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STEWART,W.L. Arizona Public Service Co. (formerly Arizona Nuclear Power
RECIP.NAME RECIPIENT AFFILIATION
Document Control Branch (Document Control Desk) See Rpt

SUBJECT: Requests temporary exemption from 10CFR50.44,10CFR50.46 & 10CFR50,App K requirements for PVNGS Unit 3.Exemption allows up to 3 Lead Fuel Assemblies containing fuel rods fabricated w/advanced Zr based cladding matl be inserted in Unit 3.

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CATEGORY 1 DOCUMENT

AA2

Arizona Public Service
PALO VERDE NUCLEAR GENERATING STATION
P.O. BOX 52034 PHOENIX, ARIZONA 85072-2034

102-03769-WLS/SAB/JRP
September 12, 1996

WILLIAM L. STEWART
EXECUTIVE VICE PRESIDENT
NUCLEAR

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

References: 1) Letter dated July 17, 1992, from C. M. Thompson, USNRC, to W. F. Conway, APS
2) Letter dated March 6, 1996, from C. R. Thomas, USNRC, to W. L. Stewart, APS

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station(PVNGS)
Unit 3
Docket No. STN 50-530
Lead Fuel Assemblies - Exemption Request

Pursuant to Title 10 of the Code of Federal Regulations (10 CFR) 50.12(a), Arizona Public Service Company (APS), requests a temporary exemption from the requirements of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50, Appendix K, for PVNGS Unit 3. This exemption will allow up to three Lead Fuel Assemblies (LFA) containing fuel rods fabricated with advanced zirconium based cladding materials to be inserted into the Unit 3 Cycle 7 core during its next refueling outage scheduled to begin in February 1997. The exemption is requested to allow continued testing of these alloys in Unit 3 during Cycles 7, 8, and 9. The advanced alloys are designated as Alloy A and Alloy F, both of which have previously been approved for limited use and testing at PVNGS (References 1 & 2.)

The advanced alloy clad demonstration program is expected to lead to the production of fuel rods that can provide improved performance margins and greater operational flexibility. As discussed in the enclosure, this exemption is necessary in order to conduct representative testing of cladding material whose chemical composition falls outside the ASTM specification for Zircaloy-4. This testing is intended to: 1) provide data to support the development of these new and improved fuel cladding materials and 2) provide a basis for future regulation changes to allow full batch use of Alloy A and/or Alloy F. This exemption will permit the LFA program to examine the behavior of a larger number of test rods clad with the two advanced alloys under operating pressurized water reactor (PWR) conditions.

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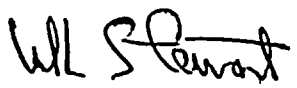
The CFR specifies standards and acceptance criteria only for fuel rods clad with Zircaloy or ZIRLO. Therefore, an exemption to use a limited number of fuel rods clad with advanced Zirconium-based alloys that are not Zircaloy or ZIRLO is requested. APS believes that the standards of 10 CFR 50.12 are satisfied in this case. Special circumstances are present, pursuant to 10 CFR 50.12(a)(ii), to warrant granting the exemption request.

It is requested that this exemption request be reviewed and approved by January 15, 1997, in order to support fuel procurement and delivery for Unit 3 Cycle 7.

Attachment 1 to the enclosure, "Safety Analysis Report for Use of Advanced Zirconium Based Cladding Materials, In PVNGS Unit 3, Lead Fuel Assemblies, August 1996," contains information which is proprietary to Combustion Engineering Inc. for which an affidavit is provided. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and specifically addresses the considerations listed in 10 CFR 2.790(b)(1). Accordingly, it is requested that Attachment 1 be withheld from public disclosure in accordance with 10 CFR 2.790(b)(1). A non-proprietary version of the safety analysis is provided as Attachment 2 to the enclosure for your use in docketing this request for an exemption.

Should you have any questions, please contact Scott A. Bauer at (602) 393- 5978.

Sincerely,



WLS/SAB/JRP/pv

Enclosure

cc: L. J. Callan
K. E. Perkins
J. W. Clifford
K. E. Johnston

ENCLOSURE

Request for Exemption from the Provisions of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K for Lead Fuel Assemblies

REQUEST FOR EXEMPTION FROM THE PROVISIONS OF 10 CFR 50.46, AND 10 CFR 50, APPENDIX K FOR LEAD FUEL ASSEMBLIES

BACKGROUND

With the recent trends in the nuclear industry regarding increased fuel discharge burnups and longer exposure cycles, the corrosion performance requirements for nuclear fuel cladding are becoming more demanding. Added to this are desires for axial blankets, higher burnups, and increased core power. Under these more demanding operating conditions, standard Zircaloy-4 cladding materials may not be the best material to maintain fuel cladding integrity or provide the operational flexibility and performance margins needed in the future.

To meet these needs, Combustion Engineering Inc. (CE Inc.), has developed new cladding materials with improved corrosion resistance. As part of this development program, several zirconium based cladding alloys were included in two lead fuel assemblies (LFA) which were inserted in the Palo Verde Unit 3 Batch F reload to begin irradiation in Cycle 4. Currently, these two LFAs are in their third cycle of irradiation, and the associated exemption for this testing will expire at the end of the cycle. Further, two LFAs were inserted at the beginning of Cycle 7 in Palo Verde Unit 2 to test in-PWR performance of another advanced clad alloy, Zirconium Alloy F. Lead test assemblies with several advanced cladding alloys, including Alloy F, are also undergoing their first irradiation cycle in Calvert Cliffs 1.

CE Inc. prepared reports CEN-411(V)-P and CEN-426-P to support initial testing of Alloys A and F at PVNGS. The attached Safety Analysis Report (SAR), CEN-429-P, documents the acceptable performance of both alloys in initial test programs and provides a basis for the continuation of testing in larger quantities and to higher burnups.

Two (2) Palo Verde Unit 3, Batch J fuel assemblies have been selected to be new LFAs for the continuation of the fuel rod cladding demonstration program at PVNGS. One of these two LFAs will have a total of up to 236 fuel rods clad with Alloy A, and the other will have up to 236 fuel rods clad with Alloy F. These LFAs are being inserted to collect data on individual rod performance as well as full bundle performance, namely rod bow. Alloys A and F are advanced zirconium-based alloys with a chemical composition other than that of conventional Zircaloy-4 or Zirlo, hence the need for an approved exemption.

A third LFA will be a carrier assembly for up to six (6) test fuel rods clad with Alloy A that are currently completing their third irradiation cycle (Cycle 6) in Unit 3. These rods will be transplanted into the carrier assembly after rod inspections are performed at the completion of Cycle 6. These rods will continue testing only through Cycle 7 in order to collect data following high burnup exposure. Up to four standard clad (OPTIN) rods will

also be transplanted into the carrier assembly in order to provide data that can be used to evaluate the relative performance of Alloy A to OPTIN. Upper bound estimates of burnups for these OPTIN and Alloy A rods are expected to reach 67,000 MWD/MTU and 73,000 MWD/MTU respectively. It is important to note that the balance of the rods in the carrier assembly are clad with OPTIN whose burnup will not exceed the current PVNGS Design Bases of 60,000 MWD/MTU.

Title 10 of the Code of Federal Regulations (10 CFR)50.46(a)(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 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." 10 CFR 50.46 continues on to delineate specifications for peak cladding temperature, 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 within 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 50.44 specifically refer to fuel with Zircaloy or ZIRLO cladding, 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 50, Appendix K, paragraph 1.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." 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.

10 CFR 50.12, SPECIFIC EXEMPTION

The standards set forth in 10 CFR 50.12 provide that the Commission may grant exemptions from the requirements of the regulations of this part for reasons consistent with the following:

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

This exemption is authorized by law. The remaining standards for the exemption are also satisfied, as described below.

The exemption will not present an undue risk to public health and safety. The attached SAR generated by CE Inc. demonstrates that the predicted chemical, mechanical, and material performance characteristics of the advanced Zirconium based cladding is within that approved for Zircaloy under anticipated operational occurrences and postulated accidents. The attached SAR also documents the acceptable inspection results following in-reactor testing of Alloys A and F. Thus, the expected nominal fuel performance characteristics of the advanced zirconium-based clad test rods continues to be the same, if not superior to those expected for standard Zircaloy-4 fuel rods. The inspection results support the conclusion that Alloys A and F will continue to meet current design bases requirements for standard Zircaloy-4 fuel rods. The lead fuel assemblies will be placed in non-limiting core locations which do not experience the highest core power density throughout the three cycles. Therefore, the use of the advanced zirconium-based cladding materials in 3 LFAs placed in non-limiting core locations will not present an undue risk to the public health and safety and is consistent with the common defense and security.

This request for an exemption involves special circumstances as set forth in 10 CFR 50.12(a)(2)(ii), which states that special circumstances are present whenever "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."

The underlying purpose 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 SARs previously mentioned conclude that the use of the Baker-Just equation to determine the metal-water reaction rate is conservative for the advanced zirconium-based cladding materials. Therefore, the amount of hydrogen generated by metal-water reaction in these materials will be within the design basis of Palo Verde Unit 3.

10 CFR 50.46 identifies acceptance criteria for ECCS system performance at nuclear power facilities. The effectiveness of the ECCS in Palo Verde Unit 3 will not be affected by the insertion of three lead fuel assemblies. Due to the similarities in the material properties of the advanced zirconium-based alloys to Zircaloy as described in the CE Inc. reports CEN-411(V)-P and CEN-426-P and the location of the lead fuel assemblies in non-limiting locations, it can be concluded that the ECCS performance in Palo Verde Unit 3 will not be adversely affected. In addition, the attached SAR verifies the acceptability of the advanced zirconium-based cladding material under 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 which conservatively bounds all post-LOCA scenarios. The attached SAR verifies 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.

CONCLUSION

A strict interpretation of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50, Appendix K, would not allow the use of the advanced zirconium-based cladding on fuel rods in lead test assemblies since the cladding material does not fall within the strict definition of Zircaloy or ZIRLO cladding. In order to support development of new cladding materials with improved corrosion resistance, an exemption from these requirements is requested. The attached SAR shows that the intent of the regulations would continue to be met, since the predicted chemical, mechanical, and material properties and performance expectation of the advanced cladding materials fall within the range of the properties for Zircaloy-4. Additionally, to date, inspection results of Alloys A and F, following in-reactor testing, confirm these expectations. Therefore, application of these regulations would not meet the underlying purpose of the rule and special circumstances exist to justify the approval of an exemption from the subject requirements.

Attachments (2)

ATTACHMENT 1

COMBUSTION ENGINEERING INC.

CEN-429-P, REVISION-00-P

PROPRIETARY INFORMATION

AFFIDAVIT PURSUANT

TO 10 CFR 2.790

I, Ian C. Rickard, depose and say that I am the Director, Operations 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 conformance with the provisions of 10 CFR 2.790 of the Commission's regulations and in conjunction with the application of Arizona Public Service Company for withholding this information.

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

> CEN-429-P, Rev. 00-P "Safety Analysis Report for Use of Advanced Zirconium Based Cladding Materials in PVNGS Unit 3 Lead Fuel Assemblies," August 1996.

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, is owned and has been held in confidence by Combustion Engineering. It consists of

data, material properties, models, test methods and analytical results which are used for design purposes with respect to advanced Zirconium-based fuel cladding materials.

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 hundreds of thousands of dollars and thousands of manhours of effort. 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 equivalent data, quantification of material properties, test methods, models, and analytical results related to advanced Zirconium-based cladding materials.

d. The information consists of data, material properties, test methods, models, and analytical results related to advanced Zirconium-based cladding materials, 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.

e. 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.

f. 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

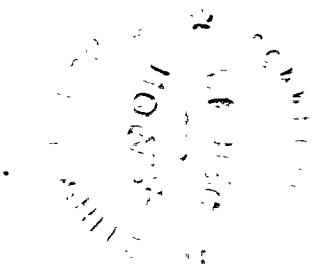
their technology development. In addition, disclosure would have an adverse economic impact on Combustion Engineering's potential for obtaining or maintaining foreign licensees.

Further the deponent sayeth not.

Ian C. Rickard
Director, Operations Licensing

Sworn to before me
this 31st day of July, 1996

Laurie J. White
Notary Public
My commission expires: 8/31/99



ATTACHMENT 2

COMBUSTION ENGINEERING INC.

CEN-429-NP, REVISION-00-NP

NON-PROPRIETARY INFORMATION