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November 1, 1994

U. S. Nuclear Regulatory Commission  
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant  
Unit No. 2; Docket No. 50-318  
Lead Fuel Assembly - Temporary Exemption Request

- REFERENCES:
- (a) Letter from Mr. R. E. Denton (BGE) to Document Control Desk (NRC), dated December 8, 1993, License Amendment Request; Content of the Design Features Section
  - (b) Letter from Ms. C. M. Thompson (NRC) to Mr. W. F. Conway (APS), dated July 17, 1992, Exemption from 10 CFR 50.46, 10 CFR Part 50, Appendix K, and 10 CFR 50.44

Pursuant to Title 10 of the Code of Federal Regulations (CFR) 50.12(a), Baltimore Gas and Electric Company (BGE) requests a temporary exemption from the requirements of 10 CFR 50.46, 10 CFR 50.44, and 10 CFR Part 50, Appendix K. This exemption will allow four lead fuel assemblies with a limited number of fuel rods clad with advanced zirconium-based alloys to be inserted into the core during the next Unit 2 refueling outage, scheduled to begin in March 1995. The CFR specify standards and acceptance criteria strictly for fuel rods clad with zircaloy or ZIRLO. Thus, a temporary exemption is requested to use a limited number of fuel rods clad with advanced zirconium-based alloys that are not zircaloy or ZIRLO.

As detailed below, this temporary exemption is necessary to conduct representative testing of lead fuel assemblies in Calvert Cliffs Unit 2 during Cycles 11, 12, and 13. This testing is intended to provide data to support the development of new and improved fuel designs and fuel evaluation codes and methods.

Currently, Calvert Cliffs Technical Specification Section 5.3.1, Design Features, only allows the use of fuel rods clad with Zircaloy-4. In Reference (a), BGE submitted a license amendment request to revise Technical Specification Section 5.3.1, "Fuel Assemblies," to allow the reactor core to contain a limited number of lead fuel assemblies with zirconium alloy fuel rods in non-limiting core regions. This Technical

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Specification change is consistent with NUREG-1432, "Standard Technical Specifications for Combustion Engineering Plants," September 1992.

Although the license amendment request has not yet been approved, we anticipate its approval prior to the insertion of the four lead fuel assemblies. Therefore, we are not requesting a Technical Specification change in addition to this temporary exemption request.

Based on the regulations, however, a specific exemption is required prior to the insertion of lead fuel assemblies containing fuel rods clad with materials other than zircaloy or ZIRLO. Baltimore Gas and Electric Company believes 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. The NRC granted an exemption in Reference (b) for similar lead fuel assemblies in Palo Verde Nuclear Generating Station Unit 3 for Cycles 4, 5, and 6.

### **BACKGROUND**

The Calvert Cliffs Unit 2 core consists of 217 fuel assemblies. Each fuel assembly consists of 176 fuel rods, 5 guide tubes, 5 guide tube sleeves, 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 fuel assembly, the fuel rods consist of slightly enriched uranium dioxide cylindrical ceramic pellets, a round wire stainless steel compression spring, and an alumina spacer disc located at the bottom of the fuel column, all encapsulated within a seamless Zircaloy-4 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.

In Calvert Cliffs Unit 2 Cycle 11, four lead fuel assemblies, containing a total of 704 fuel rods, will have a total of up to 340 of these fuel rods clad with advanced zirconium-based alloys. Besides the use of advanced cladding, the other design features that are unique to the lead fuel assemblies compared to a standard fuel assembly are:

<u>Design Feature</u>	<u>Lead Fuel Assembly</u>	<u>Standard Fuel Assembly</u>
Fuel Rod Length, inches	146.853	147.229
Clad Thickness, inches	.026	.028
Pellet Diameter, inches	.381	.3765
Pellet Length, inches	.456	.450
Pellet Stack Density, g/cc	10.31	10.12

The design features listed in the above table will be evaluated under 10 CFR 50.59.

Title 10 CFR 50.46(a)(1)(i) states, "Each boiling and 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.

In addition, 10 CFR 50.44(a) states, "Each boiling or pressurized light-water nuclear power reactor fueled with oxide pellets with cylindrical zircaloy or ZIRLO cladding, must, as provided in paragraphs (b) through (d) of this section, include means for control of hydrogen gas that may be generated, following a postulated loss-of-coolant accident (LOCA) . . . ." Since 10 CFR 50.46 and 10 CFR 50.44 specifically refer to fuel with zircaloy or ZIRLO clad, the use of fuel clad with zirconium-based alloys that do not conform to either of these two designations requires an exemption from this section of the Code.

Finally, 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 an exemption from this section of the Code.

The lead fuel assemblies are scheduled to be inserted into the core at the next Unit 2 refueling outage, scheduled to begin in March 1995, and will remain in the Calvert Cliffs Unit 2 core for Cycles 11, 12, and 13. Presently, Cycle 13 is forecasted to end on or about February 2001. We are requesting a temporary exemption to 10 CFR 50.46, 10 CFR 50.44, and 10 CFR Part 50, Appendix K, for the period when these four lead fuel assemblies reside in the core.

#### THE REQUIREMENTS OF 10 CFR 50.12 ARE MET

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

- ♦ 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.

Baltimore Gas and Electric Company believes 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 attached safety evaluation performed by ABB Combustion Engineering Nuclear Operations demonstrates that the predicted chemical, mechanical, and material performance of the advanced zirconium-based cladding is within that approved for zircaloy under all anticipated operational occurrences and postulated accidents. Furthermore, the lead fuel assemblies will be placed in non-limiting core locations. Information contained in the attached safety evaluation report (Attachment 2) is considered proprietary by Combustion Engineering, Incorporated. Accordingly, it is requested that the report be withheld from public disclosure in accordance with the provisions of 10 CFR 2.790 and that this material be appropriately safeguarded. The reasons for the classification of this material as proprietary are delineated in the affidavit provided (Attachment 1).

In the unlikely event that cladding failures occur in the lead fuel assemblies, environmental impact would be minimal and is bounded by previous environmental assessments. In addition, the insertion of the lead fuel assemblies will not foreclose the option of reverting to the use of standard zircaloy cladding. That is, the change is not irreversible. The long-term benefits expected from the lead fuel assembly 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 Emergency Core Cooling System (ECCS). The effectiveness of the ECCS in Calvert Cliffs Unit 2 will not be affected by the insertion of the four lead fuel assemblies. Due to the similarities in the material properties of the advanced zirconium-based alloys to zircaloy and the location of the lead fuel assemblies in non-limiting locations, the attached safety evaluation concludes that the ECCS performance in Calvert Cliffs Unit 2 will not be adversely affected. Thus, the attached safety evaluation demonstrates the acceptability of the advanced zirconium-based cladding material under loss-of-coolant accident (LOCA) conditions.

The intent of 10 CFR 50.44 is to ensure that there is an adequate means of controlling generated hydrogen. The hydrogen produced in a post-LOCA scenario comes from a metal-water reaction. The attached safety evaluation also shows that the use of the Baker-Just equation to determine the metal-water reaction rate is conservative for the advanced zirconium-based cladding material. Therefore, the amount of hydrogen generated by metal-water reaction in these materials will be within the design basis of Calvert Cliffs Unit 2.

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 the metal-water reaction which conservatively bounds all post-LOCA scenarios. The safety evaluation forwarded with this submittal shows that due to the similarities in the composition of the advanced zirconium-based cladding and zircaloy, the application of the Baker-Just equation will continue to conservatively bound all post-LOCA scenarios.



A strict interpretation of the regulations would render the criteria of 10 CFR 50.46, 10 CFR 50.44, and Appendix K to 10 CFR Part 50 to be inapplicable to the advanced zirconium-based cladding, even though the safety evaluation shows that the intent of the regulations are met. Therefore, application of these regulations would not meet the underlying purpose of the rule and special circumstances exist.

#### ENVIRONMENTAL IMPACT

There will be no impact on the environment as a result of this exemption. No new operational or safety considerations are introduced by this exemption. The advanced zirconium-based cladding material is expected to perform at least as well as zircaloy cladding. In the unlikely event that cladding failure occurs, the consequences are no more adverse than that of zircaloy clad fuel rods. As a result, the environmental impact would remain unchanged and is bounded by previous environmental assessments.

#### SCHEDULE

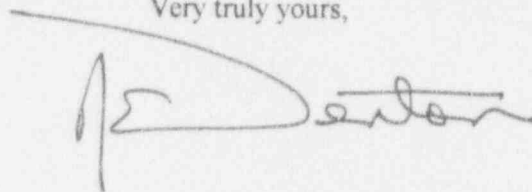
The insertion of the lead fuel assemblies is currently scheduled to occur during the next refueling outage which is expected to begin on March 17, 1995. Therefore, we request that this temporary exemption be granted prior to that date.

#### CONCLUSION

Baltimore Gas and Electric Company believes that standards of 10 CFR 50.12 are satisfied including the existence of special circumstances as required by 50.12(a)(ii). This temporary exemption is necessary to permit insertion of four lead fuel assemblies that contain fuel rods clad with advanced zirconium-based alloys that are not zircaloy or ZIRLO as required by the regulations.

Should you have any questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

A handwritten signature in dark ink, appearing to read "J. E. Carter", is written over a horizontal line.

RED/BDM/dlm

Attachments: (1) Proprietary Affidavit for Attachment (2)  
(2) Safety Evaluation Report for Use of Advanced Zirconium-Based Cladding Materials in Calvert Cliffs Unit 2 Batch N Lead Fuel Assemblies, September 1994 (Proprietary) [3 Copies]

cc: (Without Attachments)

D. A. Brune, Esquire

J. E. Silberg, Esquire

M. J. Case, NRC

D. G. McDonald, Jr., NRC

T. T. Martin, NRC

P. R. Wilson, NRC

R. I. McLean, DNR

J. H. Walter, PSC

ATTACHMENT (1)

PROPRIETARY AFFIDAVIT FOR ATTACHMENT (2)

AFFIDAVIT PURSUANT

TO 10 CFR 2.790

Combustion Engineering, Inc.    )  
State of Connecticut            )  
County of Hartford             )       SS.:

I, S. A. Toelle, depose and say that I am the Manager, Nuclear Licensing, of Combustion Engineering, Inc., duly authorized to make this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conjunction with the application of Baltimore Gas & Electric Company and in conformance with the provisions of 10 CFR 2.790 of the Commission's regulations for withholding this information.

The information for which proprietary treatment is sought is contained in the following document:

CEN 425-P, Revision 1-P, "Safety Evaluation Report for Use of Advanced Zirconium-based Cladding Materials in Calvert Cliffs, Unit 2 Batch N Lead Fuel Assemblies," October 1994.

This document has been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by Combustion Engineering in designating information as a trade secret, privileged or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.790 of the Commission's regulations, the following is furnished for



consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced document, should be withheld.

1. The information sought to be withheld from public disclosure, which is owned and has been held in confidence by Combustion Engineering, is the identification and chemical composition of zirconium-based alloys and the test and performance data on these alloys which demonstrate their superior corrosion resistance compared to Zircaloy-4.
2. The information consists of test data or other similar data concerning a process, method or component, the application of which results in substantial competitive advantage to Combustion Engineering.
3. The information is of a type customarily held in confidence by Combustion Engineering and not customarily disclosed to the public. Combustion Engineering has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The details of the aforementioned system were provided to the Nuclear Regulatory Commission via letter DP-537 from F. M. Stern to Frank Schroeder dated December 2, 1974. This system was applied in determining that the subject document

herein is proprietary.

4. The information is being transmitted to the Commission in confidence under the provisions of 10 CFR 2.790 with the understanding that it is to be received in confidence by the Commission.
5. The information, to the best of my knowledge and belief, is not available in public sources, and any disclosure to third parties has been made pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.
6. Public disclosure of the information is likely to cause substantial harm to the competitive position of Combustion Engineering because:
  - a. A similar product is manufactured and sold by major pressurized water reactor competitors of Combustion Engineering.
  - b. Development of this information by Combustion Engineering required thousands of manhours and millions of dollars. To the best of my knowledge and belief, a competitor would have to undergo similar expense in generating equivalent information.
  - c. In order to acquire such information, a competitor would also require considerable time and inconvenience to develop

or discover the identification and chemical composition of zirconium-based alloys and the test and performance data on these alloys which demonstrate their superior corrosion resistance compared to Zircaloy-4.

- d. The information required significant effort and expense to obtain the licensing approvals necessary for application of the information. Avoidance of this expense would decrease a competitor's cost in applying the information and marketing the product to which the information is applicable.
- e. The information consists of the identification and chemical composition of zirconium-based alloys and the test and performance data on these alloys which demonstrate their superior corrosion resistance compared to Zircaloy-4, the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with Combustion Engineering, take marketing or other actions to improve their product's position or impair the position of Combustion Engineering's product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.
- f. In pricing Combustion Engineering's products and services, significant research, development, engineering, analytical, manufacturing, licensing, quality assurance and other costs and expenses must be included. The ability of Combustion

Engineering's competitors to utilize such information without similar expenditure of resources may enable them to sell at prices reflecting significantly lower costs.

- g. Use of the information by competitors in the international marketplace would increase their ability to market nuclear steam supply systems by reducing the costs associated with their technology development. In addition, disclosure would have an adverse economic impact on Combustion Engineering's potential for obtaining or maintaining foreign licensees.

Further the deponent sayeth not.

S. A. Toelle

S. A. Toelle  
Manager  
Nuclear Licensing

Sworn to before me

this 26<sup>th</sup> day of October, 1994

Laurie S. White  
Notary Public

My commission expires: 8/31/99

ATTACHMENT (2)

SAFETY EVALUATION REPORT FOR USE OF ADVANCED  
ZIRCONIUM - BASED CLADDING MATERIALS IN  
CALVERT CLIFFS UNIT 2 BATCH N LEAD FUEL ASSEMBLIES  
SEPTEMBER 1994

[PROPRIETARY]