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February 23, 2007

U. S. Nuclear Regulatory Commission  
Washington, DC 20555

**ATTENTION:** Document Control Desk

**SUBJECT:** Calvert Cliffs Nuclear Power Plant  
Unit No. 1; Docket No. 50-317  
Temporary Exemption Request for Use of Lead Fuel Assemblies

Pursuant to Title 10 of the Code of Federal Regulations (CFR) 50.12(a), Calvert Cliffs Nuclear Power Plant, Inc. requests a temporary exemption for Calvert Cliffs Unit No. 1 from the requirements of 10 CFR 50.46 and 10 CFR Part 50, Appendix K.

This temporary exemption will allow the re-insertion of up to four lead fuel assemblies (LFAs) in Unit 1, Cycle 19. Two of the LFAs were manufactured by Westinghouse Electric Company (Westinghouse) and contain a limited number of fuel rods clad with advanced zirconium-based alloys. These LFAs were originally inserted into the Unit 2 core in April of 2003. The other two LFAs were manufactured by AREVA with fuel rods clad with M5™ alloy and were also originally inserted into the Unit 2 core in April of 2003. References (a) and (b) are the original exemption requests and References (c) and (d) are the Nuclear Regulatory Commission approvals.

In April 2003, eight LFAs (four from Westinghouse and four from AREVA) were inserted into the Unit 2 core in accordance with the approval granted for the LFAs in References (c) and (d). References (c) and (d) allowed operation with these eight LFAs for two cycles. References (a) and (b) noted that the LFAs would be removed after two cycles and have inspections performed prior to the assemblies being reinserted for a third duty cycle. Since References (a) and (b) were generated, Calvert Cliffs has re-evaluated our LFA program and plans to return up to four of the eight LFAs (two from each manufacturer) to the core for a third cycle of irradiation in low duty locations on the core periphery to allow evaluation of grid-to-rod fretting resistance. Requests were made [References (e) and (f)] and approved [References (g) and (h)] to permit a third cycle for four LFAs in low duty locations in either Unit 2, Cycle 17 or Unit 1, Cycle 19. The other four LFAs will be discharged to the spent fuel pool for detailed post-irradiation inspections prior to a planned reinsertion into Unit 1, Cycle 19. We plan to reinsert these four LFAs in limiting core locations to permit higher burnups to be achieved for these LFAs. We are providing this separate request to permit the reinsertion of these LFAs in limiting locations. An additional request for approval to use WCAP-15604-NP-A, "Limited Scope High Burnup Lead Test Assemblies," and a letter of intent to irradiate above 60 GWD/MTU will be submitted in support of achieving higher burnup on these LFAs. This exemption request is limited to the use of non-Zircaloy and non-Zirlo cladding on the LFAs.

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## **TEMPORARY EXEMPTION REQUEST**

The CFR specifies standards and acceptance criteria only for fuel rods clad with Zircaloy or ZIRLO™. Thus, a temporary exemption is requested to use fuel rods clad with an advanced alloy that is not Zircaloy or ZIRLO™. The original exemption was only approved for Unit 2 Cycles 15 and 16.

As noted in References (a) and (b), the Calvert Cliffs LFA program is intended to provide data to support the use of new and improved fuel cladding material and fuel evaluation codes and methods. Additionally, References (a) and (b) stated that the LFAs may be reinserted for a third cycle and that an explicit submittal for use during an additional cycle would be provided at that time. This letter constitutes that request.

The LFAs placed back in the core will exceed the peak fuel rod burnup limitation of 60,000 MWD/MTU and will meet all other applicable reload design criteria. Other changes associated with the reload core design are evaluated under 10 CFR 50.59.

A visual inspection was performed on several of the LFAs during the Unit 2 2005 refueling outage and no anomalies or unexpected cladding behavior was observed. An inspection of the LFAs addressed by this request will also be performed after the Unit 2 2007 refueling outage and include examinations for clad oxidation, rod/assembly growth, and visual inspections.

Calvert Cliffs intends to re-insert these temporarily discharged assemblies in Unit 1, Cycle 19, as justified by the inspections in order to assess performance of the cladding material at higher burnups.

## **BACKGROUND**

The Calvert Cliffs Unit 1 core consists of 217 fuel assemblies. Each standard fresh fuel assembly consists of 176 fuel rods, 5 guide tubes, a bottom Inconel and 8 Zircaloy fuel rod spacer grids, upper- and lower-end fittings, and a hold-down device. The rods are arranged in a square 14x14 array. The guide tubes, spacer grids, and end-fittings form the structural frame of the assembly. The four outer guide tubes are mechanically attached to the end-fittings and the spacer grids are welded to all five guide tubes.

In a standard fresh fuel assembly, the fuel rods consist of slightly enriched uranium dioxide cylindrical ceramic pellets and a round wire stainless steel compression spring located at the top of the fuel column, all encapsulated within a seamless ZIRLO™ tube with a Zircaloy-4 cap welded at each end. The uranium dioxide pellets are dished and chamfered on both ends to accommodate thermal expansion and swelling.

Title 10 CFR 50.46(a)(1)(i) states, "Each boiling or pressurized light-water nuclear power reactor fueled with uranium oxide pellets within cylindrical Zircaloy or ZIRLO cladding must be provided with an emergency core cooling system (ECCS) that must be designed so that its calculated cooling performance following postulated loss-of-coolant accidents conforms to the criteria set forth in paragraph (b) of this section. ECCS cooling performance must be calculated in accordance with an acceptable evaluation model and must be calculated for a number of postulated loss-of-coolant accidents of different sizes, locations, and other properties sufficient to provide assurance that the most severe postulated loss-of-coolant accidents are calculated." Section 10 CFR 50.46 goes on to delineate specifications for peak cladding temperature, maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long-term cooling.

Title 10 CFR Part 50, Appendix K, paragraph I.A.5, states, "The rate of energy release, hydrogen generation, and cladding oxidation from the metal/water reaction shall be calculated using the Baker-Just equation." Since the Baker-Just equation presumes the use of Zircaloy or ZIRLO™ cladding, the use of

fuel with zirconium-based alloys that do not conform to either of these two designations requires a temporary exemption from this section of the Code.

We plan to re-insert up to four LFAs (two from Westinghouse and two from AREVA) in Unit 1, Cycle 19 containing advanced cladding materials that do not meet the definition of Zircaloy or ZIRLO™. The LFAs are scheduled to be re-inserted into the core at the next Unit 1 refueling outage, scheduled to begin in February 2008 and will remain in the core for Cycle 19. We are requesting a temporary exemption to 10 CFR 50.46 and 10 CFR Part 50, Appendix K, for the period when these LFAs reside in the core.

We believe that the standards of 10 CFR 50.12 are satisfied in this case. Special circumstances are present, as described in 10 CFR 50.12(a)(ii), to warrant granting the temporary exemption. They are described below.

### **10 CFR 50.12 REQUIREMENTS**

The standards set forth in 10 CFR 50.12 provide that specific exemptions may be granted that:

- are authorized by law;
- are consistent with the common defense and security;
- will not present an undue risk to the public health and safety; and
- are accompanied by special circumstances.

We believe that the activities to be conducted under the temporary exemption are clearly authorized by law and are consistent with the common defense and security. The remaining standards for the temporary exemption are also satisfied, as described below.

### **No Undue Risk**

The temporary exemption will not present an undue risk to the public health and safety. The safety evaluation performed by Westinghouse (contained in Reference a) and the approved AREVA topical report (described in Reference b) demonstrates that the predicted chemical, mechanical, and material performance of the advanced zirconium-based cladding is within that approved for Zircaloy-4 or ZIRLO™ under all anticipated operational occurrences and postulated accidents.

In the unlikely event that cladding failures occur in the LFAs, environmental impact would be minimal and is bounded by previous environmental assessments. In addition, the insertion of the LFAs will not foreclose the option of reverting to the use of standard ZIRLO™ cladding. That is, the change is not irreversible. The long-term benefits expected from the LFA program include reduced incidence of fuel failure, longer operating cycles, higher fuel burnup, and improved thermal margin.

### **Special Circumstances**

This request involves special circumstances as set forth in 10 CFR 50.12(a)(ii).

The underlying purpose of 10 CFR 50.46 is to ensure that nuclear power facilities have adequate acceptance criteria for ECCS. The effectiveness of the ECCS in Calvert Cliffs Unit 1 will not be affected by the insertion of the LFAs. Due to the similarities in the material properties of the advanced zirconium-based alloys to Zircaloy-4 or ZIRLO™, the Westinghouse safety evaluation and approved AREVA topical report concluded that the ECCS performance would not be adversely affected. Thus, the Westinghouse safety evaluation and approved AREVA topical report demonstrates the acceptability of the advanced zirconium-based cladding material under loss-of-coolant accident (LOCA) conditions.

The intent of paragraph I.A.5 of Appendix K to 10 CFR Part 50 is to apply an equation for rates of energy release, hydrogen generation, and cladding oxidation from a metal-water reaction that conservatively bounds all post-LOCA scenarios. The Westinghouse safety evaluation and the approved AREVA topical report show that due to the similarities in the composition of the advanced zirconium-based cladding and Zircaloy-4 or ZIRLO™, the application of the Baker-Just equation will continue to conservatively bound all post-LOCA scenarios.

The wording of the regulations renders the criteria of 10 CFR 50.46 and 10 CFR Part 50, Appendix K inapplicable to the advanced zirconium-based cladding, even though the Westinghouse safety evaluation and the approved AREVA topical report show that the intent of the regulations are met. Application of these regulations in this particular circumstance would not meet the underlying purpose of the rule nor is it necessary to achieve the underlying purpose of the rule, and therefore special circumstances exist.

### **Conclusion**

Therefore, as described above, the requirements of 10 CFR 50.12 are met for the requested exemption to 10 CFR 50.46 and 10 CFR Part 50, Appendix K. We request this exemption be granted by December 1, 2007 to allow us to accommodate possible changes in core design that would be required if this request was not acceptable.

### **PRECEDENT**

The Nuclear Regulatory Commission has granted temporary exemptions for similar LFAs in Calvert Cliffs Nuclear Power Plant Unit 1 for Cycles 13, 14, and 15, for Unit 2 for Cycles 14, 15 and 16, and for Units 1 and 2, Cycles 19 and 17, respectively.

- Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. R. E. Denton (BGE), dated November 28, 1995, Temporary Exemption from 10 CFR 50.44, 10 CFR 50.46, and Appendix K to 10 CFR Part 50, for Lead Fuel Assemblies – Calvert Cliffs Nuclear Power Plant, Unit No. 1 (TAC No. M93232)
- Letter from Ms. D. M. Skay (NRC) to Mr. C. H. Cruse (CCNPP), dated March 6, 2001, Calvert Cliffs Nuclear Power Plant, Unit No. 2, Exemption from the Requirements of 10 CFR Part 50, Sections 50.46, 50.44, and Appendix K (TAC No. MB0008)
- Letter from Mr. G. S. Vissing (NRC) to Mr. P. E. Katz (CCNPP), dated April 11, 2003, Exemption from the Requirements of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR Part 50, Appendix K (TAC Nos. MB5648 and MB6065)
- Letter from Mr. P. D. Milano (NRC) to Mr. J. A. Spina, dated November 9, 2006, Exemption from the Requirements of 10 CFR 50.46 and 10 CFR 50, Appendix K (TAC Nos. MC9615 and MC9616)

Should you have questions regarding this matter, please contact Mr. Jay S. Gaines at (410) 495-5219.

Very truly yours,



JAS/PSF/bjd

**REFERENCES:**

- (a) Letter from Mr. P. E. Katz (CCNPP) to Document Control Desk (NRC), dated July 17, 2002, Westinghouse Lead Fuel Assemblies – Temporary Exemption Request and License Amendment Request
- (b) Letter from Mr. P. E. Katz (CCNPP) to Document Control Desk (NRC), dated August 6, 2002, Framatome Lead Fuel Assemblies - Temporary Exemption Request and License Amendment Request
- (c) Letter from Mr. G. S. Vissing (NRC) to Mr. P. E. Katz (CCNPP), dated April 11, 2003, Exemption from the Requirements of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR Part 50, Appendix K (TAC Nos. MB5648 and MB6065)
- (d) Letter from Mr. G. S. Vissing (NRC) to Mr. P. E. Katz (CCNPP), dated April 14, 2003, Amendments Re: Lead Fuel Assemblies (TAC Nos. MB5646, MB5647 and MB6064)
- (e) Letter from Mr. J. A. Spina (CCNPP) to Document Control Desk (NRC), dated January 19, 2006, Temporary Exemption Request for Use of Lead Fuel Assemblies
- (f) Letter from Mr. J. A. Spina (CCNPP) to Document Control Desk (NRC), dated February 27, 2006, License Amendment Request: Use of Lead Fuel Assemblies
- (g) Letter from Mr. P. D. Milano (NRC) to Mr. J. A. Spina (CCNPP), dated November 9, 2006, Exemption from the Requirements of 10 CFR 50.46 and 10 CFR 50, Appendix K (TAC Nos. MC9615 and MC9616)
- (h) Letter from Mr. P. D. Milano (NRC) to Mr. J. A. Spina (CCNPP), dated November 16, 2006, Amendments Re: Use of Lead Fuel Assemblies (TAC Nos. MD0243 and MD0244)

cc: D. V. Pickett, NRC  
S. J. Collins, NRC

Resident Inspector, NRC  
R. I. McLean, DNR