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W3F1-2009-0007

February 26, 2009

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Response to Request for Additional Information Regarding "License Amendment Request to Modify Technical Specification Section 5.6, Fuel Storage, and Add New Technical Specification 3/4.9.12, Spent Fuel Pool (SFP) Boron Concentration"
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

REFERENCE:

1. Entergy (Waterford 3) letter to NRC dated September 17, 2008, "License Amendment Request to Modify Technical Specification Section 5.6, Fuel Storage and Add New Technical Specification 3/4 9.12, Spent Fuel Pool Boron Concentration" (W3F1-2008-0052)
2. NRC letter dated January 2, 2008 "Request for Additional Information RE: License Amendment Request to Modify Technical Specification Section 5.6, Fuel Storage and Add New Technical Specification 3/4 9.12, Spent Fuel Pool Boron Concentration (TAC NO. MD9685)

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc. (Entergy) submitted a request for an amendment to the Technical Specifications (TS) in accordance with the provisions of 10 CFR 50.90 for Waterford Steam Electric Station, Unit 3 (Waterford 3). The proposed amendment would take credit for soluble boron in Region 1 (cask storage pit) and Region 2 (spent fuel pool and refueling canal) fuel storage racks for the storage of both Standard and Next Generation Fuel (NGF) assemblies and add a new TS which includes a surveillance that ensures the required boron concentration is maintained in the spent fuel storage racks.

On January 12, 2009, Entergy received an NRC Request for Additional Information (RAI) dated January 2, 2009 (Reference 2) to support the review of the proposed TS change request. Entergy's response to the RAI is contained in Attachment 1 of this submittal.

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NRR

With regards to other NRC Staff comments on the License Amendment Request (LAR), on January 8, 2009, Entergy and the NRC Staff held a call to discuss the content of the LAR. The NRC proposed the "No Significant Hazards" section of the LAR be revised to provide greater clarity through removal of supplemental information. In addition, on January 14, 2009, Entergy received an NRC Staff email regarding an additional TS Limiting Condition for Operation (LCO) and associated Surveillance Requirement (SR) that should be included in the LAR for Spent Fuel Storage. The additional Spent Fuel Storage specification will be consistent with NUREG-1432 Rev. 3.0, Standard Technical Specifications, Combustion Engineering Plants.

These proposed changes, consisting of a clarification to the "No Significant Hazards Consideration" section 5.2 of the original LAR (Reference 1) and changes to the TS pages, specifically the addition of TS 3/4.9.13, Spent Fuel Storage, were reviewed and approved by Entergy's Onsite Safety Review Committee (OSRC). The revised "No Significant Hazards Consideration" section is contained in Attachment 2 of this submittal and replaces the original LAR (Reference 1) section 5.2 in its entirety. The new proposed TS 3/4.9.13 is contained in Attachment 3.

There are no new commitments contained in this letter. If you have any questions or require additional information, please contact Robert Murillo, Manager, Licensing at (504) 739-6715.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 26, 2009.

Sincerely,

Kenny J. Christian

KJC/RLW/ssf

Attachments:

1. Response to Request for Additional Information Regarding License Amendment Request to Modify TS Section 5.6, Fuel Storage, and Add New TS 3/4.9.12, Spent Fuel Pool (SFP) Boron Concentration
2. Revised "No Significant Hazards Consideration" Section 5.2
3. Proposed TS 3/4.9.13, Spent Fuel Storage

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Attachment 1

To

W3F1-2009-0007

Response to Request for Additional Information Regarding "License Amendment Request to Modify TS Section 5.6, Fuel Storage, and Add New TS 3/4.9.12, Spent Fuel Pool (SFP) Boron Concentration

Response to Request for Additional Information Regarding "License Amendment Request to Modify TS Section 5.6, Fuel Storage, and Add New TS 3/4.9.12, Spent Fuel Pool (SFP) Boron Concentration)

On January 12, 2009, Entergy received an NRC Request for Information (RAI) dated January 2, 2009 (Reference 2) to support the review of the proposed TS change request. Entergy submitted the application to revise the Waterford 3 licensing basis to reflect the new spent fuel pool (SFP) criticality analysis. Entergy performed the new analysis to credit soluble boron in the fuel storage racks for both Standard and Next Generation Fuel (NGF).

Currently, there is no generically approved methodology for performing SFP criticality analysis. Therefore, each plant-specific submittal must provide reasonable assurance that the applied methodology provides conservative results. The NRC Staff has reviewed the application and determined that the following information is needed for the NRC Staff to complete its review.

RAI Question 1

Burnup Profile

In the letter dated September 17, 2008, the licensee states that, "Calculations are conservatively performed with the axial burnup distribution shown in Table 5 .3 (see Section 5.3) and with an axially constant burnup, and the higher reactivity is used in the analyses."

(a) The application, however, appears to lack information demonstrating that these distributed and axially constant profiles are bounding for the fuel assemblies at Waterford 3. Please describe the methodology used for the profile selection.

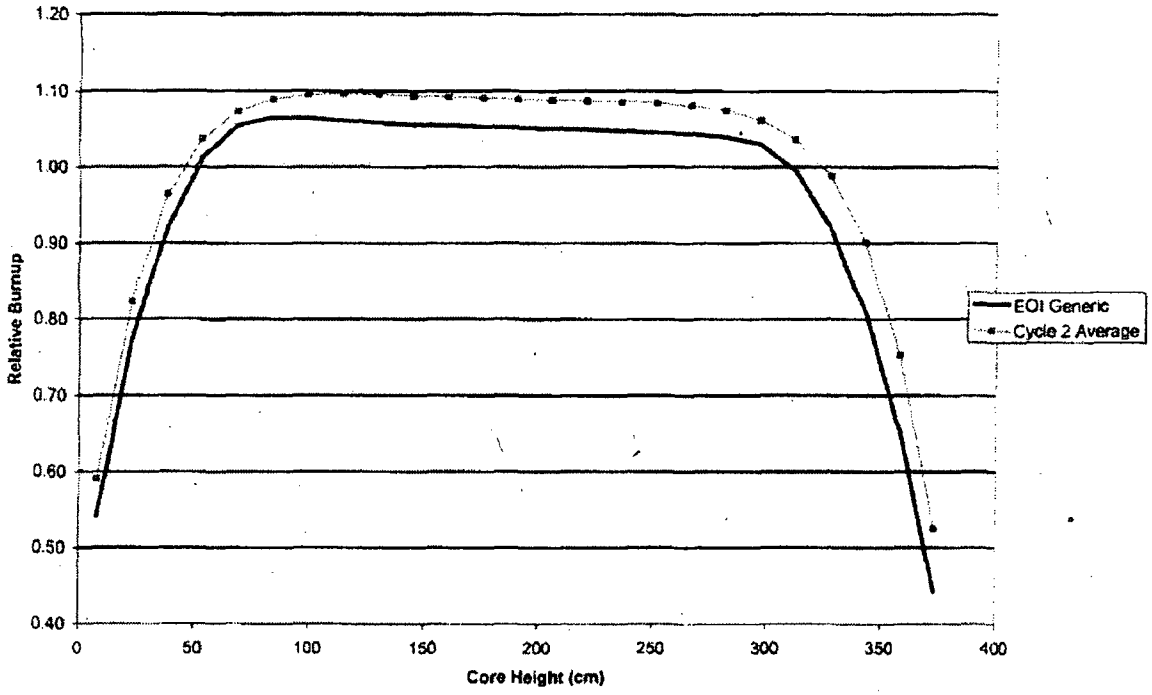
(b) Please describe how the effects of using blanketed fuel and/or operating with control rods/axial power shaping rods were considered?

(c) The application identifies two distributed profiles for two burnup intervals: one for ≤ 25 gigawatt-days/ton (GWD/T) and another for ≥ 25 GWD/T. How was the transition point determined?

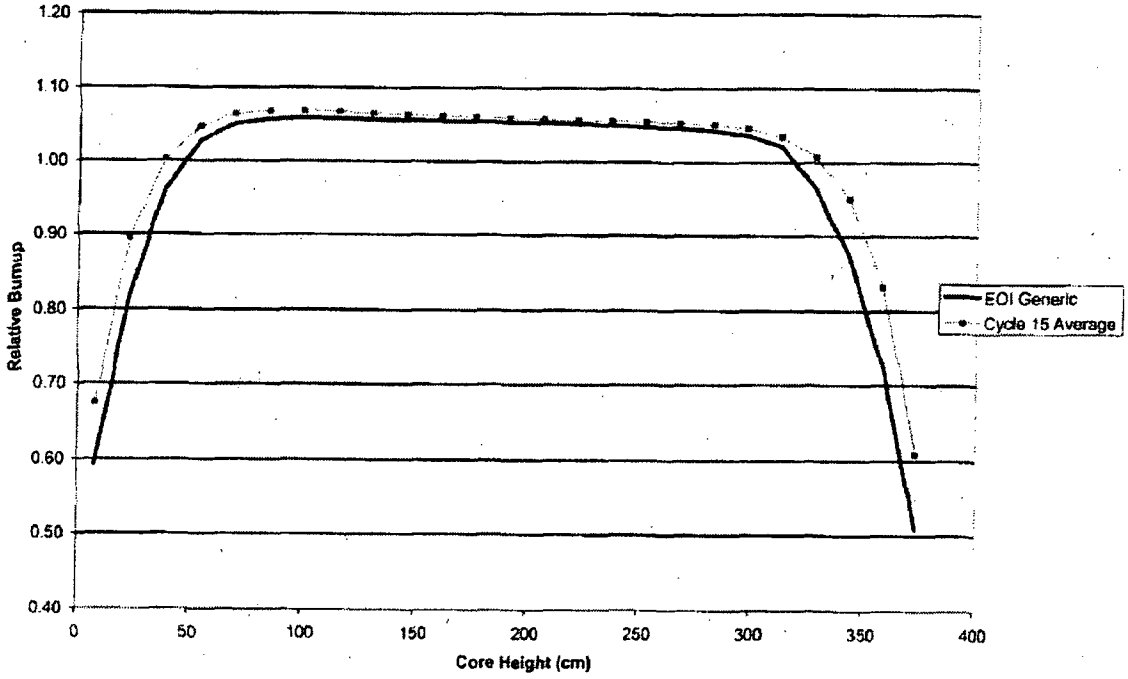
<u>Entergy Response 1</u>

(a) The distributed axial burnup profile was determined by performing a cycle-by-cycle comparison of all available data for Waterford Unit 3 fuel with burnup distributions from SIMULATE. From these fuel assembly axial burnup distributions a minimum and an average axial burnup distribution was determined for each cycle. The minimum is the lowest relative burnup for all assemblies in each axial section and was not renormalized. Then, to be bounding for all cycles, a total minimum axial burnup distribution was determined over all cycles for both the < 25 GWD/T case and the > 25 GWD/T case where applicable. The two representative figures below show that the total minimum axial burnup distribution bounds the average axial profile.

WSES-3 Cycle 2 Axial Burnup Profiles
(BU < 25.0 GWD/MT)



WSES-3 Cycle 15 Axial Burnup Profiles
(BU > 25.0 GWD/MT)



With respect to the axially constant profiles, the burnup is uniform over the entire axial length for any given burnup, i.e. a factor of 1 is applied to the given burnup step at each axial node instead of, for example, a 0.5 from a segmented profile at a specified node. For each calculation, both profiles were run separately, the results were compared, and the more reactive case was used in the analysis. See the Table below.

Region 2 MCNP Calculations for the Uniform Loading Case, Segmented and Uniform Axial Profiles

Enrichment	Burnup (GWD/MTU)	Segmented Axial		Uniform Axial		Delta (s - u)	Max
		Input File	keff	Input File	keff		
2.0	0.001	w2u20zc	0.9597	w2u20a	0.9613	-0.0016	0.9613
2.0	2.00	w2u20p	0.9447	w2u20b	0.9459	-0.0012	0.9459
2.5	5.00	w2u25q	0.9807	w2u25c	0.9827	-0.0020	0.9827
2.5	10.00	w2u25r	0.9365	w2u25d	0.9378	-0.0013	0.9378
3.0	10.00	w2u30s	0.9867	w2u30e	0.9883	-0.0016	0.9883
3.0	15.00	w2u30t	0.9501	w2u30f	0.9474	0.0027	0.9501
3.5	15.00	w2u35u	0.9885	w2u35g	0.9905	-0.0020	0.9905
3.5	20.00	w2u35v	0.9581	w2u35h	0.9539	0.0042	0.9581
4.0	20.00	w2u40w	0.9933	w2u40i	0.9912	0.0021	0.9933
4.0	25.00	w2u40x	0.9646	w2u40j	0.9559	0.0087	0.9646
4.5	25.00	w2u45y	0.9896	w2u45k	0.9901	-0.0005	0.9901
4.5	30.00	w2u45z	0.9614	w2u45l	0.9566	0.0048	0.9614
5.0	30.00	w2u50za	0.9888	w2u50m	0.9882	0.0006	0.9888
5.0	35.00	w2u50zb	0.9628	w2u50n	0.9570	0.0058	0.9628

(b) Waterford Unit 3 does not contain blanketed fuel or axial power shaping rods and generally operates with all rods out.

(c) The transition point for the two cases, 25 GWD/T, was determined based on the available spent fuel inventory, and the transition point is approximately one half of discharge exposure of the sub-batches with the highest burnup.

RAI Question 2

Burnup uncertainty:

In the letter dated September 17, 2008, the licensee states that burnup uncertainty was applied in accordance with the staff guidance (Reference 1). However, it does not indicate how the reactivity decrement was calculated. Please provide the enrichment and burnup combinations used to determine the decrement.

<u>Entergy Response 2</u>

The reactivity decrement is calculated as 5% of the difference between the CASMO calculated reactivity at zero burnup and the CASMO calculated reactivity at case dependent specified burnup (the same enrichment and burnup combination was used for all tolerance calculations with CASMO). This decrement is then statistically combined with the other tolerances. The following expanded excerpts from Tables 7.13 and Table 7.14

provide the enrichment and burnup combinations and show how the decrement was calculated:

Excerpt from Table 7.13:

Table 7.13
Region 2 Results for the Spent Fuel Uniform Loading Case

Enrichment (wt% ^{235}U)	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Burnup (GWD/MTU)	0.00	5.89	11.77	17.50	23.55	28.15	33.39
CASMO Burnup for Tolerances (and Depletion Uncertainty)	0.0	4.0	11.0	15.0	22.5	27.5	32.5
CASMO K_{inf} at 0 GWD/MTU	0.0000	1.0285	1.0784	1.1179	1.1501	1.1770	1.1998
CASMO k_{inf} at CASMO Burnup for Tolerances	0.0000	0.9897	0.9769	0.9867	0.9679	0.9673	0.9656
0 GWD/MTU k_{inf} – CASMO k_{inf} at CASMO Burnup for Tolerances	0.0000	0.0388	0.1015	0.1312	0.1822	0.2097	0.2342
5% of Decrement	0.0000	0.0019	0.0051	0.0066	0.0091	0.0105	0.0117

Excerpt from Table 7.14:

Region 2 Results for the Spent Fuel Checkerboard Loading

Enrichment (wt% ^{235}U)	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Burnup (GWD/MTU)	2.41	9.42	16.21	23.55	29.53	34.64	41.23
CASMO Burnup for Tolerances (and Depletion Uncertainty)	2.0	8.0	15.0	22.5	27.5	32.5	40.0
CASMO K_{inf} at 0 GWD/MTU	0.9631	1.0285	1.0784	1.1179	1.1501	1.1770	1.1998
CASMO k_{inf} at CASMO Burnup for Tolerances	0.9448	0.9534	0.9443	0.9298	0.9326	0.9338	0.9180
0 GWD/MTU k_{inf} – CASMO k_{inf} at CASMO Burnup for Tolerances	0.0184	0.0751	0.1341	0.1881	0.2175	0.2431	0.2818
5% of Decrement	0.0009	0.0038	0.0067	0.0094	0.0109	0.0122	0.0141

RAI Question 3

Depletion Parameters:

NUREG/CR-6665, "Review and Prioritization of Technical Issues Related to Burnup Credit for LWR Fuel" (Reference 2), recommends using the maximum fuel and core outlet temperature. Table 5.2 of HI-2084014 identifies the average temperatures for the fuel and moderator.

(a) Please state if the assumed temperatures for the fuel and moderator bound all projected operating conditions at Waterford (if that is the case). If not, provide justification for using less than the maximum temperature.

(b) The application identifies 1000 parts per million (ppm) as the bounding soluble boron concentration. Please provide the cycle-average soluble boron concentration at Waterford.

In addition to moderator/fuel temperature and soluble boron concentration the licensee is also requested to address the other core depletion parameters indicated in NUREGICR-6665 as well.

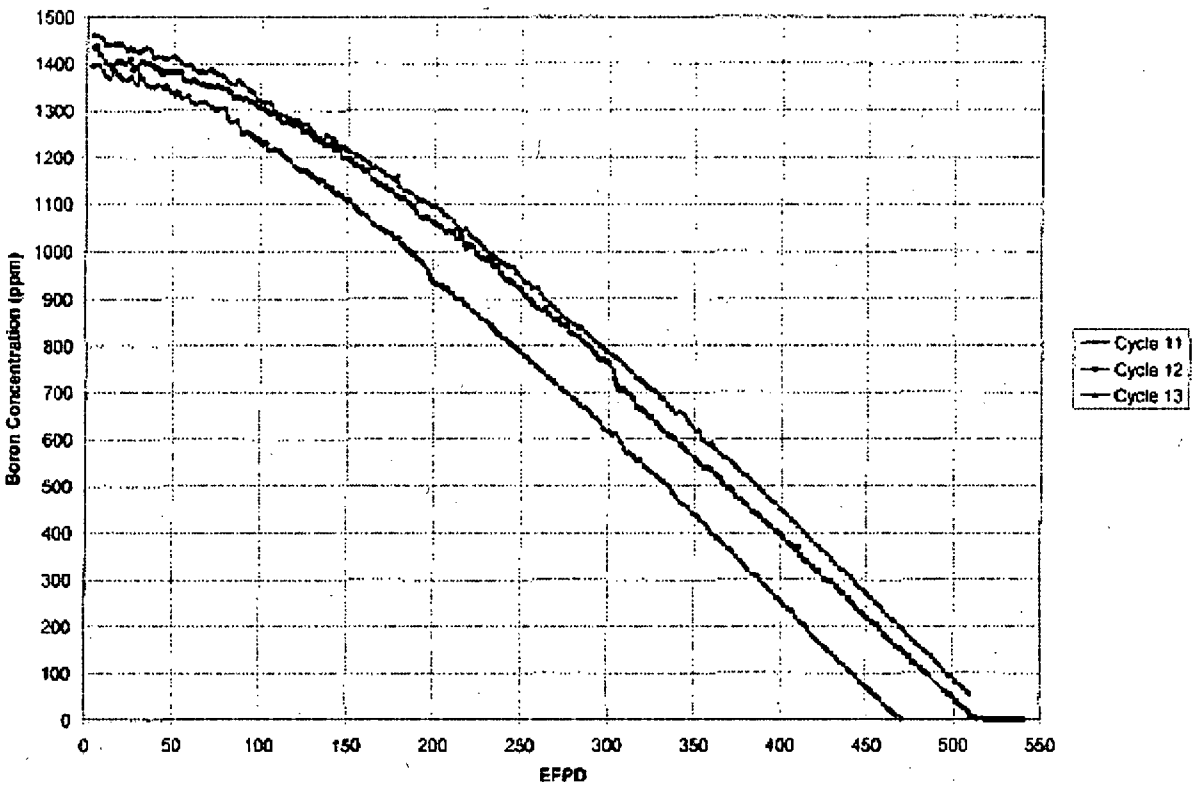
Entergy Response 3

(a) The description used in Table 5.2 is incorrect. The values for fuel and moderator temperatures are maximum values and are bounding for all projected operating conditions at Waterford Unit 3. The updated Table 5.2 is shown below:

Table 5.2
Core Operating Parameter for Depletion Analyses

Parameter	Value
Soluble Boron Concentration (bounding cycle average), ppm	1000
Maximum Reactor Specific Power, MW/MTU	40.5
Maximum Core Fuel Temperature, °F	1041.0
Maximum Core Moderator Temperature at the Top of the Active Region, °F	614.0
In-Core Assembly Pitch, Inches	8.18

(b) The soluble boron let-down curve for representative recent cycles is shown below.



Other Core Depletion Parameters Indicated in NUREG/CR-6665

All the core depletion parameters in NUREG/CR-6665 have been addressed in the original submittal (Reference 1) with the exception of the operating history. Table 4 in NUREG/CR-6665 summarizes these parameters:

(1) Fuel temperature: see Table 5.2, see also Section 5.2

(2) Moderator temperature: see Table 5.2, see also Section 5.2

(3) Soluble boron concentration: see Table 5.2, see also Section 5.2

(4) Operating history: a single full power cycle is used in depletion calculations

(5) Specific power: see Table 5 .2, a maximum value is used. The following table, that is applicable to Waterford 3, illustrates this.

Cycle	Power (MW/MTU)
1-6	36.30 - 39.39
7	36.33 - 38.99
8	37.59 - 38.96
9	36.33 - 38.99
10	36.45 - 36.68
11	36.32 - 36.68
12	36.51 - 36.74
13	36.51 - 36.78
14	39.65 - 40.04
15	39.93

Fixed/integral burnable absorbers: Table 7.8, see also Section 5.4.

RAI Question 4

Fuel rod and assembly parameters:

In the letter dated September 17, 2008, the application states that, "Tolerance calculations were performed for pure water only since the presence of soluble boron in the pool lowers reactivity and reactivity effects of tolerances, and therefore the pure water case bounds the soluble boron case." Please quantitatively support for this assertion.

Entergy Response 4

The assertion is quantitatively supported by the following table in which the calculations used to determine the tolerances in the Region 1 rack with pure water were recalculated with 600 ppm soluble boron. The final statistical combination of positive reactivity effects is 0.0128 for the 600 ppm soluble boron case and 0.0140 for the pure water case.

Region 1 CASMO-4 Manufacturing Tolerances and Uncertainty Calculations

Parameter	0 ppm Soluble Boron		600 ppm Soluble Boron	
	k_{inf}	Delta-k	k_{inf}	Delta-k
Reference Case CASMO	0.9268	n/a	0.8616	
Storage Cell ID Increase	0.9370	0.0102	0.8708	0.0091
Storage Cell ID Decrease	0.9205	-0.0063	0.8560	-0.0056
Storage Cell Pitch Increase	0.9184	-0.0084	0.8539	-0.0078
Storage Cell Pitch Decrease	0.9350	0.0082	0.8694	0.0077
Storage Cell Poison Width Increase	0.9250	-0.0018	0.8605	-0.0012
Storage Cell Poison Width Decrease	0.9289	0.0021	0.8632	0.0015
Storage Cell Poison Gap Minimum	0.9263	-0.0005	0.8613	-0.0003
Storage Cell Box Wall Decrease	0.9242	-0.0026	0.8593	-0.0023
Storage Cell Box Wall Increase	0.9285	0.0017	0.8633	0.0016
Storage Cell Poison B-10 Loading Minimum	0.9291	0.0023	0.8638	0.0021
Fuel Rod Pitch Increase	0.9277	0.0009	0.8624	0.0007
Fuel Rod Pitch Decrease	0.9259	-0.0009	0.8610	-0.0006
Fuel Rod Clad OD Increase	0.9248	-0.0020	0.8600	-0.0016
Fuel Rod Clad OD Decrease	0.9288	0.0020	0.8634	0.0017
Fuel Rod Clad Thickness Minimum	0.9267	-0.0001	0.8616	-0.0001
Fuel Pellet OD Increase	0.9271	0.0003	0.8621	0.0005
Fuel Pellet OD Decrease	0.9265	-0.0003	0.8612	-0.0004
Guide Tube OD Increase	0.9268	0.0000	0.8616	0.0000
Guide Tube OD Decrease	0.9268	0.0000	0.8617	0.0000
Guide Tube Thickness Minimum	0.9272	0.0004	0.8619	0.0002
Fuel Pellet Enrichment Increase	0.9284	0.0016	0.8635	0.0019
Fuel Pellet Density Increase	0.9285	0.0017	0.8638	0.0022
Statistical Combination of Positive Reactivity Uncertainties:		**0.0140**		**0.0128**

RAI Question 5

CASMO-2

In support of the amendment request, CASMO-4 is used to determine the reactivity effects due to rack tolerances, assembly design, and pool temperature. The application does not provide any validation of the code for these uses. Please justify CASMO-4 for these purposes.

Entergy Response 5

CASMO-4 is not used in this application to calculate absolute reactivities, but is only used to determine the isotopic inventory of spent fuel for use in MCNP-4a calculations and to determine relative reactivity differences for temperature variation, manufacturing tolerances and depletion uncertainty. References 1 and 2 are Studsvik proprietary documents related to the appropriateness of CASMO-4 for calculating the multiplication factor, k_{eff}. References 1 and 2 were previously provided to the NRC in support of staff approval of EMF-2158 (see Question 19) as documented in letter Document Control Desk ATTN: Chief, Planning,

Program and Management Support Branch, Subject: Transmittal of Copies of CASMO-4 Benchmark Reports Relevant to EMF-2158(P) Revision 0 "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2," from J. A. Umbarger, dated April 30, 1999.

Holtec International replaced the CASMO-3 code with the CASMO-4 code in approximately mid-1999 for calculating the reactivity effects of manufacturing tolerances, moderator temperature and depletion effects. CASMO-4 has been previously used and approved by the USNRC over the past ten years on multiple licensing efforts by Holtec for spent fuel storage racks. Specifically, CASMO-4 has been reviewed and approved for use on the following spent fuel pool analyses for calculating the reactivity effect of moderator temperature variation and manufacturing tolerances:

PWR

Crystal River 3
Arkansas Nuclear 1 & 2
Harris
St. Lucie
Diablo Canyon
Turkey Point
V.C. Summer
Three Mile Island
Comanche Peak
Davis-Besse
Robinson
Sequoyah

BWR

Clinton
Nine Mile Point Units 2
Cooper
Fermi
Harris (Brunswick BWR fuel in Harris PWR spent fuel pool)

From the above list of plants, the following specific subset of NRC issued SERs and amendment approval references are identified where CASMO-4 and MCNP-4a have been used by Holtec for spent fuel pool criticality analyses:

- F. E. Saba (NRC) to J. S. Forbes (Entergy) dated January 26, 2007, "Arkansas Nuclear One, Unit No. 1 - Issuance of Amendment for Use of Metamic® Poison Insert Assemblies in the Spent Fuel Pool (TAC NO. MD2674)"
- K. N. Jabbour (NRC) to C. M. Crane (Amerigen) dated October 31, 2005, "Clinton Power Station, Unit 1 - Issuance of an Amendment - Re: Onsite Spent Fuel Storage Expansion (TAC NO. MC4202)"
- S. N. Bailey (NRC) to D. E. Young (Crystal River) dated October 25, 2007, "Crystal River, Unit 3 - Issuance of Amendment Regarding Fuel Storage Patterns in the Spent Fuel Pool (TAC NO. MD3308)"

The Waterford spent fuel pool racks are similar in material and geometric configuration as those PWRs identified above. The use of CASMO-4 by Holtec for spent fuel pool licensing activities on these PWR plants, and NRC approval of that use, provides the justification for using CASMO-4 for relative reactivity calculations for the Waterford spent fuel pool criticality analysis.

References:

(1) D. Knott, "CASMO-4 Benchmark Against Critical Experiments," SOA-94-13, Studsvik of America, Inc., (proprietary)
(2) D. Knott, "CASMO-4 Benchmark against MCNP," SOA-94-12, Studsvik of America, Inc., (proprietary)

RAI Question 6

Soluble Boron Requirements:

The application provides no discussion on the soluble boron methodology. Please explain how the soluble boron requirements were determined.

Entergy Response 6

The soluble boron requirements are determined by interpolation between a 0 ppm soluble boron case and a (for example) 600 ppm boron case. Table 7.13, Table 7.14, and Table 7.15 have been recreated with additional information (in bold text) to support the conclusions of the analysis for both normal and accident conditions. The new tables are presented below.

Table 7.13

Region 2 Results for the Spent Fuel Uniform Loading Case

Enrichment (wt% ^{235}U)	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Burnup (GWD/MTU)	0.00	5.89	11.77	17.50	23.55	28.15	33.39
CASMO Burnup for Tolerances	0.0	4.0	11.0	15.0	22.5	27.5	32.5
Depletion Uncertainty	0.0000	0.0019	0.0051	0.0066	0.0091	0.0105	0.0117
Manufacturing Uncertainty	0.0045	0.0045	0.0043	0.0044	0.0043	0.0042	0.0042
Fuel Uncertainty	0.0079	0.0059	0.0050	0.0044	0.0041	0.0038	0.0036
Calculational Uncertainty	0.0012	0.0012	0.0014	0.0014	0.0012	0.0012	0.0014
Code Uncertainty	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Total Uncertainty	0.0092	0.0078	0.0085	0.0092	0.0110	0.0121	0.0131
Code Bias	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
Temperature Bias	0.0056	0.0046	0.0038	0.0036	0.0032	0.0030	0.0029
IFBA Bias	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
Target k_{eff} (0.995-corrections)	**0.9723**	**0.9747**	**0.9747**	**0.9743**	**0.9729**	**0.9720**	**0.9712**
Target k_{eff} (0.945-corrections)	**0.9223**	**0.9247**	**0.9247**	**0.9243**	**0.9229**	**0.9220**	**0.9212**
Normal k-eff 0 ppm Boron	0.9613	0.9747	0.9747	0.9743	0.9729	0.9720	0.9712
Normal k-eff 600 ppm Boron	0.8560	n/a	n/a	0.8948	n/a	n/a	0.9040
Normal Conditions ppm Soluble Boron	**222**	n/a	n/a	**377**	n/a	n/a	**447**
Mislocated k_{eff} 0 ppm Boron	n/a	**1.0103**	n/a	**1.0072**	n/a	n/a	**1.0030**
Mislocated k_{eff} 600 ppm Boron	n/a	**0.9017**	n/a	**0.9052**	n/a	n/a	**0.9077**
Mislocated Conditions ppm Soluble Boron	n/a	**473**	n/a	**487**	n/a	n/a	**515**
Misloaded k_{eff} 0 ppm Boron	n/a	**1.0140**	n/a	**1.0139**	n/a	n/a	**1.0100**
Misloaded k_{eff} 800 ppm Boron	n/a	**0.9044**	n/a	**0.9139**	n/a	n/a	**0.9187**
Misloaded Conditions ppm Soluble Boron	n/a	**651**	n/a	**716**	n/a	n/a	**778**

Table 7.14

Region 2 Results for the Spent Fuel Checkerboard Loading

Enrichment (wt% $_{235}$U)	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Burnup (GWD/MTU)	2.41	9.42	16.21	23.55	29.53	34.64	41.23
CASMO Burnup for Tolerances	2.0	8.0	15.0	22.5	27.5	32.5	40.0
Depletion Uncertainty	0.0009	0.0038	0.0067	0.0094	0.0109	0.0122	0.0141
Manufacturing Uncertainty	0.0043	0.0043	0.0042	0.0041	0.0041	0.0041	0.0040
Fuel Uncertainty	0.0075	0.0059	0.0051	0.0047	0.0043	0.0040	0.0039
Calculational Uncertainty	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012
Code Uncertainty	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Total Uncertainty	0.0088	0.0083	0.0096	0.0114	0.0125	0.0135	0.0152
Code Bias	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
Temperature Bias	0.0051	0.0041	0.0035	0.0031	0.0029	0.0028	0.0025
IFBA Bias	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
Target k_{eff} (0.995-corrections)	**0.9731**	**0.9747**	**0.9740**	**0.9726**	**0.9717**	**0.9708**	**0.9693**
Target k_{eff} (0.945-corrections)	**0.9231**	n/a	n/a	**0.9226**	n/a	n/a	**0.9193**
Normal k_{eff} without Boron	**0.9950**	**0.9950**	**0.9950**	**0.9950**	**0.9950**	**0.9950**	**0.9950**
Normal k_{eff} with 600 ppm Boron	**0.9112**	n/a	n/a	**0.9193**	n/a	n/a	**0.9265**
Normal Conditions ppm Soluble Boron	**358**	n/a	n/a	**396**	n/a	n/a	**438**
Mislocated k_{eff} 0 ppm Boron	**1.0092**	n/a	n/a	**1.0067**	n/a	n/a	**1.0061**
Mislocated k_{eff} 600 ppm Boron	**0.9072**	n/a	n/a	**0.9080**	n/a	n/a	**0.9086**
Mislocated Conditions ppm Soluble Boron	**506**	n/a	n/a	**511**	n/a	n/a	**534**
Misloaded k_{eff} 0 ppm Boron	**1.0217**	n/a	n/a	**1.0154**	n/a	n/a	**1.0137**
Misloaded k_{eff} 800 ppm Boron	**0.9201**	n/a	n/a	**0.9227**	n/a	n/a	**0.9236**
Misloaded Conditions ppm Soluble Boron	**776**	n/a	n/a	**800**	n/a	n/a	**838**

Table 7.15

Region 2 Results for the Fresh Checkerboard Loading, 5.0 wt% ^{235}Us

Enrichment (wt% ^{235}U)	5.0
Burnup (GWD/MTU)	0
CASMO Burnup for Tolerances	0.0000
Manufacturing Uncertainty	0.0053
Fuel Uncertainty	0.0029
Calculational Uncertainty	0.0014
Code Uncertainty	0.0011
Total Uncertainty	0.0063
Code Bias	0.0009
Temperature Bias	0.0034
IFBA Bias	0.0070
Normal k_{eff} 0 ppm Boron	0.8256
Target k_{eff} (0.945-corrections)	0.9274
Mislocated k_{eff} 0 ppm Boron	1.0171
Mislocated k_{eff} 600 ppm Boron	0.9091
Mislocated Conditions ppm Soluble Boron	**498**
Misloaded k_{eff} 0 ppm Boron	1.0242
Misloaded k_{eff} 800 ppm Boron	0.9220
Misloaded Conditions ppm Soluble Boron	**758**

Attachment 2

To

W3F1-2009-0007

Revised "No Significant Hazards Consideration" Section 5.2

5.2 No Significant Hazards Consideration

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

Response: No.

The purpose of the spent fuel storage racks is to maintain fresh and irradiated fuel in a safe storage condition. The proposed changes for the Region 1 (spent fuel cask storage area) and Region 2 (spent fuel pool and, after permanent plant shutdown, refueling canal) fuel storage racks, which involve taking credit for soluble boron, revising the burnup-enrichment limits and loading restrictions for the storage of fuel assemblies, and increasing the k_{eff} limit for the flooding of the fuel storage racks with unborated water will not affect any accident initiator or mitigator. The proposed changes will provide more flexibility in storing the more reactive NGF assemblies in the spent fuel pool storage racks. The effects of the new fuel parameters of NGF assemblies on radiation shielding, thermal-hydraulics, seismic/structural, and mechanical drop analyses have been separately reviewed and were found to be acceptable.

The proposed changes will not alter the configuration of the storage racks or their environment. The fuel racks will not be operated outside of their design limits, and no additional loads will be imposed on them. Therefore, these changes will not affect fuel storage rack performance or reliability. No new equipment will be introduced into the plant. The accuracies and response characteristics of existing instrumentation will not be modified. The proposed changes will not require, or result in, a change in safety system operation, and will not affect any system interface with the fuel storage racks. Fuel assembly placement will continue to be controlled in accordance with approved fuel handling procedures. The proposed changes in the Technical Specifications, including surveillance requirements, will not add any significant complexities or increase the possibility of operator error.

The proposed changes will not affect any barrier that mitigates dose to the public, and will not result in a new release pathway being created. The functions of equipment designed to control the release of radioactive material will not be impacted, and no mitigating actions described or assumed for an accident in the UFSAR will be altered or prevented. No assumptions previously made in evaluating the consequences of an accident will need to be modified. Onsite dose will not be increased, so the access of plant personnel to vital areas of the plant will not be restricted, and mitigating actions will not be impeded.

Therefore, it is concluded that the proposed changes do not significantly increase either the probability or consequences of any accident previously evaluated.

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

Response: No

The proposed changes for the Region 1 (spent fuel cask storage area) and Region 2 (spent fuel pool and, after permanent plant shutdown, refueling canal) fuel storage racks, which involve taking credit for soluble boron, revising the burnup-enrichment limits and loading restrictions for the storage of fuel assemblies, and increasing the k_{eff} limit for the flooding of the fuel storage racks with unborated water will not increase the probability of an accident which was previously considered to be credible nor create the possibility of a new or different kind of accident from any accident initiator previously evaluated in the UFSAR.

The proposed changes do not involve changes to the configuration of plant systems, or the manner in which they are operated. Crediting soluble boron in the spent fuel pool storage rack criticality analysis will have no effect on normal pool operation and maintenance since soluble boron in Region 1 and Region 2 is currently required by procedure. The crediting of soluble boron will only result in increased sampling to verify compliance with the minimum boron concentration required by the new TS 3/4.9.12. The increased sampling ensures that a new kind of accident, boron dilution in the spent fuel pool, will not be created.

The addition of large amounts of unborated water would be necessary to reduce the boron concentration in the spent fuel pool from the normal level of $\geq$ 1900 ppm specified in new TS 3/4.9.12 to either 838 ppm (needed to accommodate the most limiting fuel loading accident) or 447 ppm (required for non-accident conditions). A small dilution flow might result from a leak from the cooling system into the spent fuel pool. Routine surveillance measurements of the soluble boron concentration conducted every 7 days per the new TS 3/4.9.12 would readily detect the reduction in concentration and provide sufficient time for corrective action prior to exceeding the regulatory limits.

A high flow rate dilution accident involving continuous operation of the Condensate Storage Pool pump could add a large amount of unborated water to the spent fuel pool. However, multiple alarms would alert the Control Room to the situation, including the fuel pool high-level alarm, Fuel Handling Building sump high-level alarm, and the Liquid Waste Management Trouble alarm. It is not considered credible that either multiple alarms would fail or be ignored by Operators, or that the spilling of large volumes of water from the spent fuel pool would be observed by plant personnel who would not take corrective actions. Moreover, if the soluble boron in the spent fuel storage racks would be completely diluted, the fuel in the racks will remain subcritical by a design margin of at least 0.005 Δk, and the k_{eff} of the fuel in the racks will remain below 1.00.

Therefore, it is concluded that the proposed changes do not create the possibility of a new or different kind accident from any accident previously evaluated.

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

Response: No

The proposed changes for the Region 1 (spent fuel cask storage area) and Region 2 (spent fuel pool and, after permanent plant shutdown, refueling canal) fuel storage racks, which involve taking credit for soluble boron, revising the burnup-enrichment limits and loading restrictions for the storage of fuel assemblies, and increasing the k_{eff} limit for the flooding of the fuel storage racks with unborated water will not result in a significant reduction in a margin of safety.

Detailed analysis with approved and benchmarked methods has shown, with a 95% probability at a 95% confidence level, that the neutron multiplication factor, k_{eff}, of the Region 1 and Region 2 high-density spent fuel pool storage racks, loaded with either Standard or NGF assemblies, and including biases, tolerances, and uncertainties is less than 1.00 with unborated water and less than 0.95 with 447 ppm of soluble boron credited. In addition, the effects of abnormal and accident conditions have been evaluated to demonstrate that under credible conditions the k_{eff} will not exceed 0.95 with soluble boron credited. To ensure that the margin of safety for subcriticality is maintained and that k_{eff} will be below 0.95, a new TS 3/4.9.12 will require a soluble boron level of $\geq$ 1900 ppm in the spent fuel pool. This is significantly greater than the required soluble boron concentration of 447 ppm under normal conditions and 838 ppm for all credible accident conditions.

Therefore, it is concluded that the proposed changes do not involve a significant reduction in a margin of safety.

Attachment 3

To

W3F1-2009-0007

Proposed TS 3/4.9.13, Spent Fuel Storage

ADD TS 3/4.9.13

3/4.9.13 SPENT FUEL STORAGE

LIMITING CONDITION FOR OPERATION

3.9.13 Storage of fuel assemblies in the spent fuel storage racks of Region 1 (cask storage pit) and Region 2 (spent fuel pool and refueling canal) shall be as follows:

a. Each fuel assembly stored in Region 1 and Region 2 shall be within the limitations in Specification 5.6.1.

b. The combination of initial enrichment and burnup of each fuel assembly stored in Region 2 shall be within the Acceptable Burnup Domain of either Figure 5.6-2 or Figure 5.6-3.

APPLICABILITY:

Whenever a fuel assembly is stored in a spent fuel storage rack.

ACTION:

a. With the requirements of the LCO not met, immediately initiate action to restore the non-complying fuel assembly within requirements.

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.13 Verify by administrative means that each fuel assembly meets fuel storage requirements contained in Specification 5.6.1 prior to storing the fuel assembly in a spent fuel storage rack.