Progress Energy

10 CFR 50.12

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

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

REQUEST FOR EXEMPTION IN ACCORDANCE WITH
10 CFR 50.12 REGARDING USE OF M5 ALLOY IN FUEL ROD CLADDING

Ladies and Gentlemen:

In accordance with the provisions of the Code of Federal Regulations, Title 10, Part 50.12, Carolina Power and Light Company, also known as Progress Energy Carolinas (PEC), Inc., is submitting, as attached, a request for an exemption from the requirements of 10 CFR 50.46 and 10 CFR 50, Appendix K, to allow for the use of M5 alloy fuel rod cladding at H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2.

PEC requests approval of the proposed exemption by October 1, 2011, to allow for loading of M5 cladding fuel assemblies into the core during Refueling Outage 27, currently scheduled to begin on October 29, 2011. A License Amendment Request, which is also required to allow the use of M5 cladding, is being submitted via a separate letter.

If you have any questions concerning this matter please contact Mr. Curt Castell at (843) 857-1626.

Sincerely,

B.C. White

B. C. White
Manager – Support Services – Nuclear

Attachment

c: Mr. L. A. Reyes, NRC, Region II
Mr. T. Orf, NRC Project Manager, NRR
NRC Resident Inspector, HBRSEP

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NRR

10 CFR 50.46 and 10 CFR 50 Appendix K Exemption Request

In accordance with 10 CFR 50.12, *Specific Exemptions,* Progress Energy Carolinas (PEC), Inc., requests exemptions for H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, from the requirements specified in 10 CFR 50.46, *Acceptance criteria for emergency core cooling systems for light- water nuclear power reactors,* and 10 CFR 50 Appendix K - *ECCS Evaluation Models.* These exemption requests are related to the proposed use of the M5 advanced zirconium alloy for HBRSEP, Unit No. 2 fuel rod cladding.

Specifically, 10 CFR 50.46, Section (a)(1)(i), provides requirements for reactors containing uranium oxide fuel pellets clad in either zircaloy or ZIRLO. Additionally, Appendix K to 10 CFR 50, "ECCS Evaluation Models," presumes the use of zircaloy or ZIRLO fuel cladding when doing calculations for energy release, cladding oxidation, and hydrogen generation after a postulated loss-of-coolant accident. Therefore, both of these regulations either state or assume that either zircaloy or ZIRLO is used as the fuel rod cladding material. An exemption is required to allow the use of M5 cladding.

Per 10 CFR 50.12, the Commission may grant an exemption from requirements contained in 10 CFR 50 provided that: 1) the exemption is authorized by law, 2) the exemption will not present an undue risk to public health and safety, 3) the exemption is consistent with the common defense and security, and 4) special circumstances, as defined in 10 CFR 50.12(a)(2) are present. The requested exemptions to allow the use of M5 advanced zirconium alloy rather than zircaloy or ZIRLO for fuel cladding material for reloads at HBRSEP, Unit No. 2, satisfy these requirements as described below.

1. The requested exemption is authorized by law.

   This exemption would allow the use of M5 advanced alloy, in lieu of zircaloy or ZIRLO, for fuel rod cladding in fuel assemblies at HBRSEP, Unit No. 2. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR 50.46 and Appendix K to 10 CFR 50. Therefore, the exemption is authorized by law.

2. The requested exemption does not present an undue risk to the public health and safety.

   In the approved topical report BAW-10227(P)(A), Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," dated June 18, 2003, Framatome ANP demonstrated that the effectiveness of the ECCS will not be affected by a change from zircaloy fuel rod cladding to M5 fuel rod cladding. The analysis described in the topical report also demonstrated that the ECCS acceptance criteria applied to reactors fueled with zircaloy clad fuel are also applicable to reactors fueled with M5 fuel rod cladding.

Appendix K, paragraph I.A.5, of 10 CFR 50 ensures that cladding oxidation and hydrogen generation are appropriately limited during a loss-of-coolant accident (LOCA), and conservatively accounted for in the ECCS evaluation model. Appendix K requires that the Baker-Just equation be used in the ECCS evaluation model to determine the rate of energy release, cladding oxidation, and hydrogen generation. In the approved topical report BAW-10227(P)(A), Revision 1, Framatome ANP demonstrated that the Baker-Just model is conservative in the evaluated post-LOCA scenarios with respect to the use of the M5 advanced alloy as a fuel rod cladding material, and that the amount of hydrogen generated in an M5-clad core during a LOCA will remain within the HBRSEP, Unit No. 2, design basis. Baker-Just is the cladding oxidation correlation used in the Small Break LOCA methodology for HBRSEP, Unit No. 2. NRC-approved topical report EMF-2103(P)(A) models oxidation during a LBLOCA using Cathcart-Pawel. Appendix E of EMF-2103 (P)(A) discusses the acceptability of this correlation for use in analysis of M5 cladding.

The NRC staff has reviewed the advanced cladding and structural material, M5, for pressurized-water reactor fuel mechanical designs as described in BAW-10227(P)(A), Revision 1. In the safety evaluation for this topical report, the NRC staff concluded that, to the extent and limitations specified in the staff's evaluation, the properties of M5 and mechanical design methodology are acceptable for referencing in fuel reload licensing applications.

Based on the above, no new accident precursors are created by the use of M5 fuel cladding at HBRSEP, Unit No. 2; thus, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety.

3. The requested exemption will not endanger the common defense and security.

   The M5 fuel rod cladding is similar in design to the current cladding material used at HBRSEP, Unit No. 2. This change in cladding material will not result in any changes to the security aspects associated with the control of special nuclear material. The change in cladding material is unrelated to other security issues. Therefore, the common defense and security is not impacted by this exemption.

4. Special circumstances are present which necessitate the request of an exemption to the regulations of 10 CFR 50.46 and 10 CFR 50 Appendix K.

   Special circumstances, in accordance with 10 CFR 50.12, 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 50.46 is to ensure that nuclear power facilities have adequately demonstrated the cooling performance of their Emergency Core Cooling System (ECCS). As discussed above, topical report BAW-10227(P)(A) concluded that the

effectiveness of the ECCS will not be affected by a change from zircaloy fuel rod cladding to M5 fuel rod cladding and also demonstrated that the ECCS acceptance criteria applied to reactors fueled with zircaloy clad fuel are also applicable to reactors fueled with M5 fuel rod cladding. Normal reload safety analyses will confirm that the safety analyses performed to support the use of this fuel type will remain applicable for the HBRSEP, Unit No. 2, reactor core.

The underlying purpose of 10 CFR 50, Appendix K, paragraph I.A.5 is to ensure that cladding oxidation and hydrogen generation are appropriately limited during a LOCA and conservatively accounted for in the ECCS evaluation model. Specifically, Appendix K requires that the Baker-Just equation be used in the ECCS evaluation model to determine the rate of energy release, cladding oxidation, and hydrogen generation. Topical Report BAW- 10227(P)(A), Revision 1, demonstrated that the Baker-Just model is conservative in the evaluated post-LOCA scenarios with respect to the use of the M5 advanced alloy as a fuel rod cladding material. Baker-Just is the cladding oxidation correlation used in the Small Break LOCA methodology for HBRSEP, Unit No. 2. NRC-approved topical report EMF-2103(P)(A) models oxidation during a LBLOCA using Cathcart-Pawel. Appendix E of EMF-2103 (P)(A) demonstrates that the Cathcart-Pawel model for metal-water reaction kinetics is acceptable for analysis of a LBLOCA. Therefore, the amount of hydrogen generation for an M5 advance alloy reactor core during a LOCA would remain within the HBRSEP, Unit No. 2, design basis.

Based on the above, the underlying purpose of 10 CFR 50.46 and 10 CFR 50, Appendix K will continue to be satisfied for the planned operation with M5 fuel rod cladding. Therefore, the required special circumstances exist.

In conclusion, issuance of an exemption from the specified regulations for the use of M5 fuel rod cladding material in the HBRSEP, Unit No. 2, reactor will not compromise the safe operation of the reactor. Similar exemptions have already been issued for other licensed reactors, including Crystal River Unit 3, Arkansas Nuclear One, Unit 1, and Palisades.