]	TS Figure 5.51 and 5.5-2 2x2 Array[d]	Fuel Reactivity Rank (1 Is High)[e]
6	I	Checkerboard Array: Fresh Fuel And Empty Cells	6	I-1	I-A	1
4	I	Analysis Case 4 Fuel In Every Cell: No RCCAs	4	I-2	I-B	2
5	I	Fresh Fuel And Analysis Case 4 Fuel: RCCA In Each Fresh Fuel Assembly	4 & 6	I-1 & I-2	I-C	3[f]
9	II	Analysis Case 9 Fuel In 3 Of Every 4 Cells: Empty Cell In 1 Of Every 4 Cells	9	II-1	II-A	1
3	II	Analysis Case 3 Fuel In Every Cell: Insert (or RCCA) In 2 Of Every 4 Cells	3	II-2	II-B	2
8	II	Checkerboard Array: Analysis Case 8L and 8H Fuel, Insert (or RCCA) In 1 Of Every 4 Cells	8L	II-3	II-C	3
2	II	Analysis Case 2 Fuel In Every Cell: Insert (or RCCA) in 1 Of Every 4 Cells	2	II-4	II-D	4
8	II	Checkerboard Array: Analysis Case 8L and 8H Fuel, Insert (or RCCA) In 1 Of Every 4 Cells	8H	II-5	II-C	5
7	II	Checkerboard Array: Analysis Case 7L and 7H Fuel	7L	II-6	II-E	6
1	II	Analysis Case 1 Fuel In Every Cell	1	II-7	II-F	7
7	II	Checkerboard Array: Analysis Case 7L and 7H Fuel	7H	II-8	II-E	8

Notes to Table 3.2.1-1:

a) Analysis case in Section 4 of the Holtec Report (Attachment 9)
b) The Turkey Point SFP racks feature a two-region rack design exclusive of the Region I Cask Area Rack. Metamic inserts will be used for neutron absorption in Region II, not in Region I.
c) The fuel category identifier used in TS Tables 5.5-1 and 5.5-2.
d) The 2 x 2 array identifier used in TS Figures 5.5-1 and 5.5-2.
e) Reactivity rank is determined by a combination of burnup and cooling time for each enrichment.
f) Fuel category I-1 with a full length RCCA has a lower reactivity than either category I-1 or category I-2 without an RCCA.

The defined 2 x 2 arrays and rules are explicitly described in the proposed Technical Specifications. The maximum calculated values of the neutron multiplication factor include appropriate bias effects, a margin for uncertainty in reactivity calculations, the effect of manufacturing tolerances on reactivity, and are calculated with a 95% probability at a 95% confidence level.

In addition to the cases analyzed above, reactivity effects of gaps and interfaces between racks were evaluated to assure that under all credible conditions, the fuel pool k_{eff} will not exceed regulatory limits of ≤ 0.95 in borated water and < 1.0 in unborated water. The possible rack interfaces are summarized below.

Interface	Analysis Approach
Region II – Region II	Gaps between Region II racks were conservatively ignored so no interface-specific analyses are required for rack-to-rack interfaces within Region II.
Region I – Region I	The same approach is used as the Region II racks.
Region I – Region II	Region I and Region II racks are conservatively assumed to be separated by at least 1 inch. Calculations were performed with combinations of storage arrangements and fuel burnups. These evaluations resulted in a set of limitations included in the proposed Technical Specifications.
Cask Area Rack	The interface between the Region I and Region II racks and the Cask Area Rack was examined previously in conjunction with the criticality analysis of the Cask Area Rack. These earlier analyses of the interface considered both the condition where the existing racks contain Boraflex and the condition where the existing racks do not contain Boraflex. These analyses demonstrated that the existing racks do not increase the k_{eff} of the Cask Area Rack, and conversely the Cask Area Rack does not increase the k_{eff} of the existing racks.

Analyses of other interfaces (such as Region II racks facing the pool wall) are discussed in Attachment 9, Section 4.

Information is provided below on the following topics to supplement Holtec's description of criticality analyses provided in Attachment 9:

3.2.2 Criticality Design Criteria – The current licensing basis for the spent fuel pool is 10 CFR 50.68(b) with credit for soluble boron. FPL Letter to NRC L-2003-213[4] described Turkey Point's conformance to this regulation.

3.2.3 Sample k_{eff} Calculation – Attachment 9 describes the criticality calculations and codes. However, to illustrate the combination of uncertainties in the calculation of neutron multiplication factor (k_{eff}), the following sample calculation is provided:

$$k_{eff} = k(calc) + \delta k(bias) + \delta k(temp) + \delta k(uncert)$$

where

k(calc) = nominal conditions k_{eff}

δk(bias) = method bias determined from benchmark critical comparisons

δk(temp) = temperature bias

δk(uncert) = statistical summation of tolerance and uncertainty components

$$= [tolerance_{(1)}{}^2 + tolerance_{(2)}{}^2 + uncertainty_{(1)}{}^2 + \ldots]^{1/2}$$

As stated in the NBS-Handbook 91[5], the tolerances are defined as maximum permissible variations. Each parameter was investigated independently, the impact on k_{eff} from nominal was determined for each tolerance, and the results are presented below. This approach follows the format documented in the Kopp letter[6]. Note that no burnup effect term is considered in this calculation because the effect is included explicitly in k(calc); that is, a full 3-D analysis was utilized.

For the numerical example, the analysis for Case 3 without soluble boron (i.e., 0 ppm boron) was chosen. Case 3 represents a Region II fuel configuration with an insert in 2 out of every 4 cells.

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4 FPL Letter to NRC, L-2003-213, RAI Response for Addition of Spent Fuel Pool Cask Area Rack Amendment, Turkey Point Units 3 and 4, dated September 8, 2003.

5 Mary Gibbons Natrella, *Experimental Statistics,* NBS Handbook 91, National Bureau of Standards, Washington, DC (1963); reprinted 1966.

6 NRC memorandum L. Kopp to T. Collins, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants", dated August 19, 1998.

As background to the sample reactivity calculation it is important to know that, when developing the limiting temperature bias for non-accident conditions, CASMO-4 calculations were performed at four different temperatures (between 39 and 185°F) for three different enrichments (1.8, 3.3 and 4.5 w/o) at multiple burnup points, and post-irradiation cooling times of 0 and 20 years. The temperature bias calculations also were performed for each rack type (i.e., Region I and Region II) and for Region II racks with and without a Metamic insert present. For Region II, the limiting temperature bias is found in the no-insert calculation. This value will be used conservatively for Case 3 even though Case 3 utilizes inserts.

Since Case 3 represents a Region II fuel configuration, the limiting data for Region II in Table 4.6.3 of Attachment 9 is utilized for the tolerance calculation. The limiting tolerance data is taken from the no-insert calculations. As with the temperature bias, for conservatism, these values are utilized even though Case 3 utilizes inserts. The details of the reactivity effects for each tolerance and uncertainty and how they were calculated are provided below. A table following the discussion of parameters lists the reactivity value for each tolerance and uncertainty. A listing of this data is also provided in Table 4.6.5 of Attachment 9.

For each of the tolerance values, a case representing the nominal condition was first performed in CASMO-4. Then a specific calculation with a variation in the parameter of interest was performed in CASMO-4 to determine the reactivity effect of the tolerance. For the parameters associated with a tolerance, no statistical distribution was assumed. Conservatively, the full tolerance value was utilized to determine the maximum reactivity effect.

1) MCNP4a Statistics — This value represents two times the standard deviation of the calculated k(calc). The standard deviation value is determined directly from the MCNP4a calculation. The 2σ value[7] provides a 95% probability at a 95 percent confidence level result.

2) MCNP4a Bias Statistics — The MCNP4a bias statistics represent the uncertainty or standard error associated with the bias in the form $K\sigma_{kaverage.}$ The K value represents the one-sided statistical tolerance limits for 95 % probability at the 95 % confidence level for 56 critical experiments. The K value used for MCNP4a is 2.04 for this application. Section 4A, pages 2 and 3 of Attachment 9 to the license amendment discusses this parameter in detail. Note that the MCNP4a bias itself is applied directly to the calculated k_{eff} as the δk(bias) term.

[7] Use of a 2σ value is conservative. The K multiplier is 1.84 for a one-sided statistical tolerance with 95% probability at the 95% confidence level corresponding to a sample size of 200.

3) Fuel rack cell inner dimension — CASMO-4 was used to evaluate the impact of the fuel rack cell inner dimension tolerance. The effect of fuel rack cell inner dimension tolerance was evaluated for three enrichments (1.8, 3.3 and 4.5 w/o). Each of the three enrichments was evaluated at multiple burnup points and at post-irradiation cooling times of 0 and 20 years. In addition, for Region II, the tolerance values were also calculated with and without an insert assumed in the CASMO-4 model.

4) Fuel rack wall thickness — CASMO-4 was used to evaluate the impact of the rack wall thickness tolerance. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

5) Enrichment — CASMO-4 was used to evaluate the maximum enrichment tolerance of 0.05 w/o. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

6) Fuel density tolerance — CASMO-4 evaluations were performed with the nominal density and with the density increased to the tolerance limit. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

7) Fuel rod pitch — CASMO-4 was again used to evaluate the impact on reactivity of the rod pitch tolerance. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

8) Fuel rod clad outer diameter — CASMO-4 was used to evaluate the impact on reactivity of the clad outer diameter tolerance. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

9) Fuel rod clad inner diameter — CASMO-4 was again used to evaluate the impact on reactivity of the rod clad inner diameter tolerance. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

10) Fuel pellet outer diameter — CASMO-4 was used to evaluate the impact on reactivity of the pellet outer diameter tolerance. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

11) Guide tube outer diameter — CASMO-4 was again used to evaluate the impact on reactivity of the guide tube outer diameter tolerance. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

12) Guide tube inner diameter — CASMO-4 was used to evaluate the impact on reactivity of the guide tube inner diameter tolerance. This evaluation was performed for the same set of calculation points described above for the rack cell inner dimension.

13) Fuel assembly eccentricity — MCNP4a was utilized to evaluate the impact of eccentricity of assembly placement. It is assumed that all assemblies are placed in the corner of the storage rack cell (four assembly cluster at closest approach). For Region II calculations, eccentric fuel positioning results produced a decrease in reactivity; therefore, this effect is not included in the calculation of the final k_{eff}. These calculations were performed with four different enrichments (1.8, 2.5, 3.0 and 4.0 w/o) and considered both blanketed and non-blanketed fuel.

Table of Reactivity Effect for Limiting Tolerance Values

Parameter	Reactivity Value
MCNP statistics (95/95, 2_σ) – Calculation Bias	0.0010
MCNP bias statistics (95/95) – Bias Uncertainty	0.0011
Rack cell ID	0.00188
Rack wall thickness	0.00493
Fuel enrichment	0.00797
Fuel density	0.00171
Fuel rod pitch	0.00096
Fuel rod clad OD	0.00015
Fuel rod clad ID	0.00084
Fuel pellet OD	0.00023
Guide tube OD	0.00001
Guide tube ID	0.00013
Fuel assembly eccentricity	negative

The δk(uncert) term is then calculated using a square root of the sum of the squares (SRSS) approach to statistically combine these reactivity values. These values may be combined using SRSS since they are independent variables.

$$\delta k(\text{uncert}) = [0.0010^2 + 0.0011^2 + 0.00188^2 + 0.00493^2 + 0.00797^2 + 0.00171^2 + 0.00096^2 + 0.00015^2 + 0.00084^2 + 0.00023^2 + 0.00001^2 + 0.00013^2]^{1/2}$$

$$\delta k(\text{uncert}) = 0.0099$$

The final k_{eff} for this Case 3 sample calculation of Attachment 9 of the submittal is:

$$k_{eff} = k(\text{calc}) + \delta k(\text{bias}) + \delta k(\text{temp}) + \delta k(\text{uncert})$$

$$= 0.9811 + 0.0009 + 0.0058 + 0.0099$$

$$= 0.9977$$

It should be noted that for Case 3 with soluble boron, a complete set of calculations for each tolerance was also performed assuming a boron concentration of 800 ppm. This value bounds the necessary soluble boron concentration to maintain keff $\leq$ 0.95.

3.2.4 Quality Controls that Ensure Accurate Representation of Fuel and Rack Tolerances – The criticality analyses are based on worst-case tolerance limits for the physical parameters of the fuel, storage racks, and neutron-absorbing inserts. Quality control measures ensure that the worst-case tolerance limits used in the criticality analyses will not be exceeded. These quality control measures are an integral part of the Appendix B Quality Assurance programs for the storage rack and nuclear fuel vendors.

Storage rack tolerance parameters used in the Turkey Point criticality analyses were extracted from the approved design drawings developed for Region I and Region II storage racks. These racks were designed and fabricated under the requirements of an Appendix B Quality Assurance program.

Prior to initiating work on this criticality analysis, FPL asked the plant's nuclear fuel supplier to identify and independently verify nominal values as well as maximum and minimum values of a variety of fuel parameters, relevant to analyses, for each reload batch where fuel was supplied. Parameter values that bounded all these reload batches were subsequently used as verified input to this criticality analysis. As a result, a small amount of recoverable margin is embedded in criticality analyses.

Fuel assemblies used at Turkey Point have been, and continue to be, fabricated under the requirements of an Appendix B Quality Assurance program. Fuel assemblies fabricated in the future will conform with or be bounded by the design characteristics assumed in criticality analyses. A certification is provided for each fuel reload that the fuel assemblies comprising that reload batch have been fabricated in accordance with specifications. Non-conformance with product specifications is brought to the attention of the purchaser (normally FPL); these items must be satisfactorily dispositioned prior to fuel receipt.

3.2.5 Verification of Calculated Spent Fuel Burnup Values – A fundamental parameter that helps define a spent fuel category is its value of burnup. Adequate record-keeping, administrative controls, and calculation methods are in place to ensure the correct value is used. Burnup values used to assign fuel reactivity classifications are derived from three-dimensional fuel assembly design calculations. FPL does not currently measure fuel assembly burnup or expect to experimentally determine fuel assembly burnup in the future.

The controls ensuring that fuel assemblies possess the minimum required burnup prior to placement in a particular fuel storage rack will be similar to the controls now in place to assure the required burnup condition in current TS Table 3.9-1 is met. These controls consist of engineering guidance, typically developed as part of the fuel reload design process, and procedural requirements developed in part from this engineering guidance. This current set of controls, as modified to account for specifics of the approved license amendment, will provide assurance that all fuel placed in the Turkey Point fuel storage racks complies with burnup criteria.

The fuel reload design engineering process uses independently-verified analytical tools to calculate values of fuel assembly burnup, based on predicted in-core power distributions. These calculated values are then compared to limiting values derived from Technical Specifications, or other sources, for each fuel storage sub-region to identify permissible storage locations. Assembly burnup calculations are performed using the same techniques and analytical tools as are used to develop core-loading patterns, predict compliance with Safety Analysis assumptions, and predict operating cycle length. Isotopic inventories for nuclear material reporting are also developed using these tools.

Computer codes used in the core design process, including calculations of fuel assembly burnup, are validated after installation and are maintained in a controlled access library. Design input used to model core, control element and fuel assembly characteristics is developed in accordance with departmental quality instructions and is independently verified. The appropriate application of specific calculated results to a fuel reload or to individual discharged fuel assemblies is also independently verified. Physics model performance is periodically validated through comparisons of power distribution parameters and reactivity state-points to values derived from plant measurements.

3.2.6 Integrity of Control Rod (RCCA) Neutron-Absorbing Capability – Full-Length Rod Control Cluster Assemblies (RCCAs), with a neutron poison material composed of a silver-indium-cadmium (AgInCd) alloy, have been analyzed for use in certain storage arrays to meet subcriticality criteria. RCCAs are described in Attachment 9, Section 4 (See Table 4.4.3). It is acceptable for the criticality analyses to use the nominal value for the RCCA's poison density because RCCAs are discharged from the reactor so as not to exceed mechanical integrity criteria rather than for reasons related to its poison depletion. The RCCA poison is a strong neutron absorber and its depletion is inconsequential over its operating life due to the increasing weight percent of cadmium, a strong thermal neutron absorber. The inconsequential depletion of the RCCA is a result of epithermal neutron absorption of silver and its subsequent transmutation into stable cadmium isotopes (Reference: Control Rod Materials and Burnable Poisons, EPRI NP-1974, November 1981). Long term depletion of the RCCA in the SFP is insignificant since the thermal neutron flux is orders of magnitude lower than that experienced in the reactor.

Additionally, RCCAs are typically withdrawn from the active fuel region during full power operation of the core. Plant Technical Specifications encourage operation with RCCAs withdrawn; limiting the depth of RCCA insertion for power shaping purposes and the cumulative RCCA insertion time during power operation. Procedural controls establish the fully withdrawn condition, as defined by each unit's Core Operating Limits Report, to be the preferred operating position for RCCAs. These controls ensure conformance with the insertion requirements of Technical Specifications 3.1.3.5 and 3.1.3.6 and provide a rationale for the RCCA nominal poison density assumption.

Comparisons of predicted and measured control rod reactivity worth, performed during low power physics testing, further support an assumption that RCCA depletion is not experienced at Turkey Point. In-core residence time of full-strength RCCAs is constrained by calculations of cladding strain. FPL has an active program to track the operational parameters related to strain and to procure replacement RCCAs, when necessary. As a result, existing procedures and administrative controls ensure that the poison density levels in RCCAs will not be significantly depleted.

3.2.7 Assurance of Control Rod (RCCA) and Metamic Insert Placement – Full-Length RCCAs and Metamic inserts have been analyzed for use in certain storage arrays to meet subcriticality criteria. Neither an RCCA nor a Metamic insert is an integral (nonremovable) part of a fuel assembly or storage rack; however, FPL will use strict engineering controls, administrative controls, and independent verification to ensure that these inserts are installed as required. These controls are comparable to those described in FPL letter to NRC, L-2003-245[8]. In the aggregate, these controls satisfy the guidance provided in the L. Kopp letter[9] and Regulatory Guide (RG) 1.13, Proposed Rev. 2, "Spent Fuel Storage Facility Design Basis."

3.2.8 Metamic Inserts – Metamic inserts are an important element to the proposed amendment. They are fully described in Attachment 9, Section 2. As discussed in Attachment 9, Section 4, the criticality analysis takes credit for their nominal design dimensions with conservative penalties assigned for manufacturing tolerances, wear, corrosion, and other possible effects. Further discussion of Metamic properties is provided in Section 3.8 below. The Metamic insert will be in the form of thin panels that are inserted between the fuel assembly and storage cell wall after the fuel assembly is in place. This approach is conservative because it leaves the Boraflex in place for additional (albeit diminished) neutron absorption.

The Metamic inserts are designed for installation in any rack storage cell after a fuel assembly has been loaded into the cell. Installation and removal processes are described in Attachment 9, Section 9. The insert must be removed before the fuel assembly can be moved. The tool that handles the inserts is different from those that handle fuel, so in addition to removing the insert, a tool change is required to move a fuel assembly from a cell that has an insert. Thus, as a practical matter, it is planned that the Metamic inserts will be placed only in cells containing permanently discharged fuel; thereby limiting handling operations. Accordingly, only Region II SFP rack storage patterns employ Metamic inserts; Region I rack storage patterns proposed for this amendment do not require Metamic inserts. On this basis, and considering the storage patterns analyzed, it is expected that a maximum of 560 inserts could be used in each Turkey Point spent fuel storage pool.

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8 FPL letter to NRC, L-2003-245, "RAI Response for Proposed Amendment, Spent Fuel Pool Soluble Boron Credit", St. Lucie Unit 1, dated September 29, 2003

9 NRC memorandum L. Kopp to T. Collins, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants", dated August 19, 1998.

3.2.9 Unit Differences - As discussed in FPL letter L-2003-213[10], the physical differences between Turkey Point Units 3 & 4 are inconsequential with respect to spent fuel pool criticality analyses. These units share common Technical Specifications and procedures. Spent fuel pool layouts are symmetrical mirror images of each other.

3.2.10 New Fuel Types – Changes in the characteristics of fuel assemblies used at Turkey Point will be evaluated as part of FPL's core reload design process. Procedurally, all core reloads are treated as design modifications and are subject to appropriate engineering reviews and 10 CFR 50.59 evaluation. If the 10 CFR 50.59 evaluation concludes that the new fuel type can be implemented without prior NRC approval, the change will be implemented and the UFSAR will be revised pursuant to 10 CFR 50.71(e). Otherwise, the introduction of a new fuel type will be submitted under 10 CFR 50.90 for NRC approval.

3.2.11 Boron Dilution Event – There are two effects that the proposed amendments may have on the postulated boron dilution event:

1) the Metamic rack inserts will displace a small amount of SFP borated water; potentially reducing the response time to a given dilution event, and
2) the criticality analysis of the new configurations (no Boraflex credit) could require a higher soluble boron credit than the current configurations (with Boraflex credit) to achieve the design basis subcriticality requirements

Based on installation of Metamic rack inserts in a checkerboard pattern (i.e., every other cell contains an insert) in Region II storage racks, a maximum of 560 inserts could be installed in each spent fuel pool. (Region I storage rack patterns do not require rack inserts, as discussed previously.) Using a conservative value of 614 inserts added to the racks, approximately 600 gallons of water is displaced. When this incremental water volume is added to that of the Cask Area Rack[11] and the licensed limit of fuel assemblies, the total displaced volume of water is still less than the volume assumed in the analysis of record. Therefore, the existing boron dilution calculation remains bounding when considering the displacement of water by inserts.

The current minimum soluble boron concentration required by TS 5.5.1.1.b for safe subcritical storage of fuel assemblies in the existing spent fuel storage racks is 650 ppm. The minimum

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[10] FPL letter to NRC, L-2003-213, "RAI Response for Addition of Spent Fuel Pool Cask Area Rack Amendment", dated September 8, 2003

[11] A comparable review was also done considering the volume of a spent fuel cask rather than the Cask Area Rack. The resulting total displacement in this case was also less than that assumed in the analysis of record.

soluble boron concentration required for the proposed storage configurations under the same conditions has been calculated in Attachment 9 to be 560 ppm. Because the water volume is essentially unchanged, the time to dilute to the proposed value, 560 ppm, is bounded by the time to dilute to the current value, 650 ppm.

Thus, the existing boron dilution analysis remains bounding.

3.3 Thermal-Hydraulic Evaluation

With respect to thermal-hydraulic performance of the spent fuel pool cooling function, the net effects of the proposed changes are:

1) A very small decrease in the bulk spent fuel pool water inventory is caused by combined displacement of all Metamic inserts. If this effect were significant, the reduction in inventory could increase SFP heatup rates and reduce the time-to-boil for any given loss of cooling event.
2) A small increase in local hydraulic resistance will occur in those rack cells containing Metamic inserts. This effect will slightly increase local temperatures for any given fuel assembly heat load.

The proposed changes do not increase the number of fuel assemblies that may be stored in the pool, and do not increase the decay heat load imposed on the pool, the SFP cooling system, or the environment.

Attachment 9, Section 5 describes thermal-hydraulic analyses that demonstrate the proposed fuel storage configurations with Metamic inserts will continue to meet the same thermal-hydraulic criteria required of the current spent fuel pool. With respect to bulk thermal effects, Attachment 9 demonstrates that the existing licensing bases for bulk fuel pool water temperature and time-to-boil (after loss of forced cooling) contain sufficient conservatism to remain bounding for any possible number of Metamic inserts. With respect to local thermal effects, Attachment 9 – Section 5 demonstrates that the local water temperature and fuel rod cladding temperature are slightly higher than previously analyzed, but within acceptance criteria.

3.4 Rack Structural Evaluation

Section 6 of Attachment 9 describes structural analyses for the storage racks that demonstrate the existing structures will continue to meet acceptance criteria considering presence of Metamic inserts. The net effect of adding the Metamic inserts is to increase the weight of the loaded racks by about one percent. When reanalyzed with Holtec's Whole Pool Multi-Rack (WPMR) technique using the DYNARACK solver, rack response to a seismic event was shown to produce displacements and stresses within acceptance criteria. As indicated by Table 6.2.1 of Attachment 9, Holtec's methodology has been previously accepted by NRC.

3.5 SFP Structural Evaluation

Section 7 of Attachment 9 describes the analyses used to demonstrate that the existing fuel pool structure will continue to meet acceptance criteria considering the presence of Metamic inserts. The pool structure was recently evaluated to assess the walls and floor for the addition of a rack in the Cask Area of the Spent Fuel Pool, and considering that addition, the pool structure was shown to have satisfactory design margins. The introduction of the Metamic inserts into the Region II racks will have a negligible effect on the existing pool structure because the additional weight of the inserts represents less than 0.1% of the gross weight on the pool slab. Also, since the bulk pool temperature is not affected by the addition of the Metamic inserts, the thermal load cases, which represent a significant portion of the stresses imposed on the structure, will not be changed. Therefore, it is concluded that the loads on the pool structure remain unaltered, and the structural margins-of-safety computed in the existing licensing basis remain applicable after the Metamic inserts are installed.

3.6 Radiological Evaluation

Section 8 of Attachment 9 provides an evaluation of the potential radiological effects from the fuel movement and insert installation campaign that would implement the proposed amendments. That evaluation is supplemented by the discussion provided below, which is also included in Attachment 3, the Determination of Environmental Impact Consideration.

Implementation of the proposed project would involve two activities that could produce some form of radiological effluent: (1) spent fuel handling, and (2) insertion and removal of rack inserts. Several hundred spent fuel assemblies may be handled during this evolution using established procedures, and several hundred Metamic rack inserts may be installed.

Solid, Liquid, and Gaseous Radiological Wastes - A modicum of solid low-level radioactive waste will be generated by the normal decontamination processes (e.g., wipedown of the above-water sections of the handling equipment during each fuel move, and from discarded protective clothing worn by personnel handling fuel). However, this volume is expected to be very small compared to that generated by a typical refueling outage. Otherwise, performing the fuel movement campaign and installing Metamic inserts is not expected to generate any substantial volume of gaseous or liquid effluent that would not otherwise be generated in the course of routine spent fuel pool operations over its lifetime. For example, some waste filters may be generated as a result of vacuuming several hundred fuel assemblies to verify identification numbers; however, that waste and those operations would have to transpire sometime in the future anyhow.

Also, installation and use of Metamic inserts is not expected to generate a significant amount of radiological waste. The installation process may dislodge some crud/silt; however, the amount is expected to be no more than that created by a normal refueling. The necessity for resin replacement of spent fuel pool purification media is determined primarily by the requirement for water clarity, which is not affected by the Metamic inserts. There is no mechanism to increase the volume of solid radioactive wastes due to the addition of Metamic inserts. Therefore, implementation of the proposed amendments would not significantly increase the amounts or types of effluents released offsite.

Occupational Exposure - For each Turkey Point unit, implementation of the proposed amendments may involve a several-month campaign of fuel movements and insert installations with personnel in the respective fuel handling building. Aside from the modicum of individual and cumulative occupational radiation exposure resulting from that campaign, the proposed amendments would not result in any permanent effects that would increase occupational exposure. Fundamentally, the proposed fuel configurations and inserts do not change the inventory or radiological source term of the spent fuel. Attachment 9 (i.e., Table 8.1 of Attachment 9) computes an estimate of less than 7 person-Rem for the campaign (each unit). However, based on FPL's experience with routine fuel movement campaigns during refueling outages and the fuel movement campaigns experienced at St. Lucie to remedy Boraflex degradation, the cumulative exposure from the campaign is expected to be far less than 7 person-Rem. Therefore, implementation of the proposed amendments would not significantly increase the individual or cumulative occupational radiation exposures.

The proposed changes, including the use of Metamic inserts do not alter the fuel in the SFP, SFP chemistry, or SFP cooling and cleanup systems in any way. Therefore, occupational exposures associated with spent fuel are unchanged. However, there are three sets of activities (in addition to the initial campaign) associated with the Metamic inserts that could affect occupational exposure:

1) Inserting and removing the Metamic inserts. These operations are performed with the fuel at its stored elevation (fuel seated in the rack), so the potential exposures are less than those associated with fuel movement (fuel out of the rack with approximately 14 feet less water shielding).

2) Relocating spent fuel assemblies to take advantage of the storage flexibility provided by the new analyzed configurations. It is expected that the standard ALARA (As Low As Reasonably Achievable) processes for fuel movement at Turkey Point will ensure that this activity is performed with a minimal personnel exposure.

3) Visual inspections that are part of the Metamic surveillance program. It is expected that the standard ALARA processes will ensure that this activity is performed with a minimal personnel exposure. To the extent practicable, these inspections will be performed in the pool (under water). If performed in open air, surface contamination can be removed by washing the inserts with demineralized water as they are removed from the pool. Should the inserts become slightly activated, the majority of the activation product half-lives (including aluminum-28) are less than 1 hour. Thus, more than 98% of the activation products can be removed by radiodecay if the insert is allowed to sit for a few hours in an area where there is no neutron flux. Therefore, the exposure incurred from the surveillance program can be minimized and maintained ALARA using readily implemented measures.

3.7 Fuel Handling Accidents and Cask Drop Event

Section 8 of Attachment 9 provides a brief description of the relationship between the proposed changes and the Fuel Handling Accident (FHA). Supplementary information about the FHA and the Cask Drop Event is provided herein and in the DNSHC (Attachment 2).

The FHA is not significantly affected because implementation of the proposed amendment will employ the same equipment and process to handle fuel assemblies that is currently used. Those operations introduce to the SFP only the Metamic inserts and their handling tool; both relatively small and lightweight objects. Together, the insert plus tool will weigh less than 100 pounds and offer a size comparable to a fuel assembly. Thereby, the handling operation does not create a risk or consequence comparable to that of the FHA.

The proposed amendments do not increase the probability of dropping a fuel transfer cask because they do not introduce any new heavy loads to the SFP and do not affect heavy load handling processes. Also, the insertion of Metamic rack inserts does not increase the consequences of the SFP cask drop accident described in UFSAR Chapter 14 because the radiological source term of that accident is derived from a non-mechanistically derived quantity of damaged fuel stored in storage racks.

3.8 Materials Evaluation

Presently, Boraflex is relied on for neutron absorption in the Turkey Point SFP. As discussed previously, FPL has implemented a Boraflex surveillance program using the BADGER test method. The proposed amendment eliminates reliance on Boraflex, even though the Boraflex is not being physically removed from the SFP. Following NRC approval of the amendment and implementation of the proposed TSs, the Boraflex surveillance program will no longer be necessary and the program will be terminated.

Section 3 of Attachment 9 describes the material evaluations that demonstrate the long-term suitability of materials to perform their intended functions. Notwithstanding Boraflex, Metamic is the only material of concern in this amendment.

Metamic inserts will perform the following functions:

1. Neutron absorption. When installed, the Metamic insert will provide sufficient boron-10 areal density to satisfy the minimum design requirements of the criticality analysis for the lifetime of the storage racks. The following controls ensure that this safety-related function is performed:
   - Procured as a safety-related material, the initial boron-10 content is ensured through application of the quality standards imposed during manufacture. These standards are described in Attachment 9, Section 3.
   - By design (described in Attachment 9, Section 2), the insert dimensionally blankets the active fuel region of the host fuel assembly on two sides, except for the bottom six inches (addressed in Attachment 9, Section 4). Nominal dimensions, including provision for skew-shape on the bottom, are considered in the criticality analyses with due consideration for manufacturing tolerances. Dimensions are verified under the vendor's QA Program.

- By seismic analysis (described in Attachment 9, Section 6), physical integrity of the Metamic insert following impact loads produced by earthquake has been demonstrated with an adequate safety margin. Thereby, the Metamic insert will remain intact to perform its safety function following an earthquake.
- By combination of experiment, analysis, cleanliness controls during fabrication, and operating experience (all described in Attachment 9, Section 3), the Metamic insert is expected to provide reliable corrosion resistance over its lifetime. Metamic (aluminum) will exhibit adequate corrosion resistance in the borated environment while in contact with dissimilar metals such as Zircaloy and stainless steel. Based on the first-of-a-kind nature of Metamic inserts, corrosion resistance will be monitored by the Metamic Surveillance Program described later.
- By combination of experiment and analysis (described in Attachment 9, Section 3), the Metamic insert is expected to provide reliable wear resistance over its lifetime. Based on the first-of-a-kind nature of Metamic inserts, wear resistance will be monitored by the Metamic Surveillance Program described later.

2. Minimize the local effect on fuel cooling. When installed, the Metamic insert shall not restrict coolant flow in the host storage rack's flow channel such as to violate local thermal-hydraulic criteria. By analysis of the flow channel with the insert installed (described in Attachment 9, Section 5), the local water temperature and fuel rod cladding temperature are slightly higher than previously analyzed, but within acceptance criteria.

3. Minimize the potential for fuel damage. During insertion, the Metamic insert shall not damage the host fuel assembly. The following controls ensure that this safety-related function is performed:
   - By design (described in Attachment 9, Sections 2 and 9) and experience, the insert has appropriate dimensions and tapers to fit between the fuel assembly and the rack without damaging the fuel assembly. Prototype tests conducted by EPRI[12] and FPL confirmed that the structure could be inserted into an occupied fuel pool storage cell and withdrawn without damaging the fuel assemblies.
   - By administrative control (described in Attachment 9, Section 9), insertion and withdrawal forces are limited to 150 pounds (above the combined weight of tool plus insert) as a reasonable means to preclude fuel damage.

[12] Qualification of Metamic for Spent-Fuel Storage Application, 1003137, Final Report, October 2001, EPRI, Palo Alto, CA

4. No structural function. As described in Attachment 9 - Section 2, the Metamic insert is supported by the host fuel assembly and does not serve a structural function. Nevertheless, reasonable structural strength requirements are established for the inserts.

3.8.1 Metamic Inserts – Analysis of Potential Damage

Because Metamic inserts are capable of being inserted into and removed from spent fuel storage rack cells multiple times, there is a possibility that one or more inserts could sustain minor damage any time this evolution is performed. As demonstrated below, inserts can sustain substantial damage without adversely affecting their ability to control reactivity of the stored fuel array. Results of these calculations have been considered in developing the proposed Metamic surveillance program (discussed in Section 3.8.2).

Three different insert damage configurations have been examined: (1) a scenario where multiple Metamic inserts sustain significant localized damage, (2) a scenario where multiple inserts experience damage (such as might result from corrosion) over a large fraction of each absorber panel's surface area, and (3) a scenario involving more typical damage an insert might receive as a result of an unsatisfactory cell insertion or withdrawal evolution.

To simulate effects of localized insert damage, MCNP4a was used to model a circular, 3-inch diameter hole in each panel of an infinite array of rack storage cells containing Metamic inserts arranged in a 2 out of every 4-cell array. Water replaces the volume of Metamic material assumed lost. Holes are positioned at the axial and lateral center of the Metamic panels and an axially constant burnup distribution is used in calculations to ensure that the dominant fuel reactivity region is aligned with the panels' postulated holes. This is similar to the approach taken in many earlier analyses that conservatively assessed the effect of Boraflex panel tears and gaps. Results of current analyses showed that the presence of holes in absorber panels did not produce a significant change from base-case values of neutron multiplication.

Effects of more widespread damage to absorber panels were evaluated using CASMO calculations generated earlier to consider effects of Turkey Point rack tolerances with inserts present. Reductions in a panel absorber material volume of 1 cubic inch, replicated over an infinite array of cells containing inserts at a 50% density (i.e., in a 2 out of 4-cell array) produced a reactivity effect of less than 20 pcm (0.0002 delta-k). Considering the embedded margins and conservative assumptions of the underlying analysis, this is an insignificant effect.

Typical damage simulates a deep scratch or gouge in an insert; it is modeled as a 0.25" wide, full-length and full-thickness gap in each insert absorber panel. These dimensions correspond to an approximate 5 cubic inch loss of absorber material in each insert. Consistent with the other conditions of damage, an infinite array of cells containing damaged inserts at a 50% density was considered. Again, results of MCNP4a calculations produced an insignificant effect on neutron multiplication.

Together these sensitivity analyses bound the effects of credible damage scenarios involving Metamic inserts at Turkey Point. Results demonstrate that substantial damage to a large number of Metamic inserts produces no significant change in fuel pool reactivity.

3.8.2 Metamic Surveillance Program

Based on the first-of-a-kind nature of Metamic inserts, performance will be monitored by FPL's Metamic Surveillance Program. This program will conform with the requirements established in the Topical SER[13] issued for the use of Metamic in spent fuel pools.

The purpose of the Turkey Point Metamic surveillance program is to verify that, considering the combined environmental effects present in the SFP, the chemical, physical and neutronic properties of the Metamic inserts remain adequate to fulfill the intended neutron attenuation function.

As previously demonstrated[14], chemical, physical, and neutronic properties of Metamic remain unchanged in the boric acid environment of the SFP. Accelerated radiation testing demonstrated that boron-10 area density of Metamic remained unchanged. Except for surface corrosion and pitting, the chemical and physical properties of Metamic were unaffected following long term elevated temperature testing and accelerated corrosion testing. Therefore, the surveillance program ensures that an examination is performed to identify potential issues relative to corrosion of the Metamic insert.

The Turkey Point surveillance program will rely on visual examination of a sample of installed Metamic inserts, instead of using Metamic coupons as surrogates for the inserts. Compared to using coupons, the advantages to this approach are:

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[13] NRC Letter to Entergy, Arkansas Nuclear One, Units 1 and 2 – Review of Holtec Report RE: Use of Metamic in Fuel Pool Applications, dated June 17, 2003

[14] Qualification of Metamic for Spent-Fuel Storage Application, 1003137, Final Report, October 2001, EPRI, Palo Alto, CA

- The surface area available for examination is much larger than that from several coupons, which increases the likelihood of detecting surface related degradation if it occurs,
- If the manufacture process includes welding, the entirety of each weld is available for examination instead of inferring behavior from small coupon welds. This approach increases the likelihood of detecting weld-related degradation if it occurs, and
- The Metamic insert with the most severe service conditions may be examined directly, as opposed to inferring its condition from coupons in a different SFP cell.

The as-received condition of each insert will be determined during receipt inspection, and visible departures from a smooth uniform surface will be recorded before the insert is placed into service. As Metamic is a fully densified material, all of the mechanisms for boron loss require surface degradation. External surface examination is capable of detecting any condition that could lead to a loss of the B-10 neutron absorber. Therefore, other tests to determine boron content, including neutron transmission and/or chemical analyses (e.g., destructive examination), are not required to assess the condition of the Metamic inserts. Although details of the examination protocol are not final, it is currently planned that each examination will consist of a visual inspection performed in accordance with FPL nondestructive examination procedures.

Surface scratches caused by handling, insertion and removal are not a sign of surface degradation, and scratches due to removal of the Metamic insert for the inspection process will not have had time to develop an oxide coating. Therefore, surface scratches will be noted and recorded only if they also exhibit signs of corrosion. As discussed in Section 3.8.1 above, Metamic inserts can sustain substantial damage without adversely affecting their ability to control reactivity of the stored fuel array.

Examinations may be performed underwater in the SFP or in open air. Although the Metamic inserts are not expected to degrade, ample margin is available in design analyses to accommodate both uniform and localized degradation. The general acceptance criterion for the visual examination is for no through-wall corrosion or damage of the Metamic insert and general structural soundness of the insert (e.g., no cracks in base material or welds).

Metamic has been subjected to a three-year long experimental study (described in Attachment 9, Section 3) that simulated limiting environmental conditions in wet and dry storage. No anomalous behavior was observed in any of the tests. The performance during the tests indicates that examinations conducted within the 3-year period following installation would be too early to detect even the early stages of degradation. Therefore, the first surveillance examination will be performed in the fourth year of service. Subsequent examination intervals will be determined based on the results of this first inservice examination. Factors such as the as-found surface condition and SFP environment of the examined Metamic inserts will be taken into account.

4 Conclusion

This evaluation concludes that aspects of the Turkey Point design bases affected by the proposed changes remain bounding. The evaluation further concludes that the proposed technical specification changes do not involve a significant safety hazard and are acceptable for submittal to the NRC. Therefore, new storage patterns, use of Metamic for neutron absorption (in place of Boraflex), and replacement of the Boraflex surveillance program with a Metamic surveillance program are acceptable changes.

5 Determination of No Significant Hazards Consideration (10 CFR 50.92)

Attachment 2 provides the Determination of No Significant Hazards Consideration (NSHC) required by 10 CFR 50.92. The Determination of NSHC was written to conform with the guidance provided in NRC Regulatory Issue Summary RIS 2001-22.

6 Determination of Environmental Impact Consideration

Attachment 3 provides the Determination of Environmental Impact Consideration (EIC) required by 10 CFR 50.92. In summary, the Determination of EIC concludes that the proposed amendments do not require preparation of an Environmental Impact Statement or Environmental Assessment because the amendments meet the criteria for categorical exclusion.

Determination of No Significant Hazards Consideration

Description of amendment request: The proposed license amendments to Facility Operating License DPR-31 for Turkey Point Unit 3 and DPR-41 for Turkey Point Unit 4 will revise Technical Specifications to eliminate the current spent fuel pool storage patterns which rely on the Boraflex neutron absorbing material in the storage racks, and replace them with new spent fuel pool storage patterns. The new patterns use a combination of rod control cluster assemblies, borated aluminum (Metamic) rack inserts, and administrative controls that require dispersing higher reactivity fuel to achieve acceptable neutron multiplication.

Pursuant to 10 CFR 50.92, a determination may be made that a proposed license amendment 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; (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. Each consideration is discussed below.

1. Would operation of the facility in accordance with the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

No. Operation in accordance with proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated. The proposed amendments do not change or modify the fuel, fuel handling processes, spent fuel storage racks, number of fuel assemblies that may be stored in the spent fuel pool (SFP), decay heat generation rate, or the spent fuel pool cooling and cleanup system. The proposed amendment was evaluated for impact on the following previously evaluated events and accidents:

a. A fuel handling accident (FHA),
b. A cask drop accident,
c. A fuel mispositioning event,
d. A spent fuel pool boron dilution event,
e. A seismic event, and
f. A loss of spent fuel pool cooling event

The probability of a FHA is not significantly increased because implementation of the proposed amendment will employ the same equipment and process to handle fuel assemblies that is currently used. Also, tests have confirmed that the Metamic inserts can be installed and removed without damaging the host fuel assemblies. The FHA radiological consequences are not increased because the radiological source term of a single fuel assembly will remain unchanged. Therefore, the proposed amendments do not significantly increase the probability or consequences of a FHA.

The proposed amendments do not increase the probability of dropping a fuel transfer cask because they do not introduce any new heavy loads to the SFP and do not affect heavy load handling processes. Also, the insertion of Metamic rack inserts does not increase the consequences of the cask drop accident because the radiological source term of that accident is developed from a non-mechanistically derived quantity of damaged fuel stored in the spent fuel pool. Therefore, the proposed amendments do not significantly increase the probability or consequences of a cask drop accident.

Operation in accordance with the proposed amendment will not change the probability of a fuel mispositioning event because fuel movement will continue to be controlled by approved fuel handling procedures. These procedures continue to require identification of the initial and target locations for each fuel assembly that is moved. The consequences of a fuel mispositioning event are not changed because the reactivity analysis demonstrates that the same subcriticality criteria and requirements continue to be met for the worst-case fuel mispositioning event.

Operation in accordance with the proposed amendment will not change the probability of a boron dilution event because the systems and events that could affect spent fuel soluble boron are unchanged. The consequences of a boron dilution event are unchanged because the proposed amendment reduces the soluble boron requirement below the currently required value and the maximum possible water volume displaced by the inserts is an insignificant fraction of the total spent fuel pool water volume.

Operation in accordance with the proposed amendment will not change the probability of a seismic event, which is an Act of God. The consequences of a seismic event are not significantly increased because the forcing functions for seismic excitation are not increased and because the mass of storage racks with Metamic inserts is not appreciably increased. Seismic analyses demonstrate adequate stress levels in the storage racks when inserts are installed.

Operation in accordance with the proposed amendment will not change the probability of a loss of SFP cooling event because the systems and events that could affect SFP cooling are unchanged. The consequences are not significantly increased because there are no changes in the SFP heat load or SFP cooling systems, structures or components. Furthermore, conservative analyses indicate that the current design requirements and criteria continue to be met with the Metamic inserts installed.

Based on the above, it is concluded that the proposed amendments do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Would operation of the facility in accordance with the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

No. Operation in accordance with the proposed amendments do not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed amendments do not change or modify the fuel, fuel handling processes, spent fuel racks, number of fuel assemblies that may be stored in the pool, decay heat generation rate, or the spent fuel pool cooling and cleanup system. The effects of operating with the proposed amendment are listed below. The proposed amendments were evaluated for the potential of each effect to create the possibility of a new or different kind of accident:

a. addition of inserts to the spent fuel storage racks,
b. new storage patterns,
c. additional weight from the inserts,
d. insert movement above spent fuel, and
e. displacement of fuel pool water by the inserts,

Each insert will be placed between a fuel assembly and the storage cell wall, taking up some of the space available on two sides of the fuel assembly. Tests confirm that the insert can be installed and removed without damaging the fuel assembly. Analyses demonstrate that the presence of the inserts does not adversely affect spent fuel cooling, seismic capability, or subcriticality. The aluminum (alloy 6061) and boron carbide materials of construction have been shown to be compatible with nuclear fuel, storage racks and spent fuel pool environments, and generate no adverse material interactions. Therefore, placing the inserts into the spent fuel pool storage racks can not cause a new or different kind of accident.

Operation with the proposed fuel storage patterns will not create a new or different kind of accident because fuel movement will continue to be controlled by approved fuel handling procedures. These procedures continue to require identification of the initial and target locations for each fuel assembly that is moved. There are no changes in the criteria or design requirements pertaining to spent fuel safety, including subcriticality requirements, and analyses demonstrate that the proposed storage patterns meet these requirements and criteria with adequate margins. Therefore, the proposed storage patterns can not cause a new or different kind of accident.

Operation with the added weight of the Metamic inserts will not create a new or different accident. The net effect of the adding the maximum number of inserts is to add less than one percent to the weight of the loaded racks. Furthermore, the analyses of the racks with Metamic inserts installed demonstrate that the stress levels in the rack modules continue to be considerably less than allowable stress limits. Therefore, the added weight from the inserts can not cause a new or different kind of accident.

Operation with the insert allowed to move above spent fuel will not create a new or different kind of accident. The insert with its handling tool weighs considerably less than the weight of a single fuel assembly. Single fuel assemblies are routinely moved safely over spent fuel assemblies and the same level of safety in design and operation will be maintained when moving the inserts. Furthermore, the effect of a dropped insert to block the top of a storage cell has been evaluated in thermal-hydraulic analyses. Therefore, the movement of inserts can not cause a new or different kind of accident.

Whereas the installed rack inserts will displace a very small fraction of the fuel pool water volume and impose a very small reduction in operator response time to previously-evaluated SFP accidents, the reduction will not promote a new or different kind of accident. Also, displacement of water along two sides of a stored fuel assembly may have some local reduction in the peripheral cooling flow; however, this effect would be small compared to the flow induced through the fuel assembly and would in no way promote a new or different kind of accident.

Based on the above, it is concluded that operation with the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Would operation of the facility in accordance with the proposed amendment involve a significant reduction in a margin of safety?

No. Operation of the facility in accordance with the proposed amendment does not significantly reduce the margin of safety. The proposed change was evaluated for its effect on current margins of safety related to criticality, structural integrity, and spent fuel heat removal capability.

The margin of safety for subcriticality required by 10 CFR 50.68 (b) (4) is unchanged. New criticality analysis confirms that operation in accordance with the proposed amendment continues to meet the required subcriticality margins. Also, the margin of safety for SFP soluble boron concentration is actually increased because new analyses require less soluble boron than is currently required, and much less than the value required by Technical Specifications.

The structural evaluations for the racks and spent fuel pool with Metamic inserts installed show that the rack and spent fuel pool are unimpaired by loading combinations during seismic motion, and there is no adverse seismic-induced interaction between the rack and Metamic inserts.

The proposed change does not affect spent fuel heat generation or the spent fuel cooling systems. A conservative analysis indicates that the design basis requirements and criteria for spent fuel cooling continue to be met with the Metamic inserts in place, and displacing coolant. Thermal hydraulic analysis of the local effects of an installed rack insert blocking peripheral flow show a small increase in local water and fuel clad temperatures, but will remain within acceptable limits including no departure from nucleate boiling.

Based on these evaluations, operating the facility with the proposed amendment does not involve a significant reduction in any margin of safety.

Based on the determination made above, the proposed amendments involve no significant hazards consideration.

Determination of Environmental Impact Consideration

The proposed license amendments change requirements with respect to the use of a facility component located within the restricted area as defined in 10 CFR Part 20. As explained below, the proposed amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite, and no significant increase in individual or cumulative occupational radiation exposure. Additionally, FPL concluded that the proposed amendments involve no significant hazards consideration and therefore meet the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and that, pursuant to 10 CFR 51.22(b), an environmental impact statement or environmental assessment need not be prepared in connection with issuance of the amendments.

<u>No significant increase in the amounts or types of effluents released offsite</u>. Implementation of the proposed project involves two activities that could produce some form of radiological effluent: (1) spent fuel handling, and (2) insertion and removal of rack inserts. As many as several hundred spent fuel assemblies may be handled using established procedures, and several hundred Metamic rack inserts may also be installed at each unit. A modicum of solid low-level radioactive waste will be generated from the normal radiological waste generated from wipe-down of the above-water sections of the handling equipment during each fuel move, and protective clothing worn by personnel handling fuel. However, this quantity of waste is expected to be very small compared to that generated by a typical refueling outage. Otherwise, performing the fuel movement campaign and installing Metamic inserts is not expected to generate any gaseous or liquid effluent that would not otherwise be generated in the course of routine spent fuel pool operations over its lifetime. For example, some waste filters may be generated as a result of vacuuming several hundred fuel assemblies to verify identification numbers; however, that waste and those operations would have to transpire sometime in the future anyhow. Also, installation and use of Metamic inserts is not expected to generate a significant amount of radwaste. The installation may dislodge some crud/silt; however, the amount is expected to be no more than that created by a typical refueling. The necessity for resin replacement of spent fuel pool purification media is determined primarily by the requirement for water clarity, which is not affected by the Metamic inserts. There is no mechanistic means to increase the volume of solid radioactive wastes due to the addition of Metamic inserts. Therefore, implementation of the proposed amendments would not significantly increase the amounts or types of effluents released offsite.

No significant increase in individual or cumulative occupational radiation exposure. For each Turkey Point unit, implementation of the proposed amendments would involve a several-month campaign of fuel movements and insert installations with personnel in the respective fuel handling building. Aside from the modicum of individual and cumulative occupational radiation exposure resulting from that campaign, the proposed amendments would not result in any permanent effects that would increase occupational exposure. Fundamentally, the proposed fuel configurations and inserts do not change the inventory or radiological source term of the spent fuel. Attachment 9 (i.e., Table 8.1 of Attachment 9) computes an estimate of less than 7 person-Rem for the campaign (each unit). However, based on FPL's experience with routine fuel movement campaigns during refueling outages and the fuel movement campaigns experienced at St. Lucie (Boraflex Remedy), the cumulative exposure from the campaign is expected to be far less than 7 person-Rem. Therefore, implementation of the proposed amendments would not significantly increase the individual or cumulative occupational radiation exposures.

No significant hazards consideration. As discussed in Attachment 2, the proposed amendments do not constitute a significant hazards consideration.

Attachment 4

Technical Specifications Markup

Note Regarding Pagination:

The documents included in this attachment are controlled by the page-count indicated in the Table of Contents below. To preserve the integrity of the documents as suitable for use by the NRC Staff, the header and pagination notations (such as appears on this page) are not used on every page of Attachment 4.

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3/4 10-3	3	137	4	132
3/4 10-4	3	137	4	132
3/4 10-5	3	137	4	132
5-1	3	219	4	213
5-2	3	219	4	213
5-3	3	219	4	213
5-4	3	224	4	219
5-5	3	~~226~~	4	~~222~~
5-6	3	~~226~~	4	~~222~~
5-7	3	~~224~~	4	~~219~~
5-8	3		4	
5-9	3		4	
5-10	3		4	
5-11	3		4	
5-12	3		4	
↓				
5-19	3		4	
6-1	3	220	4	214
6-2	3	201	4	195
6-3	3	201	4	195
6-4	3	201	4	195
6-5	3	201	4	195
6-6	3	201	4	195
6-7	3	201	4	195
6-8	3	201	4	195
6-9	3	201	4	195
6-10	3	201	4	195
6-11	3	201	4	195
6-12	3	220	4	214
6-13	3	201	4	195
6-14	3	201	4	195
6-15	3	211	4	205
6-16	3	188	4	182
6-17	3	218	4	212
6-18	3	222	4	217
6-19	3	222	4	217
6-20	3	222	4	217
6-21	3	195	4	189
6-22	3	196	4	190
6-23	3	201	4	195
6-24	3	201	4	195
6-25	3	201	4	195
6-26	3	201	4	195
6-27	3	201	4	195

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

DESIGN FEATURES

3/4.9 REFUELING OPERATIONS

3/4.9.1 BORON CONCENTRATION

LIMITING CONDITION FOR OPERATION

3.9.1 The boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained uniform and sufficient to ensure that the more restrictive of the following reactivity conditions is met; either:

a. A K_{eff} of 0.95 or less, or

b. A boron concentration of greater than or equal to 1950 ppm.

APPLICABILITY: MODE 6.*

ACTION:

With the requirements of the above specification not satisfied, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and initiate and continue boration at greater than or equal to 16 gpm of a solution containing greater than or equal to 3.0 wt% (5245 ppm) boron or its equivalent until K_{eff} is reduced to less than or equal to 0.95 or the boron concentration is restored to greater than or equal to 1950 ppm, whichever is the more restrictive.

SURVEILLANCE REQUIREMENTS

4.9.1.1 The more restrictive of the above two reactivity conditions shall be determined prior to:

a. Removing or unbolting the reactor vessel head, and

b. Withdrawal of any full-length control rod in excess of 3 feet from its fully inserted position within the reactor vessel.

4.9.1.2 The boron concentration of the Reactor Coolant System and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

4.9.1.3 Valves isolating unborated water sources** shall be verified closed and secured in position by mechanical stops or by removal of air or electrical power at least once per 31 days.

~~4.9.1.4 The spent fuel pit boron concentration shall be determined at least once per 31 days.~~ Delete

* The reactor shall be maintained in MODE 6 whenever fuel is in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

** The primary water supply to the boric acid blender may be opened under administrative controls for makeup.

REFUELING OPERATIONS

3/4.9.14 SPENT FUEL STORAGE

LIMITING CONDITION FOR OPERATION

3.9.14 The following conditions shall apply to spent fuel storage:

~~a. The maximum enrichment loading for the fuel assemblies in the spent fuel racks shall not exceed 4.5 weight percent of U-235.~~

a. ~~b.~~ The minimum boron concentration in the Spent Fuel Pit shall be 1950 ppm.

Insert #1

~~c. Storage in Region II of the Spent Fuel Pit shall be further restricted by burnup and enrichment limits specified in Table 3.9-1.~~

APPLICABILITY: At all times when fuel is stored in the Spent Fuel Pit.

ACTION:

~~a. With either condition a, or c not satisfied, suspend movement of additional fuel assemblies into the Spent Fuel Pit and restore the spent fuel storage configuration to within the specified conditions.~~

a. ~~b.~~ With boron concentration in the Spent Fuel Pit less than 1950 ppm, suspend movement of spent fuel in the Spent Fuel Pit and initiate action to restore boron concentration to 1950 ppm or greater.

Insert #2

SURVEILLANCE REQUIREMENTS

4.9.14.1 The boron concentration of the Spent Fuel Pit shall be verified to be 1950 ppm or greater at least once per month.

Insert #2a

TABLE 3.9-1

SPENT FUEL BURNUP REQUIREMENTS FOR STORAGE IN REGION II OF THE SPENT FUEL PIT

Initial w/o	Discharge Burnup MWD/MTU
1.6	0.0
1.80	3706
2.00	7459
2.20	9724
2.40	12582
2.60	15338
2.63	15914
2.80	17994
3.00	20548
3.25	23312
3.40	25354
3.60	27605
3.88	30256
4.00	31804
4.20	33752
4.40	35599
4.50	36746

Linear interpolation between values may be used for intermediate points.

Delete

5.5 FUEL STORAGE

5.5.1 CRITICALITY

5.5.1.1 The spent fuel storage racks are designed ~~to provide safe subcritical storage of fuel assemblies by providing sufficient center-to-center spacing or a combination of spacing and poison~~ and shall be maintained with:

a. A k_{eff} ~~equivalent to~~ less than 1.0 when flooded with unborated water, which includes an ~~conservative~~ allowance for biases and uncertainties as described in UFSAR Chapter 9. ~~Appendix 14D.~~

b. A k_{eff} ~~equivalent to~~ less than or equal to 0.95 when flooded with water borated to 650 ppm ~~water~~, which includes an ~~conservative~~ allowance for biases and uncertainties as described in UFSAR Chapter 9 ~~Appendix 14D~~.

c. A nominal 10.6 inch center-to-center distance for Region I and 9.0 inch center-to-center distance for Region II for the two region spent fuel pool storage racks. A nominal 10.1 inch center-to-center distance in the east-west direction and a nominal 10.7 inch center-to-center distance in the north-south direction for the Region I cask area storage rack.

d. A ~~The~~ maximum enrichment loading for fuel assemblies of ~~is~~ 4.5 weight percent of U-235.

Insert #3

5.5.1.2 The racks for new fuel storage are designed to store fuel in a safe subcritical array and shall be maintained with:

a. A nominal 21 inch center-to-center spacing to assure k_{eff} equal to or less than 0.98 for optimum moderation conditions and equal to or less than 0.95 for fully flooded conditions.

b. Fuel assemblies placed in the New Fuel Storage Area shall contain no more than 4.5 weight percent of U-235.

and cooling time

acceptable

5.5.1.3 Credit for burnup is taken in determining placement locations for spent fuel in the two-region spent fuel racks. ~~Administrative controls are employed to evaluate the burnup of each spent fuel assembly stored in areas where credit for burnup is taken. The burnup of spent fuel is ascertained by careful analysis of burnup history, prior to placement into the storage locations. Procedures shall require an independent check of the analysis of suitability for storage. A complete record of such analysis is kept for the time period that the spent fuel assembly remains in storage onsite.~~

Insert #4

DRAINAGE

5.5.2 The spent fuel storage pit is designed and shall be maintained to prevent inadvertent draining of the pool below a level of 6 feet above the fuel assemblies in the storage racks.

CAPACITY

5.5.3 The spent fuel pool storage racks are designed and shall be maintained with a storage capacity limited to no more than 1404 fuel assemblies in two region storage racks, and the cask area storage rack is designed and shall be maintained with a storage capacity limited to no more than 131 fuel assemblies. The total spent fuel pool storage capacity is limited to no more than 1535 fuel assemblies.

5.6 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.6.1 The components identified in Table 5.6-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.6-1.

Move to new page 5-18

Insert #1:

b. The combination of initial enrichment, burnup, and cooling time of each fuel assembly stored in the Spent Fuel Pit shall be in accordance with Specification 5.5.1.

Insert #2:

b. With condition b not satisfied, suspend movement of additional fuel assemblies into the Spent Fuel Pit and restore the spent fuel storage configuration to within the specified conditions.

c. The provisions of Specification 3.0.3 are not applicable.

Insert #2a:

4.9.14.2 A representative sample of inservice Metamic inserts shall be visually inspected in accordance with the Metamic Surveillance Program described in UFSAR Section 16.2. The surveillance program ensures that the performance requirements of Metamic are met over the surveillance interval.

Insert #3:

e. No restriction on storage of fresh or irradiated fuel assemblies in the cask area storage rack.

f. Fresh or irradiated fuel assemblies not stored in the cask area storage rack shall be stored in accordance with Specification 5.5.1.3 or configurations that have been shown to comply with Specification 5.5.1.1a and 5.5.1.1b using the NRC approved methodology in UFSAR Chapter 9.

Insert #4:

Fresh or irradiated fuel assemblies shall be stored in compliance with the following:

a. Any 2x2 array of Region I storage cells containing fuel shall comply with the storage patterns in Figure 5.5-1 and the requirements of Table 5.5-1 and 5.5-2, as applicable. The reactivity rank of fuel assemblies in the 2x2 array (rank determined using Table 5.5-3) shall be equal to or less than that shown for the 2x2 array.

b. Any 2x2 array of Region II storage cells containing fuel shall:

   i. Comply with the storage patterns in Figure 5.5-2 and the requirements of Table 5.5-1 and 5.5-2, as applicable. The reactivity rank of fuel assemblies in the 2x2 array (rank determined using Table 5.5-3) shall be equal to or less than that shown for the 2x2 array,

   ii. Have the same directional orientation for Metamic inserts in a contiguous group of 2x2 arrays where Metamic inserts are required,

   iii. Comply with the requirements of 5.5.1.3.c for cells adjacent to Region I racks, and

   iv. Comply with the requirements of 5.5.1.3.d for cells adjacent to the spent fuel pit walls.

c. Any 2x2 array of Region II storage cells that interface with Region I shall comply with the rules of Figure 5.5-3. Arrays II-E and II-F may interface with Region I without special restriction.

Insert #4: (continued)

d. Any 2x2 array of Region II storage cells may adjoin a row of assemblies with a reactivity rank of II-2 (or lower) that is located in the outer row adjacent to the spent fuel pit wall. The outer row of reactivity rank II-2 (or lower) fuel assemblies need not contain any Metamic inserts or full length RCCAs, as long as the following additional requirements are met:

   i. Fuel is loaded to comply with the allowable storage patterns defined in Figure 5.5-4, and

   ii. Arrays II-E and II-F are loaded without any additional restriction on that 2x2 array. Arrays II-E and II-F do not have empty cells, Metamic inserts, or RCCAs that restrict the interface with the adjoining reactivity rank II-2 (or lower) fuel assemblies.

Insert the following tables and figures to follow page 5-6:

Table/Figure	# Pages
Table 5.5-1	3
Table 5.5-2	3
Table 5.5-3	1
Figure 5.5-1	1
Figure 5.5-2	1
Figure 5.5-3	1
Figure 5.5-4	1

These tables/figures are provided on the following pages.

Table 5.5-1

Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-1

Fuel Category	Blanketed Fuel Storage Curve Coefficients[1]							Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	2.5 w%	3.0 w%	3.3 w%	4.0 w%	4.5 w%
I-1[4]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
I-2	18.8602	-1.090486	0.266387	-0.00474496	-0.158563	0.00314739	-30.1637	0	10.17	16.60	20.20	27.83	32.62
								2.5	9.87	16.11	19.59	26.96	31.57
								5	9.60	15.67	19.06	26.19	30.62
								10	9.18	14.98	18.20	24.94	29.10
								15	8.92	14.52	17.62	24.08	28.04
								20	8.82	14.30	17.32	23.61	27.45
II-1	16.2639	-0.712257	0.175883	-0.00399237	-0.166686	0.00370969	-19.5118	0	16.70	22.87	26.40	34.15	39.25
								2.5	16.13	22.10	25.52	32.99	37.90
								5	15.62	21.43	24.74	31.96	36.70
								10	14.82	20.34	23.49	30.32	34.78
								15	14.27	19.61	22.65	29.23	33.50
								20	13.99	19.24	22.22	28.67	32.85
II-2	14.4600	-0.372732	0.132275	-0.00617104	-0.187813	0.00526411	-12.8293	0	20.99	27.20	30.83	39.05	44.69
								2.5	20.19	26.18	29.68	37.59	43.02
								5	19.48	25.28	28.67	36.32	41.57
								10	18.32	23.85	27.07	34.35	39.32
								15	17.50	22.89	26.04	33.11	37.94
								20	17.04	22.42	25.56	32.62	37.44
II-3	15.4624	-0.501267	-0.06553	0.00160009	-0.161078	0.00340497	-11.2483	0	24.27	30.63	34.32	42.58	48.18
								2.5	23.17	29.33	32.91	40.90	46.31
								5	22.19	28.18	31.65	39.41	44.65
								10	20.60	26.32	29.63	37.00	41.97
								15	19.53	25.05	28.25	35.36	40.13
								20	18.96	24.38	27.51	34.47	39.14

Table 5.5-1 (continued)

Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-1

Fuel Category	Blanketed Fuel Storage Curve Coefficients[1]							Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	2.5 w%	3.0 w%	3.3 w%	4.0 w%	4.5 w%
II-4	15.3172	-0.444842	-0.114363	0.00273060	-0.162664	0.00344467	-9.1868	0	26.33	32.76	36.52	44.96	50.73
								2.5	25.09	31.34	34.98	43.16	48.73
								5	24.00	30.08	33.61	41.55	46.96
								10	22.25	28.04	31.41	38.97	44.09
								15	21.06	26.67	29.92	37.20	42.14
								20	20.44	25.94	29.13	36.27	41.10
II-5	15.1701	-0.387768	-0.163521	0.00394514	-0.164014	0.00345174	-7.1273	0	28.37	34.89	38.71	47.35	53.29
								2.5	27.02	33.34	37.05	45.41	51.15
								5	25.82	31.97	35.57	43.69	49.26
								10	23.90	29.77	33.20	40.93	46.22
								15	22.60	28.28	31.59	39.05	44.14
								20	21.93	27.50	30.75	38.06	43.05
II-6	13.4516	-0.078364	-0.266734	0.00288411	-0.147006	0.00446530	-3.3460	0	29.79	36.30	40.19	49.21	55.60
								2.5	28.30	34.64	38.42	47.20	53.42
								5	26.97	33.17	36.87	45.45	51.53
								10	24.86	30.85	34.43	42.73	48.61
								15	23.44	29.35	32.88	41.05	46.85
								20	22.73	28.66	32.20	40.41	46.23
II-7	13.7900	-0.086680	-0.355570	0.00574698	-0.145745	0.00426994	-2.0705	0	31.86	38.52	42.49	51.70	58.23
								2.5	30.17	36.65	40.53	49.50	55.86
								5	28.67	35.02	38.81	47.58	53.80
								10	26.31	32.45	36.11	44.60	50.61
								15	24.76	30.80	34.41	42.76	48.67
								20	24.03	30.09	33.70	42.06	47.99

Table 5.5-1 (continued)

Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-1

Fuel Category	Blanketed Fuel Storage Curve Coefficients[1]							Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	2.5 w%	3.0 w%	3.3 w%	4.0 w%	4.5 w%
II-8	14.1212	-0.094016	-0.448138	0.00877894	-0.143511	0.00402944	-0.7808	0	33.93	40.74	44.80	54.20	60.86
								2.5	32.04	38.67	42.63	51.80	58.29
								5	30.37	36.86	40.74	49.71	56.06
								10	27.75	34.04	37.79	46.47	52.61
								15	26.07	32.25	35.94	44.47	50.51
								20	25.34	31.51	35.19	43.71	49.75

Notes

1. All relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Category, the assembly burnup must exceed the "minimum burnup" given in the table for the assembly "cooling time" and "initial enrichment." Alternatively, the specific minimum burnup required for each fuel assembly may be calculated from the following equation: $Bu = A \times En + B \times En^2 + C \times Ct + D \times Ct^2 + E \times Ct \times En + F \times Ct^2 \times En + G$. Only cooling times of 0, 2.5, 5, 10, 15 and 20 years may be used in this equation. Actual cooling time (Ct) is rounded down to the nearest value.
2. Nominal central zone U-235 enrichment: Axial blanket material is not considered when determining enrichment.
3. Cooling time in years.
4. Fresh unburned fuel up to 4.5 w% U-235 enrichment: No burnup is required.

Table 5.5-2

Non-Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-2

Fuel Category	Non-Blanketed Fuel Storage Curve Coefficients[1]							Non-Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	1.8 w%	2.5 w%	3.0 w%	3.5 w%	4.0 w%
I-1[4]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
I-2	18.1371	-0.944126	0.253120	-0.00553408	-0.151450	0.00334051	-29.3574	0	0.23	10.08	16.56	22.56	28.08
								2.5	0.18	9.79	16.08	21.90	27.25
								5	0.14	9.53	15.66	21.33	26.52
								10	0.08	9.11	14.99	20.40	25.34
								15	0.05	8.84	14.55	19.79	24.56
								20	0.03	8.70	14.33	19.48	24.16
II-1	11.9800	0.158287	0.237665	-0.00688305	-0.192273	0.00492032	-14.2029	0	7.87	16.74	23.16	29.67	36.25
								2.5	7.62	16.16	22.36	28.64	35.00
								5	7.38	15.66	21.66	27.75	33.91
								10	6.99	14.85	20.56	26.35	32.22
								15	6.69	14.31	19.85	25.46	31.16
								20	6.49	14.04	19.53	25.10	30.74
II-2	11.8419	0.287918	0.113820	-0.00527641	-0.175033	0.00507248	-9.9305	0	12.32	21.47	28.19	35.04	42.04
								2.5	11.84	20.71	27.22	33.87	40.67
								5	11.41	20.04	26.38	32.86	39.49
								10	10.69	18.98	25.07	31.30	37.68
								15	10.17	18.28	24.25	30.37	36.63
								20	9.83	17.96	23.94	30.06	36.32
II-3	12.6055	0.361578	-0.075193	0.00118870	-0.152297	0.00386780	-8.6212	0	15.24	25.15	32.45	39.93	47.59
								2.5	14.42	24.08	31.20	38.50	45.98
								5	13.70	23.14	30.11	37.25	44.58
								10	12.56	21.68	28.41	35.32	42.41
								15	11.83	20.76	27.35	34.12	41.07
								20	11.51	20.38	26.92	33.65	40.56

Table 5.5-2 (continued)

Non-Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-2

Fuel Category	Non-Blanketed Fuel Storage Curve Coefficients[1]							Non-Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	1.8 w%	2.5 w%	3.0 w%	3.5 w%	4.0 w%
II-4	12.6130	0.436168	-0.128105	0.00275389	-0.151579	0.00377707	-7.0392	0	17.08	27.22	34.73	42.45	50.39
								2.5	16.13	26.03	33.36	40.90	48.67
								5	15.31	24.99	32.16	39.56	47.17
								10	14.02	23.37	30.31	37.46	44.83
								15	13.21	22.36	29.15	36.16	43.39
								20	12.88	21.96	28.70	35.67	42.85
II-5	12.6086	0.517311	-0.185177	0.00442008	-0.150482	0.00367344	-5.3438	0	19.03	29.41	37.14	45.12	53.37
								2.5	17.96	28.09	35.64	43.45	51.52
								5	17.02	26.94	34.34	42.00	49.91
								10	15.57	25.16	32.32	39.73	47.41
								15	14.67	24.05	31.06	38.33	45.86
								20	14.32	23.62	30.58	37.80	45.27
II-6	17.1055	-0.116940	0.024104	-0.00410005	-0.262366	0.00761230	-10.7361	0	19.67	31.30	39.53	47.70	55.81
								2.5	18.61	29.81	37.74	45.61	53.42
								5	17.67	28.51	36.18	43.79	51.35
								10	16.15	26.47	33.77	41.01	48.20
								15	15.11	25.18	32.30	39.36	46.36
								20	14.55	24.63	31.76	38.83	45.85
II-7	17.5099	-0.130912	-0.143634	0.00199657	-0.235656	0.00625103	-9.1041	0	21.99	33.85	42.25	50.58	58.84
								2.5	20.65	32.13	40.25	48.31	56.29
								5	19.48	30.63	38.51	46.33	54.08
								10	17.64	28.29	35.82	43.28	50.68
								15	16.45	26.83	34.16	41.42	48.62
								20	15.93	26.25	33.54	40.76	47.92

Table 5.5-2 (continued)

Non-Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-2

Fuel Category	Non-Blanketed Fuel Storage Curve Coefficients[1]							Non-Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	1.8 w%	2.5 w%	3.0 w%	3.5 w%	4.0 w%
II-8	17.9109	-0.143928	-0.308137	0.00796481	-0.209912	0.00492410	-7.4704	0	24.30	36.41	44.97	53.45	61.87
								2.5	22.69	34.45	42.76	51.01	59.17
								5	21.29	32.75	40.85	48.87	56.82
								10	19.13	30.11	37.86	45.55	53.16
								15	17.80	28.48	36.01	43.48	50.88
								20	17.31	27.86	35.30	42.68	49.98

Notes

1. All relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Category, the assembly burnup must exceed the "minimum burnup" given in the table for the assembly "cooling time" and "initial enrichment." Alternatively, the specific minimum burnup required for each fuel assembly may be calculated from the following equation: $Bu = A \times En + B \times En^2 + C \times Ct + D \times Ct^2 + E \times Ct \times En + F \times Ct^2 \times En + G$. Only cooling times of 0, 2.5, 5, 10, 15 and 20 years may be used in this equation. Actual cooling time (Ct) is rounded down to the nearest value.

2. Nominal U-235 enrichment.

3. Cooling time in years.

4. Fresh unirradiated fuel up to 4.5 w% U-235 enrichment: No burnup is required.

Table 5.5-3

Fuel Categories Ranked by Reactivity[1]

Fuel Category	
Region I	Region II
I-1	II-1
I-2	II-2
	II-3
	II-4
	II-5
	II-6
	II-7
	II-8

Notes

1. Reactivity Rank: Fuel Category is ranked in decreasing order of reactivity, e.g. II-2 is less reactive than II-1, etc.

FIGURE 5.5-1

ALLOWABLE REGION I STORAGE ARRAYS

DEFINITION[1,4]

ILLUSTRATION[1,2,3,4]

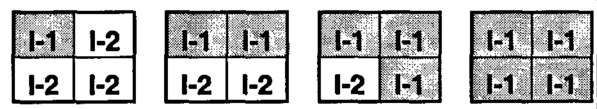
Array I-A
Checkerboard pattern of Category I-1 assemblies and empty (water filled) cells.

I-1	E
E	I-1

Array I-B
Category I-2 assembly in every cell.

I-2	I-2
I-2	I-2

Array I-C
Category I-1 assemblies and Category I-2 assemblies: Each Category I-1 assembly shall have a full length RCCA in the assembly. The number of Category I-1 assemblies with RCCAs in the assemblies is unrestricted.



Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. Attributes for each 2x2 array are as stated in the definition. Diagram is for illustrative purposes only.

FIGURE 5.5-2

ALLOWABLE REGION II STORAGE ARRAYS

DEFINITION[1,4] | **ILLUSTRATION[1,2,3,4]**

Array II-A
Category II-1 assembly in three of every four cells: One of every four cells is empty (water-filled).

II-1	II-1
II-1	E

Array II-B
Category II-2 assembly in every cell: Two of every four cells contain a Metamic insert (or full length RCCA in the assembly).

II-2	II-2
II-2	II-2

II-2	II-2
II-2	II-2

II-2	II-2
II-2	II-2

Array II-C
Checkerboard pattern of Category II-3 and II-5 assemblies: One of every four cells contains a Metamic insert (or full length RCCA in the assembly). Metamic inserts (or RCCAs) may be in either II-3 or II-5 cells.

II-3	II-5
II-5	II-3

II-5	II-3
II-3	II-5

Array II-D
Category II-4 assembly in every cell: One of every four cells contains a Metamic insert (or full length RCCA in the assembly).

II-4	II-4
II-4	II-4

Array II-E
Checkerboard pattern of Category II-6 and II-8 assemblies.

II-8	II-6
II-6	II-8

Array II-F
Category II-7 assembly in every cell.

II-7	II-7
II-7	II-7

Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate either a Metamic insert in the cell or the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. Attributes for each 2x2 array are as stated in the definition. Diagram is for illustrative purposes only.

FIGURE 5.5-3

ALLOWABLE INTERFACES BETWEEN REGION II – REGION I ARRAYS

DEFINITION[1,4]

ILLUSTRATION[1,2,3,4,5]

For Array II-A, the empty cell shall be in the row adjacent to the Region I Rack.

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2

II-1	E	II-1	E
II-1	II-1	II-1	II-1

Array II-A

For Array II-B, the reactivity rank of assemblies adjacent to the Region I rack shall be reduced from a rank of II-2 to a reactivity rank of II-4 or lower. The Array II-B pattern shall have the required Metamic insert (or full length RCCA in the assembly) placed in the row adjacent to the Region I rack.

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2

II-4	II-4	II-4	II-4
II-2	II-2	II-2	II-2

Array II-B

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2

II-4	II-4	II-4	II-4
II-2	II-2	II-2	II-2

Array II-B

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2

II-4	II-4	II-4	II-4
II-2	II-2	II-2	II-2

Array II-B

For Arrays II-C and II-D, the Metamic insert (or full length RCCA in the assembly) shall be placed in the row adjacent to the Region I rack.

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2

II-3	II-5	II-3	II-5
II-5	II-3	II-5	II-3

Array II-C

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2

II-5	II-3	II-5	II-3
II-3	II-5	II-3	II-5

Array II-C

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2

II-4	II-4	II-4	II-4
II-4	II-4	II-4	II-4

Array II-D

Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate either a Metamic insert in the cell or the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. Attributes for each 2x2 array are as stated in the definition. Diagram is for illustrative purposes only.
5. Region I Array I-2 is depicted as the example; however, any Region I array is equally representative.

FIGURE 5.5-4

ALLOWABLE REGION II STORAGE ADJACENT TO SPENT FUEL PIT WALLS

DEFINITION[1,4] — **ILLUSTRATION**[1,2,3,4]

An assembly of rank II-2 placed in the peripheral row of a Region II storage rack shall not be adjacent to a Region I storage rack.

Spent Fuel Pit Wall

II-2	II-2	II-2	II-3
II-3	II-5	II-3	II-5
II-5	II-3	II-5	II-3

Region 2 (Array II-C)

I-2	I-2	I-2	I-2	I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2	I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2	I-2	I-2	I-2	I-2

Region I (Array I-B)

For Array II-A, the empty cell in the 2x2 II-A array shall be adjacent to the peripheral row that contains the category II-2 assembly(s). For Array II-A only, the peripheral row may contain category II-1 assemblies as the outer two rows will comply with Array II-A requirements.

Spent Fuel Pit Wall

II-2	II-2	II-2	II-2
II-1	E	II-1	E
II-1	II-1	II-1	II-1

Array II-A

II-1	II-1	II-1	II-1
II-1	E	II-1	E
II-1	II-1	II-1	II-1

Array II-A

For Array II-B, the Metamic insert (or full length RCCA in the assembly) shall be adjacent to the peripheral row that contains the category II-2 assembly(s).

Spent Fuel Pit Wall

II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2

Array II-B

II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2

Array II-B

II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2

Array II-B

For Arrays II-C and II-D, the Metamic insert (or full length RCCA in the assembly) shall be adjacent to the peripheral row that contains the category II-2 assembly(s).

Spent Fuel Pit Wall

II-2	II-2	II-2	II-2
II-5	II-3	II-5	II-3
II-3	II-5	II-3	II-5

Array II-C

II-2	II-2	II-2	II-2
II-5	II-3	II-5	II-3
II-3	II-5	II-3	II-5

Array II-C

II-2	II-2	II-2	II-2
II-4	II-4	II-4	II-4
II-4	II-4	II-4	II-4

Array II-D

Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate either a Metamic insert in the cell or the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. Attributes for each 2x2 array are as stated in the definition. Diagram is for illustrative purposes only.

TABLE 5.6-1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	200 heatup cycles at ≤ 100°F/h and 200 cooldown cycles at ≤ 100°F/h.	Heatup cycle - T_{avg} from ≤ 200°F to ≥ 550°F. Cooldown cycle - T_{avg} from ≥ 550°F to ≤ 200°F.
	200 pressurizer cooldown cycles at ≤ 200°F/h.	Pressurizer cooldown cycle temperatures from ≥ 650°F to ≤ 200°F.
	80 loss of load cycles, without immediate Turbine or Reactor trip.	≥ 15% of RATED THERMAL POWER to 0% of RATED THERMAL POWER.
	40 cycles of loss-of-offsite A.C. electrical power.	Loss-of-offsite A.C. electrical ESF Electrical System.
	80 cycles of loss of flow in one reactor coolant loop.	Loss of only one reactor coolant pump.
	400 Reactor trip cycles.	100% to 0% of RATED THERMAL POWER.
	150 leak tests.	Pressurized to ≥ 2435 psig.
	5 hydrostatic pressure tests.	Pressurized to ≥ 3100 psig.
Secondary Coolant System	6 loss of secondary pressure	Loss of Secondary pressure
	50 leak tests	Pressurized to ≥ 1085 psig
	35 hydrostatic pressure tests.	Pressurized to ≥ 1356 psig.

Attachment 5

Retyped Technical Specifications

Note Regarding Pagination:

The documents included in this enclosure are controlled by the page-count indicated in the Table of Contents below. To preserve the integrity of the documents as suitable for use by the NRC Staff, the header and pagination notations (such as appears on this page) are not used on every page of Attachment 5.

Table of Contents

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

DESIGN FEATURES

3/4.9 REFUELING OPERATIONS

3/4.9.1 BORON CONCENTRATION

LIMITING CONDITION FOR OPERATION

3.9.1 The boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained uniform and sufficient to ensure that the more restrictive of the following reactivity conditions is met; either:

a. A K_{eff} of 0.95 or less, or

b. A boron concentration of greater than or equal to 1950 ppm.

APPLICABILITY: MODE 6.*

ACTION:

With the requirements of the above specification not satisfied, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and initiate and continue boration at greater than or equal to 16 gpm of a solution containing greater than or equal to 3.0 wt% (5245 ppm) boron or its equivalent until K_{eff} is reduced to less than or equal to 0.95 or the boron concentration is restored to greater than or equal to 1950 ppm, whichever is the more restrictive.

SURVEILLANCE REQUIREMENTS

4.9.1.1 The more restrictive of the above two reactivity conditions shall be determined prior to:

a. Removing or unbolting the reactor vessel head, and

b. Withdrawal of any full-length control rod in excess of 3 feet from its fully inserted position within the reactor vessel.

4.9.1.2 The boron concentration of the Reactor Coolant System and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

4.9.1.3 Valves isolating unborated water sources** shall be verified closed and secured in position by mechanical stops or by removal of air or electrical power at least once per 31 days.

* The reactor shall be maintained in MODE 6 whenever fuel is in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

** The primary water supply to the boric acid blender may be opened under administrative controls for makeup.

3/4.9.14 SPENT FUEL STORAGE

LIMITING CONDITION FOR OPERATION

3.9.14 The following conditions shall apply to spent fuel storage:

a. The minimum boron concentration in the Spent Fuel Pit shall be 1950 ppm.

b. The combination of initial enrichment, burnup, and cooling time of each fuel assembly stored in the Spent Fuel Pit shall be in accordance with Specification 5.5.1.

APPLICABILITY: At all times when fuel is stored in the Spent Fuel Pit.

ACTION:

a. With boron concentration in the Spent Fuel Pit less than 1950 ppm, suspend movement of spent fuel in the Spent Fuel Pit and initiate action to restore boron concentration to 1950 ppm or greater.

b. With condition b not satisfied, suspend movement of additional fuel assemblies into the Spent Fuel Pit and restore the spent fuel storage configuration to within the specified conditions.

c. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.14.1 The boron concentration of the Spent Fuel Pit shall be verified to be 1950 ppm or greater at least once per month.

4.9.14.2 A representative sample of inservice Metamic inserts shall be visually inspected in accordance with the Metamic Surveillance Program described in UFSAR Section 16.2. The surveillance program ensures that the performance requirements of Metamic are met over the surveillance interval.

5.5 FUEL STORAGE

5.5.1 CRITICALITY

5.5.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. A k_{eff} less than 1.0 when flooded with unborated water, which includes an allowance for biases and uncertainties as described in UFSAR Chapter 9.

b. A k_{eff} less than or equal to 0.95 when flooded with water borated to 650 ppm, which includes an allowance for biases and uncertainties as described in UFSAR Chapter 9.

c. A nominal 10.6 inch center-to-center distance for Region I and 9.0 inch center-to-center distance for Region II for the two region spent fuel pool storage racks. A nominal 10.1 inch center-to-center distance in the east-west direction and a nominal 10.7 inch center-to-center distance in the north-south direction for the Region I cask area storage rack.

d. A maximum enrichment loading for fuel assemblies of 4.5 weight percent of U-235.

e. No restriction on storage of fresh or irradiated fuel assemblies in the cask area storage rack.

f. Fresh or irradiated fuel assemblies not stored in the cask area storage rack shall be stored in accordance with Specification 5.5.1.3 or configurations that have been shown to comply with Specification 5.5.1.1a and 5.5.1.1b using the NRC approved methodology in UFSAR Chapter 9.

5.5.1.2 The racks for new fuel storage are designed to store fuel in a safe subcritical array and shall be maintained with:

a. A nominal 21 inch center-to-center spacing to assure k_{eff} equal to or less than 0.98 for optimum moderation conditions and equal to or less than 0.95 for fully flooded conditions.

b. Fuel assemblies placed in the New Fuel Storage Area shall contain no more than 4.5 weight percent of U-235.

5.5.1.3 Credit for burnup and cooling time is taken in determining acceptable placement locations for spent fuel in the two-region spent fuel racks. Fresh or irradiated fuel assemblies shall be stored in compliance with the following:

a. Any 2x2 array of Region I storage cells containing fuel shall comply with the storage patterns in Figure 5.5-1 and the requirements of Table 5.5-1 and 5.5-2, as applicable. The reactivity rank of fuel assemblies in the 2x2 array (rank determined using Table 5.5-3) shall be equal to or less than that shown for the 2x2 array.

b. Any 2x2 array of Region II storage cells containing fuel shall:

i. Comply with the storage patterns in Figure 5.5-2 and the requirements of Table 5.5-1 and 5.5-2, as applicable. The reactivity rank of fuel assemblies in the 2x2 array (rank determined using Table 5.5-3) shall be equal to or less than that shown for the 2x2 array,

ii. Have the same directional orientation for Metamic inserts in a contiguous group of 2x2 arrays where Metamic inserts are required,

iii. Comply with the requirements of 5.5.1.3.c for cells adjacent to Region I racks, and

iv. Comply with the requirements of 5.5.1.3.d for cells adjacent to the spent fuel pit walls.

c. Any 2x2 array of Region II storage cells that interface with Region I shall comply with the rules of Figure 5.5-3. Arrays II-E and II-F may interface with Region I without special restriction.

d. Any 2x2 array of Region II storage cells may adjoin a row of assemblies with a reactivity rank of II-2 (or lower) that is located in the outer row adjacent to the spent fuel pit wall. The outer row of reactivity rank II-2 (or lower) fuel assemblies need not contain any Metamic inserts or full length RCCAs, as long as the following additional requirements are met:

i. Fuel is loaded to comply with the allowable storage patterns defined in Figure 5.5-4, and

ii. Arrays II-E and II-F are loaded without any additional restriction on that 2x2 array. Arrays II-E and II-F do not have empty cells, Metamic inserts, or RCCAs that restrict the interface with the adjoining reactivity rank II-2 (or lower) fuel assemblies.

DRAINAGE

5.5.2 The spent fuel storage pit is designed and shall be maintained to prevent inadvertent draining of the pool below a level of 6 feet above the fuel assemblies in the storage racks.

CAPACITY

5.5.3 The spent fuel pool storage racks are designed and shall be maintained with a storage capacity limited to no more than 1404 fuel assemblies in two region storage racks, and the cask area storage rack is designed and shall be maintained with a storage capacity limited to no more than 131 fuel assemblies. The total spent fuel pool storage capacity is limited to no more than 1535 fuel assemblies.

Table 5.5-1

Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-1

Fuel Category	Blanketed Fuel Storage Curve Coefficients[1]							Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	2.5 w%	3.0 w%	3.3 w%	4.0 w%	4.5 w%
I-1[4]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
I-2	18.8602	-1.090486	0.266387	-0.00474496	-0.158563	0.00314739	-30.1637	0	10.17	16.60	20.20	27.83	32.62
								2.5	9.87	16.11	19.59	26.96	31.57
								5	9.60	15.67	19.06	26.19	30.62
								10	9.18	14.98	18.20	24.94	29.10
								15	8.92	14.52	17.62	24.08	28.04
								20	8.82	14.30	17.32	23.61	27.45
II-1	16.2639	-0.712257	0.175883	-0.00399237	-0.166686	0.00370969	-19.5118	0	16.70	22.87	26.40	34.15	39.25
								2.5	16.13	22.10	25.52	32.99	37.90
								5	15.62	21.43	24.74	31.96	36.70
								10	14.82	20.34	23.49	30.32	34.78
								15	14.27	19.61	22.65	29.23	33.50
								20	13.99	19.24	22.22	28.67	32.85
II-2	14.4600	-0.372732	0.132275	-0.00617104	-0.187813	0.00526411	-12.8293	0	20.99	27.20	30.83	39.05	44.69
								2.5	20.19	26.18	29.68	37.59	43.02
								5	19.48	25.28	28.67	36.32	41.57
								10	18.32	23.85	27.07	34.35	39.32
								15	17.50	22.89	26.04	33.11	37.94
								20	17.04	22.42	25.56	32.62	37.44
II-3	15.4624	-0.501267	-0.06553	0.00160009	-0.161078	0.00340497	-11.2483	0	24.27	30.63	34.32	42.58	48.18
								2.5	23.17	29.33	32.91	40.90	46.31
								5	22.19	28.18	31.65	39.41	44.65
								10	20.60	26.32	29.63	37.00	41.97
								15	19.53	25.05	28.25	35.36	40.13
								20	18.96	24.38	27.51	34.47	39.14

Table 5.5-1 (continued)

Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-1

Fuel Category	Blanketed Fuel Storage Curve Coefficients[1]							Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	2.5 w%	3.0 w%	3.3 w%	4.0 w%	4.5 w%
II-4	15.3172	-0.444842	-0.114363	0.00273060	-0.162664	0.00344467	-9.1868	0	26.33	32.76	36.52	44.96	50.73
								2.5	25.09	31.34	34.98	43.16	48.73
								5	24.00	30.08	33.61	41.55	46.96
								10	22.25	28.04	31.41	38.97	44.09
								15	21.06	26.67	29.92	37.20	42.14
								20	20.44	25.94	29.13	36.27	41.10
II-5	15.1701	-0.387768	-0.163521	0.00394514	-0.164014	0.00345174	-7.1273	0	28.37	34.89	38.71	47.35	53.29
								2.5	27.02	33.34	37.05	45.41	51.15
								5	25.82	31.97	35.57	43.69	49.26
								10	23.90	29.77	33.20	40.93	46.22
								15	22.60	28.28	31.59	39.05	44.14
								20	21.93	27.50	30.75	38.06	43.05
II-6	13.4516	-0.078364	-0.266734	0.00288411	-0.147006	0.00446530	-3.3460	0	29.79	36.30	40.19	49.21	55.60
								2.5	28.30	34.64	38.42	47.20	53.42
								5	26.97	33.17	36.87	45.45	51.53
								10	24.86	30.85	34.43	42.73	48.61
								15	23.44	29.35	32.88	41.05	46.85
								20	22.73	28.66	32.20	40.41	46.23
II-7	13.7900	-0.086680	-0.355570	0.00574698	-0.145745	0.00426994	-2.0705	0	31.86	38.52	42.49	51.70	58.23
								2.5	30.17	36.65	40.53	49.50	55.86
								5	28.67	35.02	38.81	47.58	53.80
								10	26.31	32.45	36.11	44.60	50.61
								15	24.76	30.80	34.41	42.76	48.67
								20	24.03	30.09	33.70	42.06	47.99

Table 5.5-1 (continued)

Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-1

Fuel Category	Blanketed Fuel Storage Curve Coefficients[1]							Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	2.5 w%	3.0 w%	3.3 w%	4.0 w%	4.5 w%
II-8	14.1212	-0.094016	-0.448138	0.00877894	-0.143511	0.00402944	-0.7808	0	33.93	40.74	44.80	54.20	60.86
								2.5	32.04	38.67	42.63	51.80	58.29
								5	30.37	36.86	40.74	49.71	56.06
								10	27.75	34.04	37.79	46.47	52.61
								15	26.07	32.25	35.94	44.47	50.51
								20	25.34	31.51	35.19	43.71	49.75

Notes

1. All relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Category, the assembly burnup must exceed the "minimum burnup" given in the table for the assembly "cooling time" and "initial enrichment." Alternatively, the specific minimum burnup required for each fuel assembly may be calculated from the following equation: $Bu = A \times En + B \times En^2 + C \times Ct + D \times Ct^2 + E \times Ct \times En + F \times Ct^2 \times En + G$. Only cooling times of 0, 2.5, 5, 10, 15 and 20 years may be used in this equation. Actual cooling time (Ct) is rounded down to the nearest value.
2. Nominal central zone U-235 enrichment: Axial blanket material is not considered when determining enrichment.
3. Cooling time in years.
4. Fresh unburned fuel up to 4.5 w% U-235 enrichment: No burnup is required.

Table 5.5-2

Non-Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-2

Fuel Category	Non-Blanketed Fuel Storage Curve Coefficients[1]							Non-Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	1.8 w%	2.5 w%	3.0 w%	3.5 w%	4.0 w%
I-1[4]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
I-2	18.1371	-0.944126	0.253120	-0.00553408	-0.151450	0.00334051	-29.3574	0	0.23	10.08	16.56	22.56	28.08
								2.5	0.18	9.79	16.08	21.90	27.25
								5	0.14	9.53	15.66	21.33	26.52
								10	0.08	9.11	14.99	20.40	25.34
								15	0.05	8.84	14.55	19.79	24.56
								20	0.03	8.70	14.33	19.48	24.16
II-1	11.9800	0.158287	0.237665	-0.00688305	-0.192273	0.00492032	-14.2029	0	7.87	16.74	23.16	29.67	36.25
								2.5	7.62	16.16	22.36	28.64	35.00
								5	7.38	15.66	21.66	27.75	33.91
								10	6.99	14.85	20.56	26.35	32.22
								15	6.69	14.31	19.85	25.46	31.16
								20	6.49	14.04	19.53	25.10	30.74
II-2	11.8419	0.287918	0.113820	-0.00527641	-0.175033	0.00507248	-9.9305	0	12.32	21.47	28.19	35.04	42.04
								2.5	11.84	20.71	27.22	33.87	40.67
								5	11.41	20.04	26.38	32.86	39.49
								10	10.69	18.98	25.07	31.30	37.68
								15	10.17	18.28	24.25	30.37	36.63
								20	9.83	17.96	23.94	30.06	36.32
II-3	12.6055	0.361578	-0.075193	0.00118870	-0.152297	0.00386780	-8.6212	0	15.24	25.15	32.45	39.93	47.59
								2.5	14.42	24.08	31.20	38.50	45.98
								5	13.70	23.14	30.11	37.25	44.58
								10	12.56	21.68	28.41	35.32	42.41
								15	11.83	20.76	27.35	34.12	41.07
								20	11.51	20.38	26.92	33.65	40.56

Table 5.5-2 (continued)

Non-Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-2

Fuel Category	Non-Blanketed Fuel Storage Curve Coefficients[1]							Non-Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	1.8 w%	2.5 w%	3.0 w%	3.5 w%	4.0 w%
II-4	12.6130	0.436168	-0.128105	0.00275389	-0.151579	0.00377707	-7.0392	0	17.08	27.22	34.73	42.45	50.39
								2.5	16.13	26.03	33.36	40.90	48.67
								5	15.31	24.99	32.16	39.56	47.17
								10	14.02	23.37	30.31	37.46	44.83
								15	13.21	22.36	29.15	36.16	43.39
								20	12.88	21.96	28.70	35.67	42.85
II-5	12.6086	0.517311	-0.185177	0.00442008	-0.150482	0.00367344	-5.3438	0	19.03	29.41	37.14	45.12	53.37
								2.5	17.96	28.09	35.64	43.45	51.52
								5	17.02	26.94	34.34	42.00	49.91
								10	15.57	25.16	32.32	39.73	47.41
								15	14.67	24.05	31.06	38.33	45.86
								20	14.32	23.62	30.58	37.80	45.27
II-6	17.1055	-0.116940	0.024104	-0.00410005	-0.262366	0.00761230	-10.7361	0	19.67	31.30	39.53	47.70	55.81
								2.5	18.61	29.81	37.74	45.61	53.42
								5	17.67	28.51	36.18	43.79	51.35
								10	16.15	26.47	33.77	41.01	48.20
								15	15.11	25.18	32.30	39.36	46.36
								20	14.55	24.63	31.76	38.83	45.85
II-7	17.5099	-0.130912	-0.143634	0.00199657	-0.235656	0.00625103	-9.1041	0	21.99	33.85	42.25	50.58	58.84
								2.5	20.65	32.13	40.25	48.31	56.29
								5	19.48	30.63	38.51	46.33	54.08
								10	17.64	28.29	35.82	43.28	50.68
								15	16.45	26.83	34.16	41.42	48.62
								20	15.93	26.25	33.54	40.76	47.92

Table 5.5-2 (continued)

Non-Blanketed Fuel - Minimum Required Fuel Assembly Burnup (Bu) as a Function of Enrichment (En) and Cooling Time (Ct)

See note 1 for use of Table 5.5-2

Fuel Category	Non-Blanketed Fuel Storage Curve Coefficients[1]							Non-Blanketed Fuel Minimum Burnup[1] (GWd/MTU) for Initial Enrichment[2]					
	A	B	C	D	E	F	G	Cooling Time[3]	1.8 w%	2.5 w%	3.0 w%	3.5 w%	4.0 w%
II-8	17.9109	-0.143928	-0.308137	0.00796481	-0.209912	0.00492410	-7.4704	0	24.30	36.41	44.97	53.45	61.87
								2.5	22.69	34.45	42.76	51.01	59.17
								5	21.29	32.75	40.85	48.87	56.82
								10	19.13	30.11	37.86	45.55	53.16
								15	17.80	28.48	36.01	43.48	50.88
								20	17.31	27.86	35.30	42.68	49.98

Notes

1. All relevant uncertainties are explicitly included in the criticality analysis. For instance, no additional allowance for burnup uncertainty is required. For a fuel assembly to meet the requirements of a Fuel Category, the assembly burnup must exceed the "minimum burnup" given in the table for the assembly "cooling time" and "initial enrichment." Alternatively, the specific minimum burnup required for each fuel assembly may be calculated from the following equation: $Bu = A \times En + B \times En^2 + C \times Ct + D \times Ct^2 + E \times Ct \times En + F \times Ct^2 \times En + G$. Only cooling times of 0, 2.5, 5, 10, 15 and 20 years may be used in this equation. Actual cooling time (Ct) is rounded down to the nearest value.

2. Nominal U-235 enrichment.

3. Cooling time in years.

4. Fresh unirradiated fuel up to 4.5 w% U-235 enrichment: No burnup is required.

Table 5.5-3

Fuel Categories Ranked by Reactivity[1]

Fuel Category	
Region I	Region II
I-1	II-1
I-2	II-2
	II-3
	II-4
	II-5
	II-6
	II-7
	II-8

Notes

1. Reactivity Rank: Fuel Category is ranked in decreasing order of reactivity, e.g. II-2 is less reactive than II-1, etc.

FIGURE 5.5-1

ALLOWABLE REGION I STORAGE ARRAYS

DEFINITION[1,4] | **ILLUSTRATION[1,2,3,4]**

Array I-A
Checkerboard pattern of Category I-1 assemblies and empty (water filled) cells.

I-1	E
E	I-1

Array I-B
Category I-2 assembly in every cell.

I-2	I-2
I-2	I-2

Array I-C
Category I-1 assemblies and Category I-2 assemblies: Each Category I-1 assembly shall have a full length RCCA in the assembly. The number of Category I-1 assemblies with RCCAs in the assemblies is unrestricted.

I-1	I-2
I-2	I-2

I-1	I-1
I-2	I-2

I-1	I-1
I-2	I-1

I-1	I-1
I-1	I-1

Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. *Attributes for each 2x2 array are as stated in the definition. Diagram is for illustrative purposes only.*

FIGURE 5.5-2

ALLOWABLE REGION II STORAGE ARRAYS

DEFINITION[1,4]	ILLUSTRATION[1,2,3,4]
Array II-A Category II-1 assembly in three of every four cells: One of every four cells is empty (water-filled).	II-1 II-1 / II-1 E
Array II-B Category II-2 assembly in every cell: Two of every four cells contain a Metamic insert (or full length RCCA in the assembly).	II-2 II-2 / II-2 II-2 ; II-2 II-2 / II-2 II-2 ; II-2 II-2 / II-2 II-2
Array II-C Checkerboard pattern of Category II-3 and II-5 assemblies: One of every four cells contains a Metamic insert (or full length RCCA in the assembly). Metamic inserts (or RCCAs) may be in either II-3 or II-5 cells.	II-3 II-5 / II-5 II-3 ; II-5 II-3 / II-3 II-5
Array II-D Category II-4 assembly in every cell: One of every four cells contains a Metamic insert (or full length RCCA in the assembly).	II-4 II-4 / II-4 II-4
Array II-E Checkerboard pattern of Category II-6 and II-8 assemblies.	II-8 II-6 / II-6 II-8
Array II-F Category II-7 assembly in every cell.	II-7 II-7 / II-7 II-7

Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate either a Metamic insert in the cell or the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. Attributes for each 2x2 array are as stated in the definition. Diagram is for illustrative purposes only.

FIGURE 5.5-3

ALLOWABLE INTERFACES BETWEEN REGION II – REGION I ARRAYS

DEFINITION[1,4]

ILLUSTRATION[1,2,3,4,5]

For Array II-A, the empty cell shall be in the row adjacent to the Region I Rack.

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2
II-1	E	II-1	E
II-1	II-1	II-1	II-1

Array II-A

For Array II-B, the reactivity rank of assemblies adjacent to the Region I rack shall be reduced from a rank of II-2 to a reactivity rank of II-4 or lower. The Array II-B pattern shall have the required Metamic insert (or full length RCCA in the assembly) placed in the row adjacent to the Region I rack.

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2
II-4	II-4	II-4	II-4
II-2	II-2	II-2	II-2

Array II-B

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2
II-4	II-4	II-4	II-4
II-2	II-2	II-2	II-2

Array II-B

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2
II-4	II-4	II-4	II-4
II-2	II-2	II-2	II-2

Array II-B

For Arrays II-C and II-D, the Metamic insert (or full length RCCA in the assembly) shall be placed in the row adjacent to the Region I rack.

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2
II-3	II-5	II-3	II-5
II-5	II-3	II-5	II-3

Array II-C

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2
II-5	II-3	II-5	II-3
II-3	II-5	II-3	II-5

Array II-C

Region I Rack

I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2
II-4	II-4	II-4	II-4
II-4	II-4	II-4	II-4

Array II-D

Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate either a Metamic insert in the cell or the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. Attributes for each 2x2 array are as stated in the definition. Diagram is for *illustrative* purposes only.
5. Region I Array I-2 is depicted as the example; however, any Region I array is equally representative.

FIGURE 5.5-4

ALLOWABLE REGION II STORAGE ADJACENT TO SPENT FUEL PIT WALLS

DEFINITION[1,4]

ILLUSTRATION[1,2,3,4]

An assembly of rank II-2 placed in the peripheral row of a Region II storage rack shall not be adjacent to a Region I storage rack.

Spent Fuel Pit Wall

II-2	II-2	II-2	II-3
II-3	II-5	II-3	II-5
II-5	II-3	II-5	II-3

Region 2 (Array II-C)

I-2	I-2	I-2	I-2	I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2	I-2	I-2	I-2	I-2
I-2	I-2	I-2	I-2	I-2	I-2	I-2	I-2

Region I (Array I-B)

For Array II-A, the empty cell in the 2x2 II-A array shall be adjacent to the peripheral row that contains the category II-2 assembly(s). For Array II-A only, the peripheral row may contain category II-1 assemblies as the outer two rows will comply with Array II-A requirements.

Spent Fuel Pit Wall

II-2	II-2	II-2	II-2
II-1	E	II-1	E
II-1	II-1	II-1	II-1

Array II-A

II-1	II-1	II-1	II-1
II-1	E	II-1	E
II-1	II-1	II-1	II-1

Array II-A

For Array II-B, the Metamic insert (or full length RCCA in the assembly) shall be adjacent to the peripheral row that contains the category II-2 assembly(s).

Spent Fuel Pit Wall

II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2

Array II-B

II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2

Array II-B

II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2
II-2	II-2	II-2	II-2

Array II-B

For Arrays II-C and II-D, the Metamic insert (or full length RCCA in the assembly) shall be adjacent to the peripheral row that contains the category II-2 assembly(s).

Spent Fuel Pit Wall

II-2	II-2	II-2	II-2
II-5	II-3	II-5	II-3
II-3	II-5	II-3	II-5

Array II-C

II-2	II-2	II-2	II-2
II-5	II-3	II-5	II-3
II-3	II-5	II-3	II-5

Array II-C

II-2	II-2	II-2	II-2
II-4	II-4	II-4	II-4
II-4	II-4	II-4	II-4

Array II-D

Notes:

1. Fuel Categories are determined from Tables 5.5-1 and 5.5-2.
2. Shaded cells indicate either a Metamic insert in the cell or the fuel assembly contains a full length RCCA.
3. **E** indicates an empty (water filled) cell.
4. Attributes for each 2x2 array are as stated in the definition. Diagram is for illustrative purposes only.

5.6 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.6.1 The components identified in Table 5.6-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.6-1.

TABLE 5.6-1

COMPONENT CYCLIC OR TRANSIENT LIMITS

COMPONENT	CYCLIC OR TRANSIENT LIMIT	DESIGN CYCLE OR TRANSIENT
Reactor Coolant System	200 heatup cycles at ≤ 100°F/h and 200 cooldown cycles at ≤ 100°F/h.	Heatup cycle - T_{avg} from ≤ 200°F to ≥ 550°F. Cooldown cycle - T_{avg} from ≥ 550°F to ≤ 200°F.
	200 pressurizer cooldown cycles at ≤ 200°F/h.	Pressurizer cooldown cycle temperatures from ≥ 650°F to ≤ 200°F.
	80 loss of load cycles, without immediate Turbine or Reactor trip.	≥ 15% of RATED THERMAL POWER to 0% of RATED THERMAL POWER.
	40 cycles of loss-of-offsite A.C. electrical power.	Loss-of-offsite A.C. electrical ESF Electrical System.
	80 cycles of loss of flow in one reactor coolant loop.	Loss of only one reactor coolant pump.
	400 Reactor trip cycles.	100% to 0% of RATED THERMAL POWER.
	150 leak tests.	Pressurized to ≥ 2435 psig.
	5 hydrostatic pressure tests.	Pressurized to ≥ 3100 psig.
Secondary Coolant System	6 loss of secondary pressure	Loss of Secondary pressure
	50 leak tests	Pressurized to ≥ 1085 psig
	35 hydrostatic pressure tests.	Pressurized to ≥ 1356 psig.

TS BASES

3/4.9.14 SPENT FUEL STORAGE

The spent fuel storage racks provide safe subcritical storage of fuel assemblies by providing sufficient center-to-center spacing or a combination of spacing and poison to assure: a) $K_{eff} \leq 0.95$ with a minimum soluble boron concentration of 650 ppm present, and b) $K_{eff} < 1.0$ when flooded with unborated water for normal operations and postulated accidents.

The spent fuel racks are divided into two regions; Region I and Region II. The Region I permanent racks have a 10.6 inch center-to-center spacing. and The Region I cask area rack has a nominal 10.1 inch center-to-center spacing in the east-west direction and a nominal 10.7 inch center-to-center spacing in the north-south direction. The Region II racks have a 9.0 inch center-to-center spacing. Any fuel designed for use at Turkey Point, and enriched to less than or equal to 4.5 wt.% U-235, may be stored in the Region I cask area rack. ~~Because of the larger center-to- center spacing and poison (B10) concentration of Region I cells, the only restriction~~ The restrictions for placement of fresh fuel in the permanent Region I spent fuel racks ~~is~~ are that the initial fuel assembly enrichment is equal to or less than 4.5 weight percent of U-235 and that the fresh fuel either contain a full length rod control cluster assembly (RCCA) or be in a checkerboard array of fuel and empty cells. The limiting value of U-235 enrichment ~~is~~ and requirement for full length RCCA or checkerboard array of empty cells are based upon the assumptions in the ~~spent fuel safety~~ criticality analyses and assures that the limiting criteria for criticality ~~is~~ are not exceeded. Prior to placement of irradiated fuel in Region I or II spent fuel storage rack cell locations, strict controls are employed to evaluate burnup of the fuel assembly. Upon determination that the fuel assembly meets the nominal burnup requirements of Table ~~3.9-1~~ 5.5-1 or Table 5.5-2 (for the associated post-irradiation cooling time), placement in a Region I or II cell in accordance with analyzed storage arrangements is authorized. For all assemblies with blanketed fuel, the initial enrichment is based on the central zone enrichment (i.e., between the axial blankets) consistent with the assumptions of the analysis. These positive controls assure that fuel enrichment limits, burnup, and post-irradiation cooling time requirements assumed in the safety analyses will not be ~~exceeded~~ violated.

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by FPL in this submittal. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding these commitments to Walter J. Parker, Licensing Manager, Turkey Point Units 3 and 4.

Regulatory Commitment	Due Date
Revise existing processes and databases for administratively controlling and independently verifying the classification and placement of fuel assemblies in the SFP storage racks (excluding the Cask Area Rack) to incorporate the new restrictions of this amendment.	Prior to amendment implementation
Metamic insert boron carbide content shall be limited to a maximum 31 weight percent boron carbide	Perpetual commitment documented in UFSAR

Attachment 8

Holtec Affidavit

Note Regarding Pagination:

The documents included in this enclosure are controlled by the page-count indicated in the Table of Contents below. To preserve the integrity of the documents as suitable for use by the NRC Staff, the header and pagination notations (such as appears on this page) are not used on every page of Attachment 8.

Table of Contents

AFFIDAVIT PURSUANT TO 10CFR2.390

I, Eric Bush, being duly sworn, depose and state as follows:

(1) I am the Project Manager for Holtec International and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the document entitled "Boraflex Remedy at Turkey Point Nuclear Plant for FPL," Holtec Report HI-2043149, revision 3. The proprietary material in this document is delineated by proprietary designation (i.e., shaded text) on pages 2-11, 3-1 through 3-7, 4-47, 4-49, 4-51 through 4-53, and 6-24.

(3) In making this application for withholding of proprietary information of which it is the owner, Holtec International relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4) and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10CFR Part 9.17(a)(4), 2.390(a)(4), and 2.390(b)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by Holtec's competitors without license from Holtec International constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

c. Information which reveals cost or price information, production, capacities, budget levels, or commercial strategies of Holtec International, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future Holtec International customer-funded development plans and programs of potential commercial value to Holtec International;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs 4.a, 4.b, 4.d, and 4.e, above.

(5) The information sought to be withheld is being submitted to the NRC in confidence. The information (including that compiled from many sources) is of a sort customarily held in confidence by Holtec International, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by Holtec International. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within Holtec International is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his designee), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures

outside Holtec International are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information classified as proprietary was developed and compiled by Holtec International at a significant cost to Holtec International. This information is classified as proprietary because it contains detailed historical data and analytical results not available elsewhere. This information would provide other parties, including competitors, with information from Holtec International's technical database and the results of evaluations performed using codes developed by Holtec International. Release of this information would improve a competitor's position without the competitor having to expend similar resources for the development of the database. A substantial effort has been expended by Holtec International to develop this information.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to Holtec International's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of Holtec International's comprehensive spent fuel storage technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology, and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by Holtec International.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

Holtec International's competitive advantage will be lost if its competitors are able to use the results of the Holtec International experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

AFFIDAVIT PURSUANT TO 10CFR2.390

The value of this information to Holtec International would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive Holtec International of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

STATE OF NEW JERSEY)

) ss:

COUNTY OF BURLINGTON)

Eric Bush, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at Marlton, New Jersey, this 28th day of September, 2005.

Mr. Eric Bush
Holtec International

Subscribed and sworn before me this 28th day of September, 2005.

MARIA C. MASSI
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 25, 2010