Progress Energy

Christopher L. Burton
Vice President
Harris Nuclear Plant
Progress Energy Carolinas, Inc.

JAN 1 6 2009

Serial: HNP-09-007
10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT NO. 1
DOCKET NO. 50-400/LICENSE NO. NPF-63
SUPPLEMENT TO TECHNICAL SPECIFICATIONS 5.6.1.3.a AND 5.6.1.3.b – INCORPORATION OF UPDATED CRITICALITY ANALYSES TO REFLECT REMOVAL OF CREDIT FOR BORAFLEX IN BWR SPENT FUEL POOL STORAGE RACKS

Reference:
1. Letter from C. L. Burton to the Nuclear Regulatory Commission (Serial: HNP-08-075), "Technical Specifications 5.6.1.3.a and 5.6.1.3.b – Incorporation of Updated Criticality Analyses Reflect Removal of Credit For Boraflex in BWR Spent Fuel Pool Storage Racks," dated September 29, 2008
2. Email from M. G. Vaaler, Nuclear Regulatory Commission to K. Stacy, "Harris SFP Acceptance Review R1.doc," dated December 3, 2008 (Draft)

Ladies and Gentlemen:

In accordance with the Code of Federal Regulations, Title 10, Part 50.90, "Application for Amendment of License, Construction Permit, or Early Site Permit," Carolina Power & Light Company (CP&L) doing business as Progress Energy Carolinas, Inc. (PEC), submitted the above License Amendment Request for the Harris Nuclear Plant (HNP) (Reference 1). As a result of the NRC Acceptance Review of that request (Reference 2), HNP is submitting additional information via this supplement.

This document contains no regulatory commitments.

Please refer any questions regarding this submittal to D. H. Corlett at (919) 362-3137.

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A001
NRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on
JAN 16 2009

Sincerely,

Christopher L. Burton
Vice President
Harris Nuclear Plant

CLB/kms

Enclosure: "Response to Acceptance Review Regarding Amendment to Remove Credit for Boraflex in BWR Spent Fuel Pool Storage Racks"

cc:

Mr. J. D. Austin, NRC Sr. Resident Inspector, HNP
Ms. B. O. Hall, N.C. DENR Section Chief
Mr. L. A. Reyes, NRC Regional Administrator, Region II
Ms. M. G. Vaaler, NRC Project Manager, HNP

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RESPONSE TO ACCEPTANCE REVIEW REGARDING
AMENDMENT TO REMOVE CREDIT FOR BORAFLEX IN BWR
SPENT FUEL POOL STORAGE RACKS

Summary

Progress Energy (licensee) submitted a license application to revise the Shearon Harris Nuclear Power Plant, Unit 1 (Harris) licensing basis to reflect the new spent fuel pool (SFP) criticality analysis performed for BWR spent fuel storage racks containing Boraflex. The licensee performed the new analysis removing credit for Boraflex as reactivity suppressor to address the degradation issues.

The staff completed the acceptance review of the application and finds that the information delineated below is necessary for the staff to conduct the detailed technical review.

1. *Potential Error in TS Design Features, Figure 5.6-3:*

   There appears to be an error in the equation included in Figure 5.6-3 of the TS Design Features section. Please correct, if applicable.

Response: The equation displayed on Technical Specification (TS) Figure 5.6-3 was in error and has been corrected. Attachment 3 of this Enclosure contains the corrected Figure 5.6-3 and the other retyped TS pages.

2. *Potential Error in Table 1 of HI-2043321:*

   There appears to be an error in Table 1 of HI-2043321 for the value of "Maximum Keff" corresponding to the 2% enrichment case. Please correct, if applicable.

Response: This is an editorial error. Table 1 of HI-2043321 has been corrected and is included as page 13 of Attachment 2.

3. *Boral Monitoring Program:*

   The staff understands that when a BWR fuel assembly does not satisfy the proposed burnup credit requirements, it will be stored in a Boral rack. Please describe the requirements associated with your Boral monitoring program and show how you comply with those requirements.

Response: Per the NRC/Progress Energy telephone conversation on December 17, 2008, it is understood that this question will be removed as an Acceptance Review item and presented as an RAI.

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4. *Criticality Model:*

   a) *Figure 3 of HI-2043321 shows the calculational model of a "typical" storage cell. Is this model an approximation of the actual configuration? If so, please show the impact of the approximation on the calculated reactivity.*

Response: The storage cells are composed of stainless steel boxes, joined at the corners in an egg-crate structure. The external box side is equipped with a stainless steel sheathing which holds the Boraflex neutron absorber in place. These boxes are then arranged in a checkerboard pattern, where four storage cells form "developed cells" that can also store spent fuel assemblies. The MCNP model is developed as shown in Figure 3 of HI-2043321. All material thicknesses (stainless steel and water) are preserved and the Boraflex is completely neglected. Additionally, the storage cell pitch is modeled at 6.22 inches, conservatively reduced from the nominal storage cell pitch of 6.25 inches. These conservatisms would more than offset any small reactivity effect associated with the geometry modeling.

An additional MCNP4a calculation was performed with the storage cell box and stainless steel sheathing modeled explicitly.

Reactivity Effect of Geometry Model

Geometry	Calculated k_{eff}	Sigma
Figure 3	0.9576	0.0003
Explicit geometry	0.9585	0.0003

The results in the table show that the simplified geometry modeled in the main part of the report provides an accurate representation of the actual geometry. While the explicit geometry provides a slightly larger k_{eff}, the small increase would be offset by modeling the storage cell pitch at 6.25 inches.

A plot of the explicit geometry as created in MCNP4a is shown below:

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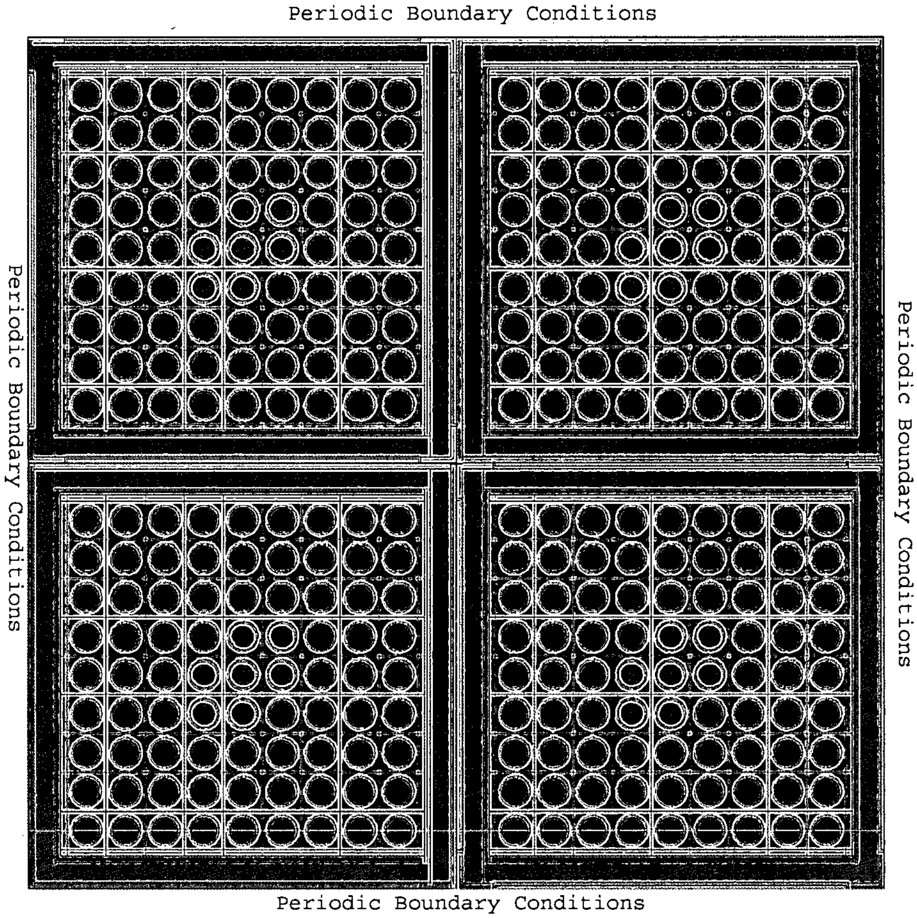

b) *Consider a four assembly configuration where each assembly is loaded closest to the common corner. Please explain how this configuration was modeled with a single cell model.*

Response: The analysis presented in HI-2043321 considered a four assembly configuration where each assembly is loaded closest to a common corner. As shown in Figure 3 of HI-2043321, reflective boundary conditions are used on the periphery of the single cell model. This creates an infinite array of storage cells. By moving the assembly in the single storage cell model to the corner of the storage cell, an infinite array of storage cells is created with each cluster of four assemblies being placed closest to a common corner.

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5. *Reference Fuel Design:*

   a. *Please explain how the reactivity values in Table 7 of HI-2043321 were calculated. Are they based on CASMO or KENO calculations? State the assumed depletion parameters (void history, axial burnup distribution, burnable absorbers, control history) and demonstrate that the assumed parameters bound the actual operating history of these fuel assemblies.*

Response: The reactivity values in Table 7 of HI-2043321 were calculated using the CASMO-4 computer code. The table below provides details of the depletion parameters used in calculating the reactivities in Table 7 of HI-2043321:

Core Operating Parameter for CASMO-4 Depletion Analyses		
Parameter	**Analysis Value**	**Reactor Value**
Reactor Specific Power, MW/MTU	30.0	26.7 max
Core Fuel Temp., °F	1038	818-936
Core Moderator Temp., °F	548	548-560
In-Core Assembly Pitch, Inches	6.0	6.0
Void History	40%	37-45%

In the case of the reactor specific power and core fuel temperature, the analysis value exceeds the maximum value in the core by more than 10%. The core pitch is modeled in-line with the actual reactor core pitch. Meanwhile, the core moderator temperature and void history are modeled within the range of values within the reactor. The non-conservatism associated with the void history and core moderator temperature would be offset by the conservatism with modeling the reactor specific power and fuel temperature over 10% above their maximum value.

The axial burnup distribution is not considered in the determination of the reference (design basis) assembly, although the MCNP calculations to determine the maximum k_{eff} do consider the axial burnup distribution. See also the response to Question 6.

No burnable absorbers are considered in the determination of the reference assembly. The only burnable absorber in BWR fuel is Gadolinium, which is demonstrated in NUREG/CR-6760 to produce a negative reactivity effect when compared to an assembly without the Gadolinium. Therefore, neglecting the integral burnable absorber is conservative.

No control rods are assumed in the depletion calculations.

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b. *The application does not provide sufficient information to justify the use of GE13 as the reference design when GE3 and GE4 show higher reactivity values. Please provide quantitative evidence showing that GE3 and GE4 assemblies residing in the spent fuel pool are bounded by the reference design. Consider the actual enrichments, burnups and cooling times for the GE3 and GE4 assemblies.*

c. *The application states that an enrichment of 4.6% and burnups between 35,000 and 42,500 MWD/MTU were assumed for the reactivity calculations in Table 7 of HI-2043321. Please demonstrate that the bounding design has been identified considering lower enrichments and lower burnup.*

Response (5b & 5c): The table below presents calculations similar to those presented in Table 7 of HI-2043321 for other burnup and enrichment combinations from Table 5 of HI-2043321 and for longer cooling times.

Burnup [MWD/MTU]	GE3 4 years	GE3 26 years	GE4 4 years	GE4 23 years	GE7 4 years	GE7 12 years	GE8 4 years	GE9 4 years	GE10 4 years	GE13 4 years
Enrichment = 2.0 wt% ^{235}U										
8,500	0.9753	0.9643	0.9700	0.9597	0.9676	0.9620	0.9644	0.9633	0.9504	0.9659
10,000	0.9563	0.9415	0.9510	0.9373	0.9482	0.9407	0.9447	0.9436	0.9307	0.9466
Enrichment = 3.0 wt% ^{235}U										
20,000	0.9710	0.9440	0.9660	0.9409	0.9644	0.9508	0.9623	0.9614	0.9470	0.9638
22,500	0.9427	0.9105	0.9378	0.9080	0.9353	0.9191	0.9326	0.9316	0.9173	0.9348
Enrichment = 4.0 wt% ^{235}U										
32,500	0.9448	0.9061	0.9402	0.9042	0.9388	0.9191	0.9374	0.9364	0.9213	0.9393
35,000	0.9197	0.8769	0.9152	0.8756	0.9129	0.8910	0.9107	0.9097	0.8947	0.9135
Enrichment = 4.6 wt% ^{235}U										
40,000	0.9283	0.8847	0.9241	0.8835	0.9227	0.9003	0.9216	0.9206	0.9167	0.9239
42,500	0.9047	0.8576	0.9008	0.8569	0.8984	0.8741	0.8964	0.8953	0.8912	0.8996

In the determination of the design basis assembly, no credit is taken for the actual burnup and enrichment of the older fuel assembly designs, i.e., GE3, GE4 and GE7. However, these fuel assemblies have significantly longer cooling times than the assumed four years credited in the analysis (26 years for GE3 assemblies, 23 years for the GE4 assemblies and 12 years for GE7 assemblies). The table above shows the reduction in reactivity associated with crediting the minimum cooling time for the GE3, GE4 and GE7 assemblies, and justifying the use of the GE13 assembly with 4 years cooling as the design basis assembly.

The table above also shows that for lower enrichments, the GE13 assembly has the highest reactivity when cooling time is considered for the GE3, GE4 and GE7 assemblies.

6. *Axial Burnup Distribution:*

   a) *The application states, "Based on the level of conservatism inherent in choosing the axial burnup distribution in the manner described above it is not necessary to confirm that the axial burnup distributions of individual assemblies are bounded by the assumed axial burnup distribution."*

   What do you mean by "inherent conservatism?"

Response: The axial burnup distribution is only relevant to calculations that credit an assembly average burnup greater than or equal to 20.5 GWD/MTU. As shown in the table on page 8 of HI-2043331, a uniform (flat) profile produces bounding results for low burnups. Therefore, for the low enrichment, low burnup points on the burnup versus enrichment curve, there is an inherent conservatism in the calculations associated with the use of the flat axial burnup distribution.

The axial burnup distribution presented in Table 6 of HI-2043321 is an average of 4 axial burnup distributions from Brunswick BWR assemblies with assembly average burnups between 34.0 GWD/MTU and 40.8 GWD/MTU. These four axial burnup distributions were representative of assemblies with an assembly average burnup near the minimum required burnup specified in Table 5 of HI-2043321. It is not appropriate to choose axial burnup distributions from assemblies having an assembly average burnup below the burnup versus enrichment curve, as these would be significantly under-exposed assemblies (having experienced only two of their expected three cycles in the core) and not able to be stored in the Harris BWR Boraflex storage racks.

The "inherent conservatism" is in selecting axial burnup profiles from assemblies near the burnup versus enrichment curve and not including profiles from assemblies with much higher exposures. To confirm the "inherent conservatism", an additional calculation was performed using an axial burnup profile from an assembly having an average burnup of 45.88 GWD/MTU. Both the results of the calculation and a comparison to the result from the axial burnup profile

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presented in Table 5 of HI-2043321 are shown in the table below. Both calculations were performed at a burnup of 42.5 GWD/MTU with an enrichment of 4.6 wt%.

Profile	Table 5	YJM160
Assembly Burnup [GWD/MTU]	37.5[1]	45.88
Calculated k_{eff}	0.9560	0.8957

As can be seen from the table, the axial burnup distribution can have a significant effect on the reactivity of the system. Therefore, the use of the profile shown in Table 5 of HI-2043321 results in a conservative value for the reactivity of the Harris BWR racks.

7. *In the application, the licensee is proposing to no longer credit Boraflex for criticality in Shearon Harris' BWR Boraflex storage racks in Pools A and B. Currently, the licensee is committed to periodic sampling of the Boraflex in the spent fuel pool as stated in their October 24, 1996 response to Generic Letter (GL) 96-04, "Boraflex Degradation in the Spent Fuel Pool Storage Racks". However, it is not clear in the submittal whether the licensee is intending to continue the Boraflex Monitoring Program.*

   a) *Please clarify whether the existing Boraflex Monitoring Program will continue to be implemented.*

Response: The Boraflex Monitoring Program will be discontinued upon implementation of the revised criticality analysis, which credits soluble boron instead of Boraflex as a reactivity suppressor.

Attachments:

1. Holtec Affidavit for Withholding of Proprietary Information
2. Holtec Report No. HI-2043321, Revision 5 (Proprietary)
3. Retyped Technical Specification Pages

[1] The assembly burnup for the burnup profile in Table 5 is an average of the assembly average burnups from the four assemblies selected to determine the axial burnup profile in Table 5.

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ATTACHMENT 1
HOLTEC INTERNATIONAL
AFFIDAVIT PURSUANT TO 10 CFR 2.390
(5 Pages)

HOLTEC INTERNATIONAL

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U.S. Nuclear Regulatory Commission
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AFFIDAVIT PURSUANT TO 10 CFR 2.390

I, Debabrata Mitra-Majumdar, being duly sworn, depose and state as follows:

(1) I am the Holtec International Project Manager for the Harris Nuclear Plant BWR Racks Criticality Analysis project and have reviewed the information described in paragraph (2) which is sought to be withheld, and am authorized to apply for its withholding.

(2) The information sought to be withheld is Holtec Report HI-2043321 containing Holtec Proprietary information.

(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).

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(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 and 4.b, 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

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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 descriptions of analytical

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approaches and methodologies 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 by Holtec International. A substantial effort has been expended by Holtec International to develop this information. Release of this information would improve a competitor's position because it would enable Holtec's competitor to copy our technology and offer it for sale in competition with our company, causing us financial injury.

(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.

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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)

Dr. Debabrata Mitra-Majumdar, 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 13th day of January, 2009.

Debabrata Mitra-Majumdar
Holtec International

Subscribed and sworn before me this 13th day of January, 2009.

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

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ATTACHMENT 2
CRITICALITY SAFETY ANALYSES OF C AND D POOLS FOR
BWR FUEL WITHOUT CREDIT FOR BORAFLEX IN THE
RACKS AT THE HARRIS NUCLEAR POWER STATION
Holtec Report No. HI-2043321 (Proprietary)
(53 Pages)