January 27, 2005

Mr. George Vanderheyden, Vice President
Calvert Cliffs Nuclear Power Plant, Inc.
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657-4702

SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2 - AMENDMENT TO INCREASE THE SPENT FUEL POOL MAXIMUM ENRICHMENT LIMIT (TAC NO. MC0935)

Dear Mr. Vanderheyden:

The Commission has issued the enclosed Amendment No. 246 to Renewed Facility Operating License No. DPR-69 for the Calvert Cliffs Nuclear Power Plant, Unit No. 2. This amendment consists of changes to the Technical Specifications (TSs) in response to your application transmitted by letter dated September 30, 2003.

The amendment modifies TS 4.3.1, "Criticality," adds TS 3.7.16, "Spent Fuel Pool Boron Concentration," and adds TS 3.7.17, "Spent Fuel Pool Storage." Specifically, the amendment increases the maximum enrichment limit of the fuel assemblies that can be stored in the Unit 2 spent fuel pool by taking credit for soluble boron, burnup, and configuration control in maintaining acceptable margins of subcriticality.

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's next regular biweekly *Federal Register* notice.

Sincerely,

/RA/

Richard V. Guzman, Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-318

Enclosures: 1. Amendment No. 246 to DPR-69
2. Safety Evaluation

cc w/encls: See next page

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DISTRIBUTION:

PDI-1 R/F	GMatakas, RGN-1	
ACRS	RGuzman	OGC
PUBLIC	SLittle	GHill (4)
SJones	RLaufer	JUhle
KManoly	TBoyce	MBarillas
RReyes		

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* Provided SE input by memo. No substantive changes made.

Accession No.: ML050140262 Package No.: ML TSs: ML

OFFICE	PDI-1/PM	PDI-2/LA	IROB/SC	SRXB/SC*	SPLB/SC*	OGC	PDI-1/SC
NAME	RGuzman	SLittle	TBoyce	JUhle	SJones	DFruchter	RLaufer
DATE	1/13/05	1/14/05	1/14/05	6/18/04	11/29/04	1/26/05	1/27/05

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Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2

cc

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CALVERT CLIFFS NUCLEAR POWER PLANT, INC.

DOCKET NO. 50-318

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 246
Renewed License No. DPR-69

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Calvert Cliffs Nuclear Power Plant, Inc. (the licensee) dated September 30, 2004, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.2. of Renewed Facility Operating License No. DPR-69 is hereby amended to read as follows:

2. Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 246, are hereby incorporated into the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Richard J. Laufer, Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: January 27, 2005

ATTACHMENT TO LICENSE AMENDMENTS

AMENDMENT NO. 246 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-69

DOCKET NO. 50-318

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove Pages	Insert Pages
iii	iii
iv	iv
v	v
3.7.16-1	3.7.16-1
- - -	3.7.17-1
- - -	3.7.17-2
- - -	3.7.17-3
4.0-2	4.0-2
4.0-3	4.0-3

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 246 TO RENEWED FACILITY

OPERATING LICENSE NO. DPR-69

CALVERT CLIFFS NUCLEAR POWER PLANT, INC.

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2

DOCKET NO. 50-318

1.0 INTRODUCTION

By letter dated September 30, 2003 (ADAMS Accession No. ML033140579), the Calvert Cliffs Nuclear Power Plant, Inc. (CCNPPI or the licensee) submitted a request for changes to the Calvert Cliffs Nuclear Power Plant, (CCNPP) Unit No. 2, Technical Specifications (TSs). The proposed changes would add the requirements of TS 3.7.16, “Spent Fuel Pool Boron Concentration,” and TS 3.7.17, “Spent Fuel Pool Storage,” and modify TS 4.3.1, “Criticality.”

The proposed changes would increase the maximum enrichment limit of the fuel assemblies that can be stored in the Unit 2 spent fuel pool (SFP) by taking credit for soluble boron, burnup, and configuration control in maintaining acceptable margins of subcriticality. The TS bases would be revised to address the proposed changes.

The objective of CCNPPI’s boron dilution analysis is to confirm that design features, instrumentation, administrative procedures, and sufficient time are available to enable adequate detection and mitigation of any boron dilution event in the SFP before the boron concentration is reduced below the value assumed in the SFP criticality analysis. These SFP criticality analyses credit boron to remain below the design basis criticality limit of 0.95 effective multiplication factor (k_{eff}). Unlike those for CCNPP Unit 1, the CCNPP Unit 2 SFP storage racks contain boraflex. The boron dilution analysis is the same for both CCNPP units.

While evaluating the proposed CCNPP licence amendment request (LAR), the Nuclear Regulatory Commission (NRC) staff reviewed other precedent amendment requests (PARs). The CCNPP boron dilution analysis is comparable to that submitted in these PARs.

2.0 REGULATORY EVALUATION

The NRC finds that CCNPPI in its September 30, 2003, submittal identified the applicable regulatory requirements. The regulatory requirements and guidance which the NRC staff considered in its review of the application are as follows:

1. Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50 Appendix A, "General Design Criteria [GDC] for Nuclear Power Plants" provides a list of the minimum design requirements for nuclear power plants. Specifically, GDC-62, "Prevention of criticality in fuel storage and handling," states that "criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations."

2. 10 CFR Section 50.68, "Criticality accident requirements," provides the regulatory requirements for maintaining subcritical conditions in spent fuel pools. Section 50.68 states, in part, that:

   a. if credit is taken for soluble boron, the k_{eff} of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k_{eff} must remain below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, if flooded with unborated water.

   b. radiation monitors are provided in storage and associated handling areas when fuel is present to detect excessive radiation levels and to initiate appropriate safety actions.

   c. the maximum nominal U-235 enrichment of the fresh fuel assemblies is limited to five (5.0) percent by weight.

In its safety evaluation (SE) of the Westinghouse Topical Report, WCAP-14416-P, the NRC staff found the report to be acceptable for referencing in license applications. The report includes a description of methodology for crediting soluble boron in the SFP when performing storage rack criticality analysis. Supporting documentation to the report specifies, in part, the following:

a. all licensees proposing to use the new method described for soluble boron credit should submit a 10 CFR 50.36 TS change.

b. all licensees proposing to use the new method described for soluble boron credit should identify potential events which would dilute the SFP soluble boron to the concentration required to maintain the 0.95 k_{eff} limit (as defined) and should quantify the time span of these dilution events to show that sufficient time is available to enable adequate detection and suppression of any dilution event. The effects of incomplete boron mixing, such as boron stratification, should be considered. This analysis should be submitted for NRC review and should also be used to justify the surveillance interval used for verification of the TS minimum pool boron concentration.

c. plant procedures should be upgraded, as necessary, to control pool boron concentration and water inventory during both normal and accident conditions.

The SFP cooling system (SFPCS) and spent fuel storage (SFS) are described in Chapter 9 of the Calvert Cliffs Updated Final Safety Analysis Report. SFPCS and SFS descriptions, along with the applicable design basis information in Chapter 9, provide criteria needed to evaluate the ability of equipment to comply with the applicable requirements of 10 CFR 50.68 and

NRC-approved WCAP guidelines, as it relates to proposed LAR changes. In addition, the NRC defined acceptable methodologies for performing SFP criticality analyses in the following documents:

1. NUREG-0800, Standard Review Plan, Section 9.1.2, “Spent Fuel Storage,” Draft Revision 4 dated April 1996.

2. Proposed Revision 2 to Regulatory Guide 1.13, “Spent Fuel Storage Facility Design Basis,” dated December 1981.

3. Memorandum from L. Kopp (NRC) to T. Collins (NRC), “Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants,” dated August 19, 1998.

3.0 TECHNICAL EVALUATION

3.1 Spent Fuel Pool Design

The SFP is a large rectangular structure that holds the spent fuel assemblies from the reactors in both CCNPP units. Borated water fills the SFP and completely covers the spent fuel assemblies. The SFP is constructed of reinforced concrete (thickness of 6 feet) and is lined with a 3/16-inch stainless steel plate, which serves as a leakage barrier. A dividing wall (thickness of 3.5 feet) separates the SFP, with the north half associated with Unit 1 and the south half associated with Unit 2. A slot in the dividing wall has removable gates, which allow movement of fuel assemblies between the two halves of the pool. The SFP is located in the auxiliary building between the two containment structures.

3.2 Boron Dilution Analysis

The first step in the boron dilution analysis is to identify potential initiating events that could cause dilution of the boron in the SFP and eventually lead to a substantial reduction of pool boron concentration. CCNPPI states that a boron dilution event in the SFP could be initiated by external events, a variety of human errors, or component malfunctions. CCNPPI’s potential initiating events were developed based on a review of the events in NUREG-1353, “Beyond Design Basis Accidents in Spent Fuel Pools,” and a systematic evaluation of the unborated water sources that interface with the pool. External events include fire in the vicinity of the pool, external floods at the site, storms causing runoff into the SFP area, seismic induced failures of piping, missile generation causing leaks in piping, and airplane crashes into the fuel handling building. Other boron dilution events include small loss of inventory occurrences, tank ruptures in the vicinity of the SFP, breaks in SFP cooling system piping or heat exchangers, random breaks in piping, dilution events initiated in the reactor coolant system, and misalignment of valves interfacing with the SFP.

The methodology employed by CCNPPI involves calculation of the SFP volumes, dilution volumes, and dilution times for SFP boron dilution events with various dilution sources and flow rates.

CCNPPI determined that a minimum boron concentration of 350 parts per million (ppm) with uncertainties is required to credit soluble boron and safely store 5.0 weight percent fuel in the SFP. The normal boron concentration maintained in the SFP is expected to be at least the same as that for the refueling boron TS, which is greater than 2150 ppm. However, CCNPPI conservatively chose an initial boron concentration of 2000 ppm for boron dilution event analysis. CCNPPI's proposed license amendment change includes the addition of TS 3.7.16 to provide sufficient negative reactivity to ensure acceptable levels of subcriticality for spent fuel storage, assuming a dilution event. TS 3.7.16 would require a SFP boron concentration greater than or equal to 2000 ppm, which supports the normal and accident conditions.

In the boron dilution event calculations, CCNPPI conservatively utilized a SFP net volume of 80,000 cubic feet up to the SFP overflow limit. This net volume equates to a SFP water inventory of 598,480 gallons and reflects the SFP gross volume minus volume displacements by structures in the SFP (e.g., racks for fuel assemblies). SFP water inventory at a height corresponding to the SFP low water level alarm limit (66 feet, 6 inches) is 590,920 gallons. The SFP net volume is a summation of the volumes for the two halves of the SFP associated with CCNPP Units 1 and 2, respectively.

The potential boron dilution sources include the two pretreated water storage tanks (500,000 gallons each), the two condensate storage tanks (314,800 gallons each), the demineralized water storage tank (350,000 gallons), the two refueling water tanks (420,000 gallons each), and three well water pumps and filters at 175 gpm each. Water for the fire protection system is supplied by two full-capacity 2500 gallons per minute (gpm) fire pumps, which take suction from the two 500,000 gallon capacity pretreated water storage tanks. Plant service water isolation valves are in low flow rate systems which take suction on the two 500,000 gallon pretreated water storage tanks. Demineralized water isolation valves are in low flow rate (150 gpm) systems which take suction on the 350,000 gallon demineralized water storage tank. Plant heating system valves are in a low flow rate system which takes suction on the two 500,000 gallon pretreated water storage tanks. The two SFP cooling pumps (1390 gpm) can supply 420,000 gallons of borated water from each refueling water tank.

Based on CCNPPI's boron dilution analysis, potential initiating events that could cause a dilution of the boron in the SFP to a level below that credited in the criticality analysis comprise three categories: i) dilution by flooding, ii) dilution by loss of coolant induced makeup, and iii) dilution by loss of cooling system induced makeup.

3.2.1 Flooding

Dilution by flooding includes the effects of natural phenomena, failure of the fire protection system, failure of the plant service isolation valves, misalignment of the demineralized water isolation valves, failure of the plant heating system valves, effects of the SFP cooling pumps, tank rupture in the vicinity of the SFP, breaks in the SFP cooling system piping or heat exchangers, and reactor coolant system failures.

The large volume of water necessary to dilute the SFP to the boron endpoint (350 ppm) precludes many small tanks as potential dilution sources. No tanks containing any significant amount of water are stored in the vicinity of the SFP. The large borated water sources, such as reactor makeup water and demineralized water, are in tanks at elevations below the SFP, so gravity feed from these tanks to the SFP is not possible.

The worst case dilution by flooding source is a 2,500 gpm fire hose discharging directly into the SFP. At a dilution rate of 2,500 gpm, it will take 6.95 hours to dilute the SFP from 2000 ppm to 350 ppm. CCNPPI states that it is not credible that dilution could occur for this length of time without plant operator notice, since this event would activate the high level alarm and initiate auxiliary building flooding. In addition, an excess of 1,043,000 gallons of unborated water must be added to the SFP to reach a soluble boron concentration of 350 ppm. This is more water volume than is contained in both pretreated water storage tanks and also more water volume than is contained in the demineralized water storage tank and both condensate storage tanks combined. CCNPPI states that this dilution by flooding scenario bounds all others (e.g., break in the heat exchanger for SFP cooling system, which would take 12.5 hours to dilute the SFP boron concentration from 2000 ppm to 350 ppm at a dilution rate of 1390 gpm).

Based on CCNPPI’s evaluation of other flooding dilution event scenarios where the time for dilution to the SFP minimum boron concentration is greater than that for the discharging fire hose scenario, the NRC staff agrees that the discharging fire hose scenario bounds the others.

Using the methodology described in Westinghouse Topical Report WCAP-14181-NP, the NRC staff verified through independent calculations, the licensee’s fire hose calculation of time (6.95 hours) and unborated water volume (1,043,000 gallons) required to dilute the SFP boron concentration from 2000 ppm to 350 ppm. This calculation is based on the assumption that the SFP had complete mixing of boron and constant volume. The NRC staff concurs that the calculated time for dilution to the minimum boron concentration of 350 ppm is adequate for detection of this boron dilution event and for CCNPP personnel to take mitigative action.

3.2.2 Loss of SFP Inventory

Dilution by loss of SFP coolant inventory includes the effects of natural phenomena, fuel cask drop, fuel assembly drop, airplane crash, pipe break and general SFP leakage. CCNPPI states that only partial structural failures, where makeup can compensate for the loss of coolant, can cause a boron dilution event. CCNPPI further states that even in the unlikely event that the SFP is completely diluted of boron by a total loss of inventory and a refill with unborated water, the SFP will remain subcritical by a design margin of k_{eff} not to exceed 0.986.

To detect low-flow, long-term dilution events, the proposed TS 3.7.16 requires that the SFP boron concentration be sampled every 7 days to ensure that the appropriate minimum concentration is maintained. Using the methodology described in Westinghouse Topical Report WCAP-14181-NP, the NRC staff independently determined that a dilution rate of 103.5 gpm would be required over 7 days to dilute the SFP boron concentration from 2000 ppm to 350 ppm. The NRC staff concluded that the addition of unborated water to the SFP at a dilution rate of 103.5 gpm would be detectable by CCNPP personnel in sufficient time to take mitigative actions. For example, assuming the SFP water inventory is above the SFP low water level alarm limit (66 feet, 6 inches) and a dilution rate of 103.5 gpm, approximately 1 hour would be required for the water level to reach the SFP overflow limit. If no mitigative actions were taken, other alarms monitored in the control room, including an alarm due to flooding in the auxiliary building, would follow.

The NRC staff also independently determined that a dilution rate of 51.7 gpm would be required for more than 7 days to dilute the SFP boron concentration from 2000 ppm to 350 ppm, if boron dilution is assumed to occur in only one-half of the SFP (i.e., an assumption reflecting closure of the gate in the wall dividing the SFP into two halves). For this second example, approximately 2 hours would be required for the water level to reach the SFP overflow limit. Again, if no mitigative actions were taken, other alarms monitored in the control room, including an alarm due to flooding in the auxiliary building, would follow.

3.2.3 Loss of SFP Cooling

Dilution may also occur by loss of SFP cooling. Even though loss of SFP cooling is not part of the design basis because the SFPCS is Class III, the effect of this event has been analyzed. CCNPPI states that assuming that the Units 1 and 2 SFPs contain 1830 assemblies generating the maximum possible heat load of 37.6E06 BTU/hr (british thermal units-per-hour) and assuming the worst case initial SFP temperature of 155 EF, then the time to boil can be calculated as 7.34 hours. Time to core uncovery is calculated to be 78.9 hours. However, loss of coolant by boiling will not result in a loss of soluble boron, since the soluble boron is not volatile. Thus, CCNPPI concludes that loss of SFPC system without makeup water flow is not a mechanism for boron dilution. CCNPPI further states that if sufficient unborated water is added to the SFP to just keep the water from boiling and if the excess fluid flows down the auxiliary building gravity drains associated with the SFP overflow level, it would take 24.88 hours to dilute the SFP to 350 ppm. It is not credible that the dilution could occur for this length of time without operator notice, since this event would activate the high level alarm and initiate auxiliary building flooding. In addition, in excess of 1,043,000 gallons of demineralized water must be added to the SFP to reach 350 ppm soluble boron concentration. This is three times more water volume than is contained in the demineralized water tank.

The NRC staff concurs with CCNPPI's above rationale for evaluating potential boron dilution events associated with loss of SFP cooling.

CCNPPI states that SFP instrumentation available for detection of boron dilution include the following: radiation monitors and alarms, high level alarms, low level alarms, temperature alarms, and cooling system alarms. Additional instrumentation is provided to monitor the pressure and flow of the SFP cooling and cleanup system. CCNPPI further states that in addition, operating and administrative procedures are available for the detection and mitigation of dilution events. For example, plant operators shall make a complete round during each 12-hour shift, including the level indication in the SFP area. The plant operator also shall identify and contain all water leakage and look for damaged piping and instrument tubing, noting excessive vibration.

In summary, CCNPPI states that the potential initiating event that could cause dilution of the boron in the SFP to a level that is below that credited in the criticality analyses comprises three categories: i) dilution by flooding, ii) dilution by loss of coolant induced makeup, and iii) dilution by loss of cooling system induced makeup. CCNPPI concludes that it is not credible that dilution could occur for the required length of time without operator notice, since the initiating event would activate the high level alarm and initiate auxiliary building flooding. In addition, in excess of 1,043,000 gallons of unborated water must be added to the SFP to reach a soluble boron concentration of 350 ppm. This is more water volume than is contained in the demineralized water storage tank and both condensate storage tanks combined. Even in the unlikely event that the SFP is completely diluted of boron, the SFP will remain subcritical by a design margin of k_{eff} not to exceed 0.986.

The NRC staff concurs that the combination of the large volume of water required for a dilution event, flow rates and dilution times, the licensee's administrative requirements, TS controlled SFP concentration, and a 7 day sampling requirement would adequately detect a boron dilution event prior to k_{eff} reaching 0.95. Therefore, the NRC staff finds that the requirements of 10 CFR 50.68 and the NRC staff's guidelines established in the SE for WCAP-14416 have been adequately satisfied.

3.3 Computer Codes

CCNPPI performed the source term analysis using SAS2H, a functional module in the SCALE system, to calculate the burnup-dependent source terms for the CCNPP Unit 2 SFP system. The SAS2H control module performs the depletion/decay analysis using the well-established codes and data libraries provided in the SCALE system. SAS2H was benchmarked to the CCNPP Unit 2 cycle 14 environmental qualification radioactive source terms of Reference 39 in Attachment 5 (ADAMS Accession No. ML033140581) of CCNPPI's application dated September 30, 2003, and to the measured data in ORNL/TM-12667, which bound the range of variables in the rack designs. The SCALE 4.4 CSAS25 code module with the 44 group ENDF/B-V cross section library was used to perform the KENO-V.a criticality analysis. KENO-V.a is a three-dimensional Monte Carlo code which was used to calculate k_{eff}.

The NRC staff reviewed CCNPPI's application of the KENO code to determine whether it could reasonably calculate the appropriate parameters necessary to support the maximum k_{eff} analysis. The NRC staff concluded that CCNPPI's use of KENO for calculation of k_{eff} was appropriate. Additionally, the NRC staff found that CCNPPI's use of the SAS2H code was acceptable in performing the fuel depletion analysis.

3.4 Criticality Analysis

CCNPP Unit 2 SFP storage racks contain boraflex. The current analysis for the Unit 2 SFP assumes the presence of Boraflex poison sheets. Boraflex is not credited in the new Unit 2 criticality analysis. Burnup is credited in the analysis in place of boraflex to assure that the TS k_{eff} limit of 0.95 is maintained. Integral Burnable Absorbers (IBAs) are burnable poisons that are an integral part of the fuel assembly. The criticality analysis conservatively neglected the presence of the IBAs by assuming non-poisoned equivalent enrichment fuel. CCNPPI made the following technical assumptions in its criticality analysis: 1) no reactivity equivalencing was used in this analysis; 2) no control element assembly insertion was credited; 3) no shims were modeled in the fuel assemblies; 4) encapsulated fuel cannot be stored in the guide tubes of fuel assemblies stored in the Unit 2 SFP; 5) the most reactive fuel type, 5.0 w/o value added pellet (VAP) fuel, is modeled; 6) U-234 and U-236 were conservatively not modeled in the fresh fuel pellet; 7) a refueling boron concentration of 2000 ppm was conservatively used in this work; and 8) a 15-percent refueling boron concentration uncertainty was assumed instead of the current 7.5 percent. CCNPPI also assumed worst case values for moderator temperature, cladding composition, soluble boron concentration, and fixed poison loading in all the reactivity calculations. The NRC staff found these assumptions to be acceptable since the conservatism stated, along with the uncertainties and biases calculated, yielded k_{eff} values which met regulatory requirements.

Based on the computations performed in this analysis, all burnup related reactivity calculations used a worst case uncertainty value of 0.02089. When benchmarked to the radiochemical assay (RCA) data of CCNPP fuel presented in ORNL/TM-12667, the results indicated SAS2H

k_{eff} was greater than the RCA value. The SAS2H generated reactivity was 0.358 percent more reactive than those adjusted to RCA isotopics. Using the uncertainty value of 0.02089 generated by SAS2H was more conservative and reflects the uncertainties associated with burnup calculations. The NRC staff finds using the uncertainty generated by SAS2H to be acceptable since it is the more conservative value.

The overall k_{eff} calculations included a reactivity bias to account for the reactivity difference between a fuel assembly with an explicit axial three-dimensional burnup profile and one with a uniform two-dimensional profile at the same average burnup. CCNPPI compared two-dimensional and three-dimensional modeling as a function of enrichment and soluble boron. The reactivity bias results indicated that the worst case reactivity bias was for the unborated highest enrichment and highest burnup fuel. Thus, all the calculations used a worst case bias of 0.00325 delta-k. CCNPPI generated actual Calvert Cliffs end-of-cycle 26-node burnups for a complete core's assemblies. Two-dimensional and three-dimensional models compared were at the highest enrichment value of 5.0 weight percent and at zero soluble boron. The reactivity bias results indicated that the worst-case reactivity bias was -0.00579 delta-k for the actual 26-node burnups. Use of the 26-node burnup profile for CCNPP Unit 2 specific fuel is less conservative than using the uniform axial burnup model. Therefore, the axial burnup bias of 0.00325 delta-k for the unborated highest enrichment and highest burnup fuel was used for all the burnup cases.

CCNPPI executed multiple cases to determine reactivity as a function of burnup, enrichment, and soluble boron concentration. Cases ran with zero soluble boron concentration and a specific burnup showed the reactivity values were less than 0.998. At 300 ppm soluble boron concentration and the same specified burnup, all of the reactivity values were less than 0.95, in accordance with 10 CFR 50.68, when crediting soluble boron. The burnup values were increased by a measured burnup uncertainty extracted from the Asea Brown Boveri, Inc./Combustion Engineering Inc. Methodology Manual for Physics Biases and Uncertainties for Asea Brown Boveri, Inc./Combustion Engineering, Inc. Fuel Assemblies. The burnups required to store fuel in the Unit 2 SFP crediting 350 ppm of soluble boron including all biases and uncertainties are detailed in Attachment 1 (ADAMS Accession No. ML033140581) of CCNPPI's application dated September 30, 2003, and in the proposed TS 3.7.17, Figure 3.7.17-1. The NRC staff found the burnup value listed with its corresponding enrichment to be acceptable since the SFP is maintained subcritical and the regulatory requirements continue to be met.

3.5 Configuration Control

Each assembly offloaded from either the reactor or from an independent spent fuel storage installation dry storage canister must be evaluated against the above burnup restrictions to determine if it can be safely stored in the CCNPP Unit 2 SFP. The analysis modeled several checkerboard fuel patterns to determine if more reactive fuel can be stored in the CCNPP Unit 2 SFP while meeting regulatory requirements. Of the several checkerboard patterns modeled in the CCNPP Unit 2 SFP, only one checkerboard pattern met 10 CFR 50.68 requirements. The pattern is described in Attachment 5 (ADAMS Accession No. ML033140581) of CCNPPI's application dated September 30, 2003. The analysis showed that a fuel assembly with insufficient burnup must be surrounded on all four adjacent faces by empty rack cells or other nonreactive materials for SFP storage to satisfy regulatory requirements. Additionally, CCNPPI has fuel handling procedures and controls in place to assure assemblies are not misplaced. The NRC staff finds the proposed TS 3.7.17 meets the requirements set forth in 10 CFR 50.68 and that the storage configuration proposed is acceptable.

3.6 Accident Analysis

The postulated accidents for the SFP are the following: 1) a dropped fuel assembly on top of the storage rack, 2) a misloading accident, 3) an abnormal location of a fuel assembly, and 4) loss of normal cooling to the SFP. CCNPPI analyzed these accidents and found there was no increase in the consequences of an accidental drop, accidental misloading, or abnormal placement of a maximum enriched fuel assembly into the SFP storage racks. The criticality analysis demonstrated that the pool will remain subcritical following one of these events. The TS limit of 2000 ppm for SFP boron concentration will assure that an adequate SFP boron concentration will be maintained in the case of an accident to prevent criticality in the CCNPP Unit 2 SFP. CCNPPI also found that in the event that soluble boron in the SFP is completely diluted via unborated makeup flow, a pool completely filled with maximum enriched unburned assemblies will remain subcritical by a design margin that meets the requirements of 10 CFR 50.68. The potential initiating events that could cause boron dilution in the SFP to a level below that credited in the criticality analyses were analyzed and CCNPPI found the SFP will remain subcritical by a design margin of k_{eff} not to exceed 0.986. The NRC staff agrees that the design features, instrumentation, administrative procedures and the 24-hour time to dilute as described in the analysis provided in Attachment 6 (ADAMS Accession No. ML033140582) of CCNPPI's application dated September 30, 2003, are adequate to detect and mitigate boron dilution in the SFP before the boron concentration is reduced below 350 ppm and exceed the design basis criticality limit of 0.95 K_{eff}.

3.7 Conclusion

Based on our review of CCNPPI's rationale and evaluation, and the experience gained from our review of precedent LARs involving SFP boron dilution analysis, the NRC staff concludes that CCNPPI adequately identified the boron concentration necessary to (1) maintain K_{eff} less than 0.95, (2) verified subcriticality with unborated water as required by 10 CFR 50.68, (3) established a TS for boron dilution with a surveillance short enough to detect potential boron dilution, and (4) evaluated potential boron dilution scenarios to satisfy the NRC staff's guidelines established in the SE for WCAP-14416. Therefore, the NRC staff concludes that the boron dilution aspects of the proposed LAR are acceptable.

The NRC staff also reviewed the effects of the proposed change using the appropriate requirements of 10 CFR 50.68 and GDC 62. The NRC staff concludes that CCNPPI's amendment request provided reasonable assurance that under normal and accident conditions, CCNPPI would be able to safely operate the plant and comply with NRC regulatory requirements. Therefore, the NRC staff finds CCNPPI's amendment request acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Maryland State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (69 FR 2739). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: January 27, 2005